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SUPPLEMENTAL REMEDY SELECTION REPORT
AMEREN MISSOURI SIOUX ENERGY CENTER
ST. CHARLES COUNTY, MISSOURI

by
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Cleveland, Ohio

for
Ameren Missouri
St. Louis, Missouri

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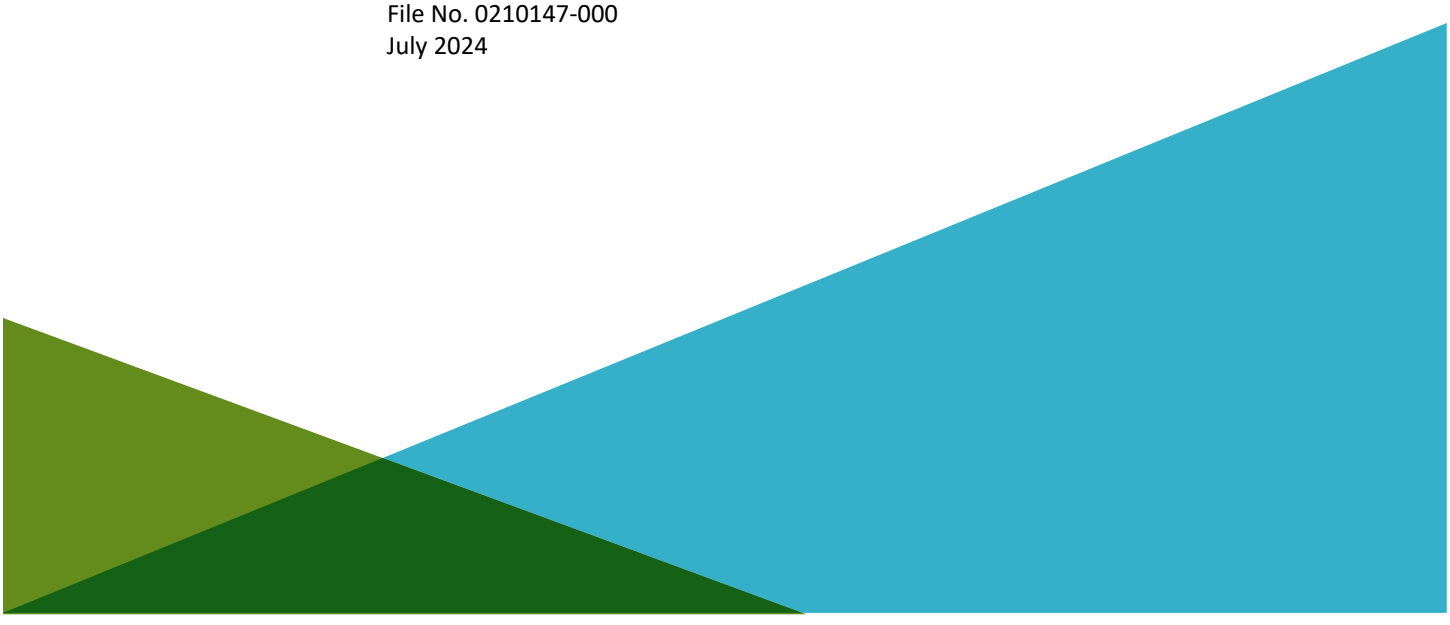


Table of Contents

Page

List of Tables ii
List of Figures ii
List of Appendices iii

1. Introduction 1

1.1 PURPOSE 1
1.2 FACILITY DESCRIPTION 1
1.3 CCR RULE COMPLIANCE SUMMARY 2
1.4 2019 SELECTION OF REMEDY REPORT SUMMARY 2

2. Remedy Implementation Progress 4

2.1 SUMMARY OF IMPLEMENTED REMEDIAL ACTIVITIES 4
2.2 SUMMARY OF REMEDIAL RESULTS 9
2.3 SUMMARY OF ANTICIPATED SUPPLEMENTAL CORRECTIVE MEASURES 11
2.4 DEMONSTRATION OF 40 CFR §257.97(B) REQUIREMENTS 11
2.5 DEMONSTRATION OF 40 CFR §257.97(C) CONSIDERATIONS 12
2.6 SCHEDULE FOR IMPLEMENTING AND COMPLETING REMEDIAL ACTIVITIES 14

3. Supplemental Remedy Selection Report Certification Statement 17

List of Tables

Table No.	Title
1 (in text)	Timeline of Remedy Implementation **(Page 4)**
2 (in text)	Summary of Implemented Remedial Activity Details (**Pages 5-6**)
3	Evaluation of Implemented Remedy – 40 CFR §257.97(c) Requirements

List of Figures

Figure No.	Title
1	Groundwater Monitoring Well Location Map
2	Selected Remedy Overview Map
3	Groundwater Extraction, Ex-situ Treatment, and Re-injection System Map
4 (in-text)	Ex-Situ Groundwater Treatment System Process Diagram (**Page 7**)
5A (in-text)	Ex-Situ Groundwater Treatment System Influent and Effluent Data Plots – Boron (**Page 9**)
5B (in-text)	Ex-Situ Groundwater Treatment System Influent and Effluent Data Plots – Molybdenum (**Page 10**)
6 (in-text)	Groundwater Constituent Concentration Trend Plots (**Page 11**)

List of Appendices

Appendix	Title
A	Response to 2019 CMA Public Comments
B	2019 Remedy Selection Report
C	SCPA Closure Completion Documentation
D	Treatability Study Documentation
E	Groundwater Extraction and Injection Well Certification Reports
F	Monitored Natural Attenuation Evaluation for Molybdenum *(produced by WSP and Rocksmith on behalf of Ameren)*
G	2018 Risk Assessment Report

1. Introduction

1.1 PURPOSE

This Supplemental Remedy Selection Report (RSR) was prepared by Haley & Aldrich, Inc. on behalf of Union Electric Company d/b/a Ameren Missouri (Ameren) for the SCPA Coal Combustion Residuals (CCR) surface impoundment located at the Sioux Energy Center (SEC, Site) located in St. Charles County, Missouri. In accordance with requirements under the U.S. Environmental Protection Agency rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities* (CCR Rule) effective 17 April 2015, including subsequent revisions, a Corrective Measure Assessment (CMA) report for SEC was prepared in May 2019 to evaluate five remedial alternatives against threshold criteria and balancing criteria outlined in the CCR Rule. An RSR for four of Ameren's CCR facilities, including SEC, was prepared on 30 August 2019 and posted to the SEC publicly available CCR website.[1] Ameren indicated in the 2019 RSR that it was actively exploring various groundwater treatment methodologies based on Site-specific data and bench scale testing. Since preparation of the 2019 RSR, such technologies have been installed and operational at SEC. Ameren applied for and received from the Missouri Department of Natural Resources (MDNR) an Underground Injection Control (UIC) permit authorizing groundwater extraction, treatment, and re-injection and has implemented the selected remedy and supplemental corrective measures. The intent of this Supplemental RSR is to document the corrective measures implemented since development of the 2019 RSR and the results of implementing those measures.

1.2 FACILITY DESCRIPTION

The SEC property encompasses approximately 1,100 acres within the floodplain between the Mississippi and Missouri Rivers approximately 12 miles west-northwest of the confluence of the rivers in northeastern St. Charles County, Missouri. CCR was historically managed in an approximately 47-acres onsite CCR surface impoundment known as SCPA located in the northwestern portion of the Site (Figure 1). The SCPA formerly operated as the primary CCR surface impoundment, collecting all CCR for the Site until 1994. In 1994, the lined SCPB CCR surface impoundment was constructed and began operating immediately east and adjacent to the SCPA. After construction of the SCPB, the SCPA began receiving only bottom ash inflows, while the adjacent SCPB began receiving fly ash inflows.

Active wet sluicing of CCR to the SCPA terminated in November 2020. Ameren initiated SCPA closure in January 2021 by dewatering, consolidating CCR material to provide stabilization and erosion control, armoring of berms, implementing stormwater controls, and installing low permeability capping. Such closure in place (CIP) activities involved dewatering in support of closure, general stabilization of existing CCR, placement of general fill, and the installation of a low-permeability geomembrane final cover system over the CCR to minimize erosion and infiltration. SCPA closure was completed on 14 October 2022, thereby transitioning the SCPA into the post-closure care requirements of the CCR Rule outlined in the Code of Federal Regulations Title 40 (40 CFR) §257.104. The estimated volume of CCR within the limits of the closed SCPA is approximately 3.3 million cubic yards.

[1] Documents referenced in this report as posted to the Ameren SEC publicly available CCR website may be obtained at the following website address: https://www.ameren.com/company/environment-and-sustainability/managing-coal-combustion/ccr-compliance-reports/sioux-energy-center

1.3 CCR RULE COMPLIANCE SUMMARY

CCR Rule groundwater monitoring has been performed in accordance with CCR Rule requirements outlined in 40 CFR §257.90 through §257.95. The monitoring has been completed through a phased approach to allow for a graduated response [i.e., detection monitoring followed by assessment monitoring and then nature and extent (N&E) investigation, as applicable]:

- The CCR groundwater monitoring network includes two background wells and six downgradient monitoring wells located around the perimeter of the SCPA (Figure 1) and are generally screened in the alluvial aquifer zone. These wells were installed in December 2015 and November 2016.
- Detection monitoring events occurred in 2017 and 2018, and results indicated concentrations of Appendix III constituents above Site-specific background values (i.e., statistically significant increases). As a result, an Assessment Monitoring Program was initiated for the SCPA.
- Assessment monitoring events initially occurred in April 2018 and subsequently in May 2018 and November 2018, and results indicated concentrations of Appendix IV constituent molybdenum above the Site-specific Groundwater Protection Standard (GWPS) (i.e., at statistically significant levels [SSLs]). As a result, a notification of the detection of SSLs above the GWPS was placed in the operating record and on the publicly available CCR website, and an investigation into the N&E of impacts to groundwater was initiated.
- N&E monitoring events occurred in November 2018 and August 2019. Results from the N&E investigation were summarized in the *2019 Annual Groundwater Monitoring and Corrective Action Report*. Those results formed the basis for the CMA report and original RSR and were used to select the Corrective Action Monitoring Well Network.

Two different groundwater monitoring networks are currently used to collect groundwater samples near the SCPA: the Detection and Assessment Monitoring Well Network (established under 40 CFR §257.91) and the Corrective Action Monitoring Well Network (established under 40 CFR §257.98). Monitoring of the two networks is conducted on a semiannual basis each year, generally simultaneously during the second and fourth quarters. A map displaying the locations of groundwater monitoring wells is provided on Figure 1.

Based on monitoring data available at the time, a CMA report for SEC was prepared in May 2019, and a public meeting was held on 31 May 2019. A summary of verbal comments received during the public meeting and written comments received after the meeting is provided in Appendix A. After completion of the CMA report and solicitation of public comment, an RSR that identified the selected remedy for the SCPA (and CCR surface impoundments at three other Ameren facilities) was prepared in August 2019. Section 1.4 provides an overview of the 2019 RSR.

1.4 2019 SELECTION OF REMEDY REPORT SUMMARY

On 30 August 2019, Ameren prepared a report entitled *Remedy Selection Report - 40 CFR § 257.97 - Rush Island, Labadie, Sioux, and Meramec CCR Basins* (2019 RSR) that outlined the remedy selected for the SCPA and CCR surface impoundments at other sites (Appendix B). The 2019 RSR indicated that numerous technical evaluations informed the final remedy selection, including groundwater modeling; human health and ecological risk assessments; groundwater treatment assessments; onsite and offsite monitoring data; rail, barge, and truck transportation studies; and a deep excavation study report.

The remedy selected for the SCPA was outlined in the CMA report as Alternative 1 (CIP with low permeability capping and monitored natural attenuation [MNA]). The 2019 RSR outlined three phases to the selected remedy:

1. Source control, stabilization, and containment of CCR by installation of a low-permeability geomembrane cap (a minimum 1 x 10^{-7} centimeters per second [cm/sec] versus 1 x 10^{-5} cm/sec required by the CCR Rule).
2. Implement MNA of groundwater concentrations upon completion of source control to address limited and localized CCR-related impacts, including modeling evaluations.
3. Preparation of Annual Groundwater Monitoring and Corrective Action Reports that address the following:
    - Demonstration that the groundwater plume(s) are stable or decreasing and not expanding.
    - An ongoing summary of baseline and periodic geochemical analysis including groundwater chemistry, subsurface soils chemical composition, and mineralogy.
    - Determination of Site-specific attenuation factors and rate of attenuation process.
    - Design of a long-term performance monitoring program based on the specific attenuation mechanism to confirm concentration reductions and document trends.

In addition, the 2019 RSR also outlined potential supplemental corrective measures that may be considered to supplement groundwater concentration reductions that are expected to result from source control (including dewatering in support of closure and installation of a low-permeability cover system) and MNA. The 2019 RSR indicated those supplemental corrective measures may include groundwater treatment and summarized results from ongoing treatment studies. The 2019 RSR also concluded that the laboratory results indicated reduction of arsenic and molybdenum concentrations may be supported by pH level adjustment in soils and groundwater, use of chemical reduction (e.g., zero valence iron), and/or bioremediation. Consideration of potential supplemental corrective measures has followed an iterative process, ultimately resulting in a groundwater extraction, ex-situ treatment, and re-injection system being constructed near the perimeter of the SCPA, as described in Section 2.1.

Since completion of the four-site 2019 RSR, annual groundwater monitoring and corrective action reports have continued to document the status of the SCPA groundwater monitoring and corrective action program, in accordance with 40 CFR §257.90(e). An alternative source demonstration was provided in the *2023 Annual Groundwater Monitoring and Corrective Action Report* to address limited cobalt and lithium SSLs that were attributed to natural geochemical variability of groundwater within the alluvial aquifer at the Site rather than impacts from the SCPA. Substantial progress has been made in implementing the selected remedy and supplemental corrective measures for the SCPA. Section 2 documents remedy implementation progress achieved to-date, including remedy activities completed and the results of those completed activities.

2. Remedy Implementation Progress

2.1 SUMMARY OF IMPLEMENTED REMEDIAL ACTIVITIES

As summarized in Section 1.4, the selected remedy for the SCPA included source control through dewatering in support of closure and CIP using a low-permeability geomembrane final cover system, MNA, preparation of Annual Groundwater Monitoring and Corrective Action Reports, and potential supplemental corrective measures. In-text Table 1 below summarizes the timeline of remedial activities that have been implemented to-date for the SCPA.

Table 1 – Timeline of Remedy Implementation

Date	Activity
August 2019	2019 RSR completed (Appendix B)
December 2019	Preliminary treatability study results report developed to document findings from a three-phase treatability study for the remediation of arsenic, molybdenum, and other metals of concern. The treatability testing focused on refining the ex-situ remedial approach in order to finalize the pilot test design. (Appendix D)
January 2020	*2019 Groundwater Monitoring and Corrective Action Report* completed[1]
November 2020	Active sluicing to the SCPA ceased
January 2021	SCPA closure initiated (Appendix C)
January 2021	*2020 Groundwater Monitoring and Corrective Action Report* completed[1]
September 2021	In-field pilot groundwater treatability study initiated
November 2021	In-field pilot groundwater treatability study completed
January 2022	Treatability study memorandum developed to document the final treatment design for ex-situ treatment based on results from extensive bench-scale laboratory treatability study and the 2021 in-field pilot study (Appendix D)
January 2022	*2021 Groundwater Monitoring and Corrective Action Report* completed[1]
October 2022	SCPA closure completed (Appendix C) Post-closure MNA initiated, as documented in *2022 Groundwater Monitoring and Corrective Action Report*[1]
January 2023	*2022 Groundwater Monitoring and Corrective Action Report* completed[1]
February 2023	Groundwater extraction, treatment, and re-injection system became fully operational[2]
September 2023	Groundwater extraction, treatment, and re-injection system started producing at target flow rates[2]
January 2024	*2023 Groundwater Monitoring and Corrective Action Report* completed[1]

[1] Annual groundwater monitoring and corrective action reports for the SCPA can be found on the Ameren RIEC publicly available CCR website

[2] After the system became fully operational in February 2023, system programming and maintenance were being adjusted to optimize system performance until target flow rates were achieved in September 2023.

In addition to development of routine annual reports that summarize groundwater monitoring and corrective action progress, the primary remedial activities that have been completed to-date include:

- SCPA source control through dewatering and CIP using a low-permeability geomembrane final cover system
  - Initiated: January 2021
  - Completed: October 2022
- Post-closure MNA
  - Initiated: October 2022
  - Ongoing
- Extraction and ex-situ treatment of downgradient impacted groundwater and re-injection of treated groundwater within the same subsurface area of impact
  - Initiated: February 2023 (full operation)
  - Ongoing

An overview of the selected remedy, including locations at the Site where the selected remedy has been implemented, is provided on Figure 2.

Table 2 below summarizes pertinent details of the remedial activities implemented to-date for the SCPA.

Table 2 – Summary of Implemented Remedial Activity Details

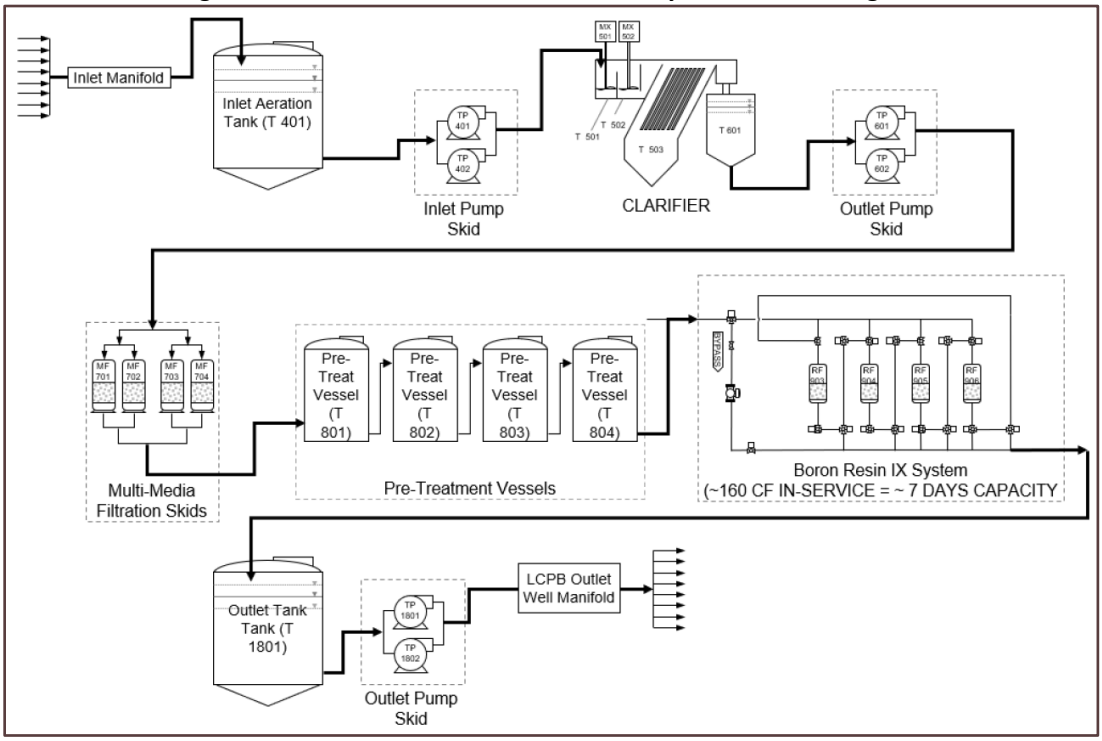
Remedial Activity	Details
SCPA Source Control	Ameren began closure of the SCPA and placed a "Notification of Intent to Close a CCR Unit and Certification for Final Cover Design System" onto its publicly available CCR website on 20 January 2021. SCPA source control entailed dewatering in support of closure, closing the CCR in-place, and installing an engineered low-permeability geomembrane cover system over the SCPA to prevent infiltration and promote stormwater drainage. Substantial installation of the low-permeability cover system was completed in 2022. As certified in a closure statement dated 14 October 2022, SCPA closure was completed in accordance with good engineering practices, including the consideration of applicable industry standards, the SCPA closure plan, and requirements of the CCR Rule. The notification of intent to close, closure completion statement, and Closure and Post-Closure Plan for the SCPA are available on the SEC publicly available CCR website and are attached to this report in Appendix C.
Post-Closure MNA	After substantial closure was completed in October 2022, post-closure MNA began with the October 2022 sampling event to address CCR-related impacts. Post-closure MNA includes monitoring of the Corrective Action Monitoring Well Network (Figure 1), and monitoring is ongoing semi-annually, generally during the second and fourth quarters of each year.
Groundwater Extraction, Ex-situ Treatment, and Re-injection System	After a series of treatability studies were completed to evaluate the feasibility and effectiveness of groundwater treatment near the SCPA, Ameren received an UIC permit (UI-0000044) and completed an in-field pilot study in 2021. Drilling of extraction and injection wells within and along the perimeter of the SCPA was completed from April 2022 through June 2022, the system became fully operational.

Table 2 – Summary of Implemented Remedial Activity Details	
Remedial Activity	**Details**
Groundwater Extraction Ex-situ Treatment, and Re-injection System (continued)	in February 2023, and achievement of target system flow rates began in September 2023. The system includes a series of nine groundwater extraction wells located within the interior of the SCPA. Extracted groundwater is pumped to one treatment building, where the influent undergoes ex-situ treatment using chemical precipitation and selective-ion exchange. After the treatment process is complete, the effluent (at significantly reduced concentrations) is re-injected into the subsurface via a series of 23 groundwater injection wells located within and along the perimeter of the SCPA (Figure 3). Available well certification records for five of the nine extraction wells and 21 of the 23 injection wells are included in Appendix E. The well certification forms for extraction wells EW-1, EW-2, EW-3, and EW-8 and for injection wells IW-5 and IW-6 are currently unavailable due to the unexpected death of the certified well driller overseeing installation of those wells; Ameren and the drilling company are working to resolve this matter.

Implementation of the remedy has followed an iterative and adaptive approach to considering potential supplemental corrective measures for the overall SCPA remedial strategy. As referenced in Appendix D, although the treatability studies were initially conducted under the assumption that results may be incorporated into in-situ groundwater treatment design considerations, evaluation of the potential for clogging from metals precipitation and considerations for treating boron led to a transition from an in-situ to an ex-situ conceptual treatment system approach for the SCPA.

Locations of the groundwater extraction wells, the ex-situ treatment building, groundwater injection wells, and associated conveyance piping are shown on Figure 3. A process flow diagram for the ex-situ treatment is illustrated on Figure 4 below.

Figure 4 – Ex-Situ Groundwater Treatment System Process Diagram



Source: Figure 2 from 2023 Annual Groundwater Monitoring and Corrective Action Report. SCPA Surface Impoundment, Sioux Energy Center, St. Charles County, Missouri, USA. 31 January 2024. Created by Loureiro Engineering Associates, Inc.

For the SCPA groundwater treatment system, a total of nine extraction wells, 23 injection wells, and one treatment building have been constructed and are operating to provide hydraulic control of impacted groundwater near the SCPA. The groundwater capture zone for the system is based on annual flow conditions radially away from the SCPA of 11 feet per year as documented in the *2018 Annual Groundwater Monitoring and Corrective Action Report*. This represents an average historical movement of a transport particle downgradient from the SCPA over a given calendar year. The average annual flow rate accounts for overall vector movement of that particle during normal, stagnant, flood, and low-level river stages throughout that calendar year. A combination of both extraction and injection wells to capture and control that movement is used in an effort to produce a net-zero difference in overall groundwater flow conditions.

Unlike other CCR surface impoundments where groundwater flow is generally linear in the downgradient direction (often to a primary surface water feature), the SCPA experiences near stagnant flow conditions in which groundwater movement from the SCPA is limited but occurs in all directions. The extraction and re-injection system is designed for internal capture with injection radially along the SCPA perimeter. While some areas in the interior of the SCPA experience reverse flow toward an extraction point, the volume treated is re-introduced within and along the perimeter, resulting in no change in overall flow conditions a short distance from the injection points.

The design accounts for radial hydraulic control along nearly 6,500 linear feet of perimeter of the 50-acre SCPA. Historical Site groundwater data along the perimeter was used to identify areas of elevated concentration as a focus for extraction and treatment. Extraction is from the interior of the pond and injection is along the perimeter. The perimeter injection provides a means of maintaining a hydraulic barrier using injection that prevents impacted water flow away from the pond while maintaining natural flow conditions (near net-zero changes) in all directions with treated water. An estimated volume of nearly 26,000,000 gallons of water will be extracted, treated, and re-injected each year. The well spacing is variable to account for the shape of the pond and address areas of highest concentration within the pond but simulates an inner circle of extraction wells (nine) and an outer circle of injection wells (twenty-three). Monthly average extraction rates [2.7 to 7.7 gallons per minute (gpm)] and injection rates (1-3 gpm) per well are variable to account for concentration ranges, well spacing, and control. The ratio of higher to lower concentration extraction is intended to maintain a boron concentration of the influent to be within an optimal range for the selected ion-exchange resin. The system is designed to operate with a greater than 90 percent run time with a total extraction rate range of 45 to 52 gpm.

The groundwater treatment system is designed to be controlled and operated physically at the Site or remotely. The system is controlled and operated by a touch screen interface with some automation routines to handle tasks that are required to operate remotely when the system is unattended. Remote access to the system can be achieved by the operator on a personal computer and via mobile phone. Remote access functionality for system controls and operations is nearly identical to managing physical system controls and operations at the Site; however, a remote operator does not have access to limited hand-operated switches which are required for some maintenance operations.

This remote access provides a wide range of functions including (but not limited to):

- Monitoring of real-time data (e.g., gallons processed, system pressures, rate of flow in process piping, individual tank levels, system temperatures, water parameters such as pH and conductivity, valve open/closed status, and system alarms).
- Initiation of automation routines (e.g., sand media backwash, sludge transfer, resin media regeneration, holding tank recirculation/pH adjustments).
- Real-time flow rate adjustments of the extraction wells, transfer pumps, and chemical dosing pumps.
- Real-time process changes such as:
  - Clear alarms and restart system, if needed.
  - Change how often automation routines initiate, for example how often sludge should be transferred from a clarifier.
  - Increase/decrease how many gallons to use for a specific event i.e. sand media backwash.
  - Adjust distribution of treated water, i.e., how much water to place in storage versus discharge to well field.
  - Increase efficiency of resin media absorption by adjust of process water pH right before it enters the resin media.

Evaluation of treatment system influent/effluent and groundwater monitoring results over the initial year of full-scale system operations indicate removal of constituent mass and generally positive results, as described in Section 2.2.

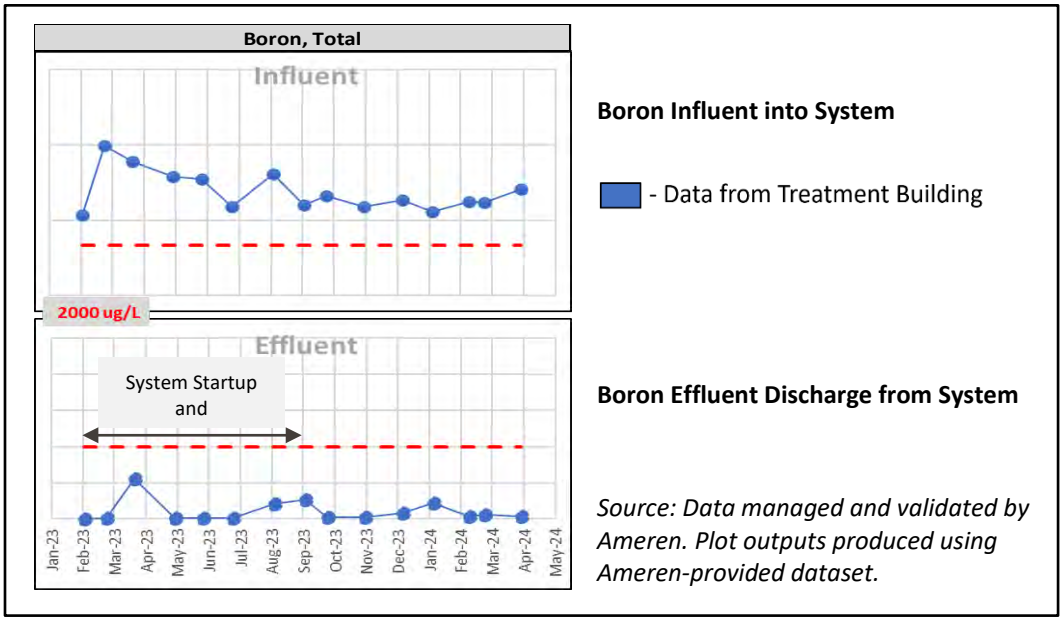
2.2 SUMMARY OF REMEDIAL RESULTS

Based on available monitoring data, completed SCPA source control (including dewatering in support of closure and installation of a low-permeability cover system), ongoing natural attenuation processes, and supplemental groundwater extraction and treatment appear to be collectively contributing to a general reduction in constituent concentrations in groundwater near the SCPA.

Since the remedy for the SCPA was selected in 2019, annual groundwater monitoring and corrective action reports have documented progress in remedy implementation and summarized groundwater monitoring results.[2] As discussed in annual groundwater monitoring and corrective measures reports posted to the SEC publicly available CCR website, implemented corrective measures are positively influencing groundwater near the SCPA by removing constituent mass and generally reducing average constituent concentrations in groundwater.

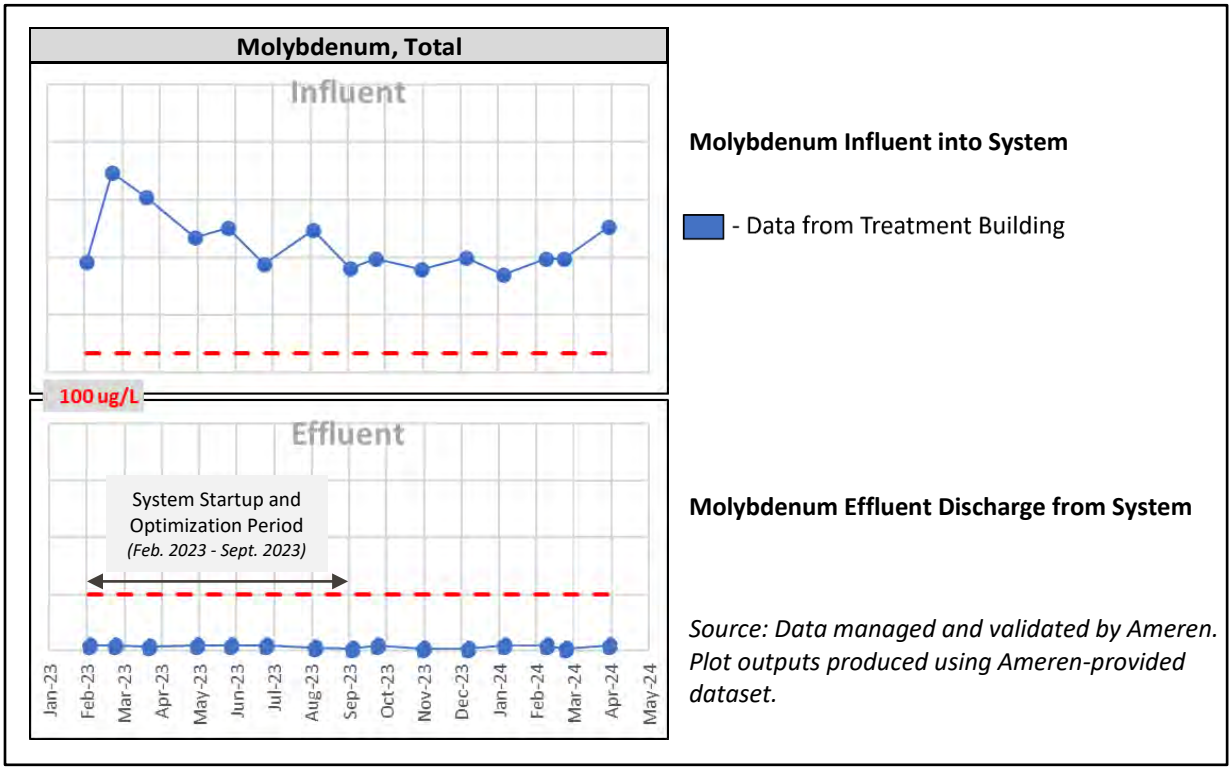
SCPA groundwater treatment system influent and effluent data collected since February 2023 (when the treatment system became fully operational), clearly demonstrate significant reductions in primary CCR constituents as a result of the ex-situ treatment process (Figure 5A and Figure 5B below). Figures 5A and 5B below illustrate that treatment system effluent (daily maximum) concentrations have remained below monthly average compliance limitations established in the MDNR UIC permit for effluent discharge to groundwater, which meet drinking water action levels for the primary Appendix IV constituent molybdenum and primary Appendix III constituent boron.

Figure 5A – Ex-Situ Groundwater Treatment System
Influent and Effluent Data Plots – Boron



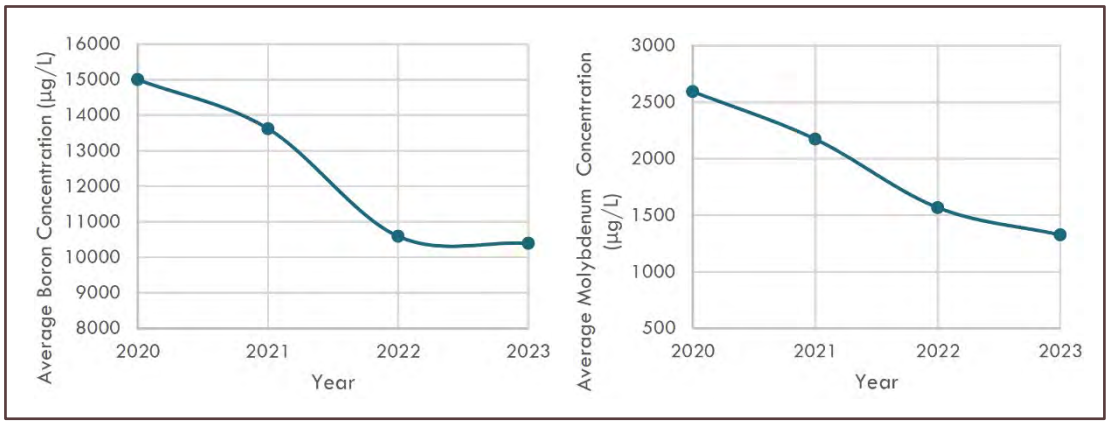
[2] Individual monitoring well statistical evaluations are conducted for semiannual assessment and corrective action monitoring results for Appendix IV constituents. Those statistical analyses are documented in annual groundwater monitoring and corrective action reports posted on the publicly available CCR website.

Figure 5B – Ex-Situ Groundwater Treatment System
Influent and Effluent Data Plots – Molybdenum



In addition to decreasing constituent concentrations recorded in ex-situ treatment system influent and effluent as a result of the treatment process, stable or decreasing constituent concentrations have been recorded in groundwater at many monitoring wells directly adjacent to the SCPA and groundwater treatment system since remedial activities have been implemented. Site groundwater monitoring data collected during the last few years appear to support a general downward trend in total constituent mass in groundwater. For instance, the average concentrations for molybdenum and boron in groundwater at monitoring wells directly adjacent to the SCPA have shown predominately decreasing concentrations over time, as illustrated on Figure 6 below.

Figure 6 – Groundwater Constituent Concentration Trend Plots



Source: Figures 4 and 5 from 2023 Annual Groundwater Monitoring and Corrective Action Report. SCPA Surface Impoundment, Sioux Energy Center, St. Charles County, Missouri, USA. 31 January 2024. Created by Rocksmith Geoengineering, LLC.

As illustrated on Figure 6 above, average concentrations in monitoring wells directly adjacent to the SCPA have decreased, with average concentration reductions as follows[3]:

- boron – decreased by 31 percent
- molybdenum – decreased by 49 percent

These results indicate that the corrective measures implemented to-date by Ameren are effectively contributing to constituent mass reductions in groundwater near the SCPA. As additional time passes since completion of SCPA source control and initiation of the groundwater treatment system, constituent mass and concentrations in groundwater near the SCPA are anticipated to continue decreasing. Furthermore, groundwater modeling for the Site (which currently does not incorporate the operating extraction and re-injection system) indicates constituent concentrations will decrease in magnitude adjacent to the SCPA in the long-term, albeit slowly over time due to near-stagnant groundwater flow conditions.

2.3 SUMMARY OF ANTICIPATED SUPPLEMENTAL CORRECTIVE MEASURES

MNA and groundwater treatment by means of extraction, ex-situ treatment, and re-injection are ongoing for the SCPA. SCPA closure was completed in October 2022. No additional supplemental corrective measures are anticipated at this time.

2.4 DEMONSTRATION OF 40 CFR §257.97(B) REQUIREMENTS

In accordance with 40 CFR §257.97(b), a remedy must meet the following requirements (i.e., "threshold criteria"):

> *(1) Be protective of human health and the environment;*
>
> *(2) Achieve the groundwater protection standard pursuant to 40 CFR §257.95(h);*
>
> *(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV [of the CCR Rule] into the environment;*

[3] Based on calculations performed by Rocksmith Geoengineering, LLC, for data collected from 2020 to 2023.

(4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and

(5) Comply with certain standards for management of wastes as specified in [40 CFR] §257.98(d).

In May 2019, Ameren completed the CMA Report for the SCPA and posted the report to its publicly available CCR website. The CMA Report considered five corrective measures alternatives, all of which were demonstrated to meet the threshold criteria listed above. The CMA Report also included the summary results of the assessment of numerous technical evaluations conducted, which include groundwater and geochemical modeling, human health and ecological risk assessments, and N&E of CCR constituents in groundwater assessments. Results of these technical evaluations indicated each of the five corrective measures alternatives effectively satisfied the requirements under 40 CFR §257.97(b), listed above.

In its 2019 RSR, Ameren selected CMA Alternative 1 (CIP with capping and MNA), noting that supplemental corrective measures were being evaluated and may be implemented as part of an iterative remedial strategy. Since completion of the CMA Report and 2019 RSR, Ameren has implemented a supplemental corrective measure for the SCPA in the form of a groundwater extraction, ex-situ treatment, and re-injection system within and along the perimeter of the SCPA, as described in Section 2.1. Although the specific details of this supplemental corrective measure were not directly evaluated in the CMA Report, groundwater pumping with ex-situ treatment was evaluated along with CIP with capping as a component of Alternative 4, which (like Alternative 1) were also considered to effectively satisfy the requirements under 40 CFR §257.97(b). The additional corrective measure of re-injecting treated water into the subsurface area of impact serves to enhance the rate of constituent concentration reductions in local groundwater, prevents the need to collect and dispose of or discharge the treated water, and meets the requirements under 40 CFR §257.97(b).

Based on the prior CMA evaluation and consideration of the supplemental corrective measures implemented for the SCPA, the remedy implemented for the SCPA meets the requirements of the 40 CFR §257.97(b) threshold criteria. The groundwater extraction, ex-situ treatment, and re-injection system has been demonstrated to effectively reduce local constituent concentrations in groundwater near the SCPA, as summarized in Section 2.2. These active remedial steps serve to supplement, or enhance, constituent concentration reductions already promoted by completed SCPA closure and ongoing natural attenuation processes.

2.5 DEMONSTRATION OF 40 CFR §257.97(C) CONSIDERATIONS

In accordance with 40 CFR §257.97(c), the owner of a CCR unit must consider the following evaluation factors (i.e., “balancing criteria”) when selecting a remedy that satisfies the threshold criteria under 40 CFR §257.97(b):

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) Magnitude of reduction of existing risks;

(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;

(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance;

(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;

(v) Time until full protection is achieved;

(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;

(vii) Long-term reliability of the engineering and institutional controls; and

(viii) Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

(i) The extent to which containment practices will reduce further releases; and

(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

(i) Degree of difficulty associated with constructing the technology;

(ii) Expected operational reliability of the technologies;

(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;

(iv) Availability of necessary equipment and specialists; and

(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) The degree to which community concerns are addressed by a potential remedy(s).

The CMA Report compared the five corrective measures alternatives relative to one another with respect to the first three primary balancing criteria identified in the CCR Rule: long-term and short-term effectiveness, source control, and implementability. The fourth balancing criterion, community concerns, was considered after the public meeting was held on 31 May 2019 and the period of public comment was completed.

Similar to consideration of the threshold criteria under 40 CFR §257.97(b) discussed in Section 2.4, appropriate consideration of the balancing criteria under 40 CFR §257.97(c) for the implemented SCPA remedy should consider how the CMA Report evaluated Alternatives 1 and 4, collectively. In the CMA Report, Alternatives 1 and 4 received a “favorable” or “less favorable” rating for each of the balancing criteria, and the alternatives received no “unfavorable” ratings under any of the balancing criteria. Based on the CMA favorability ratings for Alternatives 1 and 4, the implemented remedy (primarily a combination of Alternatives 1 and 4) is also considered relatively highly favorable.

Table 3 provides an evaluation of the implemented remedy against each of the balancing criteria outlined under 40 CFR §257.97(c). Based on the prior CMA evaluation and consideration of the supplemental corrective measures implemented for the SCPA, the remedy implemented for the SCPA effectively addresses the 40 CFR §257.97(c) balancing criteria, as documented in Table 3. The groundwater extraction, ex-situ treatment, and re-injection system has been demonstrated to generally reduce local constituent concentrations in groundwater and remove constituent mass from

groundwater, as summarized in Section 2.2. These active remedial steps serve to supplement, or enhance, constituent concentration reductions already promoted by completed SCPA closure and ongoing natural attenuation processes.

The groundwater treatment system has been fully operational at targeted flow rates for less than a year, since September 2023. Once the system has been fully operational for a few years and sampling indicates treated water has reached the compliance wells, Ameren will evaluate the need for modeling updates to assess the effects of groundwater extraction and re-injection on molybdenum concentrations near the SCPA and to predict the timeframe for attaining the molybdenum GWPS based on the existing groundwater extraction, ex-situ treatment, and re-injection system.

Previously completed modeling results indicate completed source control (including dewatering in support of closure and installation of a low-permeability cover system) and ongoing natural attenuation processes are expected to result in overall reductions of molybdenum concentrations in groundwater over time. Furthermore, the groundwater extraction and treatment occurring at the Site is expected to result in additional reductions of molybdenum concentrations in groundwater along and near the SCPA waste boundary over time to achieve the GWPS more effectively and at an increased rate when compared to source control and MNA alone.

In addition to modeling, WSP USA, Inc. (WSP) and Rocksmith Geoengineering, LLC (Rocksmith), on behalf of Ameren, developed a multi-tiered MNA evaluation report to evaluate the anticipated effects of natural attenuation processes on molybdenum concentrations in groundwater (Appendix F). This evaluation did not consider the effects of groundwater extraction and treatment, which have been recently implemented at the Site. The methods and assumptions WSP and Rocksmith used to estimate the amount of time for molybdenum concentrations in groundwater to decrease to the GWPS as well as the results of their evaluations (including their estimated timeframes to achieve the GWPS) are documented in Appendix F. Results from ongoing post-closure corrective action monitoring will be used to determine the effectiveness of MNA (in conjunction with source control and groundwater extraction and treatment) in remediating molybdenum SSLs above the GWPS outside the area of groundwater extraction and treatment influence.

2.6 SCHEDULE FOR IMPLEMENTING AND COMPLETING REMEDIAL ACTIVITIES

Section 2.1 summarizes remedial activities that have been implemented for the SCPA. Closure of the SCPA began in January 2021 and was completed in October 2022. After laboratory bench-scale testing indicated favorable results, Ameren conducted an in-field pilot study in 2021 for its groundwater extraction, ex-situ treatment, and re-injection system, which has been fully operating since February 2023 within and along the perimeter of the SCPA. Evaluation of monitoring results and documentation of remedy implementation progress have been included in annual groundwater monitoring and corrective action reports. Preparation of annual reports will continue.

In accordance with 40 CFR §257.97(d), the owner of a CCR unit must specify schedule(s) for implementing and completing remedial activities, requiring completion of remedial activities within a reasonable timeframe that considers the following factors:

> *(1) Extent and nature of contamination, as determined by the characterization required under §257.95(g);*

(2) Reasonable probabilities of remedial technologies in achieving compliance with the groundwater protection standards established under §257.95(h) and other objectives of the Remedy;

(3) Availability of treatment or disposal capacity for CCR managed during implementation of the remedy;

(4) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;

(5) Resource value of the aquifer including:

(i) Current and future uses;

(ii) Proximity and withdrawal rate of users;

(iii) Groundwater quantity and quality;

(iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to CCR constituents;

(v) The hydrogeologic characteristic of the facility and surrounding land; and

(6) Other relevant factors.

Implementation of the selected remedy has been performed in an expeditious fashion, as summarized in Section 2.1. SCPA closure was completed in approximately 21 months. Closure of the SCPA by CIP allowed source control to be completed much sooner (approximately 15 or more years sooner, based on the CMA Report) than would have been possible with an alternative closure by removal method, especially given the technical and logistical challenges with excavating near the Mississippi and Missouri Rivers.

The risk assessment report developed for the Site in 2018 concluded no unacceptable risk to human health or the environment associated with groundwater at the SCPA (Appendix G). Since completion of the risk assessment report, SCPA closure is complete, groundwater extraction and treatment are ongoing, and constituent concentration reductions have been observed. The potential for exposure of humans and the environment to CCR material that existed prior to SCPA closure has been mitigated by completion of SCPA closure and installation of an engineered final cover system. The final cover system was constructed quickly and allowed CCR material to remain onsite, thereby limiting the duration of potential exposure of humans or the environment to the CCR. Based on improved Site conditions since completion of the 2018 risk assessment report, conclusions from that risk assessment are validated.

The 2018 risk assessment report also noted that two water supply wells located within a one-mile radius of the Site, with one of the wells situated onsite and out of service. The offsite well is a private water supply well screened in the bedrock aquifer and located near the northern bank of the Missouri River south of the Site. The offsite water supply wells is beyond the extent of CCR constituent migration from the SCPA and screened in a deeper aquifer than the shallow aquifer where impacts exist onsite.

Ex-situ treatment of impacted groundwater is occurring onsite and in a sustainable manner that allows the treated groundwater to be re-injected into the area of impacted groundwater within and along the perimeter of the SCPA. Groundwater and geochemical modeling performed to-date has evaluated post-closure conditions and predicted molybdenum concentration changes over time under an MNA scenario. Groundwater modeling scenarios simulating the groundwater extraction and re-injection system that is currently operating at the Site have not been evaluated to-date. The groundwater

treatment system has been fully operational at targeted flow rates for less than a year, since September 2023. Once the system has been fully operational for a few years and sampling indicates treated water has reached the compliance wells, Ameren will evaluate the need for modeling updates to assess the effects of groundwater extraction and re-injection.

Anticipated future remedy-related activities include:

- Extraction, ex-situ treatment, and re-injection of impacted groundwater within and along the perimeter of the SCPA (ongoing).
- Semiannual corrective action monitoring (ongoing).
- Evaluation of corrective action effectiveness on CCR constituent concentrations in groundwater (ongoing).
- Annual groundwater monitoring and corrective action report development (ongoing).

Annual groundwater monitoring and corrective action reports will continue to document groundwater analytical results and constituent concentration trends over time. Updated Site data and available modeling results will be used to confirm model-predicted durations for achievement of GWPSs. Supplemental or alternative corrective measures may continue to be considered if results or modeling indicate constituent concentration reductions are not occurring sufficient to achieve GWPSs within a reasonable timeframe. In such a case, the array of potential supplemental or alternative corrective measures that may be considered would likely be similar to the measures and alternatives developed and evaluated in the CMA report.

Based on the information outlined above, the remedy has been implemented and is anticipated to be completed in a manner consistent with consideration of the factors listed in 40 CFR §257.97(d).

3. Supplemental Remedy Selection Report Certification Statement

I, Steven F. Putrich, am a professional engineer and licensed in the state of Missouri. I have reviewed this Selection of Remedy report for the Ameren Missouri Sioux Energy Center SCPA coal combustion residuals surface impoundment located in St. Charles County, Missouri. I hereby certify that this report has been prepared in general conformance with and meets the requirements of 40 CFR § 257.97 of the U. S. Environmental Protection Agency's CCR Rule entitled "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities." 80 Fed. Reg. 21302 (17 April 2015) (promulgating 40 CFR § 257.61); 83 Fed. Reg. 36435 (30 July 2018) (amending 40 CFR § 257.61) (the CCR Rule).

Signed:_____
Certifying Engineer

Print Name:	Steven F. Putrich, P.E.
Missouri License No.:	2014035813
Title:	Project Principal
Company:	Haley & Aldrich, Inc.

Professional Engineers Seal:

7/22/2024

HALEY ALDRICH

TABLES

TABLE 3
EVALUATION OF IMPLEMENTED REMEDY – 40 CFR §257.97(c) REQUIREMENTS
SUPPLEMENTAL REMEDY SELECTION REPORT – SCPA
SIOUX ENERGY CENTER – ST. CHARLES COUNTY, MISSOURI

General Description	Implemented Remedy[1] CIP with Capping, MNA, and Hydraulic Containment through Groundwater Pumping, Ex-situ Treatment, and Re-injection[1]
257.97(c)(1) The long- and short-term effectiveness and protectiveness of the remedy(s), along with the degree of certainty that the remedy will prove successful	
(i) Magnitude of reduction of existing risk	No unacceptable risk to human health and the environment exists based on the risk assessment in Appendix G and included in the CMA Report. The SCPA has been closed in place with a low-permeability engineered final cover system. The final cover system further contains the CCR material in the SCPA and reduces the risk of the CCR entering the environment. A groundwater extraction, ex-situ treatment, and re-injection system has also been constructed and is operating within and along the perimeter of the SCPA and provides hydraulic containment of impacted groundwater.
(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy	The low-permeability final cover system for the SCPA contains the underlying CCR material and significantly reduces the infiltration of precipitation into the CCR. Further protection from further releases is also provided through use of the hydraulic containment provided by the operating groundwater extraction, ex-situ treatment, and re-injection system within and along the perimeter of the SCPA. Therefore, the residual risks in terms of likelihood of further releases due to CCR remaining is considered low.
(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance	Long-term management of the implemented remedy includes limited O&M of the final cover system, monitoring wells, groundwater extraction wells, groundwater treatment building and associated equipment, re-injection wells, and associated system conveyances. The degree of long-term management required for the closed SCPA is generally limited to routine vegetative maintenance (e.g., mowing/trimming) of the final cover system during the growing season and the potential for non-routine maintenance of the final cover system (e.g., limited soil regrading in the event of side-slope erosion caused by stormwater runoff). After the groundwater extraction, ex-situ treatment, and re-injection system has sufficiently attained remedial objectives in the area within and along the perimeter of the SCPA, MNA would involve relatively less long-term management, including routine groundwater monitoring and the potential for non-routine monitoring well maintenance (e.g., repair or replacement in the event that damage occurs to a monitoring well).
(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy	Since closure and groundwater treatment system construction activities have already been completed, potential short-term risks to the community or the environment are very limited. Also, the implemented remedy is entirely contained within the Site boundary, which greatly reduces any potential risks to the community or environment. Closure of the SCPA was completed via CIP in October 2022. CIP involves a relatively lower degree of short-term risks posed to the community or environment. Construction of the groundwater extraction, ex-situ treatment, and re-injection system is already complete, and full-scale operations have been ongoing since February 2023.
(v) Time until full protection is achieved	No unacceptable risk to human health or the environment exists based on the risk assessment in Appendix G and included in the CMA Report. Therefore, protection is already achieved. Groundwater and geochemical modeling performed to-date has evaluated post-closure conditions and predicted molybdenum concentration changes over time under a post-closure MNA scenario. Groundwater modeling scenarios simulating the groundwater extraction and re-injection system that is currently operating at the Site have not been evaluated to-date. The groundwater treatment system has been fully operational at targeted flow rates for less than a year, since September 2023. Once the system has been fully operational for a few years and sampling indicates treated water has reached the compliance wells, Ameren will evaluate the need for modeling updates to assess the effects of groundwater extraction and re-injection. Previously completed modeling results indicate completed source control (including removal of free water and installation of a low-permeability cover system) and ongoing natural attenuation processes are expected to result in overall reductions of molybdenum concentrations in groundwater over time. Furthermore, the groundwater extraction and treatment occurring at the Site is expected to result in additional reductions of molybdenum concentrations in groundwater along and near the SCPA waste boundary over time to achieve the GWPS more effectively and at an increased rate when compared to source control and MNA alone. In addition to modeling, Rocksmith Geoengineering, LLC (Rocksmith) and WSP USA, Inc. (WSP), on behalf of Ameren, developed a multi-tiered MNA evaluation report to evaluate the anticipated effects of natural attenuation processes on molybdenum concentrations in groundwater (Appendix F). This evaluation did not consider the effects of groundwater extraction and treatment, which have been recently implemented at the Site. The methods and assumptions Rocksmith and WSP used to estimate the amount of time for molybdenum concentrations in groundwater to decrease to the GWPS as well as the results of their evaluations (including their estimated timeframes to achieve the GWPS) are documented in Appendix F. Results from ongoing post-closure corrective action monitoring will be used to determine the effectiveness of MNA (in conjunction with source control and groundwater extraction and treatment) in remediating molybdenum SSLs above the GWPS.
(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment	SCPA closure was completed in October 2022 via CIP, which substantially reduced the potential for exposure of humans and environmental receptors to remaining wastes during closure activities compared to CBR. The remaining CCR material is contained within a low-permeability engineered final cover system, which greatly limits the potential for post-closure exposure to the CCR. Limited potential for exposure of Site workers to secondary waste streams produced as part of the ex-situ groundwater treatment process exists; however, that potential for exposure is mitigated through use of proper personal protective equipment and best management practices.
(vii) Long-term reliability of the engineering and institutional controls	Closure of the SCPA by CIP has already been completed, and CIP is a proven long-term solution for CCR management. Extensive laboratory bench-scale testing and in-field pilot testing of the groundwater extraction, ex-situ treatment, and re-injection system were performed prior to full-scale operations began in February 2023. Results of the testing and ongoing groundwater monitoring indicate the system is able to effectively treat the primary Appendix IV constituent molybdenum. Ongoing O&M of the system will be necessary, but with proper maintenance the system is anticipated to remain effective in treating impacted groundwater over the long-term.
(viii) Potential need for replacement of the remedy	The CIP method used to close the SCPA is considered permanent and effective at preventing CCR release into the environment and reducing infiltration of precipitation into the CCR. The groundwater extraction, ex-situ treatment, and re-injection system is an effective method for removing constituent mass in impacted groundwater and reducing constituent concentrations in groundwater within and along the perimeter of the SCPA. Although groundwater modeling indicates molybdenum concentrations are predicted to reduce over time, the system could be modified in the future if remedial objectives are not being met as expected.
257.97(c)(2) The Effectiveness of the Remedy in Controlling the Source to Reduce Further Releases	
(i) The extent to which containment practices will reduce further releases	SCPA closure was completed in October 2022 via CIP using a low-permeability final cover system that limits infiltration of precipitation into underlying CCR material and protects from future CCR releases through engineered containment of the underlying CCR material. The groundwater extraction, ex-situ treatment, and re-injection system also provides hydraulic containment of impacted groundwater within and along the perimeter of the SCPA.
(ii) The extent to which treatment technologies may be used	The implemented remedy uses ex-situ treatment to reduce constituent concentrations in extracted groundwater prior to re-injecting the treated groundwater (at much lower constituent concentrations) into the same zone of impacted groundwater within and along the perimeter of the SCPA. Chemical precipitation and selective-ion exchange are the primary treatment technologies used in the ex-situ treatment process. Whereas the CMA Report previously considered use of groundwater pumping and ex-situ treatment to be less favorable under this balancing criterion due to creation of a secondary waste stream, this evaluation considers the groundwater extraction, ex-situ treatment, and re-injection system most favorable due to operation of a system that has been proven effective at removing constituent mass and reducing constituent concentrations in groundwater based on results from completed laboratory bench-scale testing and in-field pilot testing and ongoing groundwater monitoring.
257.97(c)(3) The Ease or Difficulty of Implementing a Potential Remedy	
(i) Degree of difficulty associated with constructing the technology	The CIP method used to close the SCPA was substantially less difficult to implement than the alternative CBR or ISS methods that were considered unfavorable under this balancing criterion in the CMA Report due to technical and logistical challenges. The groundwater extraction, ex-situ treatment, and re-injection system involved a moderate degree of difficulty in constructing the system relative to MNA; however, full-scale operations have been ongoing since February 2023, and no further construction is anticipated at this time.
(ii) Expected operational reliability of the technologies	Closure of the SCPA is complete, and only ongoing O&M of the final cover system is necessary. Operation of the groundwater extraction, ex-situ treatment, and re-injection system is generally reliable, with temporary shutdowns necessary for routine or non-routine maintenance, repair, or replacement.
(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies	Closure-related permitting and approvals were obtained to support SCPA closure by CIP, which required less permitting and approvals than the alternative CBR or ISS methods that were considered unfavorable under this balancing criterion in the CMA Report. After a series of treatability studies were completed to evaluate the feasibility and effectiveness of groundwater treatment near the SCPA, Ameren received an UIC permit UI-0000044 and completed an in-field pilot study in 2021. The groundwater extraction, ex-situ treatment, and re-injection system became fully operational within and along the perimeter of the SCPA in February 2023.

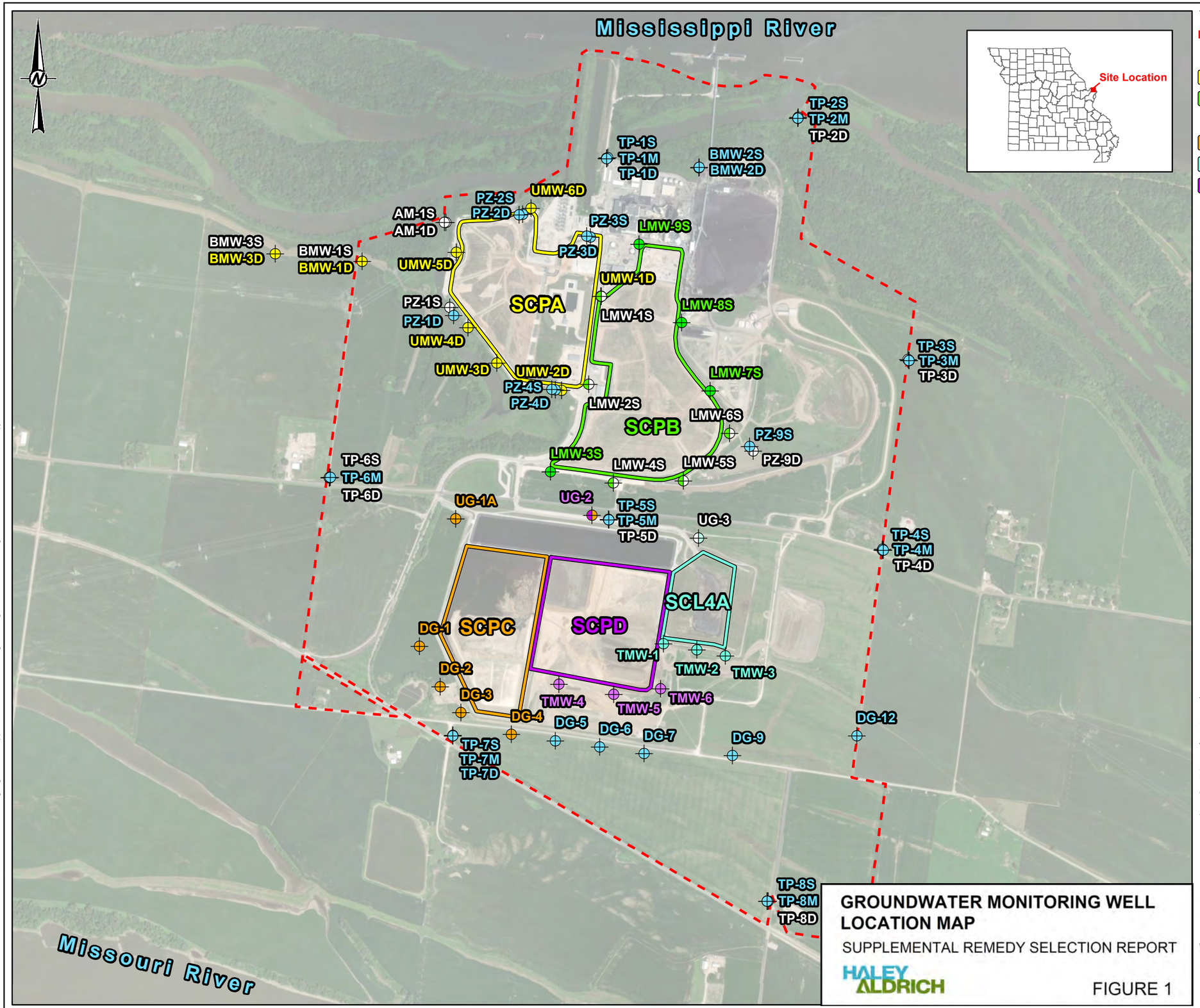
TABLE 3
EVALUATION OF IMPLEMENTED REMEDY – 40 CFR §257.97(c) REQUIREMENTS
SUPPLEMENTAL REMEDY SELECTION REPORT – SCPA
SIOUX ENERGY CENTER – ST. CHARLES COUNTY, MISSOURI

General Description	Implemented Remedy[1]
	CIP with Capping, MNA, and Hydraulic Containment through Groundwater Pumping, Ex-situ Treatment, and Re-injection[1]
(iv) Availability of necessary equipment and specialists	Equipment and specialist needs were less to support SCPA closure by CIP relative to the alternative CBR or ISS methods that were considered unfavorable under this balancing criterion in the CMA Report. Additional equipment and specialists were needed to perform laboratory bench-scale and in-field testing as well as construction of the groundwater extraction, ex-situ treatment, and re-injection system. That system became fully operational in February 2023, and limited staff are needed to support ongoing O&M of the system.
(v) Available capacity and location of needed treatment, storage, and disposal services	CIP of the SCPA allowed CCR material to remain onsite and in-place, which would not have been possible under a CBR scenario. Re-injection of treated groundwater into the same zone of impacted groundwater within and along the perimeter of the SCPA was a solution that allows the system to be self-contained, further reduces constituent concentrations in impacted groundwater, and prevents the need for disposal or discharge to surface water. Approximately 11.5 million gallons of water were treated in 2023.

Notes:
[1] *- The implemented remedy is a combination of the CMA Report's Alternative 1 and Alternative 4, with an additional corrective measure in the form of re-injecting the treated groundwater into the area of impacted groundwater within and along the perimeter of the SCPA.*

Abbreviations:
CBR = closure by removal
CCR = coal combustion residuals
CIP = closure in place
CMA = Corrective Measures Assessment
GWPS = Groundwater Protection Standard
ISS = In-situ stabilization
MNA = monitored natural attenuation
O&M = operations and maintenance
SCPA = SCPA surface impoundment (CCR unit)
UIC = Underground Injection Control

FIGURES



LEGEND

- Sioux Energy Center Property Boundary

CCR Units

- SCPA - Closed Bottom Ash Surface Impoundment
- SCPB - Closed Fly Ash Surface Impoundment

Utility Waste Landfill (UWL)

- SCPC - WFGD Surface Impoundment
- SCL4A - Dry CCR Disposal Area
- SCPD - WFGD Surface Impoundment

Monitoring Well Networks

- Corrective Action Monitoring Well
- SCPA Detection and Assessment Monitoring Well
- SCPB and Corrective Action Monitoring Well
- SCPB Detection Monitoring Well
- SCPC Detection Monitoring Well
- SCPD and SCPC Detection Monitoring Well
- SCPD Detection Monitoring Well
- SCL4A and Corrective Action Monitoring Well
- SCL4A Detection Monitoring Well
- Monitoring Well Used for Water Level Elevation Measurements Only

0 1,000 2,000 3,000

Feet

NOTE(S)

1.) ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE.
2.) WFGD - WET FLUE GAS DESULFURIZATION
3.) CCR - COAL COMBUSTION RESIDUALS

REFERENCE(S)

1.) AMEREN MISSOURI SIOUX ENERGY CENTER, SIOUX PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.

CLIENT
AMEREN MISSOURI
SIOUX ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

GROUNDWATER MONITORING WELL LOCATION MAP

SUPPLEMENTAL REMEDY SELECTION REPORT

HALEY ALDRICH

FIGURE 1

TITLE
SIOUX ENERGY CENTER GROUNDWATER MONITORING PROGRAMS AND SAMPLE LOCATION MAP

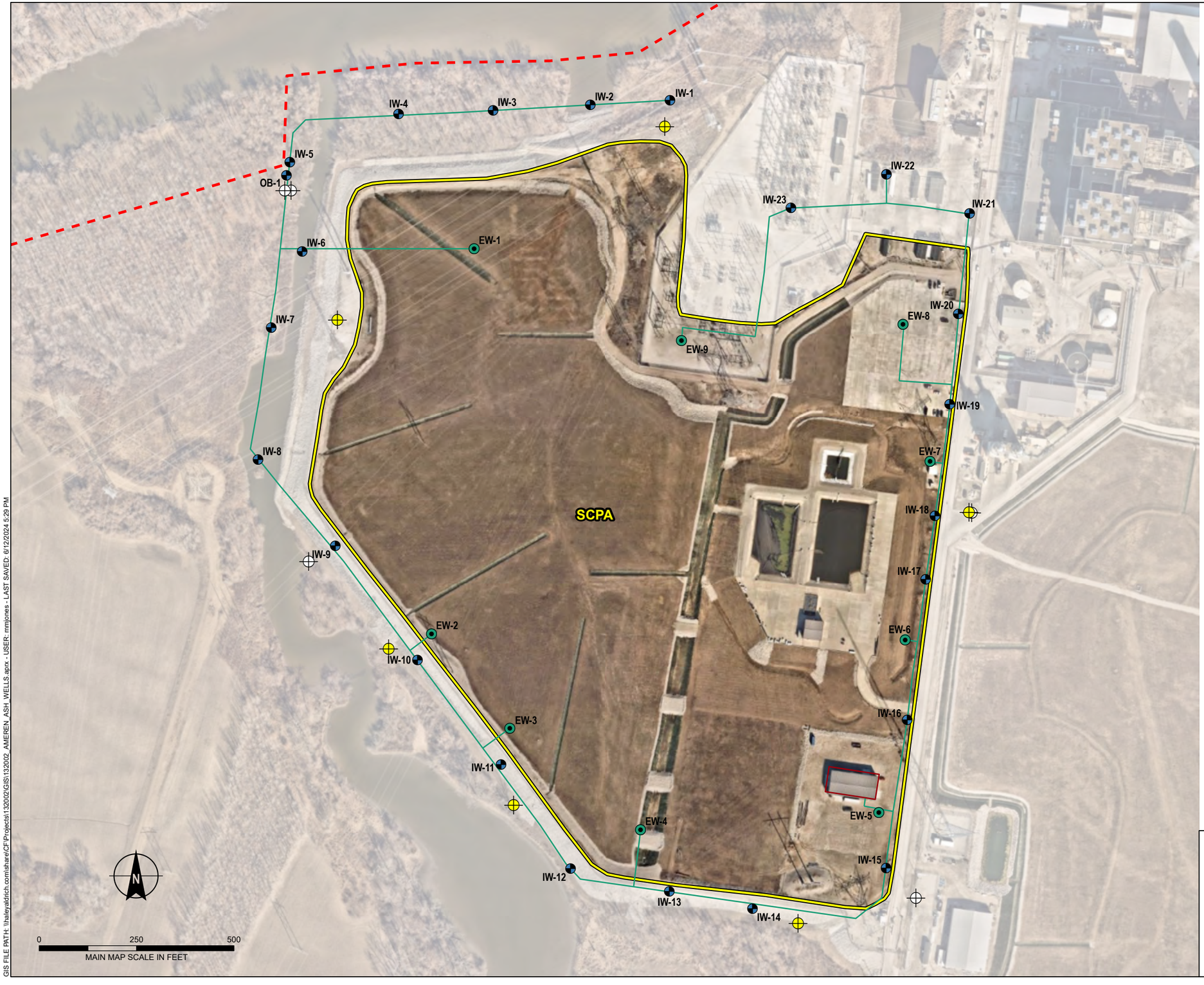
CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	JSI
PREPARED	EMS
REVIEWED	GTM/JSI
APPROVED	MNH

PROJECT NO.	CONTROL	REV.	FIGURE
1531406-04	1240	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

PATH: C:\Users\Eschneider\Golder Associates\1531406\01.02 - Ameren CCR GW Monitoring Program 2020 - APF (1)\5 Technical Work\0003-SEC\3.5-Figures-Drawings\PRODUCTION\MNA Eval\Figure XX - CCR WELL PROGRAMS - MNA - Copy.mxd PRINTED ON: 2022-12-12 AT: 8:34:56 AM

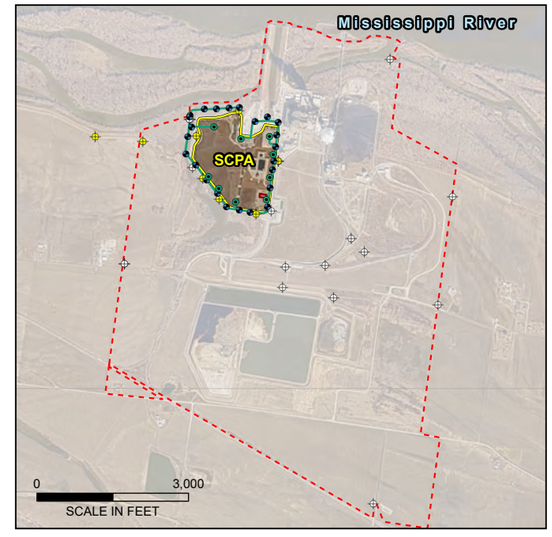


LEGEND

- GROUNDWATER INJECTION WELL
- GROUNDWATER EXTRACTION WELL
- CORRECTIVE ACTION MONITORING WELL
- SCPA DETECTION AND ASSESSMENT MONITORING WELL
- INJECTION AND EXTRACTION PIPING TRENCH
- EX-SITU GROUNDATER TREATMENT BUILDING
- SCPA - BOTTOM ASH SURFACE IMPOUNDMENT (CLOSED)
- SIOUX ENERGY CENTER PROPERTY BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SEE FIGURE 1 FOR INDIVIDUAL MONITORING WELL IDENTIFICATION INFORMATION.
3. SEE FIGURE 3 FOR INDIVIDUAL EXTRACTION AND INJECTION WELL IDENTIFICATION INFORMATION.
4. AERIAL IMAGERY SOURCE: NEARMAP, 9 FEBRUARY 2024



HALEY ALDRICH

SIOUX ENERGY CENTER
ST. CHARLES COUNTY, MISSOURI
SUPPLEMENTAL REMEDY SELECTION REPORT

SELECTED REMEDY OVERVIEW MAP

JUNE 2024

FIGURE 2

GIS FILE PATH: \\haleyaldrich.com\share\CF\Projects\132002\GIS\132002_AMEREN_ASH_WELLS.aprx - USER: mmjones - LAST SAVED: 6/12/2024 5:29 PM

Loureiro

LEGEND

- TREATMENT AREA BOUNDARY (APPROXIMATE)
- INJECTION WELL
- EXTRACTION WELL
- OBSERVATION WELL
- PIPING TRENCH
- (1,917 FT) DISTANCE (FEET) TO TREATMENT BUILDING

NOTES:

BOUNDARIES AND WELL LOCATIONS ARE APPROXIMATE.

GROUNDWATER EXTRACTION EX-SITU TREATMENT, AND RE-INJECTION SYSTEM MAP

SUPPLEMENTAL REMEDY SELECTION REPORT

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FIGURE 3

0 125 250 500

APPROXIMATE SCALE (FEET)

TITLE:

WELL FIELD AND TRENCHING LAYOUT PLAN

SIOUX ENERGY CENTER

WEST ALTON, MISSOURI

SCALE: AS SHOWN	
DATE: MARCH 2024	DRAWN BY: PC
PROJECT NO.: 21008	CHECKED BY: SC
CLIENT: AMEREN	PROJ. MGMT. APPROVAL: DI

DRAWING NO.

01-002

APPENDIX A
Response to 2019 CMA Public Comments

Response To Community Comments On Ameren Missouri Corrective Measures Assessments For Rush Island, Labadie, Sioux And Meramec Energy Centers

Contents

SUMMARY OVERVIEW 1

GENERAL COMMENTS 2

1. **The Public Meetings Facilitated One-on-One Discussions and Were Designed to Foster Collaboration** 2
2. **CCR Constituents Do Not Threaten Human Health or Drinking Water** 3
3. **The Groundwater Protection Standards Set by Ameren are Protective and Comply with the CCR Rule** 5
4. **Railing or Barging CCR from Ameren's Energy Centers is Neither Reliable Nor Economical** 7
5. **Ameren Ash Basins: Sound Structural Integrity Even Under Flood Conditions** 9
6. **The WUELC Misconstrues the CCR Rule and Seeks to Create a New Standard** 11
7. **The Estimated Timeline for Excavation is Reasonable Given the Volumes and Complexity of an Excavation Project** 12
8. **Closure Plans Posted on Ameren's Website Were Required by the CCR Rule and Do Not Indicate a Final Remedy has been Selected** 13

SPECIFIC ISSUES RASIED BY COMMENTORS 14

9. **"Litigation Risk" is not a CCR Rule Remedy Selection Factor** 14
10. **Closure of the CCR Basins Will Control Source Material and Mitigate Groundwater Impacts** 15
11. **Excavation Would Delay Compliance Until After 2050** 16
12. **Evaluation of Climate Change is Not Required by EPA** 17
13. **Transportation of Waste from Westlake Landfill has Less Impact on Community Due to Access Route and Volume** 17

SUMMARY OVERVIEW

In May 2019, Ameren Missouri held public meetings regarding Corrective Measures Assessment (CMA) Reports for the Rush Island, Labadie, Meramec and Sioux Energy Centers. At those meetings and afterwards in written comments, the public raised a variety of concerns regarding CCR basins located at the energy centers. This Response to Community Comments addresses those concerns. In addition, Ameren Missouri ("Ameren") has performed additional technical analysis which has been posted on Ameren's CCR website along with this Response. Ameren summarizes key response items below:

- *Groundwater Impacts are Limited and No Risk to Public Health Exists.* Groundwater impacts at Ameren's energy centers are limited and localized in nature. Drinking water supplies, whether residential wells or adjacent rivers, are not impacted by the energy centers. Suggestions that Ameren has somehow "skewed" or misrepresented the data are inaccurate. *See* Section 2 and 3 and Attachments 1 and 2.

- *Excavation Delays Compliance with Groundwater Standards*. Several commenters argue that the only way to comply with the CCR Rule is to excavate the ash. Not true. Concentration levels will diminish over time due to installation of a geomembrane cap, the water table lowers, and pH conditions stabilize. Excavation requires the basins to remain open to ongoing infiltration. To address such comments, Ameren performed additional modeling analysis to assess groundwater impact at Rush Island under both containment and excavation scenarios. Containment results in a predicted return to standards in 2027, approximately 6-7 years post-closure, as compared to 2057 under an excavation scenario. *See* Section 11 and in Attachments 6 and 7. Concerns relating to groundwater compliance are addressed more expeditiously by promply closing and capping the ash basins and cutting off infiltration.

- *Trucking is Less Burdensome than Rail but Neither is Fast.* The Lochmueller Extraction & Transportation Study (CMA, Appendix C) described the logistics behind hauling CCR from the energy centers to a commercial landfill. Certain commenters took issue with that analysis and instead contend that railroad carrier CSX provides such services. Connecting to the CSX railroad would require multiple carriers, installation of onsite storage yards, nine dedicated, 100-car unit trains, and commercial landfill unloading facilites. No Illinois or Missouri landfill was identified as having adequate rail facilities. *See* Section 4 and Attachment 3.

- *The CCR Basins are Structurally Sound, Built to Withstand Extreme Weather Events*. Several commenters expressed concerns regarding the risk of "wash out" or "liquefaction" of the stored material should a flood or seismic event occur. All of Ameren's CCR units are protected by massive embankments designed to prevent failure. The potential for extreme events has been specifically considered and we have provided a stability analysis summary chart. *See* Section 5.

GENERAL COMMENTS

To the extent a number of commenters raised identical or similar issues, such comments are grouped by subject matter.

1. The Public Meetings Facilitated One-on-One Discussions and Were Designed to Foster Collaboration

The public meetings provided a forum to define the community concerns; promote one-on-one communication between Ameren and the community; and to foster collaboration. Ameren and its experts presented information about the CMAs and made themselves available to discuss questions and concerns expressed by those in attendance. Importantly, the CCR Rule does not specify a format for the public meeting nor does the rule require that specific responses be provided. The rule simply states that the remedy selection by the owner should consider the "degree to which community concerns are addressed by a potential remedy(s)." Nevertheless, Ameren believes responses to the concerns are important.

Ameren organized the public meetings with much thought and consideration. The meetings featured technical experts located at discrete stations who were available to discuss a number of topics relevant to the corrective measures options; groundwater data collection; risk assessment analysis; modeling analysis; the corrective measures assessment process; and dam safety issues. The goal was to maximize for the community one-on-one time with company representatives and the experts so the community could provide their input and present questions.

A number of commenters expressed frustration with the meeting time, a perceived lack of notice and a perceived lack of time to review the CMAs. Ameren wishes to address these concerns. First, as to notice, Ameren placed notices of the meeting on its CCR website and in a variety of media outlets (***St. Louis Community News, Festus Jefferson Leader and the Washington Missourian***) during the weeks of May 1 and May 9, 2019. Second, as to the CMAs, Ameren posted the CMA reports on its CCR webpage starting on May 16, 2019, with printed copies available at the meetings.[1] We note that there is no requirement to make the CMAs available prior to the meeting but Ameren chose to do so regardless. Indeed, social media postings by the Labadie Environmental Organization (LEO) and Sierra Club clearly reflect that local environmental activists were not only well aware of the meeting dates and times, but also of the CMA posting. In fact, activist groups had members attend each of the meetings. Lastly, as to the time of day, Ameren selected the afternoon and all of the meetings were well attended. For those who could not attend, Ameren received comments through a dedicated email address box and, as requested, posted the exhibits used at the meetings to the Ameren website following the meetings. Again, all of this is more than is required by the CCR Rule.

[1] The CMA reports were removed temporarily from the website on May 30, 2019, during an IT system migration but were re-posted the next day.

While the format did not include or facilitate speechmaking, the format was informational and not a "public relations event." The amount of direct questioning and explanation clearly resonated with many members of the community. Again, Ameren chose the format to provide the greatest amount of direct contact with company representatives and the technical experts. Videos taken by the environmental activists during the meetings demonstrate that attendees effectively utilized the question and answer approach.

2. <u>CCR Constituents Do Not Threaten Human Health or Drinking Water</u>

Some commenters expressed concern that CCR constituents in groundwater at Ameren's energy centers present a risk to drinking water sources and to public health. **Public or private drinking water supplies are not at risk from Ameren's CCR units.** As depicted in the charts below and as presented in numerous technical reports including the CMAs, the CCR units have not affected the bedrock aquifer that serves as a water source to residences located within the general vicinity of the Labadie and Rush Island energy centers. To the extent impacts from coal ash exist on Ameren's property and immediately adjacent to surface impoundments, the public has no direct or indirect access to such groundwater. Further, as presented in numerous technical reports including the CMAs, sampling results demonstrate that public drinking water sources that draw from the Meramec, Mississippi and Missouri Rivers are not impacted by Ameren's CCR units. As made clear in published risk assessments, where there is no exposure, there can be no risk.

More specifically, in calendar years 2012-2014, going beyond then existing or current regulatory requirements, Ameren installed offsite monitoring well networks at both Labadie and Rush Island in an effort to provide the community with data to address concerns about the sites' impact on their drinking water wells. Through these monitoring networks, Ameren evaluated groundwater quality, flow direction and water column height within the bedrock aquifers. So that representative samples were taken, the monitoring wells mirrored the actual depths of the residential wells. Groundwater elevations in residential wells are at a higher elevation than groundwater levels near the ash basins. Groundwater moves from the bluffs to the river valleys and **no physical mechanism exists** through which groundwater from Ameren's coal ash basins could travel uphill to domestic water supplies. This is true even under an extreme flood; hypothetically assuming river levels match the highest flood of record for 55 straight days. *See Golder Technical Memorandum dated June 26, 2019* attached hereto as **<u>Attachment 1</u>**.

Labadie – No Impact to Bedrock Aquifer

Do values from offsite well network exceed CCR Rule GWPS (Yes or No)

Analyte	UNITS	GWPS	September/October 2014 Samples							
			TGP-A	TGP-B	TGP-C	TGP-D	TGP-E	TGP-F	TGP-G	BW-1
Sample Date			9/9/2014	9/8/2014	10/3/2014	10/6/2014	9/8/2014	9/30/2014	9/3/2014	9/9/2014
ARSENIC, TOTAL	µg/L	42.6	NO	NO	NO	NO	NO	NO	NO	NO
BARIUM, TOTAL	µg/L	2,000	NO	NO	NO	NO	NO	NO	NO	NO
BERYLLIUM, TOTAL	µg/L	4	NO	NO	NO	NO	NO	NO	NO	NO
CADMIUM, TOTAL	µg/L	5	NO	NO	NO	NO	NO	NO	NO	NO
CHROMIUM, TOTAL	µg/L	100	NO	NO	NO	NO	NO	NO	NO	NO
COBALT, TOTAL	µg/L	6	NO	NO	NO	NO	NO	NO	NO	NO
FLUORIDE, TOTAL	µg/L	4	NO	NO	NO	NO	NO	NO	NO	NO
LEAD, TOTAL	µg/L	15	NO	NO	NO	NO	NO	NO	NO	NO
MERCURY, TOTAL	µg/L	2	NO	NO	NO	NO	NO	NO	NO	NO
MOLYBDENUM, TOTAL	µg/L	100	NO	NO	NO	NO	NO	NO	NO	NO
SELENIUM, TOTAL	µg/L	50	NO	NO	NO	NO	NO	NO	NO	NO
THALLIUM, TOTAL	µg/L	2	NO	NO	NO	NO	NO	NO	NO	NO

Notes:
1) µg/L – micrograms per liter, mg/L – milligrams per liter,
2) GWPS – Site-specific Groundwater Protection Standard applicable to Labadie CCR units

Rush Island – No Impact to Bedrock Aquifer

Do values from offsite well network exceed CCR Rule GWPS (Yes or No)

Analyte	UNITS	GWPS	TBW-1	TBW-2	TBW-3
Samples Collected in 2014					
ARSENIC, TOTAL	µg/L	30	NO	NO	NO
BARIUM, TOTAL	µg/L	2,000	NO	NO	NO
BERYLLIUM, TOTAL	µg/L	4	NO	NO	NO
CADMIUM, TOTAL	µg/L	5	NO	NO	NO
CHROMIUM, TOTAL	µg/L	100	NO	NO	NO
COBALT, TOTAL	µg/L	6	NO	NO	NO
FLUORIDE, TOTAL	µg/L	4,000	NO	NO	NO
LEAD, TOTAL	µg/L	15	NO	NO	NO
MERCURY, TOTAL	µg/L	2	NO	NO	NO
MOLYBDENUM, TOTAL	µg/L	100	NO	NO	NO
SELENIUM, TOTAL	µg/L	50	NO	NO	NO
THALLIUM, TOTAL	µg/L	2	NO	NO	NO

Notes:
1) µg/L – micrograms per liter.
2) GWPS – Site Specific Groundwater Protection Standard applicable to Rush CCR Unit.

With respect to St. Charles and St. Louis County communities located near the Sioux and Meramec energy centers, all residences are connected to public water suppliers that draw from

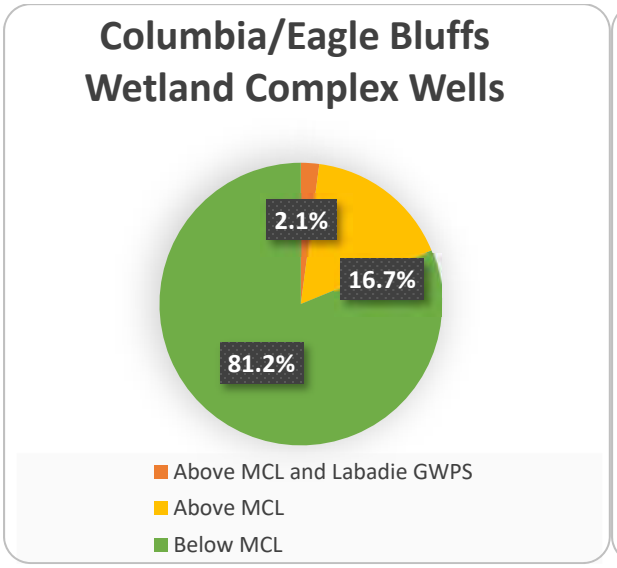
drinking water intakes located within the Missouri, Mississippi or Meramec Rivers and are miles away from the facilities. Extensive river sampling immediately adjacent, downstream and upstream from Ameren's facilities (again this sampling is over and above what is required by any rule), confirms that all such surface water samples (more than 250 sample locations and over 16,000 individual analyses) comply with federal and state drinking water standards. **Ameren's energy centers do not adversely impact those surface waterbodies.**

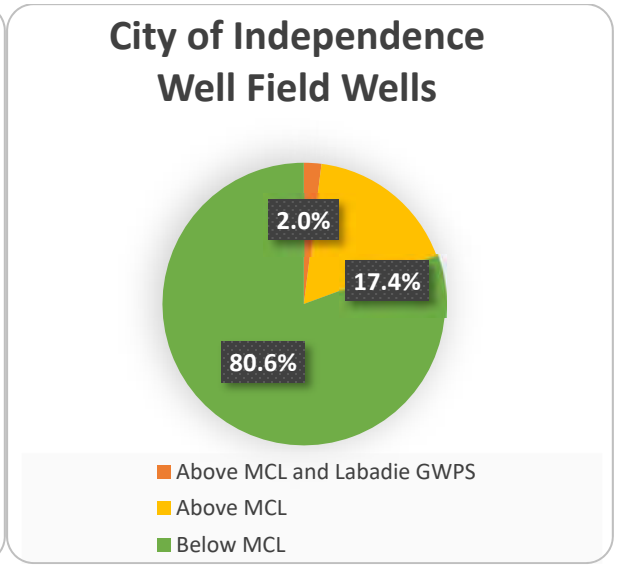
3. The Groundwater Protection Standards Set by Ameren are Protective and Comply with the CCR Rule

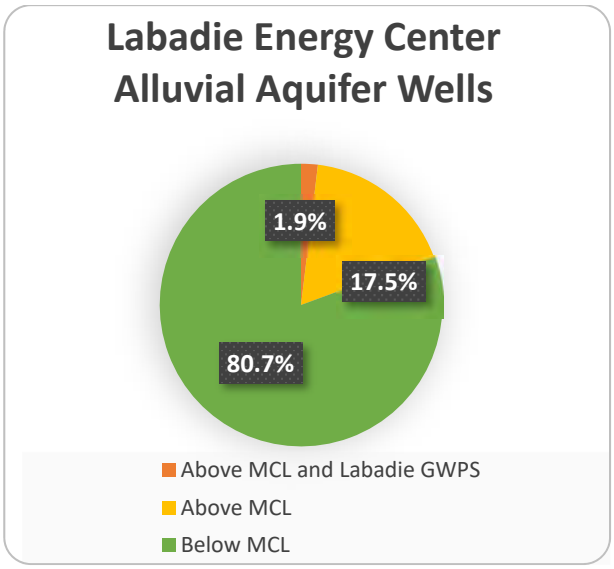
Groundwater impacts at Ameren's energy centers are limited in nature with more than 95% of assessment monitoring results statistically **below** site groundwater protection standards. This is good news. And yet, rather than being reassured by such results, activists instead argue in comments that Ameren "skewed" the data and calculated "abnormally high" background levels and, consequently, protection standards. Nothing could be further from the truth. The CCR Rule prescribes a specific process for the siting of wells, collecting data, and then statistically analyzing the results to calculate the Groundwater Protection Standards (GWPS) used in the CCR process. The CCR Rule requires that a licensed professional engineer certify all critical steps of the process and EPA has issued a Unified Guidance for determining the applicable statistical methodology, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities*, (Unified Guidance) EPA-530-F-09-020 (March 2009). The GWPS calculated for each site fully comply with the CCR Rule and Unified Guidance. Ameren's independent licensed professional engineer and hydrogeologist who certified the standards prepared an additional technical memorandum to address comments received from the Washington University Environmental Law Clinic (WUELC), **Attachment 2** to this response document.

Ameren also responds to additional more specific comments received on two naturally occurring constituents, arsenic and molybdenum. Those comments relate to the setting of GWPS for those constituents at Labadie and Rush Island. As to arsenic, contrary to the WUELC's claims that arsenic present in background wells emanates from Ameren's CCR units, naturally occurring levels of arsenic with concentrations above EPA standards are widespread within the Missouri River alluvial aquifer. In fact, the National Water Quality Monitoring Council (NWQMC) reports in a publicly available database that approximately 20% of groundwater samples collected near groundwater municipal well fields in Missouri (Columbia and Independence), have ambient arsenic levels above the MCL. As the charts below reflect (prepared using the NWQMC data), the data closely align with sampling results collected in the alluvial aquifer at Labadie. In other words, naturally occurring levels of arsenic are found within various locations in Missouri and such levels are consistent with background conditions found upgradient from Ameren's sites. But putting aside data from other locations in Missouri, it is important to note that the background wells at Labadie are ***more than one-mile upgradient/cross-gradient*** from the facility and located in an agricultural field ***unimpacted*** by CCR. Additionally, background wells at Rush Island are located north of the power plant building and upgradient/cross-gradient of the CCR unit.

Naturally Occurring/Non-CCR Arsenic Exist At Labadie and Other Municipal Sites







Golder calculated the arsenic GWPS using sixteen (16) data points per site, consisting of eight (8) baseline samples from each of the two background wells. Due to the spatial variability in the arsenic samples between the background wells (one with high results and one with low results), Golder used a statistical method consistent with EPA's Unified Guidance to calculate the GWPS. The remainder of this paragraph describes the statistical test used to determine a single background level where measured results vary. The terms used are standard statistical language, perhaps not familiar to the reader. Where spatial variability exists, Golder performed statistical outlier analysis, removed any outliers and then calculated a tolerance level. Because the background data varied spatially at both sites, the resulting GWPS is equal to the highest background value in each data set. Because the background data were not normally distributed for either site, the concentrations of 42.6 µg/L (Labadie) and 30 µg/L (Rush Island), respectively,

are from observed values, not outliers, and therefore are statistically part of the background population. In addition, it is clear from well logs that the selected background locations are not influenced by site operations due to their upgradient/cross-gradient locations and the limited groundwater concentrations of either boron or molybdenum, indicating the lack of CCR impact. As a result, and notwithstanding differences between the sample populations of the two wells at each site, the background data from the higher concentration wells must be considered. The higher concentrations in background wells at each site demonstrate that arsenic exists, unrelated to plant operations, representing a background condition that must be included in the statistical analysis of data.

As to molybdenum and based upon their comments, the Missouri Confluence Waterkeeper (Waterkeeper) seems to have misunderstood the purpose behind the Molybdenum Fact Sheet provided by Ameren at the public meetings. Molybdenum, while naturally occurring, is not a commonly known element and Ameren thought it would be helpful to provide a separate background fact sheet with each of its CMA reports to provide context for the public. The fact sheet notes that the Institute of Medicine of the National Academy of Sciences (NAS) defines molybdenum as an essential nutrient for human health. In addition to developing a Recommended Daily Allowance (RDA) that defines the amount of molybdenum needed to maintain good health, the NAS also developed an Upper Tolerable Limit for molybdenum, a limit that equates to a safe drinking water level of 600 µg/L. The Fact Sheet presented this value purely as a point of context; **Ameren knows and acknowledges that it is the GWPS that is used as the basis of decision making under the CCR Rule.**

Further, in 2018, EPA revised its regulations to designate a specific protection standard for molybdenum and adopted 100 ug/L for molybdenum. 83 Fed. Reg. 36435,36444 (June 30, 2018) (Emphasis added.) Importantly, EPA went on to say:

> "These levels were derived using the same methodology that EPA proposed to require States to use to establish alternative GWPS (*See* 83 Fed. Reg. 11598–11599, 11613). The methodology follows Agency guidelines for assessment of human health risks of an environmental pollutant. This means that **these GWPSs are expected to be concentrations to which the human population could be exposed to on a daily basis without an appreciable risk of deleterious effects during a lifetime**." *Id.* (Emphasis added.)

Ameren used the GWPS of 100 µg/L for molybdenum at all four of its facilities. While we agree with the Waterkeeper that EPA included molybdenum on its 2009 Contaminant Candidate List, 74 Fed. Reg. 51850,51852 (Oct. 8, 2009), no regulatory action has occurred in the intervening ***10-year period*** and where the EPA may go with this rulemaking is unknown.

4. Railing or Barging CCR from Ameren's Energy Centers is Neither Reliable Nor Economical

WUELC argues, seemingly based on a CSX marketing brochure that it references, that rail transport would avoid local impacts to the community inherent in truck hauling and therefore

rail is a viable option for transporting CCR for the offsite disposal. However, as the brochure notes, "CSX offers direct connections to numerous cement producers, fly ash and slag locations, and cement terminals **throughout the East Coast."** Ameren Missouri's energy centers are all located west of the Mississippi River.

Ameren receives coal via rail delivery and has extensive experience with the challenges associated with such transport mode. Ameren asked its transportation expert to expand its consideration of rail and barge in response to comments received. Set forth below are key considerations based on Ameren's experience and the Lochmueller Group review (**Attachment 3**):

- *Multiple Carriers.* Neither CSX nor its short-line rail partners have direct access to Ameren's energy centers. To connect to CSX at its Rose Lake Yard in East St. Louis, a unit train (a set of similar railcars that typically remain together in a dedicated train), would need to first transfer to the Terminal Railroad Association in St. Louis via the Burlington Northern (BNSF: Rush Island, Sioux) or Union Pacific railroads (UP: Meramec, Labadie).

- *Coal Trains Can't Be Repurposed.* Dedicated coal unit trains leave the the Powder River Coal Basin on a near-daily basis and travel directly to the energy centers via the UP or BN railroads, unload, and then return in a near-continuous loop. The train cars are specifically designed to carry and unload coal and are NOT designed to carry CCR.

- *Single Loop Rail Tracks Require Coal Delivery Prioritization.* The energy centers have single loop rail tracks that, in order to maintain reliable generating operations, must prioritize coal deliveries. The hauling of large volumes of CCR woud require separate onsite car storage areas known as "ladder tracks" and specialized, covered rail cars traveling in a "unit train". Sufficient or adequate property for ladder tracks may not be available at all locations such as Rush Island.

- *Carriers Control Haul Cycles, Not Shippers.* Unlike truck hauling, the carrier, not the shipper, controls the availability of locomotives and timing of shipments. In order to get to the CSX, the unit train would need to be staged on ladder tracks at the energy center until the originator carrier (UP or BNSF) is available to transport the unit train to a rail yard in St. Louis where a terminal railroad would then move the loaded unit train to CSX's Rose Lake yard located in East St. Louis. From there, the CSX would take possession of the unit cars and haul to a landfill with proper rail unloading facilities large enough to accommodate a unit train. Alternatively, the loaded unit train could be delivered to a train-to-truck transfer station located close to the disposal site where the CCR would be unloaded from rail cars and then hauled via truck to a landfill. Once emptied, the unit train cars would return via the reverse route (CSX, Terminal, and UP/BNSF railroads). The entire process entails multiple railroad crew exchanges.

- *Logistical Issues Impact Reliability of Rail*. Due to the haul cycles and load/unload times, a single unit, 100-car train is capable of transporting at most one load per week.

Nine (9) unit trains would be required to to maintain parity with trucking estimates of 5,000 tons per day. The cost of procuring such trainsets is approximately $90M ($100,000 per car x 9 unit trains). Interruptions with multiple railroad crews or service anywhere along the haul routes, rail yards or energy centers would disrupt shipments. Based on Ameren's experience with coal deliveries, it is highly unlikely that the rail carriers could consistently maintain such productivity.

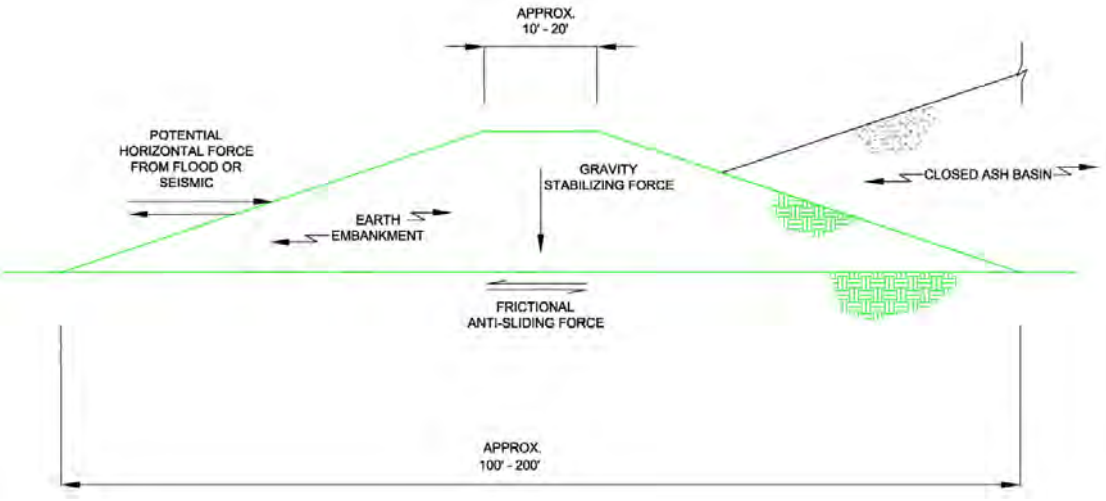
- Shipment via barge is not a viable option due to a lack of existing loading/unloading facilities and environmental concerns associated with large scale, long term shipments on unpredictable waterways.

5. <u>Ameren Ash Basins: Sound Structural Integrity Even Under Flood Conditions</u>

Several commenters expressed concerns that the in-place closure of CCR units could increase the risk of "wash out" or "liquefaction" of the stored material should a flood or seismic event occur. We understand these concerns. The CCR Rule specifically requires owners of ash basins and landfills to perform extensive structural and geotechnical analyses to verify the stability of such units during both normal operations and natural disasters. All of Ameren's CCR units have been inspected, evaluated and verified by third-party geotechnical engineering firms and are inspected weekly by specially-trained plant personnel and annually by Dam Safety specialists.

Ameren's coal ash basins are protected by massive embankments and designed to prevent failure. The potential for extreme events has been specifically considered. The embankment slopes have undergone rigorous evaluations as part of the CCR Rule's structural integrity requirements and are subject to weekly surveillance and monthly maintenance protocols. Engineering evaluations calculate the slope stability of the embankments and compare the driving forces within a cross-section of slope to the resisting forces and determining a factor of safety (FOS). Slope stability analysis includes multiple geotechnical borings and laboratory analysis to assess soil properties. Gravity forces tend to move the slope downward (driving force), while resisting forces derived from soil shear strength, tend to keep the slope in place. When the driving force on a slope is greater than the resisting force, sliding can occur. Ameren's embankments have broad foundations that are at least 4 to 6 times as wide as their height and narrow to a minimum of approximately 10 to 20 feet at their crests. This slope configuration functions as a solid pyramid designed to withstand flooding and seismic events. The diagram below depicts a typical configuration and illustrates the shear mass that would need to erode or otherwise be compromised before a "wash out" of compacted ash stored within the basin could occur.

EMBANKMENT SLOPES & FORCES



Lastly, the embankments surrounding the basins can withstand an estimated 7.0 to 8.0 magnitude earthquake. Both EPA and the Missouri Department of Natural Resources (MDNR) have published target safety factors for a variety of potential structural conditions and all of Ameren's CCR units meet or exceed those requirements.[2] The calculated FOS are expected to increase post-closure as surface waters are removed reducing internal force and pressures. In addition, an engineered cap and stormwater measures will prevent pooling on and within the basins.

SLOPE STABILITY ANALYSIS

	Condition	Target FOS	Minimum Calculated FOS
Labadie	**Major Flood Event**	1.40	1.52
	Steady State	1.50	1.64
	Liquefaction	1.20	1.27
	Slope with Seismic Forces	1.00	1.08

	Condition	Target FOS	Minimum Calculated FOS
Rush Island	**Major Flood Event**	1.40	1.42
	Steady State	1.50	1.51
	Liquefaction	1.20	1.29
	Slope with Seismic Forces	1.00	1.07

[2] 80 Fed. Reg. 214755-77

Sioux	Condition	Target FOS	Minimum Calculated FOS
	Major Flood Event	1.40	1.42
	Steady State	1.50	1.50
	Liquefaction	1.20	1.26
	Slope with Seismic Forces	1.00	1.12

Meramec	Condition	Target FOS	Minimum Calculated FOS
	Major Flood Event	1.4	1.62
	Steady State	1.5	1.71
	Liquefaction	1.2	1.62
	Slope with Seismic Forces	1.0	1.18

Lastly, closure design includes armoring the riverside of embankment slopes to mitigate erosion from floodwater rises and rapid draw down conditions. In addition to routine examinations, qualified Dam and Safety personnel inspect embankments before, during and after flood conditions to ensure proper ongoing maintenance. All of Ameren's ash pond embankments remain structurally sound following the recent 2019 floods crests.

6. <u>The WUELC Misconstrues the CCR Rule and Seeks to Create a New Standard</u>

WUELC's interpretation of the federal CCR rule as those rules relate to elimination of *"free liquids"* is simply misplaced. The requirement cited by WUELC is located within the closure provisions of the regulations that address the activity of drainage or dewatering, and subsequent stabilization of the CCR, to allow for the construction and installation of the final cover system. EPA specifically defined "f*ree liquids"* in relation to ambient pressure and temperature, a clear reference to removal of standing water as part of the draining/dewatering of a CCR basin in preparation for installation of a closure capping system in accordance with best engineering practices. Nowhere does the CCR Rule require draining or dewatering CCR impoundments at depth to meet the closure in place requirements.

The CCR rule requires that owners of CCR units meet two main performance criteria: contain the CCR waste mass in a covered, stabilized unit; and address impacted groundwater outside of the CCR unit boundaries. *See* 40 CFR §257.102 and §257.97, respectively. The rule does not require a compliance monitoring point *within* the waste that is contained in place. EPA

specifically authorized two closure options: removal or closure in place and EPA does not select, or even prefer, one to the other.[3]

By conflating CCR Rule performance standards, WUELC attempts to create a *new* performance standard, one that does not exist in the rule and in effect would mandate excavation regardless of environmental impact. WUELC's position is also in direct contradiction to the actual language of the rule and RCRA's governing standards of *"no reasonable probability of adverse effect on health or the environment.*" EPA found that monitoring groundwater throughout the active and post-closure periods and requiring the owner to perform appropriate corrective measures adequately addresses any groundwater impacts.

7. The Estimated Timeline for Excavation is Reasonable Given the Volumes and Complexity of an Excavation Project

Estimated timelines contained in the Lochmueller report are based on a number of factors including transportation related factors. Using Rush Island as an example, such factors include: volume of stored material including soil amendments; travel time and distance to disposal site; maximum daily haul rate (5,000 tons); 8-hour daily operation and a range of 115-192 days per year of operation (adjusted for equipment breakdown, weather, holidays, vacation, imperfect execution, etc.). The daily haul rate assumes a fleet of trucks making multiple roundtrips per day and that the landfill has capacity, manpower, and authority to accept the maximum daily load of trucks (192). Haul trucks leaving the site every 2.5 minutes would still take decades upon decades to complete the project. Even assuming a constant stream of available trucks, there is simply a practical limitation on how quickly an excavator can load a truck even if there were multiple trucks and multiple excavators onsite.

Furthermore, in addition to the transportation challenges outlined by Lochmueller, there are a number of construction-related issues associated with excavating large volumes of material adjacent to large river systems in alluvial (i.e., river deposited) sands and up to depths of approzimately 100 feet. To further explain the timeline for excavation, Reitz & Jens, a geotechnical engineering firm, examined the construction related issues identified by Lochmueller and supplemented the analysis. Reitz & Jens prepared a white paper outlining its analysis found here in **Attachment 4**. In its *Study of Deep Excavation*, Reitz & Jens notes the following:

- *Excavation Methods.* There are two principal methods of removal or excavation of the CCRs from the basins: 1) excavation in the "dry" by first pumping out the water to some depth below the excavation; or 2) excavation in the "wet" by dredging. Other

[3] "In practice, EPA does not routinely require complete removal of all contamination (that is, cleanup to 'background') from a closing unit even for hazardous waste units. Requiring CCR units to clean up soils to levels before the site was contaminated, would be more stringent than current hazardous waste policies. There is no basis in the current record to impose provisions for the remediation of CCR units that are more stringent than those imposed on hazardous wastes." 80 Fed. Reg. 21302, 21412.

than at the top 20-30 feet, the location of the basins would preclude large-scale excavation via "dry" techniques and the use of conventional equipment.

- *Conventional Dredging has an Adverse Impact on Groundwater.* Dredging with an open bucket (i.e., backhoe, dragline or clamshell) could result in suspension of particles in the remaining groundwater, and an increase in the hydraulic conductivity of the remaining CCR, both potentially causing additional release of contaminants to groundwater.

- *Specially Designed Equipment*. Due to these concerns, the only viable method identified by Reitz & Jens for deep excavation is a cutter-head dredge that would need to be specifically designed and manufactured for Ameren's sites. The unique dredge may pump approximately 14,000 gallons per minute and could remove up to 650 cubic yards of CCR per hour. A suction dredge may be used for depths up to 20 to 30 feet.

- *Construction and Permitting of Settling Basins.* To use the specially designed dredge, a large volume of water would need to be routed from the CCR unit to multiple lined settling ponds. These ponds currently do not exist and would require permitting from MDNR. After CCR settles in the ponds, the dredged material is excavated and dried to allow for overland hauling to a commercial landfill. This double-handling and drying process takes substantial space and time, increasing the costs substantially as well. Remaining water would need to be monitored, potentially treated, and discharged in accordance with regulatory requirements.

- *Dredging Operations Could Take a Decade or More.* It would take more than a decade of full-time dredging operation to remove the CCRs from the largest of Ameren Missouri's CCR units—this time estimate does not take into account permitting, construction activities, drying, double-handling of CCR, weather, maintenance, transportation of the CCR for disposal off-site and handling of the water that remains in the settling ponds.

With all of these considerations taken into account, Reitz & Jens' conclusions are consistent with the time estimates determined by Lochmueller in its transportation study. In no sense are Ameren's basins (total system in-place volume 31M tons) similar to the City of Columbia's three year, 90,000 ton excavation from a single, four (4) acre former farmer's pond. WUELC erroneously relies on this example to demonstrate the ease by which such a project could be executed without disclosing the dissimilarities between that site and Ameren's sites.

8. Closure Plans Posted on Ameren's Website Were Required by the CCR Rule and Do Not Indicate a Final Remedy has been Selected

Several commenters suggested that Ameren is disingenuous in even requesting comments on the CMAs because Ameren has announced previously its plans to close the CCR basins. Such comments ignore the fact that the CCR Rule required Ameren to post on its CCR

website closure and post-closure plans by October 2016, one year from the effective date of the CCR Rule. This federal requirement applied even though investigatory efforts were ongoing. (In fact, closure plans are required to be included with *applications* for *new* CCR units.)

Moreover, Ameren's approach continues to evolve through ongoing investigation and analysis, risk assessments and the corrective action options, including groundwater treatment, as outlined in the CMAs. The groundwater impacts observed at the CCR basins are few and localized in nature and do not pose a risk to human health even if the units were to remain open. Preliminary indications are that geochemical conditions within the alluvium are such that concentrations will reduce over time as pH levels stabilize.[4] In addition, Ameren is exploring a variety of treatment techniques that may reduce the amount of time needed to achieve groundwater protection standards at the designated compliance point (that is, the toe of the berm). That analysis will continue for several months.

In the meantime, Ameren has constructed wastewater treatment facilities at Rush Island and Labadie that isolate the ash basin systems and allow for the removal of surface waters from the basins. In fact, MDNR in a recently issued permit required Ameren to remove all standing surface water from the Rush Island CCR basin by this summer. The CCR Rule requires closure to commence shortly after the known final receipt of CCR. *40 CFR 257 §102.* For Labadie, Rush Island and Sioux, such "known final receipt" date is linked to the in-service dates for waste water treatment facilities. Even the most ardent environmental activist would have to concede that removing surface water reduces recharge into groundwater and that by eliminating the exposure of ponded ash to the elements, the environment benefits immensely. Having been very vocal about the ash basins for years, Ameren is surprised that activists now accuse it of moving too quickly.

SPECIFIC ISSUES RASIED BY COMMENTORS

9. "Litigation Risk" is not a CCR Rule Remedy Selection Factor

The first seven pages of the Waterkeeper's public comment contains a lengthy discussion on its view of legal issues that the United States Supreme Court may or may not entertain and the applicability or non-applicability of the Clean Water Act to CCR basins. None of that is relevant to CCR Rule requirements for remedy selection. No litigation has been brought by any person or entity regarding Ameren's CCR Units.

Furthermore, to the extent Waterkeeper suggests that Ameren should have solicited public comments before issuing its CMAs, they have clearly misread the CCR Rule requirements.

[4] A discussion of the behavior of metals in soil and groundwater can be found at **Attachment 5**.

10. Closure of the CCR Basins Will Control Source Material and Mitigate Groundwater Impacts

WUELC suggests that the only way Ameren can comply with the CCR Rule's closure performance standards is to excavate and remove all CCR, a positon rejected by EPA. In fact, EPA explicitly did not choose closure by removal over closure in place, indicating that both options, when done properly, are acceptable.

> *EPA did not propose to require clean closure nor to establish restrictions on the situations in which clean closure would be appropriate. As EPA acknowledged in the proposal, most facilities will likely not clean close their CCR units given the expense and difficulty of such an operation. Because clean closure is generally preferable from the standpoint of land re-use and redevelopment, EPA has explicitly identified this as an acceptable means of closing a CCR unit. However,* ***both methods*** *of closure (i.e., clean closure and closure with waste in place) can be* ***equally protective, provided they are conducted properly****. Thus, consistent with the proposal, the final rule* ***allows the owner or operator to determine*** *whether clean closure or closure with the waste in place is appropriate for their particular unit. EPA agrees that the RBCA [risk based corrective action] process, using recognized and generally accepted good engineering practices such as the ASTM Eco–RBCA process, can be a useful tool to evaluate whether waste removal is appropriate at the site. It is, however, not a prerequisite.*
>
> 80 Fed Reg at 21411-12 (emphasis added); *See also 80* Fed Reg at 21407.[5]

The CMAs step through the regulatory criteria for each of the considered remedial alternatives, all of which meets the requirements of 40 CFR §257.97. In addition, geochemical conditions across the sites indicate that concentration levels of the few parameters that exceed GWPS will reduce over time as infiltration is eliminated by installation of a cap, the water table lowers and pH conditions stabilize through a variety of natural in situ processes.[6] To optimize this process, Ameren is evaluating groundwater treatment options particularly for arsenic. Treatment methods for arsenic are well established.[7] While metals (unlike organics) cannot be destroyed, by changing the environmental conditions of the soil and groundwater, the leaching or dissolution of such metals can be reduced through the formation of stable minerals or by

[5] Contrary to WUELC assertions, the CCR Rule does not require returning CCR units to pre-construction conditions. EPA itself determined that was inappropriate, unnecessary, and would result in stricter standards than at hazardous waste sites. 80 Fed. Reg. 21302, 21412 **("There is no basis in the current record to impose provisions for the remediation of CCR units that are more stringent than those imposed on hazardous wastes.")**

[6] EPA specifically discussed that its lack of pH-specific data could impact its risk assessment. In its response to comments on the risk assessment, EPA indicates that pH-specific data, as well as other site-specific factors could yield site-specific remediation alternatives that cannot be addressed in a nationwide risk assessment. 80 Fed. Reg. 21302, 21434-37. Ameren is using site-specific data in the CMAs to make remedy comparisons that fit the unique nature of these surface impoundments.

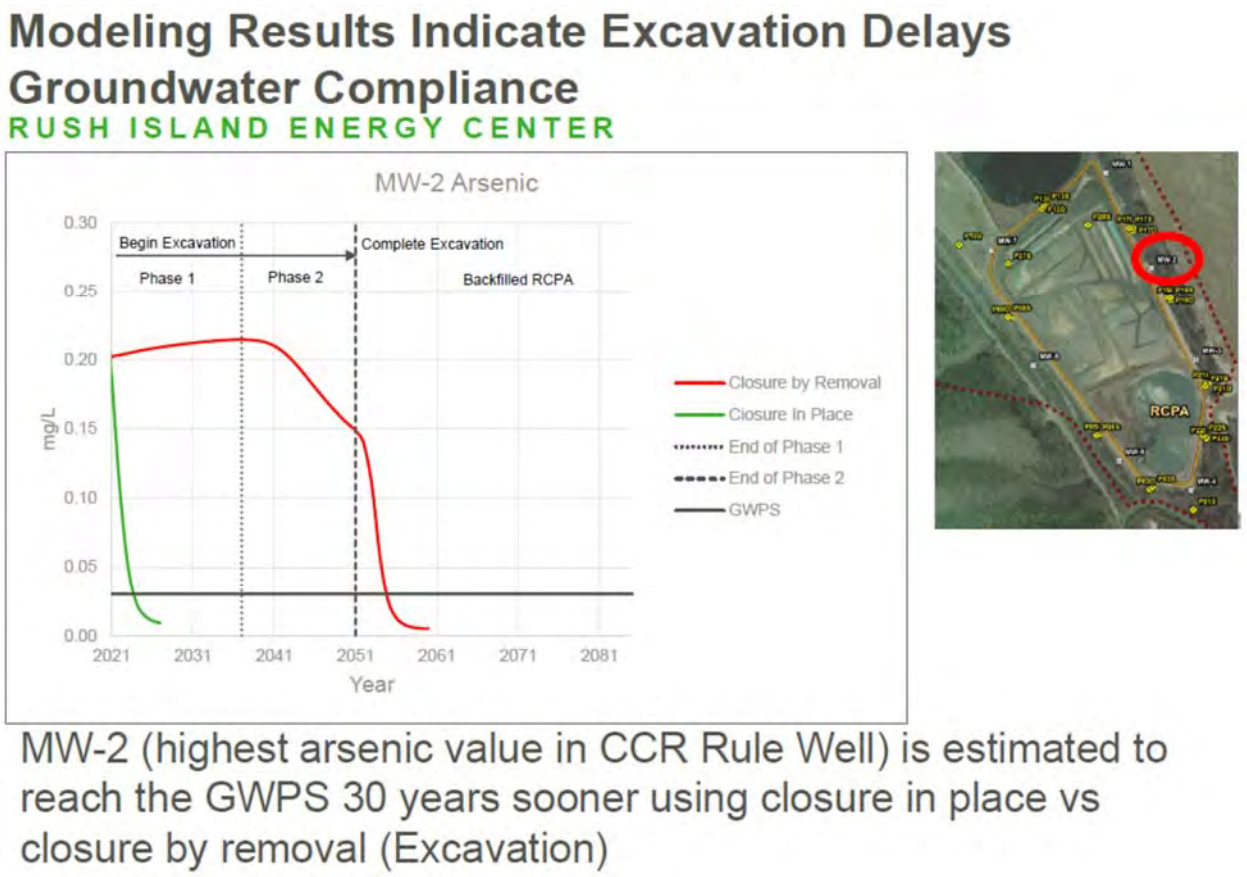
[7] https://www.epa.gov/remedytech/arsenic-treatment-technologies-soil-waste-and-water.

binding such metals more strongly to other minerals. XDD has prepared a short description of this process, appended hereto as **Attachment 5**, *Behavior of Metals in Soil and Groundwater*.

Predictive modeling also indicates that compliance with GWPS at the designated compliance point is achievable. Once that occurs and is confirmed by three years of groundwater monitoring, corrective actions are complete.

11. Excavation Would Delay Compliance Until After 2050

Several commenters believe that excavation is the only way to ensure compliance with GWPS. As the Lochmueller and Reitz & Jens reports make clear, excavation projects at these sites are complex, take decades to execute and will be a burden on local communities. During the entirety of the process, the ash basins remain open to weather, and recharge (contaminant loading due to infiltration from precipitation) to groundwater would continue during this entire period. Using Rush Island as an example, Ameren performed additional predictive modeling to illustrate the timeframe needed to come into compliance under an excavation scenario. (*See Golder Rush Island Closure by Removal Modeling,* **Attachment 6**). Under a containment/capping scenario, compliance with GWPS is predicted to occur in approximately 6-7 years post-closure (2027) as compared to thirty (30) or more years (2057) after beginning the excavation.



12. Evaluation of Climate Change is Not Required by EPA

One commentor suggested that Ameren should have evaluated climate-related issues as part of its corrective measures assessment. EPA did not designate consideration of climate change as a requirement of the CCR Rule. However, to the extent precipitation events increase in severity or number as some climate models suggest, maintaining the proper Factors of Safety and structural stability of ash basins effectively counters those risks. Ameren addressed these issues in Section 5.

13. Transportation of Waste from Westlake Landfill has Less Impact on Community Due to Access Route and Volume

At the Westlake Landfill CERCLA Site in St. Louis, EPA recently ordered the **limited** excavation of **radioactive** material improperly sent to a sanitary landfill that due to its chemical composition set off subsurface fires. The proposed excavation is limited to approximately 1.5M in-place cubic yards (cy), located up to depths of 16 feet with deeper materials left in place at depths up to 89 feet below ground surface. EPA estimates the excavation will cost approximately $274M*. See Proposed Record of Decision Amendment Westlake Landfill Superfund Site (EPA, 2018).* The volumes proposed for excavation at Westlake are a fraction (5%) of the CCR material stored in Ameren's ash ponds (30M in-place cy; 41.3M with soil amendments) and would very likely also take the fraction of the time to transport off-site. Westlake Landfill is located in close proximity to interstate highways that function as major regional transportation arteries, thus minimizing disruption to local communities and neighborhoods. To Ameren's knowledge, specific transportation plans for Westlake have not been published.

Attachment List

1. **Golder Technical Memorandum dated June 26, 2019**
2. **Golder Response to CMA Public Comments Regarding Groundwater Protection Standards and Background Water Quality**
3. **Lochmueller Group Rail & Barge Transportation Assessment**
4. **Reitz & Jenz, Inc. Deep Excavation Analysis**
5. **XDD Behavior of Metals in Soil and Groundwater**
6. **Golder Rush Island Closure by Removal Groundwater Modeling**

TECHNICAL MEMORANDUM

DATE June 26, 2019 **Project No.** 153140601

TO Ameren Missouri

CC

FROM Mark Haddock, PE, RG **EMAIL mark_haddock@golder.com**

GROUNDWATER MODELING INDICATES NO IMPACT FROM LABADIE ENERGY CENTER CCR BASINS ON RESIDENTIAL WELLS EVEN UNDER EXTREME FLOOD CONDITIONS

Ameren Missouri (Ameren) recently held public meetings to discuss its Corrective Measures Assessment (CMA) as required under the United States Environmental Protection Agency's Coal Combustion Residual (CCR) Rule. In public comments raised either at these meetings or submitted to Ameren, members of the public questioned whether groundwater used by residential supply wells could be adversely impacted by CCR basins located at the Labadie Energy Center. The results of the modeling and testing conclude that bedrock groundwater quality in the residential areas of the bluffs is unaffected by CCR impacts to the alluvial aquifer based upon the following:

- The bedrock groundwater flow direction is consistently from high elevation areas (i.e. the bluffs) to low elevation areas (river bottoms).
- The closest community water supply well is located approximately two miles south of the LEC. Some individual wells are located within a mile of the LEC and all draw water from the bedrock aquifer in the bluffs area.
- Groundwater in the bedrock beneath the bluffs flows from the bluffs to the river valley areas, even under extreme river flood stage conditions. The higher groundwater levels in the bluffs prevent groundwater impacted by CCR on Ameren's property from travelling upgradient to residential water supplies.
- To assess groundwater flow under flood conditions, Golder modeled a worst case scenario (i.e. the 1993 flood of record (486.6 feet at the LEC), at a constant elevation and lasting for 55 straight days)[1]. The modeling results indicate that groundwater in the bluffs still flows in a northward direction, towards the Bottoms, and not vice versa.
- Multiple bedrock groundwater quality samples collected from wells in the bluffs area near the existing residential wells confirm that water quality is unaffected by CCR.

[1] In 1993, this peak elevation level lasted one day at Labadie.

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Below is a reproduction of a technical memorandum originally produced on August 5, 2015 regarding Golder's groundwater modeling analysis.

August 5, 2015 Golder Technical Memorandum on flood conditions groundwater modeling at LEC

1.0 INTRODUCTION AND BACKGROUND

At the request of Ameren Missouri (Ameren), Golder performed limited groundwater modeling for the Labadie Bottoms area in the vicinity of the Labadie Energy Center (LEC) located in Labadie, Missouri. The modeling was primarily intended to investigate movement of groundwater near the LEC for a flood condition in the Missouri River. The intent of the modeling was to investigate the potential for reversal of groundwater hydraulic gradient from the alluvial aquifer toward the bedrock aquifer located in the Bluffs area south of the LEC during and following a significant flood event. Specifically, the intent was to investigate the potential that groundwater flow in the alluvial aquifer was significantly reversed toward the bedrock aquifer due to flood conditions.

1.1 Modeling Software

Groundwater modeling was accomplished using MODFLOW 2000, a finite-difference numerical modeling code developed by the United States Geological Survey, and the most widely accepted groundwater modeling platform. MODFLOW 2000 is an updated version of the original MODFLOW code and incorporates improved functionality. Model development was facilitated by Groundwater Vistas, a graphical user interface used to develop the model domain, grid, properties, and to visualize model results.

1.2 Conceptual Model, Domain and Grid

The model domain was intended to model conditions in the alluvial aquifer under and near the LEC and the adjacent limestone bedrock aquifer to the south. The domain was approximately 47,000 feet by 35,000 feet, and was developed roughly parallel to the Missouri River (Figure 1). The model domain was rotated such that the northern model boundary corresponded approximately to the Missouri River. The southern boundary was set in the bedrock aquifer a sufficient distance away from the river so as to minimize boundary effects to the model output. The direction of groundwater flow has been determined to be generally from the bedrock aquifer toward the alluvial aquifer.

The total model thickness for the alluvial aquifer was set at 100 feet based on subsurface drilling information. The individual grid cells were 500 feet by 500 feet, and the model was split into four layers, each 25 feet thick, for increased computational resolution. The model layers were sloped with the top of the model set to 600 feet at the southern model boundary and to approximately 454 feet at the Missouri River, based on general topographic trends in both areas. Initial modeling was conducted with the model layers both horizontal and sloped as a comparison. However, early model runs indicated that preliminary results for the sloped layer configuration were more conservative (i.e., greater effect at the area of interest).

1.3 Boundary Conditions

The eastern and western boundaries of the domain were treated as essentially parallel to groundwater flow and therefore were considered to be no-flow boundaries. The southern and northern boundaries of the model domain were considered to be constant head boundaries. The model boundaries are shown on Figure 2.

Groundwater elevations in the bedrock aquifer near the bluffs and the alluvial aquifer were used to extrapolate the hydraulic gradient throughout the model domain to the south. The intent was that the model emulate the approximate groundwater elevations determined in the installed bedrock wells. In order to do this, the southern constant head boundary was set to 590 feet. It is important to note that the actual groundwater elevations at the southern domain boundary are not expected to be 590 feet at all locations, but this was done as a convenience to generate the anticipated groundwater elevations in the middle of the model and avoid boundary effects.

The northern constant head boundary was set to 455.4 feet to represent a typical stage of the Missouri River. This constant head boundary was increased to 486.6 feet to represent the flood event, as observed during the flood event of 1993. This was a historic severe flood event with water in the Missouri River above flood stage for 55 days, primarily at modest elevations. The peak elevation of the flood near the LEC was 486.6 feet and only lasted one day. However, the intent was to model a worst case flood scenario so the peak elevation was extended for the entire 55-day flood event.

The alluvial aquifer was modeled as a single unit with a hydraulic conductivity of 70 feet per day (ft/d) based on a mean value for the alluvial aquifer from the Detailed Site Investigation (DSI) (GREDELL Engineering Resources and Reitz & Jens, Inc., 2011) for the LEC. The bedrock aquifer was modeled as a single unit with a hydraulic conductivity of 3 ft/d, based on a published value for limestone from Todd (1980). Specific yield for the alluvium and bedrock aquifers were set at 0.3 and 0.14, respectively, based on published estimates from Anderson and Woessner (1992), and were also used to approximate porosity. Specific storage for the alluvium and bedrock aquifers was set to 2.3E-04 ft^{-1} and 1.1E-05 ft^{-1}, respectively, based on published estimates from Anderson and Woessner (1992).

2.0 STEADY STATE GROUNDWATER MODELING RESULTS

The model was initially run in steady state to generate the typical groundwater gradient and movement from the bedrock aquifer to the alluvial aquifer toward the Missouri River, as observed from direct measurements. A general comparison was made between the model estimated groundwater elevations in the bedrock aquifer and the measured groundwater elevations in the area of the bluffs. The model estimated groundwater elevations at the edge of the bluffs were approximately 460 feet, which closely approximates the measured groundwater elevations in this area (Figure 3).

3.0 TRANSIENT GROUNDWATER MODELING RESULTS

Golder was asked to model the effects of a significant flood event, comparable to the 1993 flood event of the Missouri River, on the groundwater movement in the alluvial aquifer. The 1993 flood saw an increase in river flows and levels above flood stage for a period of 55 days. The maximum river stage in the Missouri River near the Labadie Plant during this flood was 486.6 feet, an increase of approximately 31 feet over typical flows in the Missouri River in this area. Use of the peak flood elevation for the entire length of the flood was conducted to represent an extreme worst case scenario.

A transient model run was conducted in which the southern constant head boundary, representing the Missouri River, was set to 486.6 feet for 55 days, then was returned to the same level as in the steady state model run (455.4 feet). Three stress periods were simulated in the model run: Period 1 is the steady state condition with the Missouri River set to 455.4 feet, Period 2 is a transient, 55-day period with the Missouri River set to 486.6 feet, and Period 3 is a transient, 100-year period with the Missouri River

returned to 455.4 feet. Changes to water levels near a location of interest were monitored throughout the model run. This location of interest is a hypothetical monitoring well as shown on Figure 4.

Figure 4 shows the modeled groundwater level contours after the 55 day flood event. Modeled groundwater elevations near the limestone bluffs remained at approximately 460 feet at the end of the 55 day flood event, rising less than 0.5 foot (Figure 5). The groundwater divide, the area where the original hydraulic gradient from the bedrock aquifer and the hydraulic gradient from the alluvial aquifer meet, was located well north of the northern edge of the bluff area demonstrating no reversal of flow at the location of interest.

3.1 Particle Tracking

Particle tracking was conducted using the computer code MODPATH (Polluck, 1989). With this analysis, particles are placed in an area of the model to represent points in the groundwater system, and their flow paths through the groundwater system are traced by moving the particles along the vector of maximum velocity within each model cell. In this way, particle tracking can estimate the movement of groundwater under a simulated condition, in this case, a flood event on the Missouri River. Particles were started within the area of the Labadie Plant and tracked throughout the flood event and during the subsequent recovery period. The particles moved in toward the bedrock aquifer during the flood event, and for a period of about 100 days after the event, until the hydraulic gradient reversed again toward the Missouri River in response to the decrease in river stage. The total distance traveled in toward the bedrock aquifer is small (about 50 feet). This is consistent with independent calculations of the average groundwater flow velocity assuming the same parameters used in the model (Darcy's law equation for advection, Fetter, 1988).

4.0 SENSITIVITY ANALYSIS

Numerical modeling always involves a certain level of uncertainty in assigning model parameters. A sensitivity analysis was conducted in which model parameters were systematically varied to determine the variability in the model estimated response to the flood event, as shown in Table 1. The structure of the model runs remained unchanged, only the parameters indicated in Table 1 were modified. The model presented above in this report, model 1, is the preferred model because the model parameters are considered the most likely for the aquifer systems near the LEC. Four sensitivity runs, models 2 through 5, were conducted in which the hydraulic conductivity, storage, and porosity were deliberately altered to facilitate greater movement of groundwater. The results for all of these sensitivity runs were not consistent with reversal of flow at the location of interest.

The particle tracking analysis was repeated for sensitivity model run 5 because this model had the largest response at the monitoring well location. Particles released in the area of the Labadie Plant travel toward the bedrock aquifer for approximately 60 days and travel approximately 235 feet before the hydraulic gradient is again reversed back toward the Missouri River.

5.0 CONCLUSIONS

Groundwater modeling was conducted for an extreme worst case flood event, using the maximum elevation of the 1993 flood and carrying this elevation for the entire 55 days of this flood. The results of groundwater modeling did not indicate any reversal of groundwater flow at the location of interest. Groundwater flow was consistently from the bedrock aquifer to the alluvial aquifer based on the results of this model.

Attachments or Enclosures:

Table 1 – Groundwater Model Parameters

Figure 1 – Groundwater Model Domain Boundary and Model Grid

Figure 2 – No-flow and Constant Head Boundaries

Figure 3 – Pre-flood Groundwater Elevations

Figure 4 – Groundwater Model Domain Boundary and Resulting Groundwater Elevations

Figure 5 – Water Level Changes at Point of Interest

References

Anderson, Mary P., and Woessner, William W., 1992. Applied Groundwater Modeling – Simulation of Flow and Advective Transport.

Fetter, C.W., 1988. Applied Hydrogeology, Second Edition.

GREDELL Engineering Resources and Reitz & Jens, Inc. 2011. Detailed Site Investigation. Ameren Missouri Labadie Power Plant Proposed Utility Waste Disposal Area. Franklin County, Missouri. February 4, 2011.

Todd, David Keith, 1980. Groundwater Hydrology, Second Edition.

USGS 2000, Modflow-2000, the U.S. Geological Survey Modular Ground-Water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process.

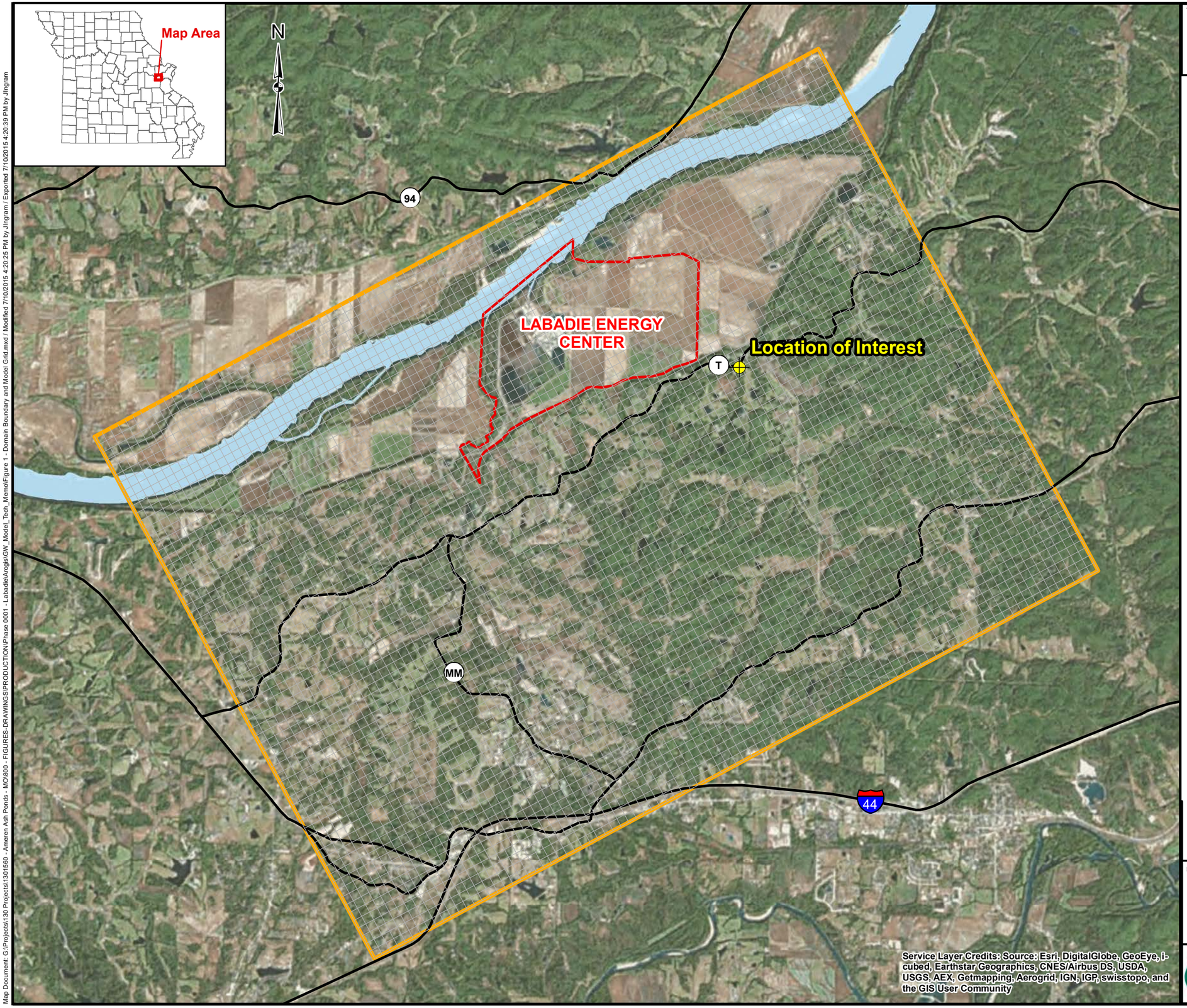
TABLES

Table 1
Groundwater Model Parameters
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Model Number	Conductivity of Alluvium (feet/day)	Conductivity of Limestone (feet/day)	Specific Yield of Alluvium	Specific Yield of Limestone	Storativity of Alluvium ($feet^{-1}$)	Storativity of Limestone ($feet^{-1}$)	Model Results
1	70	3	0.3	0.14	2.30E-04	1.10E-05	Preferred
2	70	3	0.15	0.05	2.30E-04	1.10E-05	Sensitivity
3	70	10	0.15	0.05	2.30E-04	1.10E-05	Sensitivity
4	70	10	0.1	0.01	2.30E-04	1.10E-05	Sensitivity
5	120	10	0.1	0.01	2.30E-04	1.10E-05	Sensitivity

Prepared By: BS/JSI
Checked By: JS
Review By: JRS

FIGURES



TITLE

GROUNDWATER MODEL DOMAIN BOUNDARY AND MODEL GRID

LEGEND

- Labadie Energy Center Property Boundary
- Groundwater Model Domain
- Location of Interest

NOTES

1.) All boundaries and locations are approximate.

REFERENCES

1.) Ameren, 2011. Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.
2.) MSDIS (Missouri Spatial Data Information Service) Database, 2014.
3.) MODFLOW groundwater modeling program.
4.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.

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PROJECT

Ameren

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			Figure 1 - Domain Boundary and Model Grid.mxd
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CHECK	JS	7/10/2015	**Figure 1**
REVIEW	JRS	7/10/2015	

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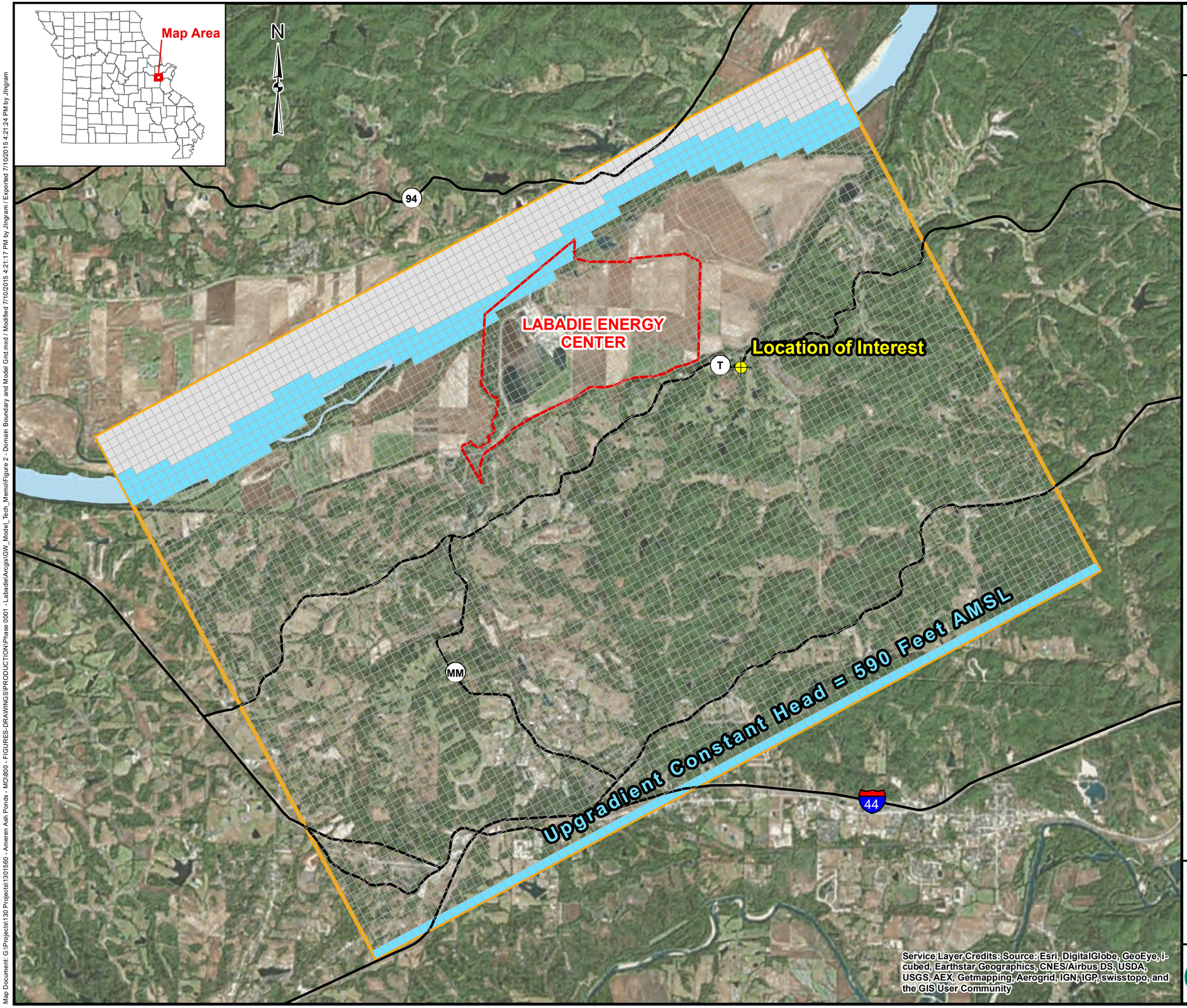

TITLE

NO-FLOW AND CONSTANT HEAD BOUNDARIES

LEGEND

- Labadie Energy Center Property Boundary
- Groundwater Model Domain
- Location of Interest
- Constant Head Boundaries
- No-Flow Boundaries

NOTES

1.) All boundaries and locations are approximate.
2.) Constant Head Boundaries are 455.4 feet AMSL under average conditions, 486.6 ft AMSL under extreme flood conditons (peak of the 1993 flood), and are 590 feet AMSL upgradient.
3.) AMSL - Above Mean Sea Level.

REFERENCES

1.) Ameren, 2011. Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.
2.) MSDIS (Missouri Spatial Data Information Service) Database, 2014.
3.) MODFLOW groundwater modeling program.
4.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.

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PROJECT

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AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			Figure 2 - Domain Boundary and Model Grid.mxd
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REVIEW	JRS	7/10/2015	

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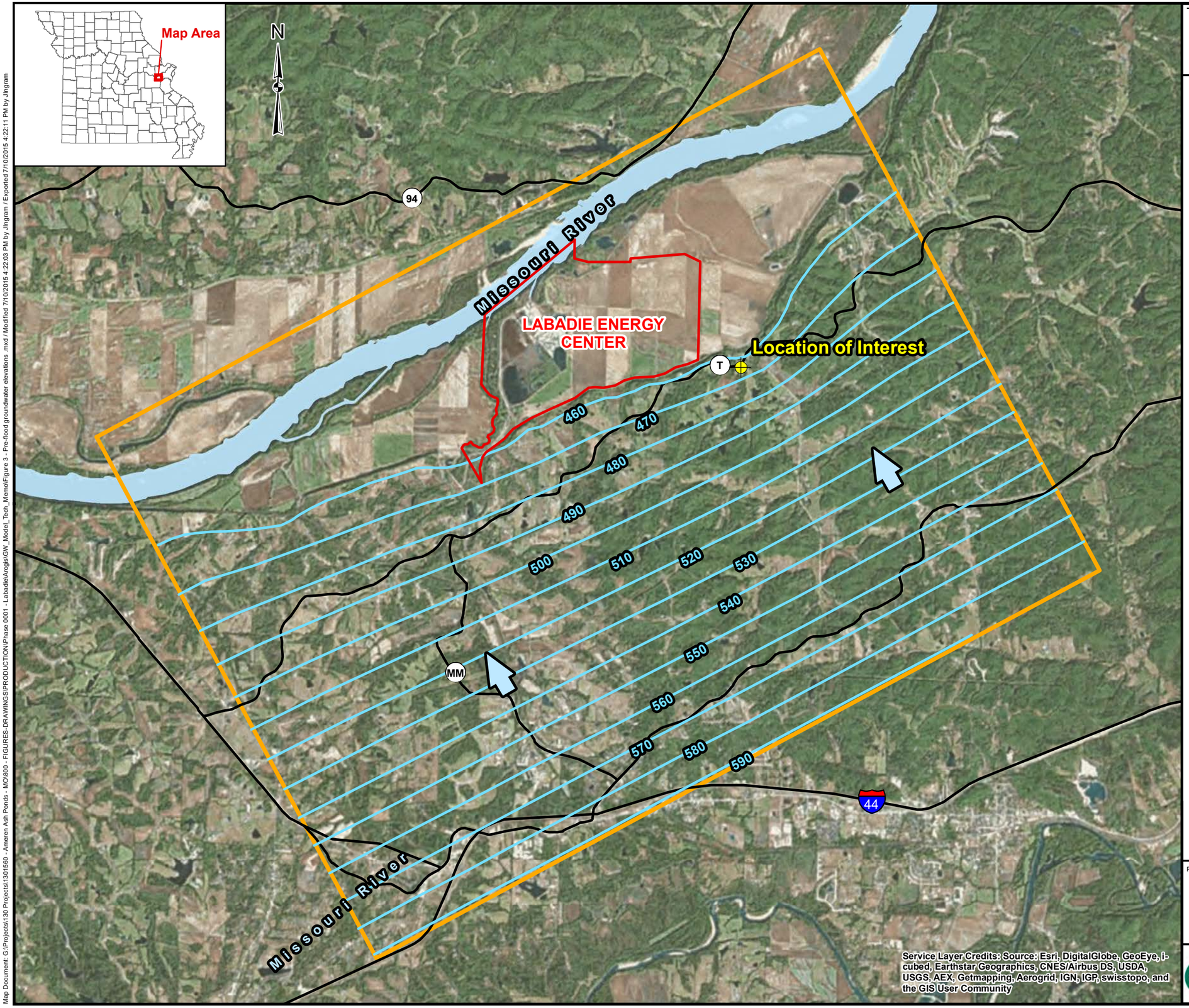

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

TITLE

PRE-FLOOD GROUNDWATER ELEVATIONS

LEGEND

- Labadie Energy Center Property Boundary
- Groundwater Model Domain
- Location of Interest
- Model Groundwater Elevation Contours
- Groundwater Flow Direction

NOTES

1.) All boundaries and locations are approximate.
2.) Model contour interval is 10 feet.
3.) Upgradient contours are used for generalized gradient and are not considered locally accurate.
4.) Model results reflect pre-flood river conditions.

REFERENCES

1.) Ameren, 2011. Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.
2.) MSDIS (Missouri Spatial Data Information Service) Database, 2014.
3.) MODFLOW groundwater modeling program.
4.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.

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PROJECT

Ameren

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			Figure 3 - Pre-flood groundwater elevations .mxd
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REVIEW	JRS	7/10/2015	

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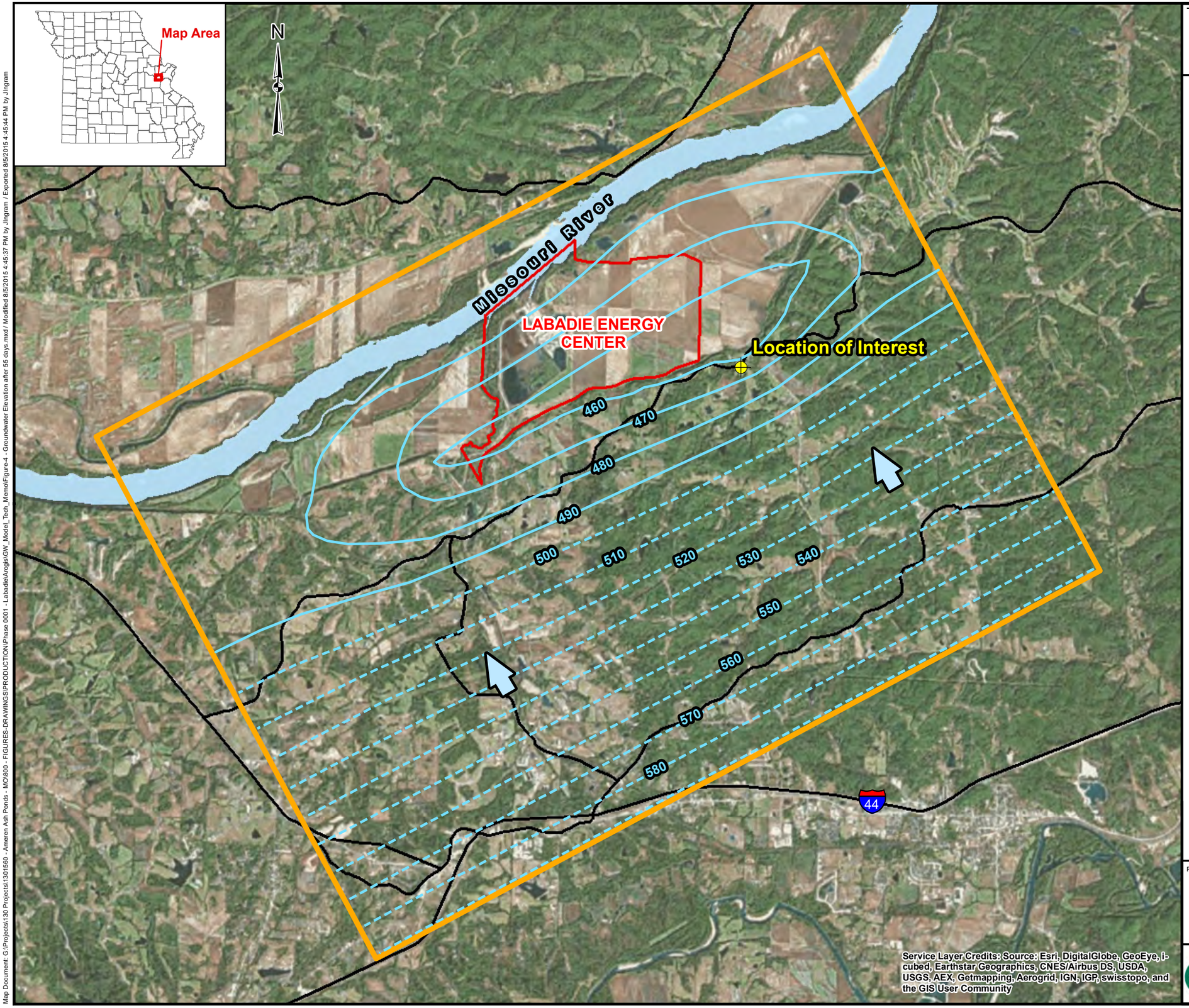

TITLE

GROUNDWATER MODEL DOMAIN BOUNDARY AND RESULTING GROUNDWATER ELEVATIONS DURING FLOOD

LEGEND

- Labadie Energy Center Property Boundary
- Groundwater Model Domain
- Location of Interest
- Model Groundwater Elevation Contours
- Model Estimated Groundwater Elevation Contours
- Groundwater Flow Direction

NOTES

1.) All boundaries and locations are approximate.
2.) Model contour interval is 10 feet.
3.) Upgradient contours are used for generalized gradient and are not considered locally accurate.
4.) Model results reflect 55 continuous days of river level at 486.6 feet above mean sea level (peak level of the 1993 flood).

REFERENCES

1.) Ameren, 2011. Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.
2.) MSDIS (Missouri Spatial Data Information Service) Database, 2014.
3.) MODFLOW groundwater modeling program.
4.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.

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PROJECT

Ameren

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560		Figure-	- Groundwater Elevation after 55 days.mxd	
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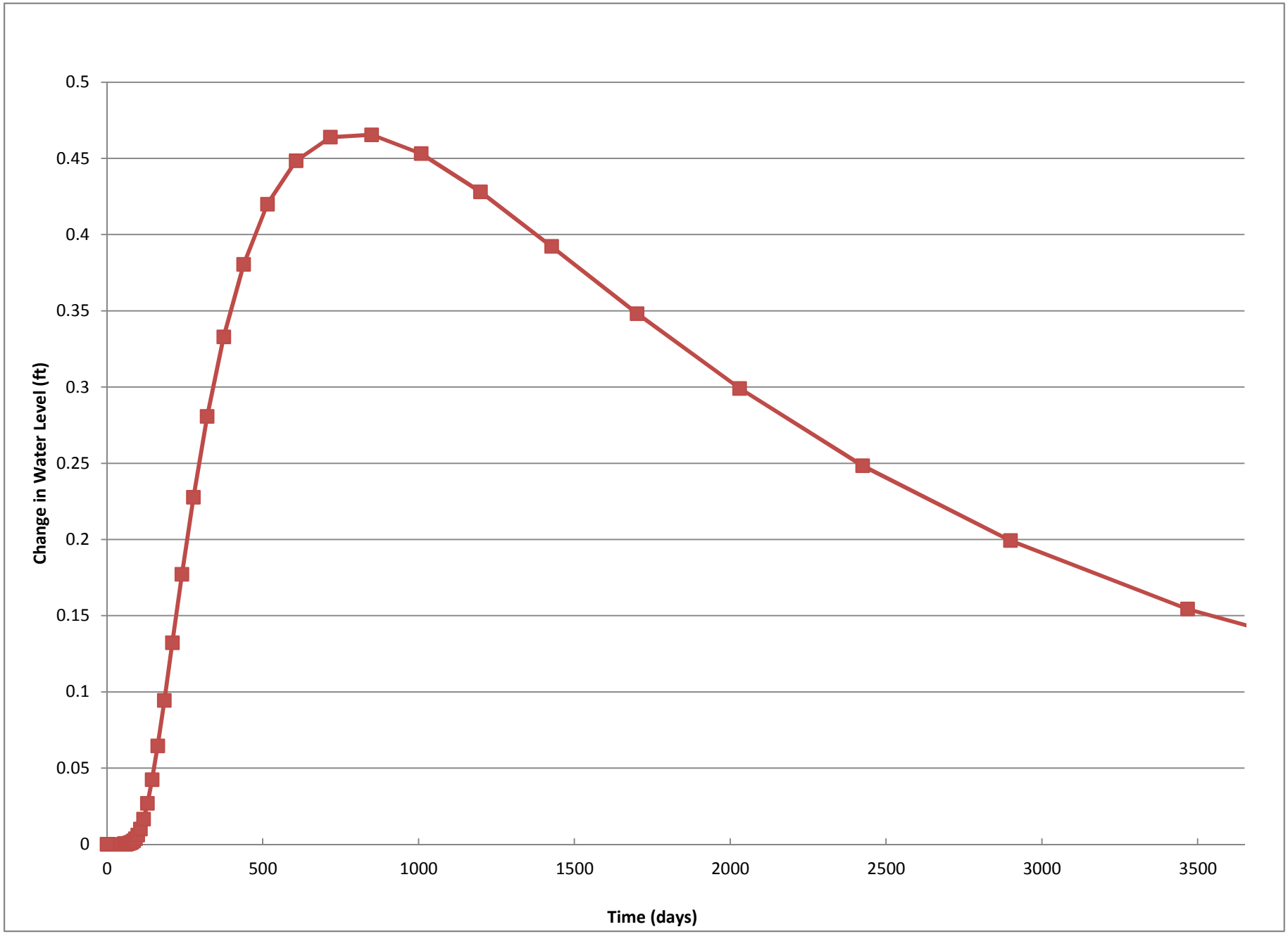
Figure 5
Water Level Changes at Point of Interest
Labadie Energy Center, Franklin County, MO
Ameren Missouri



TECHNICAL MEMORANDUM

DATE June 20, 2019 **Project No.** 1531410601

TO Ameren Missouri

CC

FROM Golder Associates Inc. **EMAIL Mhaddock@golder.com**

RESPONSE TO CMA PUBLIC COMMETNS REGARDING GROUNDWATER PROTECTION STANDARDS AND BACKGROUND WATER QUALITY

1.0 INTRODUCTION

This Technical Memorandum discusses the methods, procedures, and reasoning used to calculate the Groundwater Protection Standards (GWPS) at the Rush Island Energy Center (RIEC) and the Labadie Energy Center (LEC), as well as a brief review of publicly available data regarding arsenic in the alluvial aquifer of the Missouri River in Missouri. Recent public comments to the Corrective Measures Assessment reports (CMAs) have suggested that the calculation of the GWPS for arsenic have "skewed" the results of the monitoring evaluation and rendered the groundwater monitoring networks incapable of detecting arsenic contamination, biasing the CMAs against clean closure. This Technical Memorandum discusses the specific requirements of the CCR Rule that Golder has followed, the best practices for statistical evaluation as outlined in the United States Environmental Protection Agency's (USEPA) Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance), the locations of the background monitoring wells at the Labadie Energy Center (LEC) and Rush Island Energy Center (RIEC), and the presence of existing and naturally occurring arsenic in the alluvial aquifers of the Missouri and Mississippi River valleys.

2.0 LOCATION OF BACKGROUND MONITORING WELLS

The location of background wells is one of the most important factors in developing an effective monitoring well network. Section 257.91(a)(1) of the CCR Rule outlines the location requirements of background monitoring wells for a monitoring well network. The requirements are as follows:

(1) Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where: (i) Hydrogeologic conditions do not allow the owner or operator of the CCR unit to determine what wells are hydraulically upgradient; or (ii) Sampling at other wells will provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient wells;

The CCR Rule requirements have been carefully followed and the locations selected for background monitoring wells accurately represent quality of background groundwater that has not been affected by a CCR unit.

2.1 Background Wells at the Labadie Energy Center

The background monitoring wells for the LCPA ash basin at the LEC are BMW-1D and BMW-2D and two other wells, BMW-1S and BMW-2S provide background monitoring for the LCPB ash basin. An aerial image with the

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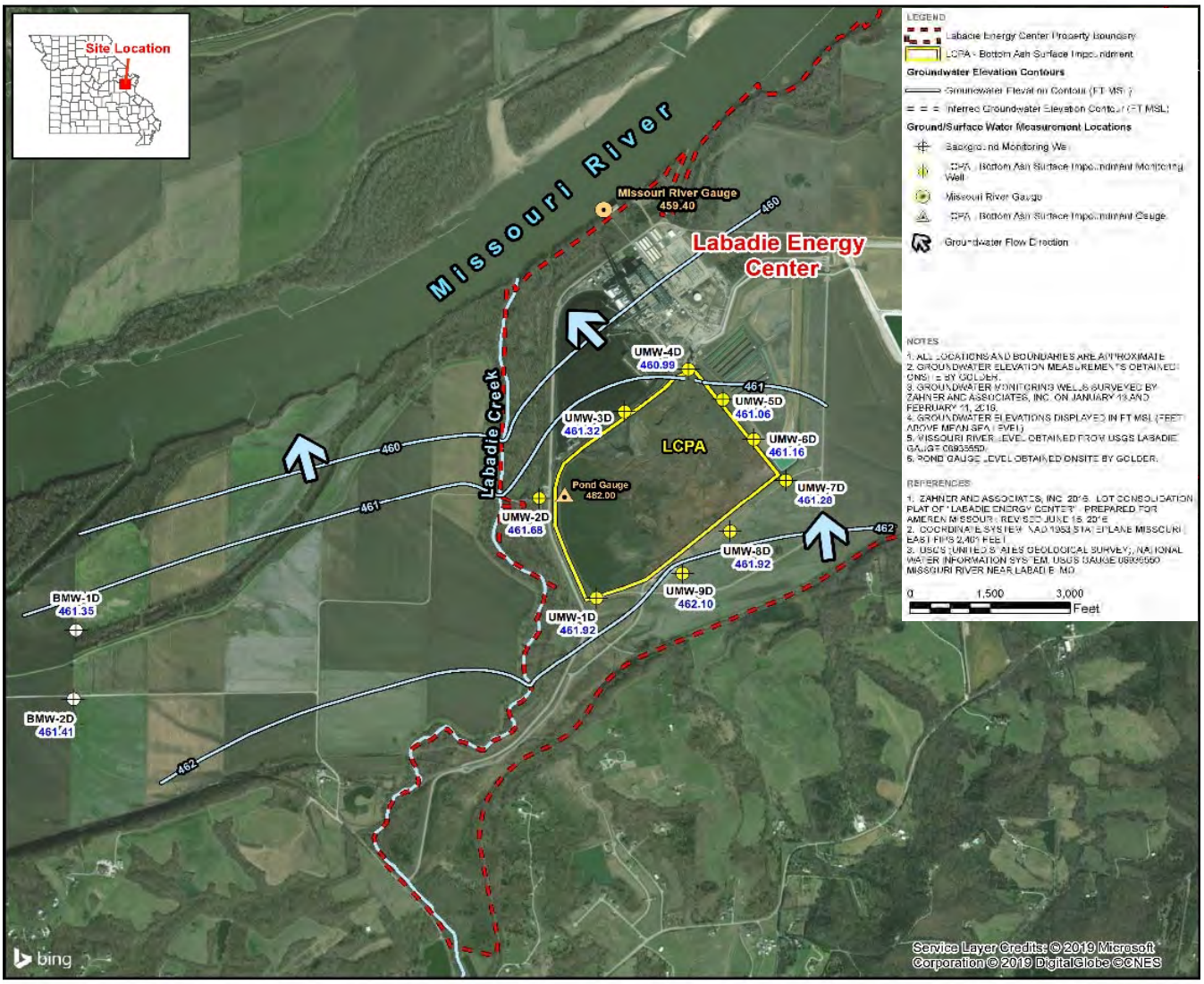

Figure 1: Labadie Monitoring Well Location and Groundwater Flow Map

location of the LCPA, the monitoring wells, and a representative groundwater flow map from 2018 is provided in Figure 1. The background monitoring wells are located approximately 1.5 miles west/southwest of the LCPA and 2,000 to 3,000 feet south of the Missouri River. These locations are upgradient and cross-gradient from the CCR at LCPA. Each of these two locations have shallow and deep zone wells (4 total) used for LCPB and LCPA monitoring purposes.

Groundwater flow within the alluvial aquifer is dynamic and can be influenced by seasonal changes in the water level of the Missouri River. Overall, as discussed in the annual reports (publicly available on Ameren website at https://www.ameren.com/company/environment-and-sustainability/managing-coal-combustion/ccr-compliance-reports), groundwater flows from the bluffs area toward the Missouri River at a rate of approximately 20 feet per year. Based on the upgradient/cross-gradient location of the background wells at LEC and the sampling results

from these wells, there are no CCR impacts from the LCPA or the operation of the LEC in these wells and they are representative of un-impacted, background groundwater quality.

Background concentrations of arsenic in these wells have ranged from 0.12 µg/L to 42.6 µg/L and the spatial variability of concentrations is evident - at one location the deep well exhibits the highest concentration and at the other well-pair location the shallow well has the highest arsenic value. Spatial variability in these concentrations is the result of the heterogeneous makeup of the alluvial aquifer porous media and geochemical interactions of the aquifer media with groundwater. The alluvial aquifer is naturally composed of fine to coarse-grained sediments and clasts derived from soil and rock sources up the river basin that can contain arsenic and metallic minerals, as described in Section 4 below.

2.2 Background Wells at the Rush Island Energy Center

Figure 2: Rush Island Monitoring Well Location and Groundwater Flow Map

The background monitoring wells for the RCPA ash basin are MW-B1 and MW-B2. In addition, two monitoring wells from the 2014 Detailed Site Investigation (DSI) are present within 50 feet of MW-B2. These two wells

include a shallow zone well (P29S) and a deep zone well (P29D). An aerial image of the location of the RCPA, the monitoring wells, and a representative groundwater flow map from 2018 are provided in Figure 2. The background monitoring wells are located approximately 2,500 to 4,500 feet north/northwest of the RCPA and 600 to 2,000 feet west of the Mississippi River. These wells are upgradient and cross-gradient from the CCR at RCPA.

Groundwater flow within the alluvial aquifer at the RIEC is also dynamic and can be influenced by seasonal changes in the water level of the Mississippi River. Overall, as discussed in the annual reports (publicly available on Ameren website at https://www.ameren.com/company/environment-and-sustainability/managing-coal-combustion/ccr-compliance-reports), groundwater flows easterly toward the Mississippi River. Based on the upgradient/cross-gradient location of the background wells at RIEC and the sampling results from these wells, there are no impacts from the RCPA or the operation of the RIEC in these wells and they are representative of un-impacted, background groundwater quality.

Background concentrations of arsenic in these wells have ranged from 1.9 to 30 µg/L in CCR Rule wells (MW-B1 and MW-B2) and from 1.1 to 51.7 µg/L in the DSI wells (P29S and P29D). Spatial variability in these concentrations is evident as the highest and lowest concentrations are in nested wells (P29S, and P29D) located 4,500 feet north of the RCPA. This variability in background concentrations is the result of the heterogeneous makeup of the alluvial aquifer porous media and geochemical interactions of the aquifer media with groundwater. The alluvial aquifer is naturally composed of fine to coarse-grained sediments and clasts derived from soil and rock sources upriver that can contain arsenic and metallic minerals, as further described in Section 4 below.

3.0 STATISTICAL METHODS AND CALCULATION OF THE GWPS

As required by the CCR Rule, prior to October 17th, 2017 Ameren posted a Statistical Method Certification (SMC) to its publicly available website for each of its CCR Units. These SMC's describe the statistical methods to be used for each CCR Unit for Detection and Assessment Monitoring. The methods included in the SMCs were selected because they comply with the requirements of the CCR Rule and are consistent with methods recommended in the USEPA Unified Guidance, which is specifically referenced as a statistical guidance document in the CCR Rule.

As required by the CCR Rule, once assessment monitoring is triggered at a site, site-specific GWPS must be calculated for each of the detected Appendix IV parameters. Following standard practice, the CCR Rule also requires that the site-specific GWPS be derived from either: (1) the United States Environmental Protection Agency's (USEPA) maximum contaminant levels (MCL), (2) health-based standards which were adopted by USEPA in July 2018 for Cobalt, Lead, Lithium, and Molybdenum, or (3) un-impacted background concentrations, for situations where the un-impacted background concentrations are higher than the MCL. Using these methods, the GWPS for arsenic at the LCPA was set at 42.6 µg/L, while the arsenic GWPS for the RCPA is 30.0 µg/L.

As outlined in the SMCs for both the LCPA and the RCPA, following the establishment of the GWPS, assessment monitoring statistics were performed using an interwell confidence interval method to compare results from downgradient/compliance monitoring wells with the GWPS. The confidence interval method used to evaluate Appendix IV results from both the LCPA and RCPA are consistent with the methods recommended in the Unified Guidance.

In summary, the methods used for the calculation of the GWPS at the LEC and RIEC, as well as the resulting GWPS values, follow standard practice in groundwater monitoring and are consistent with the CCR Rule and the USEPA Unified Guidance.

4.0 EXAMPLES OF NATURALLY OCCURING ARSENIC IN MISSOURI

There are numerous reports and publications that discuss the presence of naturally occurring arsenic in Missouri. Arsenic has been reported to occur in groundwater in Missouri from both naturally occurring and anthropogenic sources (https://health.mo.gov/living/environment/ privatedrinkingwater /contaminants.php). Additionally, as provided in the risk assessment reports for Labadie and Rush Island, United States Geological Survey (USGS) soil and groundwater maps by the United States Geological Survey (USGS) for arsenic in the groundwater and soils shows that arsenic is naturally present in our environment (USGS Reports available at https://mrdata.usgs. gov/geochem/doc/ averages/ countydata.htm and http://water.usgs.gov/nawqa/trace/pubs/ geo_v46n11 /fig2.html, Ameren risk assessment report available at https://www.ameren. com/company/environment-and-sustainability/managing-coal-combustion/water-quality).

The National Water Quality Monitoring Council's (NWQMC) Water Quality Portal (available at https://www.waterqualitydata.us/) summarizes data from the USGS, the USEPA, and the NWQMC databases. The NWQMC database includes arsenic results from a total of 1,215 groundwater samples for wells located upgradient of the LEC within the Missouri River alluvial aquifer. These 1,215 samples are from wells located just upstream of the LEC to the confluence of the Kansas and Missouri River in Kansas City, Missouri. The 1,215 samples consist of: 351 samples from the Independence Well Field near Independence Missouri, 852 samples are from the Columbia/Eagle Bluffs Wetland Complex wells, and the remaining 12 samples from various locations in the identified area. This is an extensive dataset. A USGS report on the data for Independence Missouri is available at https://pubs.er.usgs.gov/publication/sir20105232 and USGS Reports for the Columbia/Eagle Bluffs Wetland Complex wells are available at https://pubs.er.usgs.gov/publication/wri024227. Arsenic values within these samples ranged from non-detect (<0.022 ug/L) to 72 µg/L, with an average concentration of 6.7 µg/L.

Figure 3: Comparison of Missouri River Alluvial Aquifer Groundwater Arsenic Concentrations – Public Data and Labadie Results

Figure 3 compares the publicly available groundwater arsenic data in upgradient Missouri River alluvial aquifer settings to the Labadie background and monitoring well results, which ranged from non-detect (<0.052 µg/L) to 69.5 µg/L in CCR Rule monitoring wells, with an average concentration of 6.6 µg/L. Overall, the results at the upgradient locations in Missouri are nearly identical to those at the LEC with around 80% of the samples being below the MCL and 20% above the MCL. These data demonstrate that arsenic concentrations above the MCL

are not unusual in the Missouri River alluvial aquifer and are primarily from naturally occurring sources or, potentially, from anthropogenic sources that are unrelated to CCR and power plant operations.

Additionally, using the NWQMC Water Quality Portal (available at https://www.waterqualitydata.us/) from the confluence of the Mississippi and Missouri Rivers to the RIEC there are 99 arsenic groundwater sampling locations with published data from the alluvial aquifer of the Mississippi River. Arsenic test results from these published well samples range from non-detect (<1.0 µg/L) to 39 µg/L with 4 sampling locations reporting arsenic concentrations greater than the MCL and 2 locations with concentrations over the site-specific GWPS for the RIEC. These levels are similar to background arsenic concentrations at the RIEC and further support that the concentrations in background wells are derived from naturally occurring or non-CCR anthropogenic sources of arsenic in the Mississippi River alluvial aquifer.

Additional comments to the CMA's make note that boron is a clear indicator of CCR impacts, which is acknowledged by EPRI (2012) documentation that boron is "*Typically present in leachate, non-reactive and mobile in common hydrogeological environments, and not a common anthropogenic contaminant*." The public comments also attempt to draw a correlation between the arsenic concentrations present onsite and boron concentrations. Since boron is not detected in background groundwater wells, this absence further supports the case that the arsenic observed in background wells is not from a CCR source and is naturally occurring, likely derived from sulfide minerals present in the aquifer.

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ADDENDUM

Rush Island, Meramec, Labadie and Sioux Ash Pond Closure: Rail & Barge Transportation Assessment July 9, 2019

Lochmueller Group previously completed a planning-level assessment of the costs and logistics associated with extracting, stabilizing, and transporting coal combustion residuals (CCR) from existing ash ponds at the Rush Island, Meramec, Labadie, and Sioux Energy Centers to offsite landfills. Trucking is the most flexible and cost-effective mode of transporting CCR, given the relatively short distances (50 miles or less) between each energy center and the preferred landfill locations. The purpose of this addendum is to evaluate in detail the rail and barge transportation modes.

Rail and Barge Overview

Rail and barge typically become more cost-efficient than trucking over longer distances. In fact, the average barge trip length along the Mississippi River waterway system is 513 miles, which is indicative of the long distances that waterway freight commonly travels.

As compared to the highway network, the geographical reach of the rail and barge networks is limited. As such, payloads transported by rail and barge are commonly picked up by truck at the origin and delivered by truck to the destination, with intermediate transloads on and off trains and barges. Over short distances, the cost and time for these transloads renders rail and barge non-competitive with truck hauling.

To maintain parity with truck hauling, CCR transport by rail would require specialized rail cars fully lined with covers to prevent material escape (coal delivery trains are not suited for CCR removal). As such, these trains would be dedicated for CCR transportation and would run full to landfills and return empty. Such specialized rail cars are expensive and cost approximately $100,000 per car. Rail cars for each 100-car unit train are estimated to cost $10M.

CSX is a Class 1 railroad with acknowledged CCR transport capabilities. However, CSX does not directly serve any of Ameren's energy centers. For CSX to be a CCR hauler for Ameren, carrier transfers would be required involving the Class 1 serving each site (UP or BNSF). This would probably occur using the St. Louis Terminal Railroad (TRRA) as an intermediary to transfer train cars from UP and BNSF yards in Missouri to the CSX Rose Lake Yard in East St. Louis, Illinois. In total, the use of three separate carriers and multiple train yards would increase the complexity, cost, and haul cycle under the CSX option. Service disruptions would also be a concern, as Ameren would have little control over the means or methods of rail transport.

Given the carrier transfer process described above, a single 100-car unit train is assumed to be capable of transporting approximately one load every two weeks, although the actual timeframe depends on the landfill destination. To maintain the previously assumed CCR removal rates and assuming the 2-week roundtrip haul, unit trains would need to be loaded at each energy center one to four times per week dictating two to eight CCR unit trains in the cycle for each site. The capital expense to acquire a sufficient number of rail cars to support such haul cycles at Ameren's four energy centers would be approximately $90M.

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Rail and barge transportation is more susceptible to disruptions, particularly due to flooding events that can close rivers and rail lines for extended periods. In addition, congestion on rail lines and in rail yards and at lock and dams affects the reliability of these modes. Barges also present a unique environmental and safety concern. In 2018, 15 coal barges broke loose on the Monongahela River near Pittsburg with two of the barges sinking and at least one spilling coal into the river. The leakage or spillage of CCR into waterways would have environmental ramifications. Given the sensitivities surrounding CCR generally, barging is simply not a desirable transport mode.

Ameren Energy Centers

As previously noted, each energy center has the potential for direct rail and barge loading. However, there are site constraints at each location that would hamper rail or barge operations, as follows:

Rush Island

The site currently has a rail loop off the BNSF line for unloading coal trains. A full 12-hours is required to unload a coal train and the site receives about one train per day. Hence, the existing rail spur is fully utilized and does not have capacity to temporarily store or load CCR trains.

It would be necessary to construct dedicated tracks for loading CCR unit trains known as “ladder track”. The site does not have space for such a facility, so land would need to be acquired or leased from an adjacent property owner or from the BNSF itself to construct a loading area. Since the loading would occur off-site, CCR would need to be trucked to the rail loading area.

Additionally, the BNSF mainline consists of a flood-prone single track. The line has been inoperable due to multiple flooding events in 2019 alone. Due to the single track, northbound and southbound trains must pass at sidings to maintain two-way operation. This significantly diminishes the capacity of the line. It is uncertain if existing BNSF operations can accommodate additional train volume. The addition of CCR train operations could disrupt coal delivery, impacting power generation and ultimately service to customers.

Rush Island does not presently have barge loading capabilities. Ameren would need to construct barge-loading facilities in the Mississippi River along with conveyors to transport the CCR from land to the barge loading area. This would require permits from multiple agencies, including the Army Corps of Engineers and US Coast Guard. This section of the Mississippi River is very active and the ability to obtain regulatory approvals for CCR removal by barge is uncertain.

Meramec

Similar to Rush Island, Meramec is located along a single-track mainline, which is operated by the UP. It is uncertain if existing UP operations can accommodate additional train volume, as this line has the same challenges maintaining two-way operations as the BNSF line. This line is also prone to closure due to flooding.

Concerning barge transportation, Meramec has barge loading facilities in place. However, environmental and safety concerns with barge transportation persist, in terms of the potential for CCR to leak or spill from barges into waterways or for barges to break away.

Labadie

Both the UP (and BNSF via trackage rights) and Central Midland Railroad (CMR) – a short line railroad running between St. Louis and Union – operate in proximity to the Labadie site. However, CMR's line sale contract contains a service restriction prohibiting the CMR line from serving the Labadie facility. That restriction was upheld by the Surface Transportation Board (STB Dockets NOR 42126, FD 33508, FD 33537, served Feb. 27, 2013). The UP presently delivers two loaded coal trains per day to Labadie.

The site's existing rail infrastructure is fully committed to unloading coal trains and would not have capacity to temporarily store or load CCR trains. Therefore, it would be necessary to construct dedicated tracks for loading CCR unit trains on site. Given the site's location in the Missouri River flood plain, such a facility would be subject to permitting and approval from numerous regulatory authorities, which could delay or prohibit construction.

Barge transportation on the Missouri River is considerably less reliable than on the Mississippi River. There are no lock and dams along the Missouri River; water levels are highly susceptible to rainfall and spring snowpack melt in the Rocky Mountains; and the Army Corps of Engineers has not consistently maintained a navigation channel. In recent years, the barging "season" has been at most six months per year. Given these issues, barge transportation would not be a reliable mode for removing CCR from Labadie.

In addition, the Labadie site does not presently have barge loading capabilities. Ameren would need to construct docking facilities along with conveyors to transport the CCR from land to the barge loading area. This would require permits from multiple agencies, including the Army Corps of Engineers and US Coast Guard. With the river not being navigable for half of the year, pursuit of permits and capital expenditures for barge loading facilities would not be economically viable.

Sioux

The site is located along a single-track BNSF line, which is also prone to closure due to flooding and two-way volume constrained. Similar to the other sites, existing on-site rail infrastructure is dedicated to unloading coal trains. Dedicated tracks for loading a CCR unit train would need to be constructed to facilitate removal of CCR by rail.

The Sioux site does not presently have barge-loading capabilities and Ameren would need to construct docking facilities along with conveyors to transport the CCR from land to the barge loading area. This would require permits from multiple agencies, including the Army Corps of Engineers and US Coast Guard. The environmentally sensitive nature of this section of the Mississippi River – influenced by the presence of wetlands, recreation and parks along the river, and eagle habitats – would further encumber the permitting process.

Potential Landfill Destinations

To avoid the need to transload CCR from rail or barge to trucks to reach the final destination, Lochmueller reviewed landfills located in proximity to rail lines or waterways to determine if facilities are in place to enable direct unloading of CCR from rail or barge. Sites across Missouri and Illinois (excluding the Chicago area) were reviewed using location information provided by each state's environmental agency.

While several landfills were discovered along active rail lines, none appears to have active rail unloading capabilities in place. The Five Oaks Recycling and Disposal located near Taylorville, Illinois had a rail unloading spur at one time, although it seems to have fallen into disuse. Moreover, if reactivated, it would not have the ability to store long CCR unit trains and would need to be extended.

Similarly, no landfills were discovered with unloading capabilities along waterways. It is our understanding that such facilities may exist in other states. However, the increase in travel distance to access those facilities would likely render them cost-prohibitive for purposes of CCR removal from these four sites.

Study of Deep Excavation at Ameren Missouri Energy Centers

INTRODUCTION

In response to questions raised at recent public meetings held by Ameren Missouri (Ameren), Reitz & Jens was asked to prepare a white paper that discusses the methods and implications of deep excavation and removal of Coal Combustion Residuals (CCRs) from the surface impoundments ("basins") located at Ameren's four coal-fired energy centers. The technical review presented in this paper is applicable in general to a deep excavation below the water table at the Sioux, Labadie and Rush Island Energy Centers[1]; specific characteristics of each individual energy center or CCR unit are not addressed.

GENERAL DESCRIPTION OF CCR BASINS

The principal characteristics of the CCR basins at each of Ameren Missouri's energy centers are:

1. The basins are built both below and above grade (that is "partially-incised") in alluvial sands in close proximity to a major river (Mississippi River or Missouri River). The basins were created by dredging the sands in the vicinity of each plant to obtain fill material to raise the actual area of the power plant building and appurtenant facilities to above flood levels of the adjacent river. The excavation was then repurposed to manage CCRs generated from the plant. The CCRs were generally placed in the excavation by sluicing (deposited by flowing water). At some point in the history of each plant, large perimeter berms were constructed around the basins. This is illustrated below:

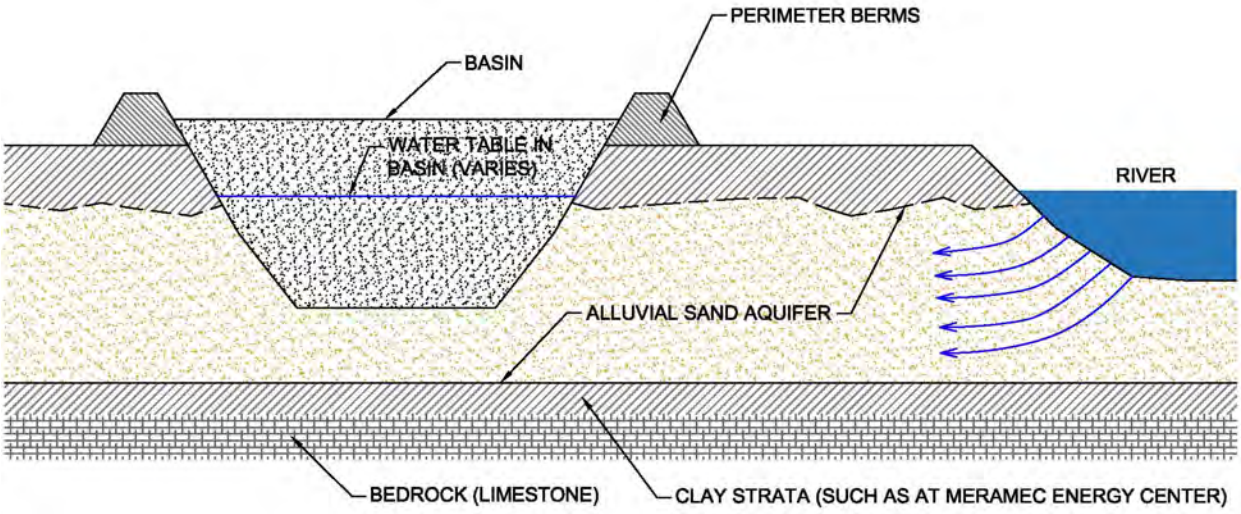


Figure 1 – Illustration of General Construction of CCR Basins (not to scale)

2. The size, depth and proximity to large rivers all impact the method of potential excavation. These basins are relatively large – up to 165 acres – compared to many CCR units at other power plants.

[1] At normal river levels, most of the CCR basins at the Meramec Energy Center are above the water table and are excluded from this description.

The basins are relatively deep – up to 100 feet. Some basins, such as at the Rush Island Energy Center, extend close to the underlying bedrock.

3. The removal process of the ponded CCR is more difficult than traditional soils and would require specialized equipment and management prior to transport to a landfill. The characteristics of the CCRs vary from plant to plant and also depend upon the nature of the CCR – fly ash, bottom ash, and other coal combustion byproducts. Fly ash tends to hold water and will not drain by gravity alone such as in a pile; it typically requires some mechanical grading or agitation. Bottom ash is more like sand and will drain more freely. In addition, CCRs are lighter in weight than soils and compressible. Near the surface of the basins CCRs are generally in a loose state due to their placement via sluicing. At greater depths within the basins, CCRs generally compress and become more dense due to settlement from the weight of the upper CCRs. CCRs become less permeable with increasing density, that is, limiting the volume and velocity of water that may move through the CCRs. Eventually, fly ash may become as impermeable as fine-grain soils.

The principal characteristics of the CCR basins listed above are the determining factors in the feasibility of excavation at Ameren's Energy Centers and could differ from that observed at other power plants which may have burned coal or built basins with different characteristics.

PRINCIPAL METHODS OF EXCAVATION

There are two principal methods of removal or excavation of the CCRs from the basins: 1) excavation in the "dry" by first pumping out the water (i.e. "dewatering") to some depth below the excavation; or 2) excavation in the "wet" by dredging, which is how the basins were excavated originally. The "dredge" may be a backhoe with an extended arm and bucket, a crane with a dragline bucket, or a crane with a clam-shell bucket. Another type of dredge is the suction dredge which pumps the material and water to a disposal site. Small suction dredges have been used in CCR basins at other power plants, but they are limited to about 20 to 30 feet deep. Because of the greater depths, removing CCRs from Ameren's basins would require a cutter-head dredge, such as pictured below.

Figure 2 – Illustration of Cutter-Head Suction Dredge

The cutter-head dredge is designed to break through and remove compacted or cemented CCRs and, due to the depths of Ameren's basins, would need to be specially manufactured. The dredge would pump approximately 14,000 gallons per minute and could remove up to about 650 cubic yards of CCR per hour.

EXCAVATION IN THE "DRY"

Complete removal of water from the CCR basin prior to excavation may not be practical or technically feasible using either deep wells or cutoff walls. The volume of water requiring handling would be tremendous because the basins are in a sand aquifer near a major river as illustrated in Figure 1.

To keep water from filling the excavation would require concentric rectangles or "rings" of deep wells installed at close spacings and completely encircling each basin, with each well pumping hundreds of gallons per minute. The use of a deep well system to dewater the basins creates a number of technical and environmental problems:

1. Space limitations around the basins could impede or preclude the installation of such a large system of concentric wells around each basin. Each concentric system of wells must be separated from the next system by 15 feet or more for equipment and maintenance. Also, a stable slope must be maintained in the sand between each system as the excavation progresses. Therefore, the outside limits of the wells and excavation would need to extend well beyond the existing limits of the basin. The basins are in close proximity to each plant and operational facilities, such as railroad tracks, tanks, and buildings.

2. The drawdown would pull CCR-impacted water from the basin; therefore, a tremendous volume of water would have to be managed and/or treated, requiring a large water treatment plant to be constructed on site[2].

3. Depending upon location, the drawdown of the groundwater table could potentially impact the surrounding environment, such as surrounding vegetation and crops, and potential settlement of the natural soils surrounding the basins. This could cause settlement of shallow foundations, roads, railroad tracks, adjacent river banks or levees, and utilities.

Therefore, in lieu of a concentric well system, a cutoff wall would need to be designed and constructed around each CCR basin to prevent the surrounding groundwater from flowing into the basin as it is pumped dry and excavated. For the Labadie Energy Center, the cutoff wall would have to be up to two (2) miles long and would extend to the bottom of the aquifer, up to 100 feet deep or deeper. Construction of the cutoff wall alone could take up to a year. The water removed during excavation of CCRs inside the cutoff wall would need to be treated.

Structural Stability: Cutoff Walls and Cofferdams

Slurry cutoffs, structural panel cutoffs or sheetpile walls alone would not be structurally adequate due to the tremendous hydrostatic pressure and lateral earth pressures that would occur on the outside of the cutoff wall as the interior CCRs are dewatered and excavated. Installation of deep wells around the outside of the

[2] Existing waste water treatment facilities are inadequate to manage the volume of water generated by a deep excavation project discussed here.

cutoff wall to reduce the hydrostatic pressure would create some of the same problems discussed above. A potential solution would be to install rows of tie-backs through the wall and into the underlying bedrock as the excavation progresses. This is illustrated in Figure 3 below:

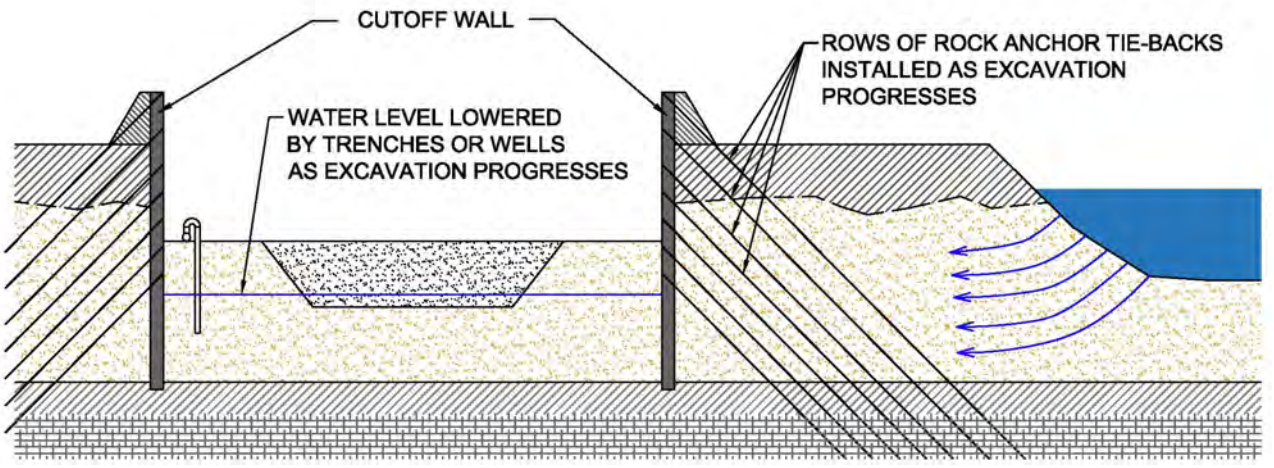


Figure 3 – Illustration of Cutoff Wall with Tie-Backs

There are several different methods of installing a structural concrete cutoff wall. One method is to excavate a deep trench, using a heavy mud slurry to keep the trench open in the sands. Reinforcing steel is then inserted into the trench, and the slurry is displaced by pumping concrete up from the bottom. An example is the structural concrete cutoff wall installed for the construction of the World Trade Center to hold back the water of the Hudson River.

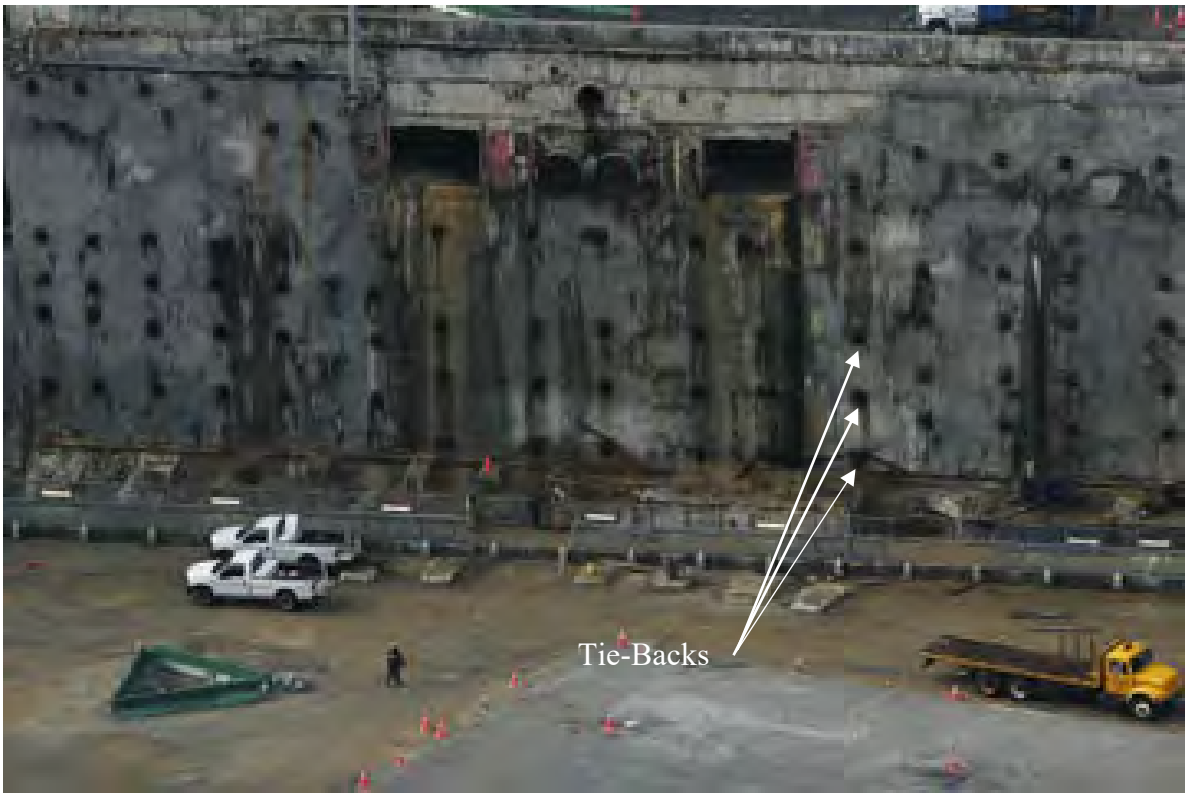


Figure 4 – Structural Concrete Cutoff Wall for the World Trade Center

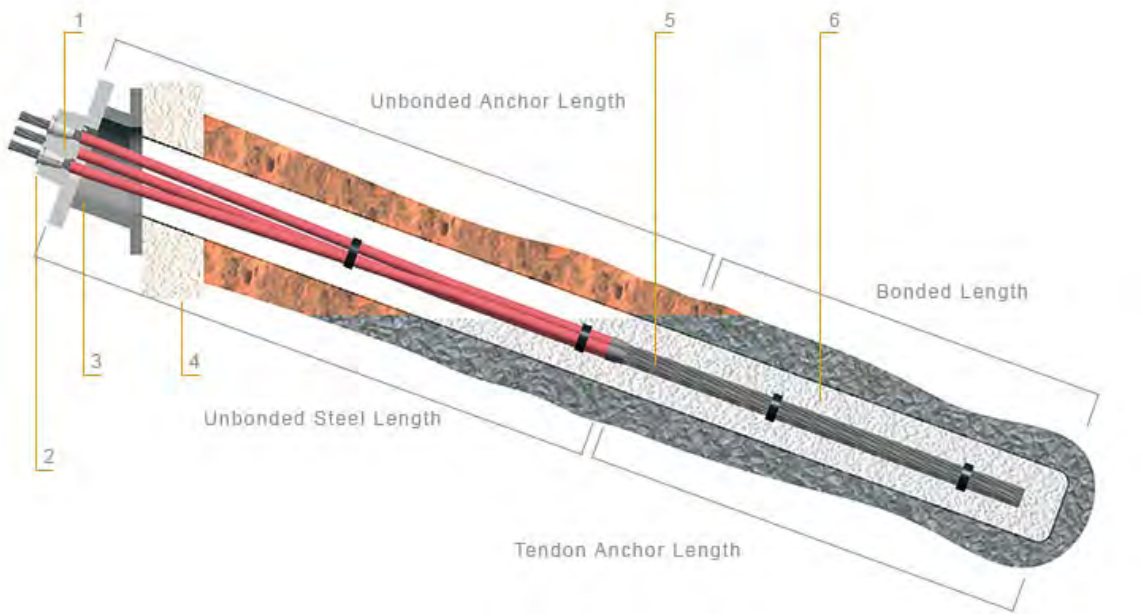


Figure 5 – Illustration of a Typical Rock Anchor Tie-Back

An illustration of a typical multi-stand rock anchor tie-back is shown in Figure 5. Tie-backs are installed by drilling in horizontal rows as the excavation progresses downward. Tie-backs ends can be seen in the photo of the cutoff wall in Figure 4. At some locations, the lengths of the upper tie-backs would need to be well over 100 feet to penetrate into the bedrock, such as at Labadie and Rush Island. The cost per tie-back could range from $10,000 to $40,000.

The construction of a structural concrete cutoff wall is problematic due to both the depths and the presence of large cobbles and boulders near the bedrock, such as at Labadie and Sioux Energy Centers. It is critical that the cutoff extend into the underlying clays where present, such as at Meramec, or into the bedrock, such as at Labadie and Rush Island. The cutoff has to be more than 90% sealed to have real effect at stopping the inflow of groundwater. Installation of hundreds to thousands of tie-backs as the excavation of the CCRs progresses would add years to the construction of the cutoff and the removal of the CCRs. The installation of the cutoff wall and tie-back rock anchors alone will add millions to tens of millions of dollars to the cost of removal of the CCRs by excavation in the dry.

Another type of cutoff sometimes used adjacent to a major river is a “cellular cofferdam.” This technique typically requires deep soil mixing, compaction grouting or drilled holes to make continuous lines of cylindrical columns to form a row of boxes or cells completely around each CCR basin. The width of the cells would have to be large to withstand the hydrostatic pressure and lateral earth pressures. This construction method requires a sufficient open area that may not exist at each energy center and is equally as expensive as a cutoff wall. The close proximity of the plant and appurtenances could be a limiting factor.

Treatment and Management of Water

As the excavation inside the cutoff walls progresses, water from the basin would need to be removed by temporary wells and trenches. This includes existing water and precipitation that falls over the years it

would take to complete the project. The water would have to be evaluated to determine regulatory status before the pumped water could be discharged. Assuming such water exceeds regulatory standards, a water treatment plant would need to be constructed on site to handle the volume.

Summary

Since removal and treatment of sufficient volumes of water would be very problematic, extremely time consuming, and exceedingly costly, excavation of CCRs in the basins in the "dry" is not practically feasible.

EXCAVATION BY DREDGING

Excavation by dredging eliminates many issues associated with the removal of the water from an area of deep alluvial sands adjacent to a major river. There are, however, a number of technical challenges that remain with dredging. First, excavation by dredging is done blindly under water. Therefore, removal of CCRs from a basin with a bottom liner should not be done because there would be a very high probability that the bottom liner would be damaged, causing more environmental harm than if the basin were closed with the CCRs in place. Secondly, dredging with an open bucket – such as with a backhoe, dragline or clamshell – could result in suspension of contaminants and an increase in the hydraulic conductivity of the CCRs, resulting in an increase in release from the unlined basin. Because of these limitations, the only viable method is a suction dredge. As stated above, a cutter-head dredge would be necessary for the deep basins.

A suction dredge discharges a slurry of water and CCRs from the basin. The volume is tremendous – on the order of 14,000 gallons per minute for a large cutter-head dredge. Due to the volume, and to allow the CCRs to settle out, the slurry would be piped into one or more lined settling ponds constructed on site. The settling ponds would need to be located adjacent to the CCR basin so that the decanted water could flow by gravity or pumped back into the CCR basin. Excess water, such as from precipitation, would have to be tested and evaluated to determine the treatment that would be required before the water could be discharged. However, at all of the energy centers, space immediately adjacent to the basins is limited. Accordingly, settling basins would need to be located away from the CCR basins complicating ongoing excavation activities with delays inherent to the pumping and settling process.

The dredged material would need to be excavated and dried sufficiently to allow overland hauling to a commercial landfill. This double-handling and drying processes requires substantially more space and time, as well as cost, to complete. We estimate that it would take 10 years or more of a continuous dredging operation to remove the CCRs from the largest of Ameren Missouri's CCR basins. This time estimate does not take into account permitting and construction of the settling ponds which would further delay the completion schedule. Delays for weather, equipment maintenance, double-handing, drying, and transporting the CCRs to a landfill have the potential to further increase project duration.

Stability of Interior Slopes

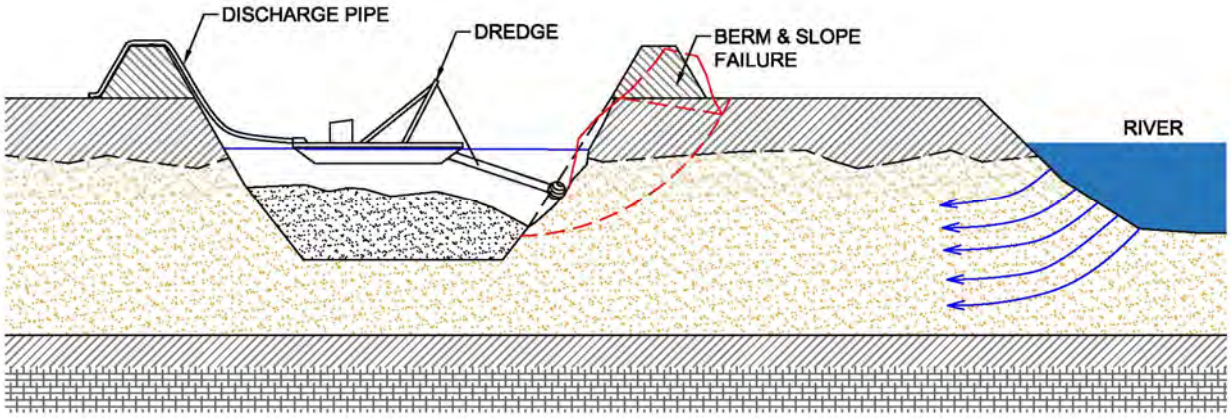


Figure 6 – Illustration of Problems with Stability of Interior Slopes

During an excavation project, the interior slopes of the basins have the potential to become unstable as illustrated in Figure 6. Instability is particularly problematic during a flood when water would be pushing on the perimeter berms. The basins were originally excavated by dredging, and the interior slopes were stable at that time. However, over time perimeter berms were constructed around the basins, in some cases after the deposition of the CCRs, to increase capacities and to protect against flooding. As excavation occurs, the interior slopes would become unstable unless the berms were removed. Removing the perimeter berms increases the risk that the basins would become flooded at high river stages. To prevent environmental risk associated with a flooded and unsecured CCR basin, new perimeter berms would need to be constructed far enough from the edge of the basin to prevent a slope failure and an uncontrolled release of CCR. Sufficient room may not exist at all energy centers to construct new temporary perimeter berms.

To ensure that all of the CCRs are removed, it is inevitable that some excavation will penetrate below the original bottom of the excavated basin and below the original interior side slopes. This would also cause instability of the interior side slopes. A failure of the perimeter of the partially-excavated basin has the potential to result in an uncontrolled release of CCR, particularly on the side adjacent to the river. An unstable slope would also be a major safety hazard for the construction and possibly for the adjacent energy center and operations. To mitigate such risks, temporary retaining walls with tie-backs may need to be constructed.

Completion of Project

Following completion of the excavation, the water remaining in each basin would have to be evaluated for compliance with regulatory water quality standards (GWPS) and some remedial clean-up activities would probably be required for each of the settling basins. After the water in each basin meets the required regulatory standards, the hole could be filled. Dredged sand from the adjacent river would likely be used for fill material because the excavation would contain water.

TECHNICAL MEMORANDUM

TO: AMEREN MISSOURI

FROM: XDD ENVIRONMENTAL, GOLDER ASSOCIATES INC.

SUBJECT: BEHAVIOR OF METALS IN SOIL AND GROUNDWATER

DATE: JULY 9, 2019

CC: SCHIFF HARDIN LLP

Metals are found naturally at varying concentrations in the minerals that make up our soil. As groundwater comes in contact with the soil, some metals leach from the soil, into the groundwater. The metals cannot be destroyed, but by changing environmental conditions of the soil and groundwater, the leaching (dissolution) can be reduced through the formation of more stable minerals or by being bound more strongly to other minerals.

Two major factors that affect the dissolved concentrations of metals in are the pH and the oxidation-reduction potential (ORP) of the water. pH is a measure of the acidic or alkaline nature of the water; strongly acidic water has a low pH (e.g., less than 4), while strong alkaline water has a pH typically greater than 10. ORP is a measurement of the tendency of a substance to oxidize or reduce another substance. Highly oxygenated water typically has a high ORP (greater than +200 millivolts), and highly reduced groundwater typically has an ORP less than 200 millivolts. The pH and ORP of the groundwater strongly influence the form of the metal present and the associated dissolution of the metals into groundwater.

Many metals increase in dissolved concentration when the groundwater is more acidic or more alkaline, because the minerals in the soils can dissolve under these conditions and the metals are released. Similarly, extremes in the ORP can also cause increases in dissolved metals due to the impact on the minerals. By optimizing pH and/or ORP levels, minerals within the groundwater and surrounding soils stabilize thereby reducing the dissolved concentrations of metals and creating more stable minerals that resist leaching / dissolution of the metals.

Groundwater conditions at Rush Island provide a useful illustration of this process. Upgradient of the ash basins, pH ranges from 6.0 to 8.5 in the shallow and deep groundwater zones to the north and west of the CCR unit (RCPA). On the downgradient side of the RCPA (eastern side), where pH is neutral, there are limited concentrations above the arsenic GWPS. However, as shown in Figures 1 and 2, on the downgradient side of the RCPA where the pH is higher than normal neutral conditions, arsenic concentrations are also present at elevated concentrations.

By optimizing natural processes, as one would do with a swimming pool, such as adjusting the pH level within the intermediate zone, a stabilization zone is created, and concentration levels are predicted to drop. Installation of an engineered cap system with a nearly impermeable geomembrane will effectively eliminate precipitation infiltration through the ash, which is a driving force behind the physical process that causes metal impacts to groundwater.

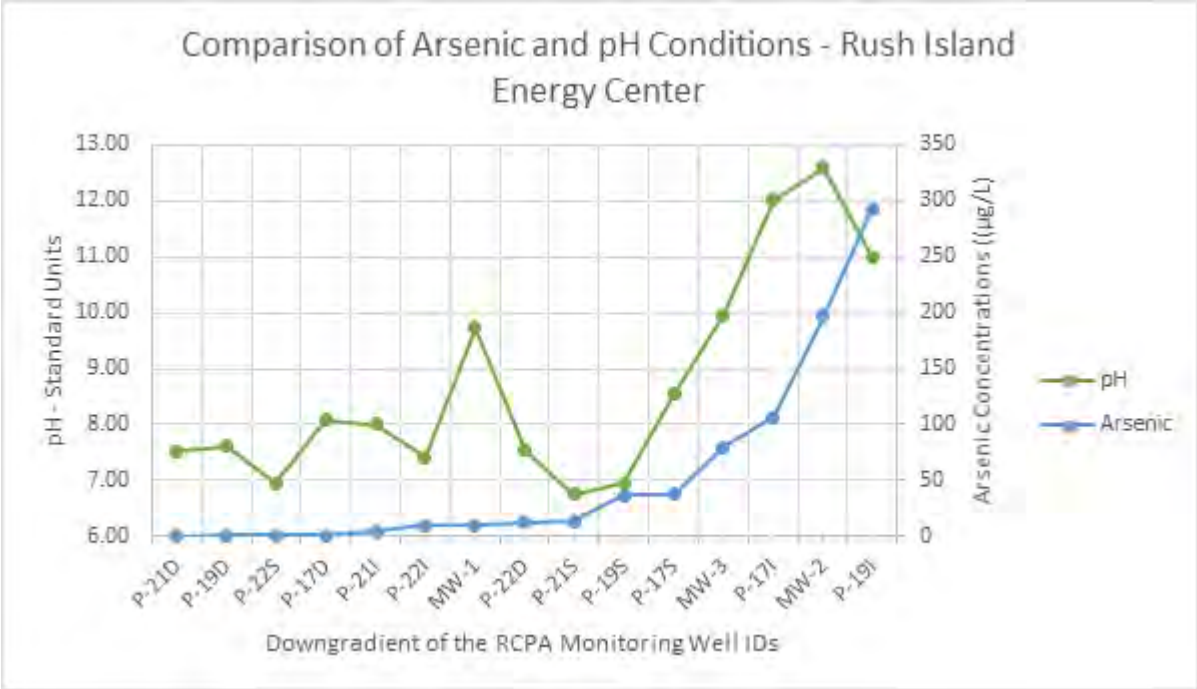
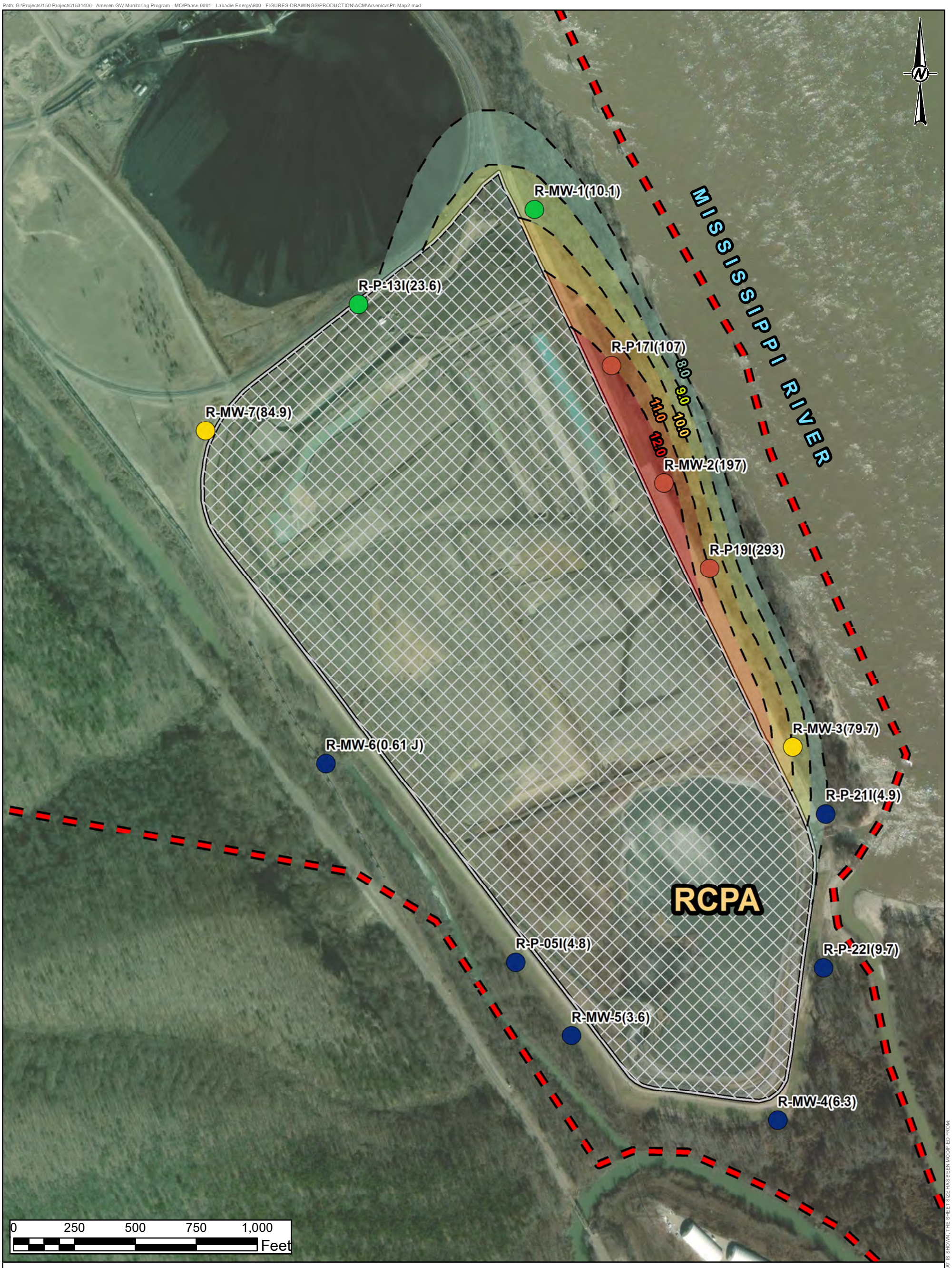


Figure 1 - Comparison of Arsenic and pH Conditions - Rush Island Energy Center

Path: G:\Projects\150 Projects\1531406 - Ameren GW Monitoring Program - MO\Phase 0001 - Labadie Energy\800 - FIGURES-DRAWINGS\PRODUCTION\ACM\ArsenicvsPh Map2.mxd



LEGEND

- Rush Island Energy Center Property Boundary
- RCPA Surface Impoundment

November 2018 Arsenic Concentrations (µg/L)

- Greater than 100 µg/L (Above Site GWPS)
- Greater than 30 µg/L (Above Site GWPS)
- Greater than 10 µg/L (Above MCL, Below GWPS)
- Less than 10 µg/L (Below MCL)

pH concentration Zones (Standard Units)

- pH values less than 8.0 are not colored
- pH between 8.0 - 9.0
- pH between 9.0 - 10.0
- pH between 10.0 - 11.0
- pH between 11.0 - 12.0
- pH above 12.0

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. J - ESTIMATED CONCENTRATION ABOVE THE ADJUSTED METHOD DETECTION LIMIT AND BELOW THE ADJUSTED REPORTING LIMIT.
3. GWPS - GROUND WATER PROTECTION STANDARD (SITE SPECIFIC).

REFERENCE

1. AMEREN MISSOURI RUSH ISLAND ENERGY CENTER, RUSH ISLAND PROPERTY CONTROL MAP, JANUARY 2012.

CLIENT
AMEREN MISSOURI
RUSH ISLAND ENERGY CENTER

PROJECT
GROUNDWATER MONITORING PROGRAM

TITLE
NOVEMBER 2018 ARSENIC VS PH CONCENTRATION MAP INTERMEDIATE ZONE OF THE ALLUVIAL AQUIFER

CONSULTANT
GOLDER

YYYY-MM-DD	2019-07-02
PREPARED	JSI
DESIGN	JSI
REVIEW	EMS
APPROVED	MNH

PROJECT No. 153-140601
PHASE 0002
FIGURE 2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in
0

GOLDER

Rush Island Closure by Removal Groundwater Modeling

June 27, 2019

AGENDA

Objective of Modeling 01

Construction/Assumptions of the Model 02

Modeling Results 03

Objective of the Model

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This modeling effort compared the estimated time to achieve groundwater concentrations below the Groundwater Protection Standard (GWPS) at monitoring wells around the RCPA. Modeling included updating the previous model(s) to simulate the effects of Closure by Removal (CBR) on the groundwater quality around the RCPA. These results were then compared with Closure in Place (CIP) to compare how long it would take to achieve GWPS at compliance wells in both scenarios.

Closure by Removal Modeling - Phases

Rush Island Energy Center

Phase 1 – Active Conditions	Active conditions were modeled the same way as previously reported. Assumed constant slurry recharge to the RCPA
Phase 2 – Dry CCR Removal	Removal of the top portion of the RCPA that would be above the static groundwater level after dewatering to static conditions.
Phase 3 – Wet CCR Removal	Removal of deeper portions of the RCPA were the CCRs are fully submerged.
Phase 4 – All CCR Removed and Backfilled	Modeling conditions after all CCR has been removed from the RCPA. Assumes fluvial sands/silts from the Mississippi River are to be used as backfill.

Phase – 1 Active Conditions

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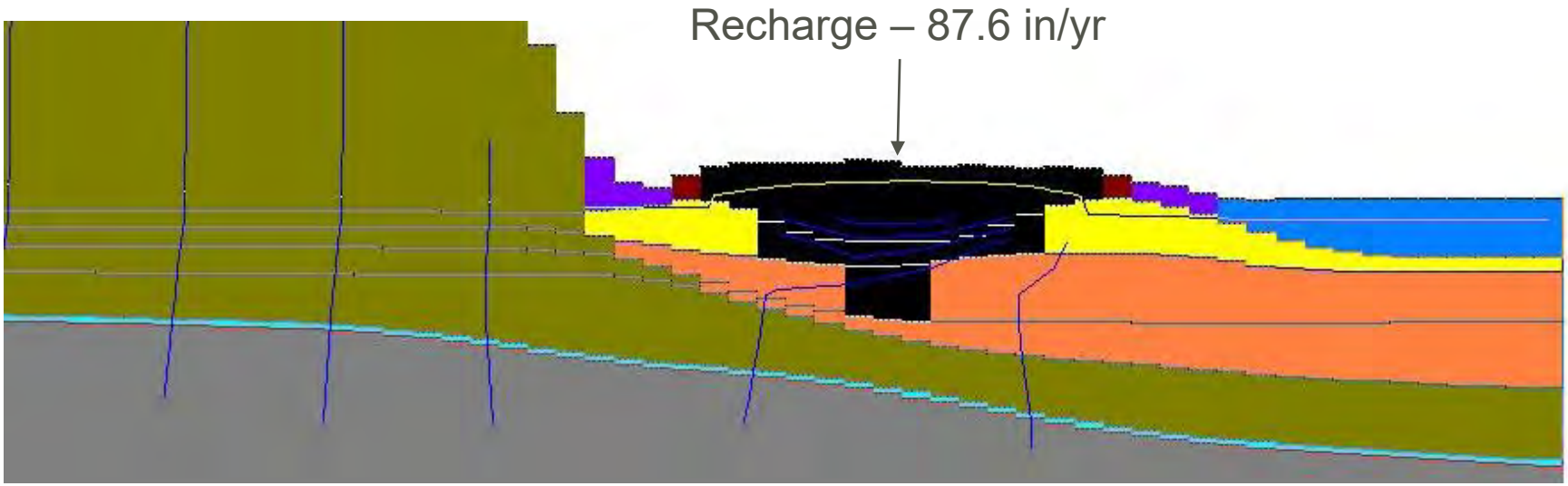

Active Conditions Assumptions

1. Same model(s) used as described in previous modeling report.
2. Recharge into RCPA 87.6 inches per year (i.e. Active Conditions).
3. Results in predicted mound in RCPA as measured in present conditions.

Phase 1 – 3D Model Design

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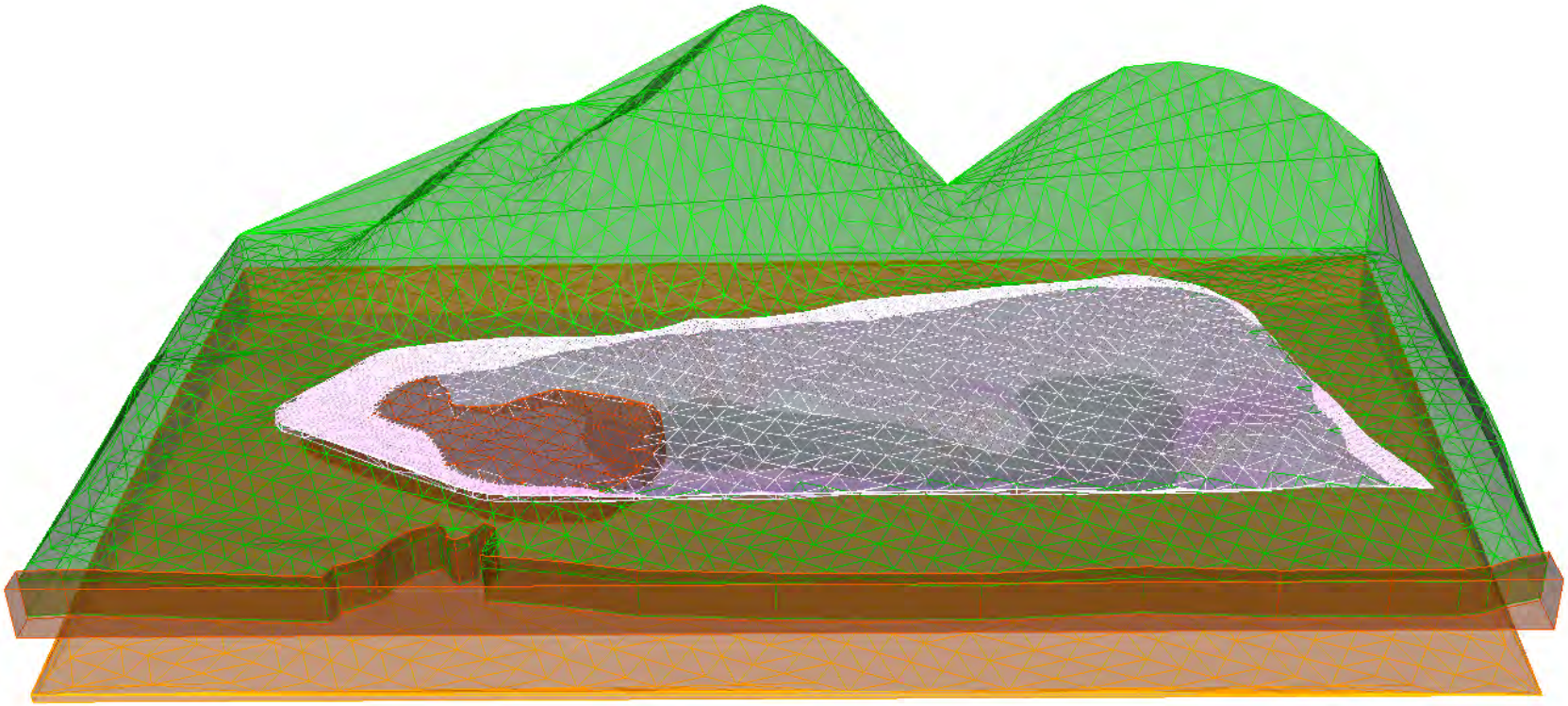
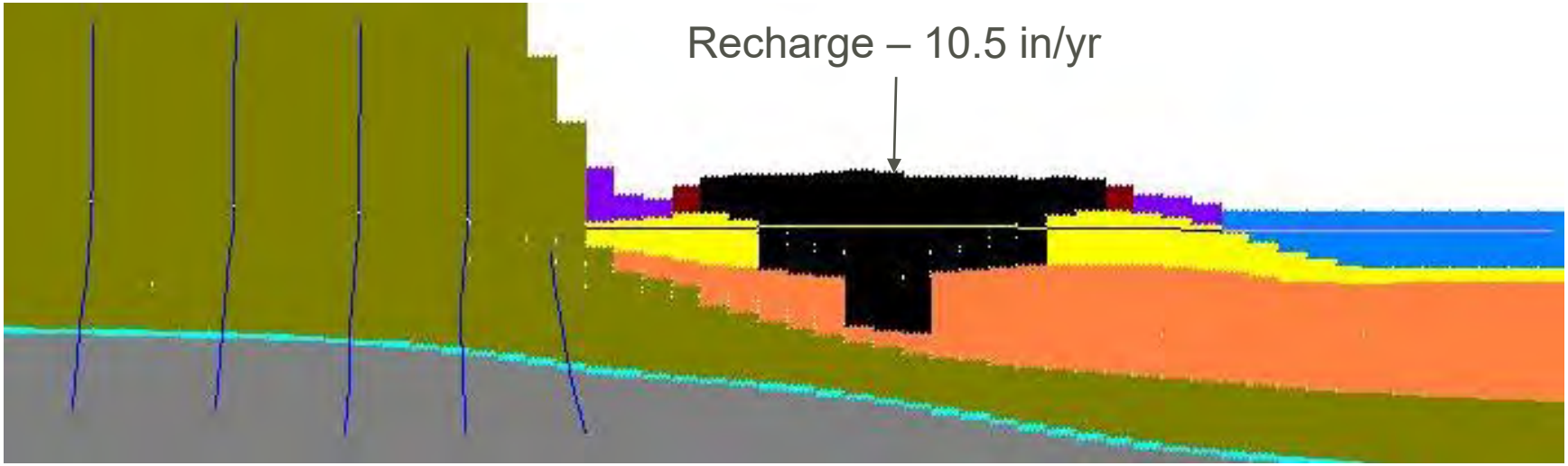


Phase 2 – Dry CCR Removal

RUSH ISLAND ENERGY CENTER



Dry CCR Removal Assumptions

1) Based on volume of CCR, it will take 16 years to excavate down the top 28 feet (dry excavation and partially wet excavation, based on lochmuller (2019) report).

2) Recharge into the pond will be less than active conditions, but higher than cap and closed conditions. The vertical conductivity (Kz) of the ash is estimated to be $1x10^{-5}$ cm/sec, so for a conservative approach, the value calculated in the help model for a $1x10^{-5}$ cm/s cap was used for recharge (10.5 in/yr) during this stage. This recharge rate causes a small mound in the RCPA of ~1-3 feet during this phase.

3) Removed polishing pond from southern portion of the RCPA.

Phase 2 – Model Design

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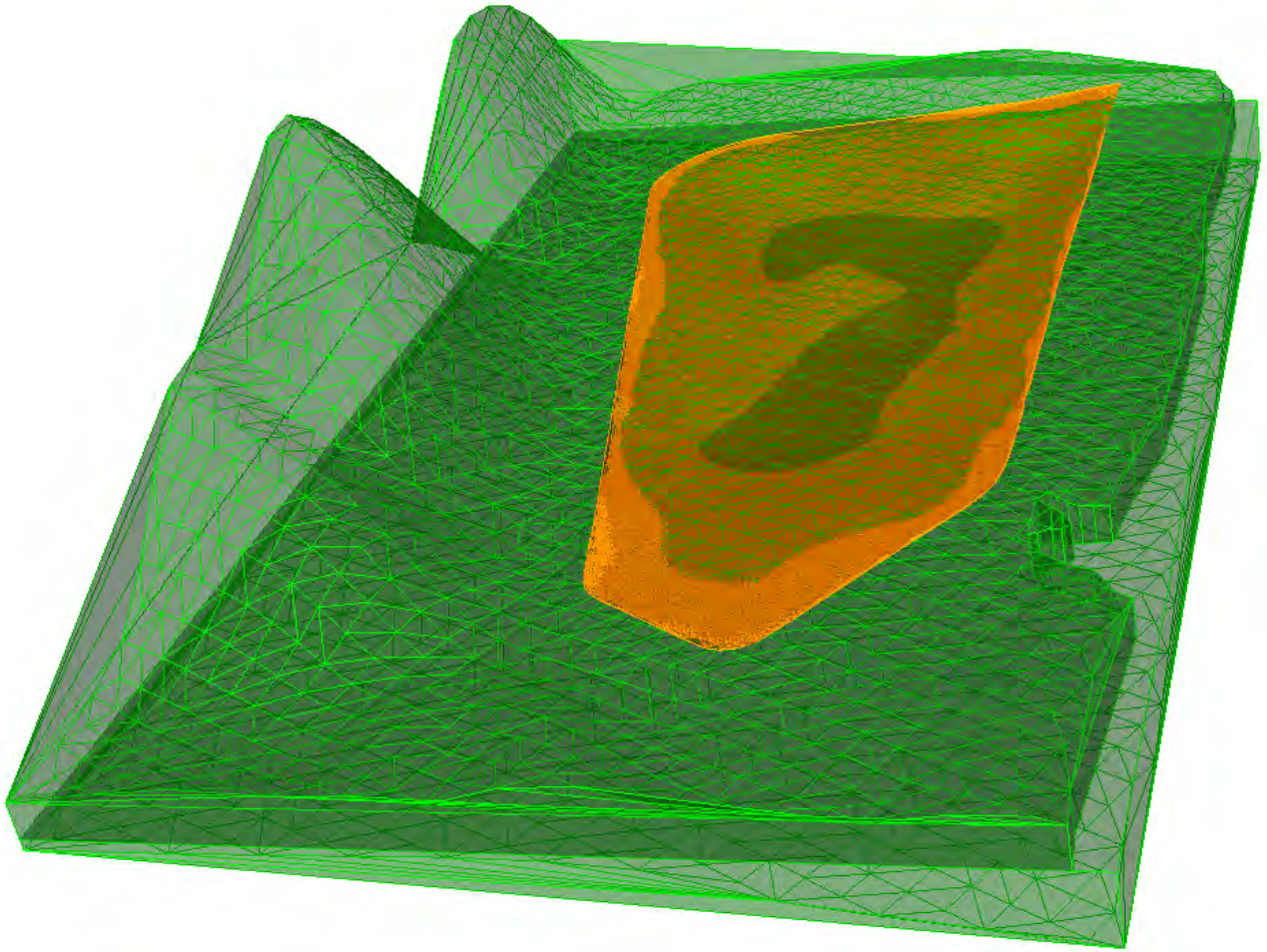
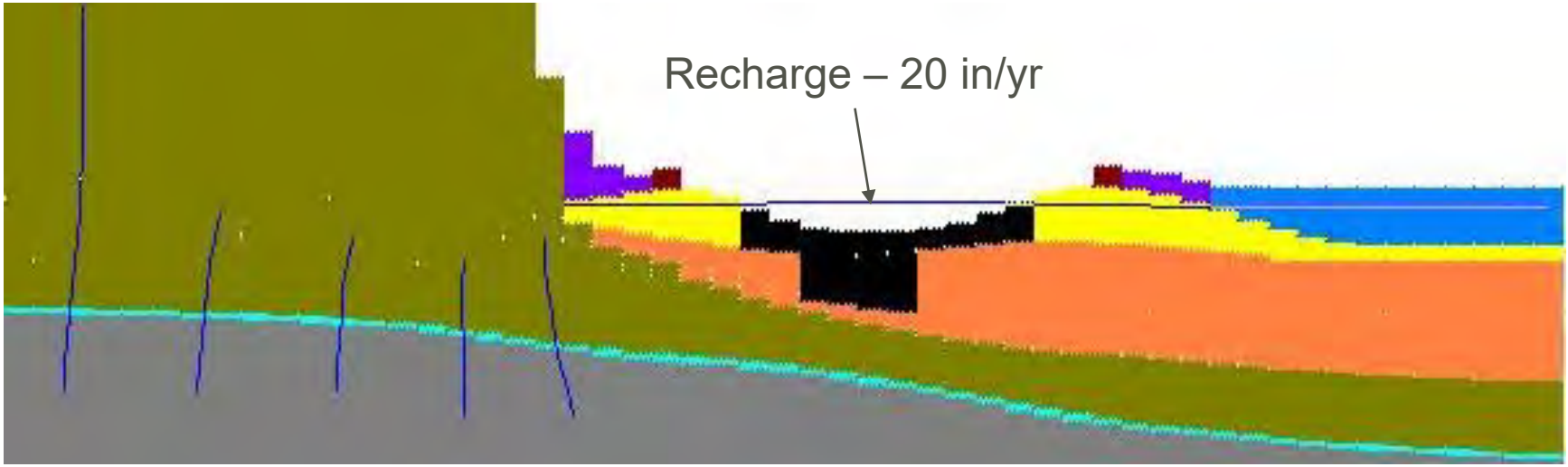


Phase 3 – Wet CCR Removal

RUSH ISLAND ENERGY CENTER



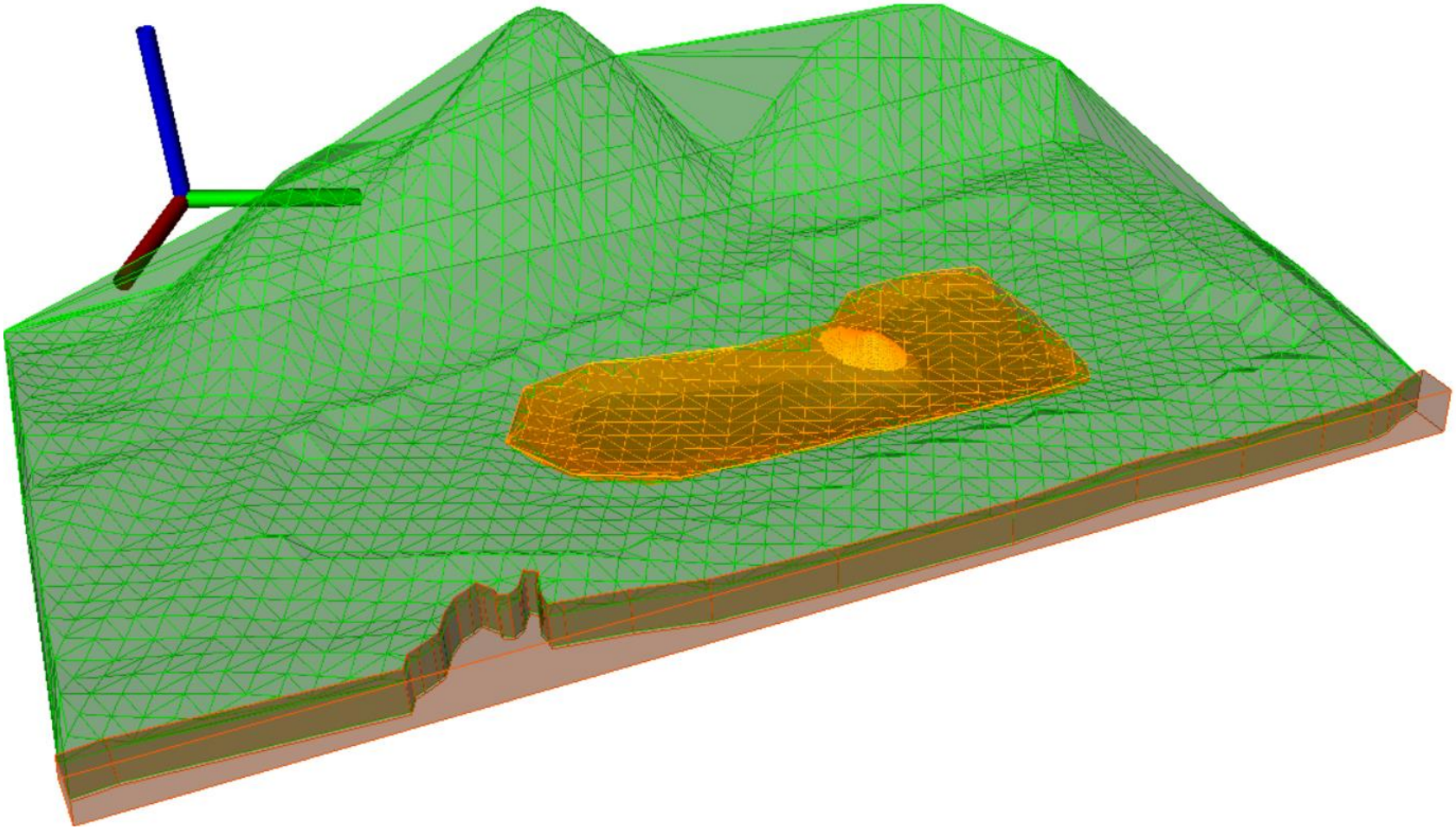
Wet CCR Removal Assumptions

1) Removed the upper portion of the CCR and treated resulting pit as an open hole.

2) Recharge was higher than the dry excavation stage, but less than the active conditions. It was assumed that there would be 43 in/year of rainfall (U.S. Climate Data, Festus). It was also assumed that the RCPA would evaporate similar to a lake, which according to U.S. Department of Commerce report, *Evaporation From Pans and Lakes*, a lake in Missouri can have ~23 inches a year in evaporation. Therefore, net annual recharge is expected to be ~20 inches/year. The rest of the water used for hydraulic dredging is assumed to be in a "closed" loop, and water used to pump the CCR out of the pond will be directed back to the RCPA after the materials are extracted.

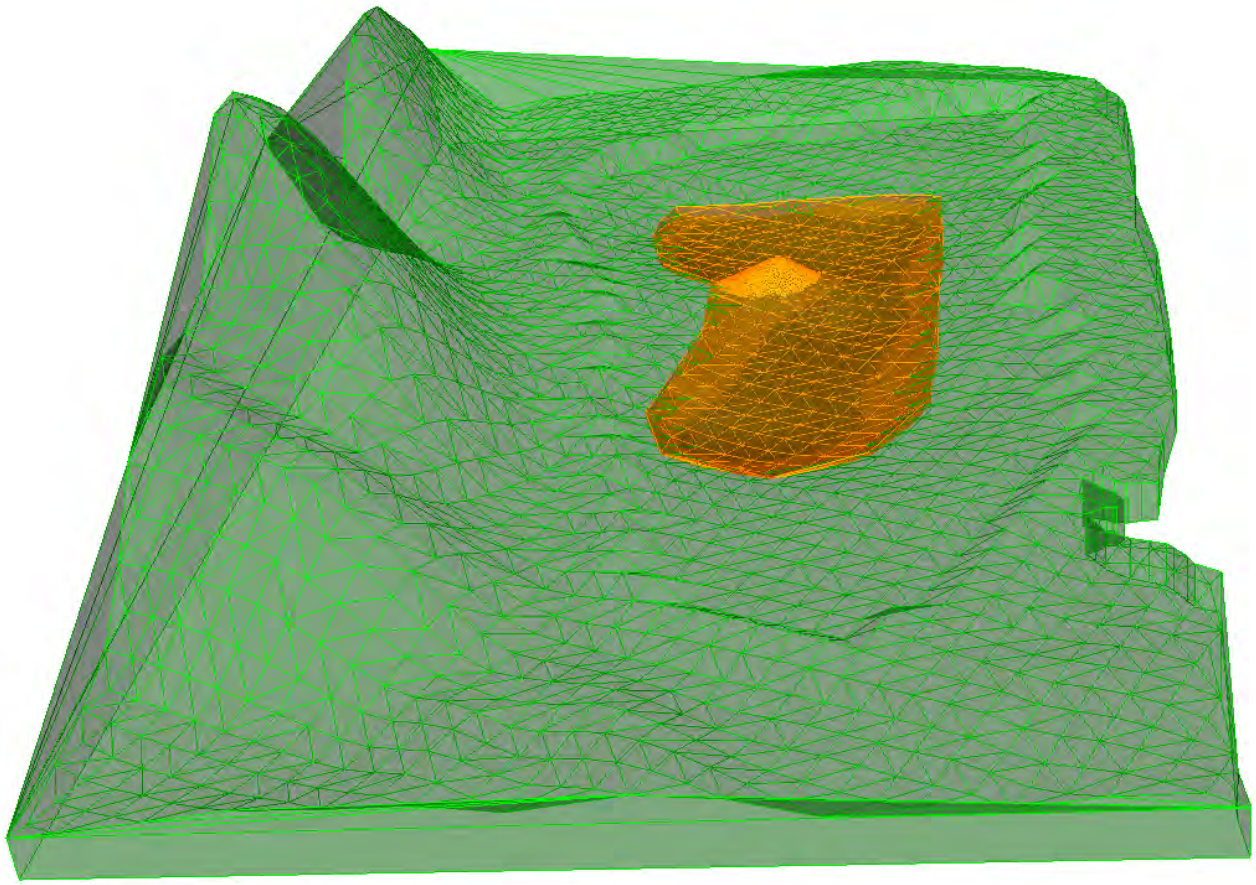
Phase 3 – Wet CCR Removal

RUSH ISLAND ENERGY CENTER



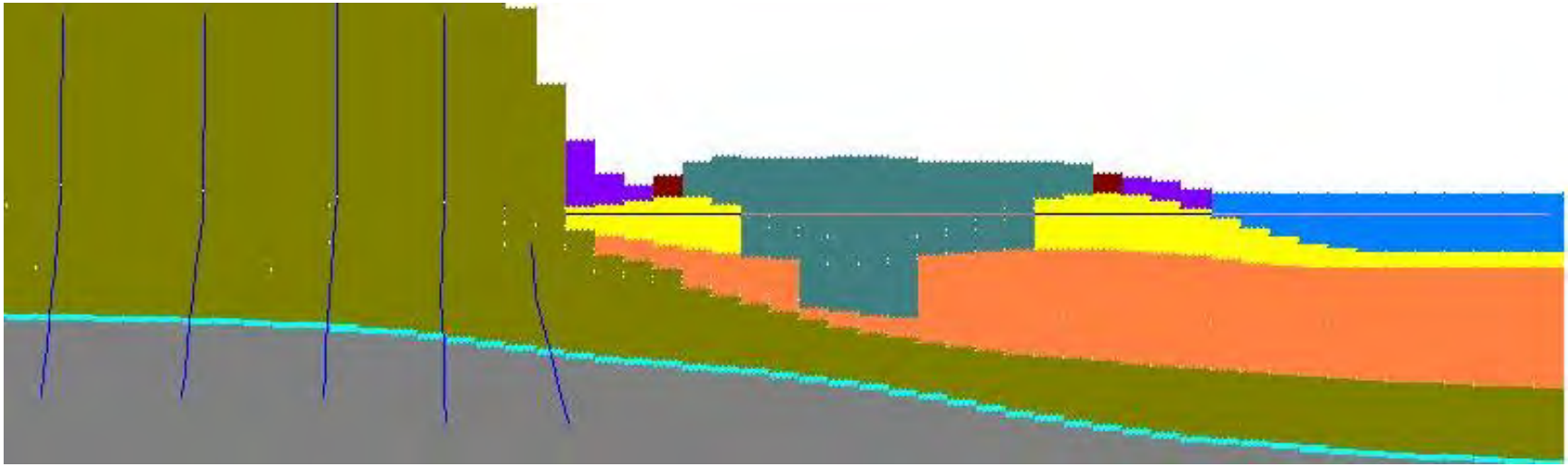
Phase 3 – Wet CCR Removal

RUSH ISLAND ENERGY CENTER



Phase 4 – Backfilled RCPA

RUSH ISLAND ENERGY CENTER



Backfilled RCPA Assumptions

1) Entire former RCPA backfilled with materials similar to the shallow alluvium onsite from dredging the Mississippi River (Lochmueller 2019). Material assumed to have a conductivity of 2.1 x 10^{-3} cm/sec (6 feet/day).

2) Recharge into the backfilled area was set equal to that estimated for the surrounding alluvial aquifer.

Phase 4 – Backfilled RCPA

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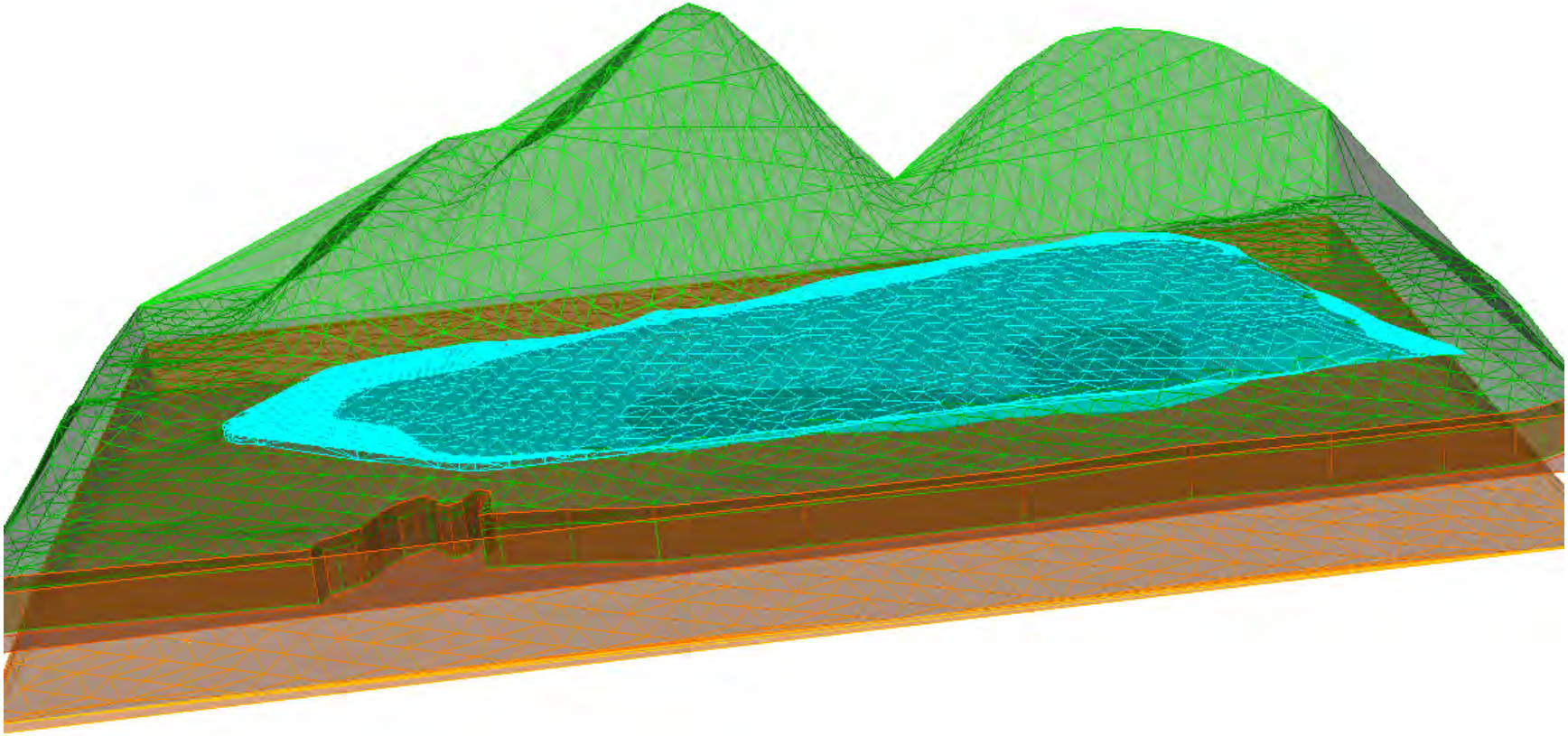
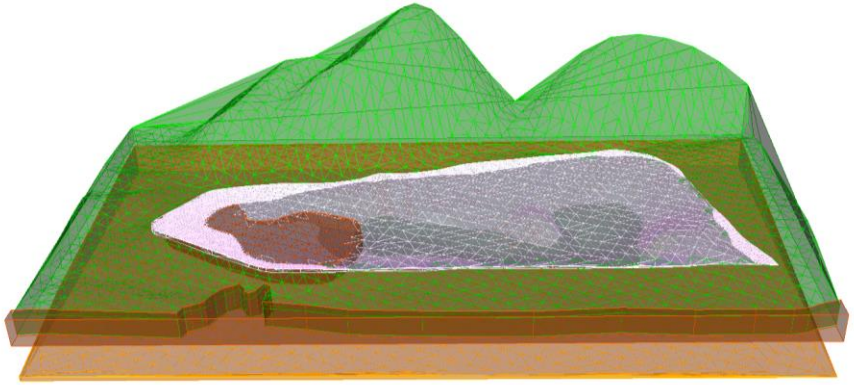


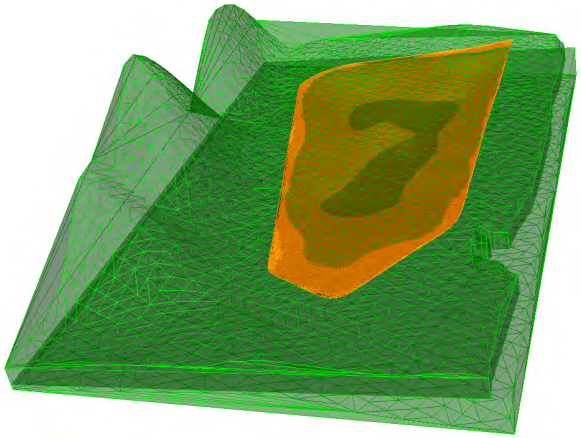
Phases of the Model

RUSH ISLAND ENERGY CENTER

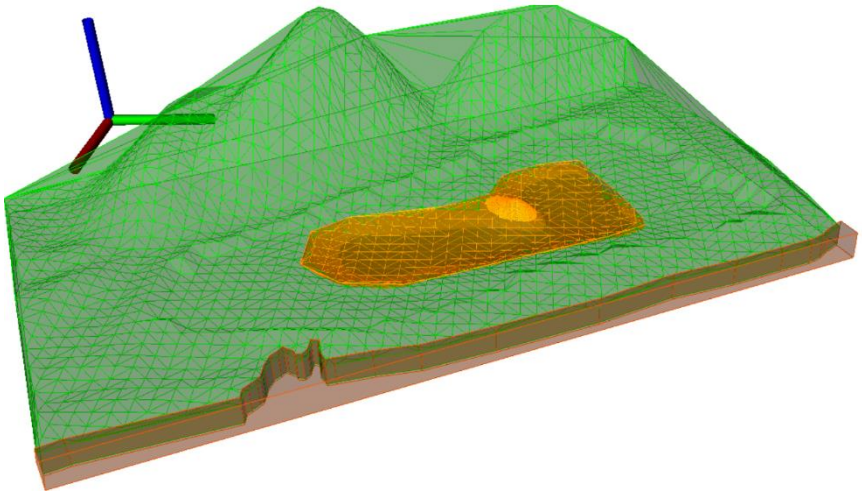
Phase 1 - Active



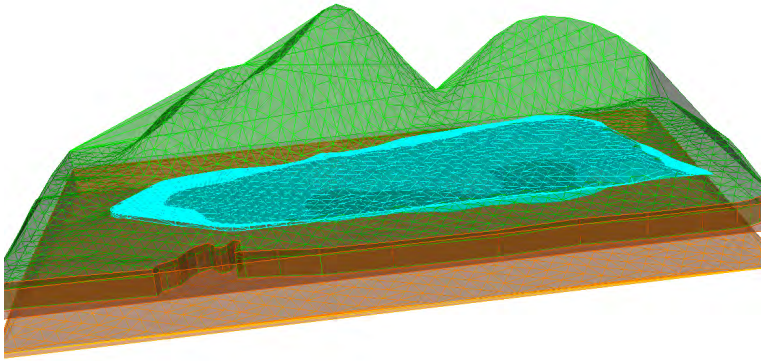
Phase 2 – Dry Removal



Phase 3 – Wet Removal

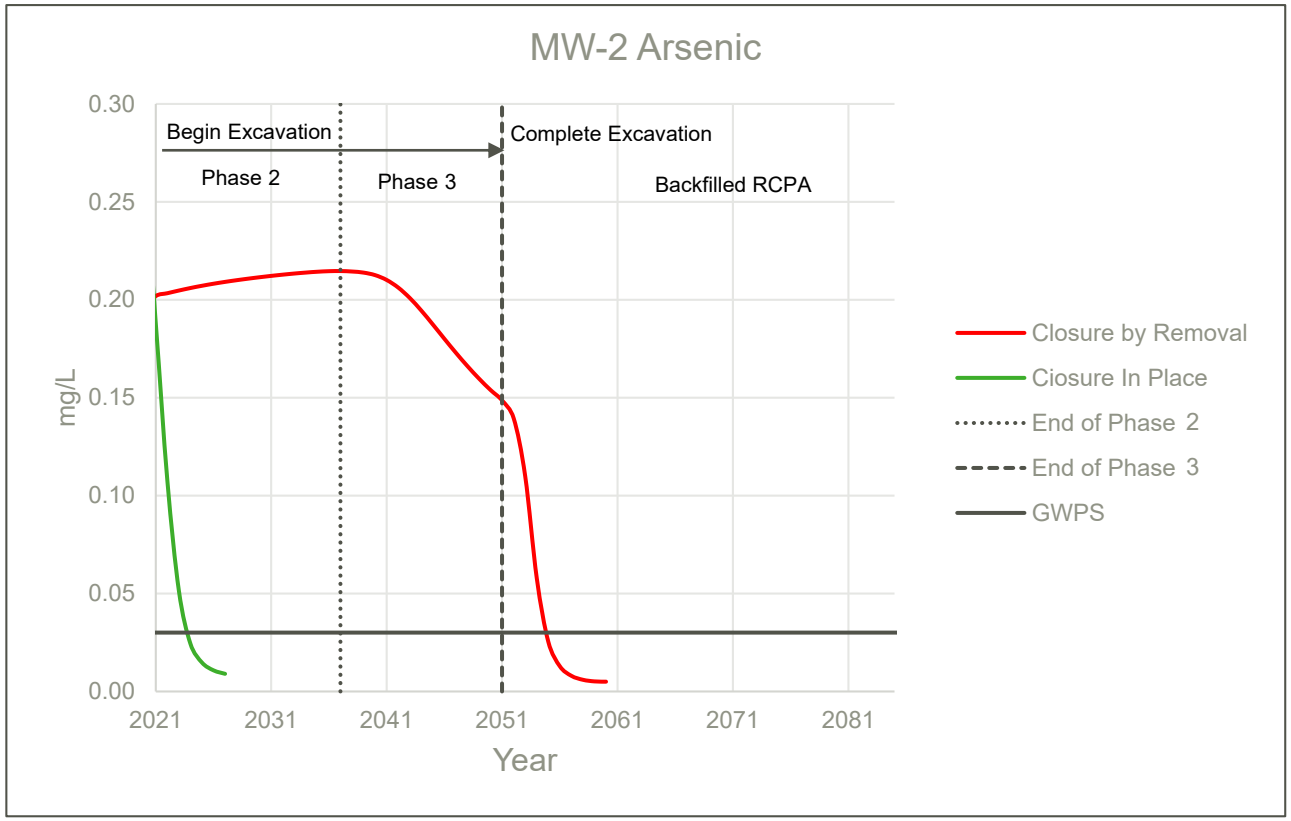


Phase 4 – Backfilled



Modeling Results Indicate Excavation Delays Groundwater Compliance

RUSH ISLAND ENERGY CENTER



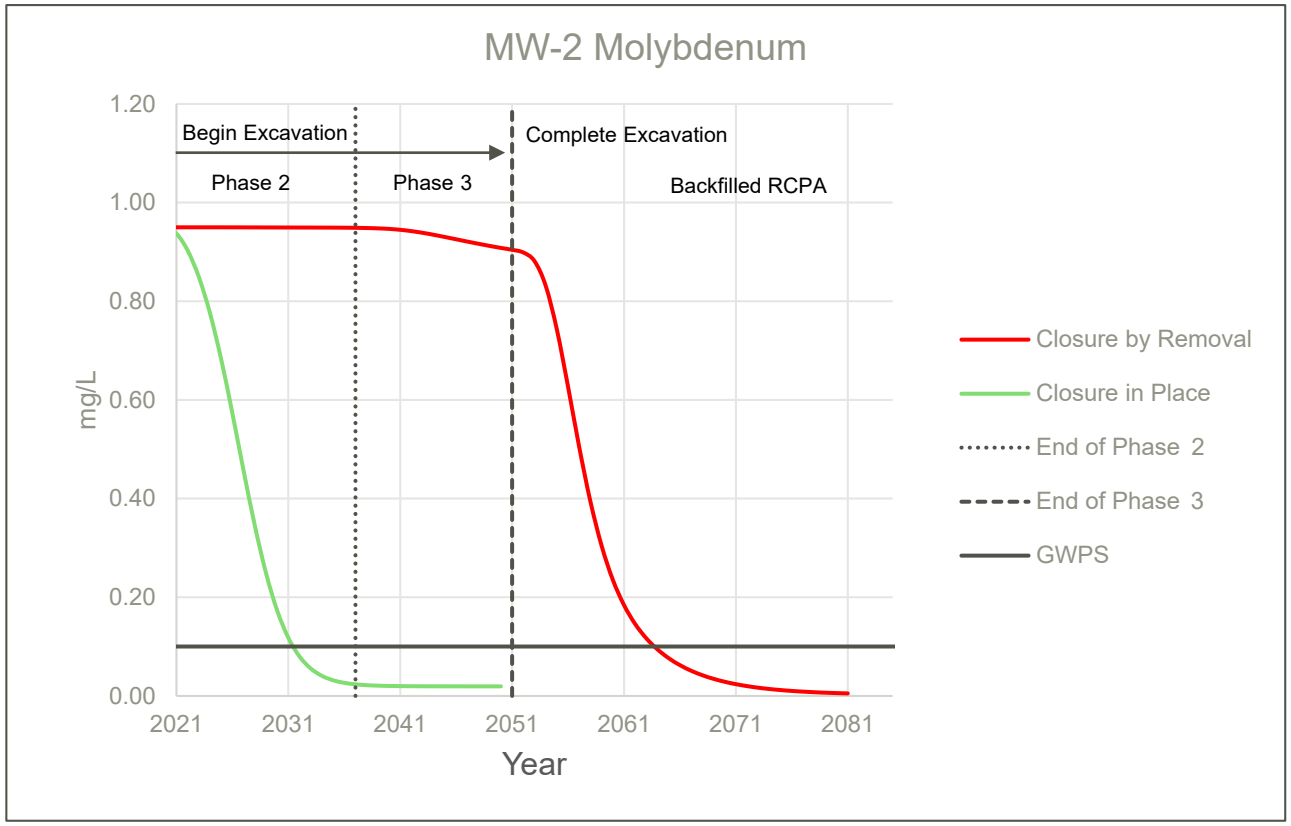
MW-2 (highest arsenic value in CCR Rule Well) is estimated to reach the GWPS 30 years sooner using closure in place vs closure by removal (Excavation)

GOLDER

Information on the closure by removal process is available in the Lochmueller (2019) and the Reitz & Jens (2019) reports

Modeling Results Indicate Excavation Delays Groundwater Compliance

RUSH ISLAND ENERGY CENTER



MW-2 is estimated to reach the GWPS 31 years sooner using closure in place vs closure by removal (Excavation)

GOLDER

Information on the closure by removal process is available in the Lochmueller (2019) and the Reitz & Jens (2019) reports

Explanation of Results

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Closure in Place reduces downgradient concentrations faster than Closure by Removal because:

- The 31-year time for CBR ash removal, during which rainfall drives outward migration of CCR impacts, adds contaminant loading and delays groundwater cleanup

APPENDIX B
2019 Remedy Selection Report

August 30, 2019

REMEDY SELECTION REPORT - 40 CFR § 257.97
RUSH ISLAND, LABADIE, SIOUX AND MERAMEC CCR BASINS

In May 2019, Ameren Missouri completed Corrective Measures Assessment (CMA) Reports for certain coal ash (CCR) basins located at the Rush Island, Labadie, Meramec, and Sioux energy centers. For each site, the CMAs considered a series of alternatives, all of which are protective of human health and the environment, control source material, minimize the potential for further releases and, over time, will attain site-specific groundwater protection standards. After sharing the CMAs publicly, Ameren Missouri solicited public input. In addition to the CMAs, Ameren Missouri and its consultants performed numerous technical evaluations, all of which help to inform the Company's remedy selection. Those evaluations include groundwater modeling; human health and ecological risk assessments; groundwater treatment assessments; onsite and offsite monitoring data; rail, barge and truck transportation studies; and a deep excavation study report.[1] The technical assessments, data and public input inform the evaluation of selection factors that has led to this final remedy selection.

Set forth below is a summary of Ameren Missouri's remedial plan that, when fully implemented and completed, will achieve CCR Rule requirements. As previously announced, Ameren Missouri intends to expeditiously close CCR basins at its energy centers by completing necessary steps to remove the basins from service and then installing an engineered cap system that exceeds, by more than two orders of magnitude, the federal regulatory requirements and, as modeling indicates, will minimize the limited and localized impact to groundwater observed at the CCR basins. In time, the sites will attain site-specific groundwater protection standards. As conditions stabilize after cover system installation, groundwater evaluations and monitoring will continue, and, as necessary, be modified. Ameren Missouri intends to implement the following corrective action measures in conjunction with the closure of CCR basins.

CORRECTIVE MEASURES REMEDIAL PLAN

CMA Reports Alternative 1: Source Control Through Installation of Low Permeable Cover System & Monitored Natural Attenuation

1. Source control, stabilization and containment of CCR by installation of a low-permeability geomembrane cap (a minimum 1 x 10 -7 centimeters per second (cm/sec) versus 1 x 10 -5 cm/sec required by the CCR Rule).

2. Once source control is achieved, monitor the natural attenuation (MNA) of groundwater concentrations to address limited and localized CCR-related impacts. Ongoing monitoring and modeling evaluations will document that concentrations are

[1] Technical assessments are appended to the CMA reports and/or to Ameren Missouri's Response to Public Concerns and all have been posted to Ameren's CCR website.

decreasing as modeled. MNA occurs due to naturally occurring processes within the aquifer.

3. Annual Groundwater *Monitoring and Corrective Action Reports* for each site will address the following:

   - Demonstrate that groundwater plume(s) are stable or decreasing and not expanding;

   - Contain an ongoing summary of baseline and periodic geochemical analysis including groundwater chemistry, subsurface soils chemical composition and mineralogy;

   - Determine site-specific attenuation factors and rate of attenuation process; and

   - Design a long-term performance monitoring program based on the specific attenuation mechanism to confirm concentration reductions and document trends.

The installation of a low-permeability, geomembrane cap system satisfies both the CCR Rule's basin closure requirements and can constitute an appropriate remedial corrective measure for groundwater impacts, as recently confirmed by the Missouri Department of Natural Resources (MDNR). A properly engineered and installed cap will practically eliminate the infiltration of water into the stored ash material. As summarized in the CMA reports, concentrations will reduce once the cap system stops recharge into the ash and groundwater conditions, such as pH levels, stabilize. Ameren Missouri will establish a long-term performance monitoring plan in accordance with the CCR Rule to document and confirm such reductions. MNA encompasses a variety of physical and chemical processes (biodegradation, sorption, dilution, chemical reactions and evaporation), which, under the right conditions, can immobilize metals in aquifer sediments. In addition to capping as a remedial corrective measure, both EPA and MDNR recognize MNA as a corrective action component for addressing inorganics (metals) in groundwater. *EPA Directive 9283.1-36 (2015); Section 644.143 RSMo (1999).* As MDNR notes, MNA is not a "no action" alternative and is complementary to source control measures. *(See Fact Sheet: MNA of Groundwater at Brownfields/Voluntary Cleanup Program Sites.)*

IMPLEMENTATION OF REMEDY

Under its current schedule, Ameren Missouri will close more than 67% (428 acres) of its CCR units by the end of 2020, with the remaining 33% by December 2023. Installation of a geomembrane cap at the energy centers will practically eliminate infiltration. Site preparation activities are underway at Rush Island and Labadie, with construction of the cap/cover systems occurring over the next 12 -18 months. Closure of additional basins at Meramec will occur in 2020 and 2021, with closure of remaining basins following the retirement of the energy center in 2023. At Sioux, use of the ash basins will terminate once wastewater and dry ash handling facilities are

completed in 2020. Set forth below are key milestones in the implementation of Ameren's remedial plans. Such schedule is subject to revision based upon each energy center's construction schedule, ongoing field investigations and, if needed, regulatory approvals.

Facility	Ash Basin Removed from Service	Ash Basin Cap System Completed	Performance Review: Groundwater & Cap System
Rush Island	04/2019	12/2020	Annual - Commencing 2021
Labadie	09/2019	12/2020	Annual - Commencing 2021
Sioux	12/2020	2021	Annual - Commencing 2023
Meramec	12/2022	2023	Annual - Commencing 2024

SUPPLEMENTAL CORRECTIVE MEASURES

In its laboratories, XDD, Ameren Missouri's environmental consultant, reproduced existing (i.e. pre-closure) groundwater and soil conditions so as to evaluate potential treatment methods to accelerate existing natural attenuation processes. Under appropriate conditions, metals can attenuate through precipitation, co-precipitation and/or sorption processes with subsurface soil minerals. XDD is evaluating potential treatment methods such as the use of pH adjustment, zero valent iron (ZVI), and bio-augmentation.[2] Laboratory results for arsenic and molybdenum, the primary contaminants of concern (COC) at some of Ameren's energy centers, indicate that through the adjustment of pH levels in subsurface soils and groundwater, groundwater protection standards (GWPS) can be met for each site[3] and that the use of chemical reduction (ZVI) and bioremediation may be helpful in the reduction process for these and other compounds.

Set forth below is a summary chart reflecting results from ongoing treatment studies. Boron is included for evaluation purposes even though under the Federal CCR Rule it is not currently an Appendix IV parameter.

[2] Ameren Missouri and XDD have experience with the use of ZVI and bio-augmentation at its Huster Substation property, a groundwater remediation project supervised by USEPA and MDNR, (CERCLA-07-2017-0129). Using a drill rig, XDD injected a slurry comprised of water and ZVI into subsurface soils and groundwater forming a reactive barrier that successfully contained groundwater contaminants that had migrated from the substation. In addition, ongoing degradation of source contaminants continues to occur through a bio-augmentation process consisting of the injection of feedstock into the sands of the aquifer.

[3] The slow groundwater flow rate at the Sioux energy center has allowed for the concentration of molybdenum at levels higher than those observed at the other energy centers. Such conditions however may be particularly conducive to the use of ZVI or bioremediation.

SUMMARY OF LABORATORY TREATMENT STUDIES

	Arsenic	Molybdenum	Boron	Lithium	Attenuation Mechanism
	mg/L				
pH 10		R/M5/M6		M6	P,C
pH 9	R				P,C
pH 8	R	M6			P,C
pH 7	R				P,C
pH 6	R/M5*/M6*	R/M5/M6/L/S			P,C
CaSx	R	R/M5/M6/L	M6	M5	P,C
Dissolved Iron (Anaerobic)	R	L			P,C
Dissolved Iron (Aerobic)	R	L			P,C
ZVI Injectable	R	R/M5/M6/L/S	L/S R/M5/M6	M5/M6	P,C
ZVI PRB	R	R/M5/M6/L	R/M5/M6	M5/M6	P,C
ZVI Injectable + Bio	R	R/M5/M6/L/S	R/M5/M6	M5/M6	P,C
ZVI Injectable pH 8 + Bio	R	R/L	R		P,C
ZVI PRB + Bio	R	M5/M6/L/S	S	M5/M6 L/S	P,C
ZVI PRB pH 8 + Bio	R	R/L	R	M6 L/S	P,C

Notes:

No Effect

Reduce

Increase

Attains Standard

Non-Detect

L = Labadie

S = Sioux

R = Rush Island

M5/M6 =Meramec monitoring wells

PRB = permeable reactive barrier

Injectable = iron particles at micro-scale; potentially applied through injection

Dissolved iron = 50 mg/L Iron(II) sulfate

CaSx = calcium polysulfide

P = Precipitation

C = Co-precipitation

* = arsenic was not detected in M5/M6 baseline despite being detected during quarterly sampling at M5. Results indicate arsenic would likely be removed under pH 6 conditions.

Additional pilot studies are needed to confirm that laboratory results can be replicated and appropriately scaled under field conditions. Assuming such confirmation, corrective action Measures may also include groundwater treatment to facilitate reductions. Field demonstrations and groundwater treatment applications could require a state-issued permit pursuant to *10 CSR 20-6.010*. Remedial actions are iterative in nature and Ameren Missouri (as part of the long-term performance monitoring program) will periodically evaluate then-existing groundwater conditions relative to GWPS and determine whether additional treatment measures are warranted.

APPENDIX C
SCPA Closure Completion Documentation

Sioux Energy Center SCPA CCR Surface Impoundment

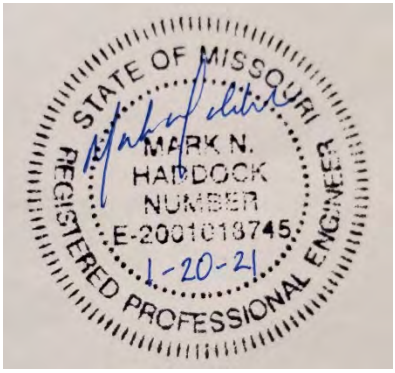
Notification of Intent to Close a CCR Unit and Certification for Final Cover System Design

In accordance with 40 C.F.R. § 257. l 02(g), this is a notification of the intent to close CCR surface impoundment unit SCPA at the Sioux Energy Center. Closure of SCPA will be performed in accordance with 40 C.F.R. § 257. 102(d).

As a licensed Professional Engineer in the state of Missouri, I certify to the best of my knowledge, information, and belief, that the final cover system design for the surface impoundment SCPA at Ameren Missouri's Sioux Island Energy Center meets the final cover system requirements of 40 C.F.R. §257. 102(d)(3).

Mark N. Haddock, PE

Missouri PE# 2001018745



SIOUX ENERGY CENTER
SCPA CCR IMPOUNDMENT – CLOSURE PLAN

Table of Contents

1.0 INTRODUCTION 1
2.0 SITE DESCRIPTION 1
3.0 CLOSURE PLAN 1
3.1 Overview of Closure Approach 1
3.2 Estimated Maximum Inventory of CCR 2
3.3 Largest Area Requiring Cover Systems 2
3.4 Closure Components 2
3.4.1 Process Water/Piping Rerouting 2
3.4.2 Impoundment Surface Dewatering 2
3.4.3 Stabilization and Grading 2
3.4.4 Design and Installation of Final Cover System 3
3.4.4.1 Alternative Cover System 3
4.0 PRELIMINARY SCHEDULE 4
5.0 POST-CLOSURE PLAN 5
5.1 Post Closure Uses 6
6.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION 6
7.0 REFERENCES 6

List of Tables

Table 1 SCPA Impoundment Status
Table 2 Anticipated Schedule

List of Appendices

Appendix A SCPA Conceptual Site and Grading Plan

1.0 INTRODUCTION

Pursuant to 40 CFR 257.102 (2), the owner or operator of a Coal Combustion Residual (CCR) unit must prepare a closure plan identifying the manner and timing of closure and, with respect to the installation method for the final cover system, describe how such cover complies with the designated performance criteria set forth in the CCR Rule. This closure plan was prepared for Ameren Missouri's (Ameren) Sioux Energy Center (SEC) SCPA impoundment, which is an active CCR surface impoundment containing fly ash and wet bottom boiler slag. Ameren will initiate closure of the SCPA impoundment consistent with the requirements of the CCR Rule, leaving the CCR in place. The information contained in this plan describes how Ameren plans to close the unit. Appendix A provides a map showing the location of the SCPA impoundment at SEC. Table 1 (below) provides a summary of the SCPA impoundment, operational status, and anticipated closure date. It is understood that the provided schedule is preliminary in nature and subject to revision based on operational needs, construction progress, budgetary constraints, and future evaluations of methods and materials for closure.

Table 1: SCPA Impoundment Status

CCR Unit	CCR Type	Operational Status	Estimated Closure Date
SCPA	Bottom Ash and Fly Ash	Active	2021

Ameren anticipates closure of the SCPA impoundment at SEC to occur in 2021.

2.0 SITE DESCRIPTION

The SEC is located in Saint Charles County, Missouri at 8501 N. State Route 94, West Alton, MO 63386; north of State Route 94 adjacent to the Mississippi River. The SEC is an active power plant that generates CCRs which are stored in SCPA and other CCR units at the facility. SCPA formerly operated as the primary ash surface impoundment, collecting all CCRs for the plant until 1994. In 1994, SCPB, a lined surface impoundment, was constructed and the SEC's CCR storage strategy changed to impounding only bottom ash in the SCPA and impounding only fly ash in the SCPB. The SCPA impoundment is located west and south of the power plant.

3.0 CLOSURE PLAN

3.1 Overview of Closure Approach

The purpose of this closure plan is to outline the steps to close the impoundment consistent with recognized and generally accepted engineering practices. This plan is designed to minimize the need for long-term maintenance and to control the post-closure release of contaminants. SCPA will be closed in accordance

with the requirements of 40 C.F.R. § 257.102. Closure will occur within the time frames set out in 40 C.F.R. § 257.102(f).

Closure of the SCPA Impoundment at SEC will consist of a cap-in-place cover system consistent with 40 C.F.R. § 257.102 (d)(3). Ameren plans to use CCRs to achieve closure design contours and grade the closure configuration to meet stability requirements and reduce the potential for water infiltration. After proper CCR contours and surface compaction are achieved, the final cover system will be installed. The final closure and cover system will use appropriate materials and could include a composite or alternative cover. The final closure will also use a drainage system to control run-on and run-off for the SCPA. Post-closure monitoring will be performed for SCPA in accordance with the CCR Rule.

3.2 Estimated Maximum Inventory of CCR

The SCPA has an estimated maximum inventory of approximately 3,338,000 cubic yards of CCR.

3.3 Largest Area Requiring Cover Systems

Under 40 CFR § 257, the entire impoundment will require a cover system totaling approximately 49 acres.

3.4 Closure Components

The primary activities and components that Ameren plans to employ to satisfy the requirements of closure for the SEC's SCPA are detailed below.

3.4.1 Process Water/Piping Rerouting

All piping and water systems will be rerouted to prevent future discharge of plant service water systems, stormwater, and other drainage to SCPA. Plant service water systems will be rerouted to an ash dewatering treatment facility and stormwater will be rerouted to the NPDES outfall (002).

3.4.2 Impoundment Surface Dewatering

Grading of the impoundment surface will be performed to promote gravity drainage of surface water to desired and/or designated collection areas within the SCPA. Water collecting in these areas will be removed and used to enhance compaction, dust suppression, or moved to a proper drainage outfall.

3.4.3 Stabilization and Grading

40 C.F.R. § 257 requires closure systems for CCR surface impoundments to prevent the probability of future impoundment of water, sediment or slurry. In addition, the CCR rule requires the stabilization of wastes within an impoundment. A CCR impoundment layer is considered stabilized when it is structurally suitable for use as a base layer and can accommodate future construction activities. Stabilization techniques for the existing CCR within SCPA may include dewatering and compaction.

Minimum design slopes are not established under 40 C.F.R. § 257. However, the Missouri Department of Natural Resources (MDNR) require utility waste landfills to use a minimum slope of one percent (1%) and it is good engineering practice to use a minimum of two percent (2%) so that no ponding occurs after construction. Therefore, the grading of SCPA will follow the industry practice of 2% minimum slope. Grading of SCPA may be accomplished using existing CCR materials for final grading and enhance drainage.

3.4.4 Design and Installation of Final Cover System

In accordance with the CCR Rule, the Final Cover System will meet the requirements of 40 C.F.R. § 257.102.

Final Cover System Design

The cover system will be designed to reduce infiltration into the landfill and to resist erosion. The permeability of the cover system and will be equal to or less than the permeability of the underlying soil below the impoundment and no greater than 1×10^{-5} cm/sec.

The final cover system for closure will be certified by a qualified professional engineer as being designed in accordance with the requirements of 40 C.F.R. § 257.102.

CCRs managed for storage/disposal could have differential settlement and/or subsidence could occur due to the fine grained characteristics and material properties of the CCR. To accommodate potential differential settlement, layers with a high allowance for strain, will be used in the final cover system.

The proposed final cover system will consist of the following from top to bottom and will be placed over the graded CCR:

- 6-inch thick vegetated erosion control layer
- 18-inch thick infiltration layer or a composite system with equivalent properties
- Low permeability layer meeting the permeability requirements of the CCR Rule (such as a geomembrane layer or other layer that meets the CCR Rule requirements)

Appendix A provides conceptual site plans for the final cover system.

3.4.4.1 Alternative Cover System

The CCR Rule authorizes the use of an alternative final cover system for closure, provided such system meets equivalent performance requirements. Alternative final systems comprised of synthetic turf material have demonstrated equivalence with the prescriptive final cover requirements in solid waste applications, and MDNR has approved synthetic turf systems for use as interim covers for use at municipal solid waste landfills. Ameren is evaluating their use for final cover. Benefits of an alternative cover system application

include reduced cover system costs when soils would otherwise be required to be imported, reduced environmental impact from haul trucks, a potential reduced construction timeframe, improvements to stormwater discharge quality, ability to accommodate settling / subsidence, and reductions in post-closure care maintenance.

Consideration of an alternative cover system will be based on interviews with manufacturers, site visits and a field demonstration assessment. Technologies to be considered will prevent contact of CCR materials with percolating rainwater, promote controlled runoff to stormwater detention systems, reduce borrow volume requirements and minimize maintenance. Performance considerations used to evaluate various synthetic products and alternative cover systems include the following: permeability, constructability, longevity, cost, installation time, thickness, puncture strength, wind resistance, flood resistance, CCR compatibility, vehicle traffic, storm flow velocity restrictions, maintenance, erosion control, and UV protection.

4.0 PRELIMINARY SCHEDULE

In accordance with 40 C.F.R. § 257.102(e), the facility will begin closure activities within 30 days after the known final receipt of waste, or if the landfill has remaining capacity and there is a reasonable likelihood that the landfill will receive additional wastes, no later than two years after the most recent receipt of wastes. Contractor mobilization will occur during the initial 30-day period after last known receipt of waste.

It is anticipated that the completion of the CCR final closure will be complete within the 5 years allowed after commencing closure, or by an approved extension deadline. 40 C.F.R. § 257.102(f)(1)]

In accordance with 40 C.F.R. § 257.102(h), within 30 days following completion of closure of the CCR unit, Ameren shall record a notation on the deed to the SCPA property stating that the property has been used as a CCR unit and its use is restricted under the Post-closure plan and the post-closure care requirements as provided by 40 C.F.R. § 257.104(d)(1)(iii).

Within 30 days of recording the notation, Ameren shall prepare a notification stating that that the notation has been recorded and placed it into the facility's operating record. Pursuant to 40 C.F.R. § 257.106(d), Ameren shall send to the appropriate regulatory agency the notification of intent to close, notification of closure completion, and notification of deed notation, within 30 days of placing each such notification in the operating record.

The anticipated schedule for closure activities is as follows:

Table 2: Anticipated Schedule

Time	Activity
Prior to last receipt of waste	Permitting, detailed closure design and contractor selection
30 days after last receipt of waste	Mobilization of contractor
Within 5 years after beginning construction	Grading, install cover system and stormwater controls
2021	Complete closure construction activities
30 days after closure construction completion	Within 30 days following completion of closure of the CCR unit, Ameren shall record a notation on the deed to the SCPA property stating that the property has been used as a CCR Unit and its use is restricted under the Post-Closure Plan and the post-closure care requirements as provided by 40 C.F.R. § 257.104(d)(1)(iii). Place closure documentation into the facility's operating record.

5.0 POST-CLOSURE PLAN

Per 40 C.F.R. § 257.104, all surface impoundments and landfills related to CCR containment are required to provide post-closure care for a minimum of thirty (30) years. These activities will include:

- Periodic inspection of the closed CCR unit
- Maintaining the integrity and effectiveness of the final cover system.
- Making repairs as necessary to correct effects of settlement, subsidence, erosion, and/or other events.
- Preventing run-on and run-off from eroding or otherwise damaging of the final cover.
- Maintaining the groundwater monitoring system.
- Semiannually sampling the groundwater monitoring wells, in accordance with the groundwater monitoring plan

This closure plan requires drainage (pipe rerouting, dewatering, and run-on and run-off plan), stabilization of CCR, placement of fill and grading, and installation of a final cover system over the CCR material to minimize erosion and infiltration. The final cover grades will promote drainage and reduce

cuts and fills (and associated construction costs). Stormwater is planned to be conveyed to an existing NPDES outfall. A conceptual site and grading plan for SCPA is presented in Appendix A.

Contact for post-closure care period:

Contact Name:	Ameren Missouri
Contact Address:	1901 Chouteau Avenue St. Louis, MO 63103
Contact Phone Number:	(800) 552-7583
Contact email address:	CCR@ameren.com

5.1 Post Closure Uses

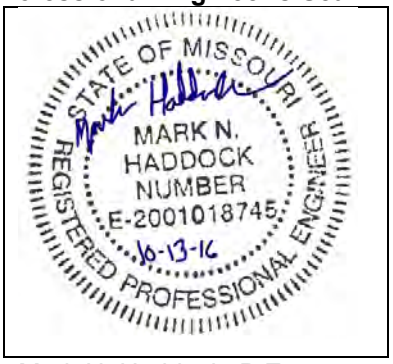
Planned uses for the CCR unit property during the post-closure period have not been decided, but will be dependent on the status and operation of the facility at the time of closure. In accordance with the CCR Rule, post-closure use of the property shall not disturb the integrity of the final cover system or components of the containment system unless it complies with the CCR Rule and a demonstration is made that it will not increase the potential threat to human health of the environment.

6.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

This certification is understood and intended to be an expression of my professional opinion as a Missouri Licensed Professional Engineer, based upon knowledge, information, and belief.

I certify that the Final Closure Cover System, Closure Plan and Post-Closure Plan meet the requirements of 40 CFR 257.102 and 40 CFR 257.104, as appropriate.

Professional Engineer's Seal



Mark N. Haddock, P.E.
License: Missouri PE-2001018745

7.0 REFERENCES

Federal Register; Part II Environmental Protection Agency 40 C.F.R. § 257 and 261; Vol. 80; No. 74; April 17, 2015.

GSE Environmental; http://www.gseword.com; 2015.

Hayward Baker Geotechnical Construction; http://www.haywardbaker.com; 2015.

Missouri Code of State Regulations; Title 10 - Department of Natural Resources (MDNR); Division 80 – Solid Waste Management; Chapter 11 – Utility Waste Landfill.

National Archives and Records Administration; 40 C.F.R. § 257; United States Environmental Protection Agency (USEPA).

APPENDIX A

SCPA CONCEPTUAL SITE AND GRADING PLAN

NOTE(S)

1. Figure for illustrative purposes only. Does not represent actual final closure plan or contours.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED	-
01	10/12/2016	PROPOSED CCR POND CLOSURE	MSG	MSG	MNH	MNH	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

CLIENT
Ameren Missouri
8501 North State Route 94
West Alton, MO 63386

CONSULTANT
Golder Associates Inc.
820 South Main Street
Suite 100
Saint Charles, MO 63301 USA
(636) 724-9191
www.golder.com

PROJECT
Sioux Energy Center (SEC) - SCPA Closure Concept

TITLE
SCPA Conceptual Site and Grading Plan

PROJECT NO. 154-7197
REV. 01
01 of 01
Figure 01

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October 14, 2022 Project No. 1547197

Alex Bias
Ameren Missouri

NOTIFICATION AND CERTIFICATION OF CLOSURE COMPLETION OF THE SCPA CCR UNIT, AMEREN SIOUX ENERGY CENTER, SAINT CHARLES COUNTY, MISSOURI

Golder Associates USA Inc. (a member of WSP) is providing notification to Ameren Missouri of Closure Completion of the Coal Combustion Residual (CCR) Unit SCPA at the Sioux Energy Center in Saint Charles County, Missouri pursaunt to 40 C.F.R. §257.102(h).

As required by 40 CFR § 257.102(h), this notification of closure completion has been prepared, including the certification of completion of closure, by a qualified professional engineer pursuant to 40 CFR §257.102(f)(3), and should be placed in the facility's operating record pursuant to 40 CFR §257.105(i)(8).

Golder Associates Inc.
13515 Barrett Parkway Drive, Suite 260, Ballwin, Missouri, USA 63021 T: +1 314 984-8800 F: +1 314 984-8770

October 14, 2022 Project Number: 1547197

Certification

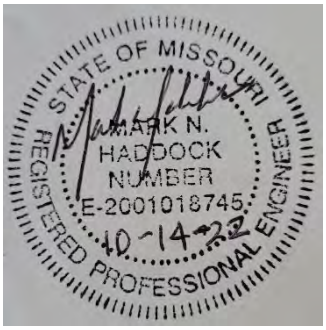
Professional Engineer Certification Statement [40 CFR §257.102(f)(3)]

I hereby certify, being familiar with the provisions of Title 40 of the Code of Federal Regulations, that the **SCPA** CCR Unit closure has been completed in accordance with good engineering practices, including the consideration of applicable industry standards, the Closure Plan developed for SCPA pursuant to 40 CFR § 257.102(b), and with the requirements of 40 CFR § 257.102(d)(1) and 40 CFR § 257.102(d)(3)(ii)(A)-(C).

Golder Associates USA Inc.

October 14, 2021

Date of Certification



Mark N. Haddock, P.E.

Name

Missouri 2001018745

Professional Engineer Registration Number

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13515 Barrett Parkway Drive, Suite 260, Ballwin, Missouri, USA 63021 T: +1 314 984-8800 F: +1 314 984-8770

APPENDIX D
Treatability Study Documentation

December 31, 2019 *Via e-Mail* (bmiller2@ameren.com)

Ameren Services
1901 Chouteau Avenue
PO Box 66149, MC 6
St. Louis, MO 63166-6149

RE: Ashpond Metals Treatability Study Results

XDD Project No. 19005.00, 19005.01, 19010.00, and 19011.0

XDD ENVIRONMENTAL, LLC (XDD) appreciates the opportunity to provide Ameren Services (Ameren) with the results of the data evaluation, bench-scale treatability testing, and remedial technology evaluation to address elevated levels of arsenic (As), molybdenum (Mo), lithium (Li), boron (B), and other site metals in ashponds leachate / groundwater from the Rush Island Energy Center (RIEC), the Meramec Energy Center (MEC), the Labadie Energy Center (LEC), and the Sioux Energy Center (SEC). The bench-scale testing was performed in accordance with the scope of work described in XDD's *Proposal for Metals Treatability Study* dated February 12, 2019, *Proposal for Metals Treatability at the Labadie Energy Center* dated April 23, 2019, and *Proposal for Metals Treatability at the Sioux Energy Center* dated April 23, 2019, with modifications as noted in this report. The report herein includes preliminary results of the treatability testing for all sites with a final pilot study design approach for RIEC.

If you have any questions regarding the information presented in this report, please do not hesitate to call me at 314.609.3065.

Sincerely,

DEREK INGRAM

XDD Environmental

cc:

Michael Marley
Laurel Crawford
Bridget Cavanagh

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ASHPOND METALS TREATABILITY STUDY RESULTS

Ameren Services

Prepared For:

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Prepared By:

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TEL: (603) 778-1100
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December 31, 2019

DRAFT For Review Only

EXECUTIVE SUMMARY

XDD Environmental (XDD) was retained by Ameren Services (Ameren) to perform metals treatability studies for the remediation of arsenic, molybdenum, lithium, boron, and other metals of concern (MOC) from ashpond leachate / groundwater. Phase 1 of the three phases of treatability studies included a review of geological conditions and existing metals in leachate from four sites [Rush Island Energy Center (RIEC), Meramec Energy Center (MEC), Labadie Energy Center (LEC), and Sioux Energy Center (SEC)]. In addition, the Phase 1 involved literature research on possible treatment trains and chemical conditions favorable for the MOC remediation. The results from the Phase 1 study identified several possible in situ treatment technologies for further evaluation, including: pH adjustment, iron precipitation / coprecipitation, zero valent iron (ZVI), metals reducing geochemical conditions, and biological stimulation as possible approaches to be tested in the Phase 2 studies.

The Phase 2 studies evaluated the Phase 1 identified treatment approaches effectiveness for MOC remediation using site groundwaters and soils, mimicking an in situ treatment application. The primary objective of the Phase 2 testing was to determine which treatment approaches / changes to geochemical conditions would promote adsorption, precipitation, or coprecipitation of the MOC, without adversely affecting the dissolved and total MOC concentrations in groundwater or other metals present at the site. The tests were carried out for periods of one to eight weeks (depending on the technology under evaluation). Of the remedial approaches tested in Phase 2, microscale ZVI and pH reduction (to pH 6) were the only methods that treated arsenic and molybdenum (the two metals of greatest regulatory concern at RIEC) to the required criteria. The other remedial approaches tested had limited to no impact on the MOC in groundwater.

The results from the Phase 2 testing were to be used to refine Phase 3 testing and to develop the pilot test design for the RIEC site. However, prior to the Phase 3 testing, boron was changed from a secondary to a primary MOC. Microscale ZVI was the only technology that had been shown to remove boron from groundwater in the Phase 2 testing; additional research identified an ion-specific resin (resin) that could treat boron to the required criteria using an ex situ remedial approach. The addition of boron as a primary MOC, along with concerns with clogging of the aquifer from precipitation of site metals, and the complexity of in situ treatment of boron, resulted in a transition from an in situ to an ex situ treatment system conceptual treatment approach for all sites MOC. The primary concern /difference in the transition from in situ to ex situ treatment is the decreased treatment time; the available in situ treatment time based on site hydraulics is weeks to a month or more; ex situ treatment requires a few minutes to hours of reaction time to permit a practical and cost-effective remedial approach.

Accordingly, for the Phase 3 treatability studies, pH adjustment, microscale ZVI, and ferric chloride addition (added due to additional literature research on the decreased available reaction

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timeframes for ex situ treatment) were tested for the treatment of arsenic and molybdenum in the RIEC groundwater, with polishing of the treated groundwater using resin for boron removal. The results of the Phase 3 testing identified pH adjustment, ferric chloride aided precipitation, sand filtration, and resin polishing as the most effective and reliable ex situ treatment option for RIEC groundwater.

Going forward, the results of the Phase 3 treatability testing for the RIEC groundwater will be used to guide the finalization of the treatability testing of the other sites ashpond leachate / groundwaters. Each of the individual sites unique water geochemical conditions, MOC, and hydraulics will require evaluation to ensure a reliable treatment approach design for each site.

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TABLE OF CONTENTS

Executive Summary ii
1.0 Introduction 1
2.0 Phase 1 Literature Review 4
3.0 Phase 2 – Treatability Testing 5
3.1 Phase 2 Experimental Procedures 5
3.2 Phase 2 – Treatability Testing - Results 6
4.0 Phase 3 – treatability Testing - RIEC 7
4.1 Phase 3 Experimental Procedures 7
4.2 Phase 3 – Treatability Testing – RIEC – Results 9
5.0 Conclusions and Recommendations From Treatability Testing 12
Appendix A: Phase 1 Literature Review 15
Primary Metals of Concern 16
Metals of Concern Potentially Released as a Result of Treatment: 18
References 19

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LIST OF TABLES

Table 1	Baseline Metals Concentrations and Action Levels
Table 2	Summary of In Situ Test Conditions for Metal Treatability Study
Table 3	Summary of Rush Island In Situ Total Metals Treatment Performance
Table 4	Summary of Meramec MW-5 In Situ Total Metals Treatment Performance
Table 5	Summary of Meramec MW-6 In Situ Total Metals Treatment Performance
Table 6	Summary of Labadie In Situ Total Metals Treatment Performance
Table 7	Summary of Sioux In Situ Total Metals Treatment Performance
Table 8	Summary of Preliminary Ferric Chloride Treatability Testing – Rush Island
Table 9	Summary of Ferric Chloride Continuous Flow Test – Rush Island
Table 10	Summary of pH Adjustment and Resin Column Testing – Rush Island
Table 11	Summary of Zero Valent Iron Column Treatment – Rush Island

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1.0 INTRODUCTION

XDD Environmental (XDD) was retained by Ameren Services (Ameren) to perform metals treatability studies on ashpond leachate / groundwater from four sites: Rush Island Energy Center (RIEC), Meramec Energy Center (MEC), Labadie Energy Center (LEC), and Sioux Energy Center (SEC). The primary objective of the studies was to evaluate potential remedial technologies for metals of concern (MOC) identified as part of the requirements of United States Environmental Protection Agency (USEPA) 40 CFR Part 257 "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule" (the CCR Rule). The CCR Rule requires owners or operators of existing CCR units to produce an Annual Groundwater Monitoring and Corrective Action Report (Annual Report) each year (§§ 257.90(e)). XDD was provided, through a third party, data from the annual reports, samples from compliance wells with previously identified elevated MOC concentrations, and applicable statistically determined action levels (target goals for MOC treatment) for each site.

The treatability studies were developed and completed using a conservative approach of testing groundwaters from the areas of highest MOC concentrations, with the understanding that proposed engineered caps for each site should result in reduced MOC groundwater concentrations over time. Though the MOC and regulatory concerns are similar at each site, site-specific groundwater geochemistry's and varying MOC concentrations required XDD to approach treatment for each site separately. This approach ensures certainty in the MOC treatment effectiveness based on the differing site conditions and MOC concentrations for each site. It also provides for information needed in developing a treatment train specific to each site to address the differing geochemical conditions.

Initially, the primary MOC at the sites (though not all present at all sites) were arsenic, molybdenum, and lithium. Other potential MOC carried through the studies for each site (though again not all present at all sites) included boron, lead, cobalt, and selenium. A key component of the study was to determine if a potential MOC treatment approach would affect other metals in site groundwater and soil in either a positive (reduced concentration) or negative (increased concentration) manner. Baseline MOC / metals concentrations for all four sites (five locations; two sample sets being studied at MEC due to the presence of localized lithium) are presented in **Table 1**. The initial conceptual remedial approach was to treat the metals in situ, taking advantage of the slow moving groundwaters at the sites (allowing weeks of treatment time for MOC removal to occur), and for the potential for the most cost-effective treatment.

Around June 2019, during the performance of the treatability studies, per direction from Ameren, boron was transitioned from a potential MOC to a primary MOC, to account for an anticipated revision in the CCR Rule compliance. With this transition, any remedial option would be required to include boron treatment to below the applicable action. The complexity of in situ treatment

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of boron and its limited treatability options became a primary driver to change the conceptual treatment approach to ex situ treatment for the sites groundwaters.

This report focuses on the initial literature research conducted for all sites, initial treatability testing of the leachate / groundwater for all sites (for in situ treatment), then a refocus of the studies to consider ex situ treatment of the MOC (with boron added as a MOC), and finally the refinement of the treatment effectiveness and development of a MOC remedial approach for pilot testing at RIEC. The results from the additional treatability studies performed for RIEC will be used to guide refinement of the treatability studies and pilot test design for the other three sites (MEC, LEC, and SEC).

The three primary approaches for metals removal from groundwater are:

- **Precipitation**: Transformation of a dissolved species to a solid form, which can then settle out of suspension.
- **Coprecipitation with other minerals**: Transformation of a dissolved species to a solid form that combines with another material (such as iron), which can then then settle out of suspension.
- **Adsorption**: Introduction or production of a solid that will absorb the MOC from the groundwater.

The treatability studies for each site consisted of two phases; with a final / third phase conducted on RIEC only, at this time, each of the three phases of testing are described below:

- Phase 1 – Site Review and Data Evaluation for Preparation of the Treatability Study Design (**Appendix A**)
    - Compare site-specific data to each site's MOC target goals and develop a conceptual MOC remedial approach based on a summary of the site-specific geochemical and hydrological conditions.
    - Evaluate existing literature to identify potential remedial options for the MOC to be tested for each site.
- Phase 2 – Bench-Scale Treatability Study for In Situ Remediation of MOCs
    - Based on the literature review results from Phase 1, bench-scale reactors were developed, using site soil and groundwater, to evaluate promising in situ treatment technologies or treatment trains. Treatment options identified in the Phase 1 review included (**Table 2**):
        - pH adjustment

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- Addition of calcium polysulfide (CaSx)
- Addition of dissolved iron
- Addition of microscale zero valent iron (ZVI)
- Addition of particle size ZVI
- Biodegradation / biostimulation in conjunction with ZVI.

- The focus of Phase 2 testing was to identify specific MOC removal methods from site groundwater over the course of a one month treatment period without adversely affecting other MOCs in the groundwater (e.g., mobilizing MOCs present on site soils). The one month treatment period was selected based on the groundwater flow rates from the proposed in situ treatment application area to the regulatory point of compliance; actual site-specific treatment periods will have some variance greater than this selected period.

- Phase 3 –Treatment Train Development for Ex Situ Remediation of the MOCs at RIEC
  - Per above, boron was added as a primary MOC during the Phase 2 testing timeframe. The limitation to the availability and the complexity of in situ remedial options for boron removal, along with concern for long-term aquifer clogging from MOC precipitation / coprecipitation, caused a change in the conceptual remedial approach for the sites from an in situ to an ex situ treatment train process. The primary consequence of the change was the available time for treatment of metals in an above-surface treatment train. For in situ remediation, a one month MOC treatment period was readily available for the sites; however, for practical and cost-effective ex situ MOC remediation, the treatment period would need to be reduced to minutes to a few hours, dependent upon groundwater extraction rates and storage limitations of the ex situ treatment processes.
  - Additional literature research suggested that the most reliable approach for removal of boron from groundwater was boron selective ion-exchange resins (resin)
  - Based on the RIEC Phase 2 treatability study results, ZVI and pH adjustment were identified as potential effective in situ remedial options for the initial MOCs at RIEC. One of the ZVI products tested in Phase 2 was effective on boron, though pH adjustment had no effect. Accordingly, the following column tests were conducted in the Phase 3 testing:
    - Initial groundwater pH adjustment, followed by passing groundwater through a column filled with a ZVI/sand mixture for treatment of arsenic

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and molybdenum, with evaluation of the treatment effectiveness of that system for boron

- pH adjustment of groundwater to approximately pH 6, followed by passing the groundwater through a sand column for treatment of arsenic and molybdenum only
- Addition of a column filled with resin after the ZVI/sand column and the pH followed by sand column tests, for additional treatment of boron

o Based on the change to an ex situ remedial approach, requiring fast treatment periods (faster reaction kinetics), additional literature research identified the addition of ferric chloride to the groundwater as a potential approach for rapid arsenic removal through coagulation / flocculation / precipitation. The following additional tests were conducted to further evaluate ex situ treatment of arsenic and molybdenum:

- Initial groundwater pH adjustment, followed by the addition of ferric chloride, followed by settling of the developed precipitants and filtration to remove the suspended precipitants from the groundwater
- A resin filled column after the above filtration step for treatment of boron

Details on each of these three phases of treatment are provided in the following sections of this report.

2.0 PHASE 1 LITERATURE REVIEW

An extensive literature review was conducted for in situ treatment and general chemical behavior of the MOC prior to the selection of remedial options for consideration for the sites. The results of the literature review are presented in **Appendix A**. The literature review was necessary since the MOC precipitate, co-precipitate, or adsorb under varying geochemical conditions; however, these preferred MOC treatment geochemical conditions may result in increased mobility of other metals / MOC at the sites. The literature review identified the geochemical conditions that were either favorable for the MOC to be removed from the groundwater or would not negatively affect other MOC present. From this research, potential treatment trains were identified for remediating site MOC and for Phase 2 treatability testing.

DRAFT - For Review Only

3.0 PHASE 2 – TREATABILITY TESTING

3.1 Phase 2 Experimental Procedures

Based on the initial literature review, five mechanisms were identified as possible treatment approaches for the in situ removal of arsenic, molybdenum, and lithium from the sites groundwaters. The selection of arsenic, molybdenum, and lithium as the MOC was based on detections above the provided statistically-derived action levels for at least one of the four sites evaluated (**Table 1**). Boron was initially not on the list of primary MOC but as a metal being analyzed for since it does not have a current regulatory required action level. Boron was added as a primary MOC in the Phase 3 testing, per the request of Ameren and as a statistically-derived action level for each site was provided.

Below is a summary of each of the Phase 2 potential in situ approaches tested. A breakdown of the experimental setup for the approaches tested are presented in **Table 2**.

1. pH adjustment (7-day test)
    - For the pH adjustment, a range of pH of 6 to 10 was evaluated for RIEC to determine how the MOC concentrations would change as the pH decreased (at RIEC the initial pH in groundwater from monitoring well MW-2 was 11). Reduction and maintaining a pH of 6 resulted in arsenic and molybdenum removal after a week of treatment, without adversely affecting the concentrations of the other MOC present; therefore, this approach was maintained for testing of the other sites groundwaters.
2. Addition of calcium polysulfide (CaSx) (7-day test)
    - CaSx has been proven to reduce certain dissolved metal concentrations through forcing of reduced groundwater chemistry and subsequent metal sulfide formation. The dosage of CaSx used in these tests was based on a 1:2 mass of metals to mass of CaSx, with a 100 percent (%) safety factor (**Table 2**).
3. Addition of ferrous iron (4-week test)
    - The RIEC site groundwater samples have low concentrations of dissolved iron; dissolved iron is beneficial for the coprecipitation of certain MOC and as a sorbent for MOC. Dissolved iron (ferrous sulfate at 50 mg/L) was added to the site groundwater and soil. The test was conducted under both aerobic and anaerobic groundwater chemistries to determine if coprecipitation or sorption of the MOC can be induced.

DRAFT - For Review Only

4. Addition of ZVI (4-week test)
    - ZVI can also introduce dissolved iron, under anaerobic conditions, into groundwater for coprecipitation and possible adsorption of the MOC.
    - Two ZVI products were evaluated as potential remedial options: a microscale (7 micron) product, which is typically injected into the subsurface, and granular ZVI, which is commonly used in permeable reactive barriers (PRBs) (SR.25 particle size). Given the MOC concentrations present in site groundwater, ZVI dosages were established for the RIEC and MEC (MW-5 and MW-6) sites, based on manufacturer recommendations. While preliminary results from this approach suggested ZVI as a promising method for MOC removal, the required ZVI dosage was determined to be impractical for full-scale implementation. The ZVI dosage for the LEC and SEC site treatability tests were reduced to more practical dosage levels (see **Table 2**).
5. Biostimulation with ZVI addition (8-week test)
    - Test conditions, described in Test 4 above, were duplicated with the addition of food and nutrients, which are typically lacking in site groundwater and soils, to promote biotransformation of metals from a soluble to an insoluble form. Since biological processes are often slower than chemical processes, the biostimulated reactors were maintained for twice as long a treatment period as the ZVI only reactors (8 weeks vs. 4 weeks).

3.2 Phase 2 – Treatability Testing - Results

The results of the metals in groundwater analyses for the Phase 2 testing are presented in **Table 3** (RIEC), **Table 4** (MEC, MW-5), **Table 5** (MEC, MW-6), **Table 6** (LEC), and **Table 7** (SEC) for the in situ treatment approaches tested. The Phase 2 testing results suggest:

- A pH adjustment to 6 resulted in the reduction of arsenic and molybdenum to near action levels at all sites (Test 1).
- There was some benefit to using the granular size ZVI and a pH adjustment (reduction to 6) for the removal of arsenic and molybdenum (Test 4). Granular ZVI achieved action levels for arsenic and molybdenum for all sites, with the exception of molybdenum at SEC.
- There was minimal reduction in total metals concentrations for the tests conducted at a pH greater than 8 (Test 1).

DRAFT - For Review Only

- There was minimal reduction in MOCs as a result of treatment with CaSx, dissolved ferrous iron, or biostimulation (Tests 2, 3, and 5, respectively).
- Microscale ZVI was the only product tested that reduced boron to action levels for all sites, except for SEC.

Upon completion of the Phase 2 testing, per the request of Ameren, boron was added as a primary MOC with an action level of 4 mg/L. Of the approaches tested, microscale ZVI was the only approach that had a positive impact in reducing boron levels in groundwater. The literature research, supported by the phase 2 test results, suggests boron is most efficiently and reliably treated via ex situ filtration through a ion-selective resin. Given the addition of boron as a primary MOC and with concerns of long-term clogging of the site aquifers from metals precipitation, it was collectively decided to change the conceptual remedial approaches from an in situ to an ex situ treatment process. At this point in the testing (entering Phase 3), it was suggested by XDD and presented to Ameren, to focus on developing an ex situ remedial approach for RIEC to expedite the design and testing of a pilot scale system. The proposed Phase 3 treatability work and developed pilot test approach for RIEC would then be used to guide future Phase 3 testing and pilot test designs for the other sites (MEC, LEC, and SEC). An additional advantage of an ex situ remedial approach is the flexibility and ease of adjustment of an ex situ treatment system, given the variability in the groundwater geochemistry's and hydraulics across the four sites under evaluation. In addition, changes in site groundwater conditions are expected over time as both the consequences of the engineered cap placement and the potential ex situ treatment implementations stabilize, with respect to groundwater MOC concentrations.

4.0 PHASE 3 – TREATABILITY TESTING - RIEC

4.1 Phase 3 Experimental Procedures

The Phase 3 treatability testing focused on refining the ex situ remedial approach for RIEC and to finalize the RIEC pilot test design. The initial results from the Phase 2 testing for the in situ treatment of the MOC at RIEC, conducted in batch reactors with site groundwater and soil, supported that pH adjustment and the addition of ZVI were the most promising remedial options for treatment of arsenic and molybdenum (the primary MOC at RIEC) to action levels. The phase 3 testing consisted of a treatment train that was scaled, for the bench testing, using an ex situ conceptual pilot test design sized to fit within single or double Conex box (portable storage unit) treatment units, that could be positioned above ground at any of the sites.

The major design issue, refined in the Phase 3 testing, was the transition from the Phase 2 test results developed for an in situ treatment approach, to a reliable ex situ treatment train. For ex situ treatment to be practical and cost-effective the time of reaction (kinetics) to create

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precipitants needs to be on the order of minutes to a few hours. For the in situ approaches tested in Phase 2, a month-long contact time was available between amendments addition and for precipitation of metals to occur (based on the site groundwater velocity and distance from the remedial implementation area to the compliance sampling locations). For the in situ reaction timeframe, batch reactors were ideal. The required reaction timeframes for the Phase 3 testing made it necessary to use columns in the test procedures and to scale the reactor sizes and groundwater flow rates to match the conceptual field pilot and full-scale Conex box remedial systems sizing.

The Phase 3 treatability tests were also scaled for site hydraulics, assuming a 200-ft long cross-sectional treatment length, perpendicular to impacted groundwater flow, at the RIEC. Site-specific groundwater modeling was performed to determine the full-scale groundwater capture / flow rates required to permit an approximate 6 to 12-month pilot test duration to demonstrate the effectiveness of the treatment train. The pilot test treatment results need to be reflected both within the ex situ treatment process sampling points but also in existing compliance monitoring wells located within and downgradient of the treatment system hydraulic capture zone. For the RIEC site, the projected pilot test groundwater flow rate was estimated at 8 gallons per minute (gpm) (2 gpm per well) which is approximately four times the projected full-scale required groundwater flow rate.

It was also initially estimated that the ex situ treatment vessels (either filters or settling tanks) within the proposed Conex box system would have to be on the order of 750 to 1,000 gallons maximum capacity to fit in the unit, and that the Phase 3 testing would need to have reaction timeframes (kinetics) that would match the available vessel sizing. To scale the pilot test treatment train conceptual design to the Phase 3 treatability study design, the treatability study columns were made 3-inch (in) long and 1.5-in in diameter, with a groundwater flow rate of 0.7 milliliters per minute (mL/min).

Based on the results of the literature research and the Phase 2 testing, the initial Phase 3 tests were conducted with pH adjustment to pH 6 for the RIEC groundwater. The pH adjusted groundwater was then passed through a sand filter (with a residence time of 40 minutes) for arsenic and molybdenum removal. The pH adjusted groundwater was also tested by adding dissolved iron either via a ZVI/sand filter or by the addition of ferric chloride. Ferric chloride was incorporated into the Phase 3 testing due to the potential faster reactions times to create metal precipitates, per the discussion in Section 1 of this report. The ferric chloride was added to the groundwater to a concentration of 40 mg/L, the ferric chloride treated groundwater was passed into a settling vessel with a residence time of 1.25 hours, the metals were allowed to precipitate and settle, and the treated groundwater was passed through either a bag or a sand filter.

DRAFT - For Review Only

Since pH adjustment and iron addition had proved ineffective at boron removal in the Phase 2 testing, a resin filter was added to the effluent of the pH and iron addition ex situ treatment processes tested to evaluate the resins effectiveness for boron removal given the RIEC groundwater geochemistry. The resin was added post pH and ferric chloride addition as the resin is relatively expensive and focusing its use on the boron only is considered an overall more cost-effective approach for the groundwater treatment.

4.2 Phase 3 – Treatability Testing – RIEC – Results

Ferric Chloride ($FeCl_3$) Addition

The ex situ treatment method that proved most successful and reliable in the Phase 3 testing for pilot and full-scale implementation at the RIEC site is the pH adjusted, $FeCl_3$ aided flocculation / removal of arsenic and molybdenum. Preliminary testing with the ZVI and pH adjustment, discussed below, helped guide the design of the $FeCl_3$ treatment train. Understanding that the resin can be successful at removing boron at the concentrations present at the RIEC, Phase 3 testing focused on arsenic and molybdenum removal and developing a removal approach that worked effectively in the available ex situ treatment timeframes.

A preliminary Phase 3 test was performed to evaluate varying dosages of $FeCl_3$ and pH adjustment specific to the treatment of the arsenic in the RIEC groundwater. A kinetics / rate of treatment / reaction test was conducted where $FeCl_3$ was added to the groundwater and allowed to react, flocculate / precipitate and settle out of the groundwater for periods of 1 hour, 3 hours, and 6 hours, prior to flowing the groundwater through a sand filter column (**Table 8**). Since arsenic(V) is the form of arsenic that coprecipitates more readily with iron, hydrogen peroxide was tested as an oxidizer to transform any arsenic(III) in the groundwater to arsenic(V), prior to removal with the $FeCl_3$ addition. The results from the preliminary $FeCl_3$ tests suggested that:

- Both arsenic and molybdenum can be reduced to concentrations at or below action levels, using $FeCl_3$ addition.
- An initial pH of 6 (prior to the addition of $FeCl_3$) caused faster settling of the precipitants than an initial pH of 4 (also, pH 6 was determined to be a more favorable pH for RIEC groundwater treatment, based on the Phase 2 test results).
- Higher $FeCl_3$ dosage (40 mg/L vs. 20 mg/L) provided greater removal of arsenic and molybdenum. Though the difference in $FeCl_3$ dosage performance for the RIEC groundwater was not significant, based on the concentrations detected in the groundwater and the applicable action levels for the MOC at the RIEC site. The dosage evaluation results were however considered beneficial for refinement of Phase 3 testing for the other sites.

DRAFT - For Review Only

- The additional of hydrogen peroxide did not improve the arsenic removal efficiency. However, a check on the arsenic form in groundwater at RIEC showed the arsenic to be predominantly arsenic(V), so the pre-oxidation step was not needed for RIEC.

The reaction time determined for the $FeCl_3$ coagulation and flocculation / precipitation and associated removal of arsenic and molybdenum from groundwater in the preliminary testing was adequate for the conceptual ex situ treatment approach.

Following the preliminary testing it was considered beneficial to run further testing to confirm the preliminary test results, and to optimize the pilot test design. Based on additional literature research, aeration of the groundwater prior to $FeCl_3$ addition was added as a treatment step. Additional treatability tests were conducted using pH adjustment of the RIEC groundwater to approximately 6, followed by addition of 40 mg/L of $FeCl_3$, followed by settling and filtration of precipitants using either sand or bag filters. The treated groundwater was then passed through the resin filter for boron removal. Results of these additional tests are presented in **Table 9**. Key observations and conclusions from the additional $FeCl_3$ testing are:

- Aeration of the groundwater prior to the addition of $FeCl_3$ accelerates the formation of precipitants.
- Influent pH should be close to pH of 6 at RIEC for optimal precipitant settling times.
- Higher $FeCl_3$ concentrations added to the groundwater appear to provide larger precipitant particles that settle faster. However, the higher dosage of $FeCl_3$ will also increase the sludge volume that will require additional disposal and may increase maintenance needs.
- 100-micron bag filters are insufficient to remove the arsenic particles in the groundwater (and reduce total arsenic concentrations to below action levels). Though 10-micron filters work effectively to meet action levels, the 10-micron filter is likely to cause operational issues in a pilot and full-scale system and is therefore not a preferred treatment option. Also, bag filters are unlikely to remove iron in the treated groundwater to below 2 mg/L, which may negatively impact the resin filter longevity.
- The sand filter was effective as a polishing step to reduce total arsenic and molybdenum concentrations to below action levels, while also decreasing total iron concentrations to approximately 0.3 mg/L. Sand filtration is therefore recommended for the pilot scale system.
- The resin filter is needed to remove boron from the groundwater to action levels. The resin operates optimally between a pH of 4 and 10. The $FeCl_3$ addition reduces the

DRAFT - for Review Only

groundwater pH to approximately 4 so pH adjustment back to pH 6 is recommended prior to resin treatment.

- Though total lead is reported in groundwater at RIEC below action levels, the $FeCl_3$ addition reduced the total lead concentration from 0.0057 mg/L to 0.0026 mg/L or lower, suggesting that $FeCl_3$ is a potential option at other sites for treatment of total lead levels which exceed action levels.

pH Adjustment followed by Resin Column Treatment

The Phase 2 pH adjustment only bench testing had proven effective for arsenic and molybdenum removal (though not boron) over a week-long treatment period in the presence of site soils. The Phase 3 tests included an evaluation of pH adjustment followed by the resin as an alternative RIEC treatment train. Since the resin is specially designed for boron removal, the manufacturer could not provide insight into its effectiveness, performance or sustainability for arsenic or molybdenum treatment, so it was assumed that pre-treatment to remove arsenic and molybdenum was still needed.

The columns tests were conducted by decreasing the pH of the RIEC groundwater to pH 5 then passing the pH adjusted groundwater through a sand filter sized to provide a hydraulic residence time of 40 minutes. The filtered groundwater was then passed through a resin column. Groundwater exiting the resin column were collected for analysis of MOC (**Table 10**). The analysis results showed that MOC action levels were achieved after Days 1 and 3 of treatment for all MOCs; however, breakthrough of arsenic occurred by Day 7.

Groundwater samples collected between the sand filter and the resin columns showed that the pH adjustment by itself did not effectively treat the arsenic or molybdenum in the groundwater, over the short treatment period available in the scaled ex situ treatment train. Consequently, it was determined that the resin was responsible for the removal of arsenic, molybdenum, and boron in the RIEC groundwater. A further review of the data and the procedures used in this test suggests that for pH adjustment to be successful for removing arsenic and molybdenum from the RIEC groundwater, the groundwater needs to be maintained at a reduced pH for longer than 40 minutes (the residence time in the tested columns). Hence, pH adjustment alone would not be a viable ex situ treatment approach as an ex situ treatment system design.

Further, while the resin was successful at temporarily removing arsenic, molybdenum, and boron, it was not designed for arsenic and molybdenum treatment, and the arsenic concentration reduction could not be sustained below REIC action levels for up to a week. This indicates that a large resin vessel and / or frequent regeneration of the resin would be needed for resin to be considered as a stand-alone treatment approach. Also, since the resin was not

DRAFT - For Review Only

designed to remove arsenic and molybdenum, it is unknown if the metals will desorb during the resin regeneration, in which case, the resin could be ineffective for further arsenic and molybdenum removal. The adsorption capacity of the resin for arsenic and molybdenum should only be considered as a safety factor in the final pilot test design, if the pretreatment for arsenic and molybdenum failed, but not as a stand-alone remedial option.

ZVI Column Testing

Since the microscale ZVI was identified in the Phase 2 tests as a possible approach for removing boron, arsenic, and molybdenum from the RIEC site groundwater, test columns were constructed using a mixture of the microscale ZVI and commercial sand (to allow the required flow through the column / ZVI, without clogging due to the ZVI microscale particle size). The columns were prepared using a 5:1 ratio of sand to microscale ZVI, and a 2:1 ratio of sand to microscale ZVI. The columns were operated for 7 days, with treated groundwater samples collected from the column effluent after 1, 3, and 7 days of treatment time (simulating groundwater treatment over a one week period through a pilot or full-scale 1,000-gallon capacity column / filter).

Table 11 presents the results of the ZVI column testing. The results show partial treatment of arsenic and molybdenum, though not to action levels. Both the 5:1 and 2:1 sand to ZVI dosed columns showed some treatment occurred the first day, but treatment effectiveness decreased by Days 3 and 7. Results for both the columns showed that concentrations did not decrease to action levels for arsenic, and results for only one column sample showed that molybdenum concentrations decreased to action levels (Day 1 of the 5:1 dose column). Boron concentrations did not change passing through the ZVI columns.

From the Phase 3 test results, it was determined that the ZVI treatment effectiveness (at the design sand to ZVI dosages) and the associated treatment longevity was questionable, and likely not reliable as a sustainable remedial option. To ensure the ZVI was being adequately evaluated, XDD had additional discussions with the ZVI vendor on the system design and effectiveness. It was determined that the recommendations by the vendor on how to use ZVI in an ex situ process was impractical for the site given the conceptual pilot test design constraints (action levels, MOC, flow rates, vessel sizing, etc.).

5.0 CONCLUSIONS AND RECOMMENDATIONS FROM TREATABILITY TESTING

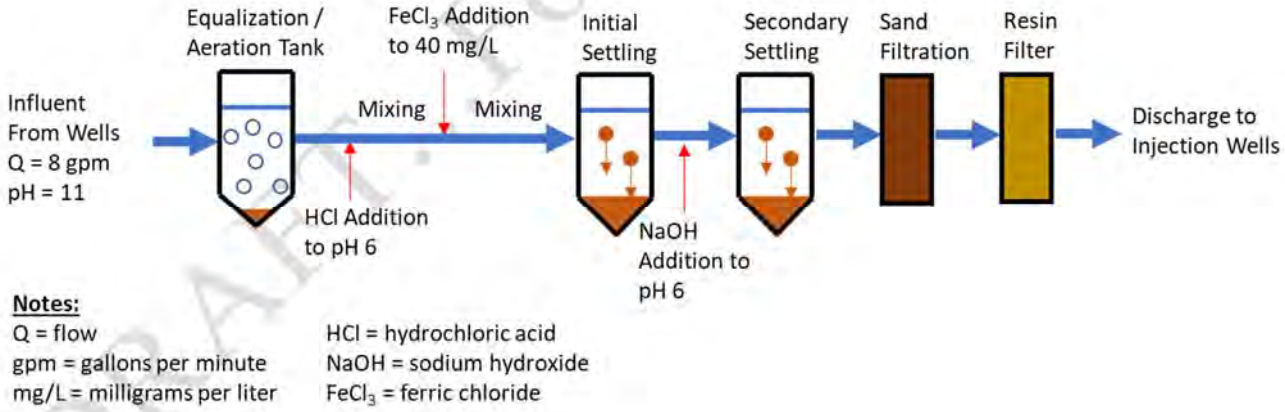
Several potential treatment technologies were evaluated for the MOC at the sites. While ZVI and pH adjustment were the most promising remedial approaches from the Phase 2 testing for in situ treatment of the initially identified primary MOC, the subsequent addition of boron as a primary

DRAFT - For Review Only

MOC resulted in the requirement to transition to an ex situ remedial approach. Added benefits of the transition to an ex situ remedial approach are concerns with potential aquifer clogging from in situ MOC precipitation and the benefits of the flexibility in ex situ system design for varying site groundwater geochemistry's. The difference in available and practical treatment times (reaction kinetics) for in situ treatment versus ex situ treatment systems resulted in the elimination of the ZVI and pH adjustment alone technologies as viable ex situ remedial options and the evaluation of additional technologies for the MOC treatment.

Based on the results of the Phase 1 through Phase 3 treatability testing, the proposed treatment train identified for the RIEC pilot test is presented below in **Figure 1**. Modifications and optimizations to the treatment train will be evaluated during the pilot scale startup. The Phase 3 remedial approach refinement testing demonstrated that pH adjustment, followed by $FeCl_3$ aided coagulation/flocculation for arsenic and molybdenum treatment of the RIEC groundwater was effective and reliable. Boron removal requires the addition of an ion-specific resin following the $FeCl_3$ treatment. To expedite the arsenic and molybdenum removal, aeration of the groundwater prior to pH adjustment and the addition of 40 mg/L of $FeCl_3$ is required. The $FeCl_3$ reduces the groundwater pH to approximately 4 so pH adjustment back to pH 6 is recommended prior to resin treatment for boron removal.

Figure 1: Conceptual Treatment Train for Pilot Scale System at RIEC



Going forward, MEC, LEC, and SEC have similar MOC to RIEC (primarily molybdenum and boron) but with a few distinct deviations from the RIEC groundwater quality. The main points of difference that need to be considered in subsequent Phase 3 testing for the individual sites are:

- At MEC (monitoring well MW-6), lithium has been detected above action levels. The literature review performed during Phase 1 (**Appendix A**) suggests ZVI is a viable

DRAFT For Review Only

remediation approach for lithium; it is suspected that $FeCl_3$ may also be effective at lithium removal.

- The boron concentration at SEC is above the manufacturer's maximum concentration recommendation for the resin (10 mg/L maximum vs. 22 to 25 mg/L measured at SEC). A recirculation method or resin vessels in series may be needed to reduce the boron concentration in SEC groundwater to meet action levels in the resin treated groundwater.
- SEC also has significantly higher molybdenum concentrations (3.05 mg/L) than RIEC (0.16 mg/L) so testing is needed to ensure $FeCl_3$ can be effective at removing molybdenum to action levels at these higher groundwater concentrations.
- Higher remediation system flow rates are likely to be encountered at some of the sites (in particular LEC) so refinement of the system hydraulics and available treatment timeframes need to be evaluated.
- The high pH at RIEC resulted in the need for an initial pH adjustment. This may not be necessary at the other locations, but confirmation tests should be performed.
- $FeCl_3$ flocculation / precipitation is facilitated with increased groundwater alkalinity. Additional alkalinity may be needed to be added to the treatment systems at the other sites to increase the rates of formation and settling of the precipitants.
- General groundwater geochemistry's are also likely to have subtle differences for the other sites. Testing is needed to provide confidence in the effectiveness of the treatment train at the other sites / locations.

The information gathered in the Phase 3 RIEC treatability testing will be used to guide the design of treatability testing and remedial approaches for the other three sites.

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APPENDIX A: PHASE 1 LITERATURE REVIEW

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Primary Metals of Concern

Arsenic

- Detected at 0.22 milligrams per liter (mg/L) (RIEC) and 0.02 mg/L (MEC, monitoring well MW-5). Arsenic was not detected at LEC, SEC, or at monitoring well MW-6 at MEC.
- Action levels are 0.030 mg/L (RIEC), 0.01 mg/L (MEC and SEC), and 0.0426 mg/L (LEC).
- Potential treatment methods include precipitation/coprecipitation, pH adjustment, adsorption, and ZVI/ZVI with carbon:
    - Speciation – trivalent arsenite [As (III)] is more soluble and mobile than pentavalent arsenate [As(V)].
    - Redox – arsenic is more readily mobilized under reducing conditions.
    - pH – mobility is lowest at pH 3 to 7, increases under very acidic or alkaline pH conditions.
    - Competing ions – phosphate and sulfate can limit arsenic adsorption and increase mobility.
    - Adsorption – iron oxides sorb arsenic and can greatly limit arsenic mobility.
    - Precipitation – formation of insoluble calcium arsenates can reduce leaching and mobility.
- Application of ferrous sulfate to soils has shown promise in reducing arsenic concentrations in groundwater at utility substation sites (EPRI, 2010).
    - Data review has shown that both RIEC and MEC lack iron – this indicates ZVI treatment may be promising.
- pH adjustment in trench application case study: The pH was raised from 1.93 to 7.9, leading to a reduction in groundwater arsenic concentrations from 35,000 micrograms per liter (µg/L) to <4 µg/L (EPRI, 2006).
- Summary of favorable conditions for arsenic removal:
    - pH range of 3 to 7, oxidizing conditions
    - Addition of Iron and calcium complexes
    - Low phosphate and sulfate concentrations

Molybdenum

- Detected at 0.16 mg/L (RIEC), 0.11 mg/L (MEC, monitoring well MW-5), 0.15 mg/L (MEC, monitoring well MW-6), 0.155 mg/L (LEC), and 3.05 mg/L (SEC).
- Action Level is 0.1 mg/L for all sites.
- Potential treatment methods include precipitation/coprecipitation, pH adjustment, adsorption, and ZVI/ZVI with carbon

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- Molybdenum adsorption is highly pH-dependent. Peak adsorption for most sorbents (except maghemite nanoparticles) occurs at pH < 5 and limited adsorption occurs at pH > 8. In alkaline conditions, molybdenum behaves conservatively, and its dissolved concentration is controlled by precipitation, not adsorption, reactions (EPRI, 2011).
- Permeable Reactive Barrier (PRB)/ZVI/pH adjustment case study: Molybdenum was sequestered under reducing/oxidizing conditions with pH 7.3 to 10; effective for 15 months (reducing conditions sustained for 5 to 9 months) (Bellantoni, 2014).
- Summary of potential treatment options for molybdenum removal:
    - Maintaining a neutral or slightly alkaline pH with ZVI addition.

Lithium

- Detected at 0.12 mg/L (MEC, monitoring well MW-6), and either non-detect or below action levels at the other sites.
- Action Levels are 0.0647 mg/L (RIEC), 0.04 mg/L (MEC and SEC), and 0.055 mg/L (LEC).
- Potential treatment is limited to precipitation using ZVI PRBs.
- "Additional research is needed to evaluate, and possibly develop, in situ groundwater treatment technologies for lithium, specifically reagents for in situ injection or media for a permeable reactive barrier. Zeolites such as clinoptilolite and clays such as bentonite and kaolinite have been shown to exhibit lithium-sorbing characteristics in a laboratory setting, making these candidates for future in situ injection and PRB application studies" (EPRI, 2018).
- Summary of potential treatment options for lithium removal:
    - ZVI

Boron

- Detected at 3.85 mg/L (RIEC), 5.2 mg/L (MEC, monitoring well MW-5), 7.9 mg/L (MEC, monitoring well MW-6), 7.9 mg/L (LEC), 23.5 mg/L (SEC).
- Action Level is 4 mg/L for all sites.
- "Additional research is needed on the mechanisms of boron attenuation, both precipitation and adsorption, for a wider range of soil and mineral types, and in hydrogeologic environments typical of CCP management sites. While the literature suggests nonlinear sorption and some dependence on general soil type and pH, these relationships are not well understood. The same is true for competing ion effects, such as sulfate and fluoride. In addition, there are few field studies documenting boron attenuation at utility sites" (EPRI, 2005).

DRAFT . . For Review Only

- "There is a need to measure boron sorption in the alkaline pH range associated with ash leachate, and to make these measurements with a wider range of soil and mineral types. Moreover, there are relatively few field-scale studies available on the fate and transport of boron derived from coal ash in groundwater. Studies based on site-specific sorption, hydrogeologic, and leaching data may yield a better understanding of the long-term impacts of boron from coal-combustion residues (EPRI, 2005)."
- Case study: pH adjustment to > 9.1 and the addition of proprietary ionizing agents resulted in 99% removal (sorption of boron complexes) (Kreinberg, 2017).
- Summary of potential treatment options for boron removal:
    - ZVI or boron specific ion-exchange resin (ex situ)

Metals of Concern Potentially Released as a Result of Treatment:

Cobalt

- Not detected in baseline samples collected at any of the sites.
- Action Level is 0.006 mg/L for all sites.
- Potential treatment methods include ZVI PRB and carbon substrate injections
    - Ontario ZVI case study: sulfate-reducing conditions (anaerobic, ORP <-250 mV), cobalt remediation achieved (reduction of ~260 parts per billion [ppb] to 40 ppb) (Pare, 2014, RPIC).

Lead

- Either reported below action levels or not detected in baseline samples collected at all sites.
- Action Level is 0.015 mg/L for all sites.
- Potential treatment methods include metal cation precipitation as sulfides, adsorption to iron corrosion products, pH adjustment using Acid-B Extra™ reagent (10%) (EPRI, 2006).
    - Success Mine PRB case study: Lead was reduced from 0.658 mg/L upgradient of the PRB to <0.002 mg/L downgradient of the PRB. The pH was buffered from 4.9 to 6.9 throughout the thickness of the barrier wall. PRB is anaerobic and creates conditions optimal for sulfate-reducing bacteria. Expected to provide treatment for 30 years (EPRI, 2006).
    - Case study at Gilt Edge Mine, SD: leachate pH was raised from 1.93 to 7.9, resulting in the following reductions in metals concentrations: arsenic from 35,000 µg/L to <4 µg/L, antimony from 500 µg/L to 10 µg/L, and lead from 390 µg/L to <10 µg/L (EPRI, 2006).

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Selenium

- Not detected in baseline samples from any of the sites.
- Action Level is 0.05 mg/L for all sites.
- Potential treatment methods include reductive precipitation with oxidized iron minerals, adsorption to iron oxides, ZVI, and ZVI/carbon – many positive case studies (EPRI, 2006)
- Oxyanions (e.g., arsenic, chromium, selenium, molybdenum, vanadium, and sulfate) adsorb most strongly at low pH levels and cations (e.g., lead, cadmium, and nickel) adsorb most strongly at high pH levels.
- Like arsenic, selenium is generally present in predominantly two oxyanion forms in natural waters: Se (IV) as selenite ion SeO_3^{-2}, and Se (VI) as selenate ion SeO_4^{-2}. Selenite tends to dominate in impoundment settings when the source coal is bituminous or a mixture of bituminous and subbituminous, while selenate tends to predominate in landfill settings and when the source coal is subbituminous/lignite (EPRI, 2006). Selenate is generally soluble and mobile and is readily taken up by organisms and plants. Selenite is less soluble and mobile than selenate; therefore, reductive precipitation/coprecipitation of selenium could serve as a viable remediation approach. However, re-oxidation is a potential problem. Phytoremediation has also been reported and adsorption has been used.

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DRAFT - For Review Only

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Tables

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Table 1
Baseline Metal Concentrations and Action Levels
Ameren Services, Missouri

	Rush Island			Meramec MW-5			Meramec MW-6		
	Action Levels	Baseline/Baseline Dup		Action Levels	Baseline/Baseline Dup		Action Levels	Baseline/Baseline Dup	
	Total Metals (mg/L)								
Arsenic	0.03	0.22	0.22	0.01	0.020	0.020	0.01	0.005 U	0.005 U
Molybdenum	0.1	0.16	0.16	0.1	0.11	0.11	0.1	0.15	0.15
Boron	4	4.0	3.7	4	5.2	5.2	4	7.8	8.0
Lead	0.015	0.007	0.007	0.015	0.005 U	0.005 U	0.015	0.005 U	0.005 U
Cobalt	0.006	0.01 U	0.01 U	0.006	0.01 U	0.01 U	0.006	0.01 U	0.01 U
Selenium	0.05	0.01 U	0.01 U	0.05	0.01 U	0.01 U	0.05	0.01 U	0.01 U
Lithium	0.0647	0.06 U	0.06 U	0.04	0.06 U	0.06 U	0.04	0.12	0.12

	Labadie			Sioux		
	Action Levels	Baseline/Baseline Dup		Action Levels	Baseline/Baseline Dup	
	Total Metals (mg/L)					
Arsenic	0.0426	0.025 U	0.025 U	0.01	0.025 U	0.025 U
Molybdenum	0.1	0.15 J	0.16 J	0.1	3.20 J	2.90 J
Boron	4	7.7	8.1	4	25.0	22.0
Lead	0.015	0.025 U	0.025 U	0.015	0.025 U	0.025 U
Cobalt	0.006	0.05 U	0.05 U	0.006	0.05 U	0.05 U
Selenium	0.05	0.05 U	0.05 U	0.05	0.05 U	0.05 U
Lithium	0.055	0.019 J	0.016 J	0.04	0.029 J	0.020 J

Notes:

mg/L = milligrams per liter

U = not detected above the indicated reporting limit concentration

J = estimated value

Concentrations are at or below action level

Concentrations are between action level and reporting limit

Table 2
Summary of In Situ Test Conditions for Metal Treatability Study
Ameren Services, Missouri

Test Conditions				Rush Island			Meramec MW-5			Meramec MW-6		
Test condition	Soil (g)	Addition	Duration (week)	Amount	pH	Aerobic or Anaerobic	Amount	pH	Aerobic or Anaerobic	Amount	pH	Aerobic or Anaerobic
pH adjusted	48	HCl 36%	1	Varied	10, 9, 8, 7, 6	Aerobic	Varied	10, 8, 6	Aerobic	Varied	10, 8, 6	Aerobic
CaSx- No pH change	48	CaSx	1	2.1 mg		Aerobic	3.1 mg		Aerobic	5.5 mg		Aerobic
CaSx- pH adjusted	48	CaSx	1	2.1 mg	8	Aerobic	NA			NA		
Fe- anaerobic	48	Fe(II) sulfate	4	12 mg		Anaerobic	12 mg		Anaerobic	12 mg		Anaerobic
Fe -anaerobic- pH adjusted	48	Fe(II) sulfate	4	12 mg	8	Anaerobic	NA			NA		
Fe - aerobic	48	Fe(II) sulfate	4	12 mg		Aerobic	12 mg		Aerobic	12 mg		Aerobic
Fe - aerobic- pH adjusted	48	Fe(II) sulfate	4	12 mg	8	Aerobic	NA			NA		
ZVI (SR.2S)	48	SR.2S	4	96 mg		Anaerobic	96 mg		Anaerobic	96 mg		Anaerobic
ZVI (SR.2S)- pH adjusted	48	SR.2S + HCl	4	96 mg	8	Anaerobic	NA			NA		
ZVI (SR.2S)-Food	48	SR.2S + Food	8	96 mg		Anaerobic	96 mg		Anaerobic	96 mg		Anaerobic
ZVI (SR.2S)-Food- pH adjusted	48	SR.2S + Food + HCl	8	96 mg	8	Anaerobic	NA			NA		
ZVI (7 micron)	48	7 micron	4	96 mg		Anaerobic	96 mg		Anaerobic	96 mg		Anaerobic
ZVI (7 micron)- pH adjusted	48	7 micron + HCl	4	96 mg	8	Anaerobic	NA			NA		
ZVI (7 micron)- Food	48	7 micron + Food	8	96 mg		Anaerobic	96 mg		Anaerobic	96 mg		Anaerobic
ZVI (7 micron)- Food- pH adjusted	48	7 micron + Food + HCl	8	96 mg	8	Anaerobic	NA			NA		

Test Conditions				Labadie			Sioux		
Test condition	Soil (g)	Addition	Duration (week)	Amount	pH	Aerobic or Anaerobic	Amount	pH	Aerobic or Anaerobic
pH adjusted	48	HCl 36%	1	Varied	6	Aerobic	Varied	6	Aerobic
CaSx- No pH change	48	CaSx	1	0.09 mg		Aerobic	0.09 mg		Aerobic
CaSx- pH adjusted	48	CaSx	1	0.09 mg	7	Aerobic	NA		
Fe- anaerobic	48	Fe(II) sulfate	4	13.8 mg		Anaerobic	13.8 mg		Anaerobic
Fe -anaerobic- pH adjusted	48	Fe(II) sulfate	4	13.8 mg	7	Anaerobic	NA		
Fe - aerobic	48	Fe(II) sulfate	4	13.8 mg		Aerobic	13.8 mg		Aerobic
Fe - aerobic- pH adjusted	48	Fe(II) sulfate	4	13.8 mg	7	Aerobic	NA		
ZVI (SR.2S)	48	SR.2S	4	11 mg		Anaerobic	11mg		Anaerobic
ZVI (SR.2S)- pH adjusted	48	SR.2S + HCl	4	11 mg	7	Anaerobic	NA		
ZVI (SR.2S)-Food	48	SR.2S + Food	8	11 mg		Anaerobic	11mg		Anaerobic
ZVI (SR.2S)-Food- pH adjusted	48	SR.2S + Food + HCl	8	11 mg	7	Anaerobic	NA		
ZVI (7 micron)	48	7 micron	4	11 mg		Anaerobic	11mg		Anaerobic
ZVI (7 micron)- pH adjusted	48	7 micron + HCl	4	11 mg	7	Anaerobic	NA		
ZVI (7 micron)- Food	48	7 micron + Food	8	11 mg		Anaerobic	11mg		Anaerobic
ZVI (7 micron)- Food- pH adjusted	48	7 micron + Food + HCl	8	11 mg	7	Anaerobic	NA		

Notes:

SR.2S = particle size ZVI

ZVI = zero valent iron

7 micron = microscale ZVI

Food = lactate, EOL, cornsweet, and nutrients

NA = test condition not run

HCl = hydrochloric acid

CaSx = calcium polysulfide

Fe = iron (dissolved)

Table 3
Summary of Rush Island In Situ Total Metals Removal Performance
Rush Island Energy Center, Missouri

	Arsenic	Molybdenum	Boron	Lead	Cobalt	Selenium	Lithium
	mg/L						
Action Levels	0.03	0.1	4	0.015	0.006	0.05	0.065
Average of All Controls[1]	0.18	0.12	3.10	0.13	0.03 J*	0.03 J*	0.13
pH 10	0.17	0.12	3.05	0.08	0.02	0.02	0.07
pH 9	0.12	0.12	2.80	0.08	0.02	0.02	0.09
pH 8	0.10	0.13	3.15	0.05	0.01 J*	0.01 J*	0.06
pH 7	0.07	0.11	3.05	0.06	0.02	0.01	0.08
pH 6	0.02 J*	0.08	3.80	0.03 U	0.06 U	0.06 U	0.06 U
CaSx	0.23	0.12	3.60	0.08	0.07 U	0.07 U	0.07
CaSx pH7	0.05	0.14	3.75	0.03 U	0.06 U	0.06 U	0.04 J*
Dissolved Iron (Anaerobic)	0.20	0.13	3.20	0.11	0.05 U	0.05 U	0.11
Dissolved Iron pH 8 (Anaerobic)	0.11	0.14	3.20	0.08	0.05 U	0.05 U	0.06
Dissolved Iron (Aerobic)	0.19	0.13	3.05	0.13	0.05 U	0.05 U	0.10
Dissolved Iron pH 8 (Aerobic)	0.06	0.14	3.45	0.04 J*	0.05 U	0.05 U	0.13
ZVI Injectable	0.03 U	0.05 U	0.30	0.03 U	0.05 U	0.05 U	0.08 U
ZVI Injectable pH 8	0.03 U	0.05 U	0.13 J*	0.03 U	0.05 U	0.05 U	0.09 U
ZVI PRB	0.02 J*	0.39	3.60	0.03 U	0.05 U	0.05 U	0.04 U
ZVI PRB pH 8	0.03 U	0.04 J*	2.55	0.03 U	0.05 U	0.05 U	0.02 J
ZVI Injectable + Bio	0.025 U	0.05 U	0.32 J	0.025 U	0.05 U	0.05 U	0.06 U
ZVI Injectable pH 8 + Bio	0.025 U	0.05 U	0.07 J	0.025 U	0.05 U	0.05 U	NS
ZVI PRB + Bio	0.03 U	0.32 J	4.45 J	0.03 U	0.05 U	0.05 U	0.02 J
ZVI PRB pH 8 + Bio	0.03 U	0.05 U	2.20 J	0.03 U	0.05 U	0.05 U	0.04 J

Notes:

U = not detected above the indicated concentration

PRB = permeable reactive barrier

Injectable = iron particles at micro-scale; potentially applied through injection

Dissolved iron = 50 mg/L Iron(II) sulfate

NS = not sampled

CaSx = calcium polysulfide

At or below action level

Approaching action level

Above action level and increase relative to control

Non-detect but detection limit greater than action level

NA = no action level

mg/L = milligrams per liter

J* = half the detection limit was used for non-detect when duplicates had a detection and a non-detect.

pH adjustment testing was conducted over a 7-day test period. The native pH in monitoring well MW-2 was pH 11.

1) Average of All Controls = average of all controls used in the Phase 2 testing for Rush Island Energy Center

Table 4
Summary of Meramec MW-5 In Situ Total Metals Removal Performance
Meramec Energy Center, Missouri

	Arsenic	Molybdenum	Boron	Lead	Cobalt	Selenium	Lithium
	mg/L						
Action Levels	0.01	0.1	4	0.015	0.006	0.05	0.040
Average of All Controls[1]	0.034 J*	0.174	5.5	0.028 J*	0.062 U	0.062 U	0.028 J
pH 10	0.031	0.18	5.55	0.013	0.01 U	0.01 U	0.0285 J
pH 8	0.03	0.16	5.30	0.02	0.01 U	0.01 U	0.04 J
pH 6	0.029	0.11	5.6	0.027	0.01	0.01 U	0.049 J
CaSx	0.05 U	0.17	5.3	0.05 U	0.1 U	0.1 U	0.026 J
Dissolved Iron (Anaerobic)	0.039	0.18 J	4.8	0.035	0.05 U	0.05 U	0.029 J
Dissolved Iron (Aerobic)	0.031	0.17 J	4.6	0.03	0.05 U	0.05 U	0.03
ZVI Injectable	0.025 U	0.05 U	0.33	0.025 U	0.05 U	0.05 U	0.06 U
ZVI PRB	0.025 U	0.08	3.7	0.025 U	0.05 U	0.05 U	0.035 J
ZVI Injectable + Bio	0.05 U	0.1 U	0.31	0.05 U	0.1 U	0.1 U	NS
ZVI PRB + Bio	0.05 U	0.1 U	4.8 J	0.05 U	0.1 U	0.1 U	0.032 J

Notes:

U = not detected above the indicated concentration

PRB = permeable reactive barrier

Injectable = iron particles at micro-scale; potentially applied through injection

Dissolved iron = 50 mg/L Iron(II) sulfate

NS = not sampled

CaSx = calcium polysulfide

At or below action level

Approaching action level

Above action level and increase relative to control

Non-detect but detection limit greater than action level

NA = no action level

mg/L = milligrams per liter

J* = half the detection limit was used for non-detect when duplicates had a detection and a non-detect.

pH adjustment testing was conducted over a 7-day test period. The native pH in monitoring well MW-6 was approximately pH 7.5.

1) Average of All Controls = average of all controls used in the Phase 2 testing for Merimec Energy Center MW-5

Table 5
Summary of Meramec MW-6 In Situ Total Metals Removal Performance
Meramec Energy Center, Missouri

	Arsenic	Molybdenum	Boron	Lead	Cobalt	Selenium	Lithium
	mg/L						
Action Levels	0.01	0.1	4	0.015	0.006	0.05	0.040
Average of All Controls[1]	0.0259 J*	0.22 J	10.24 J	0.027 J*	0.062 U	0.062 U	0.128
pH 10	0.0285	0.215	10.5	0.0135	0.01 U	0.01 U	0.12
pH 8	0.013	0.18	11	0.016	0.01 U	0.01 U	0.15
pH 6	0.03	0.14	10	0.027	0.01	0.01 U	0.16
CaSx	0.05 U	0.19	10	0.05 U	0.1 U	0.1 U	0.12
Dissolved Iron (Anaerobic)	0.032	0.26 J	8.5	0.041	0.05 U	0.05 U	0.13
Dissolved Iron (Aerobic)	0.027	0.22 J	8.6	0.033	0.05 U	0.05 U	0.13
ZVI Injectable	0.025 U	0.05 U	0.69	0.025 U	0.05 U	0.05 U	0.5 U
ZVI PRB	0.025 U	0.05	6.5	0.025 U	0.05 U	0.05 U	0.11
ZVI Injectable + Bio	0.05 U	0.1 U	0.72	0.05 U	0.1 U	0.1 U	NS
ZVI PRB + Bio	0.05 U	0.1 U	8.5 J	0.05 U	0.1 U	0.1 U	0.1

Notes:

U = not detected above the indicated concentration

PRB = permeable reactive barrier

Injectable = iron particles at micro-scale; potentially applied through injection

Dissolved iron = 50 mg/L Iron(II) sulfate

CaSx = calcium polysulfide

mg/L = milligrams per liter

At or below action level

Approaching action level

Above action level and increase relative to control

Non-detect but detection limit greater than action level

NA = no action level

half the detection limit was used for non-detect when duplicates had a detection and a non-detect.

pH adjustment testing was conducted over a 7-day test period. The native pH in monitoring well MW-6 was approximately pH 7.6.

1) Average of All Controls = average of all controls used in the Phase 2 testing for Merimec Energy Center MW-6

Table 6
Summary of Labadie In Situ Total Metals Removal Performance
Labadie Energy Center, Missouri

	Arsenic	Molybdenum	Boron	Lead	Cobalt	Selenium	Lithium
	mg/L						
Action Levels	0.0426	0.1	4	0.015	0.006	0.05	0.055
Average of All Controls[1]	0.042 U	0.162 J	9.133 J	0.042 U	0.083 U	0.083 U	0.022 J*
pH 6	0.025 U	0.13 J	7.6	0.025 U	0.05 U	0.05 U	0.018 J
CaSx	0.025 U	0.16 J	7.5	0.025 U	0.05 U	0.05 U	0.016 J
CaSx pH7	0.025 U	0.13 J	7.6	0.025 U	0.05 U	0.05 U	0.017 J
Dissolved Iron (Anaerobic)	0.05 U	0.17	9.5	0.05 U	0.1 U	0.1 U	0.06 U
Dissolved Iron (Aerobic)	0.05 U	0.17	9.6	0.05 U	0.1 U	0.1 U	0.023 J
Dissolved Iron pH 7 (Anaerobic)	0.05 U	0.15	9.5	0.05 U	0.1 U	0.1 U	0.06 U
Dissolved Iron pH 7 (Aerobic)	0.05 U	0.16	9.7	0.05 U	0.1 U	0.1 U	0.06 U
ZVI Injectable	0.05 U	0.1 U	6.5	0.05 U	0.1 U	0.1 U	0.06 U
ZVI Injectable pH 7	0.05 U	0.1 U	6.3	0.05 U	0.1 U	0.1 U	0.06 U
ZVI PRB	0.05 U	0.1	9.3	0.05 U	0.1 U	0.1 U	0.06 U
ZVI PRB pH 7	0.05 U	0.1 U	8.9	0.05 U	0.1 U	0.1 U	0.022 J
ZVI Injectable + Bio	0.05 U	0.1 U	10 J	0.05 U	0.1 U	0.1 U	0.016 J
ZVI Injectable pH 7 + Bio	0.05 U	0.1 U	8.9 J	0.05 U	0.1 U	0.1 U	0.019 J
ZVI PRB + Bio	0.05 U	0.1 U	9.9 J	0.05 U	0.1 U	0.1 U	0.063 J
ZVI PRB pH 7 + Bio	0.05 U	0.1 U	9.2 J	0.05 U	0.1 U	0.1 U	0.038 U

Notes:

U = not detected above the indicated concentration

PRB = permeable reactive barrier

Injectable = iron particles at micro-scale; potentially applied through injection

Dissolved iron = 50 mg/L Iron(II) sulfate

CaSx = calcium polysulfide

mg/L = milligrams per liter

J* = half the detection limit was used for non-detect when duplicates had a detection and a non-detect.

pH adjustment testing was conducted over a 7-day test period. The native pH at Labadie was approximately pH 8.3.

1) Average of All Controls = average of all controls used in the Phase 2 testing for Labadie Energy Center

At or below action level

Approaching action level

Above action level and increase relative to control

Non-detect but detection limit greater than action level

NA = no action level

Table 7
Summary of Sioux In Situ Total Metals Removal Performance
Sioux Energy Center, Missouri

	Arsenic	Molybdenum	Boron	Lead	Cobalt	Selenium	Lithium
	mg/L						
Action Levels	0.01	0.1	4	0.015	0.006	0.05	0.040
Average of All Controls[1]	0.033 J*	2.867 J	26.7 J	0.065 J*	0.052 J*	0.083 U	0.049
pH 6	0.025 U	1.7 J	23	0.025 U	0.05 U	0.05 U	0.028 J
CaSx	0.025 U	2.7 J	21	0.025 U	0.05 U	0.05 U	0.025 J
Dissolved Iron (Anaerobic)	0.05 U	2.7	28	0.05 U	0.1 U	0.1 U	0.028 J
Dissolved Iron (Aerobic)	0.05 U	2.6	27	0.069	0.1 U	0.1 U	0.085
ZVI Injectable	0.05 U	0.1 U	23	0.05 U	0.1 U	0.1 U	0.06 U
ZVI PRB	0.05 U	0.81	26	0.05 U	0.1 U	0.1 U	0.024 J
ZVI Injectable + Bio	0.05 U	0.5 J	19 J	0.05 U	0.1 U	0.1 U	0.029 J
ZVI PRB + Bio	0.05 U	0.1 U	27 J	0.05 U	0.1 U	0.1 U	0.021 J

Notes:

U = not detected above the indicated concentration

PRB = permeable reactive barrier

Injectable = iron particles at micro-scale; potentially applied through injection

Dissolved iron = 50 mg/L Iron(II) sulfate

CaSx = calcium polysulfide

mg/L = milligrams per liter

J* = half the detection limit was used for non-detect when duplicates had a detection and a non-detect.

pH adjustment testing was conducted over a 7-day test period. The native pH at Sioux was approximately pH 7.8.

1) Average of All Controls = average of all controls used in the Phase 2 testing for Sioux Energy Center

At or below action level

Approaching action level

Above action level and increase relative to control

Non-detect but detection limit greater than action level

NA = no action level

Table 8
Summary of Preliminary Ferric Chloride Treatability Testing - Rush Island
Rush Island Energy Center, Missouri

	Arsenic			Molybdenum		
	1 hour [1]	3 hour [2]	6 hour [3]	1 hour [1]	3 hour [2]	6 hour [3]
	mg/L					
Action Level	0.03			0.1		
Total Metals						
Baseline	0.224			0.146		
20 mg/L $FeCl_3$, pH 6[4]	0.0072	0.0109	0.0126	0.0205	0.0241	0.0283
40 mg/L $FeCl_3$, pH 6[4]	0.0049	0.0059	0.0062	0.01 U	0.01 U	0.01 U
40 mg/L $FeCl_3$, pH 4[5]	0.0056	0.0085	0.0105	0.01 U	0.01 U	0.01 U
40 mg/L $FeCl_3$, 3% H_2O_2, pH 6[4,6]	0.0269	NM	NM	0.188	NM	NM

Notes:

U = not detected above the indicated concentration

mg/L = milligrams per liter

NM = not measured

$FeCl_3$ = ferric chloride

At or below action level

Approaching action level

Above action level and increase relative to baseline

Non-detect but detection limit greater than action level

1) 1 hour sample started collecting 1.5 hours after $FeCl_3$ added (flow through column started 0.5 hours after $FeCl_3$). Ended collection 3 hours after $FeCl_3$ added.

2) 3 hour sample started collecting 3.5 hours after $FeCl_3$ added. Ended collection 5 hours after $FeCl_3$ added.

3) 6 hour sample started collecting 5.5 hours after $FeCl_3$ added. Ended collection 7 hours after $FeCl_3$ added.

4) pH of 6 was the goal but after adding the $FeCl_3$, the 20 mg/L test was a pH of 4.65 and the 40 mg/L was a pH of 3.66. Did not measure the final pH of the H_2O_2 test.

5) pH of 4 was the goal but after adding the $FeCl_3$, the 0 mg/L test was a pH of 3.45.

6) this was the only sample that had a brownish tent to it in the effluent. The flocks had formed faster and seemed to settle out better than those without the H_2O_2. Bubbles noted in effluent of column.

Table 9
Summary of Ferric Chloride Continuous Flow Test - Rush Island
Rush Island Energy Center, Missouri

Sand Filter									
	Action Level	Influent	Intermediate			Effluent Sand Filter			
			19 hr	2 day	8 day*	Ave first 19 hr	19 hr	2 day	7 day
Total mg/L									
Arsenic	0.03	0.212	NM	NM	0.0288	0.0013	0.001	0.001 U	0.0107
Molybdenum	0.1	0.156	NM	NM	0.0267	0.01 U	0.01 U	0.01 U	0.0151
Lead	0.015	0.0057	NM	NM	0.0016	0.0026	0.0023	0.001 U	0.001 U
Lithium	0.0647	0.005 U	NM	NM	NM	0.005 U	0.005 U	0.005 U	NM
Iron	NA	0.0769	NM	NM	1.15	NM	NM	NM	0.299
Boron	4	4**	NM	NM	NM	NM	NM	NM	NM
Dissolved mg/L									
Arsenic	0.03	0.198	0.0019	0.0032	0.0219	0.001 U	0.001 U	0.001 U	0.0094
Molybdenum	0.1	0.144	0.01 U	0.01 U	0.0224	0.01 U	0.01 U	0.01 U	0.0136
Lead	0.015	0.0052	0.0022	0.0035	0.0014	0.0029	0.0027	0.001 U	0.001 U
Lithium	0.0647	0.005 U	0.005 U	0.005 U	NM	0.005 U	0.005 U	0.005 U	NM
Iron	NA	0.0552	NM	NM	0.831	NM	NM	NM	0.204
Boron	4	NM	NM	NM	NM	NM	NM	NM	NM

Filters - Mimic Resin Filtration Followed By Resin						
	Action Level	Influent	Effluent 100 micron filter - 3 Days	Effluent 10 micron filter - 3 Days	filter pH to 7.5 adjusted - 3 Days	Post Resin
Total mg/L						
Arsenic	0.03	0.212	0.0363	0.0023	NM	0.0016
Molybdenum	0.1	0.156	0.0257	0.01 U	NM	0.01 U
Lead	0.015	0.0057	NM	NM	NM	NM
Lithium	0.0647	0.005 U	NM	NM	NM	NM
Iron	NA	0.0769	4.41	2.69	NA	5.11
Boron	4	4**	NM	4**	NA	0.02 U
Dissolved mg/L						
Arsenic	0.03	0.198	0.0032	0.0016	0.001 U	0.0012
Molybdenum	0.1	0.144	0.01 U	0.01 U	0.01 U	0.01 U
Lead	0.015	0.0052	NM	NM	NM	NM
Lithium	0.0647	0.005 U	NM	NM	NM	NM
Iron	NA	0.0552	1.92	2.33	0.951	0.503
Boron	4	NM	NM	NM	NM	0.02 U

Notes:

U = not detected above the indicated concentration

mg/L = milligrams per liter

$FeCl_3$ = ferric chloride at 40 mg/L

NM = not measured

NA = not applicable. Not a metal of concern

hr = hour

Ave = average of the flow collected in the first 19 hours

Intermediate = collected after $FeCl_3$ has been added and mixed, and the flocculants are being settled

Rush Island water was adjusted to a pH of 5.8-6.0 prior to adding the $FeCl_3$ and had a final pH of 4.0-4.3.

Effluent water was adjusted to a pH of 6-8 prior to passing through the resin.

* = the total intermediate sample was passed through a 5 micron filter to simulate a bag filter.

** = results are internal XDD measurements using colorimetric Hach testing

At or below action level

Approaching action level

Above action level and increase relative to baseline

Non-detect but detection limit greater than action level

Table 10
Summary of pH Adjustment and Resin Column Testing - Rush Island
Rush Island Energy Center, Missouri

	Arsenic	Boron	Molybdenum
	mg/L		
Action Level	0.03	4	0.1
Total Metals			
Baseline	0.224	3.72	0.146
Day 1	0.0261	0.02 U	0.01 U
Day 3	0.0042	0.02 U	0.01 U
Day 7 - pH only	0.198	3.64	0.153
Day 7	0.0568	0.02 U	0.01 U
Dissolved Metals			
Baseline	0.211	3.39	0.14
Day 1	0.0242	0.02 U	0.01 U
Day 3	0.0032	0.02 U	0.01 U
Day 7 - pH only	0.189	3.27	0.142
Day 7	0.0525	0.02 U	0.01 U

Notes:

U = not detected above the indicated concentration

mg/L = milligrams per liter

pH was adjusted to 5

pH only = sample collected after pH adjustment and flowing through sand, but before the ion-specific resin

	At or below action level
	Approaching action level
	Above action level and increase relative to baseline
	Non-detect but detection limit greater than action level

Table 11
Summary of Zero Valent Iron Column Metals Removal - Rush Island
Rush Island Energy Center, Missouri

	Column Construction: 5 Parts Sand per 1 Part ZVI				Column Construction: 2 Parts Sand per 1 Part ZVI			
	Arsenic	**Boron**	**Iron**	**Molybdenum**	**Arsenic**	**Boron**	**Iron**	**Molybdenum**
	mg/L							
Action Level	0.03	4	--	0.1	0.03	4	--	0.1
Total Metals								
Baseline	0.195	3.84	0.0721	0.143	0.211	3.51	0.0817	0.148
Day 1	0.034	3.48	0.357	0.0954	0.0419	3.47	0.503	0.145
Day 3	0.114	3.86	0.0959	0.15	0.082	3.4	0.166	0.134
Day 7	0.113	3.9	0.15	0.151	0.089	3.51	0.11	0.143
Dissolved Metals								
Baseline	0.18	3.71	0.0614	0.139	0.212	3.47	0.0489	0.143
Day 1	0.025 U	3.117	0.047	0.0792	0.0439	3.42	0.04 U	0.143
Day 3	0.104	3.59	0.0569	0.134	0.0836	3.36	0.0702	0.133
Day 7	0.101	3.61	0.114	0.135	0.0898	3.34	0.0805	0.138

Notes:

U = not detected above the indicated concentration

ZVI = zero valent iron - micro-scale size

mg/L = milligrams per liter

At or below action level

Approaching action level

Above action level and increase relative to baseline

Non-detect but detection limit greater than action level

MEMORANDUM

To: Barbara Miller
(Ameren Missouri)

Date: January 6, 2022

From: XDD (DRAFT)

cc: Michael Marley (XDD)

RE: **Sioux Treatability Memo**
Sioux Energy Center
8501 MO-94, West Alton, MO

1.0 INTRODUCTION

XDD Environmental (XDD) was retained by Ameren Missouri (Ameren) to perform a metals treatability study for the remediation of metals of concern (MOC) from ash pond groundwater at the Sioux Energy Center (SEC) in West Alton, MO. Groundwater is currently monitored as required by the United States Environmental Protection Agency (USEPA) in 40 CFR Part 257 "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule" (the CCR Rule), the facility's NPDES permit (No MO-000043), and the facilities UIC permit (UI-0000043). Groundwater is analyzed for metals via EPA Methods 200.7 and 200.8, alkalinity via SM Method 2320B, total dissolved solids via SM Method 2450C, ferric and ferrous iron via SM Method 3500, anions via EPA Method 300, and phosphorous via EPA Method 365.4. Based on statistical analysis, elevated levels of molybdenum exceed the site-specific groundwater protection standard (GWPS) established under the CCR Rule at SEC.

While metals cannot be destroyed, they can be susceptible to treatment and undergo changes in form to become either (a) less soluble; or (b) more sorbent and bind to particle surfaces. Both methods involve the physical removal of metals from the dissolved state (a very mobile state) to either a solid state or an adsorbed state. The three primary approaches for metals removal from groundwater are:

- Precipitation: Transformation of a dissolved species to a solid form, which can then settle out of suspension.
- Co-precipitation with other minerals: Transformation of a dissolved species to a solid form that combines with another material (such as iron), which can then settle out of suspension.
- Adsorption: Introduction or production of a solid that will absorb the MOC from the groundwater.

Where multiple metals are present, there is a potential that one metal can inadvertently affect

other metal(s) either positively (reduced dissolved concentration) or negatively (increased dissolved concentration). Therefore, a treatment chain consisting of a sequence of multiple technologies is often needed to address all metals of concern at a site. The focus of this study is on MOC which have regulatory action levels exceeded at SEC ash pond.

Due to the fluctuation of groundwater flow directions at SEC and the slow groundwater velocity, the treatment objective for SEC is to create hydraulic controls where groundwater is extracted along the border of the ash pond to capture and contain the groundwater MOC plume. The water will then be treated above ground and reinjected between the extraction wells to create a hydraulic control that will minimize the extraction rate, maintain natural hydraulic flow, and prevent further migration of MOC from the ash pond groundwater.

Since the treated water will be injected into the extracted aquifer for hydraulic control, the treated water also will be required to meet groundwater permit levels for compounds such as sulfate and boron, as well as molybdenum, which currently exceed permit discharge levels. The primary MOC at SEC is molybdenum.

This memo will address the treatability work performed for SEC groundwater to remove molybdenum along with an evaluation of sulfate and boron removal to meet the discharge permit levels. The treatability lab testing for SEC was done in parallel with the treatability studies performed for two other Ameren sites; Labadie Energy Center (LEC) and Rush Island Energy Center (RIEC). All three sites have overlap on treatment objectives, MOC, and similar water chemistry; therefore, promising results at one site were used to guide treatment at the other two sites.

Preliminary evaluations focused on in-situ treatment options; however, due to concerns of precipitation clogging pore space thereby affecting subsurface flow conditions, along with the lack of available in-situ options for removing or stabilizing boron, the focus transitioned to ex-situ treatment options. This memo will focus on the ex-situ treatment options only. The findings presented will focus on SEC but will include relevant results obtained from treatability tests from LEC and RIEC.

2.0 TREATABILITY OBJECTIVE

The focus of the treatability study is to remove the site MOC so that the water will meet the groundwater permit discharge levels. This will allow safe injection of the treated groundwater back into the aquifer from which it was extracted. For SEC, the proposed treatment system must address molybdenum, sulfate, and boron. The target discharge permit levels for these compounds are:

- molybdenum = 100 micrograms per liter (µg/L)
- sulfate = 250,000 µg/L
- boron = 2,000 µg/L

This memo will summarize the tests performed to address each compound, conditions under which each method was tested, how successful each remedial option was shown to be, and recommendations for full scale implementation.

2.1 Molybdenum

Groundwater samples collected from SEC for the treatability test showed molybdenum concentrations to be over 10 times greater than the target discharge limit. Preliminary treatability work performed on groundwater from RIEC determined that processes shown to treat arsenic were also successful at removing molybdenum. The methods developed for arsenic and molybdenum removal at RIEC were tested on SEC and found to be affected at treating molybdenum at SEC.

Tests were performed using RIEC water for precipitation of molybdenum at a pH of 5, filtering the water through zero valent iron (ZVI) columns, pH adjustment followed by ferric chloride ($FeCl_3$) precipitation, and pH adjustment followed by $FeCl_3$ and oxidative (hydrogen peroxide) precipitation. Results are discussed below. Confirmation testing of RIEC best treatment option was performed on SEC water. It was determined that the pH adjustment using hydrochloric acid (HCl) followed by $FeCl_3$ could transform the dissolved molybdenum to solid iron-molybdenum but that the solid particles formed would not settle within a reasonable timeframe for treatment. Additional tests were performed on SEC water to aid in the precipitation process and is discussed below in Section 2.1.4.

2.1.1 pH adjustment

The pH adjustment process involved adjusting the pH of RIEC water to 5 using HCl followed by flow through a sand filter than a SIR-150 boron resin filter (see Section 2.2 for more information on SIR-150). Since the resin is specially designed for boron removal and it is not desirable to have the resin capacity exacerbated with high concentrations of other groundwater constituents, samples were collected prior to the resin to determine the effects of the pH adjustment on molybdenum treatment (**Table 1, Test M-1**).

Groundwater samples collected between the sand filter and the resin columns showed that the pH adjustment followed by sand filtration did not effectively remove the molybdenum in the groundwater to the discharge permit levels (**Table 1, Test M-1**) . A further review of the data and the procedures used in this test suggests that, for pH adjustment to be successful for removing molybdenum from RIEC groundwater, the groundwater needs to be maintained at a reduced pH for longer than 40 minutes (the residence time in the sand filter tested columns). Hence, pH adjustment alone would not be a viable ex-situ remedial approach.

2.1.2 ZVI Columns

Iron can precipitate molybdenum as a low-solubility iron-molybdenum. To test the feasibility of using a ZVI column to remove molybdenum ex-situ, test columns were constructed using a mixture of the microscale ZVI and commercial sand. Microscale ZVI was tested due to its highly reactive surface and increased potential to remove molybdenum. The sand was added to allow the required flow through the ZVI column without clogging due to the microscale ZVI particle size. The columns were prepared using a 5:1 and 2:1 ratios of sand to microscale ZVI. The columns were operated for 7 days, with effluent groundwater samples collected from the column after 1, 3, and 7 days of flow.

The Day 7 results are shown on **Table 1 Test M-2** (5:1 sand to ZVI ratio) and **M-3** (2:1 sand to ZVI ratio). The results show partial removal of molybdenum, though not to action levels. Boron concentrations did not change passing through the ZVI columns though research suggested there may be a reduction. It was concluded that the ZVI removal effectiveness (at the design sand to ZVI dosages) was questionable, and likely not reliable as a sustainable remedial option.

2.1.3 Ferric Chloride Co-Precipitation

The ex-situ remediation method that proved most successful and reliable for molybdenum treatment of groundwater is pH adjusted followed by $FeCl_3$ aided flocculation. Preliminary testing with the ZVI and pH adjustment, discussed above, helped guide the design of the $FeCl_3$ treatment train.

$FeCl_3$ testing was performed to determine reaction time needed (**Table 1 Tests M-4** to **M-12**), optimal pH ranges (**Table 1 Tests M-7** to **M-12**), optimal $FeCl_3$ dosage (**Table 1 tests M-4** to **M-9**), and if oxidation through hydrogen peroxide addition could increase performance (**Table test M-13**) for RIEC water. A summary of the finding are:

- Molybdenum can be reduced to concentrations at or below action levels, using $FeCl_3$ addition.
- An initial pH of 6 (prior to the addition of $FeCl_3$) caused faster settling of the precipitants than an initial pH of 4.
- Higher $FeCl_3$ dosage (40 mg/L vs. 20 mg/L) provided greater removal of arsenic and molybdenum.
- The additional of hydrogen peroxide hindered molybdenum removal efficiency.

The reaction time determined for the $FeCl_3$ coagulation and flocculation/precipitation and associated removal of molybdenum from groundwater in the preliminary testing using RIEC groundwater was adequate for the conceptual ex-situ remedial approach (an hour or less).

Confirmation testing using SEC water showed that:

- 40 mg/L of $FeCl_3$ was insufficient to reach discharge limits for molybdenum (**Table 1 Test M-14**)
    - For SEC, 80 mg/L $FeCl_3$ is required to meet molybdenum discharge limits (**Table 1 Test M-15**).
- The dissolved concentrations of molybdenum were significantly lower than the total molybdenum concentrations using the pH 6 adjustment followed by $FeCl_3$ addition method established for RIEC (**Table 1 Tests M-14** and **M-15**)
- Visually observations noted little to no settling of the pin flocs formed in SEC water after an hour.

The results of SEC confirmation testing suggested that, while the chemistry needed to remove dissolved molybdenum from the groundwater was similar between RIEC and SEC, the higher concentration of molybdenum found at SEC require a higher dose of $FeCl_3$ (80 mg/L as compared to 40 mg/L for RIEC) and a flocculant aid is needed to remove the total molybdenum from the suspended solid phase.

2.1.4 Coagulant Aid Testing

All coagulant aid testing was done after the water had been adjusted to a pH of 6 followed by $FeCl_3$ addition of 40 or 80 mg/L (except the test of the alternative coagulant). There are several approaches to increase the formation of larger flocs that can help in settling of total metals and water clarity:

- Increase alkalinity
- Shifting to another coagulant (alum instead of $FeCl_3$)
- Bulking agent
- Polymers

The addition of calcium hydroxide was tested to see if increasing the alkalinity of the water would increase the size of the flocculants (**Table 1 Tests M-16** to **M-19**). While the 2:3 molar ratio of $FeCl_3$ to calcium hydroxide (**Table 1 Tests M-16** and **M-17**) greatly increased the formation of flocculants, the calcium hydroxide increased the pH above the target range which resulted in the settling of the iron without the molybdenum. Testing was done adding calcium hydroxide at lower dosages which would not increase the pH much above the target range (target is a final pH of 4 after the $FeCl_3$ is added) (**Table 1 Tests M-18** and **M-19**) but this was insufficient alkalinity to form flocs that would settle and the pH increases from 4 to pH of 5 or 6 decreased the removal of dissolved molybdenum compared to the conditions with no calcium hydroxide added.

Alum is another coagulant that may remove molybdenum from water as a lower soluble aluminum-molybdenum compound. Alum was added at 120 mg/L but had little to no affect on the molybdenum removal and no significant increase in floc formation (**Table 1 Test M-20**).

Bulking agents are often added to water to act as a nucleus on which smaller flocs can bind to and settle out. One bulking agent that is often used in water treatment systems is bentonite. Bentonite was tested as a powder form (**Table 1 Test M-21**) and as a liquid slurry form (**Table 1 Test M-22**) to look at alternative methods of application. The bentonite slurry test where 80 mg/L $FeCl_3$ was tested showed significant reduction in total molybdenum and had significant floc formation resulting in increased density of flocks for settling and improved water clarity. The one concern with bentonite is the difficulty in handling and maintenance of a clay in a flow through semi-automated system and dispersion of the bentonite in a water mixture.

Polymer coagulant aids are often used when flocs are too small to settle on their own. They act as a charge surface to draw solids to them and increase the density of the solids resulting in an increase rate of flocculation. Two polymers were tested; a cationic and an anionic inorganic polymer (**Table 1 Tests M-23** to **M-26**). While both polymer formed large flocs that aided in water clarity and were capable of removing molybdenum, the cationic polymer resulted in the lowest molybdenum concentrations at an $FeCl_3$ concentration of 80 mg/L (**Table 1 Test M-26**).

Based on the coagulant aid test results and considering the ease of implementation, the cationic inorganic polymer is the recommended approach for increasing the settling of the solids from the flocculation tank (**Table 1 Tests Final 1** and **Final 3**).

2.2 Boron

Resins and reverse osmosis are the primary methods used to remove boron from water sources. There is a low efficiency of treated water to wastewater using reverse osmosis, so the boron treatment has focused on resins. Three commercially available boron-removal resins were identified and tested; SIR-150, IRA-743, and PWA-10.

As discussed in Section 2.1.1, a pH of 5 adjusted water followed by a column test of the SIR-150 was tested over 7 days using RIEC water. After 7 days of passing through the column, boron concentrations were still below the detection limit of 10 ug/L (**Table 1 Test B-1**). As shown in the sample collected between pH adjustment to 5 and the resin column (**Table 1 Test M-1**), molybdenum was not treated sufficiently by the pH adjustment showing that molybdenum removed to discharge levels in **Table 1 Test B-1** is from attachment to the resin.

While the resin beds in this treatability test were designed for a 15 minute residence time, when scaling the lab test to field application flow rates, the mass of resin was much larger than would be used in a site application. In addition, these tests were performed on RIEC water where molybdenum is much lower compared to SEC water. For RIEC test, breakthrough of arsenic after 7

days suggests that, given field-sized vessels, the resin utilization would be too high without pre-treatment for molybdenum prior to resin filtration. With the high concentration of molybdenum at SEC, SEC water is likely to put a higher demand on the resin resulting is quicker breakthroughs and increased in frequency of regeneration.

Subsequent testing used the procedure discussed in Section 2.1.3 prior to filtration through the resin beds. The process involved RIEC water adjusted to a pH of 6 with HCl followed by $FeCl_3$ (40 mg/L), settling, and sand filtration. The water was then passed through one of three columns containing SIR-150 (**Table 1 Test B-2**), IRA-743 (**Table 1 Test B-3**), or PWA-10 (**Table 1 Test B-4**). While all resins were capable of removing the boron and polishing the arsenic and molybdenum, SIR-150 showed the highest performance for sulfate removal. Additional temporal testing was performed on the SIR-150 and PWA-10 resins for sulfate removal along with surfactant coated zeolite (**Table 1 Tests B,S-1** to **B,S-24**). These tests are discussed further in Section 2.3.2.

Confirmation testing of the treatment process discussed in Section 2.1.4 followed by filtration through the SIR-150 resin using SEC water was performed with results shown in **Table 1 Tests Final 2** and **Final 4** with both results showing successful treatment of molybdenum, sulfate, and boron.

2.3 Sulfate

2.3.1 Sorption and Precipitation

Sulfate can be precipitated out at high concentrations (thousands of milligrams per liter (mg/L) concentration ranges) but is difficult to reduce at lower concentrations (hundreds of mg/L concentration ranges). The primary approaches used for the lower level concentration of sulfate are reverse osmosis and resin removal. As mentioned for boron, there is a low efficiency of treated water to wastewater using reverse osmosis. The cost, maintenance, and waste stream of resins are such that it would be preferable to not rely on a second resin bed for sulfate removal which would result in a second resin waste stream. Other options discussed in literature were:

- sorption using
    - zeolite (**Table 1 Tests S-1, S-5, S-22**);
    - surfactant coated zeolite (**Table 1 Tests S-2, S-6, S-11, S-12, S-19** to **S-21**);
    - sodium chloride coated zeolite (**Table 1 Tests S-3, S-7, S-9, S-10**).
- precipitation using
    - limestone (**Table 1 Tests S-4, S-8**);
    - cement (**Table 1 Tests S-13** to **S-15**);
    - calcium hydroxide (**Table 1 Tests S-16** to **S-18**);

- chitosan (**Table 1 Tests S-23** to **S-25**);
- sodium aluminate (**Table 1 Test S-26**);
- calcium aluminate (**Table 1 Test S-27**);
- calcium aluminate cement (**Table 1 Test S-28**).

Since the success of these processes are sensitive to water quality and water chemistry (alkalinity, pH, total dissolved solids, etc.), several dosages, treatment train applications, product formulations, and pH ranges were tested to identify if there was a method for success.

Of the methods and conditions tested, none were shown to greatly reduce the sulfate concentration relative to the baseline value.

2.3.2 Resin

Based on the results of RIEC pilot study which was conducted in parallel with the sulfate portion of the lab treatability testing, approximately 20% of the influent sulfate can be removed through the $FeCl_3$ coagulation/flocculation process and is removed after the sand filtration. This reduction brings the sulfate concentrations at RIEC below the discharge permit levels. In addition, the pilot study showed an average of 58% reduction in sulfate between the influent and post resin treatment (**Table 1 Tests P1** to **P20**).

Based on the lack of success of the options in Section 2.3.1 and the ability of the current proposed treatment train to treat RIEC sulfate concentrations to below discharge permit levels (250,000 µg/L), the best option would be to use the treatment train developed for molybdenum to decrease the sulfate concentrations and then polish the water with the boron resin.

As mentioned in Section 2.2, there were three resins identified that could remove boron and preliminary results suggested that sulfate coated zeolite could reduce sulfate. Temporal testing was performed to evaluate the longevity of two of the resins (SIR-150 and PWA-10) and the surfactant coated zeolite. Columns were constructed that were scaled to the proposed full scale vessel sizes for the lab defined flow rate and were run for 6 days. While the residence time and vessel sizing was scaled appropriately, due to water volume restraints, the surface area of vessel media to flow is an underestimate of the full scale system. Regardless, the design allowed for a comparison of the performance of the two resins and the surfactant coated zeolite. Based on the results, the SIR-150 resin (**Table 1 Tests B,S-19** to **B,S-24**) outperformed the PWA-10 resin (**Table 1 Tests B,S-1** to **B,S-6** and **B,S-13** to **B,S-18**) with lower magnitudes of breakthrough. The surfactant coated zeolite (**Table 1 Tests B,S-7** to **B,S-12**) was shown to be ineffective at treatment under the design residence times.

2.4 Final Design

As mentioned above, final confirmation tests were performed of SEC water to 1) confirm the treatment train process works for molybdenum, sulfate, and boron and 2) identify if cationic or anionic polymers are more successful (**Table 1 Tests Final 1** to **4**). The final treatment train process is to aerate, adjust the pH to 6 with HCl, add $FeCl_3$ at 80 mg/L, add the cationic inorganic polymer at 0.5 mg/L, settling, sand filter, and finally SIR-150 resin filtration. Key observations and conclusions from the treatability testing, pilot study, and additional $FeCl_3$ testing are:

- Aeration of the groundwater prior to the addition of $FeCl_3$ accelerates the formation of precipitants.
- The initial adjustment pH should be close to pH of 6 at SEC for optimal molybdenum removal.
- Higher $FeCl_3$ concentrations provided greater removal of dissolved molybdenum.
- SEC water requires a coagulant aid to increase the density of the iron-molybdenum flocks. The cationic inorganic polymer had higher removal of molybdenum than the anionic inorganic polymer.
- The sand filter was effective as a polishing step to reduce total molybdenum concentrations to below action levels, while also decreasing total iron concentrations.
- The resin filter is needed to remove boron from the groundwater to action levels. The SIR-150 resin performed best of those tested. The SIR-150 resin operates optimally between a pH of 4 and 10.
- While removing boron from the groundwater, the resin also acts as a polishing tool for removal of residual molybdenum and additional reduction of sulfate.

The final proposed treatment design is shown in **Figure 1** below:

Figure 1: Proposed Treatment Process

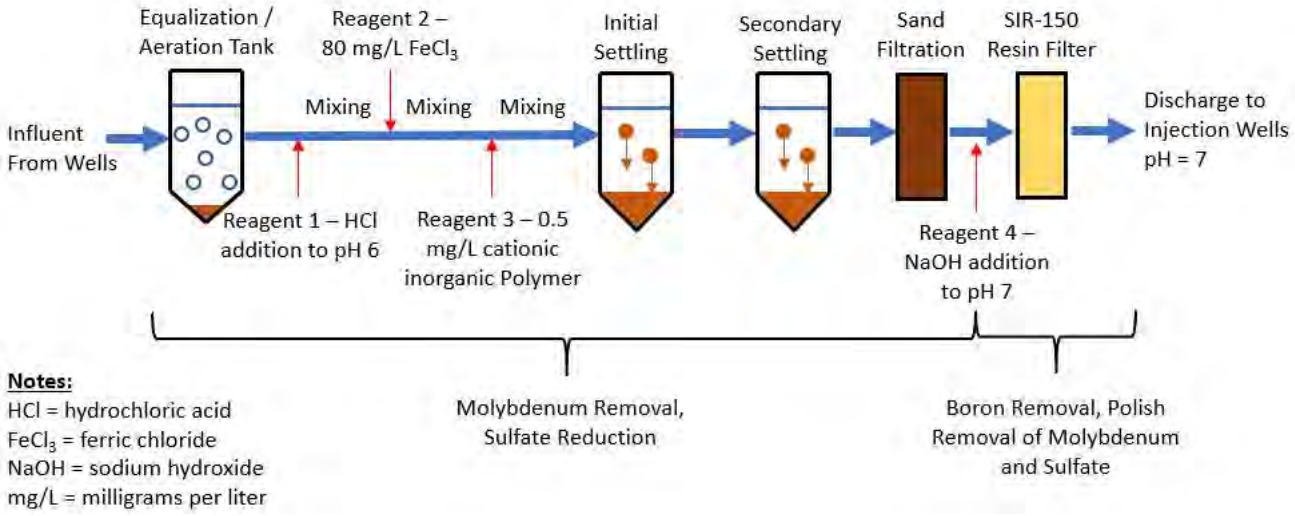


Table 1
Summary of Sioux Energy Center Treatability Testing
Sioux Energy Center, Missouri

Test Condition Reference		Molybdenum	Sulfate	Boron
	Permit Limits	100	250,000	2,000
	High Concentraiton Area Water	3,470	725,000	32,200
	Low Concentration Area Water	65	71,000	756
	Blended Water	1,767	398,000	16,478
				Focus on Molybdenum Removal - RIEC
M-1	Adjust water to pH of 5 - Day 7	142	NM	3,270
M-2	Zero Valent Iron Column - 5 parts sand, 1 Part ZVI - Day 7	151	NM	3,900
M-3	Zero Valent Iron Column - 2 parts sand, 1 Part ZVI - Day 7	143	NM	3,510
M-4	Adjust water to pH 6, $FeCl_3$ (20 mg/L) - 1 hour reaction	20.5	NM	NM
M-5	Adjust water to pH 6, $FeCl_3$ (20 mg/L) - 3 hour reaction	24.1	NM	NM
M-6	Adjust water to pH 6, $FeCl_3$ (20 mg/L) - 6 hour reaction	28.3	NM	NM
M-7	Adjust water to pH 6, $FeCl_3$ (40 mg/L) - 1 hour reaction	<10	NM	NM
M-8	Adjust water to pH 6, $FeCl_3$ (40 mg/L) - 3 hour reaction	<10	NM	NM
M-9	Adjust water to pH 6, $FeCl_3$ (40 mg/L) - 6 hour reaction	<10	NM	NM
M-10	Adjust water to pH 4, $FeCl_3$ (40 mg/L) - 1 hour reaction	<10	NM	NM
M-11	Adjust water to pH 4, $FeCl_3$ (40 mg/L) - 3 hour reaction	<10	NM	NM
M-12	Adjust water to pH 4, $FeCl_3$ (40 mg/L) - 6 hour reaction	<10	NM	NM
M-13	Adjust water to pH 6, $FeCl_3$ (40 mg/L) and 3% H_2O_2 - 1 hour reaction	188	NM	NM
				Focus on Molybdenum Removal - SEC
M-14	Adjusting water to pH of 6, $FeCl_3$ (40 mg/L)	440 total 240 dissolved	NM	NM
M-15	Adjusting water to pH of 6, $FeCl_3$ (80 mg/L), Sand Filter	1,170 total 38 Dissolved	NM	31500
				Focus on Molybdenum Removal and Settling Conditions - SEC
M-16	Adjust water to pH 6, $FeCl_3$ (80 mg/L), 2:3 molar ratio FeCl3 to $Ca(OH)_2$, Sand Filter	1,890	NM	NM
M-17	Adjust water to pH 6, $FeCl_3$ (40 mg/L), 2:3 molar ratio FeCl3 to $Ca(OH)_2$, Sand Filter	2,560	NM	NM
M-18	Adjust water to pH 6, $FeCl_3$ (40 mg/L), $Ca(OH)_2$ to pH of 6, Sand Filter	2,490	NM	NM
M-19	Adjust water to pH 6, $FeCl_3$ (40 mg/L), $Ca(OH)_2$ to pH of 5, Sand Filter	1,430	NM	NM
M-20	Adjust water to pH 6, Alum (120 mg/L), Sand Filter	2,880	NM	NM
M-21	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Bentonite Powder, Sand Filter	340	NM	NM
M-22	Adjust water to pH 6, $FeCl_3$ (80 mg/L), Bentonite Slurry, Sand Filter	170	NM	NM
M-23	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Anionic Polymer, Sand Filter	200	NM	NM
M-24	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Cationic Polymer, Sand Filter	170	NM	NM
M-25	Adjust water to pH 6, $FeCl_3$ (80 mg/L), Anionic Polymer, Sand Filter	120	NM	NM
M-26	Adjust water to pH 6, $FeCl_3$ (80 mg/L), Cationic Polymer, Sand Filter	27	NM	NM
				Focus on Boron Removal - RIEC
B-1	Adjust water to pH of 5, SIR 150 Resin Column - Day 7	<20	NM	<10
B-2	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, SIR-150 Boron Resin	<10	600	<10
B-3	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, IRA-743 Boron Resin	<10	17,000	<10
B-4	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Resin	<10	4,400	<10
B-5	Adjusting water to pH of 6, $FeCl_3$ (40 mg/L), Sand Filter, SIR 150 Resin Column - System Operated 7 Days	<10	NM	<20

Table 1
Summary of Sioux Energy Center Treatability Testing
Sioux Energy Center, Missouri

Test Condition Reference		Molybdenum	Sulfate	Boron
	Permit Limits	100	250,000	2,000
	High Concentraiton Area Water	3,470	725,000	32,200
	Low Concentration Area Water	65	71,000	756
	Blended Water	1,767	398,000	16,478
				Focus on Sulfate Removal - SEC
S-1	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Zeolite Filter	180	380,000	14,000
S-2	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Surfactant Coated Zeolite Filter	160	360,000	15,000
S-3	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, NaCl treated Zeolite Filter	200	370,000	14,000
S-4	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Limestone Filter	200	380,000	14,000
S-5	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, adjust to pH 10, Zeolite Filter	220	390,000	14,000
S-6	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, adjust to pH 10, Surfactant Coated Zeolite Filter	220	390,000	15,000
S-7	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, adjust to pH 10, NaCl treated Zeolite Filter	200	360,000	13,000
S-8	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, adjust to pH 10, Limestone Filter	220	390,000	14,000
S-9	Adjust water to pH6, NaCl Treated Zeolite Filter	NM	430,000	1,500
S-10	NaCl Treated Zeolite Filter Only	NM	420,000	1,600
S-11	Adjust water to pH 6, Surfactant Coated Zeolite Filter	NM	270,000	540
S-12	Surfactant Coated Zeolite Filter Only	NM	230,000	370
S-13	Adjust water to pH 6, $FeCl_3$ (80 mg/L - Bentonite to help settling), Sand Filter, 1:1 cement:sulfate molar ration (20 min mixing)	NM	460,000	NM
S-14	Adjust water to pH 6, $FeCl_3$ (80 mg/L - Bentonite to help settling), Sand Filter, 1.5:1 cement:sulfate molar ration (20 min mixing)	NM	470,000	NM
S-15	Adjust water to pH 6, $FeCl_3$ (80 mg/L - Bentonite to help settling), Sand Filter, 2:1 cement:sulfate molar ration (20 min mixing)	NM	490,000	NM
S-16	Adjust water to pH 6, $FeCl_3$ (80 mg/L - Bentonite to help settling), Sand Filter, 1:1 $Ca(OH)_2$:sulfate molar ration (60 min mixing)	NM	430,000	NM
S-17	Adjust water to pH 6, $FeCl_3$ (80 mg/L - Bentonite to help settling), Sand Filter, 3:1 $Ca(OH)_2$:sulfate molar ration (60 min mixing)	NM	420,000	NM
S-18	Adjust water to pH 6, $FeCl_3$ (80 mg/L - Bentonite to help settling), Sand Filter, 5:1 $Ca(OH)_2$:sulfate molar ration (60 min mixing)	NM	420,000	NM
				Focus on Sulfate Removal - RIEC
S-19	DS-200 Zeolite Only	1,000	300,000	8,300
S-20	OC-300 Zeolite Only	1,100	360,000	9,100
S-21	HS-200 Zeolite Only	890	330,000	8,400
S-22	Clinoptilolite Zeolite Only	1,100	230,000	8,400
S-23	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Chitosan High MW (50 mg/L), adjust pH to 3.5, Mix for 1 hour	NM	230,000	8,300
S-24	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Chitosan Medium MW (50 mg/L), adjust pH to 3.5, Mix for 1 hour	NM	230,000	9,100
S-25	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Chitosan Low MW (50 mg/L), adjust pH to 3.5, Mix for 1 hour	NM	230,000	9,400
S-26	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Sodium Aluminate at 2:1 molar ration with sulfate, adjust pH to 11.3, Mix for 1 hour	NM	230,000	8,100
S-27	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Calcium Aluminate at 2:1 molar ration with sulfate, adjust pH to 11.3, Mix for 1 hour	NM	230,000	8,200
S-28	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Calcium Aluminate Cement at 2:1 molar ration with sulfate, adjust pH to 11.3, Mix for 1 hour	NM	230,000	8,100

Table 1
Summary of Sioux Energy Center Treatability Testing
Sioux Energy Center, Missouri

Test Condition Reference		Molybdenum	Sulfate	Boron
	Permit Limits	100	250,000	2,000
	High Concentraiton Area Water	3,470	725,000	32,200
	Low Concentration Area Water	65	71,000	756
	Blended Water	1,767	398,000	16,478
	Focus on Sulfate and Boron Resin Removal - RIEC			
B,S-1	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - RIEC - 1 Day	14	210,000	<10
B,S-2	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - RIEC - 2 Day	20	210,000	<10
B,S-3	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - RIEC - 3 Day	<10	220,000	180
B,S-4	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - RIEC - 4 Day	<10	220,000	3,400
B,S-5	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - RIEC - 5 Day	<10	220,000	7,300
B,S-6	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - RIEC - 6 Day	<10	220,000	9,100
B,S-7	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Surfactant Coated Zeolite - RIEC - 1 Day	200	220,000	8,600
B,S-8	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Surfactant Coated Zeolite - RIEC - 2 Day	200	220,000	9,100
B,S-9	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Surfactant Coated Zeolite - RIEC - 3 Day	220	220,000	9,900
B,S-10	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Surfactant Coated Zeolite - RIEC - 4 Day	220	220,000	9,400
B,S-11	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Surfactant Coated Zeolite - RIEC - 5 Day	240	220,000	9,300
B,S-12	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, Surfactant Coated Zeolite - RIEC - 6 Day	240	220,000	9,500
	Focus on Sulfate and Boron Resin Removal - SEC			
B,S-13	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - SEC - 1 Day	<10	360,000	<10
B,S-14	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - SEC - 2 Day	<10	380,000	750
B,S-15	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - SEC - 3 Day	<10	370,000	8,600
B,S-16	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - SEC - 4 Day	<10	370,000	16,000
B,S-17	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - SEC - 5 Day	<10	380,000	19,000
B,S-18	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, PWA-10 Boron Resin - SEC - 6 Day	<10	360,000	17,000
B,S-19	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, SIR-150 Boron Resin - SEC - 1 Day	<10	330,000	<20
B,S-20	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, SIR-150 Boron Resin - SEC - 2 Day	<10	370,000	30
B,S-21	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, SIR-150 Boron Resin - SEC - 3 Day	<10	370,000	4,300
B,S-22	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, SIR-150 Boron Resin - SEC - 4 Day	<10	380,000	13,000
B,S-23	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, SIR-150 Boron Resin - SEC - 5 Day	<10	360,000	17,000
B,S-24	Adjust water to pH 6, $FeCl_3$ (40 mg/L), Sand Filter, SIR-150 Boron Resin - SEC - 6 Day	<10	360,000	18,000
	Focus on Final Design; Settling and Treatment - SEC			
Final 1	Adjust water to pH 6, $FeCl_3$ (80 mg/L), Anion Polymer (2.5 mg/L), Sand Filter	360	400,000	17,000
Final 2	Resin	<100	7.2	<100
Final 3	Adjust water to pH 6, $FeCl_3$ (80 mg/L), Cation Polymer (0.5 mg/L), Sand Filter	22	400,000	16,000
Final 4	Resin	<10	12.0	<100

Table 1
Summary of Sioux Energy Center Treatability Testing
Sioux Energy Center, Missouri

Test Condition Reference		Molybdenum	Sulfate	Boron
	Permit Limits	100	250,000	2,000
	High Concentraiton Area Water	3,470	725,000	32,200
	Low Concentration Area Water	65	71,000	756
	Blended Water	1,767	398,000	16,478
				Pilot Study Results - RIEC
P-1	2/10/21 RIEC Pilot Influent	1,070	263,000	7,510
P-2	2/10/21 RIEC Pilot Post Resin Filter	14	8,000	<250
P-3	2/12/21 RIEC Pilot Influent	852	261,000	8,110
P-4	2/12/21 RIEC Pilot Post Sand Filter	349	253,000	2,230
P-5	2/12/21 RIEC Pilot Post Resin Filter	0.7	7,000	20
P-6	2/15/21 RIEC Pilot Influent	871	280,000	1,620
P-7	2/15/21 RIEC Pilot Post Sand Filter	93	228,000	7,530
P-8	2/15/21 RIEC Pilot Post Resin Filter	<5	63,000	<10
P-9	2/25/21 RIEC Pilot Influent	880	265,000	7,940
P-10	2/25/21 RIEC Pilot Post Sand Filter	134	237,000	NM
P-11	2/25/21 RIEC Pilot Post Resin Filter	10	208,000	<10
P-12	3/3/21 RIEC Pilot Influent	1,030	255,000	8,550
P-13	3/3/21 RIEC Pilot Post Resin Filter	6	212,000	<10
P-14	4/9/21 RIEC Pilot Influent	1,060	278,000	9,940
P-15	4/9/21 RIEC Pilot Post Resin Filter	33	128,000	62
P-16	5/7/21 RIEC Pilot Influent	946	228,000	8,710
P-17	5/7/21 RIEC Pilot Post Resin Filter	248	100,000	2,330
P-18	5/11/21 RIEC Pilot Influent	1,020	235,000	9,480
P-19	5/11/21 RIEC Pilot Post Sand Filter	4	186,000	6,910
P-20	5/11/21 RIEC Pilot Post Resin Filter	8	136,000	NM

Notes and Abreviations:

RIEC = Rush Island Energy Center
SEC = Sioux Energy Center
NM = not measured
< = concentration is less than value
Red values exceed discharge permit limits
H_2O_2 = hydrogen peroxide
mg/L = milligrams per liter
ug/L = micrograms per liter
$Ca(OH)_2$ = calcium hydroxide
ZVI = zero valent iron
NaCl = sodium chloride
$FeCl_3$ = ferric chloride

APPENDIX E
Groundwater Extraction and Injection Well Certification Reports

WELL CERTIFICATION FORM FOR EW-1 CURRENTLY UNAVAILABLE

WELL CERTIFICATION FORM FOR EW-2 CURRENTLY UNAVAILABLE

WELL CERTIFICATION FORM FOR EW-3 CURRENTLY UNAVAILABLE

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	EW-4	05/13/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap ☐ Weep Hole

SURFACE COMPLETION: ☐ Steel ☐ Aluminum ☐ Plastic

Elevation 438.925 FT.

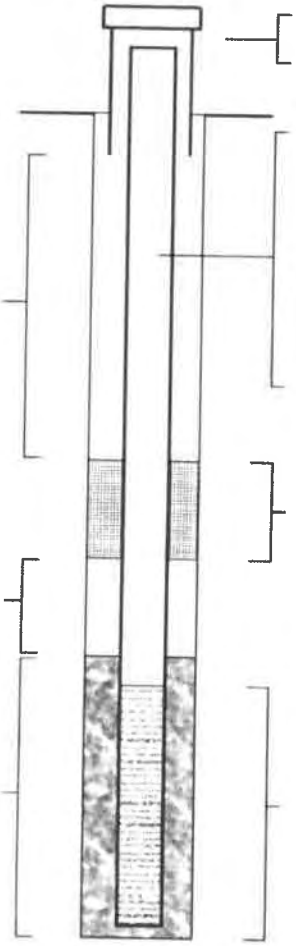
ANNULAR SEAL
Length 54 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 25
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
62 FT.

LENGTH OF PRIMARY FILTER PACK
62.5 FT.



RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 63 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 60 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 63 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 38.5695"
Longitude -90° 17' 40.2808"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☑ Extraction ☐ Inclinometer
☐ Gas Migration ☐ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	123.5	Silty sand to sand with gravel

TOTAL DEPTH: 123.5 FT. ☐ *Boring Log Attached

STATIC WATER LEVEL 22.9 FT. PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	6/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	EW-5	05/18/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap ☐ Weep Hole

Elevation 447.331 FT.

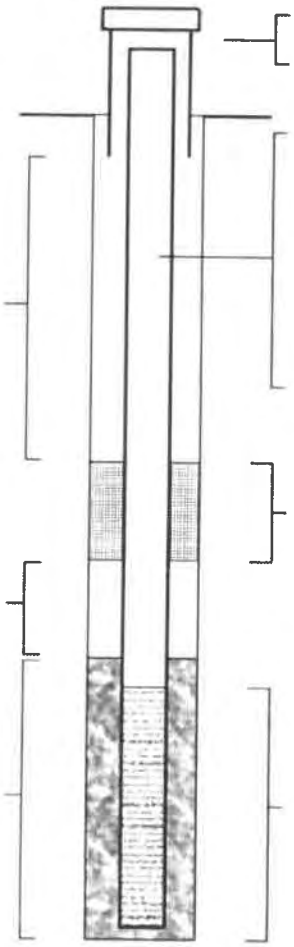
ANNULAR SEAL
Length 57 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 24
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
65 FT.

LENGTH OF PRIMARY FILTER PACK
62 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 66 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 60 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 66 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)

Latitude 38° 54' 38.7261"
Longitude -90° 17' 33.7900"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☑ Extraction ☐ Inclinometer
☐ Gas Migration ☐ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	128	Silty sand to sand with gravel

TOTAL DEPTH: 128 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 27.9 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	EW-6	05/17/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE
☐ Above Ground
☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION
Length _____ FT.
Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
Diameter _____ IN.
Length _____ FT.

SURFACE COMPLETION GROUT
☐ Concrete
☐ Other _____

☐ Locking Cap
☐ Weep Hole

Elevation 444.792 FT.

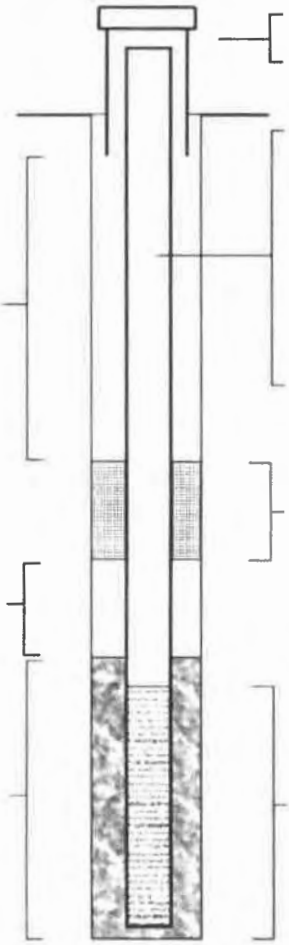
ANNULAR SEAL
Length 60 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
68 FT.

LENGTH OF PRIMARY FILTER PACK
62 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 69 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 60 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 69 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' ~~42.6187"~~
Longitude -90° 17' ~~32.6666"~~

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☑ Extraction ☐ Inclinometer
☐ Gas Migration ☐ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130	Silty sand to sand with gravel

TOTAL DEPTH: 130 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 27.4 FT.
PUMP INSTALLED ☐ Yes ☑ No

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	EW-7	05/24/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap
☐ Weep Hole

SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

Elevation 445.406 FT.

ANNULAR SEAL
Length 56 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 32
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 65 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
64 FT.

LENGTH OF PRIMARY FILTER PACK
61.5 FT.

SCREEN
Screen Diameter 4 IN.
Screen Length 60 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 65 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 46.8680"
Longitude -90° 17' 32.0077"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☑ Extraction ☐ Inclinometer
☐ Gas Migration ☐ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	125.5	Silty sand to sand with gravel

TOTAL DEPTH: 125.5 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL: 27.8 FT.
PUMP INSTALLED: ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

WELL CERTIFICATION FORM FOR EW-8 CURRENTLY UNAVAILABLE

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	EW-9	06/9/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE
- ☐ Above Ground
- ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION
- Length _____ FT.
- Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
- Diameter _____ IN.
- Length _____ FT.

SURFACE COMPLETION GROUT
- ☐ Concrete
- ☐ Other _____

☐ Locking Cap
☐ Weep Hole

Elevation 443.914 FT.

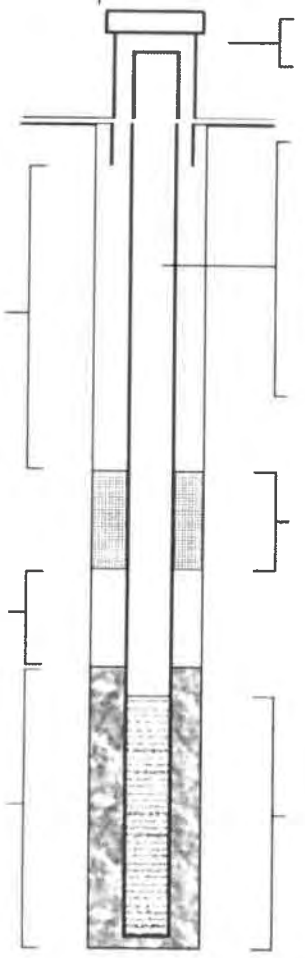
ANNULAR SEAL
Length 58 FT.
- ☐ Slurry ☐ Chips
- ☐ Pellets ☐ Granular
- ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
- Bags of Cement Used 20
- % of Bentonite Used 5
- Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
66 FT.

LENGTH OF PRIMARY FILTER PACK
63 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
- Riser/Casing Diameter 4 IN.
- Riser/Casing Length 67 FT.
- Diameter Of Drill Hole 10 IN.
- Weight Or SDR# S80

MATERIAL
- ☐ Steel ☑ Thermoplastic (PVC)
- ☐ Other _____

BENTONITE SEAL
Length 5
- ☐ Chips ☑ Pellets ☐ Granular
- ☐ Saturated Zone ☐ Hydrated

SCREEN
- Screen Diameter 4 IN.
- Screen Length 60 FT.
- Diameter Of Drill Hole 10 IN.
- Depth To Top 67 FT.

SCREEN MATERIAL
- ☐ Steel ☑ Thermoplastic (PVC)
- ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
- Latitude 38° 54' 49.5700"
- Longitude -90° 17' 39.4963"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
- ☐ Direct Push ☑ Extraction ☐ Inclinometer
- ☐ Gas Migration ☐ Injection ☐ Lysimeter
- ☐ Observation ☐ Open Hole ☐ Other (specify)
- ☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
- ☐ Explosives ☐ Metals
- ☐ Pesticides/Herbicides ☐ Petroleum
- ☐ Radionuclides ☐ SVOCS
- ☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	129	Silty sand to sand with gravel

TOTAL DEPTH: 129 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 27.6 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED: Ameren Missouri	PRIMARY PHONE NUMBER WITH AREA CODE: (314)-544-2555	WELL NUMBER: IW-1	WELL COMPLETION DATE: 06/8/22
PROPERTY OWNER MAILING ADDRESS: One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	CITY: St. Louis	STATE: MO	ZIP CODE: 63166-6149
PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED: 8501 N. State Route 94	CITY: West Alton	COUNTY: St. Charles	
NAME OF SITE, BUSINESS, OR CLEANUP PROJECT: Sioux Generation Plant	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE):	VARIANCE NUMBER (IF ISSUED): V006940	
PRIMARY CONTRACTOR NAME (PLEASE PRINT): John C. Bostwick, R.G.	PERMIT NUMBER: 003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.	

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount ☐ Locking Cap ☐ Weep Hole

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

Elevation 446.199 FT.

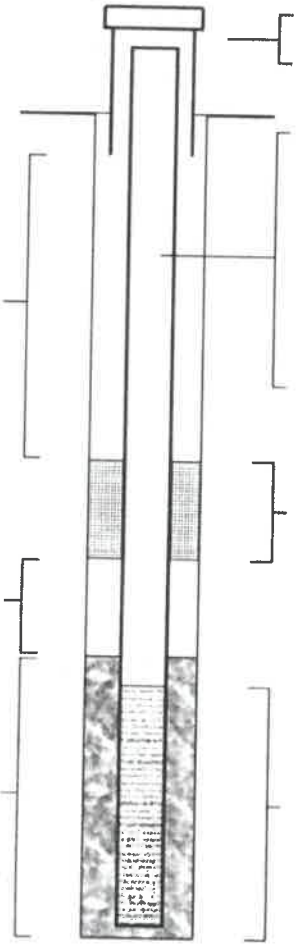
ANNULAR SEAL
Length 50 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
58 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 59 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 59 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 55.2642"
Longitude -90° 17' 39.8430"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130	Silty sand to sand with gravel

TOTAL DEPTH: 130 FT. ☐ *Boring Log Attached

STATIC WATER LEVEL: 26.1 FT. PUMP INSTALLED: ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE
			/ /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-2	06/7/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap
☐ Weep Hole

Elevation 446.095 FT.

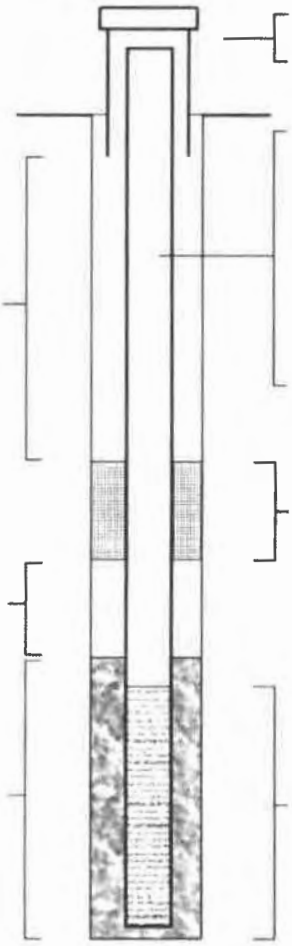
ANNULAR SEAL
Length 50 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
58 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 59 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 59 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 55.1400"
Longitude -90° 17' 42.2461"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130	Silty sand to sand with gravel

TOTAL DEPTH: 130 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL: 29 FT.
PUMP INSTALLED: ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-3	06/6/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap
☐ Weep Hole

Elevation 445.257 FT.

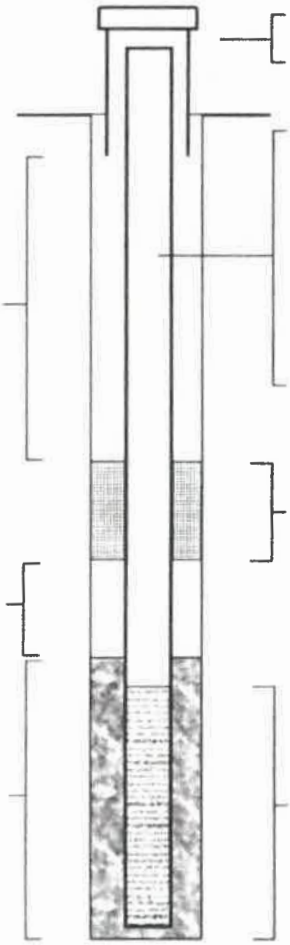
ANNULAR SEAL
Length 51 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 23
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
59 FT.

LENGTH OF PRIMARY FILTER PACK
72.5 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 60 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 60 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' ~~55.0066~~
Longitude ~~-90°~~ ~~45'~~ ~~45.0895"~~

SMALLEST ¼ ¼ ¼ LARGEST
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130.5	Silty sand to sand with gravel

TOTAL DEPTH: 130.5 FT. ☐ *Boring Log Attached

STATIC WATER LEVEL 27.9 FT.

PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/11/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-4	06/3/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE	LENGTH AND DIAMETER OF SURFACE COMPLETION	DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED	SURFACE COMPLETION GROUT
☐ Above Ground ☐ Flush Mount	Length _____ FT. Diameter _____ IN.	Diameter _____ IN. Length _____ FT.	☐ Concrete ☐ Other _____

☐ Locking Cap
☐ Weep Hole

Elevation 443.722 FT.

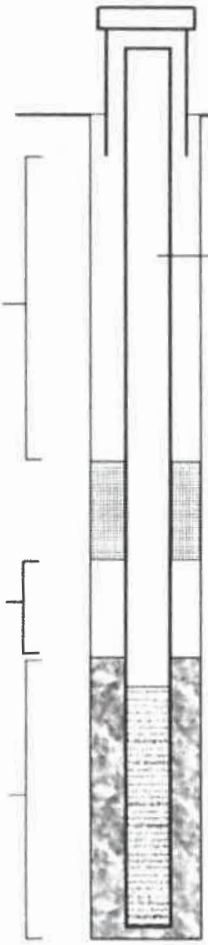
ANNULAR SEAL
Length 49 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☒ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 21
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
57 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 58 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☒ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☒ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 58 FT.

SCREEN MATERIAL
☐ Steel ☒ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54 ' 54.8436"
Longitude -90° 17' 48.0266"

SMALLEST ¼ ¼ ¼ LARGEST
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☒ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	129	Silty sand to sand with gravel

TOTAL DEPTH: 129 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 27.1 FT.
PUMP INSTALLED ☐ Yes ☒ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

WELL CERTIFICATION FORM FOR IW-5 CURRENTLY UNAVAILABLE

WELL CERTIFICATION FORM FOR IW-6 CURRENTLY UNAVAILABLE

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-7	06/2/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length ____ FT. Diameter ____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter ____ IN. Length ____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other ____

☐ Locking Cap ☐ Weep Hole

Elevation 444.772 FT.

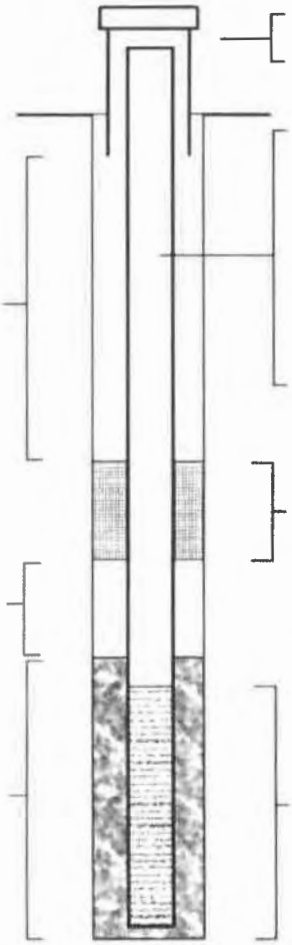
ANNULAR SEAL
Length 48 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
56 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 57 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 57 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' ~~50.9845"~~
Longitude -90° 17' ~~51.3918"~~

SMALLEST ¼ LARGEST ¼ ¼
Section ____ Township ____ North
Range ____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	128	Silty sand to sand with gravel

TOTAL DEPTH: 128 FT. ☐ *Boring Log Attached

STATIC WATER LEVEL 27.2 FT.

PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-8	04/29/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap ☐ Weep Hole

Elevation 445.15 FT.

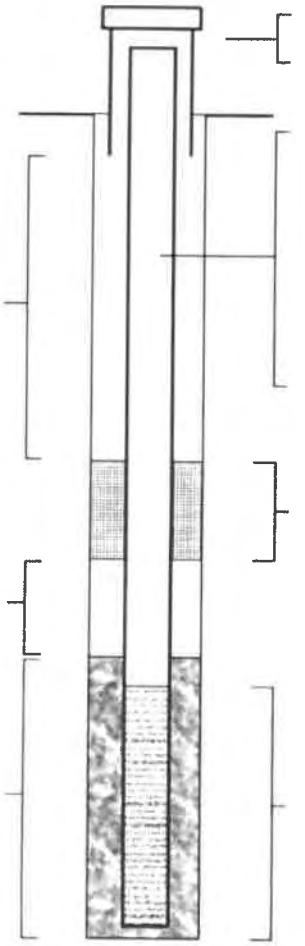
ANNULAR SEAL
Length 49.5 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
57.5 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 60 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 58.5 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 46.9333"
Longitude -90° 17' 52.2788"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	129.5	Silty sand to sand with gravel

TOTAL DEPTH: 129.5 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 28.3 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-9	05/2/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3). RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap
☐ Weep Hole

Elevation 444.442 FT.

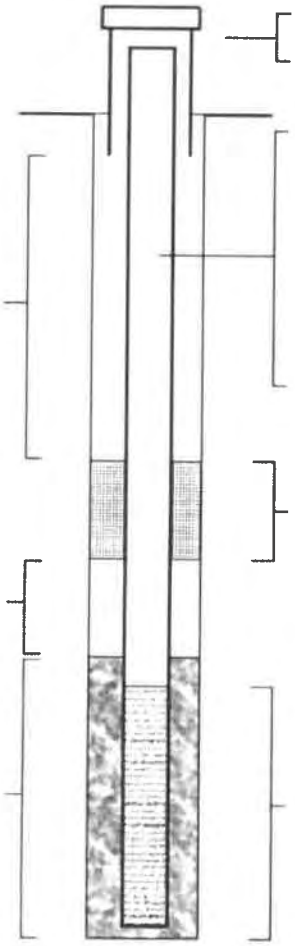
ANNULAR SEAL
Length 49 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
57 FT.

LENGTH OF PRIMARY FILTER PACK
71.5 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 58 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 58 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38 54' 44.7652"
Longitude -90° 17' 50.3796"

SMALLEST ¼ ¼ ¼ LARGEST
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	128.5	Silty sand to sand with gravel

TOTAL DEPTH: 128.5 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 28.1 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/12/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-10	05/3/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length ____ FT. Diameter ____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter ____ IN. Length ____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other ____

☐ Locking Cap ☐ Weep Hole

Elevation 444.841 FT.

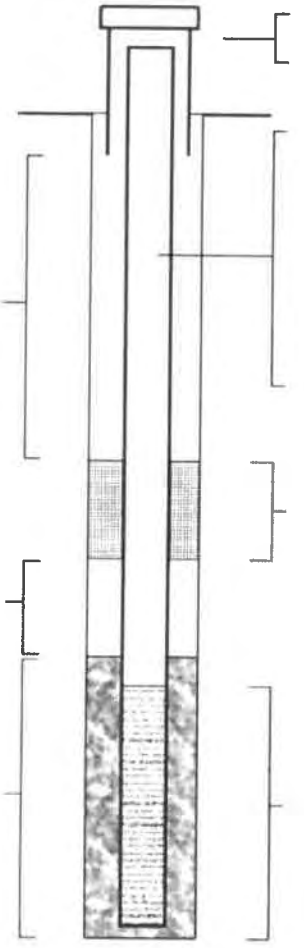
ANNULAR SEAL
Length 48 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 26
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
56 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 57 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 57 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 41.9729"
Longitude -90° 17' 47.6370"

SMALLEST ¼ LARGEST ¼ ¼
Section ____ Township ____ North
Range ____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	128	Silty sand to sand with gravel

TOTAL DEPTH: 128 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 27.3 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-11	05/4/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length ____ FT. Diameter ____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter ____ IN. Length ____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other ____

☐ Locking Cap ☐ Weep Hole

Elevation 445.036 FT.

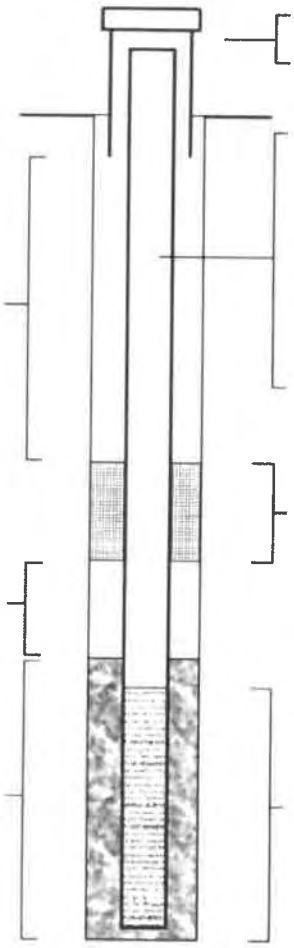
ANNULAR SEAL
Length 48 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
56 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 57 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 57 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 39.6657"
Longitude -90° 17' 45.3333"

SMALLEST ¼ LARGEST ¼ ¼
Section ____ Township ____ North
Range ____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	128	Silty sand to sand with gravel

TOTAL DEPTH: 128 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL: 26.7 FT.
PUMP INSTALLED: ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-12	05/9/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap
☐ Weep Hole

Elevation 444.429 FT.

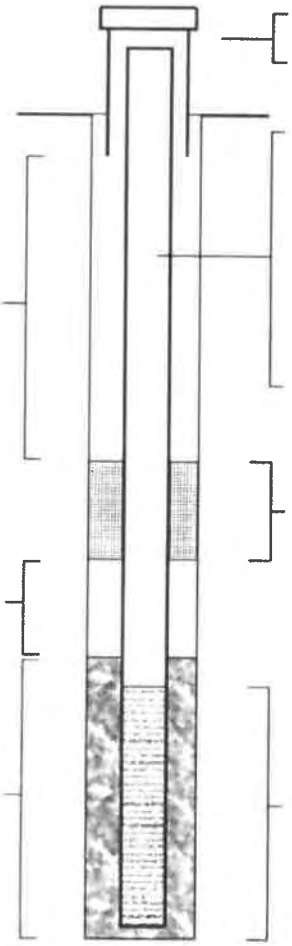
ANNULAR SEAL
Length 48 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
56 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 57 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 57 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)

Latitude 38° 54' 37.3883"
Longitude -90° 17' 43.1132"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	128	Silty sand to sand with gravel

TOTAL DEPTH: 128 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL: 26.7 FT.
PUMP INSTALLED: ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/12/22		

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-13	05/11/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap ☐ Weep Hole

Elevation 446.301 FT.

ANNULAR SEAL

Length 51 FT.

☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:

Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH

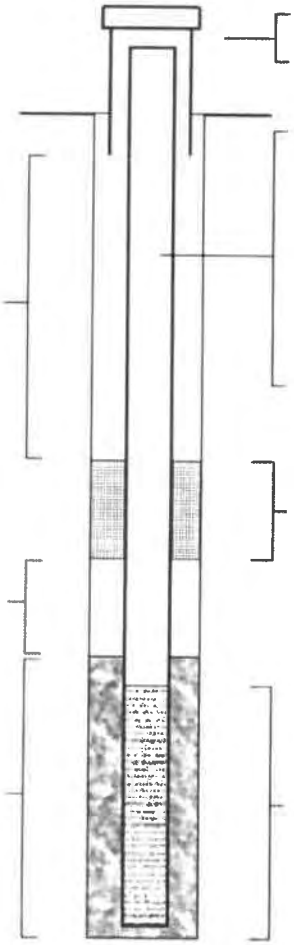
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK

59 FT.

LENGTH OF PRIMARY FILTER PACK

71.5 FT.



SURFACE COMPLETION

☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)

Riser/Casing Diameter 4 IN.
Riser/Casing Length 60 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL

☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL

Length 5

☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN

Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 60 FT.

SCREEN MATERIAL

☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)

Latitude 38° 54' 36.7895"
Longitude -90° 17' 39.8419"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)

☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)

☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130.5	Silty sand to sand with gravel

TOTAL DEPTH: 130.5 FT.

☐ *Boring Log Attached

STATIC WATER LEVEL 27.1 FT.

PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

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PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

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STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-14	05/12/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap ☐ Weep Hole

Elevation 446.008 FT.

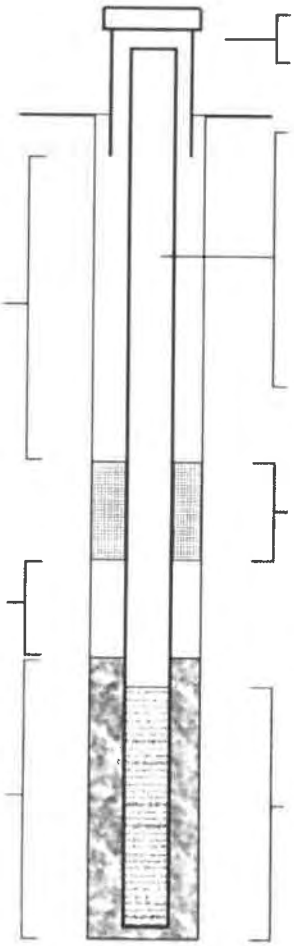
ANNULAR SEAL
Length 49 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
57 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 58 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 58 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)

Latitude 38° 54' 36.4982"
Longitude -90° 17' 37.2251"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	129	Silty sand to sand with gravel

TOTAL DEPTH: 129 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL: 27.4 FT.
PUMP INSTALLED: ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-15	04/27/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3). RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length ____ FT. Diameter ____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter ____ IN. Length ____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other ____

☐ Locking Cap ☐ Weep Hole

Elevation 444.815 FT.

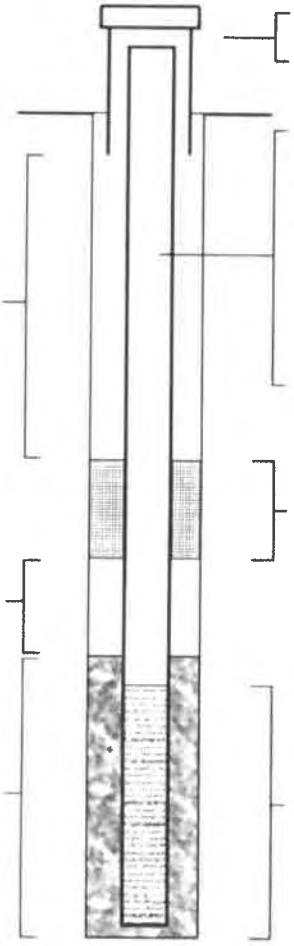
ANNULAR SEAL
Length 53 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 20
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
59 FT.

LENGTH OF PRIMARY FILTER PACK
71.5 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 60 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 60 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38 ° 54 ' 37.4800 "
Longitude -90 ° 17 ' 33.4672 "

SMALLEST ¼ LARGEST ¼ ¼
Section ____ Township ____ North
Range ____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130.5	Silty sand to sand with gravel

TOTAL DEPTH: 130.5 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 26.9 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-16	04/26/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE
- ☐ Above Ground
- ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION
- Length _____ FT.
- Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
- Diameter _____ IN.
- Length _____ FT.

SURFACE COMPLETION GROUT
- ☐ Concrete
- ☐ Other _____

☐ Locking Cap
☐ Weep Hole

Elevation 445.073 FT.

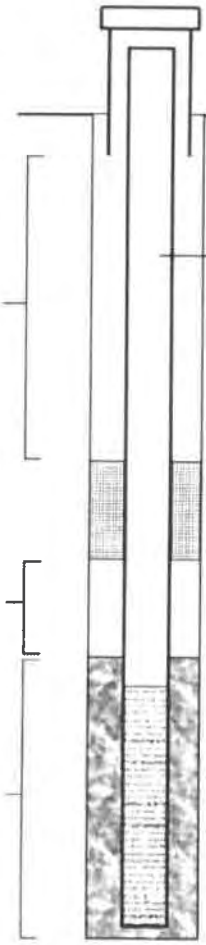
ANNULAR SEAL
Length 51 FT.
- ☐ Slurry ☐ Chips
- ☐ Pellets ☐ Granular
- ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
- Bags of Cement Used 20
- % of Bentonite Used 5
- Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
59 FT.

LENGTH OF PRIMARY FILTER PACK
71.5 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
- Riser/Casing Diameter 4 IN.
- Riser/Casing Length 60 FT.
- Diameter Of Drill Hole 10 IN.
- Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
- Screen Diameter 4 IN.
- Screen Length 70 FT.
- Diameter Of Drill Hole 10 IN.
- Depth To Top 60 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)

Latitude 38° 54' 41.0376"
Longitude -90° 17' 32.8989"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
- ☐ Direct Push ☐ Extraction ☐ Inclinometer
- ☐ Gas Migration ☑ Injection ☐ Lysimeter
- ☐ Observation ☐ Open Hole ☐ Other (specify)
- ☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
- ☐ Explosives ☐ Metals
- ☐ Pesticides/Herbicides ☐ Petroleum
- ☐ Radionuclides ☐ SVOCS
- ☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130.5	Silty sand to sand with gravel

TOTAL DEPTH: 130.5 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 26.9 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-17	05/19/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length ____ FT. Diameter ____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter ____ IN. Length ____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other ____

☐ Locking Cap ☐ Weep Hole

Elevation 445.054 FT.

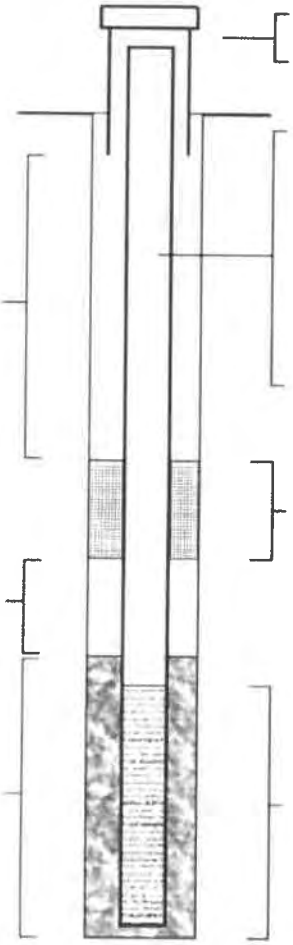
ANNULAR SEAL
Length 48 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
56 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 57 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 57 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other ____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 44.2393"
Longitude -90° 17' 32.3608"

SMALLEST ____ ¼ LARGEST ____ ¼ ____ ¼
Section ____ Township ____ North
Range ____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	128	Silty sand to sand with gravel

TOTAL DEPTH: 128 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 28.3 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-18	05/23/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap ☐ Weep Hole

Elevation 445.742 FT.

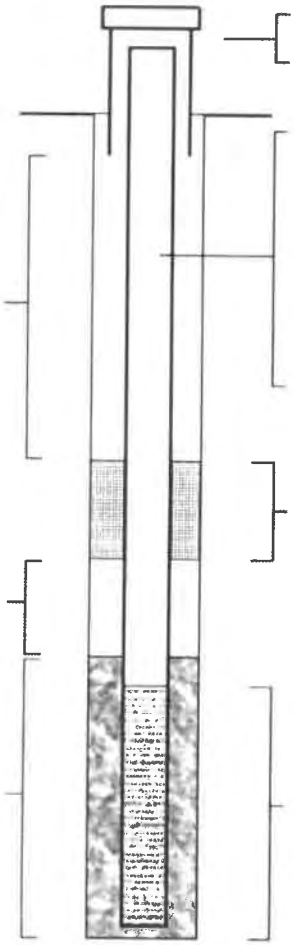
ANNULAR SEAL
Length 50 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 27
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
58 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 59 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 59 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)

Latitude 38° 54' 44.2393"
Longitude -90° 17' 32.3608"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130	Silty sand to sand with gravel

TOTAL DEPTH: 130 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 28.6 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE
			/ /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-19	05/26/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

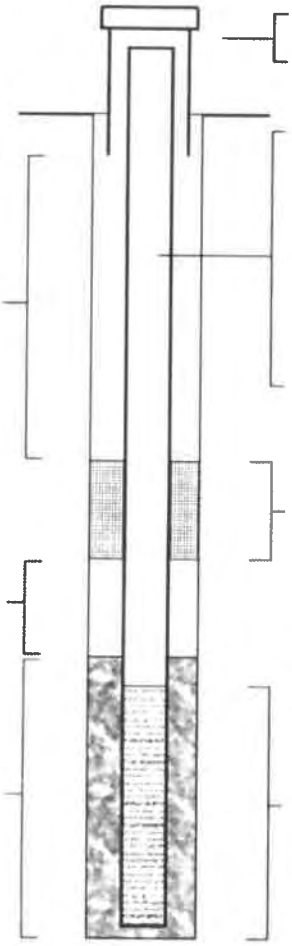
TYPE
- ☐ Above Ground
- ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION
- Length _____ FT.
- Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
- Diameter _____ IN.
- Length _____ FT.

SURFACE COMPLETION GROUT
- ☐ Concrete
- ☐ Other _____

☐ Locking Cap
☐ Weep Hole



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

Elevation 444.917 FT.

ANNULAR SEAL
Length 48 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 21
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
56 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.

RISER OR CASING (IF OPEN HOLE COMPLETION)
- Riser/Casing Diameter 4 IN.
- Riser/Casing Length 57 FT.
- Diameter Of Drill Hole 10 IN.
- Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
- Screen Diameter 4 IN.
- Screen Length 70 FT.
- Diameter Of Drill Hole 10 IN.
- Depth To Top 57 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 48.4390"
Longitude -90° 17' 31.6185"

SMALLEST ____¼ ____¼ ____¼ LARGEST
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	128	Silty sand to sand with gravel

TOTAL DEPTH: 128 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 26.6 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

SEND COMPLETED FORM AND FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, PO BOX 250, ROLLA MO 65402
FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: dnr.mo.gov/mowells

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

NOTE: This form is not to be used for nested wells

OFFICE USE ONLY		DATE RECEIVED	
REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-20	05/31/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length ____ FT. Diameter ____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter ____ IN. Length ____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other ____

☐ Locking Cap
☐ Weep Hole

Elevation 445.228 FT.

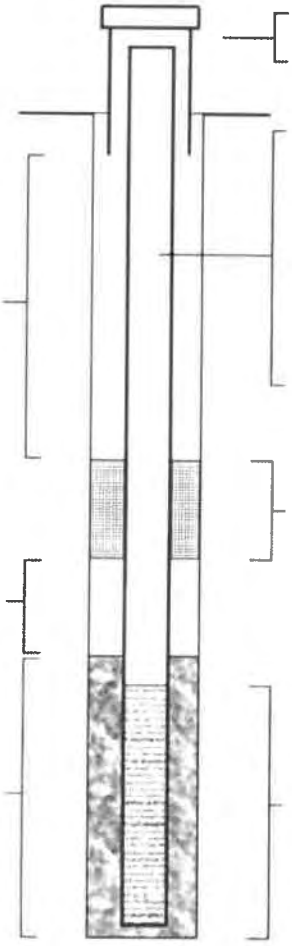
ANNULAR SEAL
Length 51 FT.
☐ Slurry ☐ Chips
☐ Pellets ☐ Granular
☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 15
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
59 FT.

LENGTH OF PRIMARY FILTER PACK
71.5 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 60 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other ____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 60 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other ____

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 50.3064"
Longitude -90° 17' 31.1272"

SMALLEST ¼ LARGEST ¼ ¼
Section ____ Township ____ North
Range ____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130.5	Silty sand to sand with gravel

TOTAL DEPTH: 130.5 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 26.1 FT.
PUMP INSTALLED ☐ Yes ☑ No

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

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PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
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MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

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STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-21	05/31/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

☐ Locking Cap ☐ Weep Hole

Elevation 444.609 FT.

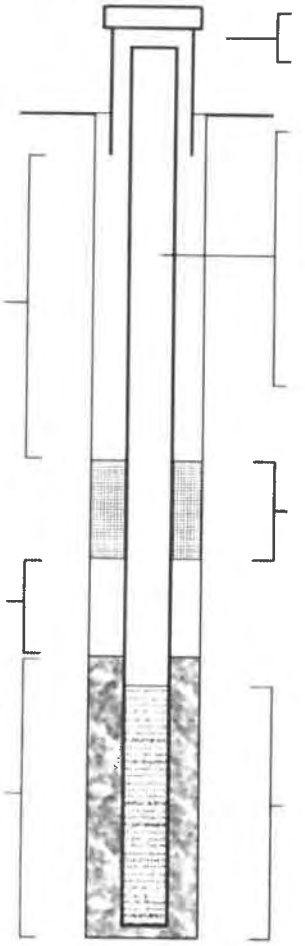
ANNULAR SEAL
Length 51 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 24
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
59 FT.

LENGTH OF PRIMARY FILTER PACK
71.5 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 60 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 60 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 52.7574"
Longitude -90° 17' 30.8670"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130.5	Silty sand to sand with gravel

TOTAL DEPTH: 130.5 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL 27.8 FT.
PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
[signature]	003469M	8/17/22		

MO 780-1415 (09-20)

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FOR REGISTRATTION FEES, PLEASE SEE: https://dnr.mo.gov/pubs/pub2494.htm
PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: welldrillers@dnr.mo.gov
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MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION REPORT

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REFERENCE NO.		CHECK NO.	
STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE / /

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED	PRIMARY PHONE NUMBER WITH AREA CODE	WELL NUMBER	WELL COMPLETION DATE
Ameren Missouri	(314)-544-2555	IW-22	06/10/22

PROPERTY OWNER MAILING ADDRESS	CITY	STATE	ZIP CODE
One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	St. Louis	MO	63166-6149

PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED	CITY	COUNTY
8501 N. State Route 94	West Alton	St. Charles

NAME OF SITE, BUSINESS, OR CLEANUP PROJECT	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE)	VARIANCE NUMBER (IF ISSUED)
Sioux Generation Plant		V006940

PRIMARY CONTRACTOR NAME (PLEASE PRINT)	PERMIT NUMBER	
John C. Bostwick, R.G.	003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.

SURFACE COMPLETION

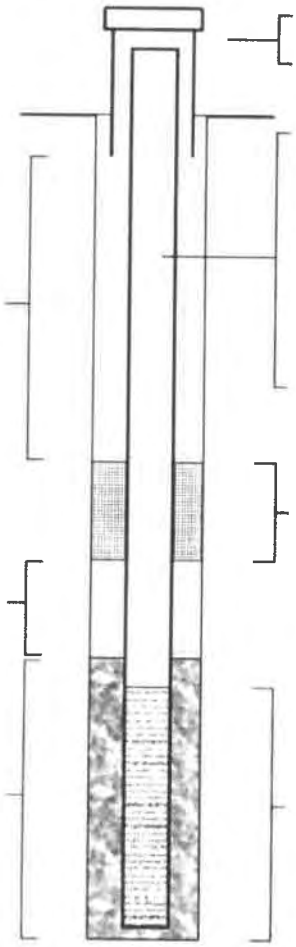
TYPE
- ☐ Above Ground
- ☐ Flush Mount

LENGTH AND DIAMETER OF SURFACE COMPLETION
- Length _____ FT.
- Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED
- Diameter _____ IN.
- Length _____ FT.

SURFACE COMPLETION GROUT
- ☐ Concrete
- ☐ Other _____

☐ Locking Cap
☐ Weep Hole



Elevation 445.34 FT.

ANNULAR SEAL
Length 50 FT.
- ☐ Slurry ☐ Chips
- ☐ Pellets ☐ Granular
- ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
- Bags of Cement Used 21
- % of Bentonite Used 5
- Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
58 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.

SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
- Riser/Casing Diameter 4 IN.
- Riser/Casing Length 59 FT.
- Diameter Of Drill Hole 10 IN.
- Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular
☐ Saturated Zone ☐ Hydrated

SCREEN
- Screen Diameter 4 IN.
- Screen Length 70 FT.
- Diameter Of Drill Hole 10 IN.
- Depth To Top 59 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC)
☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
- Latitude 38° 17' 53.2060"
- Longitude -90° 54' 33.0356"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
- ☐ Direct Push ☐ Extraction ☐ Inclinometer
- ☐ Gas Migration ☑ Injection ☐ Lysimeter
- ☐ Observation ☐ Open Hole ☐ Other (specify)
- ☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
- ☐ Explosives ☐ Metals
- ☐ Pesticides/Herbicides ☐ Petroleum
- ☐ Radionuclides ☐ SVOCS
- ☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	130	Silty sand to sand with gravel

TOTAL DEPTH: 130 FT.

☐ *Boring Log Attached

STATIC WATER LEVEL 29.4 FT.

PUMP INSTALLED ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/2/22		

MO 780-1415 (09-20)

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GEOLOGICAL SURVEY PROGRAM

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STATE WELL NO.		REVENUE NO.	
ENTERED	APPROVED	DATE	ROUTE

OWNER AND SITE INFORMATION

PROPERTY OWNER NAME WHERE WELL IS LOCATED: Ameren Missouri	PRIMARY PHONE NUMBER WITH AREA CODE: (314)-544-2555	WELL NUMBER: IW-23	WELL COMPLETION DATE: 06/13/22
PROPERTY OWNER MAILING ADDRESS: One Ameren Plaza, 1901 Chouteau Avenue, P. O. Box 66149	CITY: St. Louis	STATE: MO	ZIP CODE: 63166-6149
PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED: 8501 N. State Route 94	CITY: West Alton	COUNTY: St. Charles	
NAME OF SITE, BUSINESS, OR CLEANUP PROJECT: Sioux Generation Plant	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE):	VARIANCE NUMBER (IF ISSUED): V006940	
PRIMARY CONTRACTOR NAME (PLEASE PRINT): John C. Bostwick, R.G.	PERMIT NUMBER: 003839M	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.	

SURFACE COMPLETION

TYPE: ☐ Above Ground ☐ Flush Mount ☐ Locking Cap ☐ Weep Hole

LENGTH AND DIAMETER OF SURFACE COMPLETION: Length _____ FT. Diameter _____ IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: Diameter _____ IN. Length _____ FT.

SURFACE COMPLETION GROUT: ☐ Concrete ☐ Other _____

Elevation 445.794 FT.

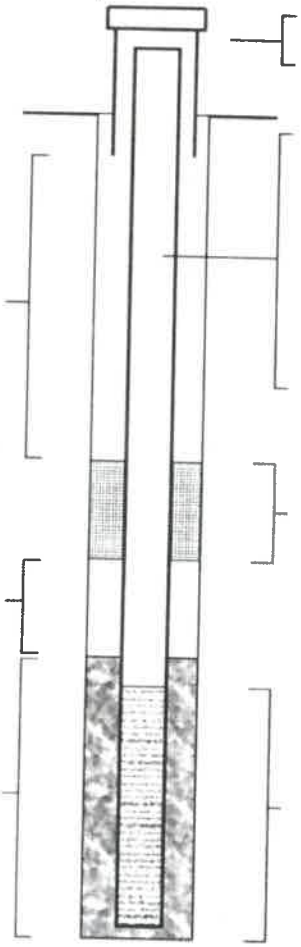
ANNULAR SEAL
Length 49 FT.
☐ Slurry ☐ Chips ☐ Pellets ☐ Granular ☑ Cement/Slurry

IF CEMENT/BENTONITE MIX:
Bags of Cement Used 18
% of Bentonite Used 5
Water Used Per Bag 7-8 GAL.

SECONDARY FILTER PACK LENGTH
1 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK
57 FT.

LENGTH OF PRIMARY FILTER PACK
72 FT.



SURFACE COMPLETION
☐ Steel ☐ Aluminum ☐ Plastic

RISER OR CASING (IF OPEN HOLE COMPLETION)
Riser/Casing Diameter 4 IN.
Riser/Casing Length 58 FT.
Diameter Of Drill Hole 10 IN.
Weight Or SDR# S80

MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

BENTONITE SEAL
Length 5
☐ Chips ☑ Pellets ☐ Granular ☐ Saturated Zone ☐ Hydrated

SCREEN
Screen Diameter 4 IN.
Screen Length 70 FT.
Diameter Of Drill Hole 10 IN.
Depth To Top 58 FT.

SCREEN MATERIAL
☐ Steel ☑ Thermoplastic (PVC) ☐ Other _____

For cased wells, submit additional as-built diagrams showing well construction details including type and size of all casing, hole diameter and grout used.

LOCATION OF WELL (D/M/S FORMAT ONLY)
Latitude 38° 54' 52.5496"
Longitude -90° 17' 36.3562"

SMALLEST ¼ LARGEST ¼ ¼
Section _____ Township _____ North
Range _____ ☐ E ☐ W

TYPE OF WELL (CHECK ONE)
☐ Direct Push ☐ Extraction ☐ Inclinometer
☐ Gas Migration ☑ Injection ☐ Lysimeter
☐ Observation ☐ Open Hole ☐ Other (specify)
☐ Piezometer ☐ Standard

MONITORING FOR (CHECK ALL THAT APPLY)
☐ Explosives ☐ Metals
☐ Pesticides/Herbicides ☐ Petroleum
☐ Radionuclides ☐ SVOCS
☐ VOCS (non-petroleum) ☐ Geotechnical Data

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION (OR ATTACH BORING LOG*)
0	40	Sand and Clay
40	129	Silty sand to sand with gravel

TOTAL DEPTH: 29 FT.
☐ *Boring Log Attached

STATIC WATER LEVEL: 29.9 FT.
PUMP INSTALLED: ☐ Yes ☑ No

I hereby certify that the monitoring well herein described was constructed in accordance with Missouri Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER	DATE	MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER
	003469M	8/17/22		

MO 780-1415 (09-20)

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APPENDIX F

Monitored Natural Attenuation Evaluation for Molybdenum *(produced by WSP and Rocksmith on behalf of Ameren)*

REPORT

Monitored Natural Attenuation Evaluation for Molybdenum

Sioux Energy Center

Submitted to:

Ameren Missouri
1901 Chouteau Ave
St. Louis, Missouri 63103

Submitted by:

WSP USA Inc.

Rocksmith Geoengineering, LLC

July 2, 2024

MNA Checklist

Elements of MNA Evaluation	Characterization	Applicable Section(s)
Pre-Tier 1 - Site Background Information		
Site Layout	Identify potential source(s)	2.0, 2.1, 2.2, 4.1
	Identify potential exposure points/receptors	2.0, 2.1, 2.2, 3.0
Site History	History and Inventory of contaminants released	1.0, 2.0, 2.1, 2.2
	Mode of contaminant release	2.0, 2.1, 2.2, 4.1
	Chemistry of CCR source and release	4.1, 5.0
Tier 1 - Demonstrate Active Contaminant Removal from Groundwater		
Hydrogeologic Elements	Potential migration pathways identified	3.0, 6.0, 7.2
	Nature and extent of contaminant plume	5.0, 7.2, 8.0
	Basic groundwater flow direction and aquifer hydrostratigraphy	3.0, 6.0
General Site Chemistry	General chemistry (groundwater, surface water, and/or aquifer solids) for preliminary evaluation of contaminant degradation	5.1, 5.2
	Trend evaluation of groundwater data	5.1, 7.3
	Distribution of contaminants between aqueous and solid phases	5.1, 5.2, 7.3
Tier 2 - Determine Mechanisms and Rate of Attenuation		
Define Contaminant/Aquifer Solid Interactions	Identify aquifer mineralogy, attenuation mechanisms, and microbiological processes (if applicable)	5.2, 7.1, 7.2, 9.0
Chemistry and Spatial Distribution of Contaminants	Groundwater characteristics for source(s) and contaminant plume, including field parameters, Appendix III parameters, Appendix IV parameters, major cations and anions, and speciation data (if applicable)	2.0, 2.1, 2.2, 4.1, 5.1, 7.2, 9.0
Detailed Hydrogeology	Groundwater flow regime, including direction, velocity, potentiometric surface, gradients, etc.	3.0, 6.0, 9.0
Tier 3 – Determine System Capacity and Stability of Attenuation		
Measurement of Attenuation Capacity	Determination of contaminant and dissolved reactant fluxes (concentration data and water flux)	5.1, 7.3, 8.0, 10.0
	Determination of mass of available solid phase reactant(s)	5.2, 7.0, 7.3, 10.0
Stability of Attenuated Contaminated Mass	Laboratory testing of immobilized contaminant stability	5.2, 7.0, 10.0
	Model analyses to characterize aquifer capacity and evaluation of immobilized contaminant stability	7.2, 7.3, 10.0
Tier 4 - Design of Performance Monitoring Program and Identify Alternative Remedy		
Long-Term Monitoring Program	Selection of monitoring locations and sampling frequency based on site conditions	Not applicable - provided in separate report.
	Selection of key monitoring parameters used to assess effectiveness of the remedy	
	Selection of monitoring criteria that would trigger re-evaluation of adequacy of the monitoring program and the remedy selected	

Table of Contents

1.0 INTRODUCTION 1

2.0 SITE BACKGROUND AND CCR RULE COMPLIANCE 1

2.1 Supplemental Corrective Measures 3

2.2 Remedial Strategy for the SCPA 4

3.0 SUMMARY OF SITE HYDROGEOLOGIC CONDITIONS 5

4.0 TIER I EVALUATION 5

4.1 Groundwater and Porewater Sampling 6

4.1.1 Groundwater and Porewater Analysis 6

4.2 Soil Sampling and Analysis 7

4.2.1 Sample Collection 7

4.2.2 Soil Analyses 8

5.0 GROUNDWATER AND POREWATER 9

5.1 Geochemical Evaluation 9

5.1.1 Mineralogical Controls in Groundwater and Porewater 11

5.2 Compositional Analysis of Alluvial Aquifer Soil 11

5.2.1 Mineralogical Composition 11

5.2.2 Chemical Composition and Sequential Extraction 11

6.0 GROUNDWATER MODELING 12

7.0 GEOCHEMICAL ANALYSIS AND MODELING 13

7.1 Empirical Attenuation Rates 13

7.2 Geochemical Modeling 14

7.2.1 Surface Complexation Modeling 14

7.2.2 Mineral Precipitation and Co-precipitation 16

7.2.3 Long-Term Stability of Attenuated Constituents 16

7.2.4 Geochemical Modeling Assumptions and Data Handling 16

7.3 Results 17

7.3.1 Empirical Attenuation Rate 17
7.3.2 Model Predicted Attenuation Rate 18
7.3.3 Capacity of Attenuation Mechanisms 18
7.3.4 Long-Term Stability of Attenuated Constituents 19
8.0 TIER I EVALUATION SUMMARY 19
9.0 TIER II EVALUATION 21
10.0 TIER III EVALUATION 21
11.0 CONCLUSIONS 22
12.0 REFERENCES 23

Tables

Table 1: SCPA Monitoring Well Networks
Table 2: Sampling Locations Used for the MNA Assessment
Table 3: Boring Sample ID and Descriptions
Table 4: Cation Exchange Capacity of Soils from Select Borings
Table 5: Relevant Mineral Phases – Saturation Indices and Water Types
Table 6: Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results
Table 7: Summary of Sequential Analysis of Metals in Soils from Borings
Table 8: Calculation of Ferrihydrite and Gibbsite Surface Parameters for Geochemical Modeling
Table 9: Empirical Attenuation Rate of Molybdenum in the Compliance Monitoring Network

Figures

Figure 1: Site Location Map
Figure 2: Sioux Energy Center Groundwater Monitoring Programs and Sample Location Map
Figure 3: pH of Groundwater at (a) Compliance Monitoring and Background Wells, (b) Corrective Action Network Wells, and (c) Nature and Extent Wells
Figure 4: ORP of Groundwater at (a) Compliance Monitoring and Background Wells, (b) Corrective Action Network Wells, and (c) Nature and Extent Wells

Figure 5: Total Dissolved Solids in Groundwater at (a) Compliance Monitoring and Background Wells, (b) Corrective Action Network Wells, and (c) Nature and Extent Wells

Figure 6: Trilinear Diagram – Groundwater Characterization of Compliance, Corrective Action, and Nature and Extent Monitoring Network Wells

Figure 7: Molybdenum in Groundwater at (a) Compliance Monitoring and Background Wells, (b) Corrective Action Network Wells, and (c) Nature and Extent Wells

Figure 8: Mann-Kendall Test of Trend for Molybdenum at well UMW-1D for Molybdenum since 3/17/2016

Figure 9: Mann-Kendall Test of Trend for Molybdenum at well UMW-2D for Molybdenum since 3/17/2016

Figure 10: Mann-Kendall Test of Trend for Molybdenum at well UMW-3D for Molybdenum since 3/17/2016

Figure 11: Mann-Kendall Test of Trend for Molybdenum at well UMW-4D for Molybdenum since 3/17/2016

Figure 12: Mann-Kendall Test of Trend for Molybdenum at well UMW-5D for Molybdenum since 3/17/2016

Figure 13: Mann-Kendall Test of Trend for Molybdenum at well UMW-6D for Molybdenum since 3/17/2016

Figure 14: Mann-Kendall Test of Trend for Molybdenum at well TP-5D for Molybdenum since 7/10/2018

Figure 15 Mann-Kendall Test of Trend for Molybdenum at well LMW-2S for Molybdenum since 3/17/2016

Figure 16 Mann-Kendall Test of Trend for Molybdenum at well LMW-5S for Molybdenum since 3/17/2016

Figure 17 Mann-Kendall Test of Trend for Molybdenum at well LMW-8S for Molybdenum since 3/17/2016

Figure 18 Mann-Kendall Test of Trend for Molybdenum at well AM-1D for Molybdenum since 3/17/2016

Figure 19: Molybdenum Pourbaix Diagram - (with Aluminum Stability Overlaid)

Figure 20: Molybdenum Pourbaix Diagram - (with Iron Stability Overlaid)

Figure 21: Sequential Extraction of Aluminum from Soil in Select Borings

Figure 22: Sequential Extraction of Iron from Soil in Select Borings

Figure 23: Sequential Extraction of Molybdenum from Soil in Select Borings

Figure 24: pH MNA Stability Evaluation

Figure 25: Redox MNA Stability Evaluation

Figure 26: TDS MNA Stability Evaluation

Figure 27: Modeled Concentrations of Molybdenum along a Transect Running from SCPA-3 to TP-8D

Figure 28: Modeled Concentrations of Molybdenum along a Transect Running from SCPA-3 to TP-4S

Figure 29: Modeled Attenuation Capacity of the Compliance and Nature and Extent Well Network for Molybdenum at the SCPA

Appendices

Appendix A: Mann-Kendall Trend Evaluations for Molybdenum

Appendix B: Mineralogical Analyses Laboratory Report

Appendix C: Sequential Extraction Laboratory Report

1.0 INTRODUCTION

Based on the results of the Corrective Measures Assessment (Haley and Aldrich, 2019; CMA) conducted under 40 CFR § 257.96, groundwater, Coal Combustion Residual (CCR) porewater, and solid materials were characterized and evaluated to determine the effectiveness and help predict the attenuation rate of Monitored Natural Attenuation (MNA) as a component of remedial strategy for Ameren Missouri's (Ameren) SCPA bottom ash surface impoundment (SCPA or CCR Unit) located at Sioux Energy Center (SEC) in St. Charles, County, Missouri (the Site). The structure of this evaluation closely follows the United States Environmental Protection Agency (USEPA) guidance on using MNA as a remedial strategy (USEPA 2007a, b) and considers best practices from the Interstate Technology Regulatory Council (ITRC) document: "A Decision Framework for Applying Monitored Natural Attenuation Processes to Metals and Radionuclides in Groundwater" (ITRC 2010). This MNA evaluation was completed using the following tiers (USEPA 2007a, b):

1) Demonstrate active constituent removal from groundwater and dissolved plume stability (Tier I)
2) Determine the mechanism(s) and rate(s) of the operative attenuation processes (Tier II)
3) Determine the long-term capacity for attenuation and the stability of immobilized constituents (Tier III)

Following the completion of this multi-tier evaluation, the fourth and final tier (Tier IV) of an MNA program, which involves the design of a performance monitoring program and the development of a contingency plan, will be updated as needed based on the findings of this evaluation.

2.0 SITE BACKGROUND AND CCR RULE COMPLIANCE

The SEC is located approximately 20 miles northwest of downtown St. Louis in St. Charles, County, Missouri. The Facility encompasses approximately 1,025 acres and is situated within the floodplain between the Mississippi and Missouri Rivers. The Facility is bounded to the north by wooded areas associated with the Mississippi River, to the south by railroad, and to the east and west by agricultural fields. Figure 1 shows the CCR Unit, along with Site monitoring wells and the Mississippi River.

The Detection and Assessment monitoring Well Network for the SCPA includes four background monitoring wells and six compliance monitoring wells adjacent to the CCR Unit. There is also a Corrective Action Monitoring Well Network for the SCPA which consists of 17 monitoring wells. The well networks are summarized in Table 1 and shown on Figure 2.

Table 1 – SCPA Monitoring Well Networks

Monitoring Well Network	Well IDs
Background (Compliance Monitoring Network)	BMW-1D, BMW-3D, BMW-1S, and BMW-3S
Compliance Monitoring Network Wells	UMW-1D, UMW-2D, UMW-3D, UMW-4D, UMW-5D, and UMW-6D
Corrective Action Monitoring Wells	PZ-1S, PZ-9D, LMW-1S, LMW-2S, LMW-4S, LMW-5S, LMW-6S, UG-3, TP-2D, TP-3D, TP-4D, TP-5D, TP-6S, TP-6D, TP-8D, AM-1S, and AM-1D

Statistical analysis of the November 2023 SCPA detection monitoring results has identified the following statistically significant increases (SSIs) of Appendix III constituents over background:

- Boron – UMW-1D, UMW-2D, UMW-3D, UMW-4D, UMW-5D, UMW-6D
- Calcium - UMW-2D, UMW-3D
- Chloride – UMW-1D, UMW-2D, UMW-3D, UMW-4D, UMW-5D
- Fluoride – UMW-2D
- pH – UMW-2D, UMW-3D
- Sulfate – UMW-1D, UMW-2D, UMW-3D, UMW-4D
- Total Dissolved Solids (TDS) - UMW-2D, UMW-3D, UMW-4D

Assessment monitoring of the SCPA in accordance with §257.95 was initiated on April 15th, 2018. Assessment monitoring identified statistically significant levels (SSLs) at the SCPA as follows:

- Molybdenum – UMW-2D, UMW-3D, UMW-4D, and UMW-5D

On January 9, 2019, Ameren initiated its Corrective Measures Assessment (CMA) and posted the CMA report on May 20, 2019. A public meeting was held on May 31, 2019, and responses to public comments are posted on Ameren's CCR website. On August 30, 2019, Ameren published its “Remedy Selection Report – 40 CFR § 257.97 Rush Island, Labadie, Sioux and Meramec CCR Basins” (Remedy Selection Report) that identified source control through installation of a low permeability cover system, use of Monitored Natural Attenuation (MNA), and installation of Supplemental Corrective Measures as its chosen corrective action remedial plan. The Remedy Selection Report’s remedial plan consists of two phases as follows:

1) Source control, stabilization, and containment of CCR by installation of a low permeability geomembrane cap (a minimum 1 x 10^{-7} centimeters per second (cm/sec) versus 1 x 10^{-5} cm/sec required by the CCR Rule).
2) Once source control is achieved, monitor the natural attenuation of groundwater concentrations to address limited and localized CCR-related impacts. Ongoing monitoring and modeling evaluations will document that concentrations are decreasing as modelled. MNA occurs due to naturally occurring processes within the aquifer.

In addition to MNA as a Corrective Measure, Ameren has also initiated a supplemental corrective measure at the SCPA consisting of groundwater extraction, treatment, and re-injection using ex-situ treatment technologies with chemical precipitation and selective-ion exchange which is discussed further in Section 2.1.

The first phase of the remedial plan commenced on January 20, 2021, and was substantially completed on April 10, 2022, with the installation of a low permeability cover system on the SCPA. The SCPA unit was certified closed on October 14, 2022, and the SCPA has transitioned into the post-closure care requirements of the CCR Rule effective October 2022, and second phase of the remedial plan has begun. The initial Corrective Action groundwater sampling event was completed in April 2020, and a total of nine sampling events have been completed to-date for Corrective Action monitoring at the SCPA. Three sampling events have been completed after closure of the SCPA.

As of November 2023, the wells with constituents exceeding the site Groundwater Protection Standard (GWPS) are as follows:

- Cobalt at S-LMW-6S
- Lithium at S-LMW-5S, S-TP-2D, and S-TP-6S
- Molybdenum at S-LMW-1S, S-LMW-2S, S-LMW-5S, S-AM-1D, S-AM-1S, S-TP-5D, and S-PZ-1S

Cobalt and lithium have not historically been identified as an SSL in Assessment Monitoring and a review of the data determined that the statistical exceedances at wells LMW-6S (cobalt) as well as LMW-5S, TP-2D, and TP-6S (lithium) are not caused by the SCPA CCR unit. Alternative Source Demonstrations (ASDs) have been prepared and are included in the Annual Reports provided on Ameren's publicly available website. The ASDs concluded that the low concentration statistical exceedances for cobalt and lithium are not a result of impacts from the SCPA and appear to result from natural geochemical variability within the alluvial aquifer.

Based on the evaluations completed at the SCPA, molybdenum is the only Appendix IV parameter statistically exceeding the groundwater protection standard, therefore, molybdenum is the focus of this MNA evaluation and is considered the Constituent of Concern (COC).

2.1 Supplemental Corrective Measures

As outlined in Ameren's Remedy Selection Report, once source control is achieved, Ameren planned to monitor natural attenuation of groundwater and complete supplemental corrective measures using groundwater treatment. In 2021, Ameren began implementing the supplemental corrective measure for CCR groundwater compliance using ex-situ treatment technologies of chemical precipitation and selective-ion exchange by completing a pilot study at the Rush Island Energy Center. The results of this groundwater treatment pilot study displayed significant reductions in key CCR indicator concentrations. Due to the success, Ameren expanded this technology to the Sioux Energy Center and operation of the treatment system at the SCPA began in February 2023. After a period of optimization, the system achieved target run-time and flow rate beginning in September 2023. The groundwater treatment system was developed to successfully capture the CCR impacted groundwater from the SCPA, treat the water by removing contaminants, and return treated water to the same hydrogeologic horizon.

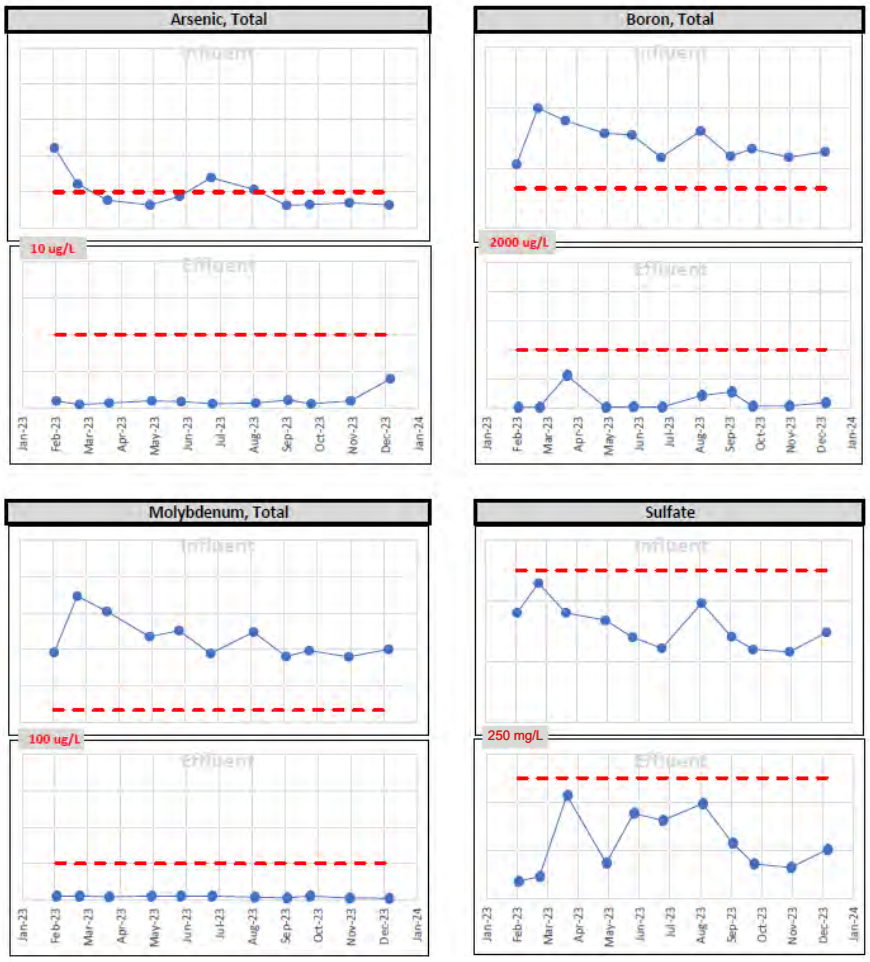
The design of the treatment system was completed by XDD Environmental, LLC (XDD, now Loureiro Engineering Associates, Inc (Loureiro)) and is based on groundwater monitoring and annual estimates of net groundwater velocities averaging approximately 11 ft/year as documented in the 2018 Annual Groundwater Monitoring and Corrective Action Report. This represents an average net movement of a water molecule in all directions over a given calendar year and it accounts for movement during normal, stagnant, flood and low-level river stages throughout a calendar year (More details on the groundwater flow at the site is provided in Section 3.0). The treatment system uses a combination of extraction and injection wells to capture and control movement. Typical gradients at the Sioux Energy Center are low and result in low groundwater velocities with little net movement.

As discussed in Ameren's 2024 List of Requested Information, available on Ameren's publicly available website (section 4.a.i) the treatment system is designed for internal capture with injection radially along the ash pond perimeter. While some areas in the SCPA's interior experience reverse flow towards an extraction point, the volume treated is re-introduced along the perimeter, resulting in no change in overall flow conditions a short

distance from the injection points. The well spacing and locations provide for placement of treated water along the SCPA perimeter. This design resulted in 9 extraction wells and 23 injection wells.

Inset 1 shows the influent (top) and effluent (bottom) data from the SCPA groundwater treatment system collected over the optimization period through initial, full-scale operation from Loureiro (2024). The figure illustrates that after a few months of optimization, the system effluent concentrations have consistently been below the discharge target concentrations for groundwater (indicated in red). The discharge concentrations meet drinking water standards for the applicable constituents.

Inset 1: SCPA Groundwater Treatment System Influent and Effluent Concentrations – System Optimization Period and Full-Scale Operation



Notes:
Figure from Loureiro Engineering Associates (LEA).
mg/L – miligrams per liter.
µg/L – micrograms per liter.

The treatment system as currently operated is intended to prevent further CCR impacts from migrating downgradient of the SCPA in the alluvial aquifer.

2.2 Remedial Strategy for the SCPA

Currently, the remedial strategy for the SCPA consists of the following:

1) Cap and close the SCPA with a low-permeability geomembrane cover system. This effectively eliminates precipitation infiltration into the SCPA.
2) Installation of an active remedy (groundwater treatment system) that captures and treats porewater of the SCPA and prevents it from leaving the footprint of the CCR waste boundary and migrating downgradient in the alluvial aquifer. This system also targets the areas of highest boron, sulfate, and molybdenum concentrations on the southern side of the SCPA, reducing concentrations below the GWPS.
3) Use of MNA to address CCR-related impacts outside of the influence of the treatment system. The effectiveness of MNA as a remedy for the distal portions of the plume is documented in this evaluation.

This MNA evaluation documents the physical and chemical attenuation present within the alluvial aquifer for the constituents of concern listed below in Section 2.3. While both physical and chemical attenuation are occurring for these constituents, physical attenuation of dilution and dispersion appears to be a significant factor, especially at distal portions of the plume. Although physical attenuation (dilution and dispersion) is not typically appropriate as the primary mechanism, EPA has acknowledged that it can be appropriate as a "polishing step" if active remedies are in place in its 2015 report titled *"Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites*" where it states the following (page 14):

"Dispersion and dilution resulting from mixing with influent precipitation, up- or cross-gradient groundwater or leakage from overlying surface water bodies may be elements of an MNA response action for inorganic contaminants. However, dilution and dispersion generally are not appropriate as primary MNA mechanisms because they reduce concentrations through dispersal of contaminant mass rather than destruction or immobilization of contaminant mass. Dilution and dispersion may be appropriate as a "polishing step" for distal portions of a plume when an active remedy is being used at a site, source control is complete and appropriate land use and ground water use controls are in place. Results of conservative tracer studies can be used to estimate the contribution of dilution and dispersion to contaminant attenuation rates."

3.0 SUMMARY OF SITE HYDROGEOLOGIC CONDITIONS

A detailed discussion of the Site Hydrogeology is presented in the Corrective Measures Assessment (Haley and Aldrich, 2019), the Groundwater Monitoring Plan (GMP, Golder 2017), and the Corrective Action Groundwater Monitoring Plan (CAGMP, Golder, 2020). In summary, geological and hydrogeological units present at the Site include two different geologic terrains: (1) floodplain deposits of the Mississippi and Missouri River Valleys and (2) older sedimentary bedrock formations. The alluvial floodplain deposits are typically comprised of sands and gravels with varying amounts of silts and clays, generally resulting in an overall fining-upward sequence. The bedrock formations are comprised of relatively flat-lying Mississippian-aged limestones, dolomites, and shales.

The alluvial deposits form the uppermost aquifer at the Site and are influenced by the nearby Mississippi and Missouri Rivers. Site groundwater conditions are directly controlled by river stages of the Mississippi and Missouri Rivers. Under typical alluvial aquifer conditions, groundwater flows slowly to the east and southeast, but fluctuates in direction due to river levels. Groundwater potentiometric surface maps indicate that groundwater flow direction is variable, and gradients are generally flat.

Prior to closure of the SCPA, the surface impoundment ponded water at elevations higher than the static groundwater levels in the underlying alluvial aquifer resulting in mounding and localized radial groundwater flow. Since closure of the SCPA was completed, the mounding has been eliminated and groundwater flow has returned to natural conditions.

4.0 TIER I EVALUATION

This evaluation was performed to further evaluate the mechanisms, rates, and stability of MNA as a remedy for groundwater impacts for the SCPA. To conduct this evaluation, a review of available groundwater, CCR porewater, and soil samples was completed. Data collection and evaluation in support of MNA included:

- Groundwater characterization (including major cations and anions) to identify water types and temporal and geographical trends, where present.

- Mineralogical analysis of aquifer soil materials to identify and quantify the major mineral components.
- Chemical analysis of aquifer soil materials to quantify the total metal content and identify the environmentally available fraction of metals.
- Geochemical modeling to identify the major aqueous species and evaluate saturation indices of minerals relevant to attenuation of molybdenum.

The results generated by this supplemental assessment were used by WSP and Rocksmith to complete the Tier I, Tier II, and Tier III evaluations in accordance with USEPA (2007a, b; USEPA 2015). The results of the Tier I, Tier II, and Tier III are summarized in the subsequent sections.

4.1 Groundwater and Porewater Sampling

Numerous groundwater samples have been collected at the Site as a part of CCR Rule, NPDES Permitting process, and State Utility Waste Landfill (UWL) monitoring programs. For this evaluation, monitoring wells from the compliance, corrective action, and NPDES site characterization networks as well as porewater from the CCR Unit piezometers were evaluated. The network sampling locations and designations are presented on Figure 2 and in Table 2.

Table 2: Sampling Locations Used for the MNA Assessment

Monitoring Network	Background Monitoring Wells	SCPA Compliance Monitoring Network Wells	SCPA Corrective Action (Performance) Monitoring Well Network	SCPA Nature and Extent Monitoring Network	CCR Unit Porewater Piezometers
Years Data Is Available	**2016 – Present**	**2016 – Present**	**April 2020 – Present**	**November 2018 – August 2019**	**January 2018**
Well IDs	BMW-1D, BMW-3D, BMW-1S, and BMW-3S	UMW-1D, UMW-2D, UMW-3D, UMW-4D, UMW-5D, and UMW-6D	PZ-1S, PZ-9D, LMW-1S, LMW-2S, LMW-4S, LMW-5S, LMW-6S, UG-3, TP-2D, TP-3D, TP-4D, TP-5D, TP-6S, TP-6D, TP-8D, AM-1S, and AM-1D	TP-1D, TP-1M, TP-1S, TP-2D, TP-2M, TP-2S, TP-3D, TP-3M, TP-3S, TP-4D, TP-4M, TP-4S, TP-5D, TP-5M, TP-5S, TP-6D, TP-6M, TP-6S, TP-7D, TP-7M, TP-7S, TP-8D, TP-8M, and TP-8S	SCPA-1S, SCPA-1D, SCPA-2, SCPA-3D, and SCPA-3S

Notes: Monitoring wells TP-2D, TP-3D, TP-4D, TP-5D, TP-6S, TP-6D, TP-8D are included in both the SCPA Corrective Action and Nature and Extent Networks. For this evaluation, they will be analyzed with the SCPA Corrective Action Monitoring Well Network.

4.1.1 Groundwater and Porewater Analysis

Geochemical analysis of groundwater and porewater samples included the determination of field parameters and the concentrations of total metals and major cations and anions. The rationale and methods used were as follows:

- **Field Parameters:** Parameters measured in the field included pH, dissolved oxygen, oxidation reduction potential (ORP), conductivity, and temperature. These parameters were used to determine general geochemical conditions in the groundwater and support geochemical modeling.
- **Metals:** Analysis of Appendix III and IV metals concentrations was conducted to understand the geochemical composition of groundwater and CCR Unit porewater. Metals analysis allows for the delineation of a potential plume, evaluation of mineral saturation indices through geochemical modeling, and evaluation of contributions from natural or anthropogenic sources.
- **Major Cations and Anions:** Geochemical modeling of mineral solubility, metals attenuation, and background contributions requires analysis of major cations and anions because they affect and participate in sorption and mineral dissolution or precipitation reactions.

The groundwater and porewater samples were analyzed and the results and methods are provided in the Annual Reports for the SCPA, SCPB, SCPC, SCPD, and SCL4A from 2017 to 2023, which are available on Ameren's publicly available website at https://www.ameren.com/company/environment-and-sustainability/managing-coal-combustion/ccr-compliance-reports.

4.2 Soil Sampling and Analysis

4.2.1 Sample Collection

In May 2021, ten soil samples were collected from three boreholes to evaluate geochemical properties of the alluvial aquifer materials at the Site. Samples were obtained from a boring (S-BH-01) at a background location as well as at IW-2 and EW-3 (Figure 1) located near the SCPA. Three depth intervals were selected in each boring: shallow, intermediate, and deep. Sample intervals are shown in Table 3 and soil sample analyses are described in Section 4.2.2.

Table 3: Boring Sample ID and Descriptions

Boring ID	Sample ID (Depth in Feet Below Ground Surface)	Geologic Material
IW-2 (Downgradient)	IW-2S (40-48)	Poorly Graded Sand
	IW-2M (75-80)	Poorly Graded Sand
	IW-2D (125-129)	Poorly Graded Sand
EW-3 (Downgradient)	EW-3S (35-40)	Poorly Graded Sand
	EW-3M (70-80)	Poorly Graded Sand
	EW-3D (120-125)	Well Graded Sand
S-BH-01	S-BH-01S (20-27)	Poorly Graded Sand
	S-BH-01M (45-54)	Well Graded Sand

Boring ID	Sample ID (Depth in Feet Below Ground Surface)	Geologic Material
(Background)	S-BH-01 (93-96)	Fine Poorly Graded Sand
	S-BH-01D (100-110)	Well Graded Sand

4.2.2 Soil Analyses

Multiple geochemical analytical methods were used to assess the mineralogical and chemical composition of the shallow, intermediate, and deep intervals at the three alluvial aquifer borehole locations across the Site. The selected geochemical test methods included:

- **Mineralogical composition**: The purpose of the mineralogical analysis was to identify and quantify the crystalline mineral phases in each sample. This information is required for geochemical modeling as the release or attenuation of molybdenum is influenced by the mineral phase(s) present in the aquifer (Hem 1985). The mineralogical analysis was performed using quantitative (Rietveld) X-ray diffraction (XRD) (ME-LR-MIN-MET-MN-DO5) and a Bruker AXS D8 Advance Diffractometer.
- **Sequential extraction (SEP):** This test consists of a seven-step metals extraction from solids as per Tessier et al. (1979) to identify the provenance of trace metals such as arsenic (i.e., the operationally defined fraction that contains the metal)[1] and determine their potential environmental mobility. For instance, metals bound in the carbonate fraction, or that are exchangeable, are much more likely to become mobile due to changes in groundwater conditions than metals bound within a sulfide or silicate fraction. The total concentration of a metal measured from all seven steps can be compared to the concentration determined from the total metal analysis for compositional accountability. Metals extracted in Steps 1 through 5 are considered environmentally available, whereas metals extracted in Steps 6 and 7 are not environmentally available under typical groundwater conditions (Tessier et al. 1979). The term environmentally available is used to describe steps 1 through 5 combined and implies the fraction available to participate in environmental reactions such as adsorption, desorption, ion exchange and other reactions that facilitate removal or attenuation of specific constituents. Acid/sulfide and residual fraction combines step 6 and 7, and generally

[1] Sequential extraction of metals from aquifer materials consisted of seven discrete steps for this investigation:

Step 1 - Exchangeable Fraction: This extraction includes trace elements that are reversibly adsorbed to aquifer minerals, amorphous solids, and/or organic material by electrostatic forces.

Step 2 - Carbonate Fraction: This extraction targets trace elements that are adsorbed or otherwise bound to carbonate minerals.

Step 3 - Non-Crystalline Materials Fraction: This extraction targets trace elements that are complexed by amorphous minerals (e.g., iron).

Step 4 - Metal Hydroxide Fraction: Trace elements bound to hydroxides of iron, manganese, and/or aluminum.

Step 5 - Organic Fraction: This extraction targets trace elements strongly bound via chemisorption to organic material.

Step 6 - Acid/Sulfide Fraction: The extraction is used to identify trace elements precipitated as sulfide minerals.

Step 7 - Residual Fraction: Trace elements remaining in the solids after the previous extractions will be distributed between silicates, phosphates, and refractory oxides.

reflect the natural abundance of target constituents in silicates and sulfides, which do not readily interact with groundwater on short time scales.

- **Cation exchange capacity (CEC):** The CEC represents the total number of negative charge sites in a given amount of solid at which reversible cation adsorption and desorption can occur (Hem 1985). The CEC of a material also commonly refers to the replacement of one cation by another in a selective series or preferred adsorption. In this case, the sorption selectivity increases with the ionic radius of the ion, for instance in the following series: $K^+ > Na^+ > Li^+$ and $Ba^{2+} > Sr^{2+} > Ca^{2+} > Mg^{2+}$ (Smith 1999). This information is used for geochemical modeling as the release or attenuation of many trace metals is affected by the CEC of soil in the aquifer. The laboratory analyzed the CEC of soil samples (Table 4) using the method USEPA SW-846 9081 “Cation-Exchange Capacity of Soils (Sodium Acetate)”, (September 1986).

5.0 GROUNDWATER AND POREWATER

5.1 Geochemical Evaluation

The water quality monitoring data used for the geochemical evaluation were obtained from Site monitoring wells and CCR Unit piezometers. The results discussed in this section apply to the Compliance Monitoring Network, the Corrective Action Monitoring Network, and porewater piezometers. Data used are provided in the CCR Rule Annual Reports which are available on Ameren’s Public website.

- **pH** (Figure 3)**:** The pH of samples collected from the SCPA Compliance Monitoring Network in November 2023 ranged from 7.1 to 8.5. Historically, the pH in the Compliance Monitoring Network has ranged from 6.5 to 8.6 from March 2016 to May 2023. The pH of samples collected from the SCPA Corrective Action Monitoring Network in November 2023 ranged from 6.7 to 7.5. Historically, the pH in the Corrective Action Monitoring Network has ranged from 6.0 to 7.6 (with a high outlier of 9.0 at TP-3D on 8/7/2019) from March 2016 to May 2023. The pH of samples collected from the SCPA Nature and Extent Monitoring Network between August 2018 to November 2023 had pH values ranging from 6.2 to 9.9. The pH of samples collected from the CCR Unit porewater piezometers in January 2018 ranged from 6.9 to 8.9. The pH of the background monitoring wells in November 2023 ranged from 7.0 to 7.3.

- **ORP (Oxidation/Reduction Potential)** (Figure 4)**:** The ORP of groundwater samples collected from SCPA Compliance Monitoring Network ranged from -151.8 to +112.8 millivolts (mV) in November 2023. Historically, the ORP in the Compliance Monitoring Network has ranged from -231.4 to +230.5 mV between March 2016 to May 2023. The ORP of groundwater samples collected from SCPA Corrective Action Network ranged from -102.5 to +175.5 millivolts (mV) in November 2023. Historically, the ORP in the Compliance Monitoring Network has ranged from –460.7 to +281.3 mV between March 2016 to May 2023. Between August 2018 to November 2023, the SCPA Nature and Extent Monitoring Network redox values ranged from -147.1 to +212.2 mV. The ORP samples collected from the CCR Unit porewater piezometers in January 2018 ranged from -191.8 to +148 mV. In November 2023 the ORP of groundwater in the background monitoring wells ranged from -27.2 to +181.7 mV.

- **Total Dissolved Solids (TDS)** (Figure 5)**:** Groundwater TDS concentrations ranged from 345 to 1,440 mg/L in the SCPA Compliance Monitoring Network in November 2023. Historically, TDS values have ranged from 268 to 1,660 mg/L in the Compliance Monitoring Network from March 2016 to May 2023. Groundwater TDS concentrations ranged from 346 to 1,290 mg/L in the SCPA Corrective Action Monitoring Network in

November 2023. Historically, TDS values have ranged from 7.5 to 2,490 mg/L in the Corrective Action Monitoring Network from March 2016 to May 2023. Between August 2018 to November 2023 the SCPA Nature and Extent Monitoring Network's TDS concentrations ranged from 199 to 1,140 mg/L. The TDS of groundwater samples collected from the CCR Unit porewater piezometers in January 2018 ranged from 320 to 3,440 mg/L. The TDS of the background monitoring wells ranged from 398 to 475 mg/L in November 2023.

- **Major ion chemistry** (Figure 6, Table 5)**:** A Piper plot was generated for groundwater and porewater samples to facilitate the identification of water types and source contributions from the well network. The wells that are water type Ca-HCO_3 are the majority of the Corrective Action and SCPA Nature and Extent Monitoring Network wells, the background wells, SCPA Compliance Monitoring Network wells UMW-1D, UMW-5D, and UMW-6D, and CCR Unit porewater piezometer SCPA-2. The remainder of the samples had a water type of Ca-SO_4 and had a similar major ion relative abundance to the high TDS (>2,000 mg/L) porewater samples. Samples from the SCPA Nature and Extent Monitoring Network were similar to samples collected from the background monitoring wells, with the exception of some samples whose geochemical signature were generally closer to the signatures of the high TDS porewater and Compliance Monitoring wells. The Corrective Action samples signatures were similarly distributed to all other samples, apart from the background wells.

- **Molybdenum** (Figures 7 to 20)**:** Molybdenum concentrations in groundwater samples collected from the SCPA Compliance Monitoring Network have ranged from 0.02 mg/L to 9.04 mg/L. Monitoring wells UMW-2D, UMW-3D, UMW-4D, and UMW-5D have exceeded the GWPS (0.1 mg/L) since March 2016. However, based on Mann-Kendall tests, molybdenum is no statistically significant increase at these wells, rather trends are currently stable or decreasing. It is anticipated that molybdenum concentrations at the Site will continue to decrease based on the closure strategy at the SCPA (Section 2.1).

  Molybdenum concentrations in the Corrective Action Monitoring Network ranged from 0.0003 mg/L to 9.3 mg/L. Based on Mann-Kendall tests, molybdenum concentrations are not increasing at a statistically significant rate with trends currently stable or decreasing in the Compliance Monitoring Network and in Corrective Action Monitoring Network wells LMW-2S and AM-1D. However, wells LMW-5S and LMW-8S show a statistically significant increasing trend.

  Molybdenum in groundwater in the SCPA Nature and Extent Monitoring Network has been historically lower than or within same range of the SCPA Compliance Monitoring Network concentrations, with a range of 0.0004 to 0.59 mg/L. Molybdenum concentrations appear to be generally stable or decreasing, with the exception of well TP-5D. The visual increase at TP-5D however is not statistically significant. Molybdenum levels in the porewater samples ranged from 0.027 mg/L to 56.6 mg/L within the SCPA, with a mean molybdenum concentration of 22.1 mg/L. However, with the water treatment facility on site that is actively recovering and treating the groundwater within the footprint of the SCPA, preventing porewater from impacting groundwater. Along with the completion of closure activities, the water treatment should assist in decreasing the concentrations of molybdenum in groundwater over time. See Section 2.2 for specific details.

  Molybdenum is expected to be predominately present in the form of the divalent anionic molybdate (MoO_4^{-2}) species under the pH and redox conditions present in groundwater.

5.1.1 Mineralogical Controls in Groundwater and Porewater

The results of saturation index modeling for minerals potentially relevant to molybdenum attenuation in background, Compliance Monitoring, Nature and Extent, and Corrective Action Monitoring Network wells are presented in Table 5. Minerals can play an important role in attenuation of COCs directly by their removal through mineral precipitation or by providing sorptive surfaces or opportunities for co-precipitation. The results of the saturation index modeling can be summarized as follows:

- Iron-bearing minerals: Ferrihydrite was indicated to be at equilibrium with groundwater or oversaturated in the majority of the monitoring well and porewater samples, indicating a strong potential for ongoing precipitation of solid-phase iron oxides. Thus, it is assumed that iron (hydr)oxides are ubiquitous in the Site aquifer.
- Other minerals: All groundwater and porewater samples were simulated to be in equilibrium or oversaturated with respect to calcite [$CaCO_3$] and barite ([$BaSO_4$], with the exceptions of UMW-5D and AM-1S. Other carbonate minerals, i.e., rhodochrosite [$MnCO_3$] and siderite [$FeCO_3$], were oversaturated or in equilibrium in most groundwater samples. Gypsum [$CaSO_4$:H_2O] was simulated to be in equilibrium or oversaturated in several porewater samples (SCPA-1S, SCPA-3S, SCPA-3D) and SCPA Compliance Monitoring Network well UMW-3D. Magnesite [$MgCO_3$] was simulated to be in equilibrium or oversaturated in several porewater samples (SCPA-1S, SCPA-3D) and SCPA Nature and Extent Monitoring Network wells (TP-2M, TP-2S, TP-3M, TP-3S). Fluorite was simulated to be in equilibrium or oversaturated in porewater sample SCPA-3D.

In summary, several mineral phases likely control groundwater composition at some or all wells: barite, calcite, ferrihydrite, fluorite, magnesite, rhodochrosite, siderite, and gypsum. In the case of ferrihydrite, the dissolved concentrations of molybdenum can be attenuated through sorption.

5.2 Compositional Analysis of Alluvial Aquifer Soil

5.2.1 Mineralogical Composition

Quantitative X-ray diffraction (XRD) with Rietveld refinement was used to identify and quantify minerals in ten soil samples collected during the drilling activities – multiple samples from at least three depths (shallow, middle, and deep) from each of the soil borings (BH-01, IW-2, EW-3), as described in Section 4.2. These samples were obtained to determine the mineralogical composition of the aquifer system and identify any minerals that would potentially influence attenuation of molybdenum. In contrast, the presence of certain minerals could also indicate a potential for a naturally occurring release of molybdenum into groundwater, such as molybdenite [MoS_2].

The mineralogical analysis identified the aquifer materials to predominately consist of quartz, with varying amounts of the silicate minerals plagioclase, potassium feldspar, and muscovite (Table 6). Laboratory analytical reports for the XRD samples, including the XRD patterns, are provided in Appendix B.

5.2.2 Chemical Composition and Sequential Extraction

Chemical analysis and sequential extractions were used to determine the chemical composition of the alluvial aquifer soils and the distribution of molybdenum over various operationally defined fractions. As described in Section 4.2, this testing was conducted on ten soil samples from three borehole locations. Select results are presented in Table 7 and the laboratory data are included in Appendix C.

A description of the individual fractions determined by sequential extraction is presented in Footnote 1, Section 4.2.2. Metals extracted in steps 1 through 5 are considered environmentally available, whereas metals extracted

in steps 6 and 7 are present in refractory fractions and are not expected to be released under conditions typically encountered in aquifers (Tessier et al. 1979). The sum of the sequential extraction steps is also presented for comparison but does not represent an analytically determined value.

The results from the chemical analysis and sequential extraction can be summarized as follows:

General Chemistry Parameters

- **Aluminum** (Figure 21): Aluminum is not a constituent of interest (COI) at the Site, but it has been well studied as a potential sorbing medium in soils (e.g., Karamalidis and Dzombak 2010). Total aluminum in soils ranged from 13,872 to 31,555 mg/kg, and the environmentally available fraction ranged from 340 (IW-2D) to 839 mg/kg (IW-2S). Aluminum in the soil at the site is, therefore, largely (> 95%) present in the residual, or silicate-bound fraction. The environmentally available fraction is likely partially represented by hydrous aluminum phyllosilicate minerals or clays intermixed in the silica sand matrix. Clays can represent an important sorptive reservoir for numerous trace metals and metalloids, including molybdenum at this site (Uddin 2017).
- **Iron** (Figure 22): While not a COI, iron and its minerals commonly represent one of most abundant reservoirs for metal/metalloid attenuation in soils (Dzombak and Morel 1990; Smith 1999). Iron was present in all ten core samples analyzed, varying from 4,886 (EW-3M) to 12,903 mg/kg (EW-3D). In all ten soil borings, the non-environmentally available (sulfide and residual) fractions accounted for the largest proportion of total iron (55 to 76%) and, as such, most of the iron is not environmentally available. The remainder of iron in the samples is present in either the carbonate, amorphous, metal hydroxide fractions and to a very limited extent the amorphous and organic phases also. These phases, part of the labile fraction in steps 1 through 5, can generally be considered representative of the amount of iron in soil that may be available as a sorbing medium and can, therefore, be important for attenuation of molybdenum under certain conditions.

Metals identified as an SSL

- **Molybdenum** (Figure 23): Total molybdenum in soil ranged from 0.17 to 1.64 mg/kg, of which up to 100% (IW-2S and L-EW-3M) was present in the environmentally available fraction. Environmentally available molybdenum was contained in the amorphous and metal hydroxide fractions. In boring EW-3D, of the small amount of molybdenum identified, all was present in the residual fraction. These results indicate that attenuation of molybdenum by amorphous and metal hydroxide minerals is occurring at the Site.

The results of the SEP analysis confirm both the natural occurrence of molybdenum in the aquifer materials and that attenuation of molybdenum is occurring by aquifer materials through adsorption/co-precipitation onto/with amorphous and metal hydroxide minerals.

6.0 GROUNDWATER MODELING

In 2019, a groundwater model and draft report was prepared by Golder (Golder 2019a) to provide a predictive analysis for groundwater flow at the SEC for the Corrective Measures Assessment. In 2021, this groundwater model was updated by XDD, to provide predictive analysis for groundwater flow at the SEC for the design of a pump, treat, and re-injection system for SCPA Corrective Action.

The numerical computer code MODFLOW – developed by the United States Geological Survey (USGS) – was selected for the groundwater modeling because it is well suited to represent a wide range of hydrologic and hydrogeologic conditions, has been widely tested and accepted in the professional hydrology community and by regulatory agencies, and has been scrutinized closely in a number of legal proceedings over the past 20 years. In total, five software packages were used for the groundwater investigation:

- Groundwater flow: USGS software package MODFLOW (McDonald and Harbaugh 1988, Harbaugh and McDonald 1996, Harbaugh et al. 2000, Harbaugh 2005). MODFLOW-2005 was the version used in the analyses presented here.
- Groundwater transport: USGS software package MT3DMS (Zheng and Wang, 1999).
- Particle tracking: USGS software package MODPATH (Pollock 2012)
- Parameter estimation: PEST (Doherty 2010 and 2016)
- Graphical user interface: Groundwater Vistas (Environmental Simulations 2020, Rumbaugh and Rumbaugh 2011).

The groundwater model simulates steady-state and transient flow conditions for the site area. The groundwater model was developed and updated based on the following:

- Natural hydrologic boundaries wherever possible.
- Ground surface topography and CCR unit geometries.
- Geologic layers with representative hydrogeological properties based on boring logs.
- Hydraulic properties of geologic layers based on aquifer tests conducted at the site.
- Historical groundwater elevation measurements.

7.0 GEOCHEMICAL ANALYSIS AND MODELING

7.1 Empirical Attenuation Rates

To evaluate the attenuation of molybdenum in groundwater at the Site and to assess the rate of attenuation, WSP applied the point decay method (Newell et al. 2002). The point decay method is used to determine the rate at which a constituent's concentrations are increasing or decreasing in groundwater at a single well between sampling events and this method can thus be used to predict when the constituent's concentrations will fall back below regulatory limits.

Equation 1 describes first-order decay for a constituent:

$$Ln(C_t) = k_t + Ln(C_0) \quad \text{(Equation 1)}$$

where C_0 is the initial constituent concentration, Ct is the constituent concentration at time t, t is the amount of time in years that has passed since the initial concentration measurement, and k is the first-order decay rate constant (1 per year). Equation 2 shows Equation 1 reorganized to solve for the decay rate constant:

$$k = (Ln(C_t) - Ln(C_0))/t \quad \text{(Equation 2)}$$

Groundwater water quality data from the Site wells collected between March 2016 and November 2023 were used to determine the mean first-order decay rate for each constituent of interest. Due to variable detection limits, results that were reported as below detection limits were not used in the point decay analysis. Using Equation 1 and the mean first-order decay rate, WSP calculated the approximate number of years that it would take for molybdenum concentrations higher than their respective GWPS to decline below these values and these results are provided in Section 7.3.

7.2 Geochemical Modeling

Geochemical modeling was conducted to evaluate general groundwater and porewater quality, determine the potential for precipitation of sorbent media, evaluate the potential for mineral precipitation or adsorption in the aquifer, and determine the speciation of metals of interest. The geochemical computer code developed by the USGS, PHREEQC, was used for these simulations (Parkhurst and Appelo 2013). PHREEQC version 3.7 is a general-purpose geochemical modeling code used to simulate reactions in water and between water and solid mineral phases (e.g., rocks and sediments). Reactions include aqueous equilibria, mineral dissolution and precipitation, ion exchange, surface complexation, solid solutions, gas-water equilibrium, and kinetic biogeochemical reactions. The widely accepted thermodynamic database Minteq.v4, 2017 edition (USEPA 1998, as amended), was used as a basis for the thermodynamic constants required for modeling, with additions and modifications from recent literature as required.

The Geochemist's Workbench (Release 17; Bethke et al. 2024) was used to generate graphical representations of geochemical modeling outputs in the form of predominance, or Pourbaix diagrams (also known as Eh-pH diagrams) for the species of interest (i.e., molybdenum) and trilinear plots (also known as Piper plots) displaying the relative abundance of major ions. The Minteq.v4 database was used as the basis for the Pourbaix diagrams.

7.2.1 Surface Complexation Modeling

Adsorption is an important mechanism by which constituents in groundwater can be attenuated. The adsorptive partitioning between dissolved and solid phases was simulated using a two-layer surface complexation model (SCM). The SCM approach is described in Davis and Kent (1990), with additional parameterization based on Dzombak and Morel (1990) and Karamalidis and Dzombak (2010) utilizing iron (hydrous ferric oxide [Hfo]) as ferrihydrite [$Fe(OH)_{3(am)}$], and aluminum (hydrous aluminum oxide [Hao]) as gibbsite [$Al(OH)_{3(am)}$], as adsorbing surfaces.

The amounts of Hfo and Hao available at the site for attenuation were based on the amorphous and metal hydroxide phase iron and aluminum concentrations measured in the SEP as described in Section 5.2.2. The minimum, mean, and maximum concentrations in soil borings were used in the adsorption models to capture the range of expected site concentrations. The Hfo and Hao surface properties (i.e., surface area, site density, and types of sites) from Dzombak and Morel (1990) and Karamalidis and Dzombak (2010) were used to quantify the iron and aluminum adsorption sites per mole of mineral.

The calculation methodology of Appelo and Postma (2010) was used to determine the specific quantity of sites on each mineral surface type as a function of the amount of mineral available to participate in these reactions. The methodology assumes the number of surface sites (sites) equals the product of the moles of iron ([Fe]) and the moles of surface sites per mole of iron ([sites]/[Fe]= 0.2 moles of sites per mole of iron). For the amount of

ferrihydrite available for sorption, the Appelo and Postma methodology further assumes the mass of ferrihydrite (mHfo) in grams (g) available equals the product of the [Fe] and the molecular weight of ferrihydrite (mwHfo = 88.85 g/mole). The same approach was used to calculate the number of sites from gibbsite, assuming the [sites]/[Al] is 0.41 moles of sites per mole of aluminum and the molecular weight of gibbsite is 78.003 g/mole.

The geochemical thermodynamic database Minteq V.4 was used to conduct adsorption modeling. However, new and updated thermodynamic data have been released in scientific literature. These new data are important to include in the geochemical modeling exercises for certain elements or minerals as they allow further refinement of potential reactions, or for correction of previous data that may have been less accurate or more broadly defined. For groundwater modeling at the Site, WSP made numerous updates to the Minteq V.4 database, including the addition of data relating to partitioning coefficients for metals on gibbsite, developed by Karamalidis and Dzombak (2010).

To quantify current levels of adsorption of molybdenum, its adsorbed concentration (as milligram (mg) of constituent/kilogram (kg) of soil) was modeled for the minimum, maximum, and mean Hfo and Hao contents when equilibrated with the range of groundwater qualities observed at the Site. To quantify the capacity of soil to adsorb additional molybdenum, a stepwise increase in molybdenum concentrations was simulated, similar in concept to a titration. This was accomplished using the mean concentration of molybdenum observed in porewater, as well as the concentrations of other constituents present in porewater, allowing for site competition. This simulated "titration" took place into the range of observed groundwater qualities while allowing equilibration with the sorption surfaces in soils as shown in Table 8 (minimum, maximum and mean Hfo and Hao). The model was then used to predict the quantity of each constituent that would adsorb due to this titration of additional molybdenum and other porewater constituents.

Table 8: Calculation of Ferrihydrite and Gibbsite Surface Parameters for Geochemical Modeling

Parameter	Unit	Ferrihydrite			Gibbsite		
		Minimum	Mean	Maximum	Minimum	Mean	Maximum
Geometric Mean of Aquifer Solids Composition	mg/kg X	1,170	2,270	4,600	295	484	745
	mol X	2.1E-02	4.1E-02	8.2E-02	1.1E-02	1.8E-02	2.8E-02
Surface Site Concentration	mol weak sites / mol X	0.2	0.2	0.2	0.41	0.41	0.41
	mol strong sites / mol X	0.005	0.005	0.005	---		
Surface Sites	mol weak	4.2E-03	8.1E-03	1.6E-02	4.5E-03	7.4E-03	1.1E-02
	mol strong	1.0E-04	2.0E-04	4.1E-04	---		
Mass of Ferrihydrite or Gibbsite	grams	1.86	3.61	7.32	0.85	1.4	2.15

Note: Gibbsite only has one site type

7.2.2 Mineral Precipitation and Co-precipitation

The potential for mineral precipitation was assessed in PHREEQC using a saturation index (SI) calculated according to Equation 4.

$$SI = \log (IAP/Ksp) \quad \text{(Equation 4)}$$

The saturation index is the ratio of the ion activity product (IAP) of a mineral to the solubility product (Ksp). An SI value greater than zero indicates that the solution is supersaturated with respect to a particular mineral phase and, therefore, precipitation of this mineral may occur. An evaluation of precipitation kinetics is then required to determine whether the supersaturated mineral will indeed form. An SI value less than zero indicates the solution is undersaturated with respect to a particular mineral phase. An SI value close to zero indicates equilibrium conditions exist between the mineral and the solution. SI values between -0.5 and 0.5 are considered to represent 'equilibrium' in this report to account for the uncertainties inherent in the analytical methods and geochemical modeling.

In addition to adsorption, co-precipitation, or the direct incorporation of trace metals such as molybdenum into precipitated iron oxide-oxyhydroxides, has been previously identified as a process of potential importance in trace metal sequestration (e.g., Butt et al. 2000; Dzombak and Morel 1990; Smith 1999). Molybdenum may also be attenuated during the formation of ferrihydrite in addition to following its formation (Tebo et al. 2004).

7.2.3 Long-Term Stability of Attenuated Constituents

Three sensitivity analyses were performed to assess the long-term stability of attenuated molybdenum under variable pH, redox, and ionic strength conditions (Figures 24 to 26). Variations in pH, redox, and ionic strength are the most likely types of changes that will occur in an aquifer over time, thereby potentially affecting the stability of molybdenum (ITRC 2010). The sensitivity analyses were conducted applying the minimum, mean, and maximum Hfo and Hao contents determined for the Site soils, equilibrated with the groundwater qualities observed at the Site at the measured pH and redox conditions. For each sensitivity analysis, a single parameter was varied:

- **pH** - Hydrochloric acid or sodium hydroxide addition was used in the modeling simulations to vary the pH between 4 and 12. A pH range of 4 to 10 is the typical range considered for evaluating metal speciation, but at a pH lower than 5, Hfo tends to become unstable, limiting attenuation/adsorption, which causes an observed decrease in modeled attenuation at lower pH values. Hao remains stable until a pH range of approximately 3.5 and, as such, may provide attenuation capacity under more acidic conditions.
- **Redox** – Addition of dissolved oxygen (DO) was simulated to adjust redox (Eh) values between -200 and +700 millivolts (mV) based on the historical and anticipated range of Eh in the region.
- **Ionic Strength** - Total dissolved solids (TDS) concentrations were increased by titrating in calcium, magnesium, sodium, potassium, chloride, and sulfate in the proportions observed in porewater. TDS concentrations up to ~3,849 mg/L were evaluated, which is approximately 4-5 times the average TDS concentration observed in groundwater at the CCR Monitoring Network (765 mg/L).

7.2.4 Geochemical Modeling Assumptions and Data Handling

Geochemical modeling assumptions and data handling included the following:

- **Groundwater continuity:** Groundwater quality samples were collected from each well during sampling events conducted in November 2023. Samples from this period were selected for the geochemical modeling because all wells within the compliance and corrective action monitoring well Networks were sampled and analyzed for the full suite of parameters required and the resulting data are assumed to provide a comprehensive overview of groundwater conditions. Temporal trend analysis for molybdenum made use of all available sampling events between March 2016 and November 2023.
- **Porewater chemistry:** Porewater samples collected in January 2018 were assumed to be representative of porewater found in the CCR Unit.
- **Redox values:** ORP values measured in the field were converted to Eh by adding +200 mV to the field-measured values as per YSI Tech Note (YSI 2015).
- **Non-detect values:** Constituents with concentrations less than their respective method reporting limits were assumed to have a concentration one half the minimum detection limit in model simulations.
- **Total recoverable concentrations:** Total recoverable fraction results were used for geochemical modeling.
- **Charge balance:** Groundwater and porewater compositions with charge balance errors less than 10% were considered valid. Compositions with charge balance errors greater than 10% were flagged as potentially less reliable, but still included in the geochemical modeling effort.

7.3 Results

7.3.1 Empirical Attenuation Rate

The results of the point decay analysis (Section 7.1) for the background, monitoring, and downgradient wells between March 2016 and November 2023 are provided in Table 9. Results are presented as mean, site-wide attenuation rates. This decay rate analysis does **NOT** consider the effects of treatment or groundwater flow direction/velocity.

This evaluation demonstrates that, in the Compliance Monitoring Network, a net decrease in the concentration of molybdenum at downgradient monitoring wells has been occurring, as indicated by negative point decay constants. Compliance wells are typically downgradient of the groundwater treatment zone and the effects of treatment are beginning to be observed at certain well locations (i.e. UMW-5D) where concentration levels have reduced by up to approximately 91.5% since the implementation of corrective measures[2]. The effects of treatment should become more prevalent over the next few years as the treatment system has only been in operation since 2023.

[2] UMW-5D has decreased 91.5% in molybdenum concentrations since the implementation of corrective measures at the SCPA (closure and treatment) from 2,240 µg/L in April 2020 to 191 µg/L November 2023. UMW-4D has decreased 55% in molybdenum concentrations in the same timeframe from 8,860 to 3,990 µg/L.

Table 9: Empirical Attenuation Rate of Molybdenum in the Compliance Monitoring Network

Constituents	Units	Average Point Decay Rates			
		Background Wells	Compliance Monitoring Network Wells	All Downgradient Wells	Time to Compliance (years)
March 2016 to November 2023					
Molybdenum	yr^{-1}	-0.31	-0.11	-0.08	48

The mean downgradient decay rates can be used to estimate the number of years it would take for elevated groundwater molybdenum concentrations to decrease to its GWPS for the Compliance Monitoring Network. At the maximum concentration of molybdenum observed in downgradient wells in November 2023 (3.99 mg/L), this would require approximately 48 years based on the site decay rate, which, as noted above, does not yet consider the effects of treatment or groundwater flow direction/velocity. In addition, the estimate does not account for various attenuation processes (e.g., dilution, dispersion, or sorption).

7.3.2 Model Predicted Attenuation Rate

Attenuation rates for molybdenum in groundwater were modeled using fate and transport modeling techniques as discussed in section 5.0 in combination with a 1-Dimensional geochemical reactive transport model. Groundwater concentrations were modeled to decrease in concentration in wells both adjacent to the SCPA (Detection and Assessment Network) and within the molybdenum plume (Corrective Action Network). Additionally, it was predicted that the plume of molybdenum would not exceed the GWPS at the property boundary within the timeframe modeled (50 years). However, these models are unable to account for the influences and the complex dynamics of the treatment system that is discussed in Section 2.2. Thus, the calculated empirical first order decay rates determined in Section 7.1 and the current trend in concentration in molybdenum across the monitoring network (Figures 3,4,5,7); Appendix A), based on empirical data, are the best representation of the attenuation rate for the constituents across the site. The geochemical models for the transects are included (Figures 27-28) to further support that molybdenum will not exceed at the property boundary as the degree in source concentrations decrease based on treatment system operations and to estimate future decreasing concentrations of molybdenum taking into account groundwater flow.

7.3.3 Capacity of Attenuation Mechanisms

Attenuation modeling was conducted in PHREEQC as a function of the amount of attenuating substrate present (minimum, mean and maximum from soil analyses). The modeling revealed a large range of attenuation capacities for molybdenum. Figure 29 displays the predicted trajectories of aqueous molybdenum concentrations in the Compliance Monitoring and Corrective Action Monitoring Networks, respectively, before and after attenuation, as additional molybdenum is titrated into solution. The bold lines display the geometric means for all groundwater scenarios within each soil scenario and the grey area represents the range for the 5th to 95th percentile of all soil scenarios.

The predicted trajectories are compared against the GWPS and porewater concentrations. On the plots, the further the predicted trajectories are to the right of the diagonal 1:1 line, the larger the amount of molybdenum that is attenuated in soils and is no longer predicted to reside in the aqueous phase.

For the minimum adsorption cases, the trajectories run nearly parallel to the 1:1 line, indicating that sorption capacity is directly proportional to the concentration before adsorption as sites become filled. The modeling results suggest that adsorption has the capacity to reduce molybdenum concentrations of up to originally 1.0 mg/L down to below the GWPS of 0.1 mg/L in the Compliance Monitoring Network once wells reach around that level. The Corrective Action Monitoring Network currently demonstrates decreased capacity for molybdenum attenuation as evidenced by molybdenum concentrations in multiple wells that are currently above the GWPS. In this case, the closure of SCPA in combination with active treatment is expected to result in no contribution from porewater to the alluvial aquifer for future loading. The future increase in capacity is demonstrated by the decreasing molybdenum concentrations across the network in response to closure of the SCPA (Section 7.3.2).

7.3.4 Long-Term Stability of Attenuated Constituents

To determine the long-term stability of sequestered molybdenum, simulations were conducted varying three variables known to affect its attenuation: pH, redox, and TDS. The modeled variations in dissolved molybdenum concentration as a function of changes in pH, Eh, and TDS are shown in Figures 24, 25, and 26 respectively. Results are presented along with the GWPS value and the range of pH, Eh, or TDS values (5th percentile to 95th percentile) observed at the Site.

The results of the attenuation stability modeling for molybdenum as a function of changes in pH, Eh and TDS can be summarized as follows:

- **Molybdenum** (Figures 24-26)**:** Lower pH values (more acidic conditions) are generally more favorable for adsorption. Under more alkaline conditions (pH greater than 9), molybdenum desorbs and is present in the dissolved phase in concentrations potentially to exceed the GWPS. It is expected that pH values across the Site will decrease post closure, benefiting molybdenum attenuation. Notably the range of groundwater pH across the site has typically been <7.5 (Section 3.0). Over the range of Eh values at the Site, molybdenum sorption is generally stable. Even highly reducing and oxidizing conditions are predicted to have minimal impact on molybdenum concentrations, which remain below the GWPS. Molybdenum adsorption is moderately affected by increases in TDS concentrations. Molybdenum is modeled to desorb at TDS concentrations comparable to the maximum observed porewater concentration which would not account for any dilution as pore water left the SCPA (3,440 mg/L). However, these simulations do not account for decreases in porewater flux that will likely result from capping and the current active treatment that is in place, so it is not expected or likely that TDS levels will increase in the future.

8.0 TIER I EVALUATION SUMMARY

The evaluation of natural attenuation of molybdenum was completed in accordance with recommended practices and guidance promulgated by the USEPA and the ITRC (USEPA 2007a, b; USEPA 2015; ITRC 2010). According to USEPA (USEPA 2007a), the purpose of the Tier 1 evaluation is to “Demonstrate that the groundwater plume is not expanding and that sorption of the contaminant onto aquifer solids is occurring where immobilization is the predominant attenuation process.” Based on this definition, the following observations support further MNA for the

CCR Unit in coordination with other closure and corrective measure efforts (treatment) that are currently being undertaken:

- **Plume Stability:** Based on the water quality monitoring data presented in this assessment, groundwater concentrations of molybdenum at the Site appear to be stable or decreasing due likely in part to the closure treatment plan. Alkaline conditions (pH > 9) result in desorption of molybdenum from solids and can contribute to molybdenum levels above the GWPS at the Site. But the pH of groundwater in the SCPA Compliance Monitoring Network are neutral or slightly above neutral, and, consequently, molybdenum concentrations are anticipated to continue decline. All downgradient wells across the site show a decreasing trend in concentrations in molybdenum based on a 1st order decay constant. This trend should continue as treatment also continues. In combination, these observations indicate that overall, concentrations of molybdenum in the aquifer are stable or decreasing across the site.
- **Magnitude of Exceedances:** The highest molybdenum concentration (since monitoring began) in the Compliance Monitoring Network was observed at downgradient well UMW-4D in November 2020 at 9.04 mg/L. However, results from the most recent sampling have indicated that the concentration in this well has decreased to 4.0 mg/L. Wells UMW-2D, UMW-3D, UMW-4D, and UMW-5D continue demonstrating a molybdenum GWPS exceedance since closure efforts began in September 2019. These concentrations are expected to decrease with the input from the water treatment facility in tandem with closure activities.
- **Porewater:** Historical records are not available for ash additions or porewater concentrations over the lifespan of the SCPA surface impoundment. However, based on 2018 porewater data, molybdenum concentrations in porewater ranged from 0.026 mg/L to 56.6 mg/L. This indicates variable concentrations of molybdenum in the CCR Unit. While in the past the SCPA may have been a source for molybdenum in groundwater, it is currently not considered to be an active source due to the leaching characteristics of CCR, groundwater predominantly flowing around instead of into the SCPA after closure, and the installation of a clean injection wells from the treatment system encircling the SCPA. As demonstrated by decreasing site-wide concentrations of all three constituents the SCPA is no longer an active source of porewater at the site.
- **Groundwater Chemistry:** Groundwater monitoring results and the findings of the geochemical modeling support the potential for natural attenuation of molybdenum. The groundwater was modeled to be in equilibrium with the mineral phase ferrihydrite for all monitoring wells included in this assessment. This is consistent with the results from the sequential extraction analysis that indicate amorphous and metal hydroxide fractions sequester molybdenum.
- **Confirmation of Attenuation/Immobilization:** Based on both mineralogical and chemical analysis, it is demonstrated that attenuation of molybdenum by aquifer materials is occurring. Iron and aluminum, capable of forming (hydr)oxide phases that facilitate metals attenuation (Dzombak and Morel 1990; Karamalidis and Dzombak 2011), was identified in all samples. This indicates that it is likely aquifer solids have been and are actively attenuating molybdenum. Additional attenuation is expected after closure due to a reduced contribution from porewater and an accompanying decrease in groundwater pH around the SCPA, which will only be further aided by the groundwater treatment system. As discussed previously, molybdenum attenuation by soils is enhanced under moderately acidic conditions.

Based on these findings, molybdenum is confirmed to be viable for an MNA remedy application due to the aquifer response observed from closure activities and is, therefore, deemed to meet the criteria for Tier I MNA in accordance with USEPA guidance (USEPA 2007a, b; USEPA 2015).

9.0 TIER II EVALUATION

The purpose of the Tier II evaluation is to "Identify mechanisms and rates of the operative attenuation process." Based on this definition, the following modeling results and observations support MNA as a viable corrective measure for the CCR Unit:

- **Attenuation Mechanisms:** PHREEQC modeling results (supported by results of SEP analysis) indicate that adsorption is attenuating molybdenum downgradient of the CCR Unit. This is concluded based on equilibration of site-specific groundwater compositions with the range of Hfo and Hao concentrations observed in SEP results of Site soils. The attenuation capacity of Hfo and Hao surface sites is partially dependent on the concentrations of molybdenum in groundwater. In addition to metal oxyhydroxides, clay minerals and/or particulate organics can also act as a substrate for attenuation (Goldberg and Forster 1996). Although likely present, these mechanisms were not directly addressed in the current evaluation.
- **Estimated Site Attenuation Rates:** Concentrations of molybdenum are decreasing at downgradient Compliance Monitoring Network wells, resulting in negative calculated point decay rates. Using the mean empirical decay rate, the maximum 2023 concentrations of molybdenum observed in downgradient monitoring wells would take approximately 48 years to attenuate to below GWPS based on the current trend in concentrations (without considering the effects of treatment or groundwater flow direction/velocity). Modeling additionally indicated that molybdenum would not exceed the GWPS at the property boundary based on the current closure strategy and treatment plan.

Based on these findings, molybdenum is viable as an MNA remedy application in combination with closure activities and deemed to meet the criteria for Tier II MNA in accordance with USEPA guidance (USEPA 2007a, b; USEPA 2015).

10.0 TIER III EVALUATION

According to USEPA (USEPA 2007a), the purpose of the Tier III evaluation is to eliminate sites for an MNA remedy where (1) "Capacity of the aquifer is insufficient to attenuate the COC mass to regulatory standards" and/or (2) "Stability of the immobilized COC is insufficient to prevent remobilization due to future changes in groundwater chemistry". Based on this definition, the following observations support MNA as a viable corrective measure for the CCR Unit:

- **Adsorption Capacity Modeling** (Figure 29)**:** For molybdenum, modeling results suggest that adsorption has the capacity to reduce molybdenum concentrations from 1.0 mg/L down to the GWPS of 0.1 mg/L. The titration modeling demonstrates the soil's capacity to attenuate molybdenum if concentrations of molybdenum were to increase above current levels. The Compliance Monitoring Network (located immediately adjacent to the SCPA) shows reduced capacity for attenuation currently because levels of molybdenum currently exceed the GWPS. However, the Nature and Extent Network, which is more distant from the SCPA, demonstrates additional capacity for molybdenum attenuation. As concentrations of molybdenum decrease from closure and treatment, capacity for attenuation will return immediately adjacent to the SCPA. The 95th percentiles of modeled trajectories show that most pH conditions at the Site are

favorable for attenuating molybdenum and will become more conductive to attenuation as the groundwater pH reverts to natural background levels post closure.

- **Stability Modeling for Adsorbed Constituents** (Figures 24-26)**:** Stability modeling indicates that over the ranges of pH, Eh, and TDS observed in groundwater at the Site, the adsorbed molybdenum is relatively stable and will likely remain attenuated. The modeling results further suggest that the adsorption of molybdenum could be reversed if conditions become sufficiently alkaline, but there is no historical basis to expect such an occurrence and, in fact, the opposite (decreasing pH at wells) is expected to continue post closure. Generally, site groundwater is circumneutral and has remained stable across the sampling period which supports continued molybdenum attenuation or increased attenuation as pH decreases. Changes in redox conditions are modeled to have little to no impact on aqueous molybdenum concentrations and molybdenum attenuation efficiency. Modeling results also indicate that increasing TDS concentrations could result in a very slight increase in aqueous concentrations of molybdenum due to competition for sorption sites. However, this effect is predicted to be minor over the range of TDS concentrations observed at the Site and the risk will be lessened over time as closure causes a decrease in porewater flux and greater mixing of ambient groundwater in the aquifer, especially from the groundwater treatment system. Based on the closure and treatment strategy, no additional impacts are foreseen that will affect the alluvial aquifer outside of the treatment system and once concentrations decrease below the GWPS, they are predicted to remain stable or decrease further.

Based on these findings, molybdenum is a candidate for MNA and deemed to meet the criteria for Tier III MNA in accordance with USEPA guidance (USEPA 2007a, b; USEPA 2015).

11.0 CONCLUSIONS

This evaluation has been completed in accordance with guidance and best practices promulgated by the USEPA (USEPA 2007a, b; USEPA 2015) and the ITRC (ITRC 2010). Based on the results of this evaluation, the following is concluded for molybdenum in Site groundwater:

- Molybdenum concentrations across the site are decreasing based on measured groundwater data.
- Physical and chemical attenuation is occurring, and concentrations are stable or declining across the site.
- Modeling indicates that molybdenum attenuation will be stable in the long term.
- Molybdenum meets the USEPA requirements (Tiers I, II, and III) to be viable as an MNA remedy application in combination with the capping and closure of the SCPA.

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TABLES

Table 4
Cation Exchange Capacity of Soils from Select Borings
Monitored Natural Attenuation Evaluation
Sioux Energy Center, St. Charles County, MO

Sample Location	L-BH-01S	L-BH-01M	L-BH-01D	L-BH-02S	L-BH-02M	L-BH-02D	L-BH-03S	L-BH-03M	L-BH-03D
Sample Depth (ft bgs)	23 - 30	65 - 70	100 - 114	40 - 50	67.5 - 70	80 - 87	22.5 - 30	70 - 80	108 - 114
Cation Exchange Capacity (cmol/Kg	6.3	6.5	3.5	6.6	47.9	4.8	5.2	3.3	3.1

Notes:
mg/L = milligrams per liter.
cmol/Kg = centimole per kilogram.
ft bgs = feet below ground surface

Table 5
Relevant Mineral Phases – Saturation Indices and Water Types
Monitored Natural Attenuation Evaluation
Sioux Energy Center, St. Charles County, MO

MINERAL PHASES - Saturation Indices		S-BMW-1D	S-BMW-3D	S-BMW-1S	S-BMW-3S	S-UMW-1D	S-UMW-2D	S-UMW-3D	S-UMW-4D	S-UMW-5D	S-UMW-6D	S-TP-1D	S-TP-1M	S-TP-1S	S-TP-2D	S-TP-2M	S-TP-2S	S-TP-3D	S-TP-3M	S-TP-3S	S-TP-4D
Water Type		Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-SO4	Ca-SO4	Ca-SO4	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-SO4	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3
Charge Balance	%	3.14	0.92	-2.46	-0.59	-0.73	-0.17	0.29	1.07	1.74	2.13	-2.11	**-5.25**	-2.15	1.82	**-6.40**	-2.90	2.07	-2.19	1.20	1.37
Otavite	$CdCO_3$				-2.76		-1.33	-1.27	-1.72	-2.48										-1.62	
Ferrihydrite	$Fe(OH)_3$	**0.23**	**3.20**	**-0.42**	**-0.43**	**2.24**	**1.28**	**0.13**	**0.09**	-0.62	-1.20	**2.49**	**1.49**	-1.92	**1.16**	**4.41**	**3.18**	**-0.18**	**3.47**	**3.89**	**0.71**
Siderite	$FeCO_3$	**0.77**	**0.47**	-1.61	-1.56	**-0.39**	**-0.17**	**0.16**	**0.38**	**0.54**	**0.51**	**-0.19**	**0.01**	**0.93**	**0.51**	**1.16**	**2.38**	**0.60**	**2.11**	**1.99**	**0.25**
Melanterite	$FeSO_4{:}7H_2O$	-5.70	-5.64	-7.57	-8.07	-6.27	-6.13	-5.44	-4.83	-7.07	-5.61	-5.81	-5.46	-5.61	-4.36	-6.22	-5.27	-5.17	-5.38	-5.96	-5.20
Rhodochrosite	$MnCO_3$	**0.22**	**-0.20**	**-0.27**	-0.58	-0.70	**0.06**	**0.38**	**0.20**	**0.10**	**-0.05**	-0.73	-0.88	**0.93**	**-0.16**	**2.25**	**2.36**	**-0.04**	**1.50**	**2.26**	-0.51
Birnessite	MnO_2	-21.19	-14.91	-18.02	-18.60	-16.39	-19.21	-21.55	-21.26	-23.04	-23.74	-16.12	-18.29	-25.07	-18.74	-14.72	-18.00	-21.98	-18.01	-16.44	-19.80
Manganite	MnOOH	-9.15	-6.29	-7.95	-8.28	-7.21	-7.44	-8.54	-8.99	-9.98	-10.65	-7.26	-8.57	-11.21	-8.28	-3.33	-5.74	-9.63	-6.04	-4.73	-8.85
Gypsum	$CaSO_4{:}2H_2O$	-2.13	-2.00	-1.73	-2.33	-1.71	-0.84	**-0.45**	-0.99	-3.25	-1.98	-1.96	-1.83	-2.11	-0.68	-0.93	-1.70	-1.55	-1.70	-1.89	-1.49
Calcite	$CaCO_3$	**0.34**	**0.12**	**0.22**	**0.19**	**0.10**	**1.10**	**1.14**	**0.21**	**0.34**	**0.13**	**-0.44**	**-0.44**	**0.30**	**0.21**	**2.45**	**1.95**	**0.24**	**1.77**	**2.04**	**-0.01**
Magnesite	$MgCO_3$	-0.94	-1.13	-1.13	-1.18	-1.15	-1.19	-0.93	-1.28	-0.95	-1.14	-1.78	-1.77	-1.02	-0.95	**1.29**	**0.82**	-0.98	**0.52**	**0.76**	-1.23
Barite	$BaSO_4$	**0.28**	**0.78**	**0.26**	**-0.25**	**0.52**	**0.77**	**1.09**	**0.58**	-0.57	**0.16**	**0.14**	**0.41**	**0.02**	**0.73**	**1.12**	**0.52**	**1.16**	**0.95**	**0.51**	**1.16**
Witherite	$BaCO_3$	-2.59	-2.44	-3.13	-3.07	-2.99	-2.63	-2.66	-3.55	-2.31	-3.07	-3.64	-3.51	-2.87	-3.72	-0.84	-1.17	-2.40	-0.91	-0.88	-2.71
Fluorite	CaF_2	-3.35	-3.38	-3.34	-3.36	-3.55	-1.14	-2.03	-2.30	-2.70	-3.41	-2.10	-2.09	-1.83	-3.25	-2.27	-2.06	-3.39	-2.12	-1.84	-3.40
CoCO3	$CoCO_3$	-3.80	-3.98	-3.96	-3.90	-3.79	-3.15	-3.32	-3.91	-3.58	-3.93	-4.34	-4.48	-3.63	-3.90	-2.85	-1.96	-3.87	-2.76	-2.68	-4.08
Carbon Dioxide	pCO2(g)	-1.64	-1.49	-1.41	-1.59	-1.99	-3.38	-3.13	-2.13	-2.04	-1.54	-1.72	-1.37	-1.21	-1.24	-4.79	-3.20	-1.71	-3.48	-3.76	-1.56

		S-TP-4M	S-TP-4S	S-TP-5D	S-TP-5M	S-TP-5S	S-TP-6D	S-TP-6M	S-TP-6S	S-TP-7D	S-TP-7M	S-TP-7S	S-TP-8D	S-TP-8M	S-TP-8S	S-SCPA-1D	S-SCPA-1S	S-SCPA-2	S-SCPA-3D	S-SCPA-3S	S-AM-1D
Water Type		Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-SO4	Ca-HCO3	Ca-SO4	Ca-SO4	Ca-HCO3
Charge Balance	%	0.08	-0.03	0.76	1.51	**7.18**	-0.04	-1.16	0.71	-2.53	0.27	1.08	1.19	-3.78	4.12	**-6.32**	**-13.96**	0.92	**-7.65**	-4.02	-0.95
Otavite	$CdCO_3$			-2.72					-2.69							-1.50	**0.11**	-2.89	-0.72	-1.15	-2.50
Ferrihydrite	$Fe(OH)_3$	-0.60	**-0.10**	**0.79**	**1.69**	**1.92**	-0.62	**1.76**	**0.13**	-1.40	-1.57	-1.53	**-0.24**	**-0.43**	-1.45	-0.83	**1.86**	-1.53	**3.20**	**2.61**	**3.57**
Siderite	$FeCO_3$	**0.54**	-0.52	**0.41**	**0.27**	**0.52**	**0.64**	**0.33**	-1.01	**0.61**	**0.84**	-1.18	**0.42**	**0.55**	-2.61	**0.31**	-2.77	-0.57	-1.71	-2.86	**0.33**
Melanterite	$FeSO_4{:}7H_2O$	-5.32	-6.93	-4.69	-4.91	-6.23	-5.32	-5.35	-7.14	-4.75	-5.34	-7.01	-5.62	-5.89	-8.69	-5.78	-8.87	-6.12	-6.87	-8.29	-6.69
Rhodochrosite	$MnCO_3$	**-0.09**	**0.47**	**-0.08**	-0.65	**0.09**	**-0.10**	**-0.49**	**-0.41**	**-0.19**	**-0.21**	**-0.23**	**-0.29**	**-0.29**	-1.44	**-0.14**	-1.74	-1.26	**-0.37**	-1.16	**-0.03**
Birnessite	MnO_2	-22.75	-19.30	-19.70	-18.01	-17.22	-23.07	-17.85	-18.47	-24.78	-25.42	-21.08	-21.91	-22.75	-19.37	-23.91	-14.80	-23.64	-12.38	-13.36	-14.38
Manganite	MnOOH	-10.16	-8.03	-8.58	-8.20	-7.43	-10.19	-7.99	-8.16	-11.17	-11.59	-9.56	-9.76	-10.27	-9.25	-10.07	-6.01	-11.37	-4.39	-4.58	-5.73
Gypsum	$CaSO_4{:}2H_2O$	-1.64	-2.09	-1.06	-1.18	-2.55	-1.68	-1.61	-1.82	-1.21	-1.87	-1.69	-1.92	-2.20	-2.00	-1.23	**0.13**	-1.88	**-0.03**	**-0.12**	-2.69
Calcite	$CaCO_3$	**0.20**	**0.30**	**0.03**	**-0.04**	**0.17**	**0.29**	**0.05**	**0.31**	**0.12**	**0.28**	**0.11**	**0.13**	**0.21**	**0.04**	**0.88**	**2.20**	**-0.41**	**1.11**	**1.31**	**0.31**
Magnesite	$MgCO_3$	-1.11	-1.04	-1.19	-1.42	-1.13	-0.92	-1.25	-0.99	-1.10	-0.97	-0.80	-1.13	-1.08	-1.25	**-0.35**	-0.63	-1.68	**-0.48**	-1.03	-1.01
Barite	$BaSO_4$	**0.87**	**0.14**	**1.09**	**1.03**	**0.03**	**0.88**	**0.94**	**0.50**	**1.27**	**0.59**	**0.49**	**0.60**	**0.05**	**0.22**	**0.72**	**1.04**	**0.36**	**1.27**	**0.83**	**-0.17**
Witherite	$BaCO_3$	-2.62	-2.80	-3.16	-3.15	-2.58	-2.50	-2.74	-2.70	-2.73	-2.59	-3.04	-2.69	-2.88	-3.06	-2.52	-2.22	-3.47	-2.92	-3.08	-2.50
Fluorite	CaF_2	-1.87	-2.06	-3.40	-1.79	-2.35	-3.40	-1.94	-3.36	-2.16	-1.88	-1.77	-3.38	-1.87	-2.00	-0.87	-0.74	-2.43	**0.23**	-1.06	-3.51
CoCO3	$CoCO_3$	-4.07	-3.37	-3.82	-3.82	-3.74	-3.79	-4.23	-3.84	-4.14	-4.00	-3.76	-3.44	-3.99	-4.21	-3.35	-3.04	-3.78	-3.82	-3.60	-3.59
Carbon Dioxide	pCO2(g)	-1.61	-1.85	-1.65	-1.40	-1.34	-1.76	-1.45	-1.60	-1.76	-1.58	-1.32	-1.62	-1.66	-1.44	-2.84	-3.57	-1.48	-3.07	-4.40	-2.04

		S-AM-1S	S-LMW-1S	S-LMW-2S	S-LMW-4S	S-LMW-5S	S-LMW-6S	S-PZ-1S	S-PZ-9D	S-UG-3
Water Type		Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-SO4	Ca-SO4	Ca-HCO3	Ca-HCO3	Ca-HCO3
Charge Balance	%	-1.30	-0.69	-1.24	**-8.32**	-2.38	-4.08	1.12	-0.90	1.37
Otavite	$CdCO_3$		-2.75	-2.34	-2.67	-2.45	-2.13	-2.23		-2.43
Ferrihydrite	$Fe(OH)_3$	**3.36**	**2.39**	**1.75**	**3.88**	**0.92**	**0.95**	**3.03**	**1.98**	**1.36**
Siderite	$FeCO_3$	-0.74	-3.78	-4.03	-1.13	-1.71	-1.85	**0.23**	**0.43**	-3.00
Melanterite	$FeSO_4{:}7H_2O$	-8.36	-9.57	-9.14	-6.92	-6.35	-6.53	-5.20	-4.73	-8.72
Rhodochrosite	$MnCO_3$	**0.53**	-0.94	-0.54	**-0.10**	**-0.29**	-0.74	**-0.26**	**-0.07**	**0.00**
Birnessite	MnO_2	-12.02	-9.34	-9.14	-9.75	-15.17	-15.12	-15.39	-17.36	-11.59
Manganite	MnOOH	-4.41	-3.86	-3.68	-3.99	-6.58	-6.83	-6.36	-7.33	-4.59
Gypsum	$CaSO_4{:}2H_2O$	-3.43	-1.46	-1.06	-1.73	-0.63	-0.63	-1.52	-1.06	-1.67
Calcite	$CaCO_3$	**0.15**	**0.27**	**0.04**	**0.04**	**0.00**	**0.05**	**-0.11**	**0.11**	**0.03**
Magnesite	$MgCO_3$	-1.21	-1.04	-1.27	-1.19	-1.31	-1.19	-1.44	-1.11	-1.33
Barite	$BaSO_4$	-1.21	**0.74**	**0.73**	**0.37**	**0.87**	**0.70**	**0.55**	**0.76**	**0.62**
Witherite	$BaCO_3$	-2.95	-2.85	-3.51	-3.19	-3.84	-3.96	-3.37	-3.41	-3.02
Fluorite	CaF_2	-3.51	-3.44	-3.32	-3.38	-3.35	-3.31	-3.50	-3.38	-3.43
CoCO3	$CoCO_3$	-2.96	-3.44	-3.38	-4.17	-3.70	-3.22	-4.01	-4.04	-2.90
Carbon Dioxide	pCO2(g)	-1.88	-1.83	-1.39	-0.93	-1.37	-1.23	-1.98	-1.71	-1.51

Notes:
Charge balances greater than 5% shown in red
Saturation indices >=-0.5 shown in bold and gray
Blank cells represent the absense of that mineral in the sample
Most recent sampling data used to calculate saturation indicies
pCO2(g) values presented at $10^{\wedge value}$ atm
atm = atmospheres
CA-HCO3 = water sample with calcium as the dominant cation and bicarbonate as the dominant anion
Ca-SO4 = water sample with calcum as the dominant cation and sulfate as the dominant anion

Table 6
Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results
Monitored Natural Attenuation Evaluation
Sioux Energy Center, St. Charles County, MO

Mineral	Mineral Formula	Sample Location									
		IW-2S	IW-2M	IW-2D	EW-3S	EW-3M	EW-3D	S-BH-01-S	S-BH-01-M	S-BH-01-D	S-BH-01
		Sample Interval (ft bgs)									
		40-48	75-80	125-129	35-40	70-80	120-125	20-27	45-54	100-110	93-96
Quartz	SiO_2	68.7	63.4	60.7	61.8	66.5	40.1	72.4	58.2	68.5	60.4
Plagioclase	$(NaSi,CaAl)AlSi_2O_8$	13.8	17.4	15.6	16.5	12.7	8.3	13.8	19.6	13.5	15.8
K-Feldspar	$KAlSi_3O_8$	7.1	6.8	8.4	10.1	12.6	7.0	6.5	10.4	5.4	11.1
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	3.2	3.8	1.8	4.5	3.9	3.9	2.1	3.6	3.2	2.7
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	2.1	1.7	3.2	2.1	-	1.6	1.9	2.3	1.9	1.5
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$	1.4	1.7	2.5	0.8	1.1	1.2	0.8	0.3	1.3	0.6
Diopside	$CaMgSi_2O_6$	1.4	2.9	2.6	2.6	2.8	-	1.2	2.5	2.2	3.1
Pyrite	FeS_2	0.1	0.1	-	0.2	-	-	0.1	0.3	0.1	-
Hematite	Fe_2O_3	0.6	-	-	-	-	2.7	0.3	0.2	0.3	-
Montmorillonite	$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot nH_2O$	1.6	-	-	-	-	-	0.9	1.1	-	-
Baryte	$BaSO_4$	-	0.2	-	-	-	-	-	-	-	-
Rhodochrosite	$MnCO_3$	-	0.4	-	0.6	0.4	0.4	-	-	0.6	0.1
Calcite	$CaCO_3$	-	1.7	2.7	1.0	-	25.8	-	1.5	3.1	1.9
Dolomite	$CaMg(CO_3)_2$	-	-	2.5	-	-	7.4	-	-	-	2.8
Grossular	$Ca_3Al_2Si_3O_{12}$	-	-	-	-	-	1.6	-	-	-	-
Maghemite	$\gamma^{-}Fe_2O_3$	-	-	-	-	-	-	-	-	-	-
Paragonite	$NaAl_2(AlSi_3O_{10})(OH)_2$	-	-	-	-	-	-	-	-	-	-
Anhydrite	$CaSO_4$	-	-	-	-	-	-	-	-	-	-
Andalusite	Al_2SiO_5	-	-	-	-	-	-	-	-	-	-
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes:
Results provided in wt% - percent by weight of each mineral.
ft bgs - feet below ground surface.
Non-detect minerals within a sample are represented by "-".
Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.
Samples were collected by Golder Associates between May 5, 2021 and May 22, 2021.

Table 7
Summary of Sequential Analysis of Metals in Soils from Borings
Monitored Natural Attenuation Evaluation
Sioux Energy Center, St. Charles County, MO

Analyte	SEP Step	Sample Location									
		IW-2S	IW-2M	IW-2D	EW-3S	EW-3M	EW-3D	S-BH-01-S	S-BH-01-M	S-BH-01-D	S-BH-01
		Sample Interval (ft bgs)									
		40-48	75-80	125-129	35-40	70-80	120-125	20-27	45-54	100-110	93-96
Aluminum	SEP Step 1	< 49 U	< 52 U	< 42 U	< 50 U	< 48 U	< 43 U	< 50 U	< 47 U	< 45 U	< 44 U
Aluminum	SEP Step 2	6.1 J	10 J	7.4 J	< 37 U	11 J	19 J	< 37 U	7.8 J	8.8 J	19 J
Aluminum	SEP Step 3	55	49	25	42	30	83	38	48	51	110
Aluminum	SEP Step 4	690	470	270	520	330	270	530	530	420	450
Aluminum	SEP Step 5	88 J	31 J	38 J	40 J	73 J	100 J	70 J	99 J	76 J	44 J
Aluminum	SEP Step 6	1100	690	1500	780	300	1400	700	870	710	540
Aluminum	SEP Step 7	27000	19000	29000	30000	24000	12000	21000	30000	21000	28000
Aluminum	SEP SUM	29000	21000	30000	32000	24000	14000	22000	31000	22000	30000
Aluminum	SEP Total[1]	2100	1800	1200	1400	900 F1	3200	1700	2000	1500	1600
Aluminum	SEP Total[2]	31000 B	37000 B	14000 B	29000 B	28000 B	22000 B	29000	45000	30000	41000
Iron	SEP Step 1	< 25 U	< 26 U	< 21 U	< 25 U	< 24 U	13 J	< 25 U	< 23 U	< 22 U	< 22 U
Iron	SEP Step 2	14 J	170.0	300	100	99	290	13 J	110	370	86
Iron	SEP Step 3	1400	680	890	450	170	1100	590	390	1200	800
Iron	SEP Step 4	3200	1500	1600	1600	1000	1700	2000	1200	1300	1300
Iron	SEP Step 5	< 92 U	< 97 U	< 79 U	< 93 U	84 J B	< 81 U	< 93 U	< 88 U	< 84 U	< 83 U
Iron	SEP Step 6	3800	2000	5000	1900	800	5900	2600	2000	2500	1400
Iron	SEP Step 7	3100	3000	3600	3500	1000	3900	2500	2700	6200	1300
Iron	SEP SUM	12000	7400	11000	7500	3200	13000	7700	6400	12000	4900
Iron	SEP Total[1]	11000	7900	11000	5700	4700	10000	5300	4400	6400	4000
Iron	SEP Total[2]	8100	5300	5500	3700	2100	9400	7500	7200	10000	6200
Molybdenum	SEP Step 1	< 9.8 U	0.99 J	< 8.4 U	0.92 J	0.86 J	< 8.6 U	< 9.9 U	< 9.3 U	< 8.9 U	< 8.9 U
Molybdenum	SEP Step 2	< 7.4 U	< 7.8 U	< 6.3 U	< 7.4 U	< 7.2 U	< 6.4 U	< 7.5 U	< 7.0 U	< 6.7 U	< 6.7 U
Molybdenum	SEP Step 3	0.35 J	0.32 J	0.16 J	0.32 J	0.21 J	< 2.1 U	< 2.5 U	< 2.3 U	< 2.2 U	0.25 J
Molybdenum	SEP Step 4	< 2.5 U	0.22 J	< 2.1 U	0.23 J	0.18 J	< 2.1 U	< 2.5 U	< 2.3 U	< 2.2 U	0.12 J
Molybdenum	SEP Step 5	< 37 U	< 39 U	< 31 U	< 37 U	< 36 U	< 32 U	< 37 U	< 35 U	< 33 U	< 33 U
Molybdenum	SEP Step 6	< 2.5 U	< 2.6 U	0.13 J	< 2.5 U	< 2.4 U	0.17 J	< 2.5 U	< 2.3 U	< 2.2 U	< 2.2 U
Molybdenum	SEP Step 7	< 2.5 U	0.12 J	< 2.1 U	0.17 J	< 2.4 U	< 2.1 U	< 2.5 U	< 2.3 U	< 2.2 U	0.13 J
Molybdenum	SEP SUM	0.35 J	1.7 J	0.30 J	1.6 J	1.2 J	0.17 J	< 2.0 U	< 2.0 U	< 2.0 U	0.50 J
Molybdenum	SEP Total[1]	0.54 J	2.0 J	0.37 J	1.5 J	3.1	0.38 J	< 4.6 U	< 4.3 U	< 4.1 U	0.91 J
Molybdenum	SEP Total[2]	0.46 J	2.1 J	0.47 J	1.3 J	1.1 J	0.15 J	0.12 J	0.31 J	0.11 J	0.90 J

Notes:

All Results displayed in milligram per kilogram (mg/kg).

ft bgs - feet below ground surface.

1 = result using SEP_Tot_Prep method

2 = result using 3050B method

U= The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ= The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit, the quantitation limit is considered estimated.

J= The analyte was positively identified. The associated numerical value is the approximate concentration.

J+= The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample and biased high.

B= Compound was found in the blank and sample.

Table 7
Summary of Sequential Analysis of Metals in Soils from Borings
Monitored Natural Attenuation Evaluation
Sioux Energy Center, St. Charles County, MO

SEP: Sequential Extraction Procedure.

Step 1 - Exchangeable Phase: This extraction includes trace elements that are reversibly adsorbed to soil minerals, amorphous solids, and organic material by electrostatic forces.

Step 2 - Carbonate Phase: This extraction targets trace elements that are adsorbed or otherwise bound to carbonate minerals.

Step 3 - Non-Crystalline Materials Phase: This extraction targets trace elements that are complexed by amorphous minerals (e.g. iron).

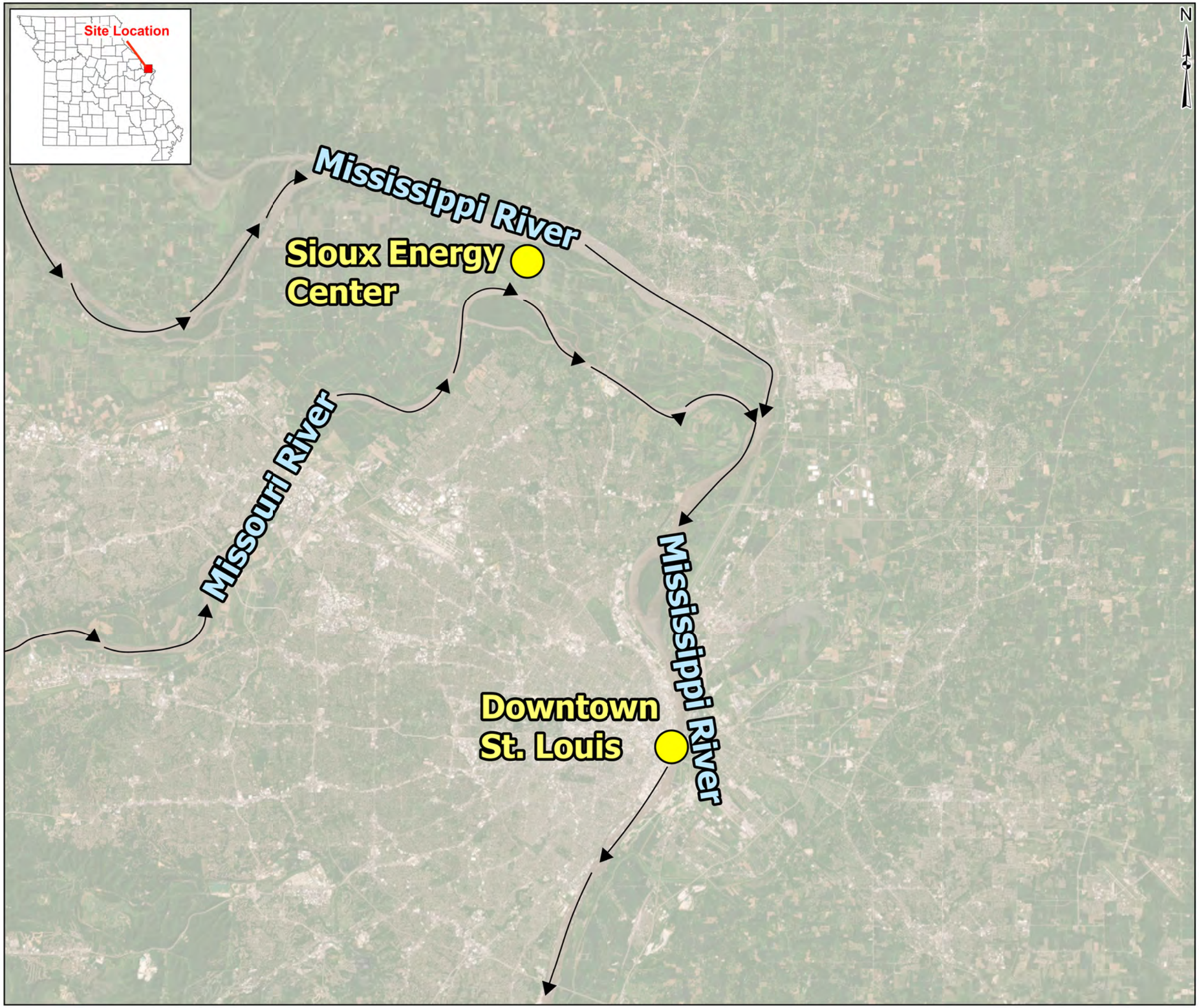
Step 4 - Metal Hyrdoxide Phase: This extraction targets trace elements bound to hydroxides of iron, manganese, and/or aluminum.

Step 5 - Organic Phase: This extraction targets trace elements strongly bound via chemisorption to organic material.

Step 6 - Acid/Sulfide Fraction: The extraction is used to identify trace elements precipitated as sulfide minerals.

Step 7 - Residual Fraction: Trace elements remaining in the soil aftrer the previous extractions will be distributed between silicates, phosphates, and refractory oxides.

FIGURES



TITLE

SITE LOCATION MAP

N

River Flow Direction

NOTES

1. All boundaries and locations are approximate.

REFERENCES

1. Ameren Missouri Sioux Energy Center, Sioux Property Control Map, February 2011.

0 2.5 5 10 Miles

PROJECT
CCR RULE GROUNDWATER MONITORING PROGRAM

CLIENT
AMEREN MISSOURI
SIOUX ENERGY CENTER

Ameren

ROCKSMITH GEOENGINEERING

DESIGN	JSI	YYYY-MM-DD	2024-05-31
PREPARED	JSI	PROJECT No.	23009-24MNA
REVIEW	AMT		
APPROVED	MNH		FIGURE 1

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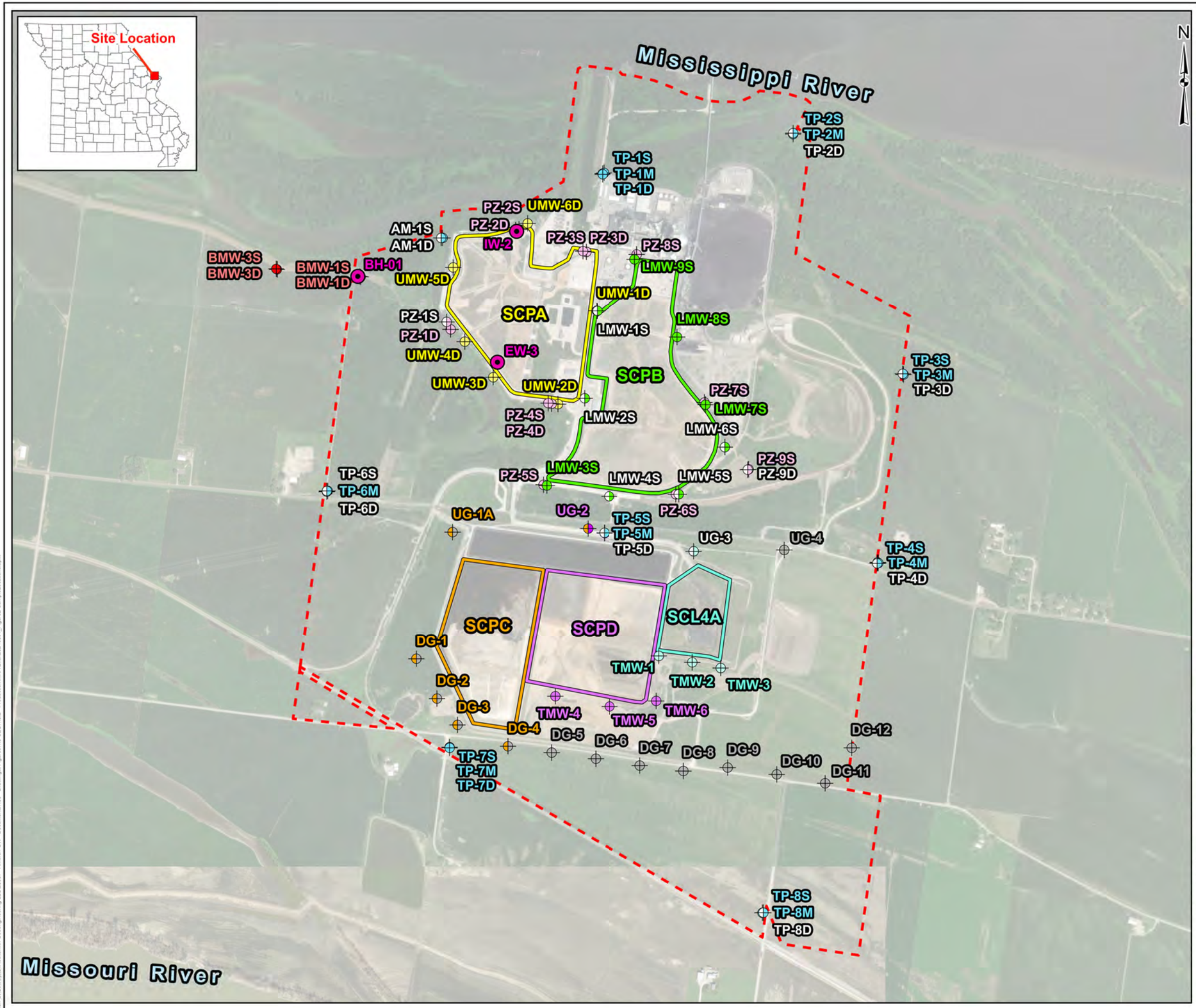

TITLE

SIOUX ENERGY CENTER GROUNDWATER MONITORING PROGRAMS AND SAMPLE LOCATION MAP

Legend

- Sioux Energy Center Property Boundary

Groundwater and Porewater Sampling Locations

- Background Monitoring Well
- SCPA Monitoring Well
- Nature and Extent Monitoring Well
- SCPA Corrective Action and Nature and Extent Monitoring Well
- NPDES Site Characterization Report Monitoring Well
- SCPA Corrective Action and NPDES Site Characterization Report Monitoring Well
- SCL4A Monitoring Well
- SCL4A, State UWL, and SCPA Corrective Action Monitoring Well
- SCPB Monitoring Well
- SCPB and SCPA Corrective Action Monitoring Well
- SCPC, SCPD, and State UWL Monitoring Well
- SCPC and State UWL Monitoring Well
- SCPD Monitoring Well
- State UWL Monitoring Well
- MNA Soil Samples

Sioux Energy Center CCR Units

- SCPA - Closed Bottom Ash Surface Impoundment
- SCPB - Closed Fly Ash Surface Impoundment
- SCL4A - Dry CCR Disposal Area
- SCPC - Closing FGD Surface Impoundment
- SCPD - FGD Surface Impoundment

NOTES

1. All boundaries and locations are approximate.
2. FGD - Flue Gas Desulfurization.
3. CCR - Coal Combustion Residuals.
4. UWL - Utility Waste Landfill.
5. MNA - Monitored Natural Attenuation.
6. NPDES - National Pollutant Discharge Elimination System.

REFERENCES

1. Ameren Missouri Sioux Energy Center, Sioux Property Control Map, February 2011

0 500 1,000 2,000 3,000 Feet

PROJECT
CCR RULE GROUNDWATER MONITORING PROGRAM

CLIENT
AMEREN MISSOURI
SIOUX ENERGY CENTER

ROCKSMITH GEOENGINEERING

DESIGN	JSI	YYYY-MM-DD	2024-05-31
PREPARED	JSI	PROJECT No.	23009-24MNA
REVIEW	ANT/GTM		
APPROVED	MNH		

FIGURE 2

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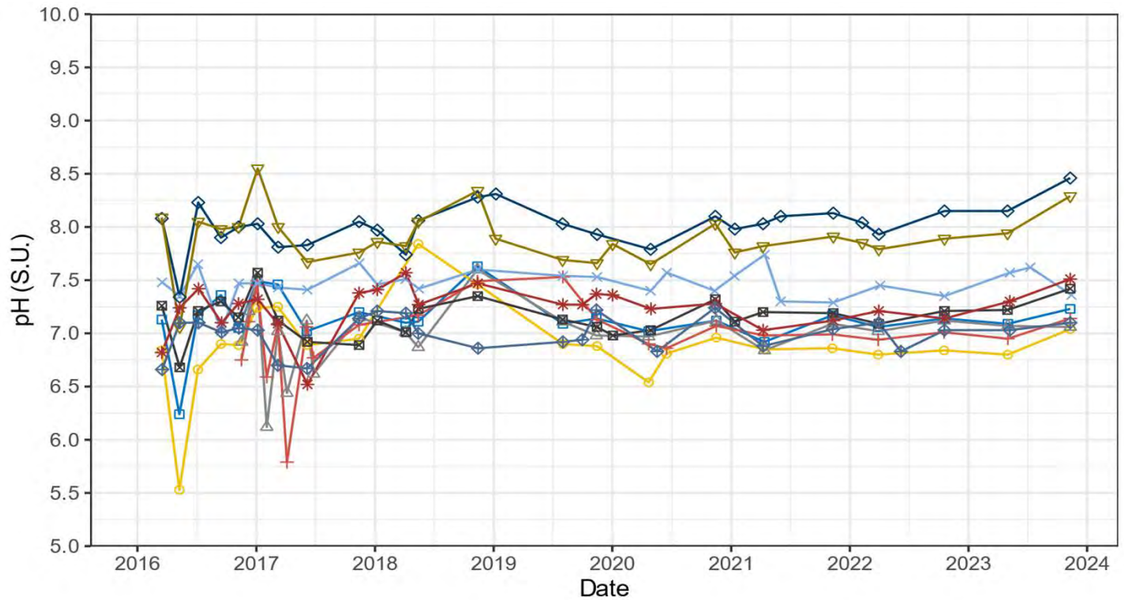

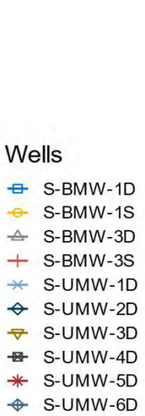

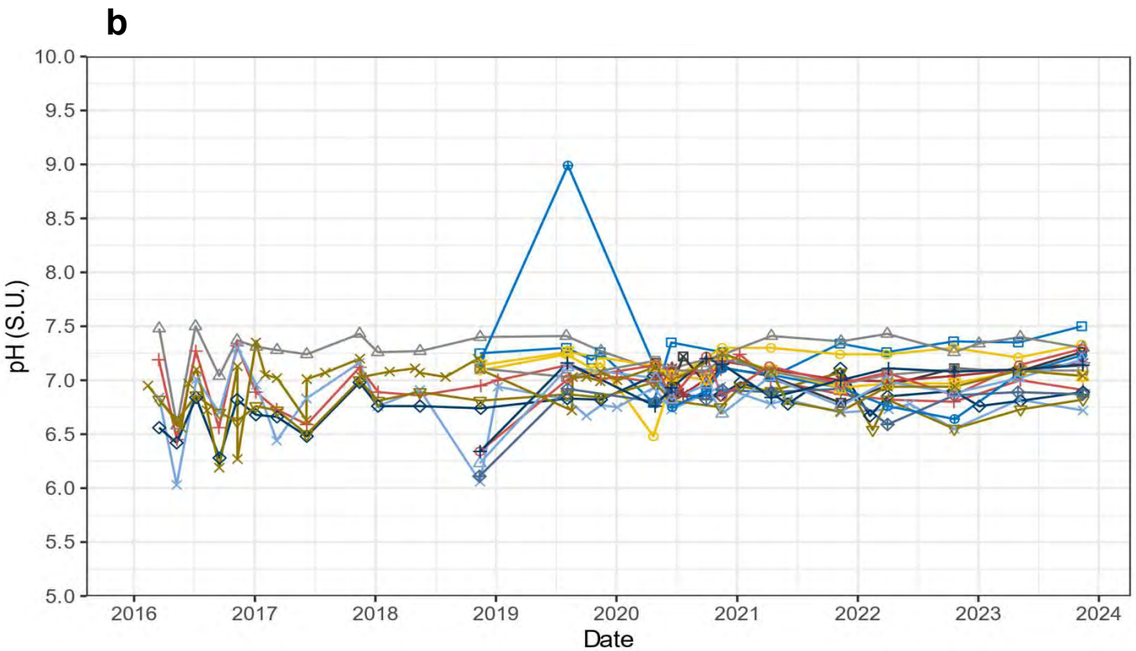

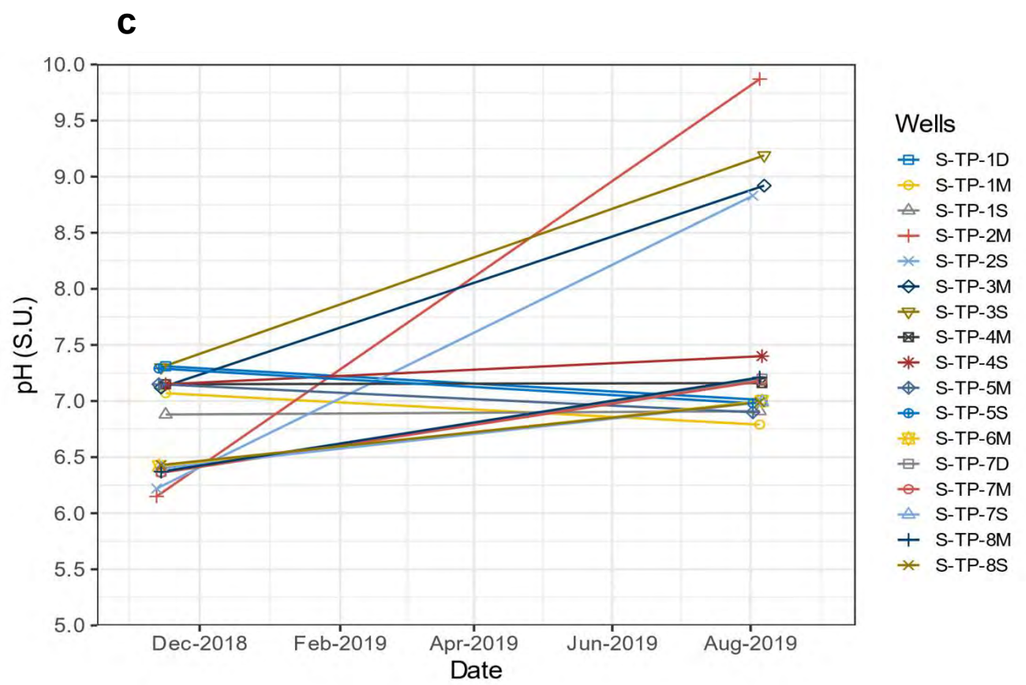

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
pH of Groundwater at (a) Compliance Monitoring and Background Wells, (b) Corrective Action Network Wells, and (c) Nature and Extent Wells

PROJECT NO.	PHASE	REV.	FIGURE
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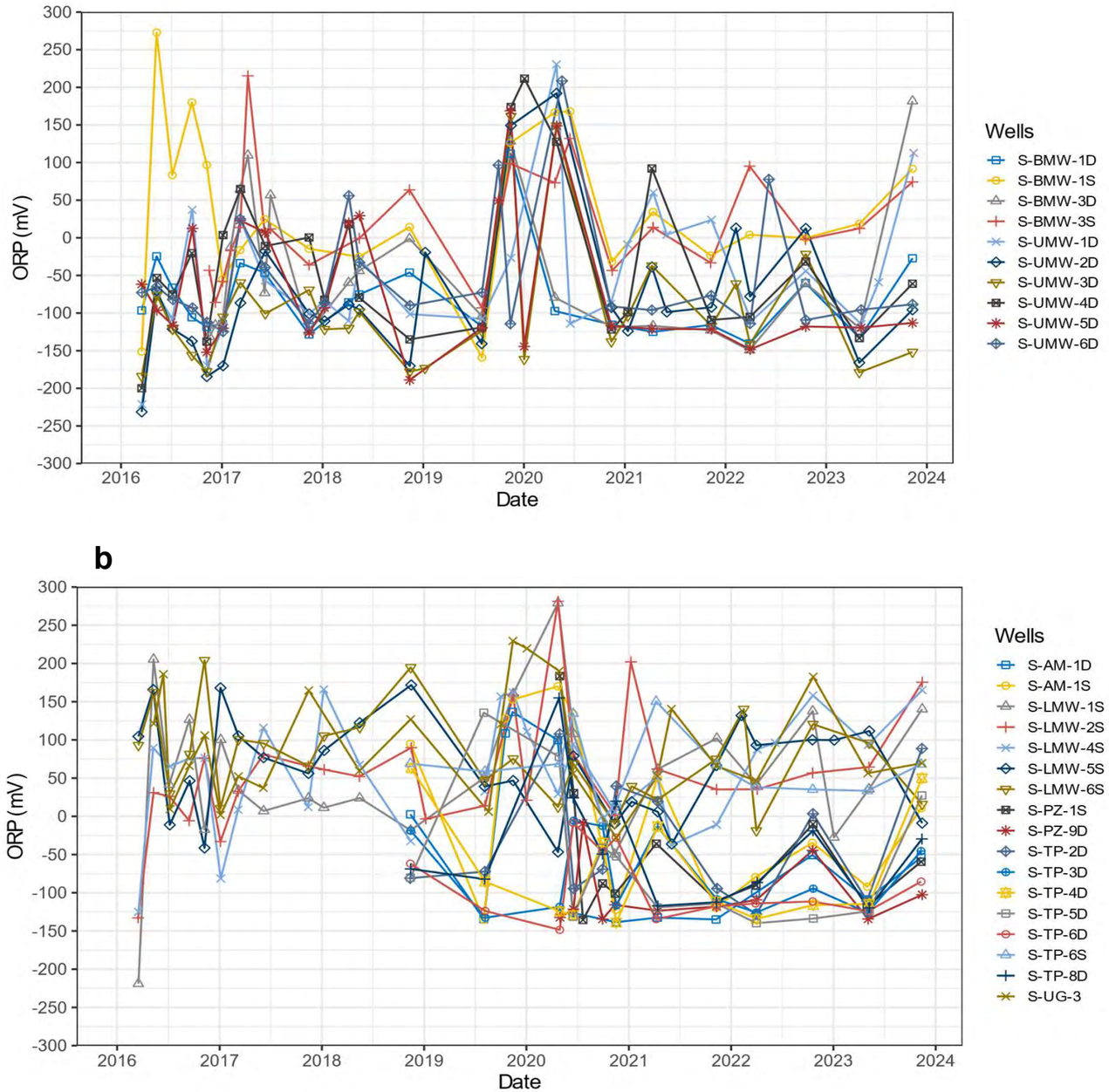


CLIENT
Ameren Missouri

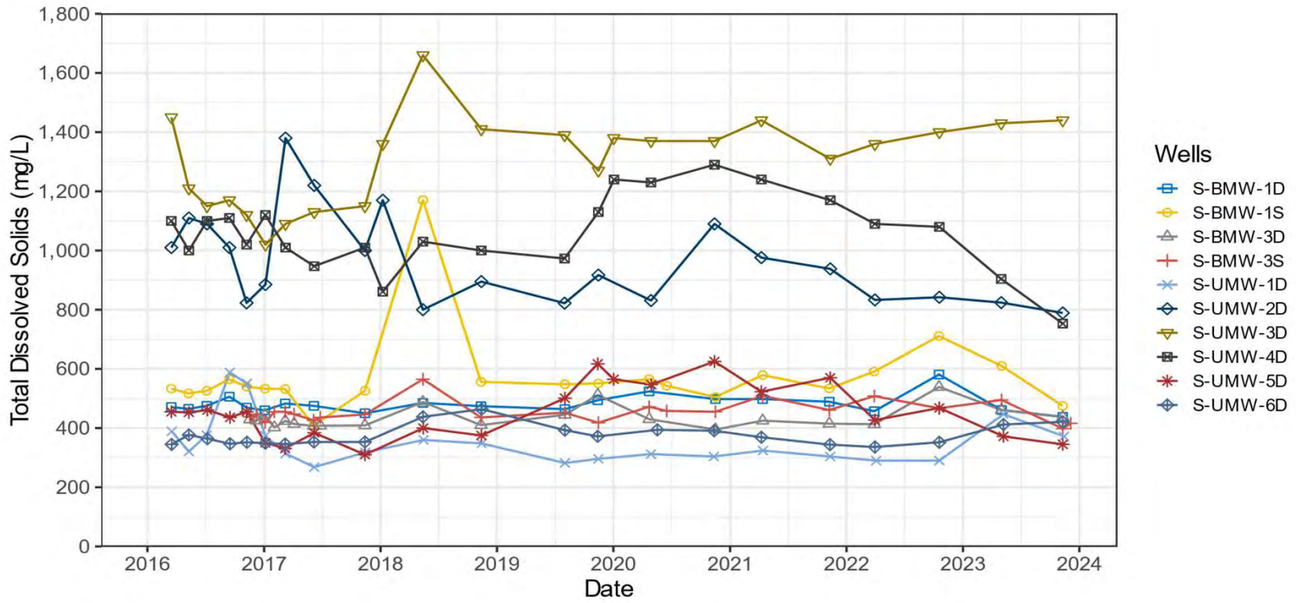
PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
ORP of Groundwater at (a) Compliance Monitoring and Background Wells, (b) Corrective Action Network Wells, and (c) Nature and Extent Wells

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	4

a



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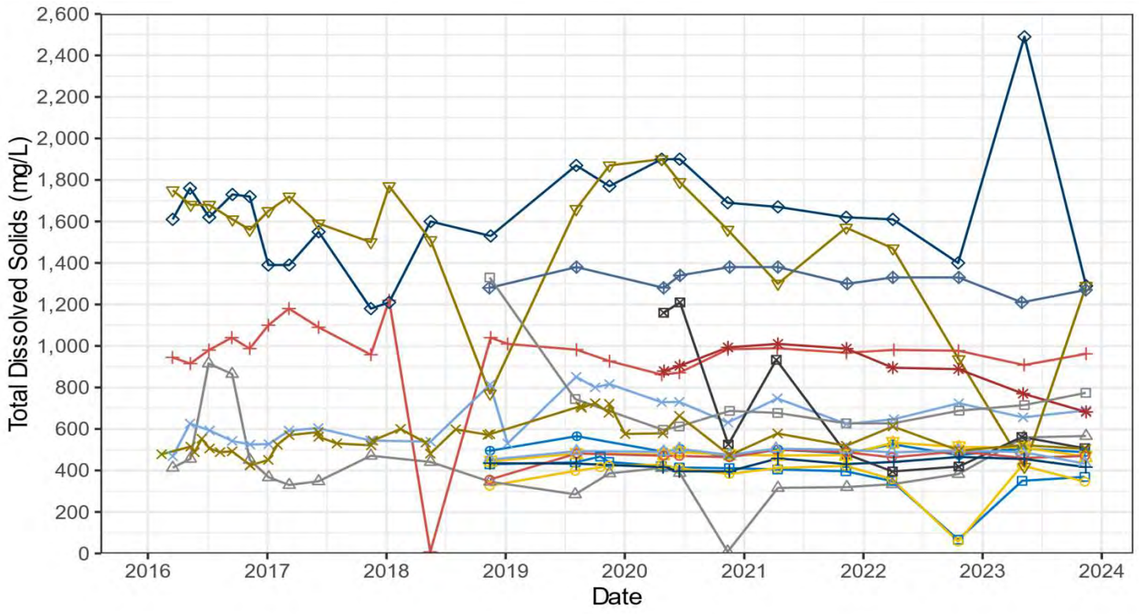

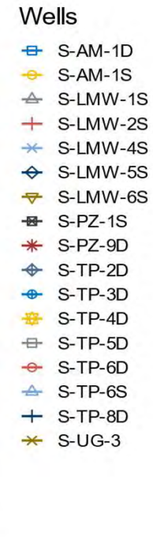

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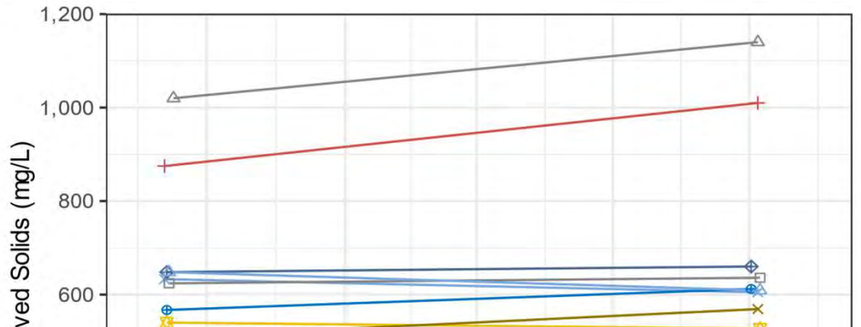

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT

TITLE
Total Dissolved Solids in Groundwater at (a) Compliance Monitoring and Background Wells, (b) Corrective Action Network Wells, and (c) Nature and Extent Wells

PROJECT NO.	PHASE	REV.	FIGURE
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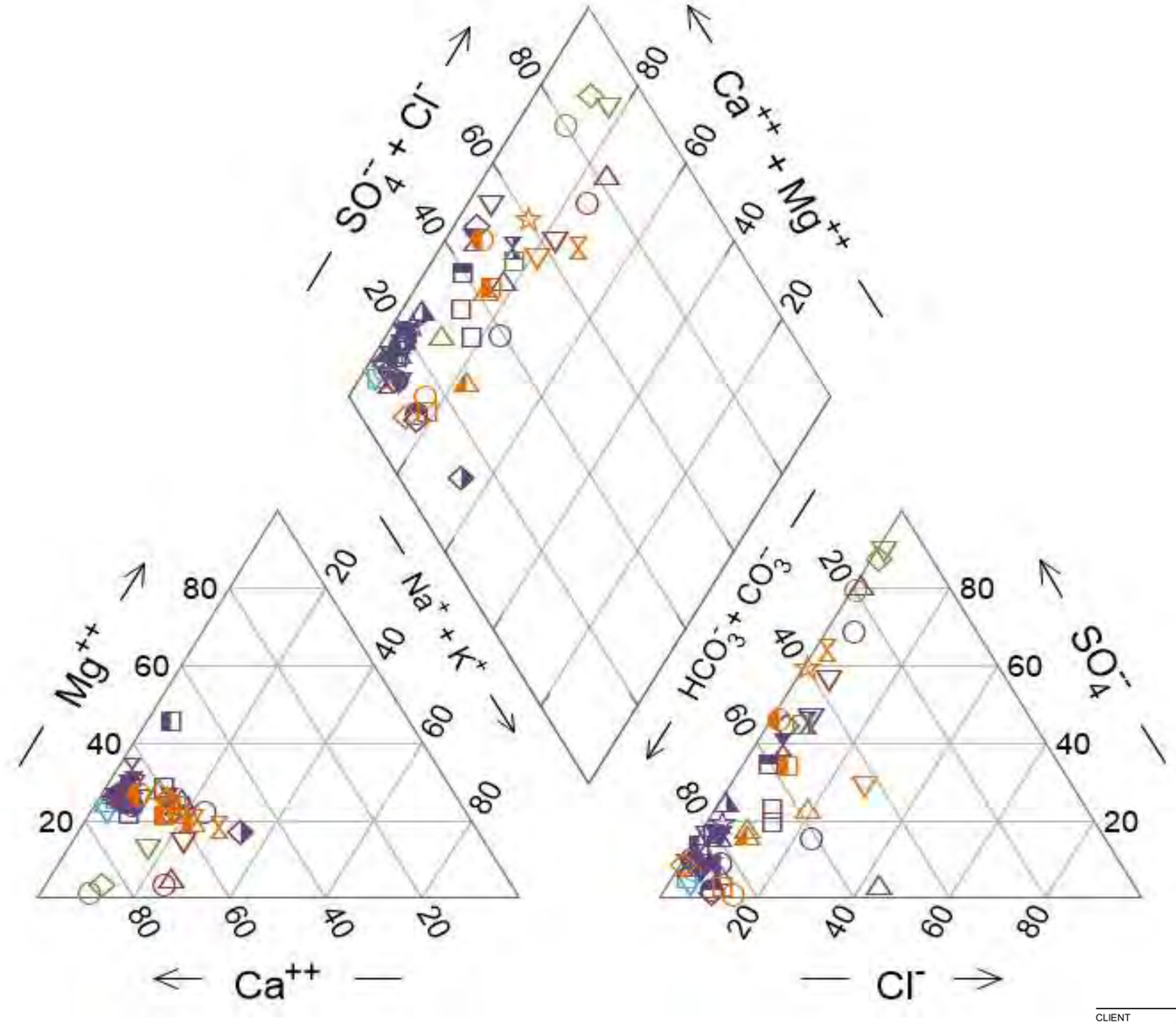


%meq/kg

CCR Unit Porewater Piezometers
- S-SCPA–1D
- S-SCPA–1S
- S-SCPA–2
- S-SCPA–3D
- S-SCPA–3S

Background
- S-BMW–1D
- S-BMW–3D
- S-BMW–1S
- S-BMW–3S

SCPA Compliance Monitoring
- S-UMW–1D
- S-UMW–2D
- S-UMW–3D
- S-UMW–4D
- S-UMW–5D
- S-UMW–6D

SCPA Corrective Action[1]
- S-AM–1D
- S-AM–1S
- S-LMW–1S
- S-LMW–2S
- S-LMW–4S
- S-LMW–5S
- S-LMW–6S
- S-PZ–1S
- S-PZ–9D
- S-UG–3

SCPA Nature and Extent Monitoring
- S-TP–1D
- S-TP–1M
- S-TP–1S
- S-TP–2D
- S-TP–2M
- S-TP–2S
- S-TP–3D
- S-TP–3M
- S-TP–3S
- S-TP–4D
- S-TP–4M
- S-TP–4S
- S-TP–5D
- S-TP–5M
- S-TP–5S
- S-TP–6D
- S-TP–6M
- S-TP–6S
- S-TP–7D
- S-TP–7M
- S-TP–7S
- S-TP–8D
- S-TP–8M
- S-TP–8S

Notes:
1 - Excluding wells also found in Nature and Extent monitoring network

CLIENT
Ameren Missouri

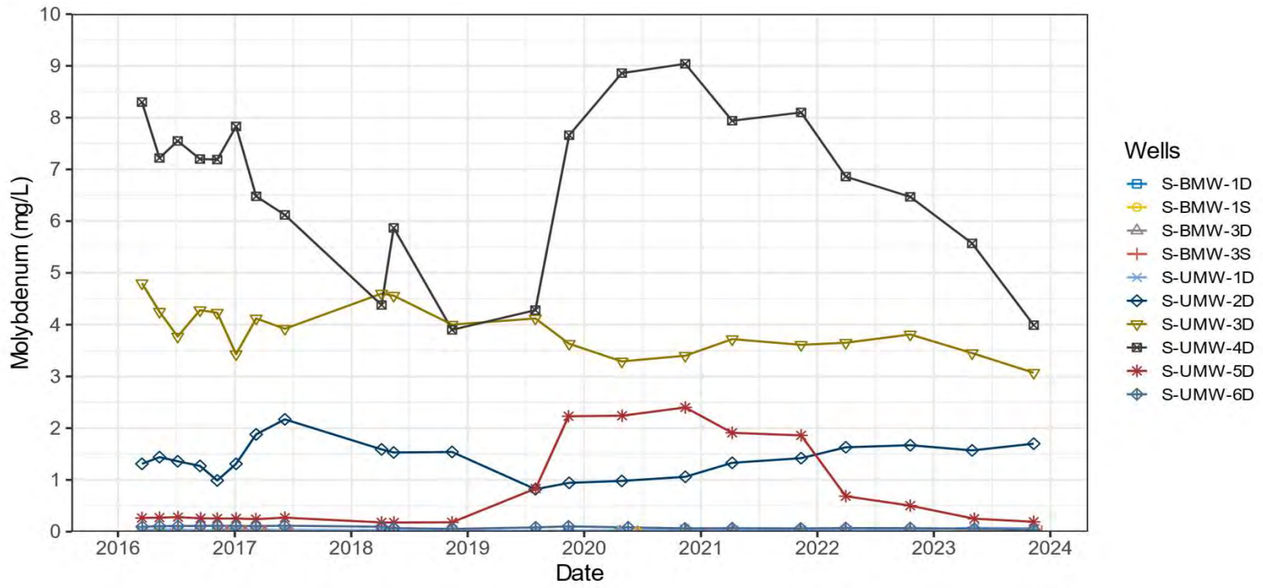
PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Trilinear Diagram – Groundwater Characterization of Compliance, Corrective Action, and Nature and Extent Monitoring Network Wells

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	6

a



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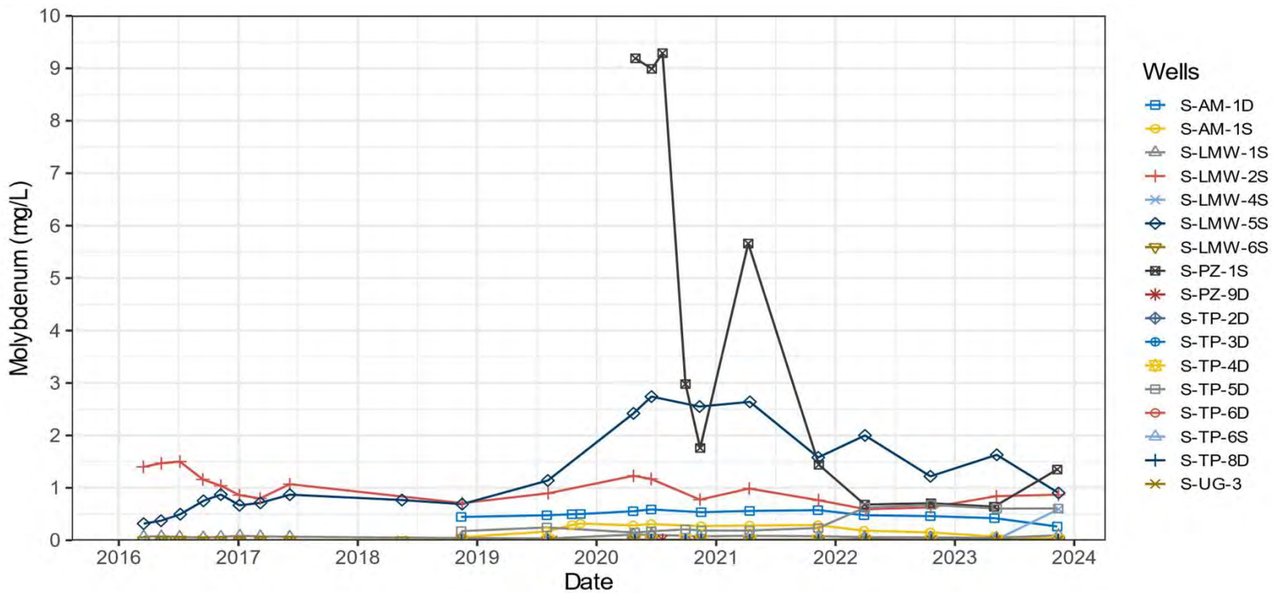

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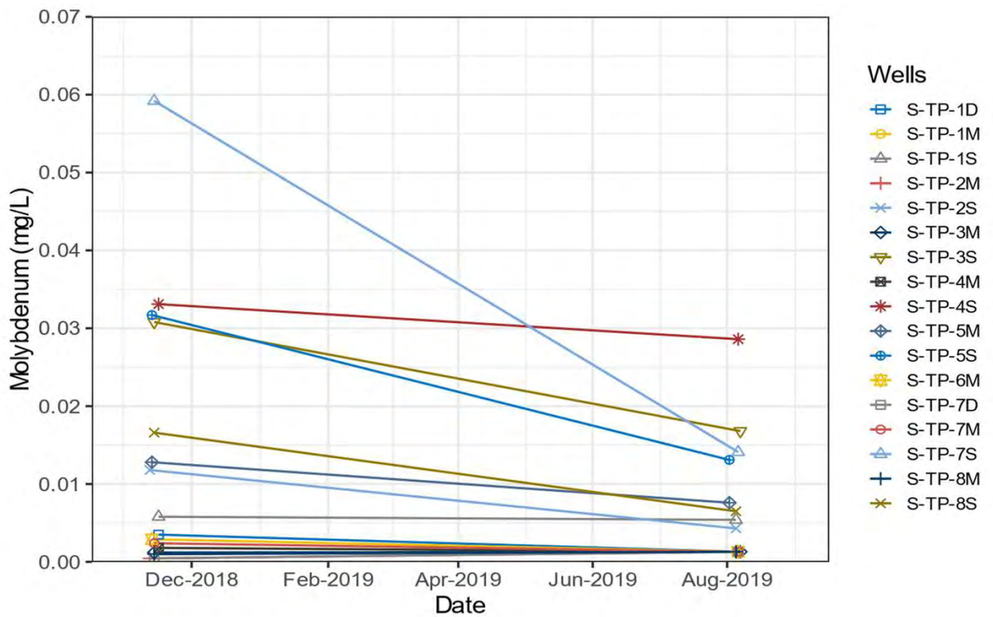

CLIENT
Ameren Missouri

CONSULTANT
wsp

PROJECT
Monitored Natural Attenuation Evaluation

TITLE
Molybdenum in Groundwater at (a) Compliance Monitoring and Background Wells, (b) Corrective Action Network Wells, and (c) Nature and Extent Wells

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	7

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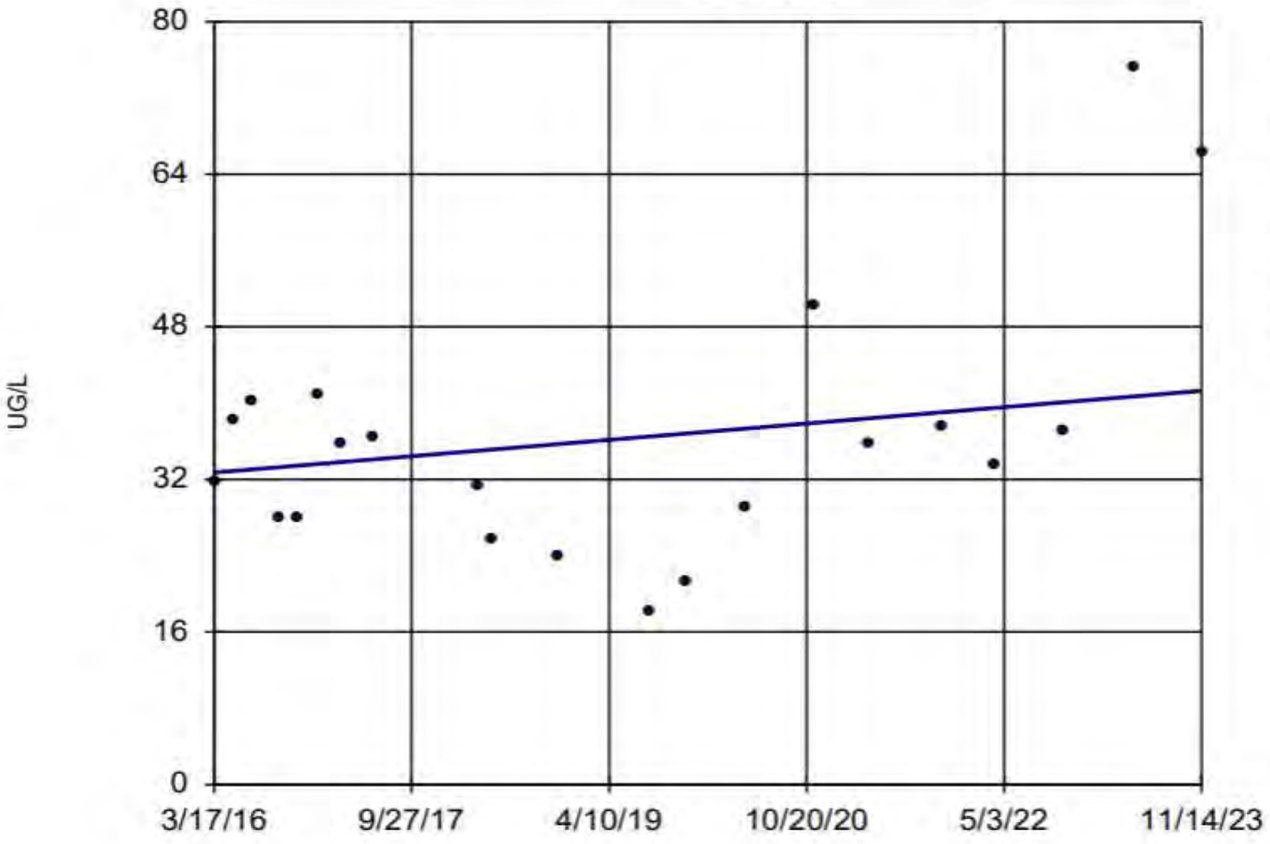
Sen's Slope Estimator

S-UMW-1D



n = 21

Slope = 1.117 units per year.

Mann-Kendall statistic = 30
critical = 78

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring
Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Mann-Kendall Test of Trend for Molybdenum at well UMW-1D for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	8

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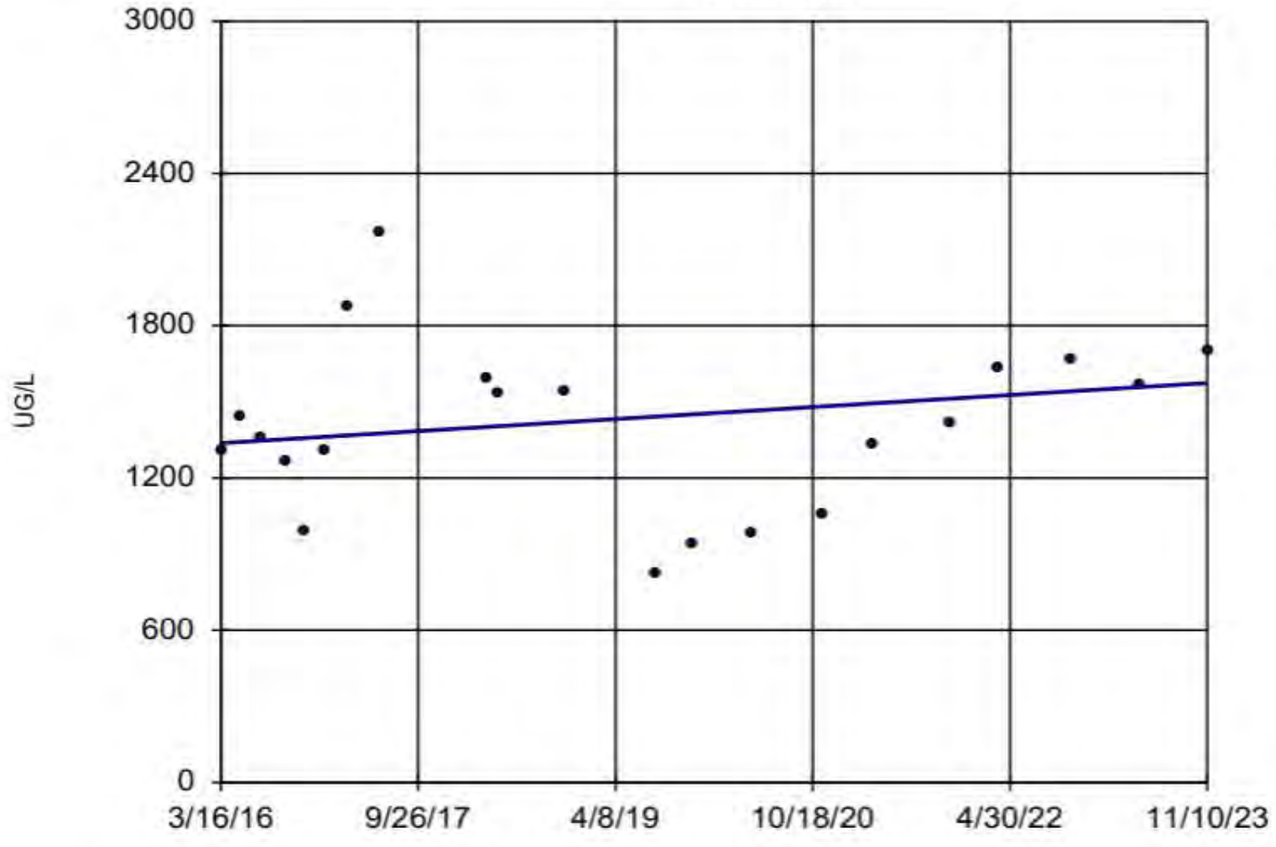
Sen's Slope Estimator

S-UMW-2D



n = 21

Slope = 30.86 units per year.

Mann-Kendall statistic = 39
critical = 78

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Mann-Kendall Test of Trend for Molybdenum at well UMW-2D for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	9

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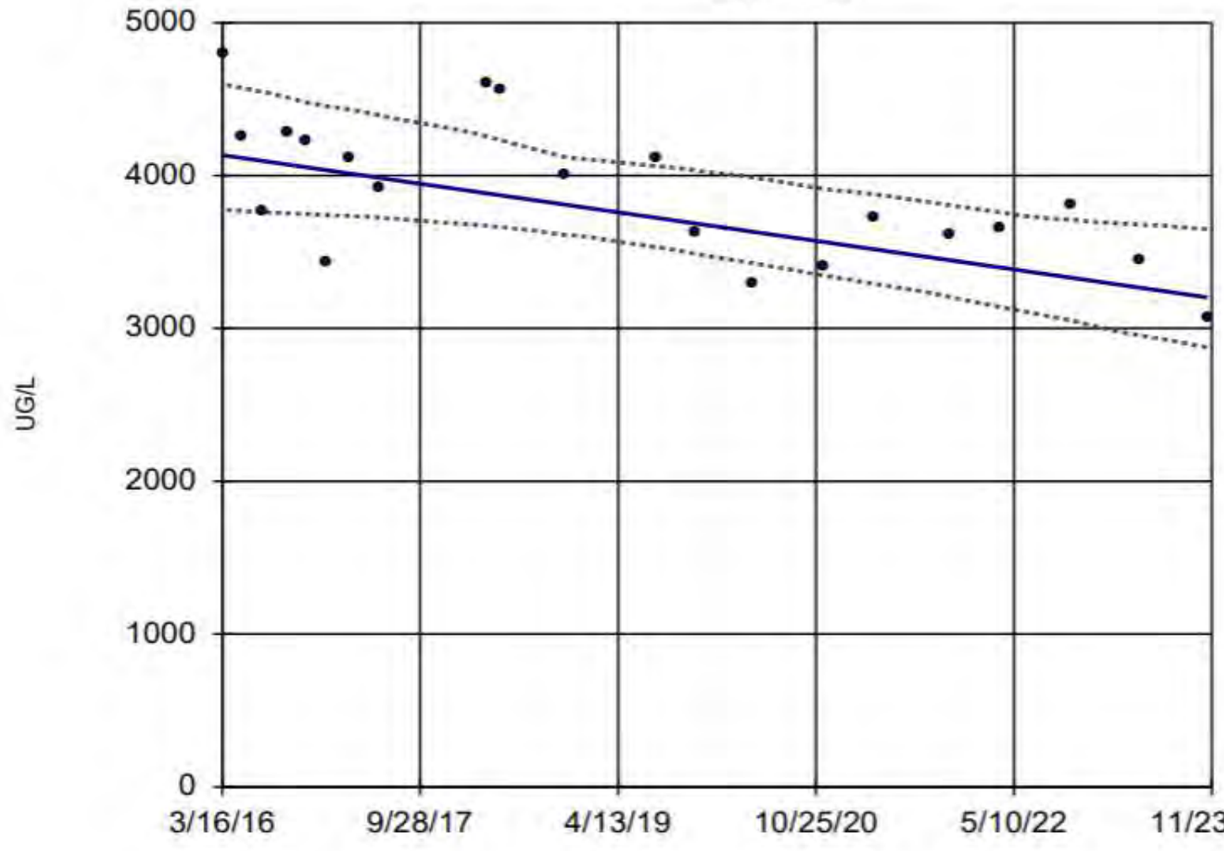
Sen's Slope and 95% Confidence Band

S-UMW-3D



n = 21

Slope = -121.4 units per year.

Mann-Kendall statistic = -103
critical = -78

Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring
Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Mann-Kendall Test of Trend for Molybdenum at well UMW-3D for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	10

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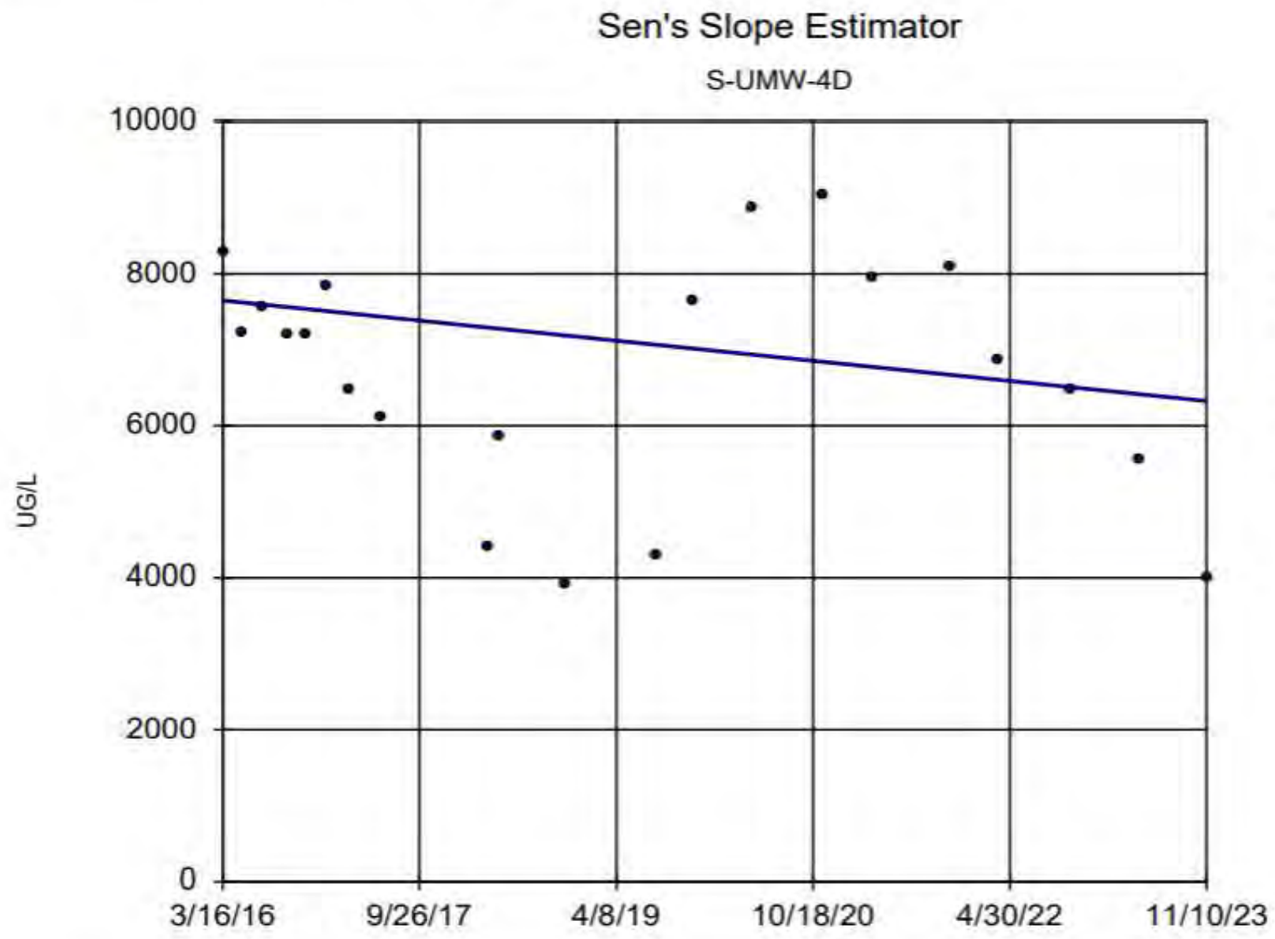

n = 21

Slope = -173.1 units per year.

Mann-Kendall statistic = -42
critical = -78

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring
Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT

TITLE
Mann-Kendall Test of Trend for Molybdenum at well UMW-4D for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	11

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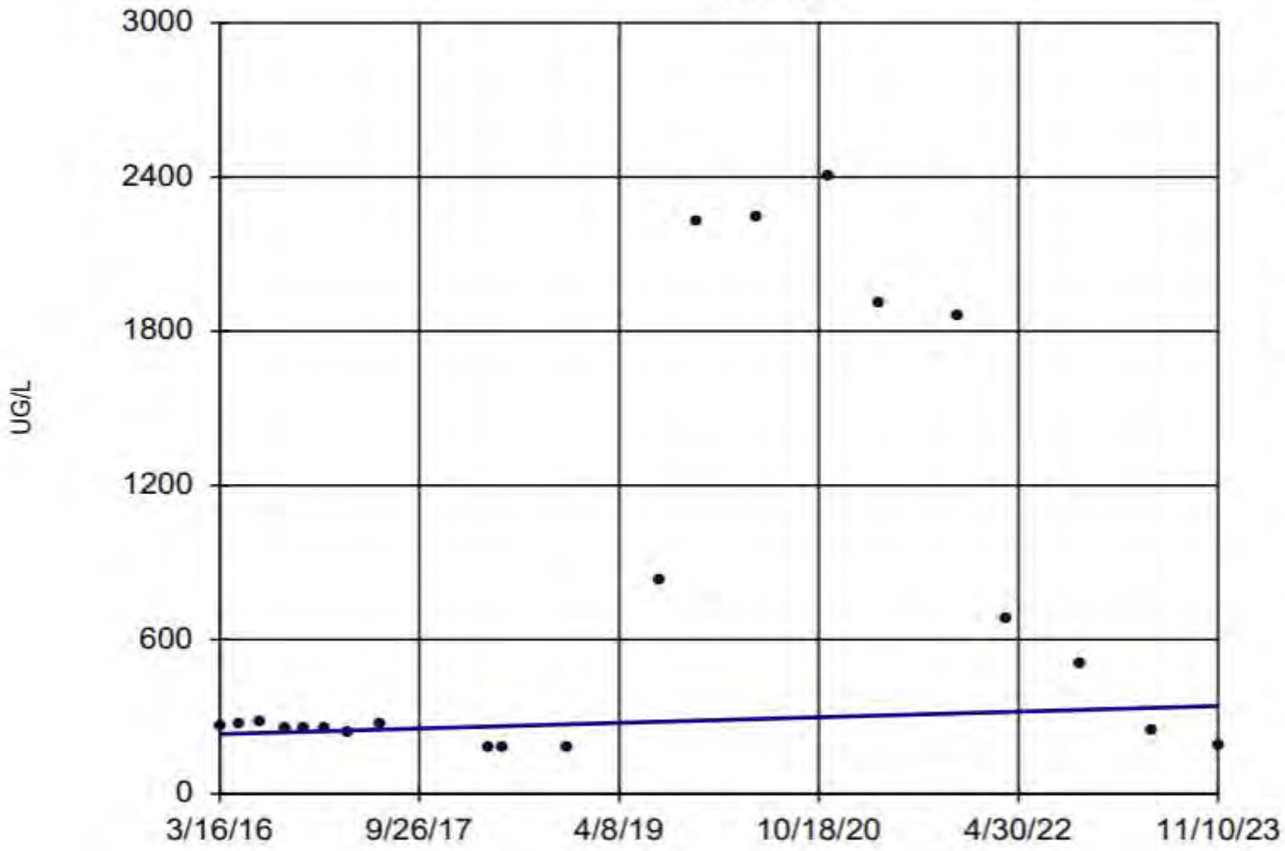
Sen's Slope Estimator

S-UMW-5D



n = 21

Slope = 14.3 units per year.

Mann-Kendall statistic = 18
critical = 78

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT

TITLE
Mann-Kendall Test of Trend for Molybdenum at well UMW-5D for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	12

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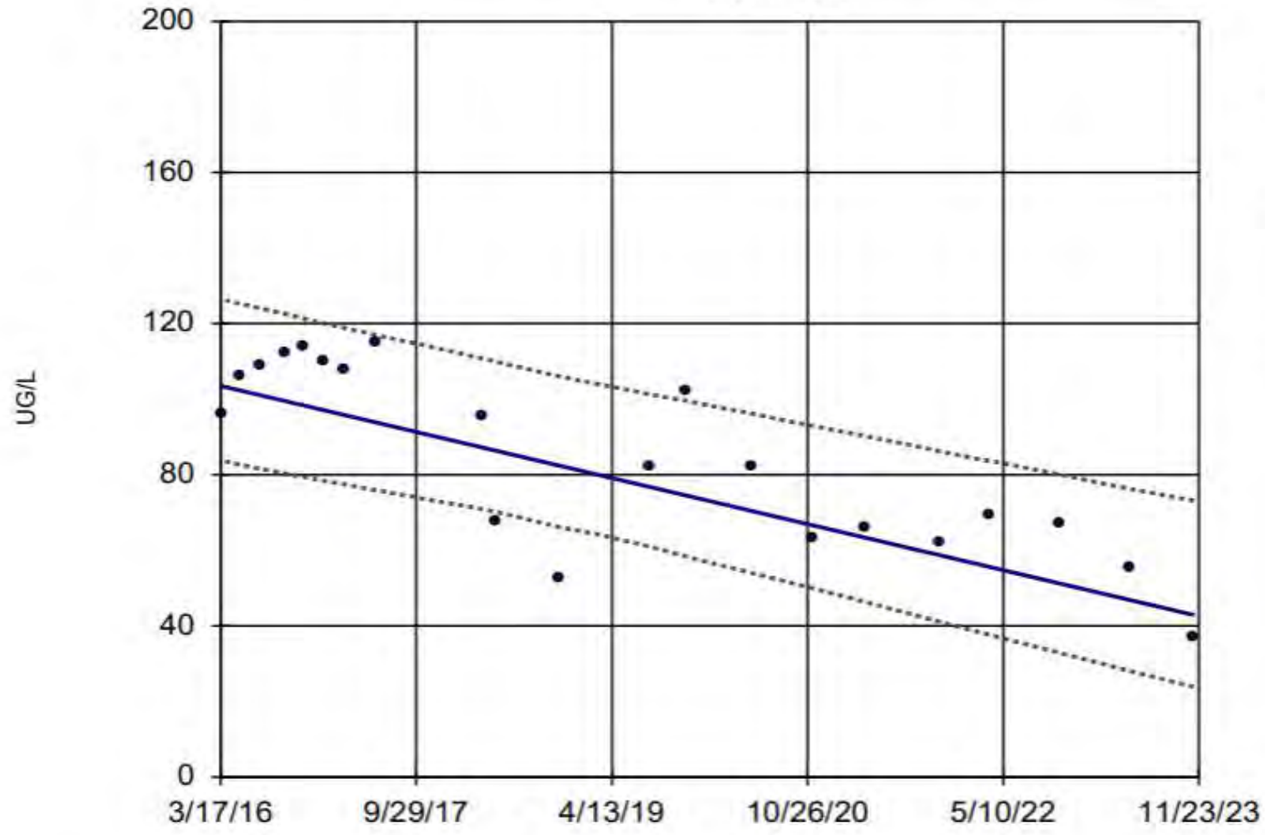
Sen's Slope and 95% Confidence Band

S-UMW-6D



n = 21

Slope = -7.923 units per year.

Mann-Kendall statistic = -118 critical = -78

Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT

TITLE
Mann-Kendall Test of Trend for Molybdenum at well UMW-6D for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	13

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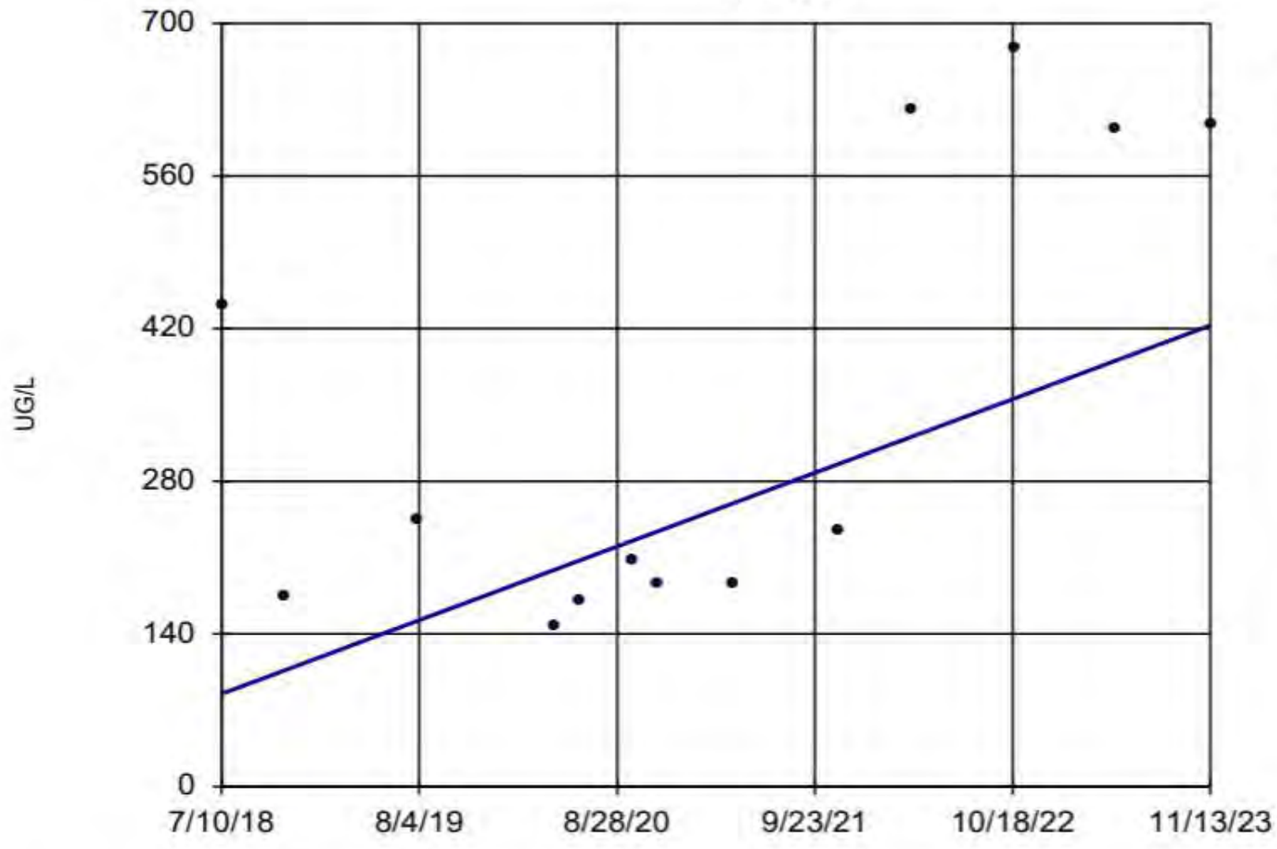
Sen's Slope Estimator

S-TP-5D



n = 13

Slope = 63.19 units per year.

Mann-Kendall statistic = 33
critical = 39

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Mann-Kendall Test of Trend for Molybdenum at well TP-5D for Molybdenum since 7/10/2018

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	14

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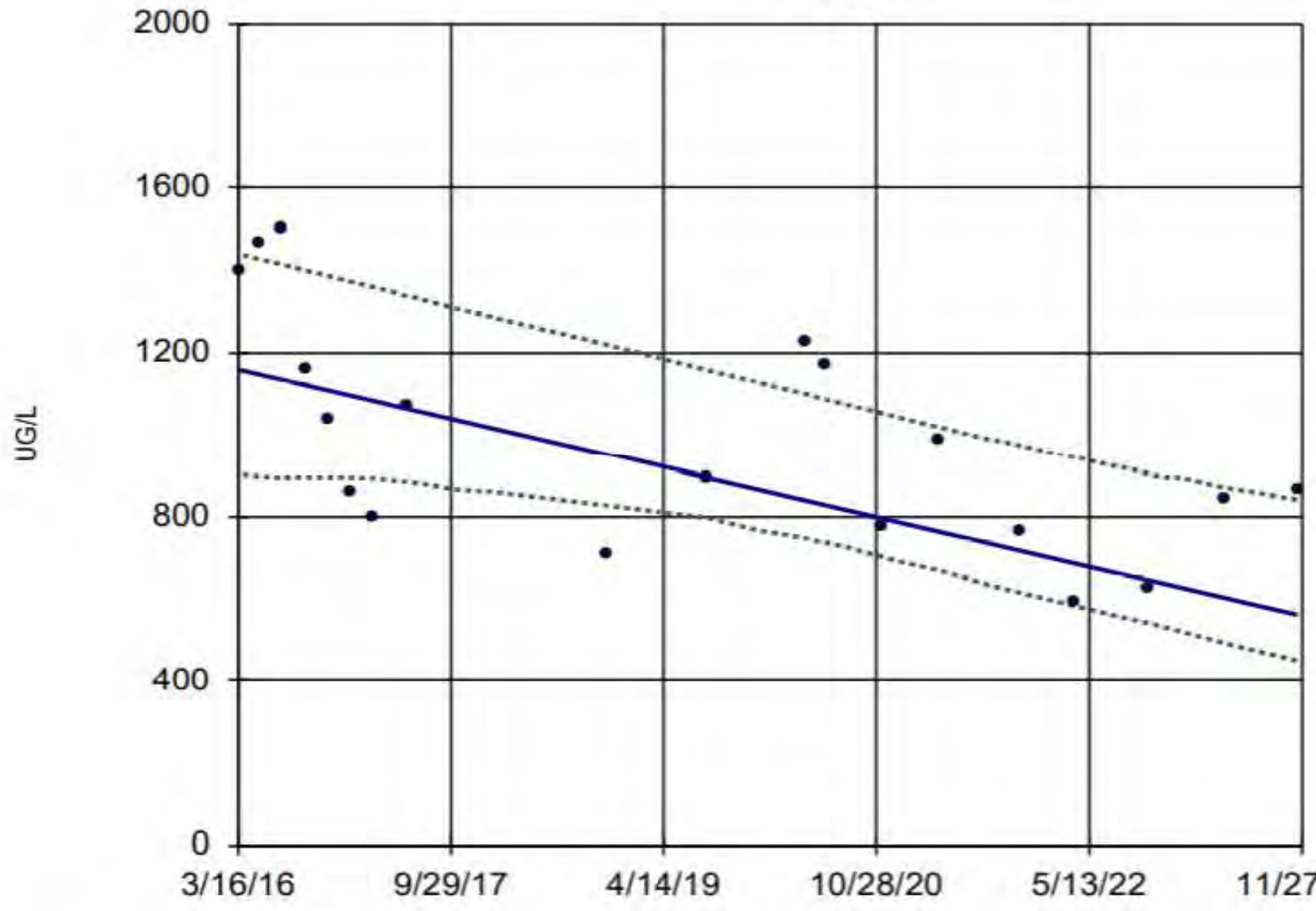
Sen's Slope and 95% Confidence Band

S-LMW-2S



n = 19

Slope = -78.06 units per year.

Mann-Kendall statistic = -81
critical = -68

Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Mann-Kendall Test of Trend for Molybdenum at well LMW-2S for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	15

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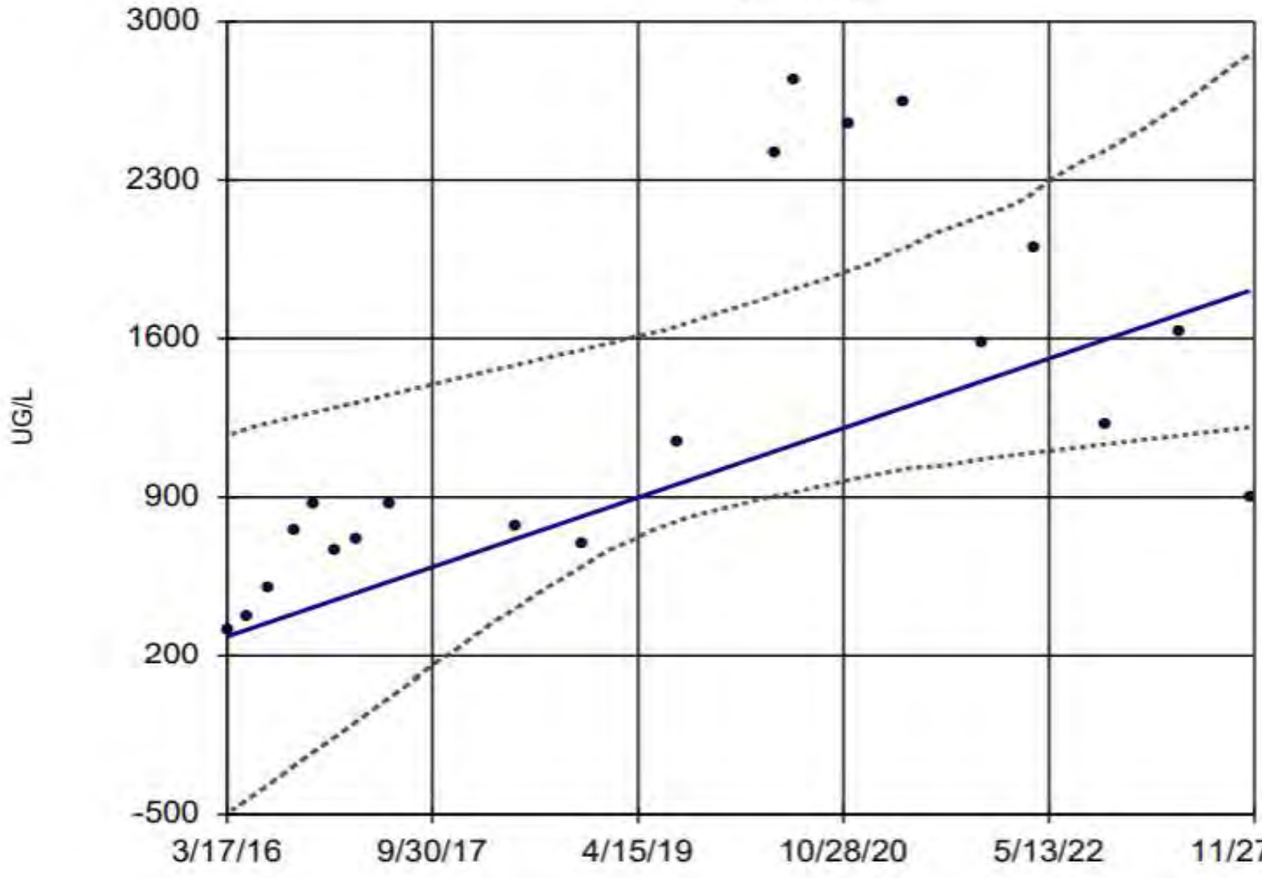
Sen's Slope and 95% Confidence Band

S-LMW-5S



n = 20

Slope = 199.1 units per year.

Mann-Kendall statistic = 106 critical = 73

Increasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT

TITLE
Mann-Kendall Test of Trend for Molybdenum at well LMW-5S for Molybdenum since 3/17/2016

PROJECT NO. US0023766.2548 | PHASE | REV. 0 | FIGURE 16

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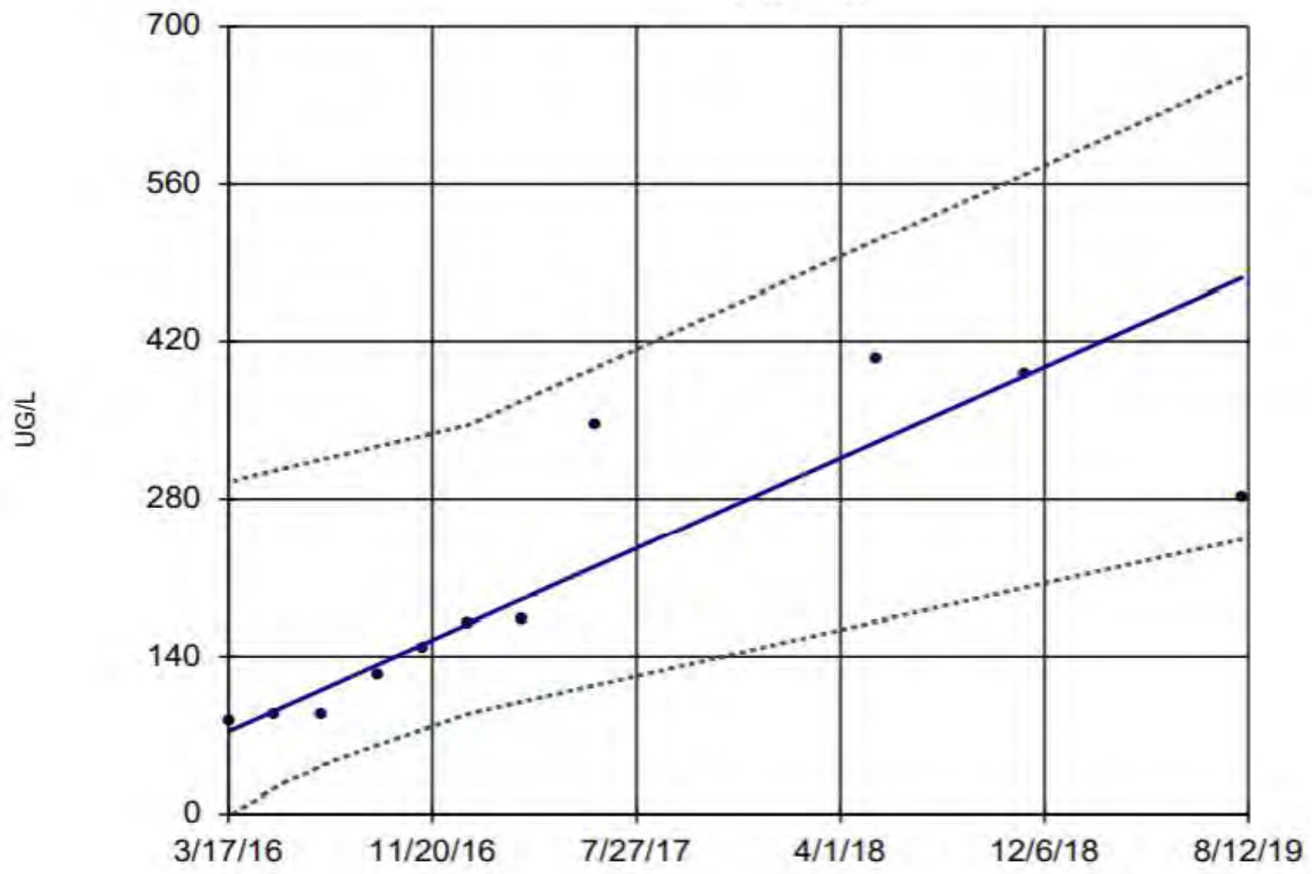
Sen's Slope and 95% Confidence Band

S-LMW-8S



n = 11

Slope = 118.8 units per year.

Mann-Kendall statistic = 47
critical = 31

Increasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT

TITLE
Mann-Kendall Test of Trend for Molybdenum at well LMW-8S for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	17

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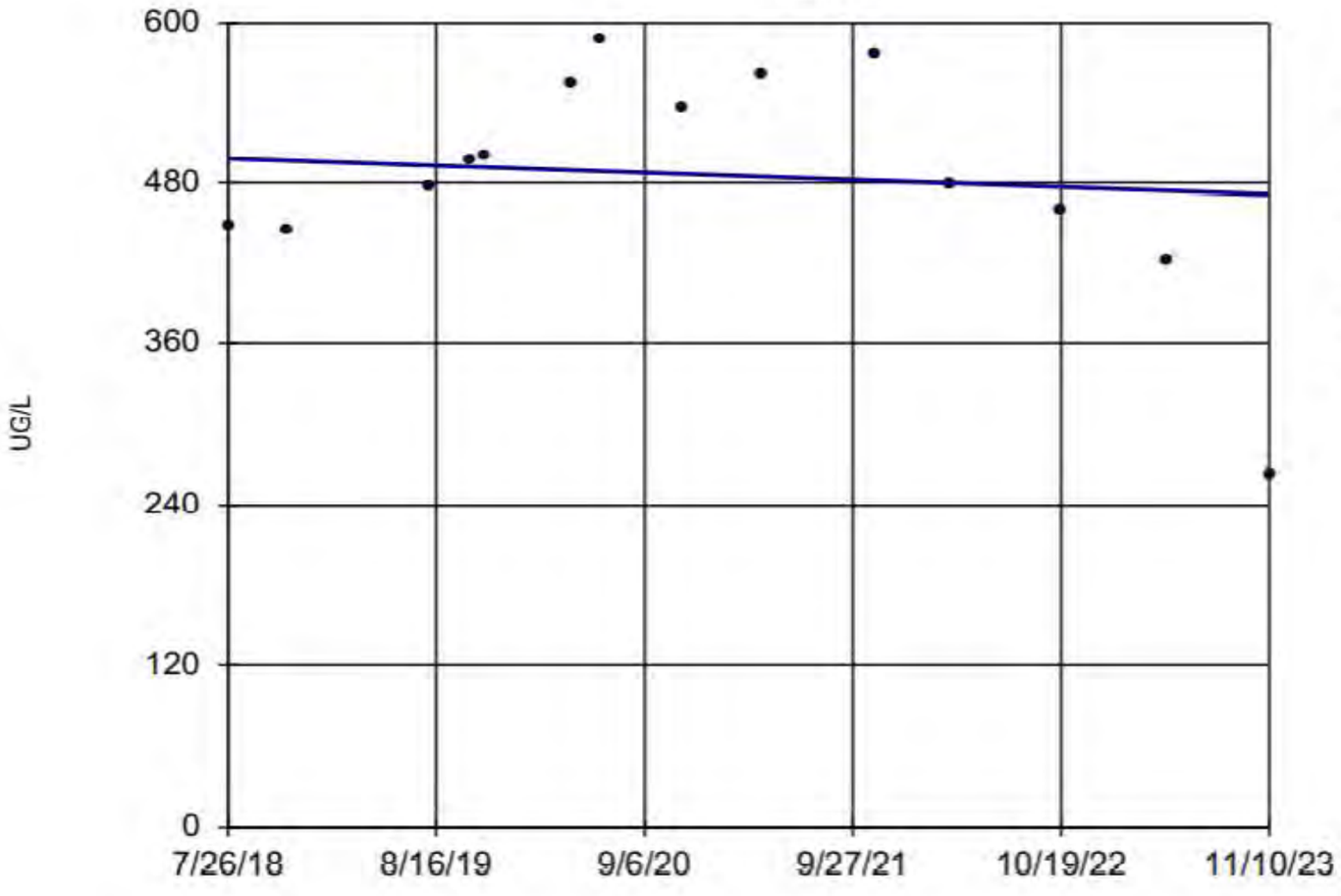
Sen's Slope Estimator

S-AM-1D



n = 14

Slope = -4.979 units per year.

Mann-Kendall statistic = -1
critical = -44

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring
Sioux E.C. Client: Ameren Data: SEC DATA

CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Mann-Kendall Test of Trend for Molybdenum at well AM-1D for Molybdenum since 3/17/2016

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	18

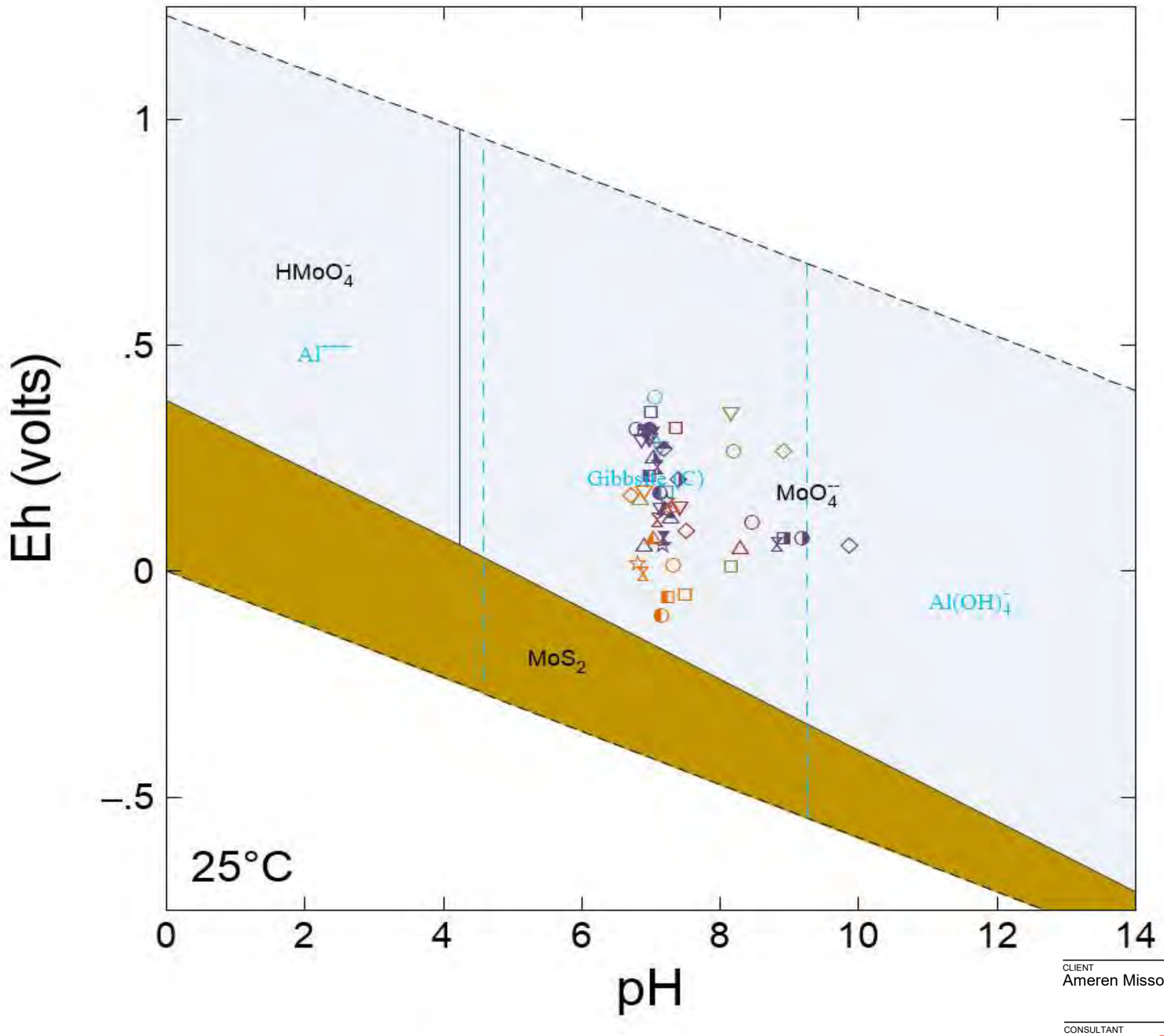


Diagram MoO_4^-, T = 25 °C, P = 1.013 bars, a [main] = 10^{-6}, a [H_2O] = 1, a [Al^{+++}] = 10^{-6} (speciates, a [SO_4^-] = 10^{-6}, a [HCO_3^-] = 10^{-6}; Suppressed: Diaspore, H_2MoO_4, $MoO_3(H_2O)_3$(aq), $MoO_3(H_2O)_3$(aq)

SCPA Compliance Monitoring

- S-UMW–1D
- S-UMW–2D
- S-UMW–3D
- S-UMW–4D
- S-UMW–5D
- S-UMW–6D

SCPA Corrective Action[1]

- S-AM–1D
- S-AM–1S
- S-LMW–1S
- S-LMW–2S
- S-LMW–4S
- S-LMW–5S
- S-LMW–6S
- S-PZ–1S
- S-PZ–9D
- S-UG–3

CCR Unit Porewater Piezometers

- S-SCPA–1D
- S-SCPA–1S
- S-SCPA–2
- S-SCPA–3D
- S-SCPA–3S

SCPA Nature and Extent Monitoring

- S-TP–1D
- S-TP–1M
- S-TP–1S
- S-TP–2D
- S-TP–2M
- S-TP–2S
- S-TP–3D
- S-TP–3M
- S-TP–3S
- S-TP–4D
- S-TP–4M
- S-TP–4S
- S-TP–5D
- S-TP–5M
- S-TP–5S
- S-TP–6D
- S-TP–6M
- S-TP–6S
- S-TP–7D
- S-TP–7M
- S-TP–7S
- S-TP–8D
- S-TP–8M
- S-TP–8S

Background

- S-BMW–1D
- S-BMW–3D
- S-BMW–1S
- S-BMW–3S

Notes:
1 - Excluding wells also found in Nature and Extent monitoring network

CLIENT
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PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Molybdenum Pourbaix Diagram - (with Aluminum Stability Overlaid)

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	19

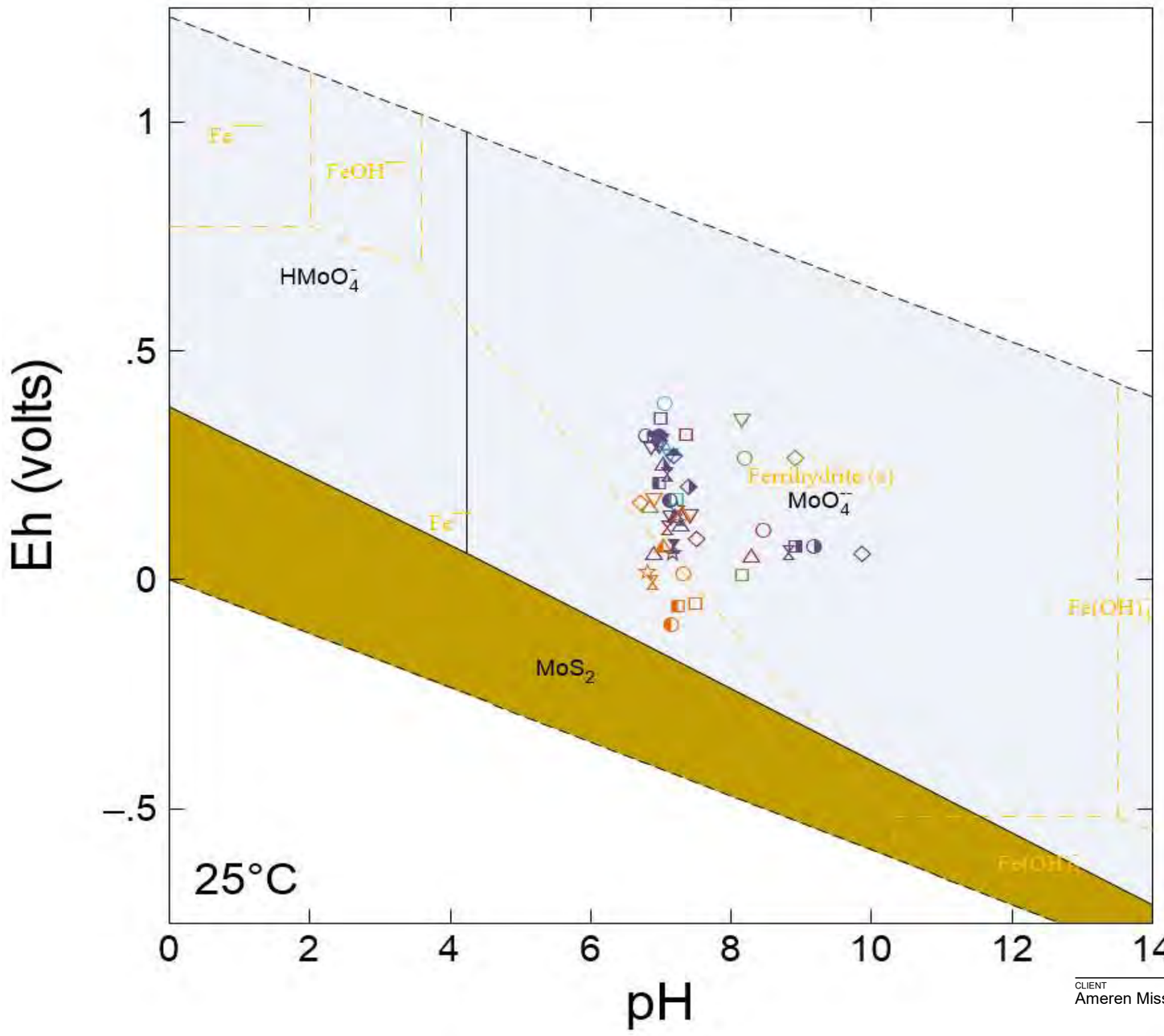

Diagram MoO_4^{--}, T = 25 °C, P = 1.013 bars, a [main] = 10^{-6}, a [H_2O] = 1, a [Fe^{++}] = 10^{-6} (speciates, a [HCO_3^-] = 10^{-6}, a [SO_4^{--}] = 10^{-6}; Suppressed: $Fe(OH)_2$ (am), $Fe(OH)_2$ (aq), $Fe(OH)_3$ (aq), $Fe(OH)_2$ (c), $Fe_3(OH)_8$, $FeOH^+$, Ferrihydrite (aged), Goethite, H_2MoO_4, Hematite, Lepidocrocite, Maghemite, Magnetite, $MoO_3(H_2O)_3$(aq)

SCPA Compliance Monitoring

- S-UMW–1D
- S-UMW–2D
- S-UMW–3D
- S-UMW–4D
- S-UMW–5D
- S-UMW–6D

SCPA Corrective Action[1]

- S-AM–1D
- S-AM–1S
- S-LMW–1S
- S-LMW–2S
- S-LMW–4S
- S-LMW–5S
- S-LMW–6S
- S-PZ–1S
- S-PZ–9D
- S-UG–3

CCR Unit Porewater Piezometers

- S-SCPA–1D
- S-SCPA–1S
- S-SCPA–2
- S-SCPA–3D
- S-SCPA–3S

SCPA Nature and Extent Monitoring

- S-TP–1D
- S-TP–1M
- S-TP–1S
- S-TP–2D
- S-TP–2M
- S-TP–2S
- S-TP–3D
- S-TP–3M
- S-TP–3S
- S-TP–4D
- S-TP–4M
- S-TP–4S
- S-TP–5D
- S-TP–5M
- S-TP–5S
- S-TP–6D
- S-TP–6M
- S-TP–6S
- S-TP–7D
- S-TP–7M
- S-TP–7S
- S-TP–8D
- S-TP–8M
- S-TP–8S

Background

- S-BMW–1D
- S-BMW–3D
- S-BMW–1S
- S-BMW–3S

Notes:
1 - Excluding wells also found in Nature and Extent monitoring network

CLIENT
Ameren Missouri

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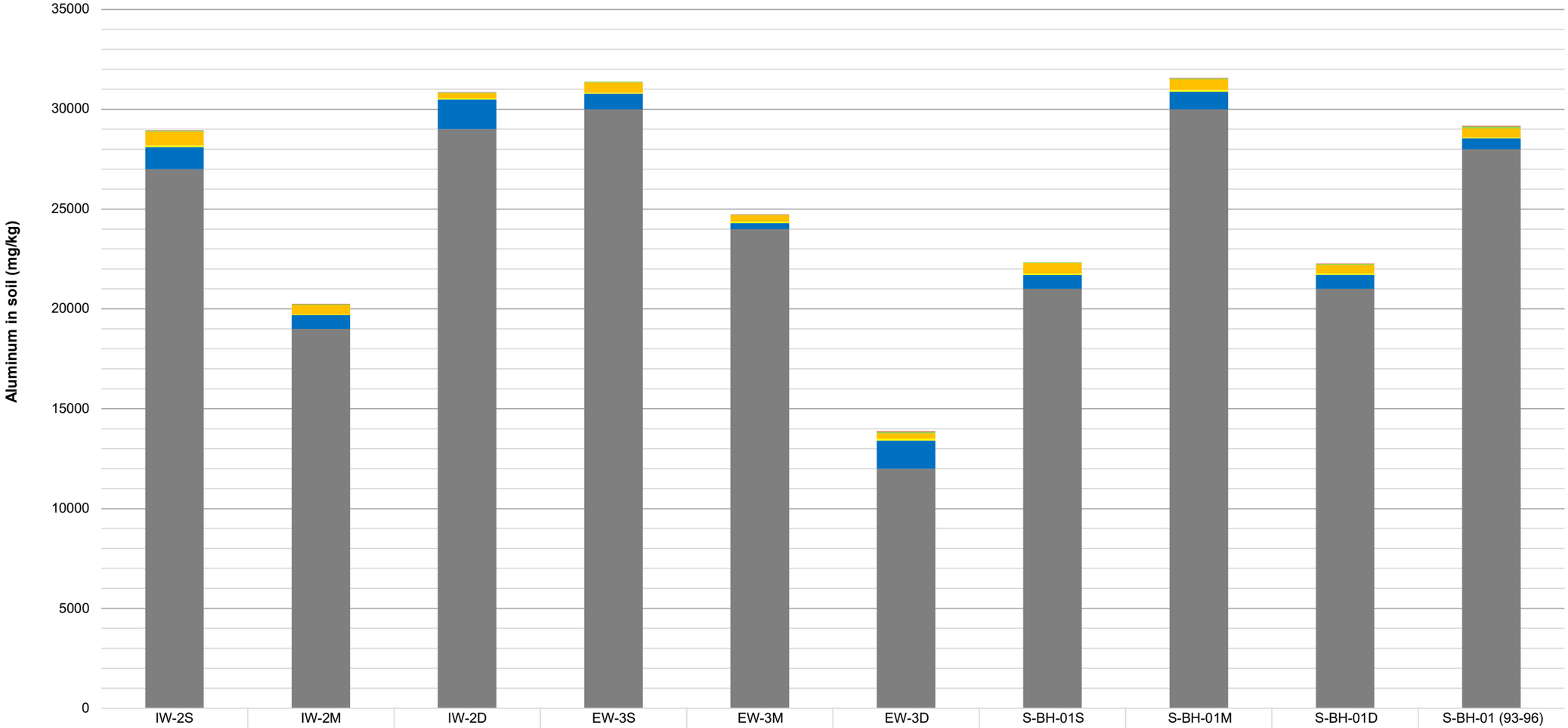
wsp

PROJECT
Monitored Natural Attenuation Evaluation

TITLE
Molybdenum Pourbaix Diagram - (with Iron Stability Overlaid)

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	20



	IW-2S	IW-2M	IW-2D	EW-3S	EW-3M	EW-3D	S-BH-01S	S-BH-01M	S-BH-01D	S-BH-01 (93-96)
Exchangeable Phase	0	0	0	0	0	0	0	0	0	0
Carbonate Phase	6.1	10	7.4	0	11	19	0	7.8	8.8	19
Amorphous Phase	55	49	25	42	30	83	38	48	51	110
Metal Hydroxide Phase	690	470	270	520	330	270	530	530	420	450
Organic Phase	88	31	38	40	73	100	70	99	76	44
Acid/Sulfide Fraction	1100	690	1500	780	300	1400	700	870	710	540
Residual Fraction	27000	19000	29000	30000	24000	12000	21000	30000	21000	28000

Borehole and depth below ground surface

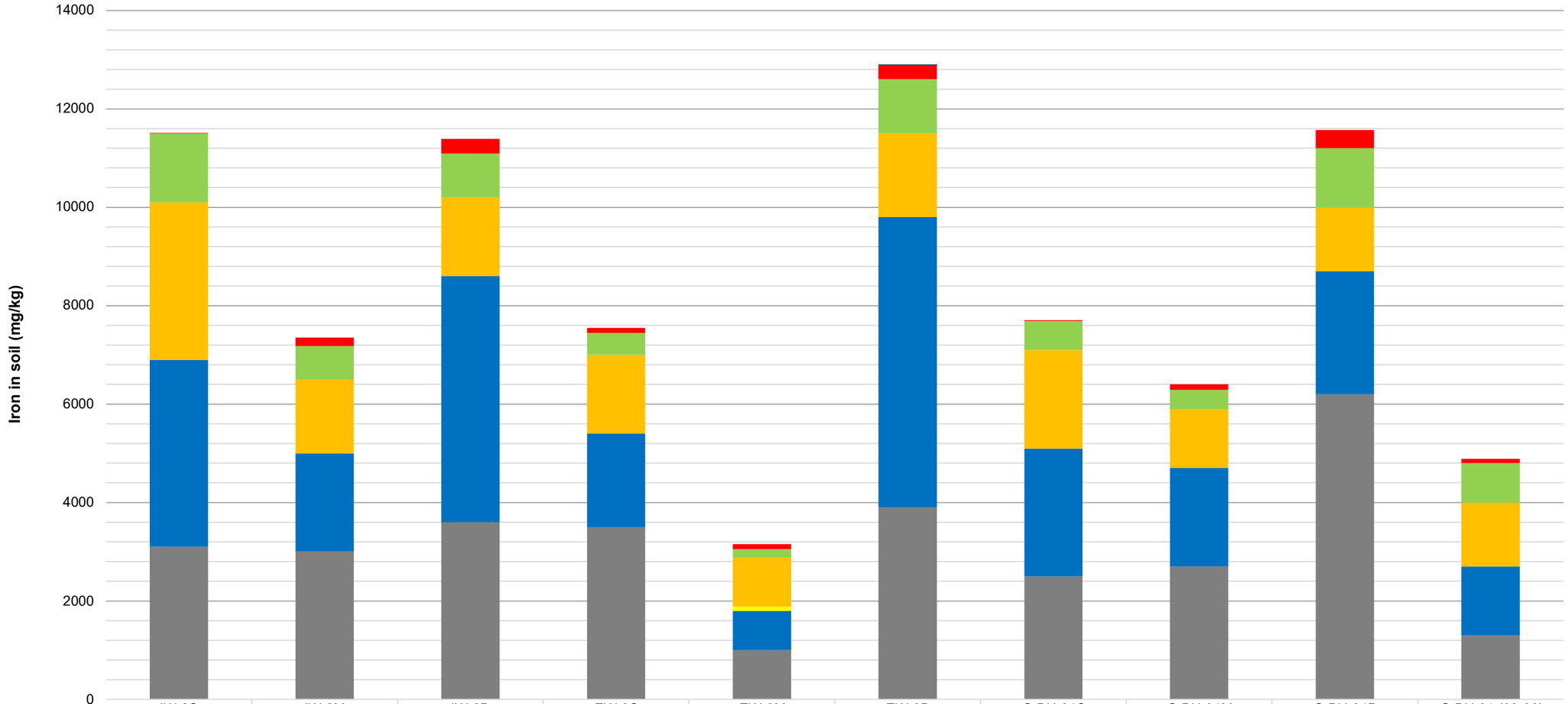
CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Sequential Extraction of Aluminum from Soil in Select Borings

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	21



	IW-2S	IW-2M	IW-2D	EW-3S	EW-3M	EW-3D	S-BH-01S	S-BH-01M	S-BH-01D	S-BH-01 (93-96)
Exchangeable Phase	0	0	0	0	0	13	0	0	0	0
Carbonate Phase	14	170	300	100	99	290	13	110	370	86
Amorphous Phase	1400	680	890	450	170	1100	590	390	1200	800
Metal Hydroxide Phase	3200	1500	1600	1600	1000	1700	2000	1200	1300	1300
Organic Phase	0	0	0	0	84	0	0	0	0	0
Acid/Sulfide Fraction	3800	2000	5000	1900	800	5900	2600	2000	2500	1400
Residual Fraction	3100	3000	3600	3500	1000	3900	2500	2700	6200	1300

Borehole and depth below ground surface

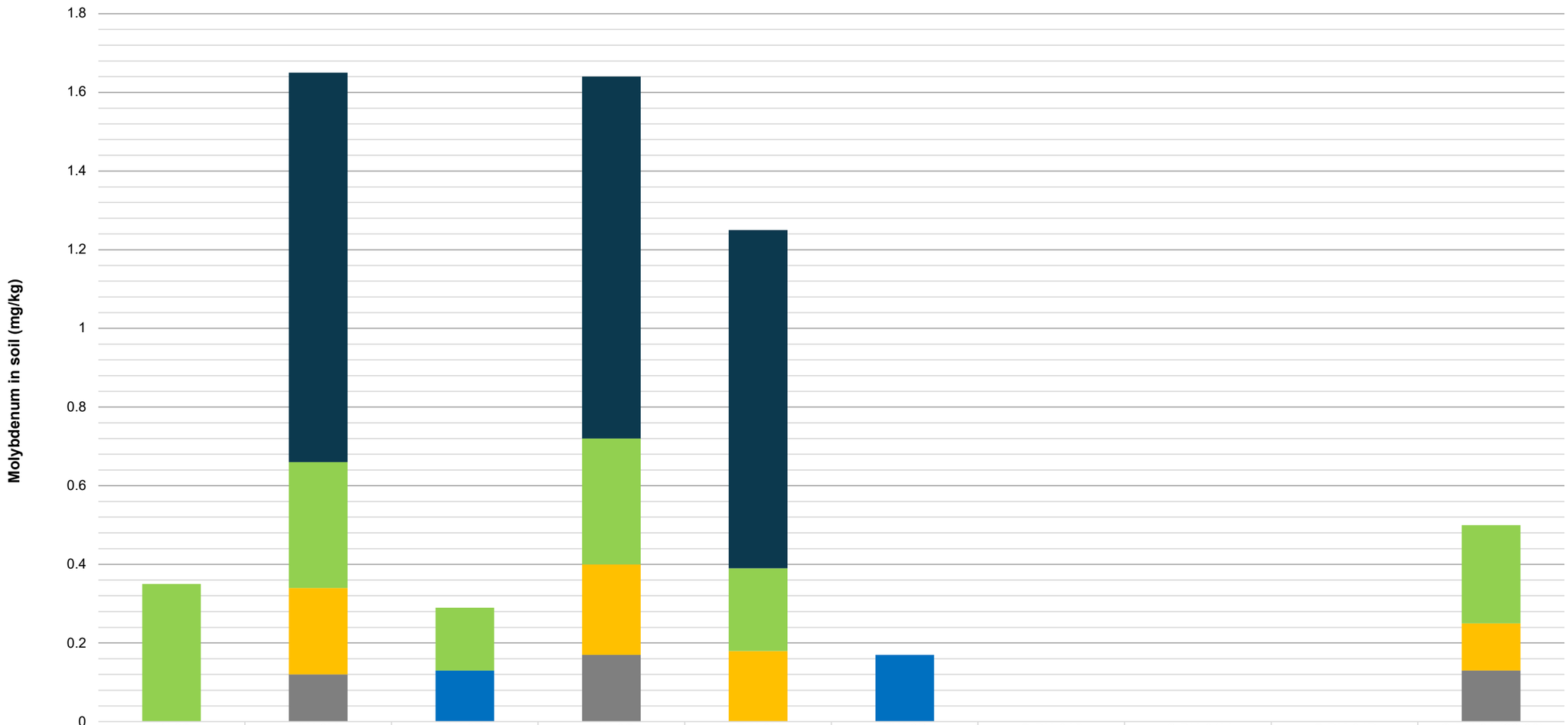
CLIENT
Ameren Missouri

CONSULTANT
wsp

PROJECT
Monitored Natural Attenuation Evaluation

TITLE
Sequential Extraction of Iron from Soil in Select Borings

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	22



	IW-2S	IW-2M	IW-2D	EW-3S	EW-3M	EW-3D	S-BH-01S	S-BH-01M	S-BH-01D	S-BH-01 (93-96)
Exchangeable Phase	0	0.99	0	0.92	0.86	0	0	0	0	0
Carbonate Phase	0	0	0	0	0	0	0	0	0	0
Amorphous Phase	0.35	0.32	0.16	0.32	0.21	0	0	0	0	0.25
Metal Hydroxide Phase	0	0.22	0	0.23	0.18	0	0	0	0	0.12
Organic Phase	0	0	0	0	0	0	0	0	0	0
Acid/Sulfide Fraction	0	0	0.13	0	0	0.17	0	0	0	0
Residual Fraction	0	0.12	0	0.17	0	0	0	0	0	0.13

Borehole and depth below ground surface

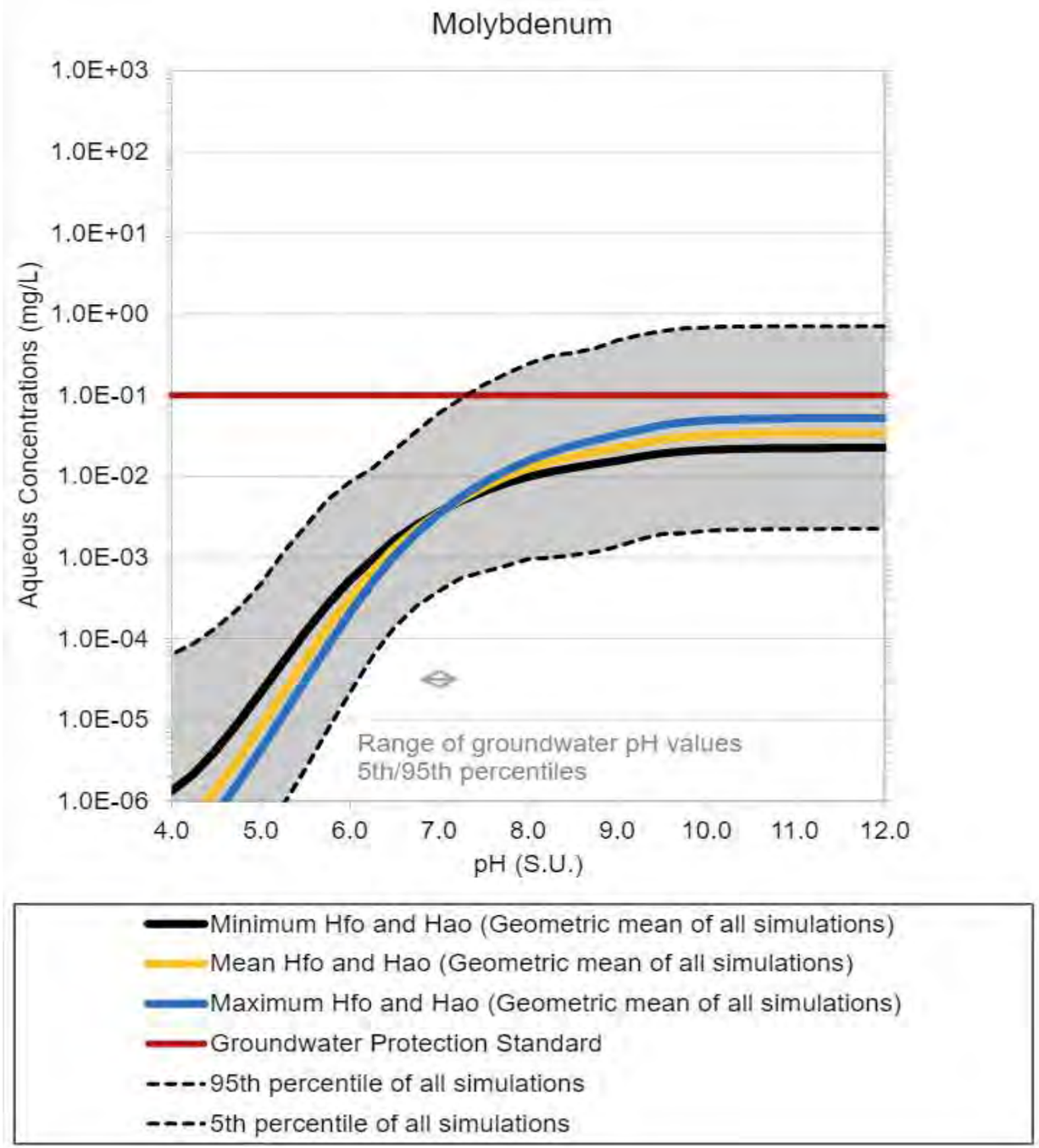
CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Sequential Extraction of Molybdenum from Soil in Select Borings

PROJECT NO. US0023766.2548 | PHASE | REV. 0 | FIGURE 23



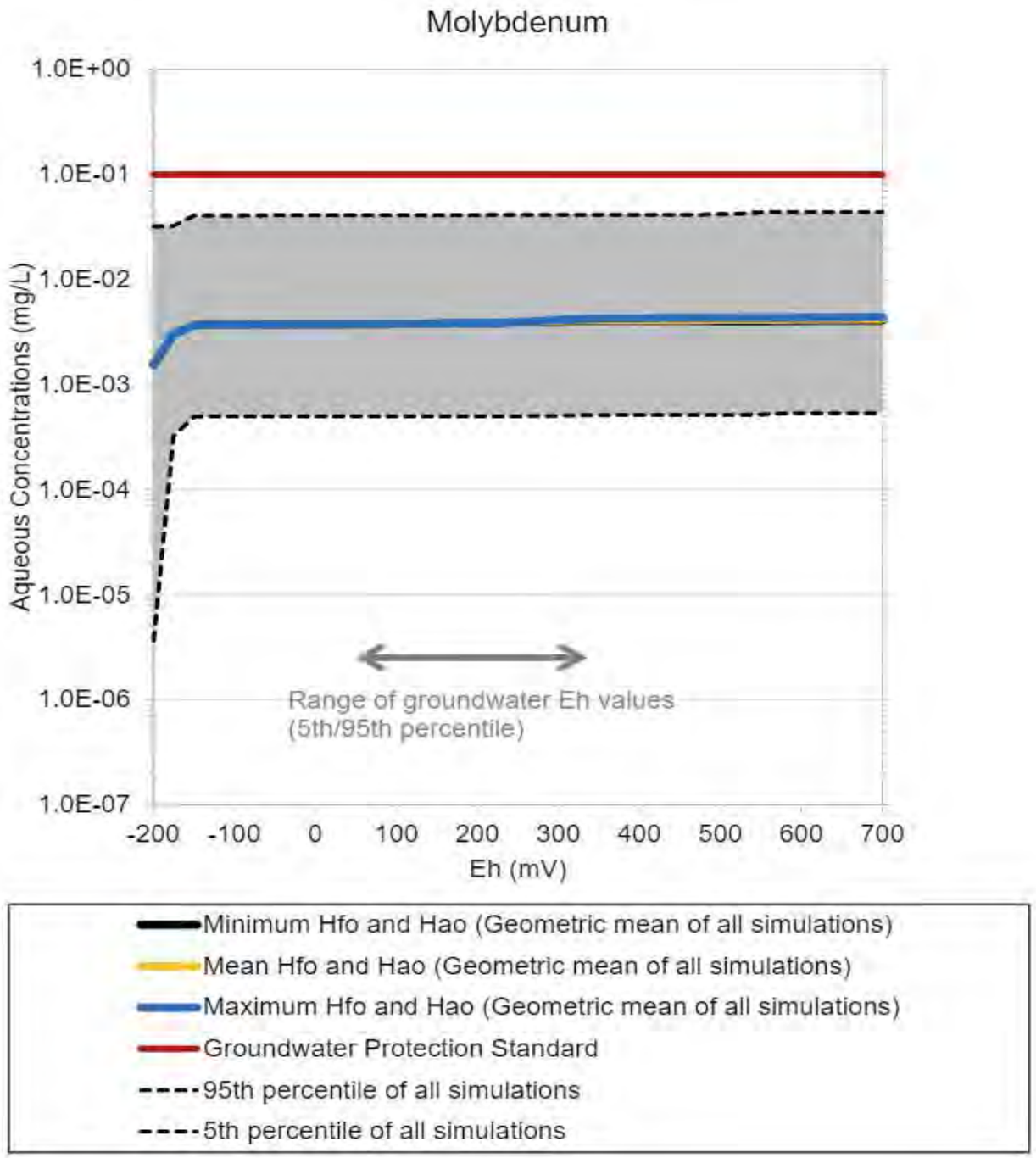
CLIENT
Ameren Missouri

CONSULTANT
wsp

PROJECT
Monitored Natural Attenuation Evaluation

TITLE
pH MNA Stability Evaluation

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	24



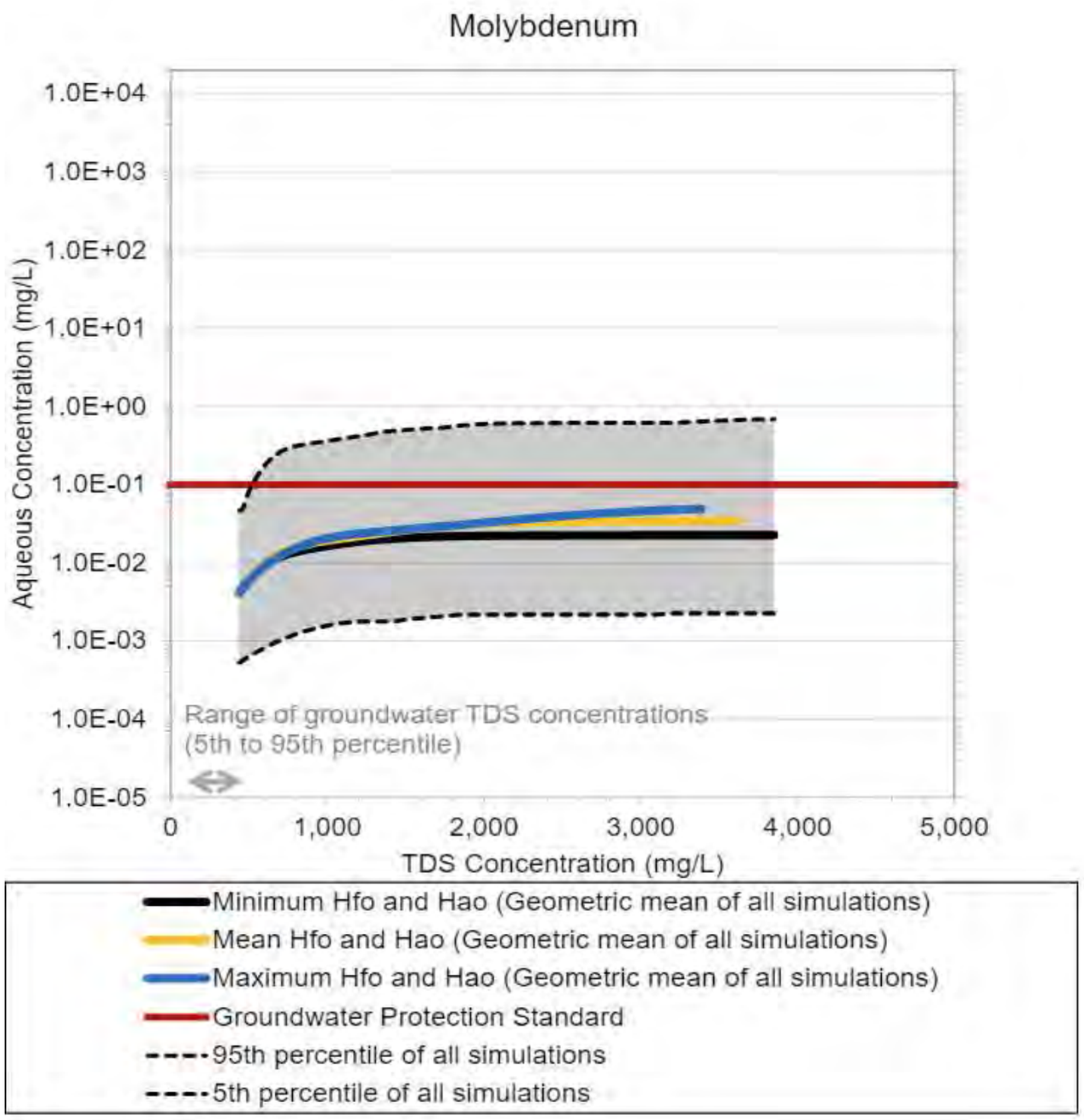
CLIENT
Ameren Missouri

CONSULTANT
wsp

PROJECT
Monitored Natural Attenuation Evaluation

TITLE
Redox MNA Stability Evaluation

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	25



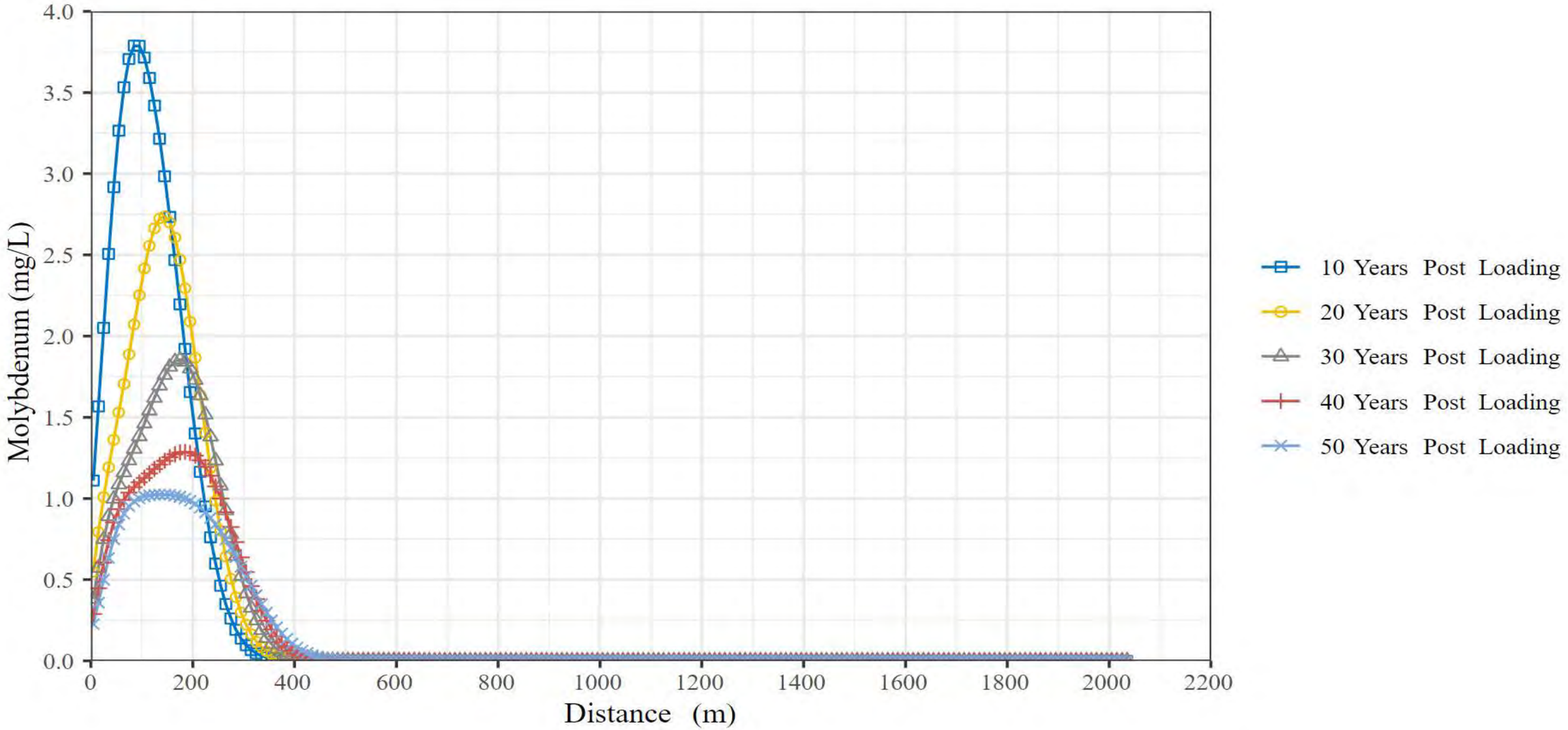
CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
TDS MNA Stability Evaluation

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	26



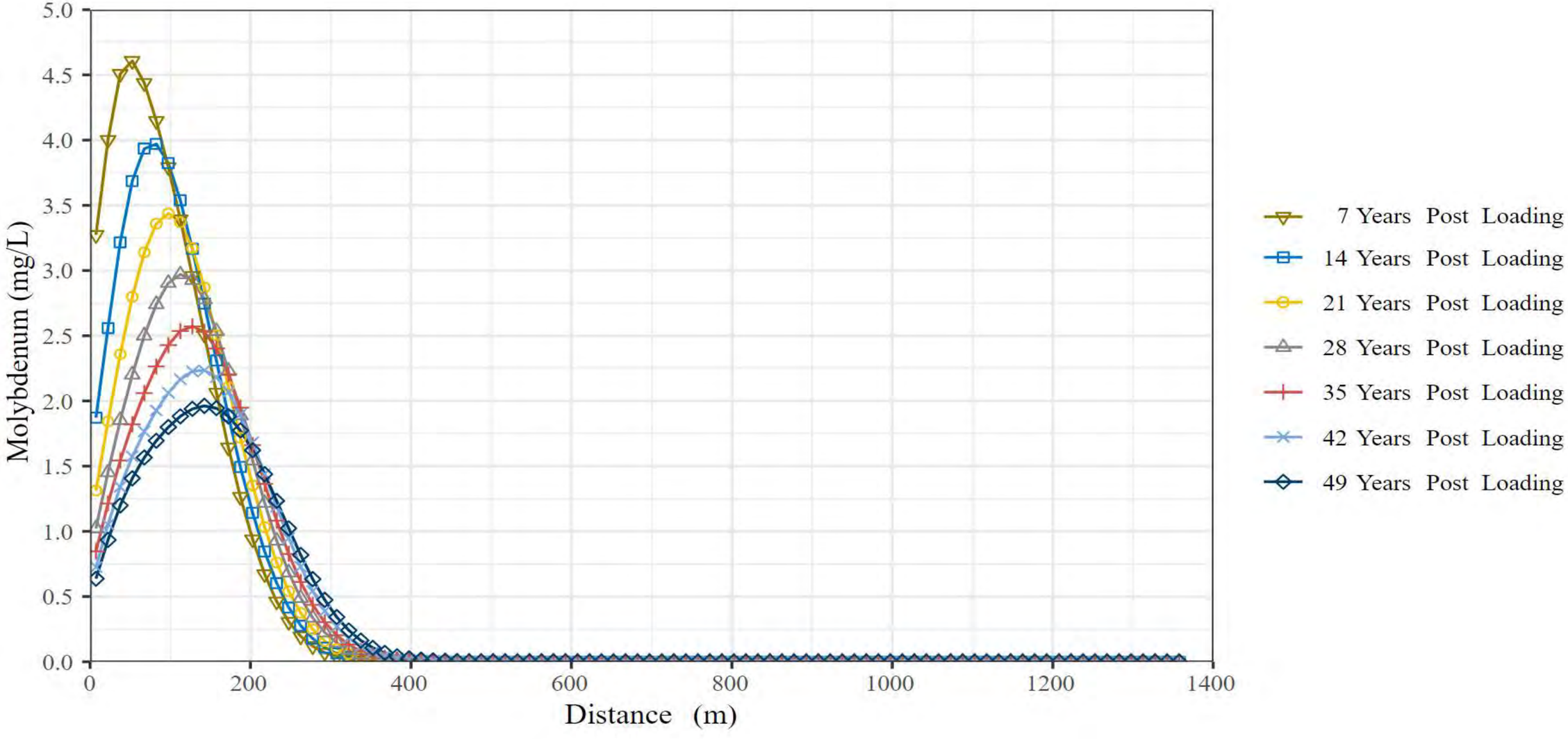
CLIENT
Ameren Missouri

CONSULTANT
wsp

PROJECT
Monitored Natural Attenuation Evaluation

TITLE
Modeled Concentrations of Molybdenum along a Transect Running from SCPA-3 to TP-8D

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	27



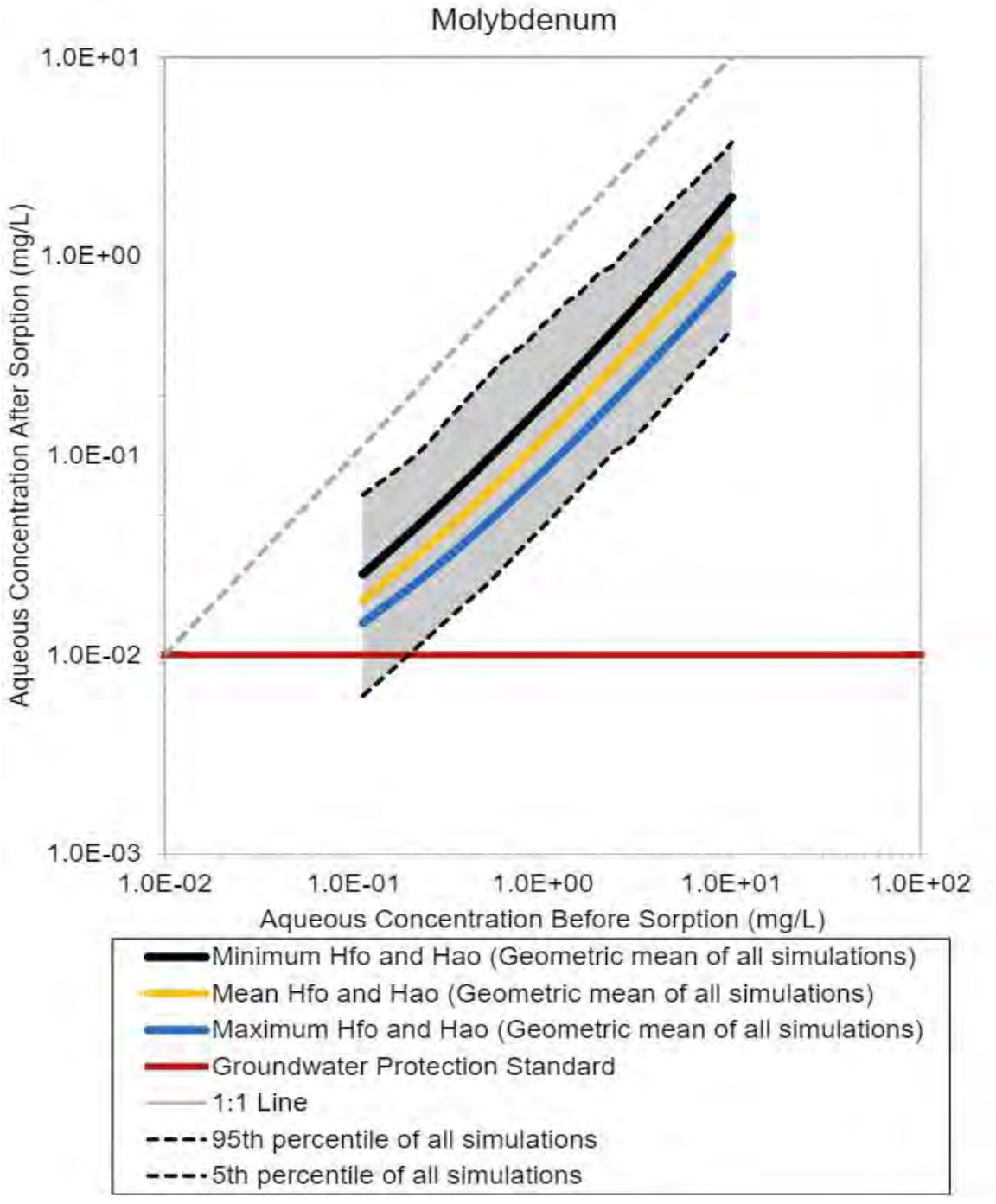
CLIENT
Ameren Missouri

PROJECT
Monitored Natural Attenuation Evaluation

CONSULTANT
wsp

TITLE
Modeled Concentrations of Molybdenum along a Transect Running from SCPA-3 to TP-4S

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	28



CLIENT
Ameren Missouri

CONSULTANT
wsp

PROJECT
Monitored Natural Attenuation Evaluation

TITLE
Modeled Attenuation Capacity of the Compliance and Nature and Extent Well Network for Molybdenum at the SCPA

PROJECT NO.	PHASE	REV.	FIGURE
US0023766.2548		0	29

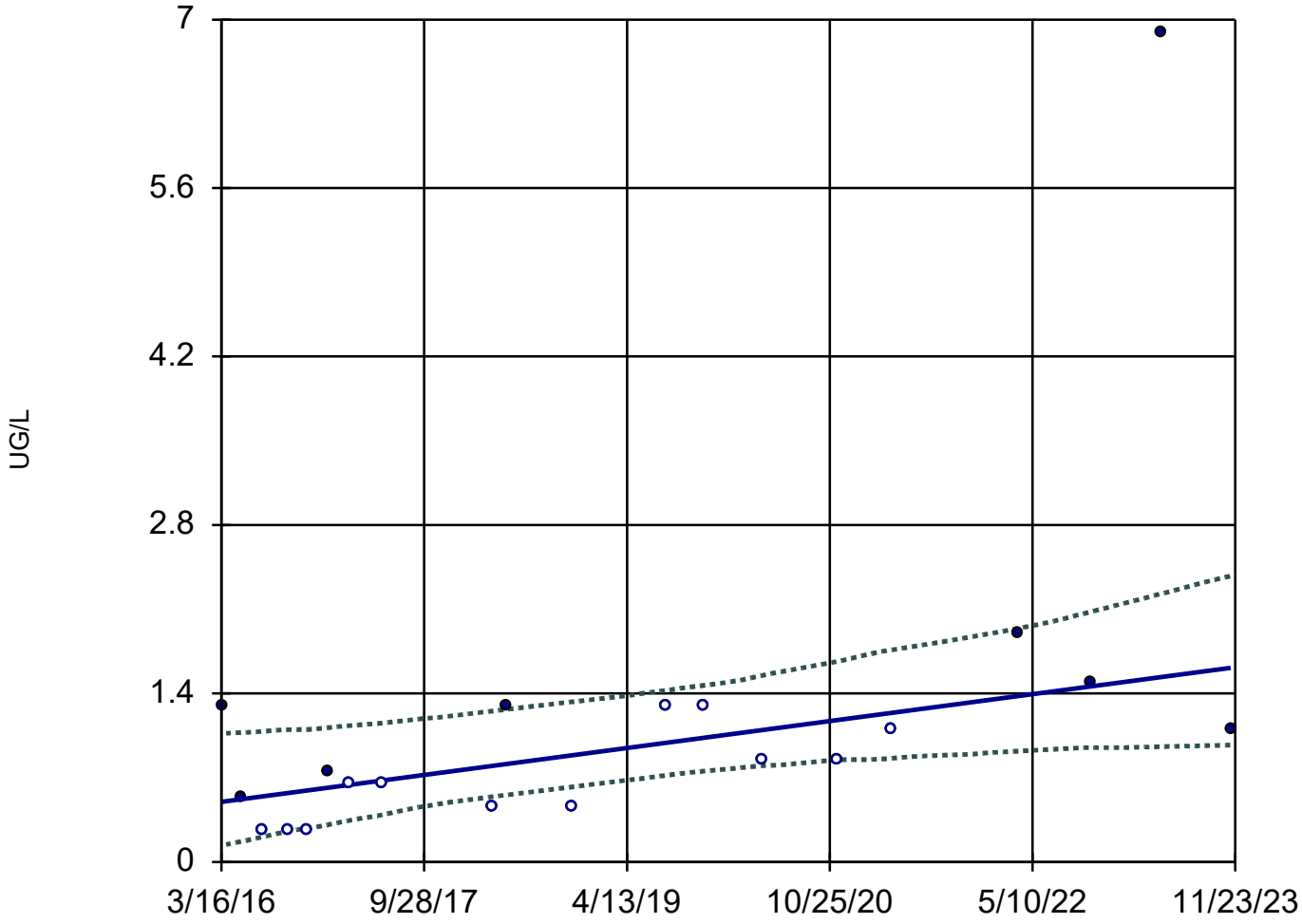
APPENDIX A

Mann-Kendall Trend Evaluations of Molybdenum

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope and 95% Confidence Band

S-BMW-1D (bg)



n = 20

Slope = 0.1455 units per year.

Mann-Kendall statistic = 91
critical = 73

Increasing trend significant at 98% confidence level (α = 0.01 per tail).

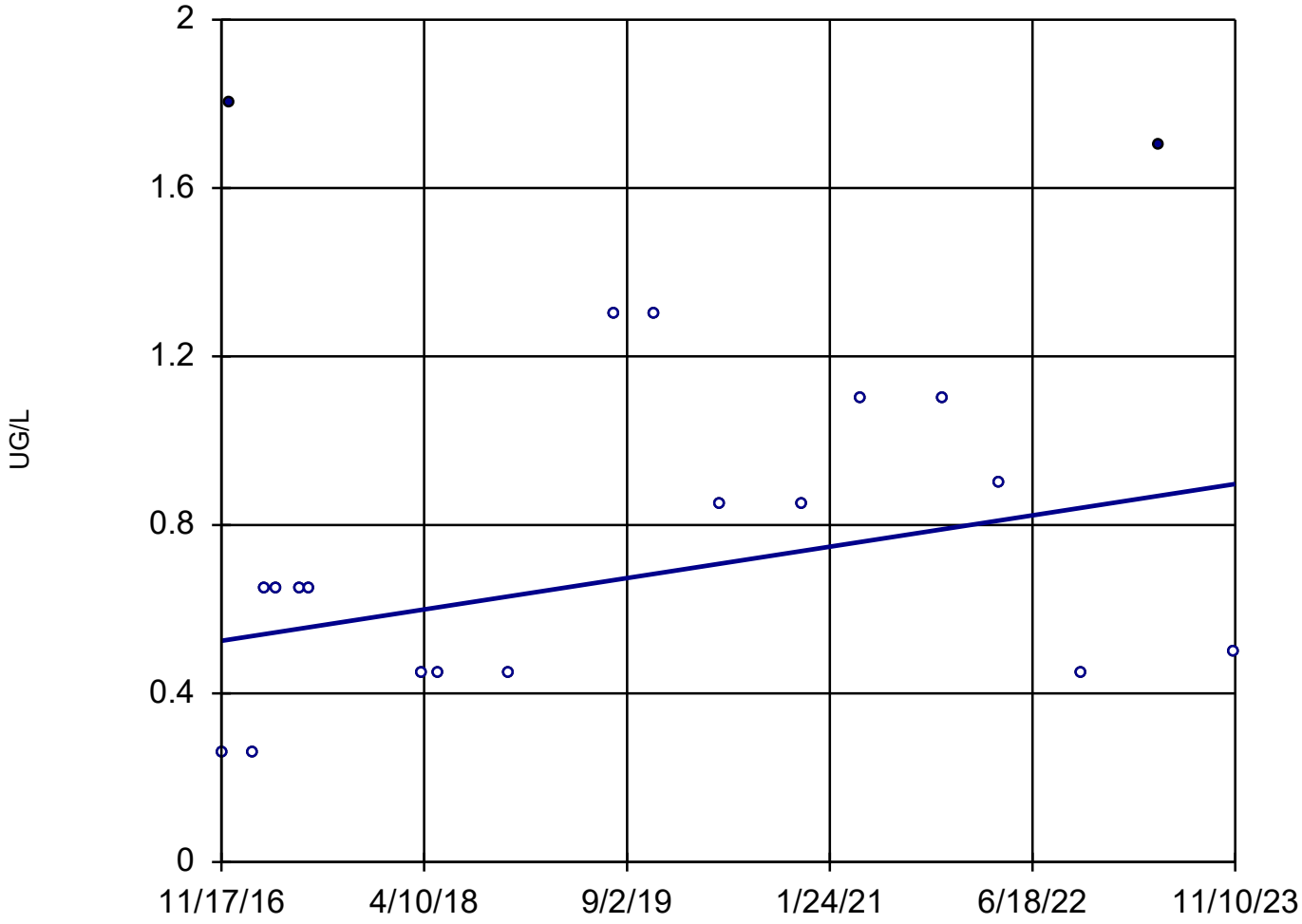
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

S-BMW-3D (bg)



n = 20

Slope = 0.05332 units per year.

Mann-Kendall statistic = 44
critical = 73

Trend not significant at 98% confidence level (α = 0.01 per tail).

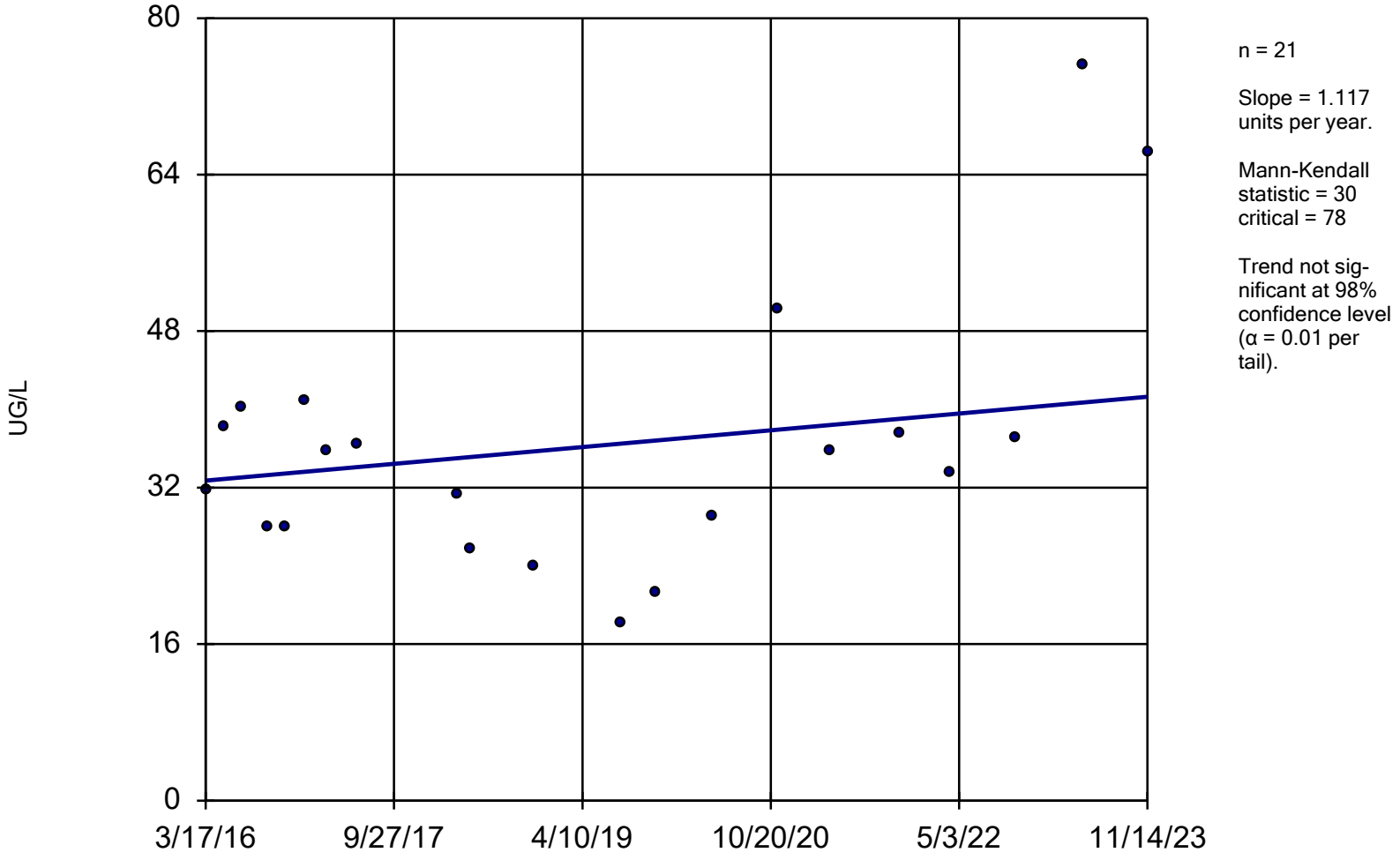
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-UMW-1D

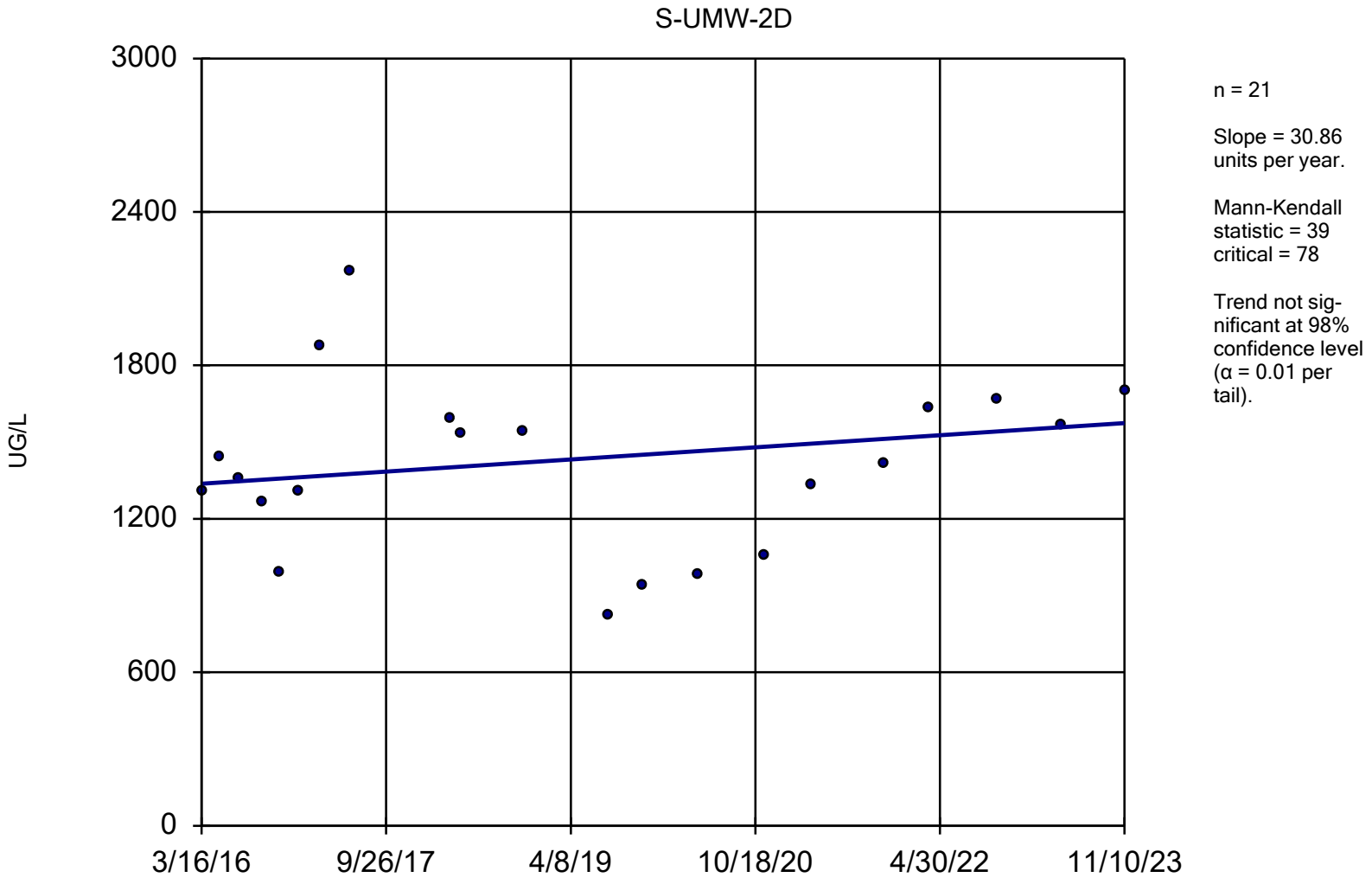


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator



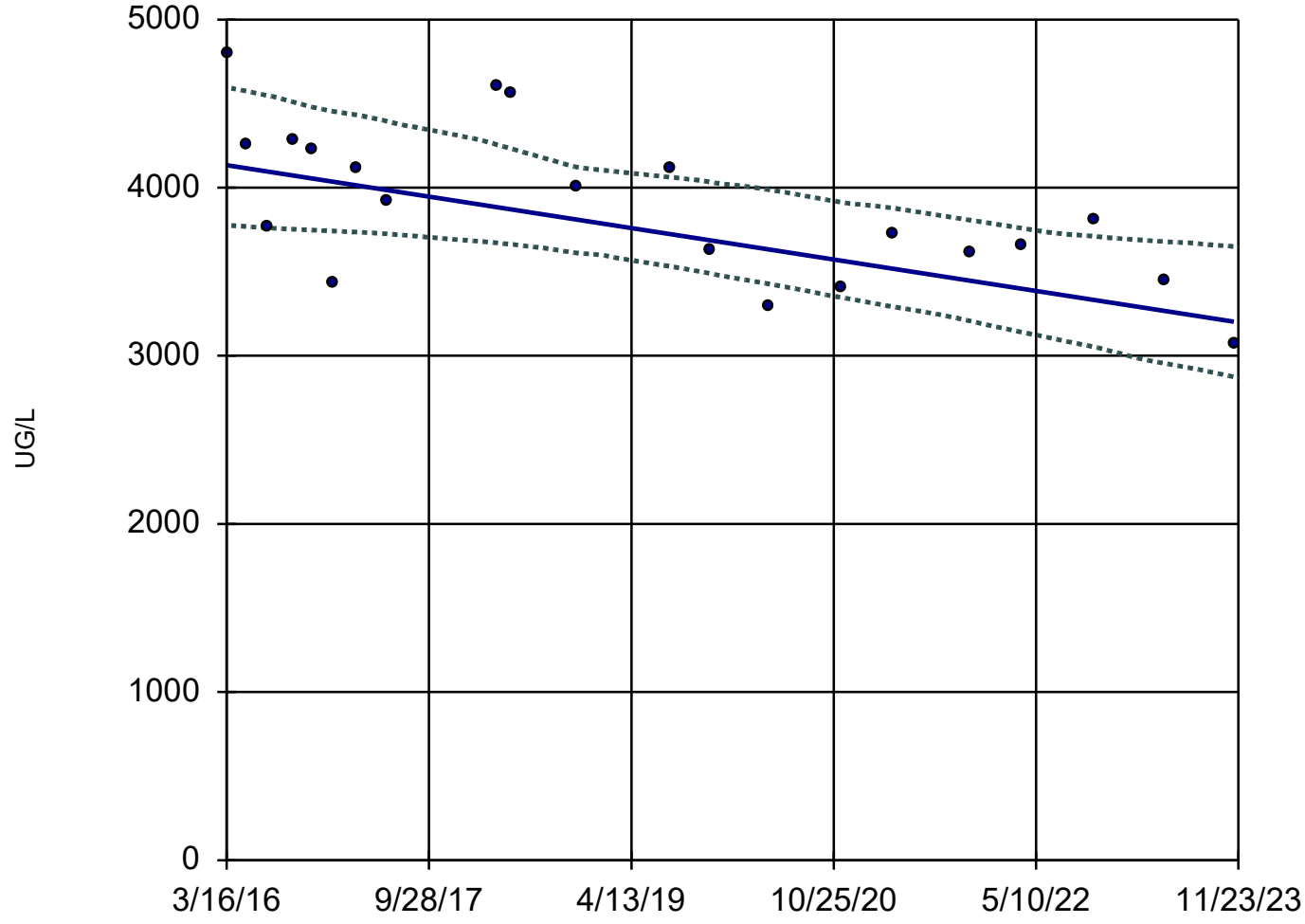
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-UMW-3D



n = 21

Slope = -121.4 units per year.

Mann-Kendall statistic = -103
critical = -78

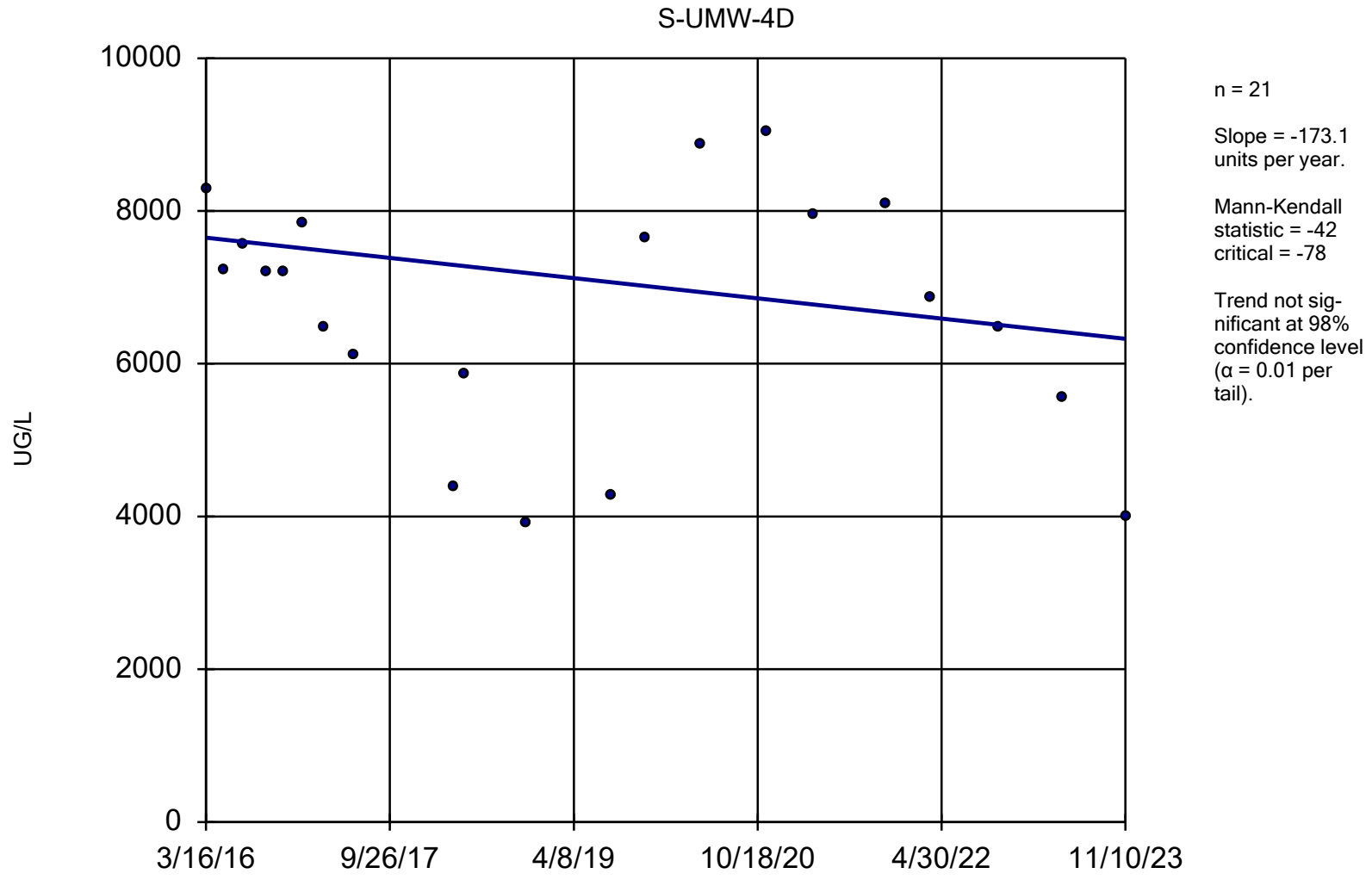
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

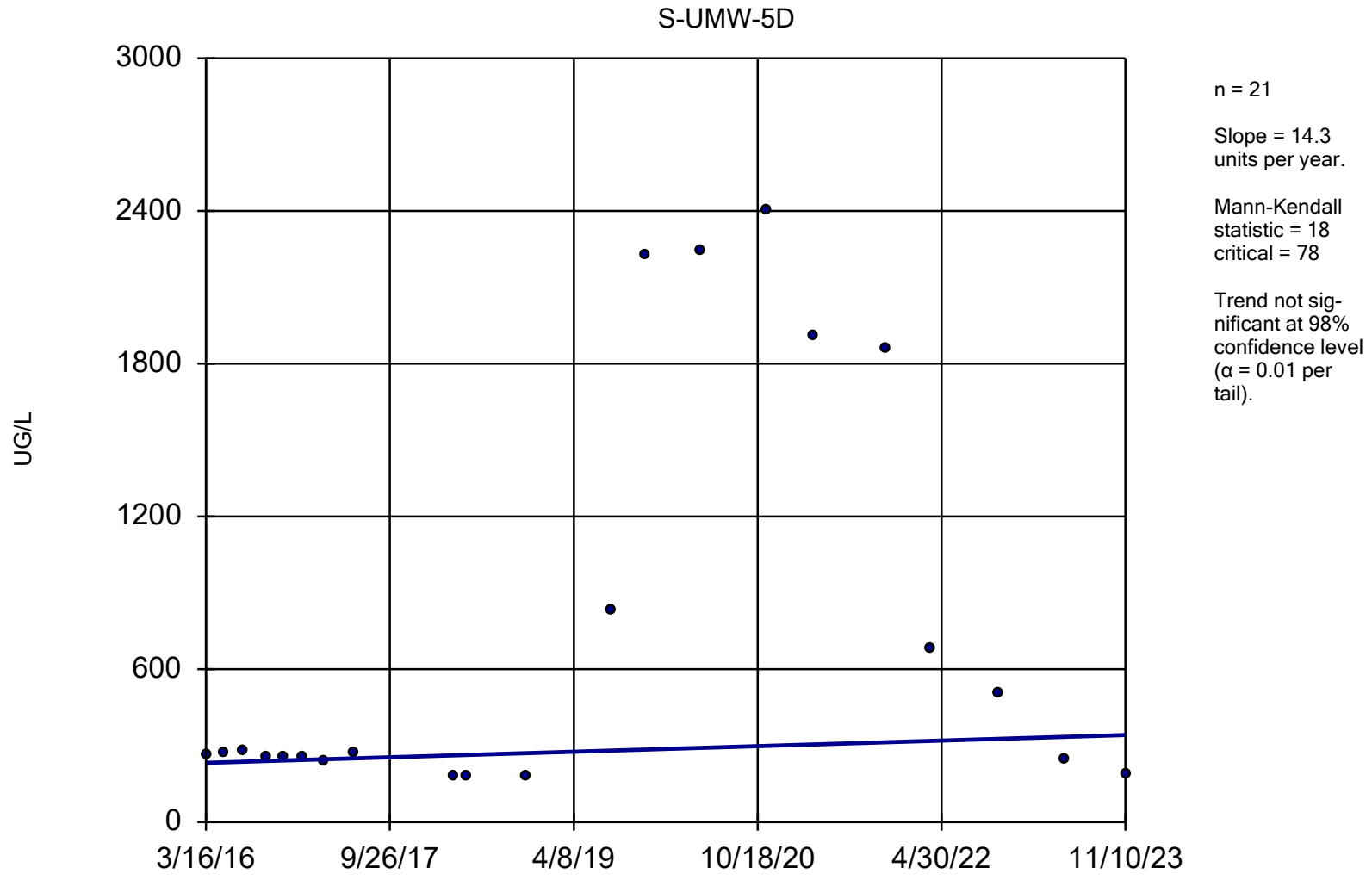


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator



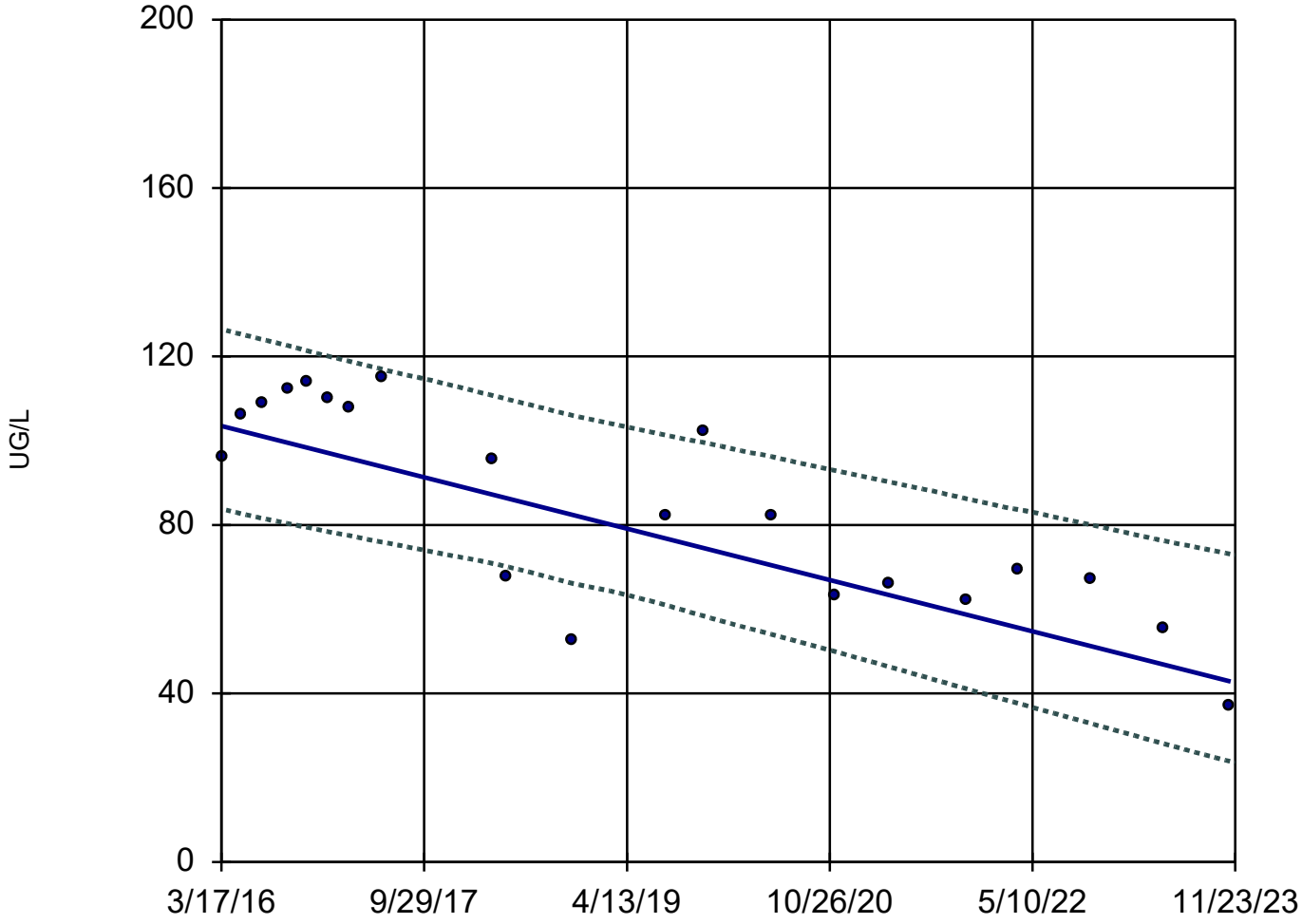
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-UMW-6D



n = 21

Slope = -7.923 units per year.

Mann-Kendall statistic = -118
critical = -78

Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

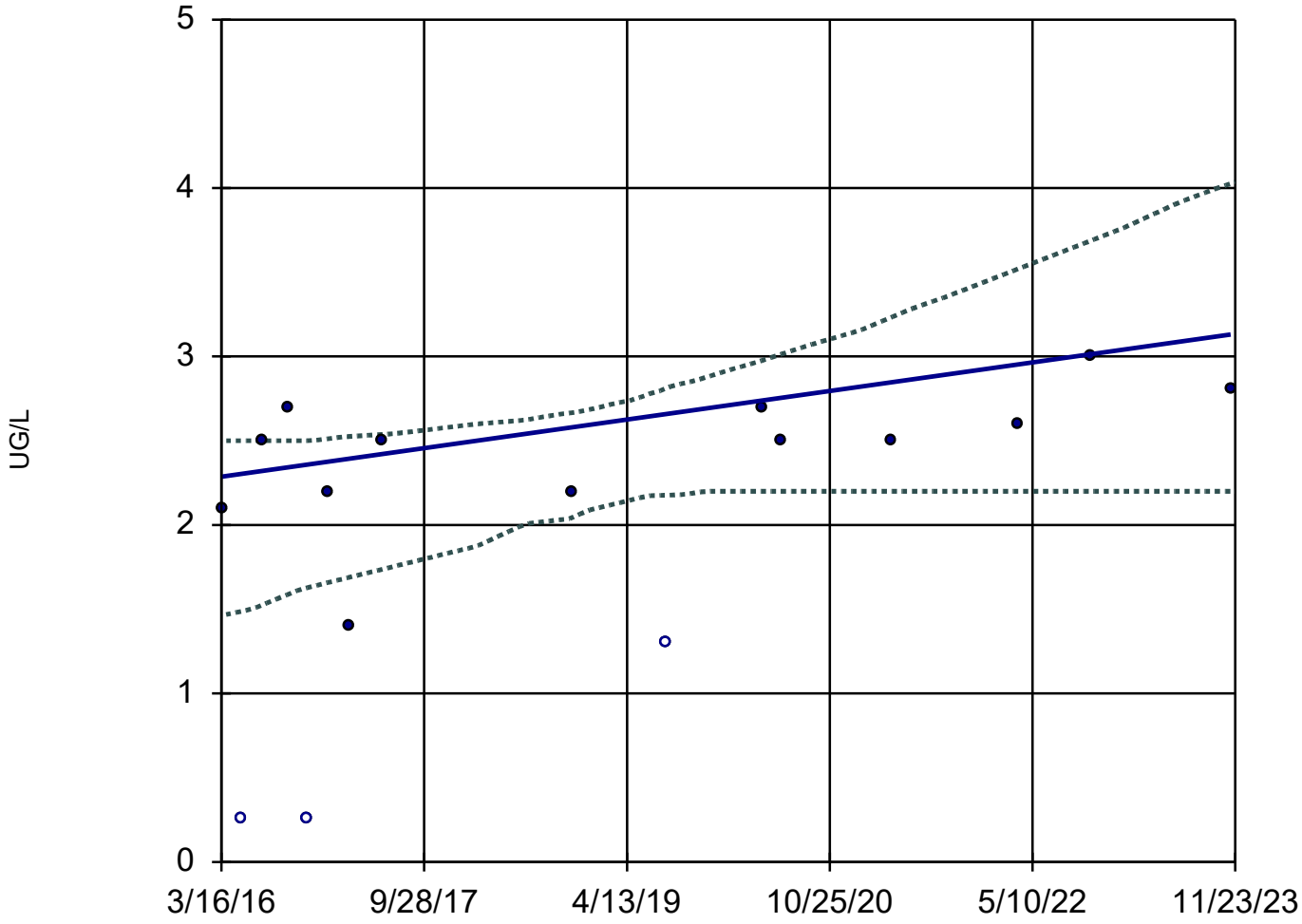
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:13 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope and 95% Confidence Band

S-BMW-1S (bg)



n = 16

Slope = 0.1103 units per year.

Mann-Kendall statistic = 55
critical = 53

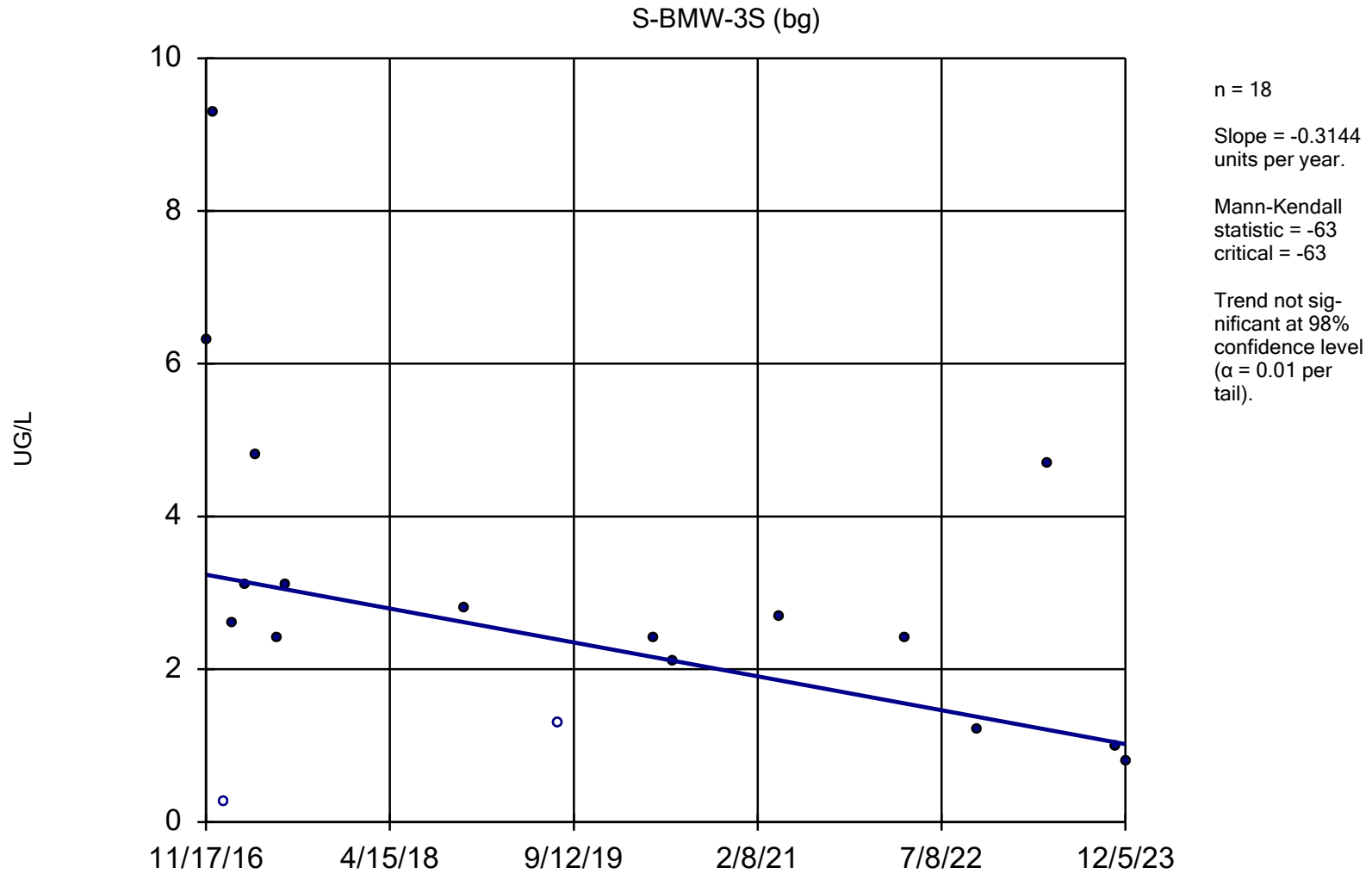
Increasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

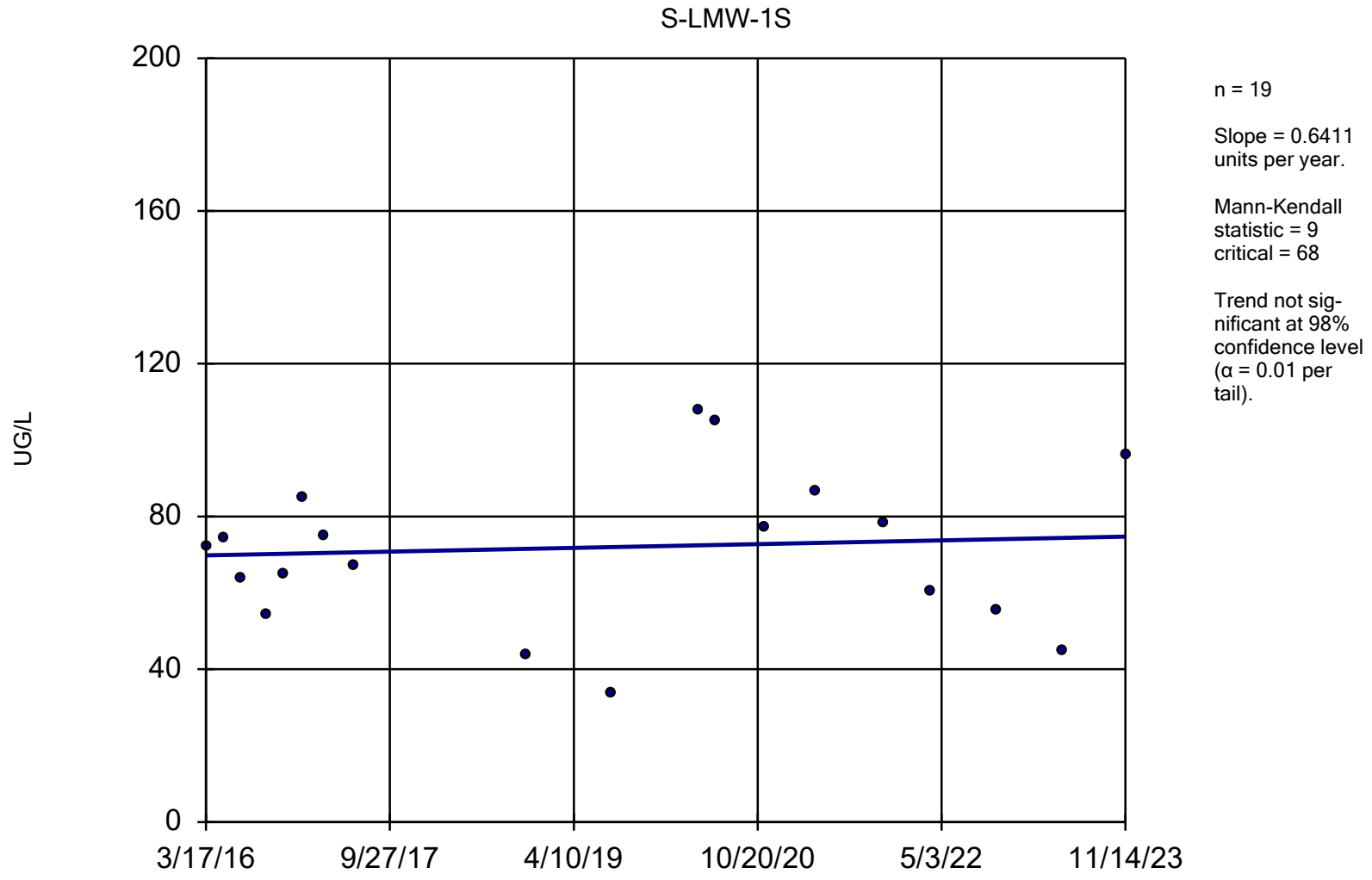


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator



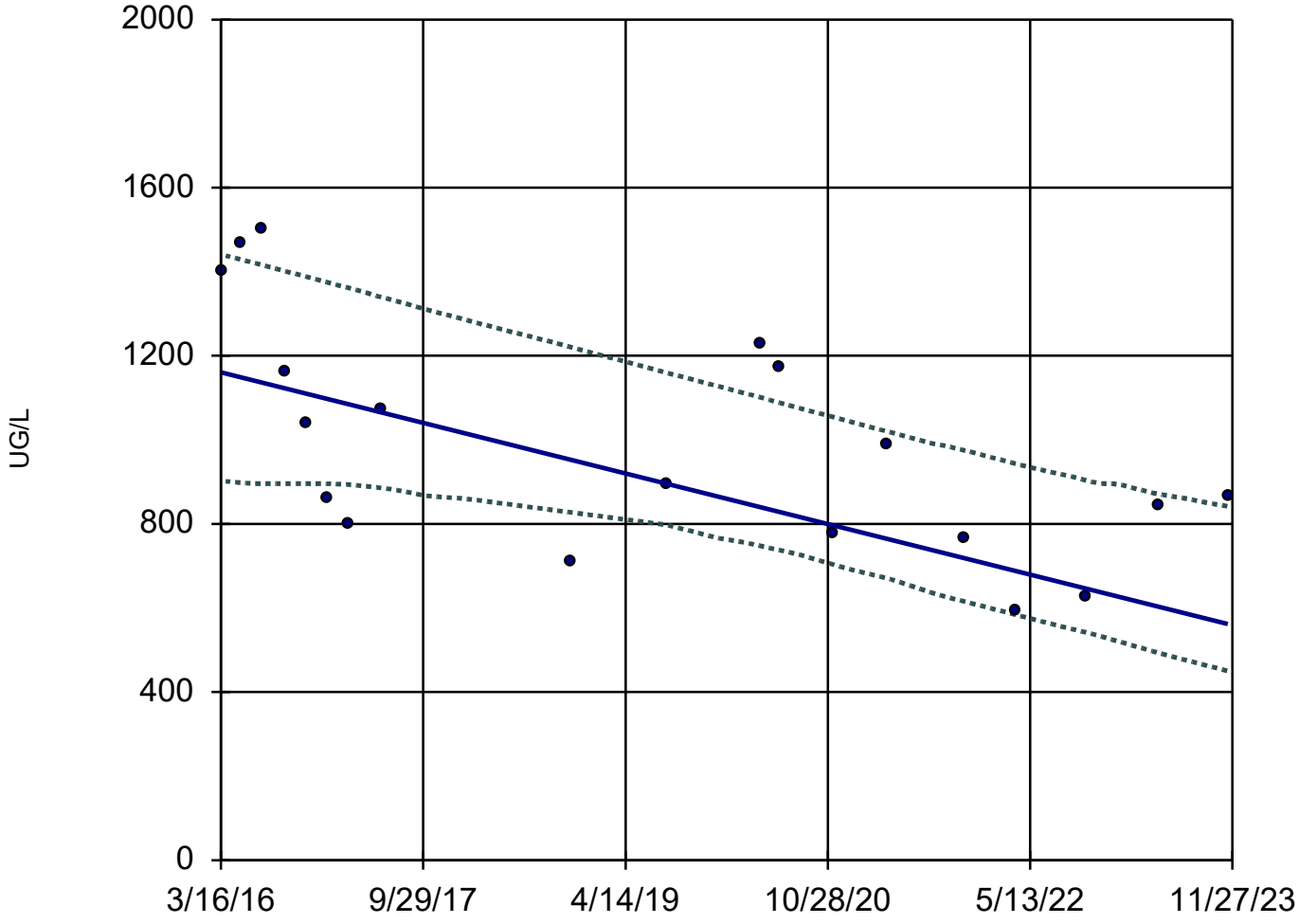
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-LMW-2S



n = 19

Slope = -78.06 units per year.

Mann-Kendall statistic = -81
critical = -68

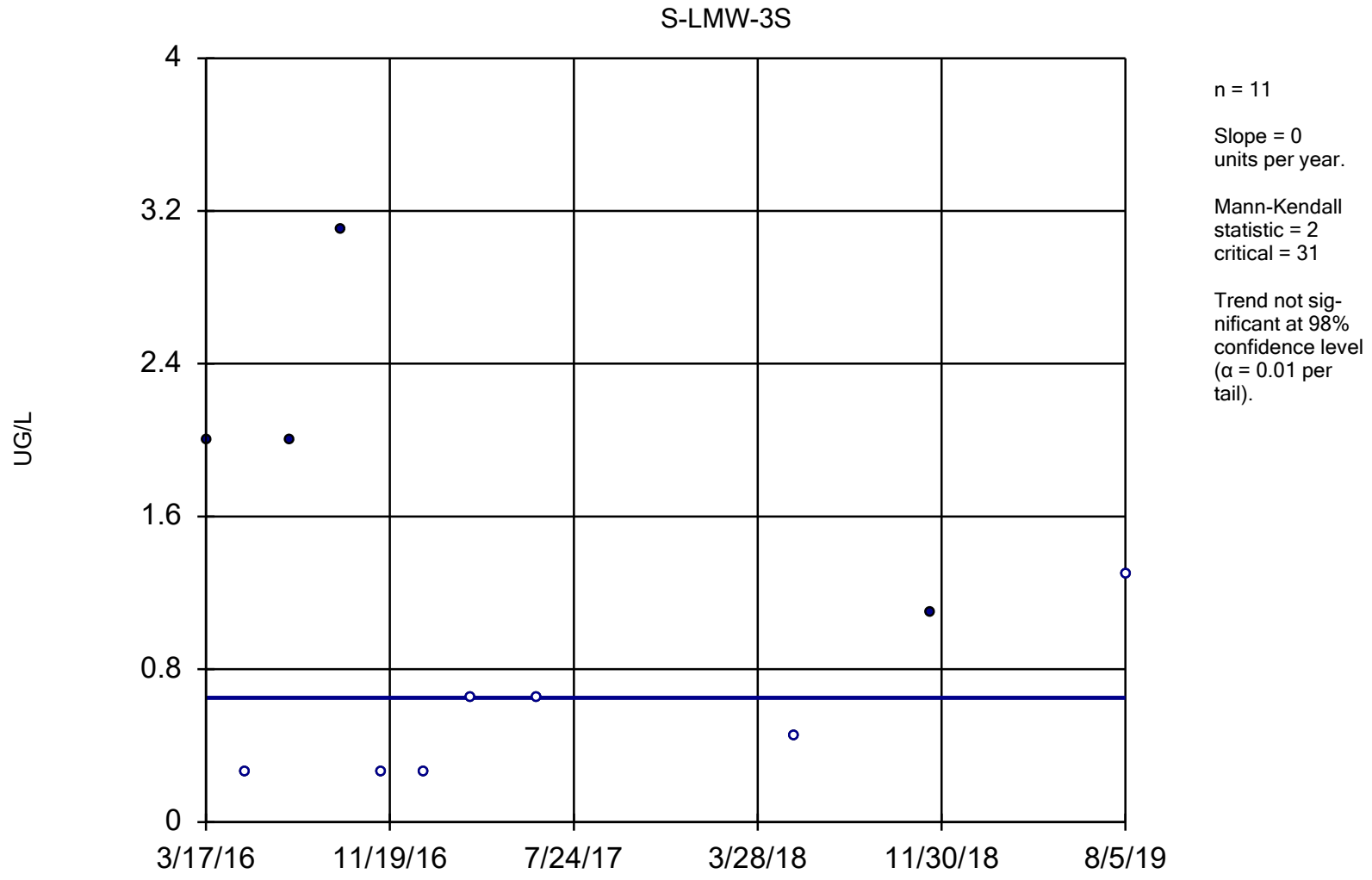
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

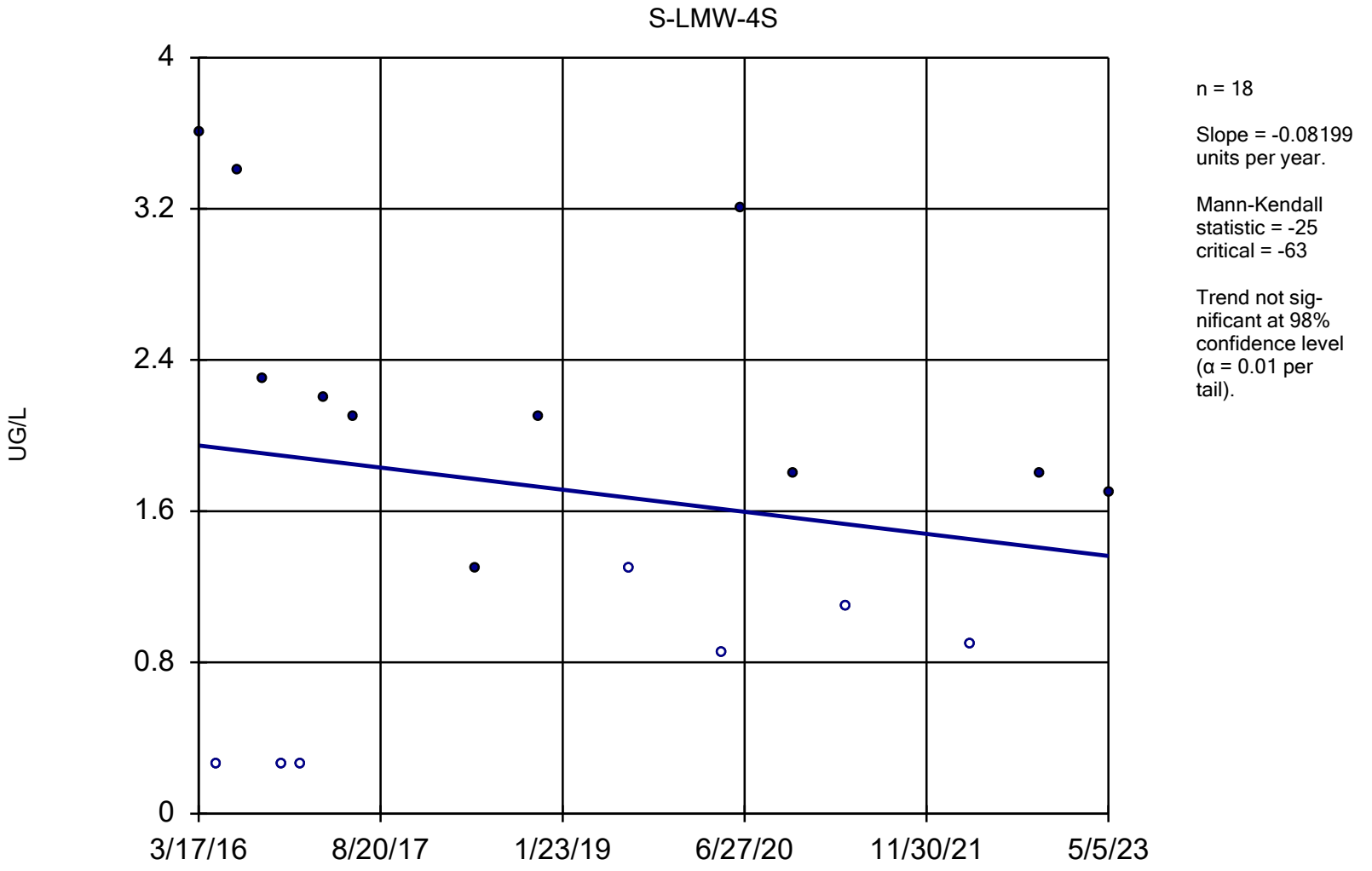


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



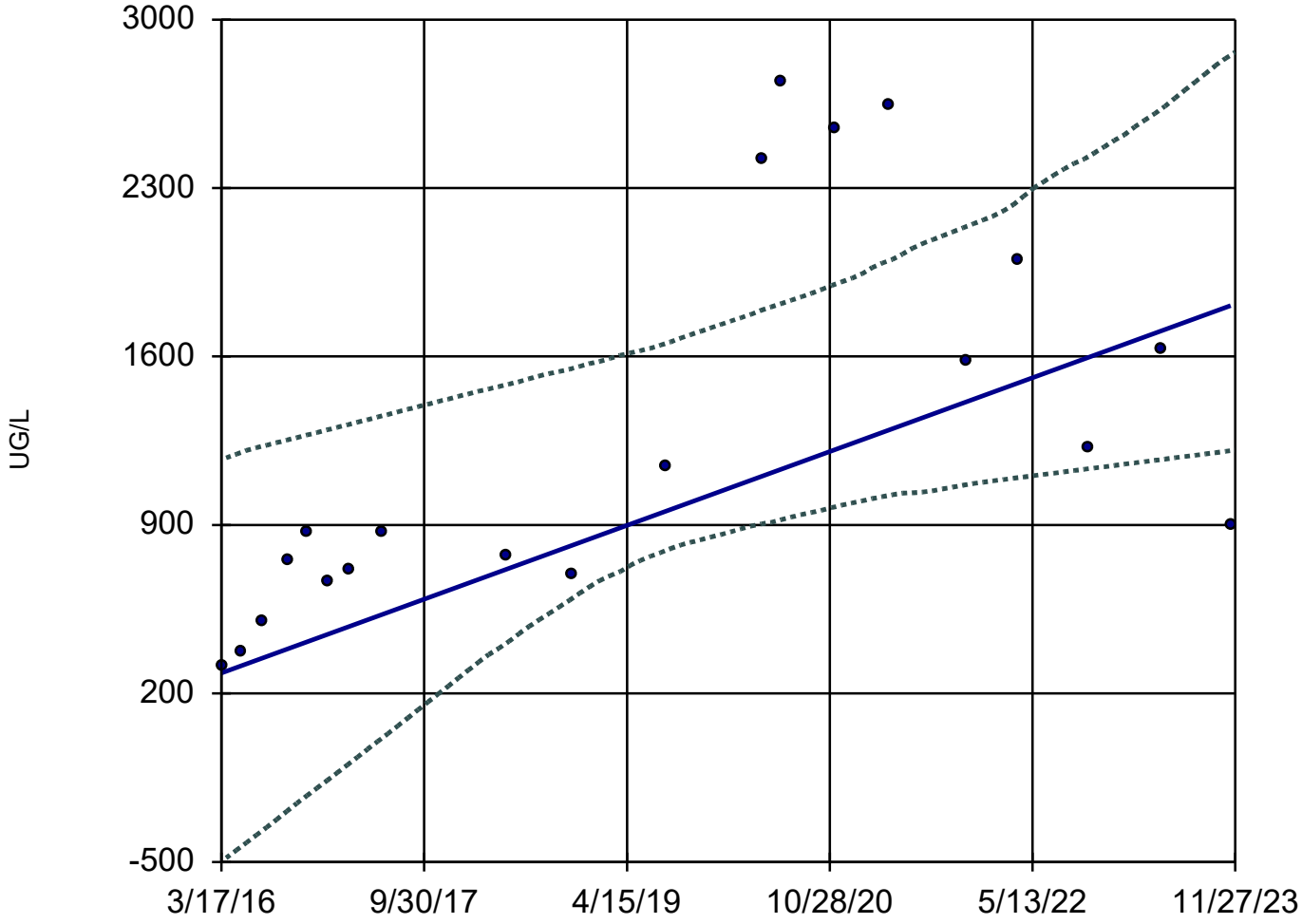
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-LMW-5S



n = 20

Slope = 199.1 units per year.

Mann-Kendall statistic = 106
critical = 73

Increasing trend significant at 98% confidence level (α = 0.01 per tail).

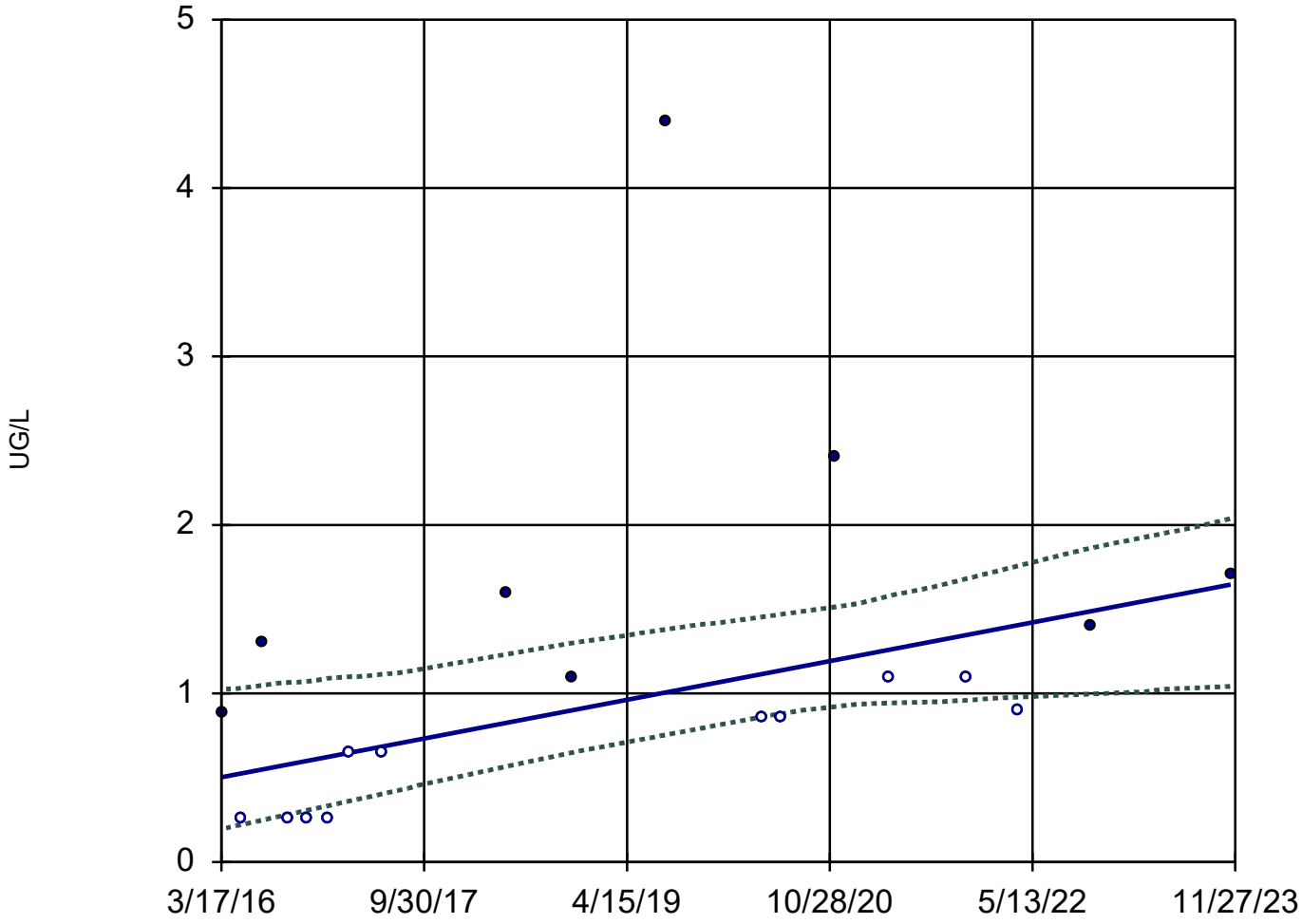
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope and 95% Confidence Band

S-LMW-6S



n = 19

Slope = 0.1492 units per year.

Mann-Kendall statistic = 72
critical = 68

Increasing trend significant at 98% confidence level (α = 0.01 per tail).

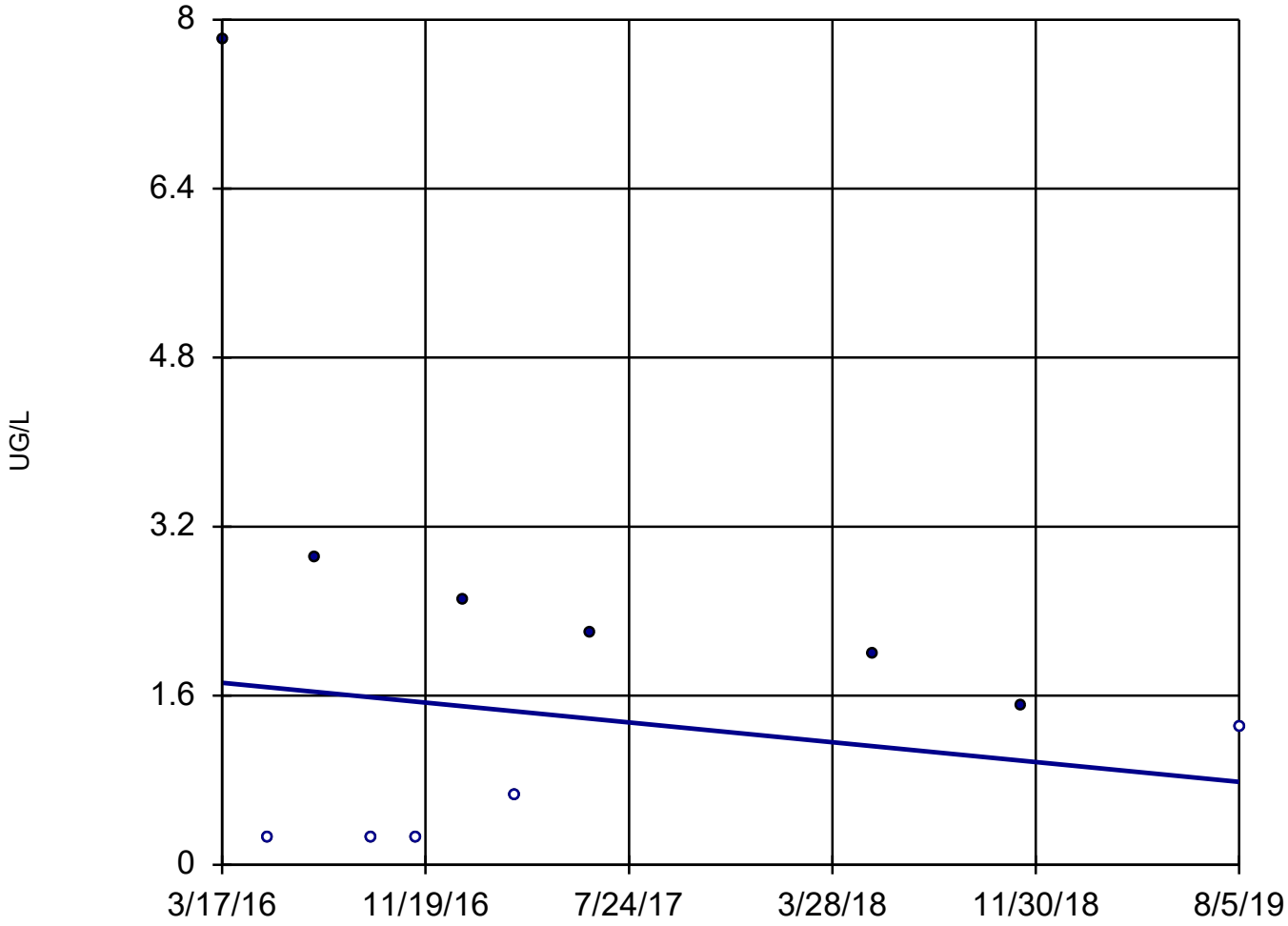
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

S-LMW-7S



n = 11

Slope = -0.2765 units per year.

Mann-Kendall statistic = -6
critical = -31

Trend not significant at 98% confidence level (α = 0.01 per tail).

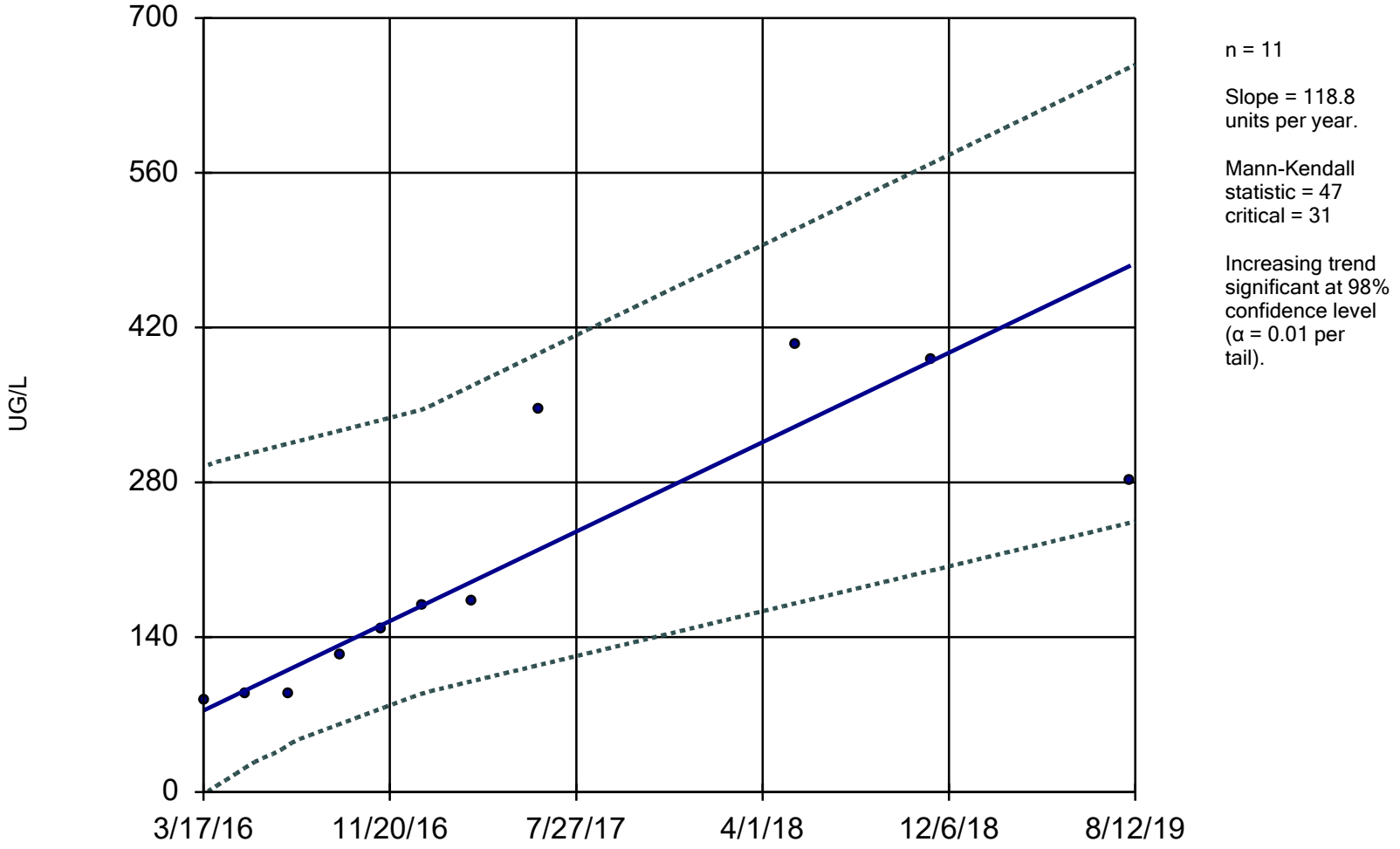
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-LMW-8S



n = 11

Slope = 118.8 units per year.

Mann-Kendall statistic = 47
critical = 31

Increasing trend significant at 98% confidence level (α = 0.01 per tail).

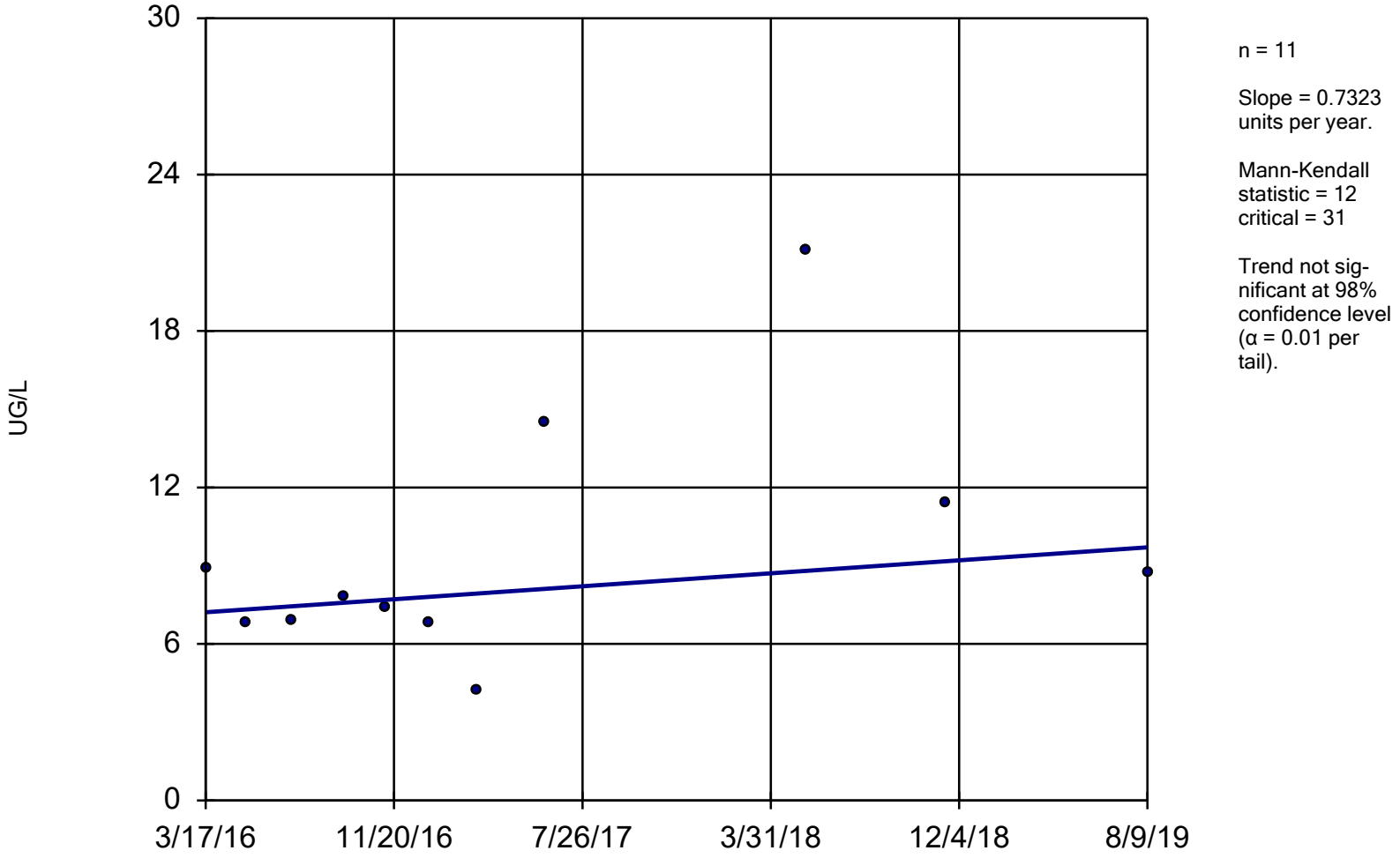
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-LMW-9S



n = 11

Slope = 0.7323 units per year.

Mann-Kendall statistic = 12
critical = 31

Trend not significant at 98% confidence level (α = 0.01 per tail).

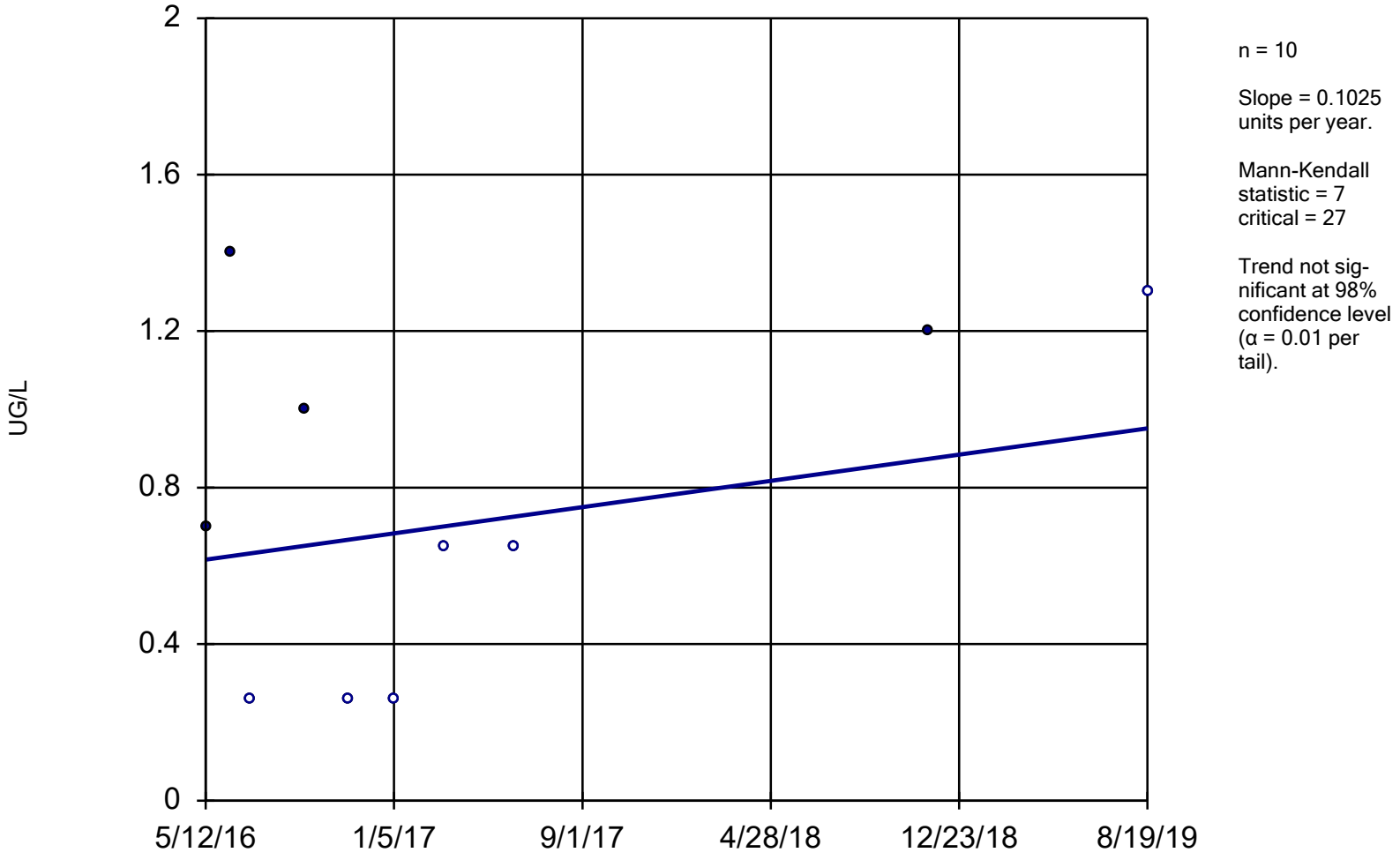
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

S-DG-1 (bg)



n = 10

Slope = 0.1025 units per year.

Mann-Kendall statistic = 7
critical = 27

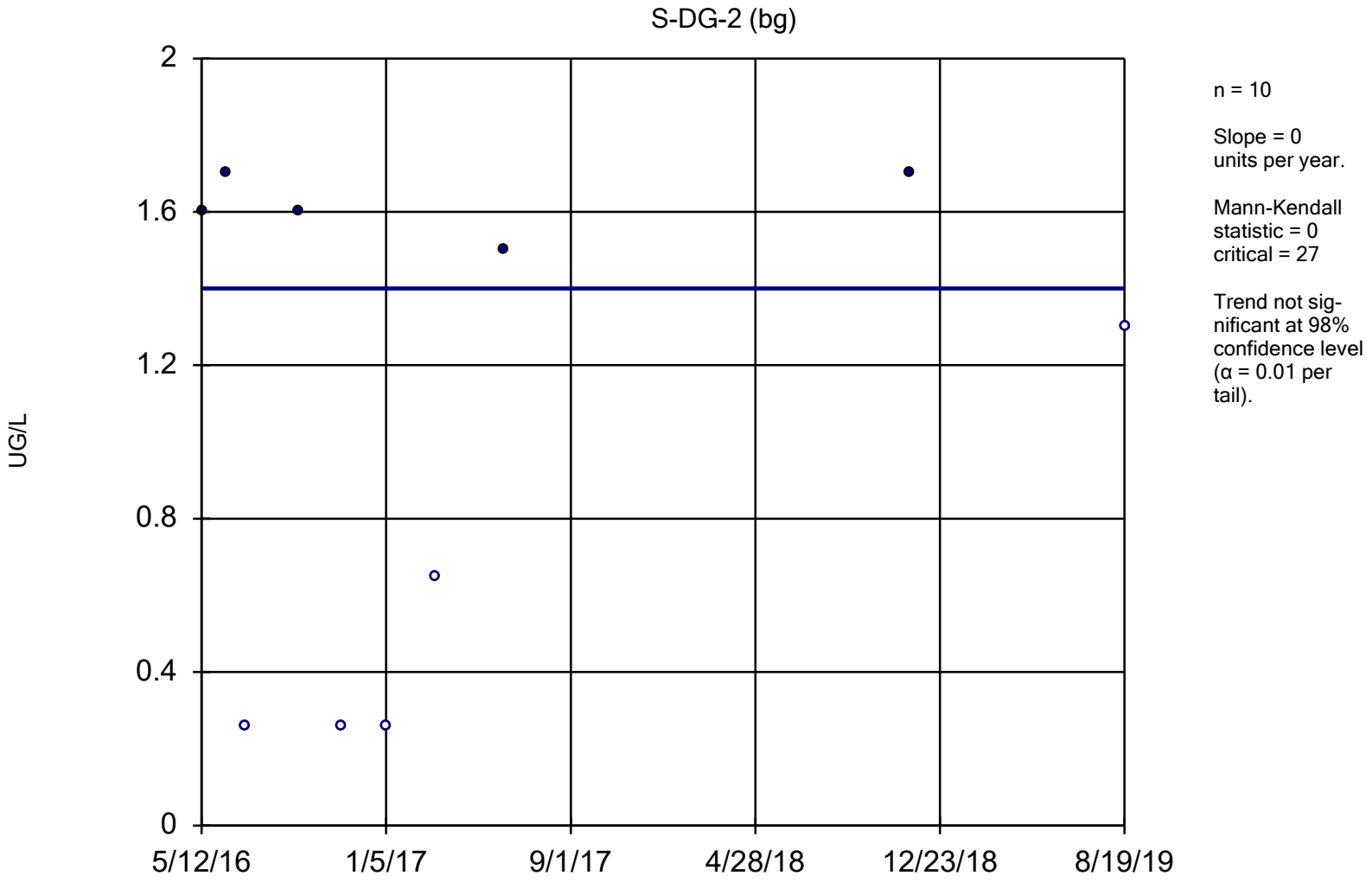
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

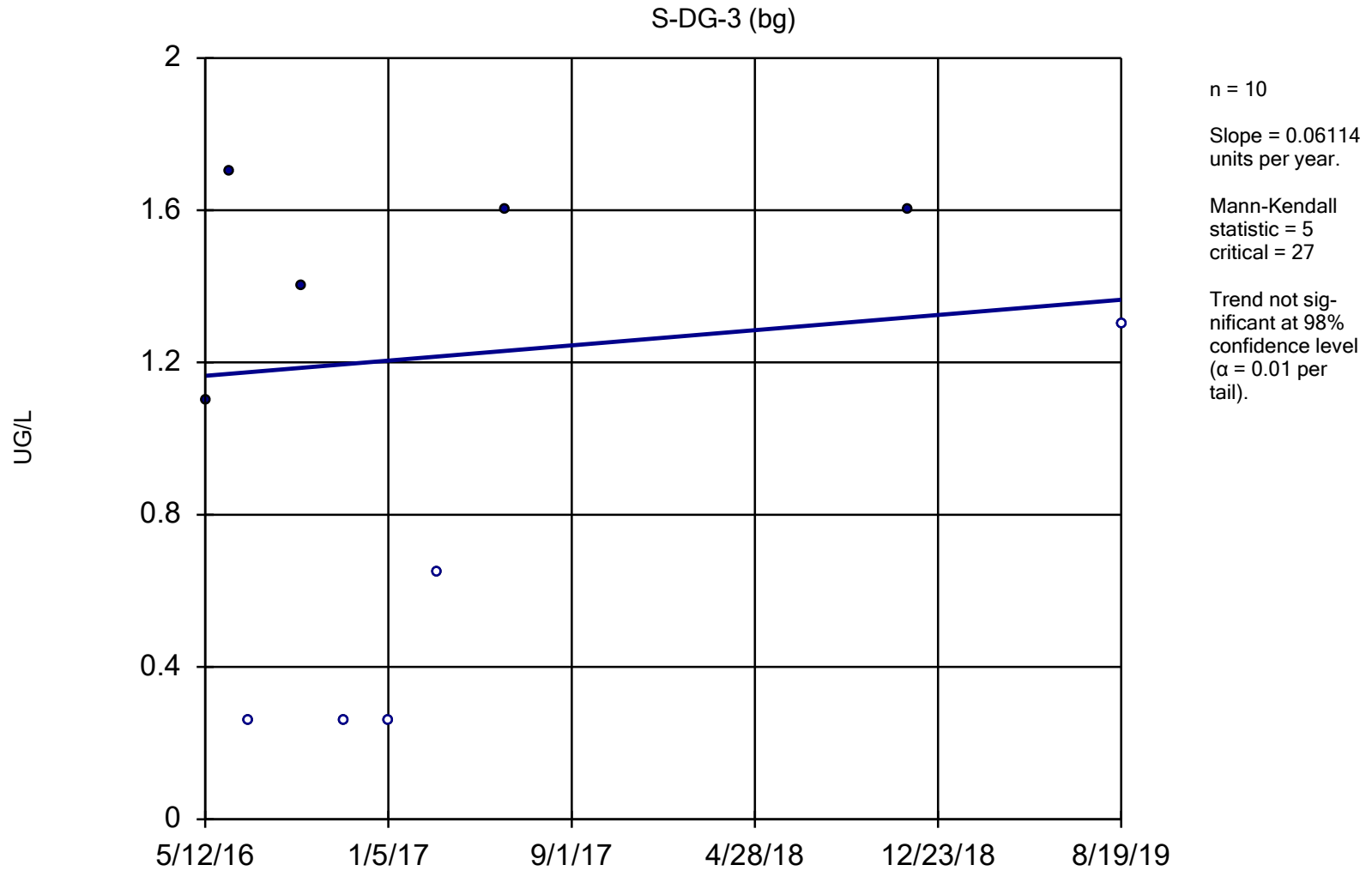


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



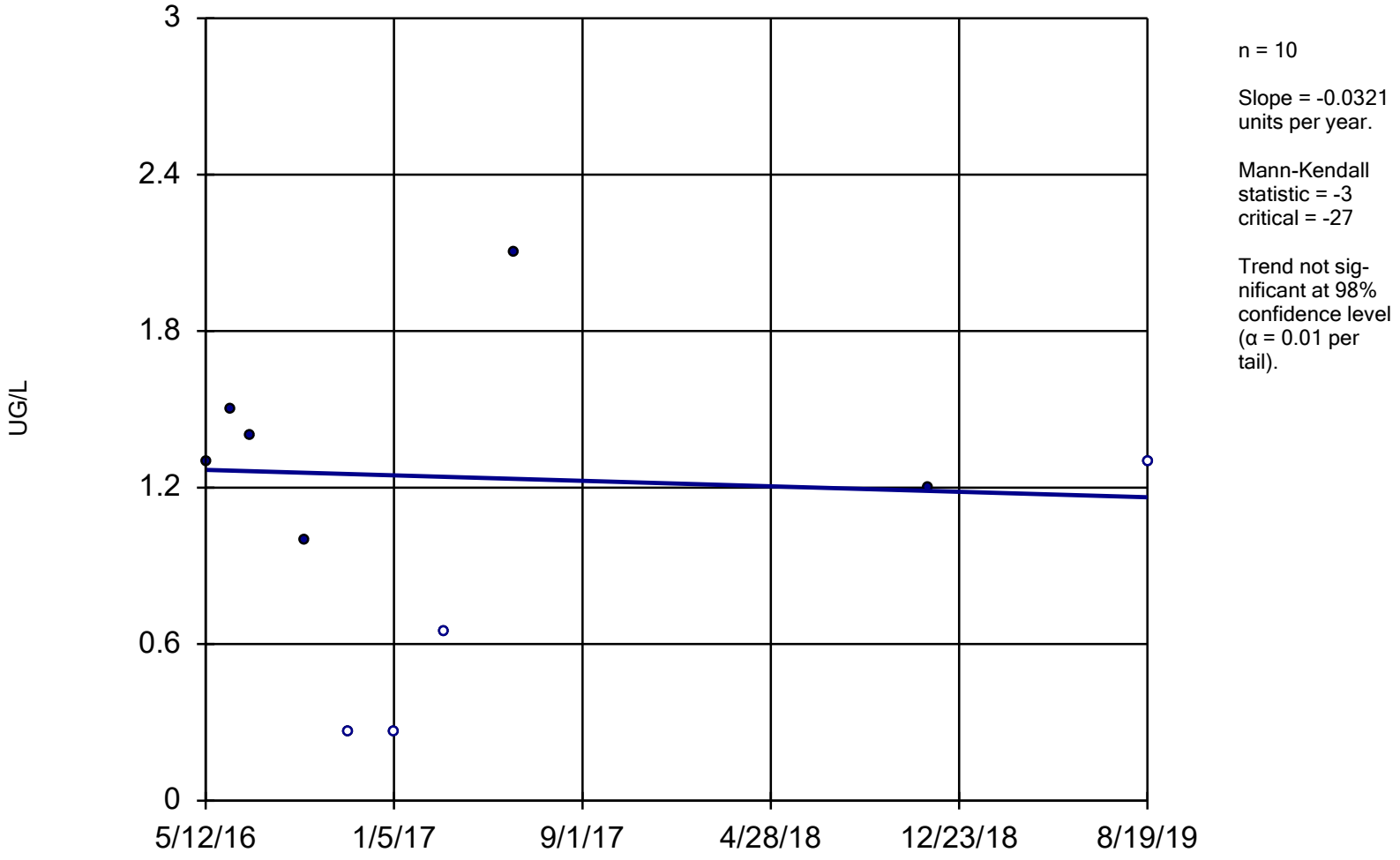
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

S-DG-4 (bg)



n = 10

Slope = -0.0321 units per year.

Mann-Kendall statistic = -3
critical = -27

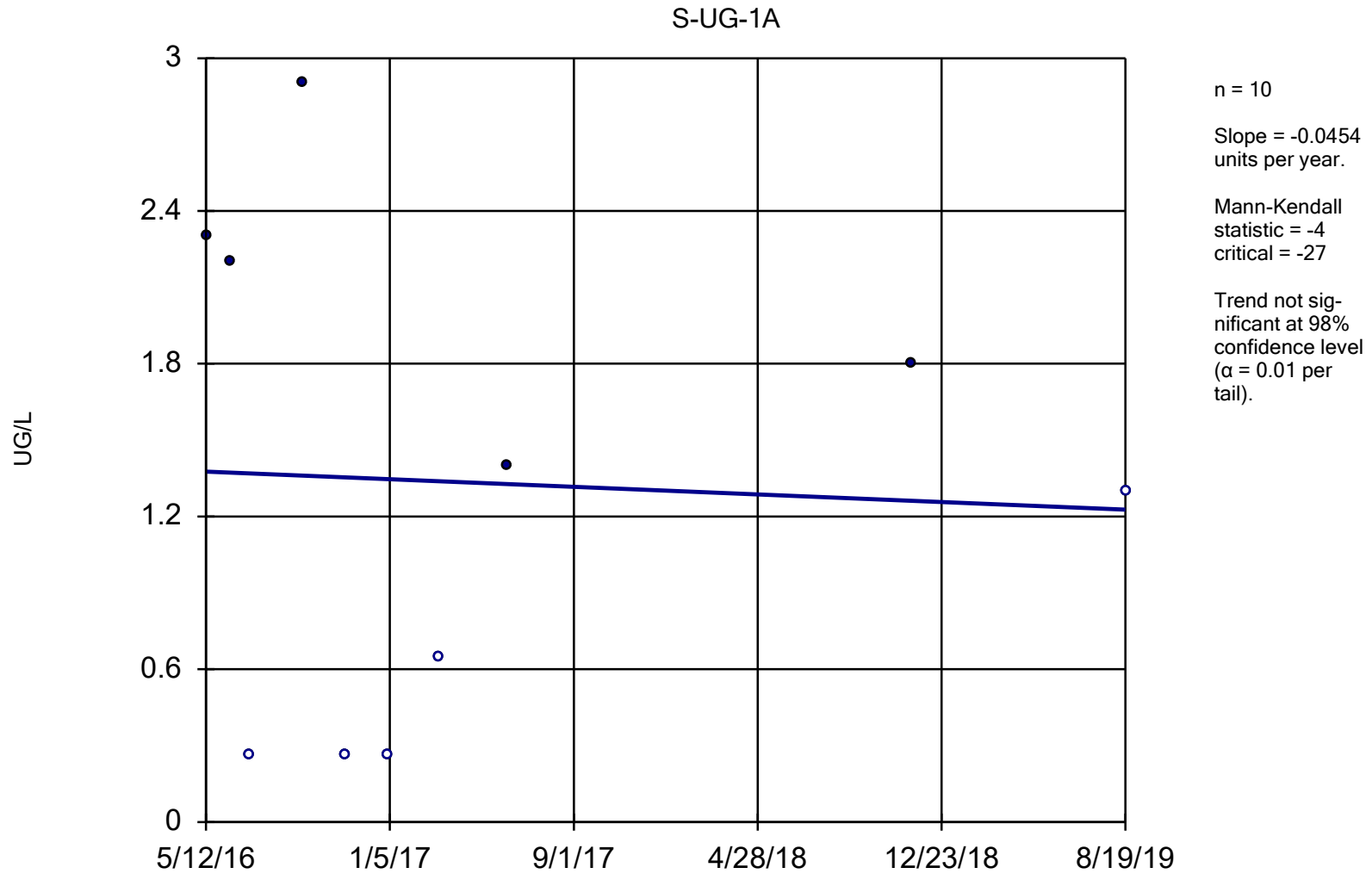
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



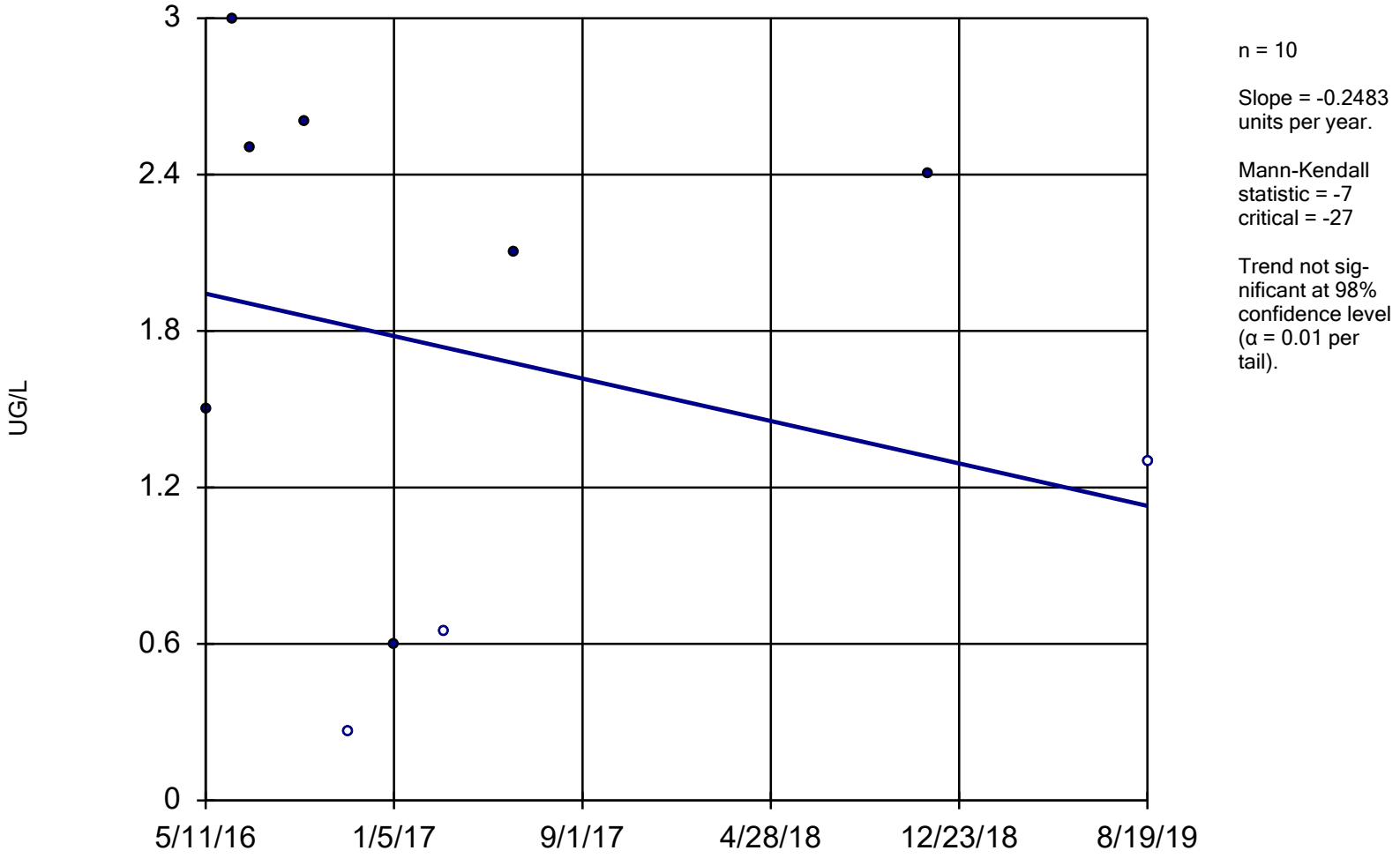
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

S-UG-2



n = 10

Slope = -0.2483 units per year.

Mann-Kendall statistic = -7
critical = -27

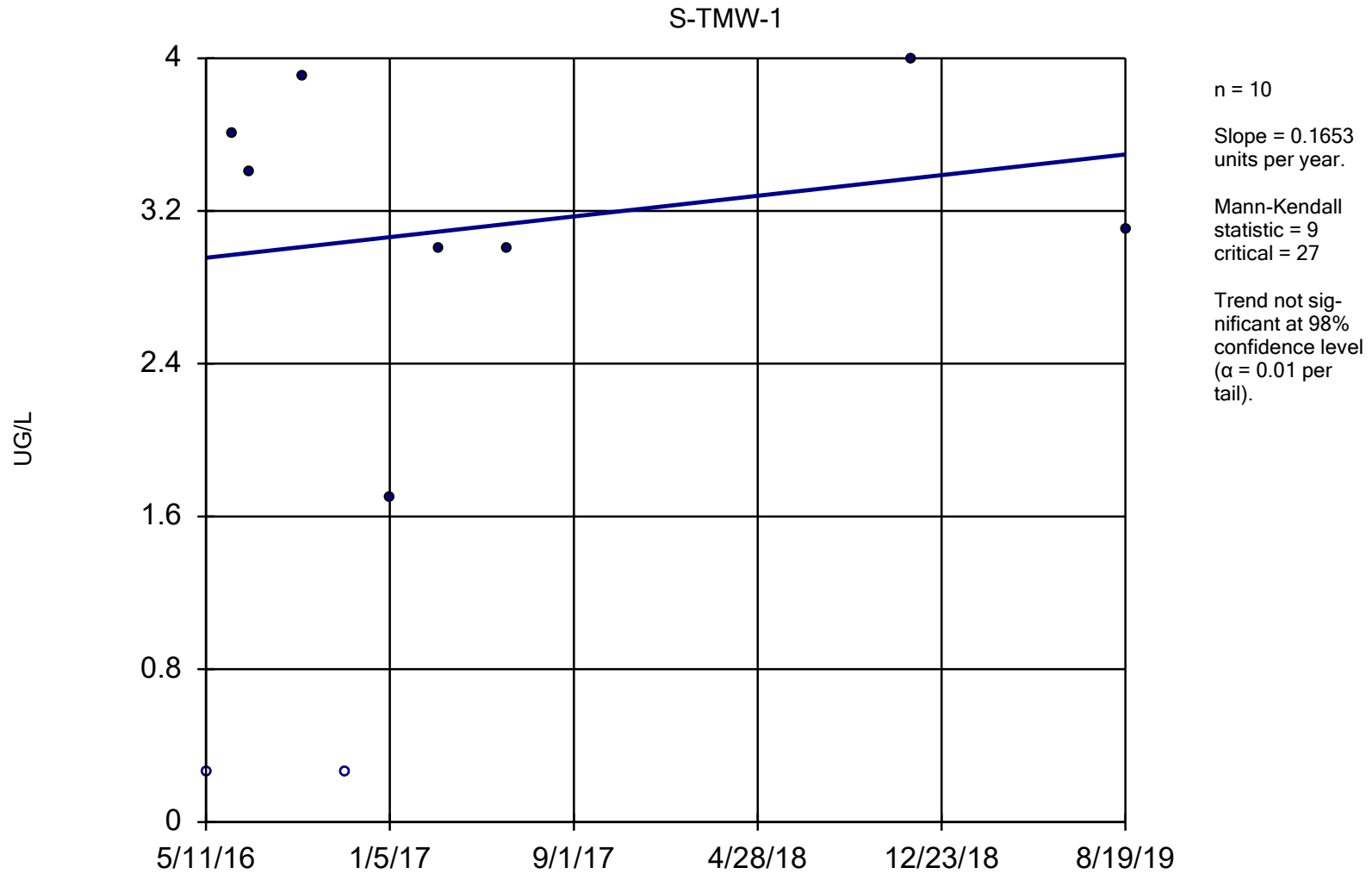
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

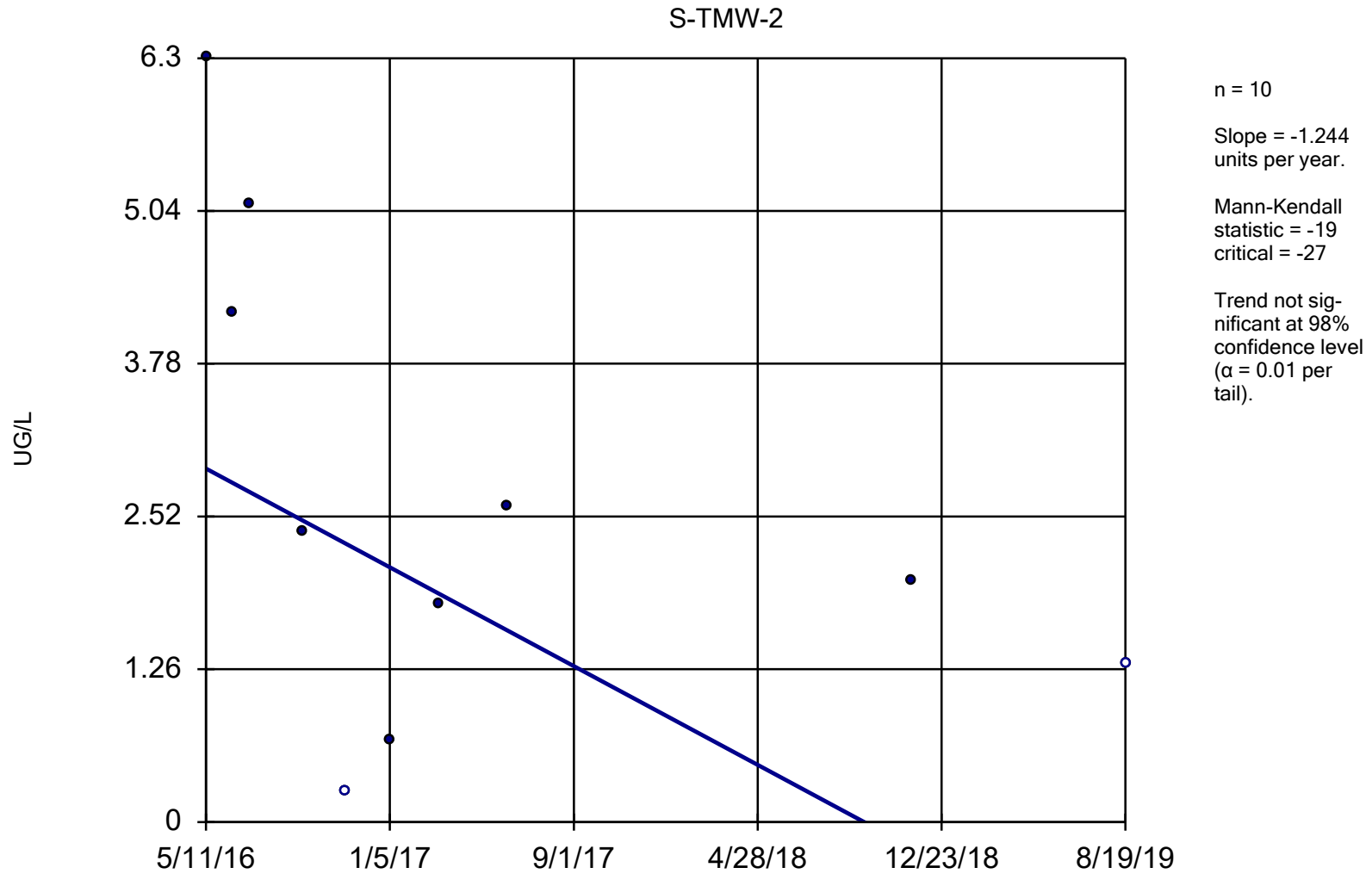


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

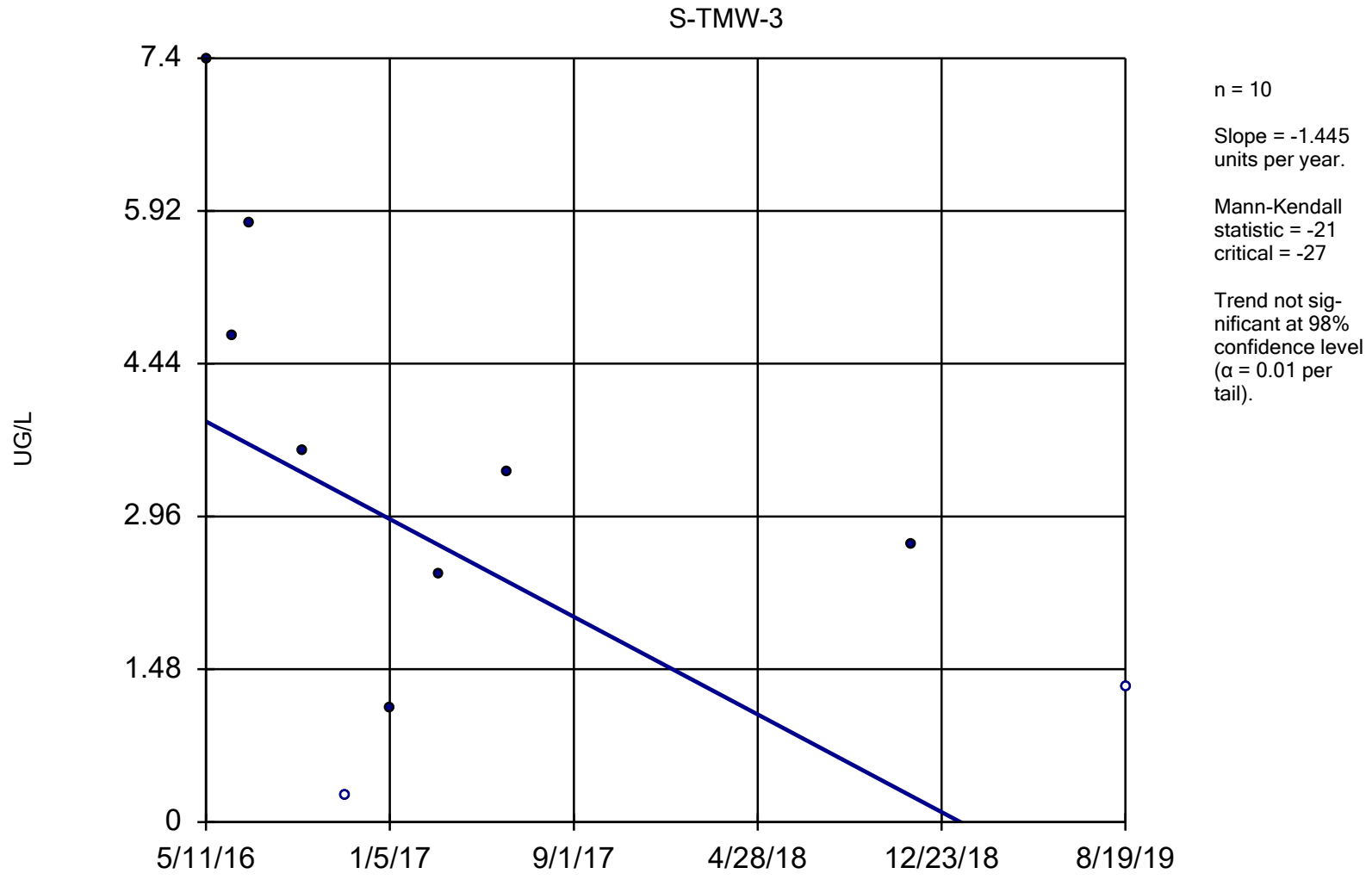


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

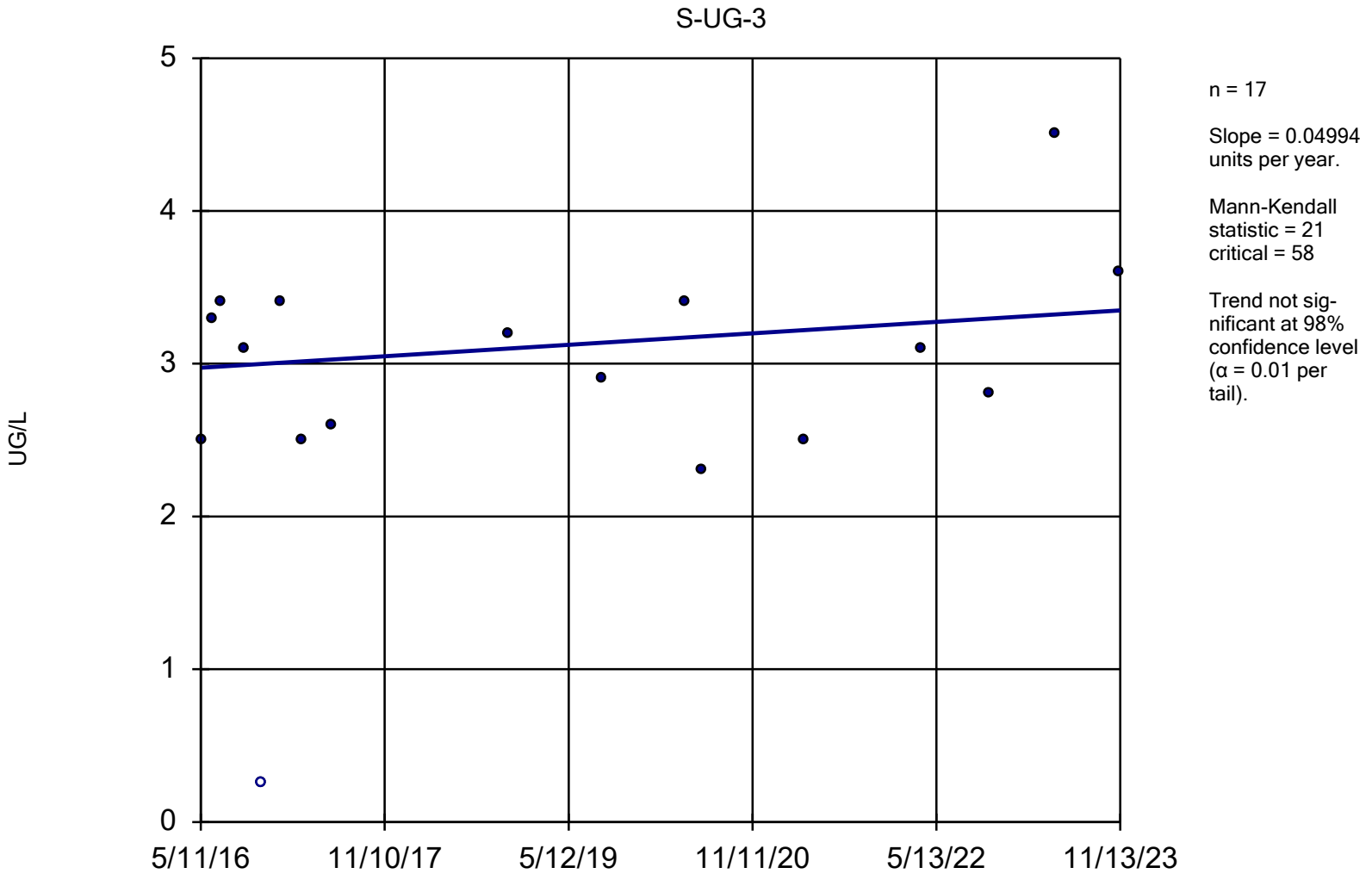


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

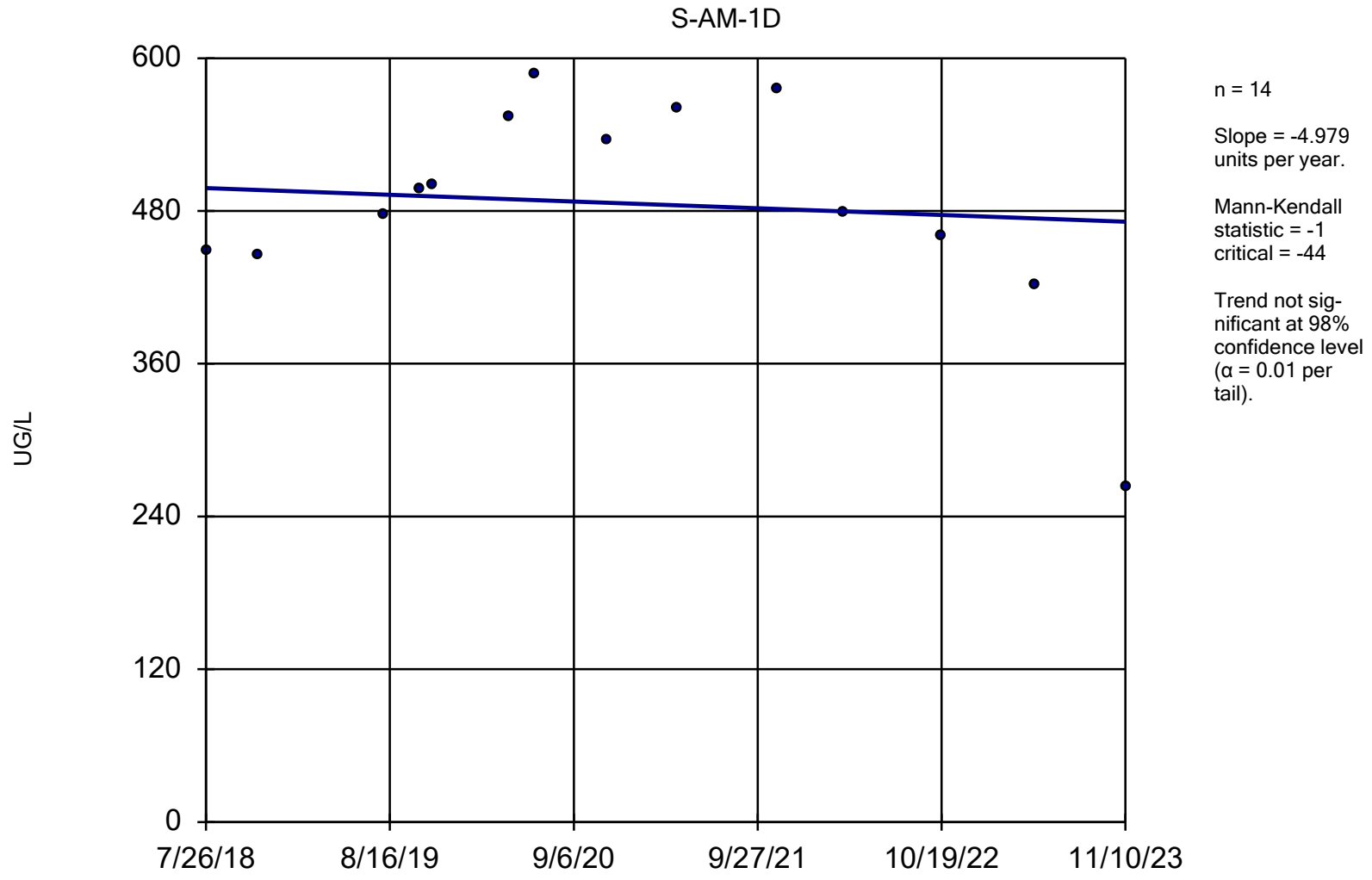


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator



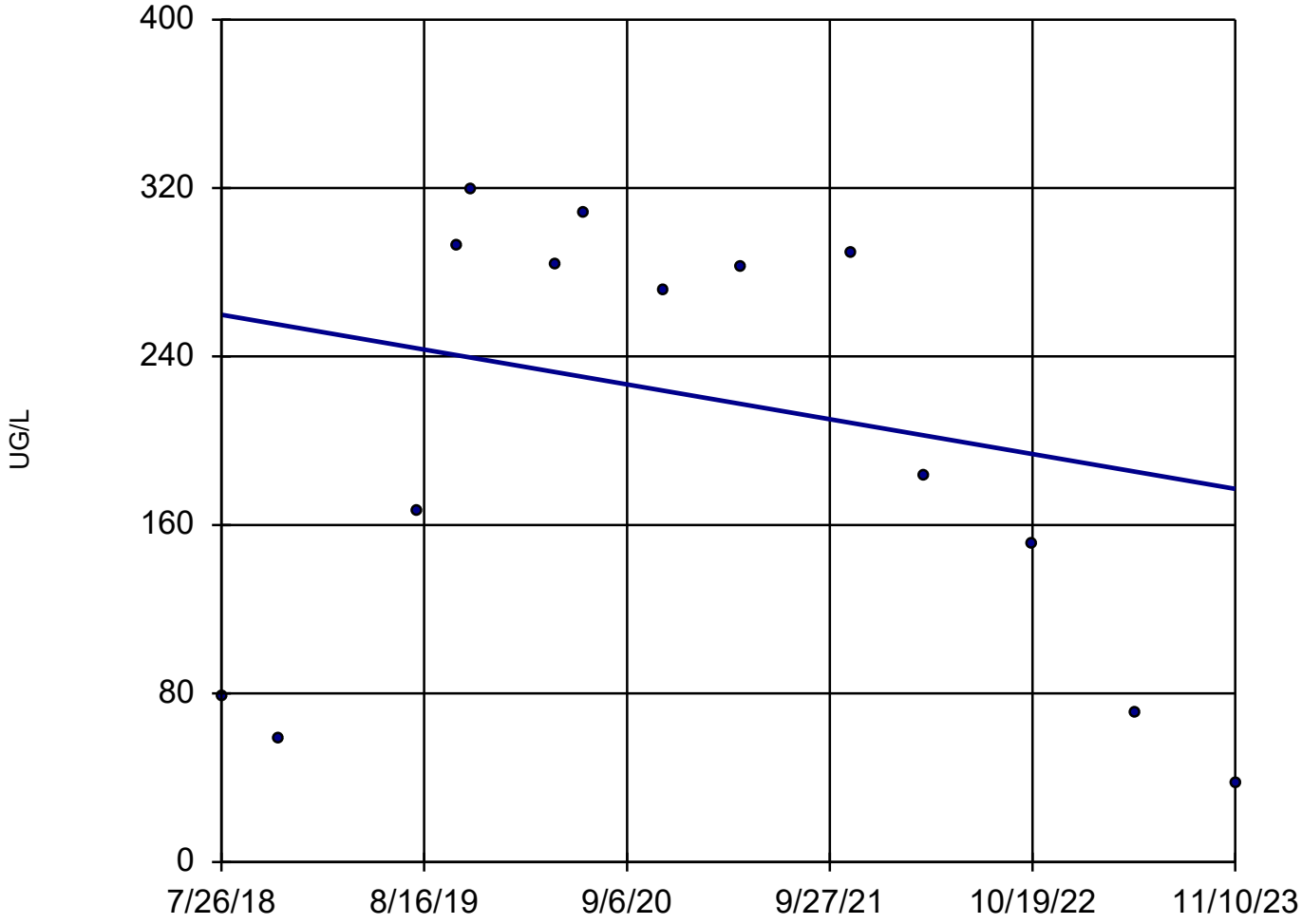
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-AM-1S



n = 14

Slope = -15.61 units per year.

Mann-Kendall statistic = -19 critical = -44

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

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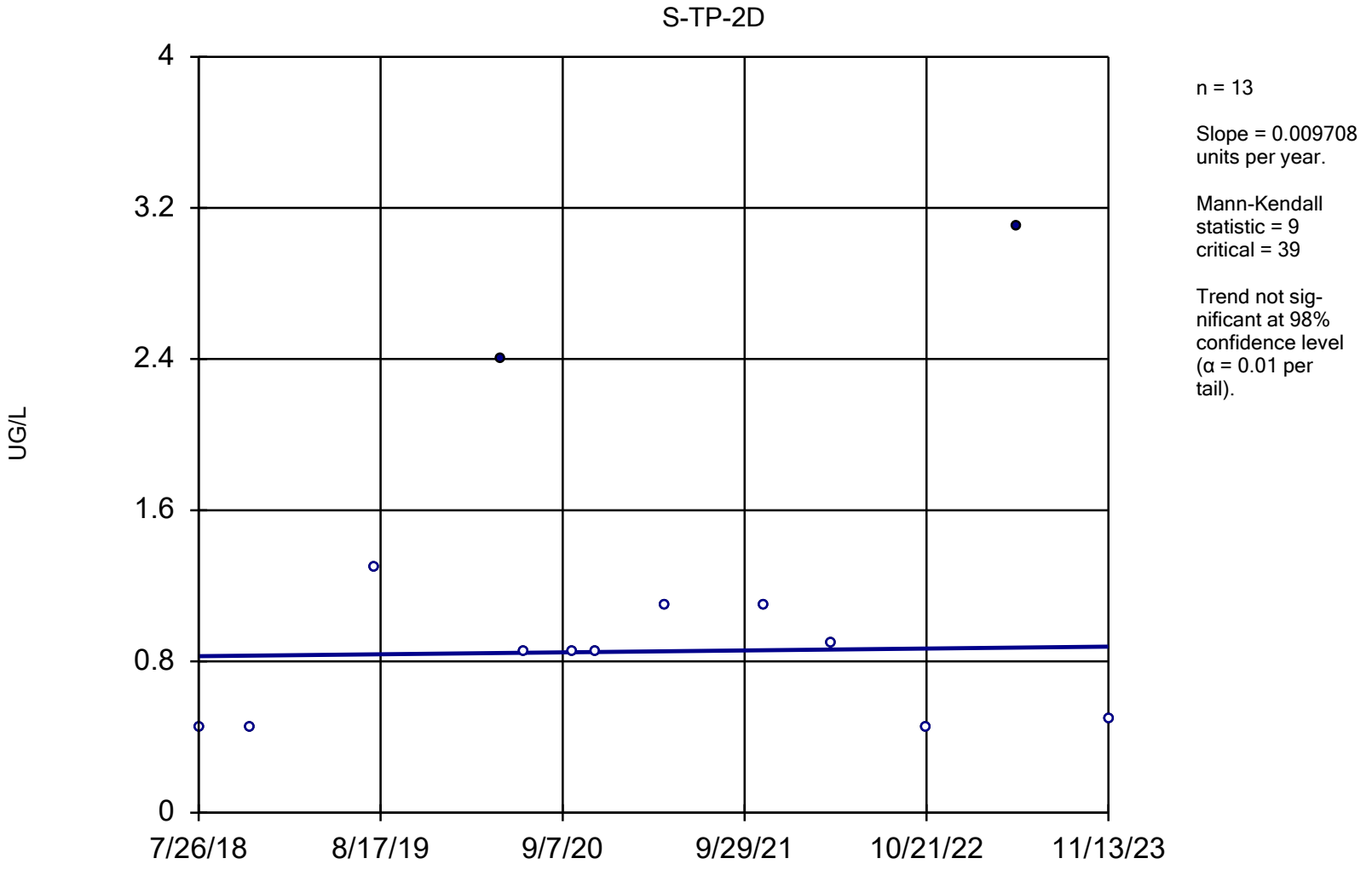
Hollow symbols indicate censored values.

Sen's Slope Estimator



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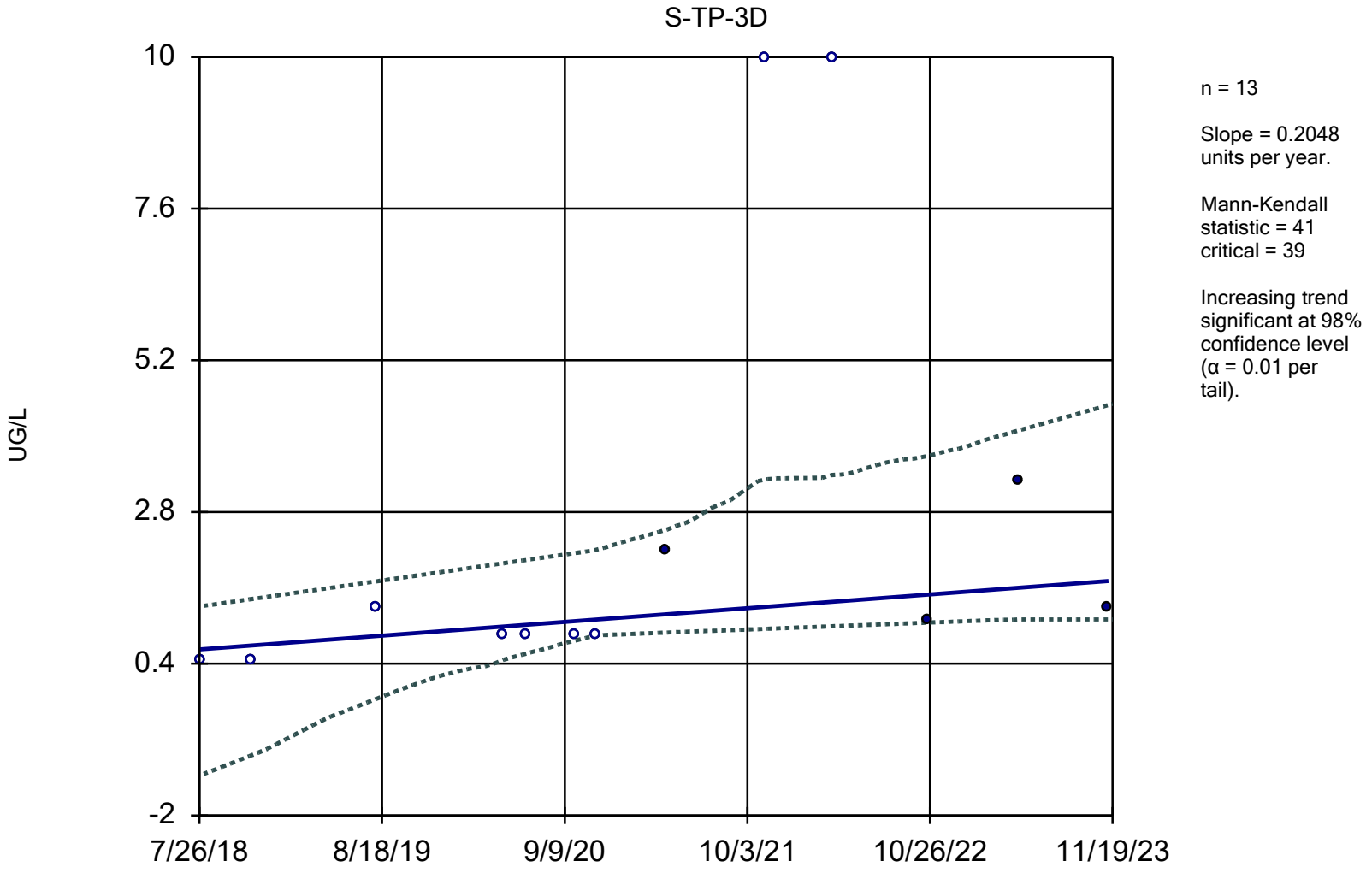
Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope and 95% Confidence Band



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Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
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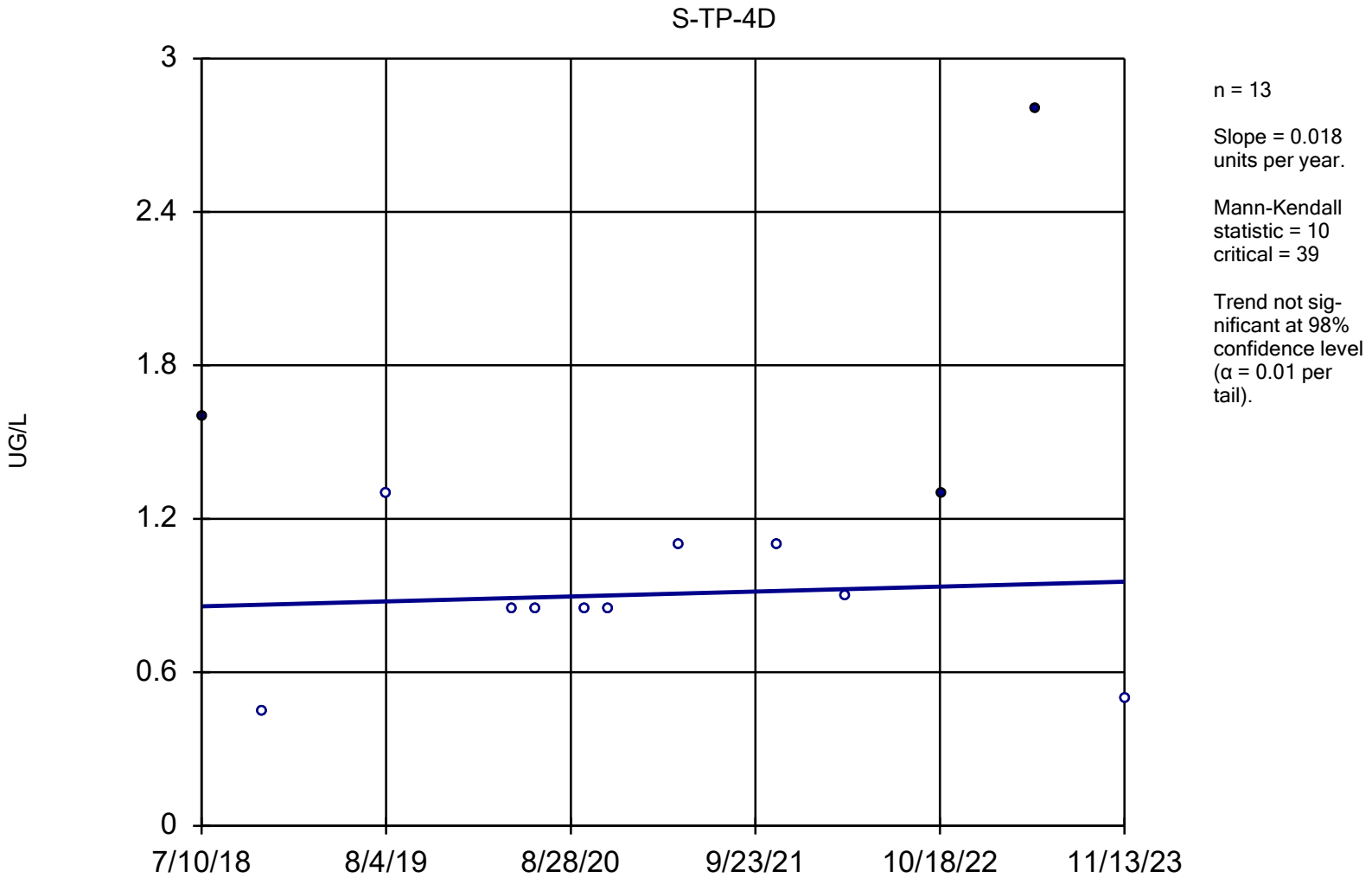
Sen's Slope Estimator

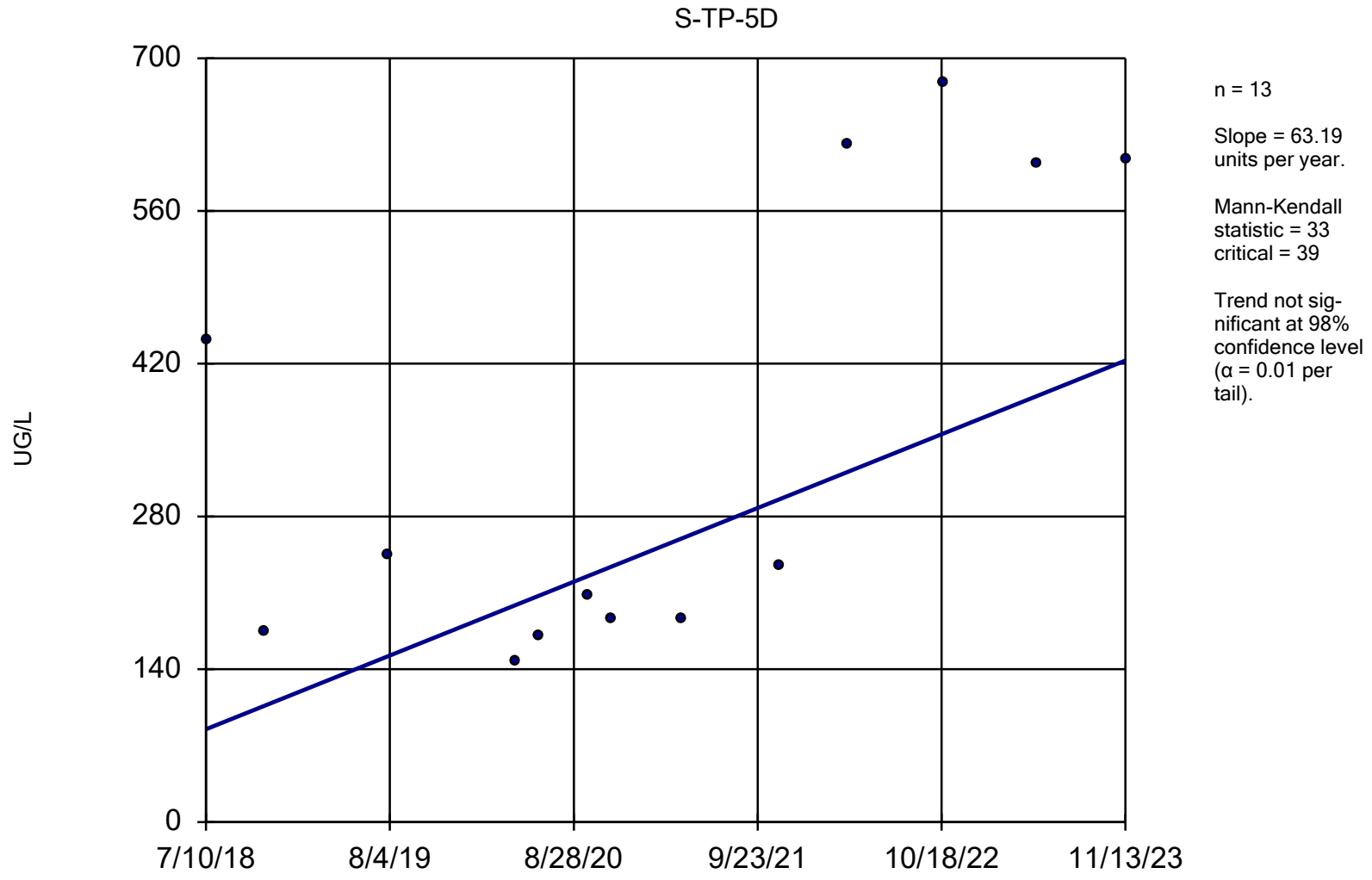


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator



Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
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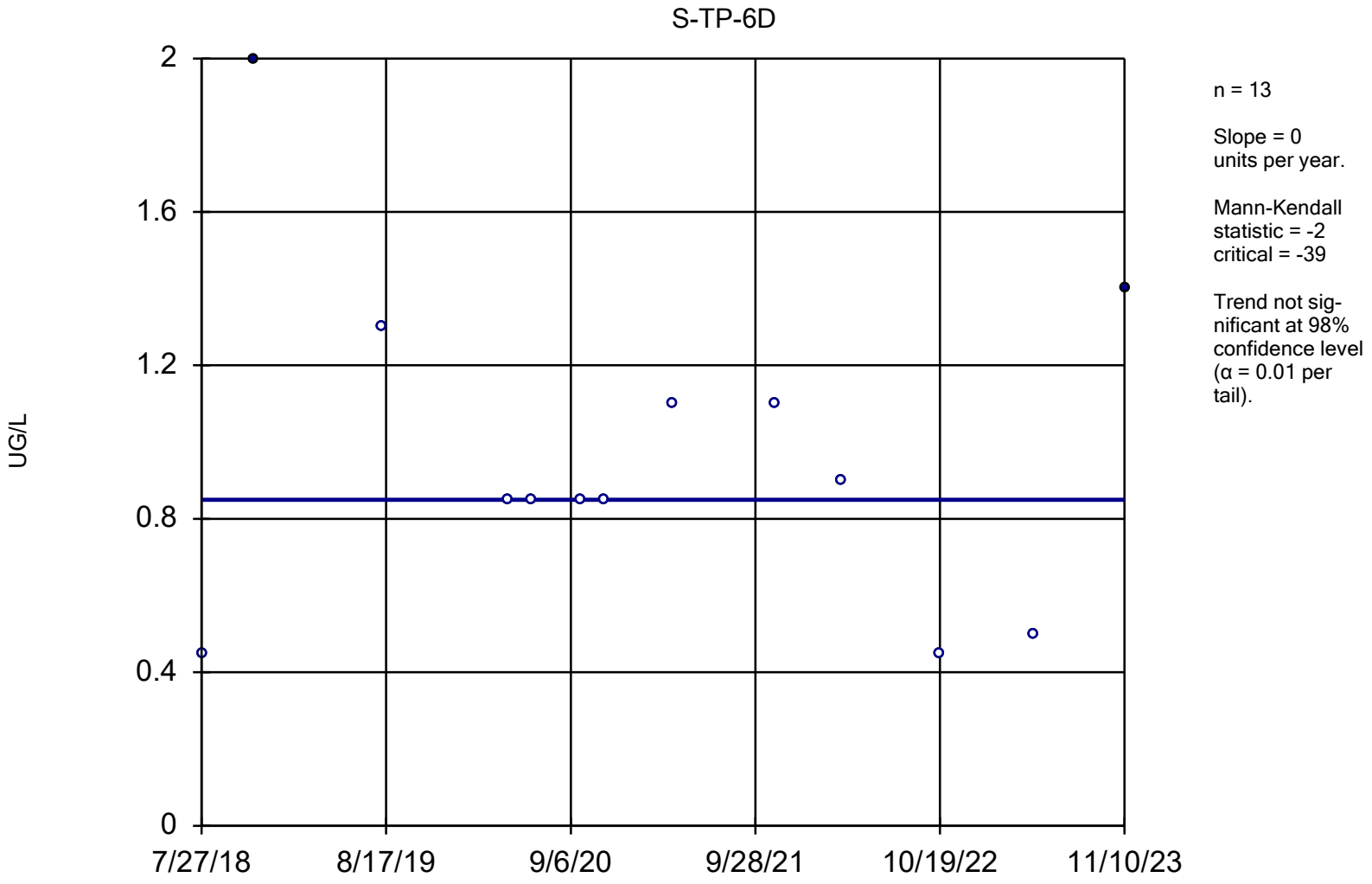
Sen's Slope Estimator



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Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
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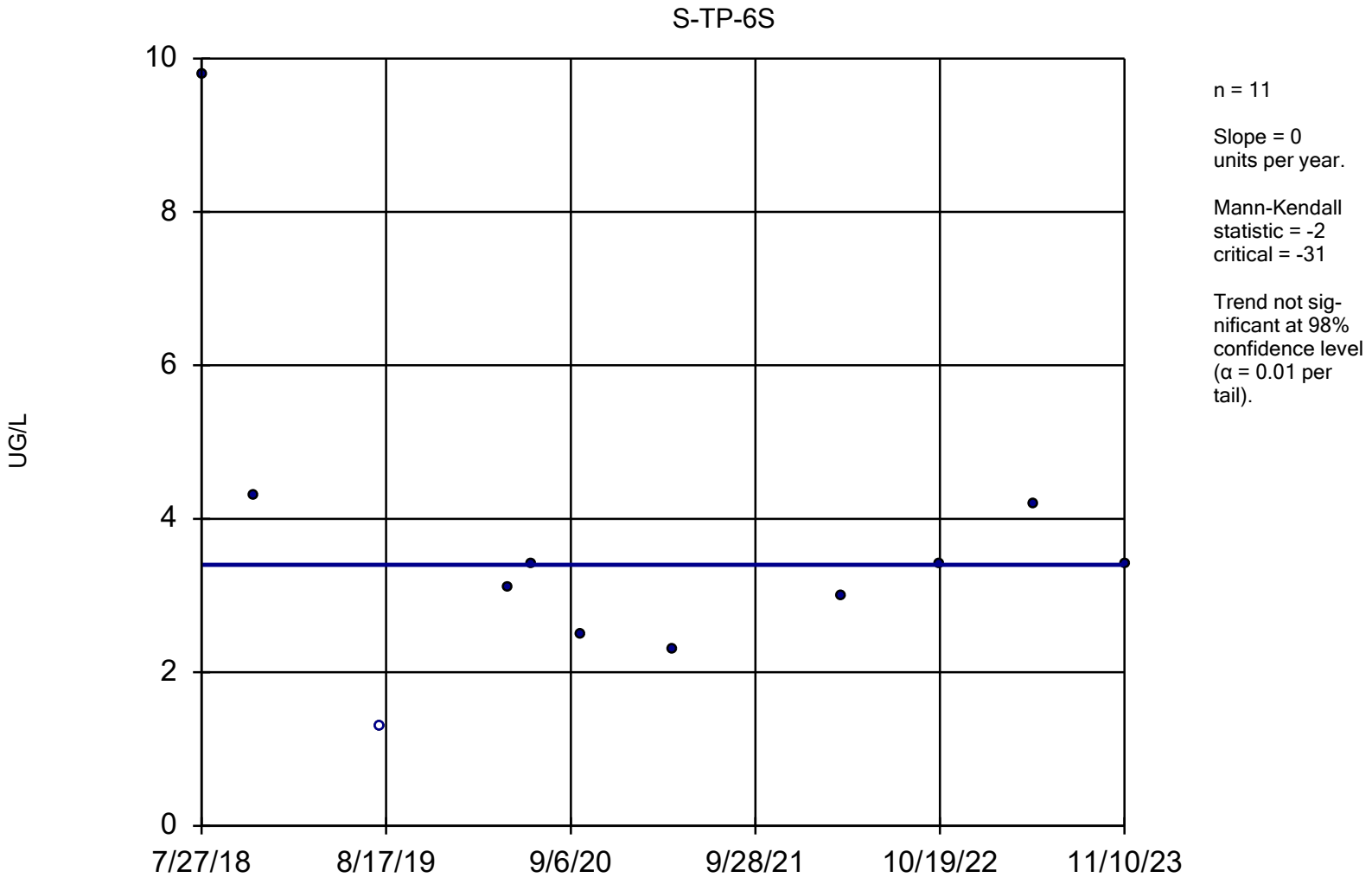
Sen's Slope Estimator



Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
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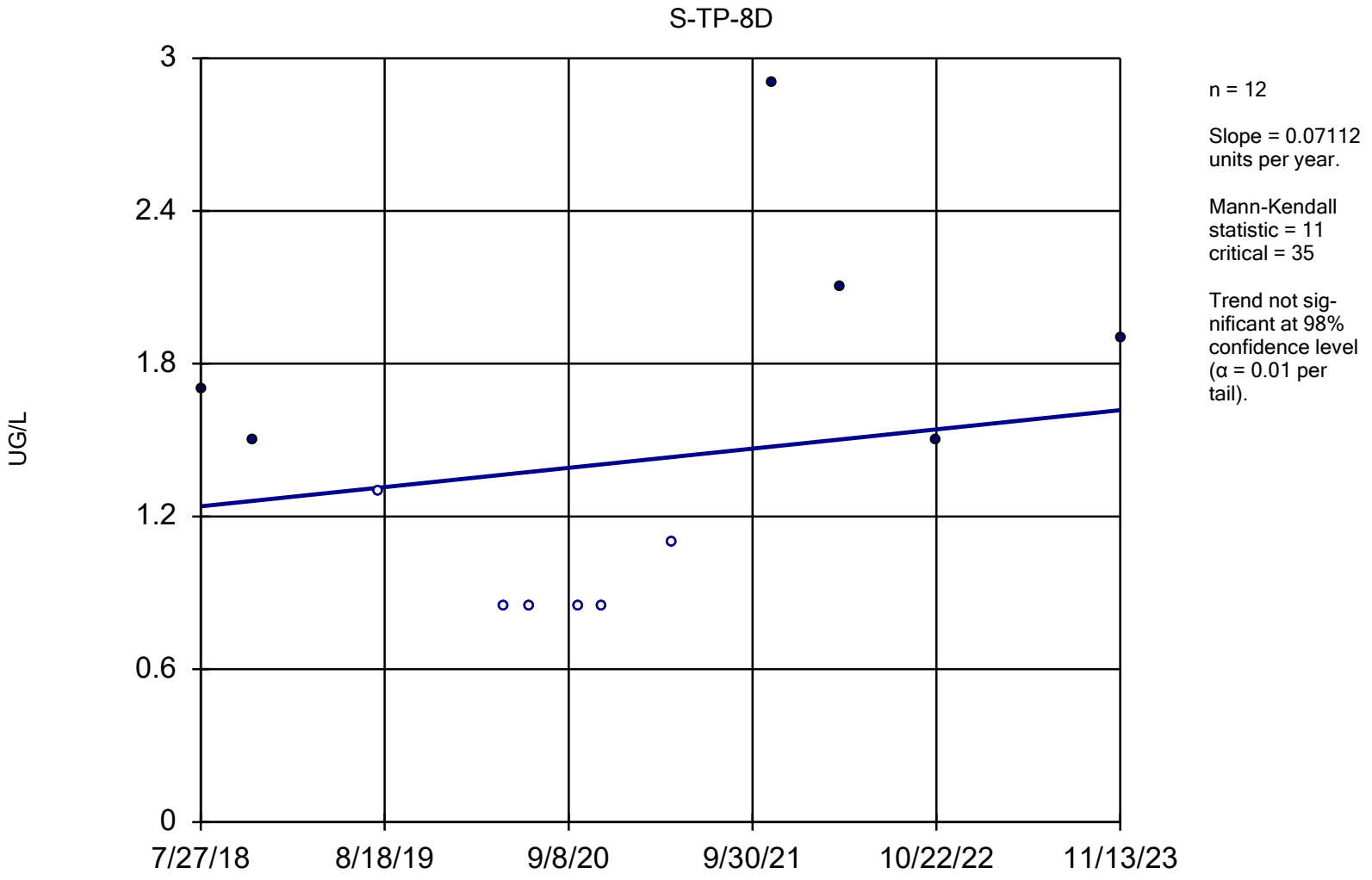
Sen's Slope Estimator



Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
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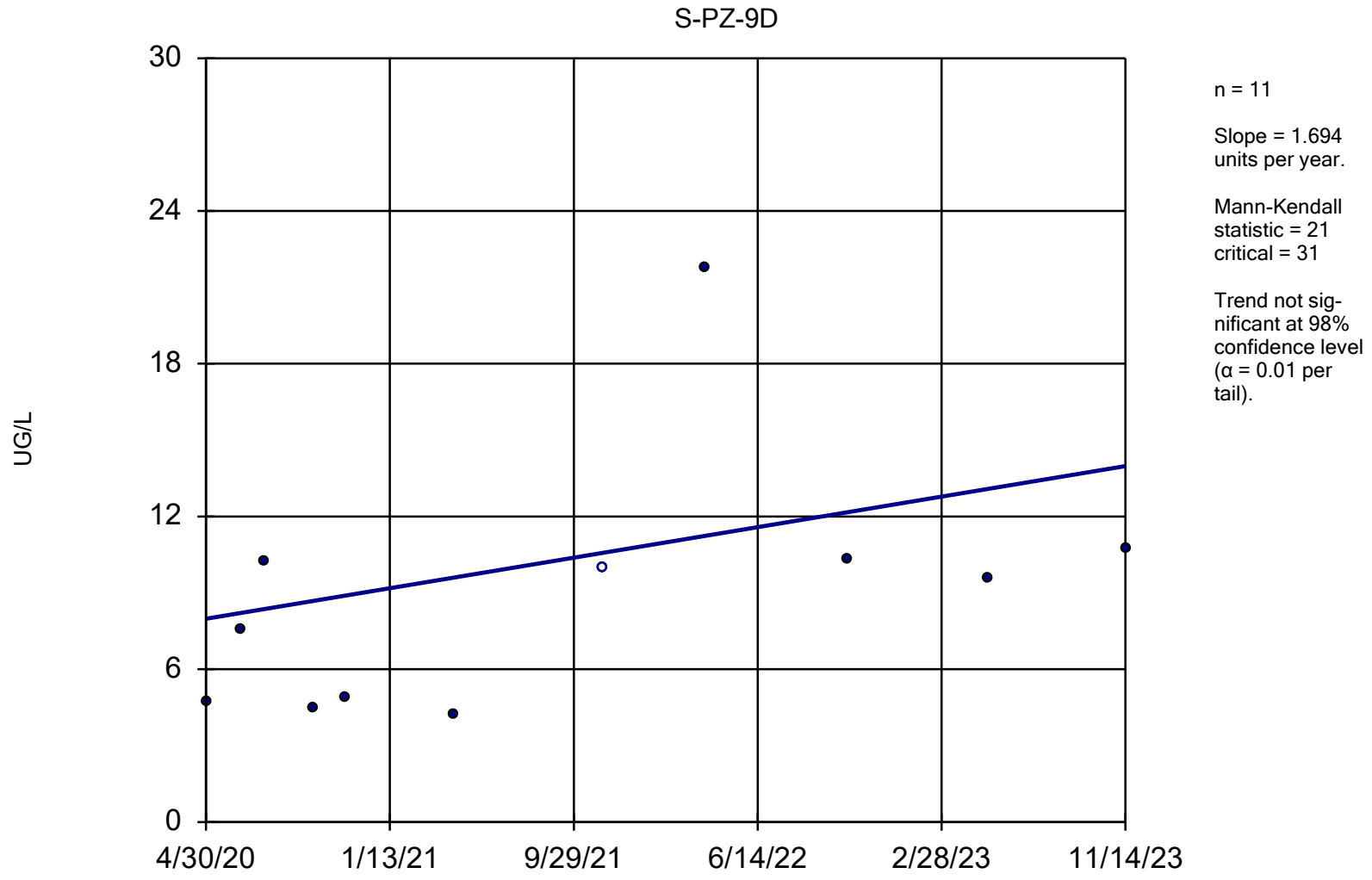
Sen's Slope Estimator



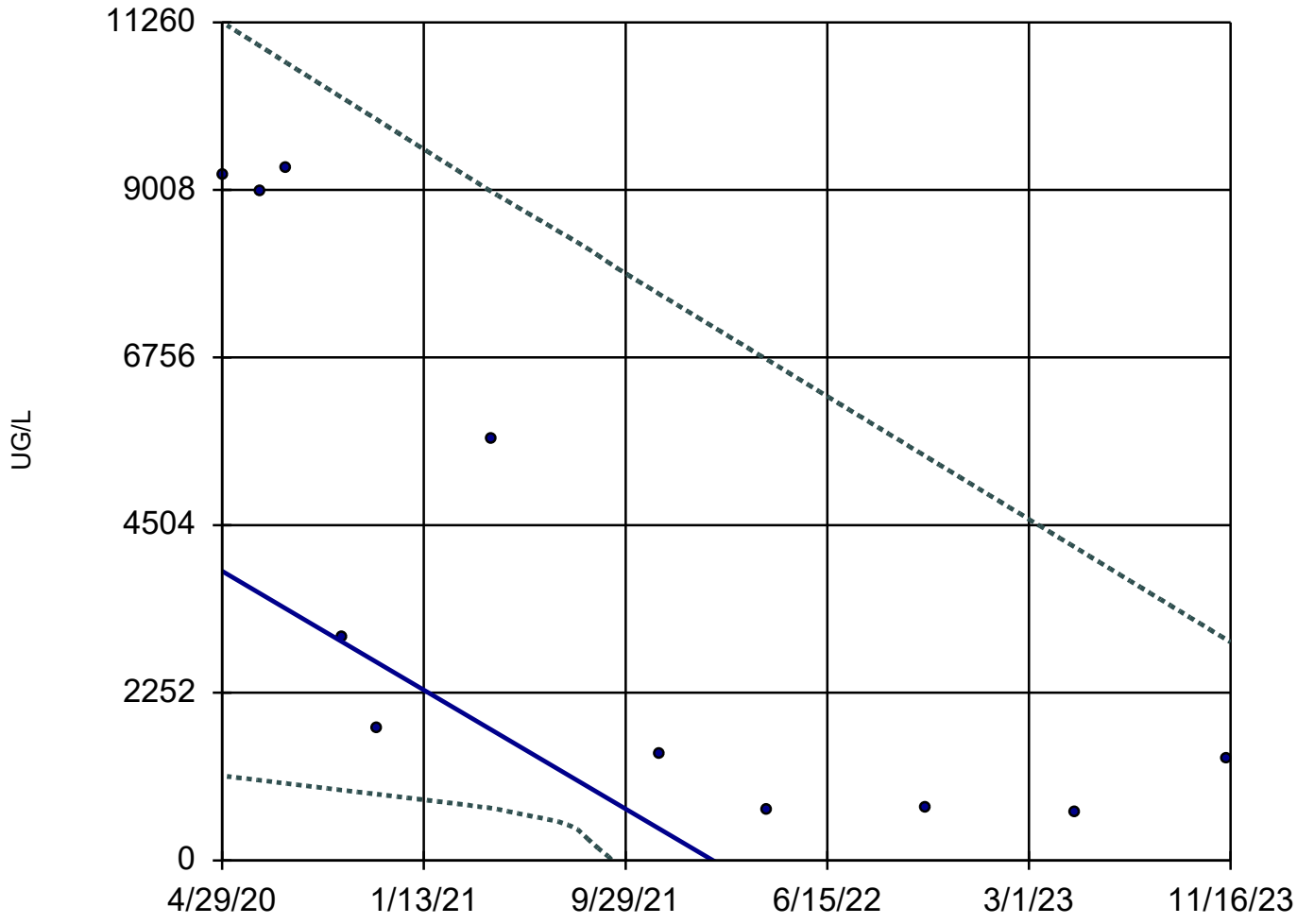
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:14 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-PZ-1S



n = 11

Slope = -2249 units per year.

Mann-Kendall statistic = -39
critical = -31

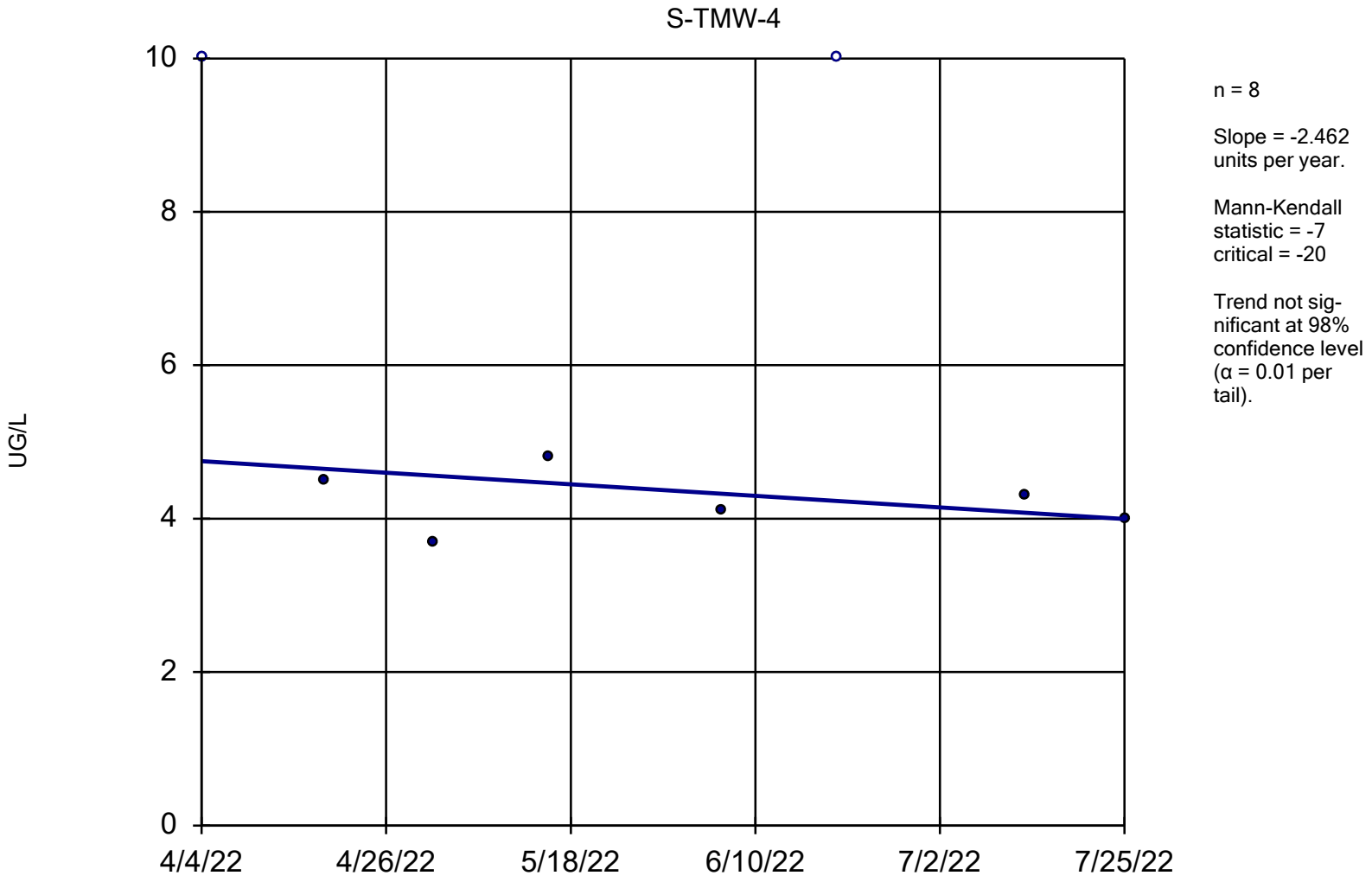
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:15 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

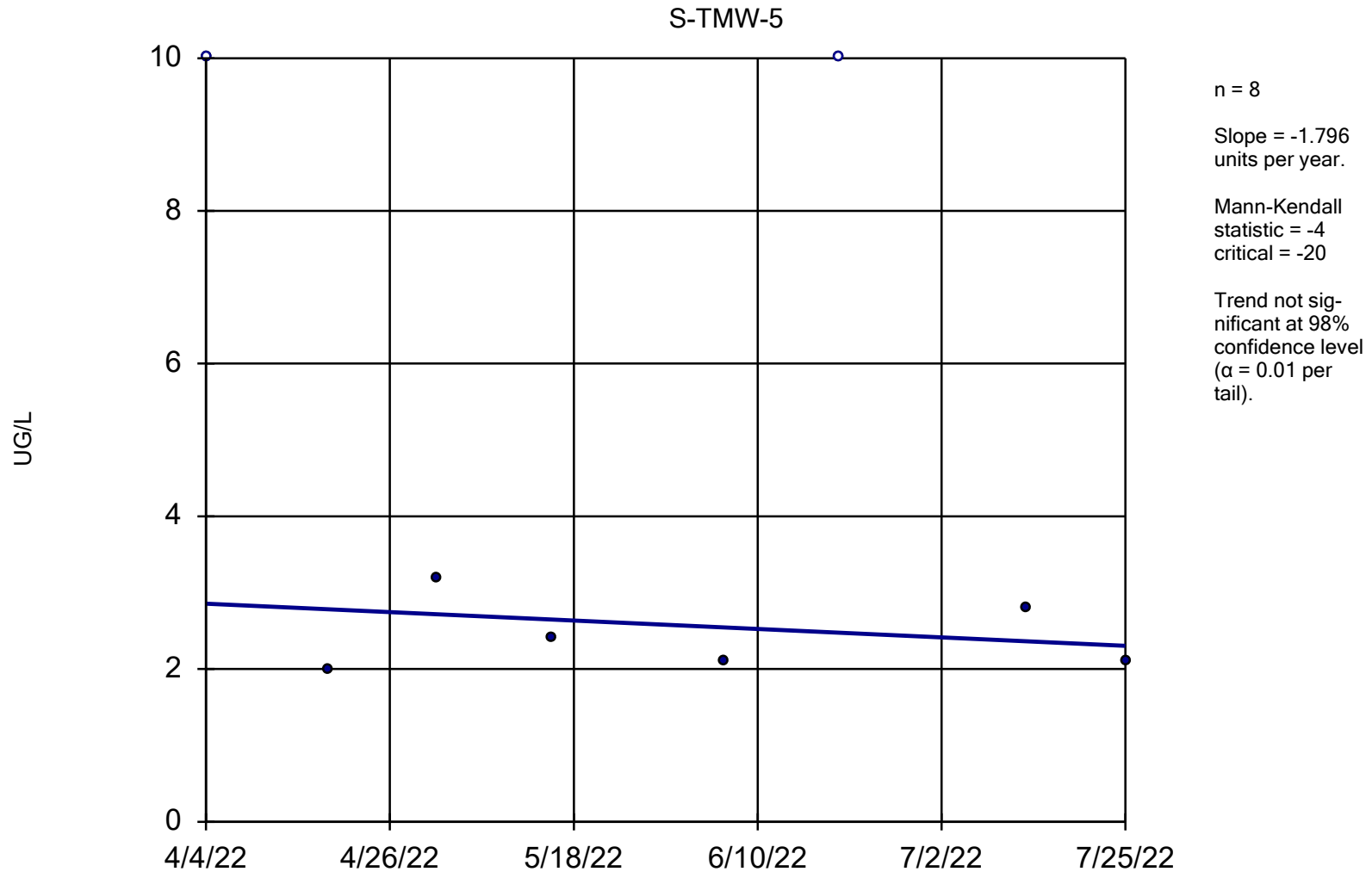


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:15 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

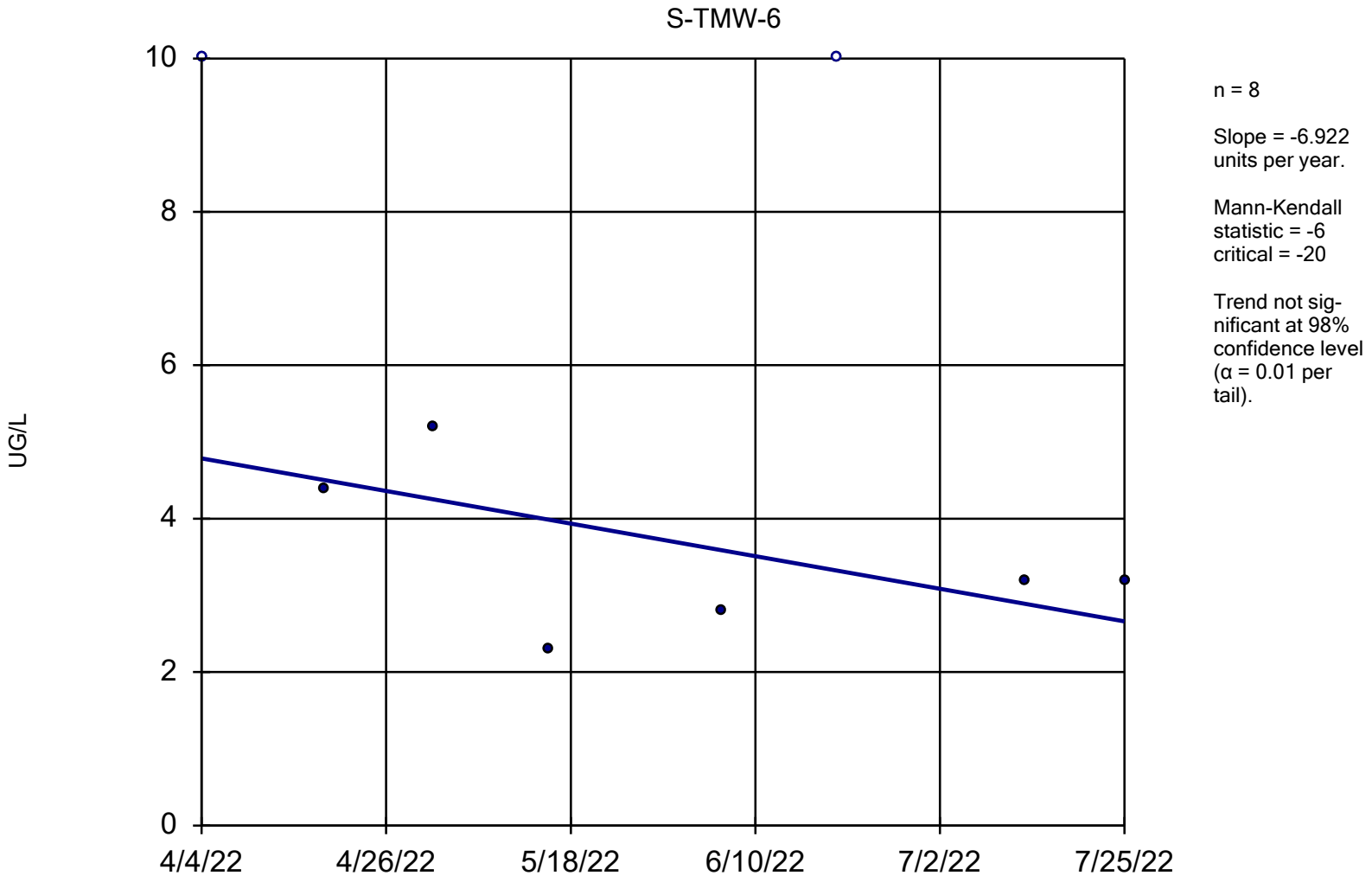


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:15 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

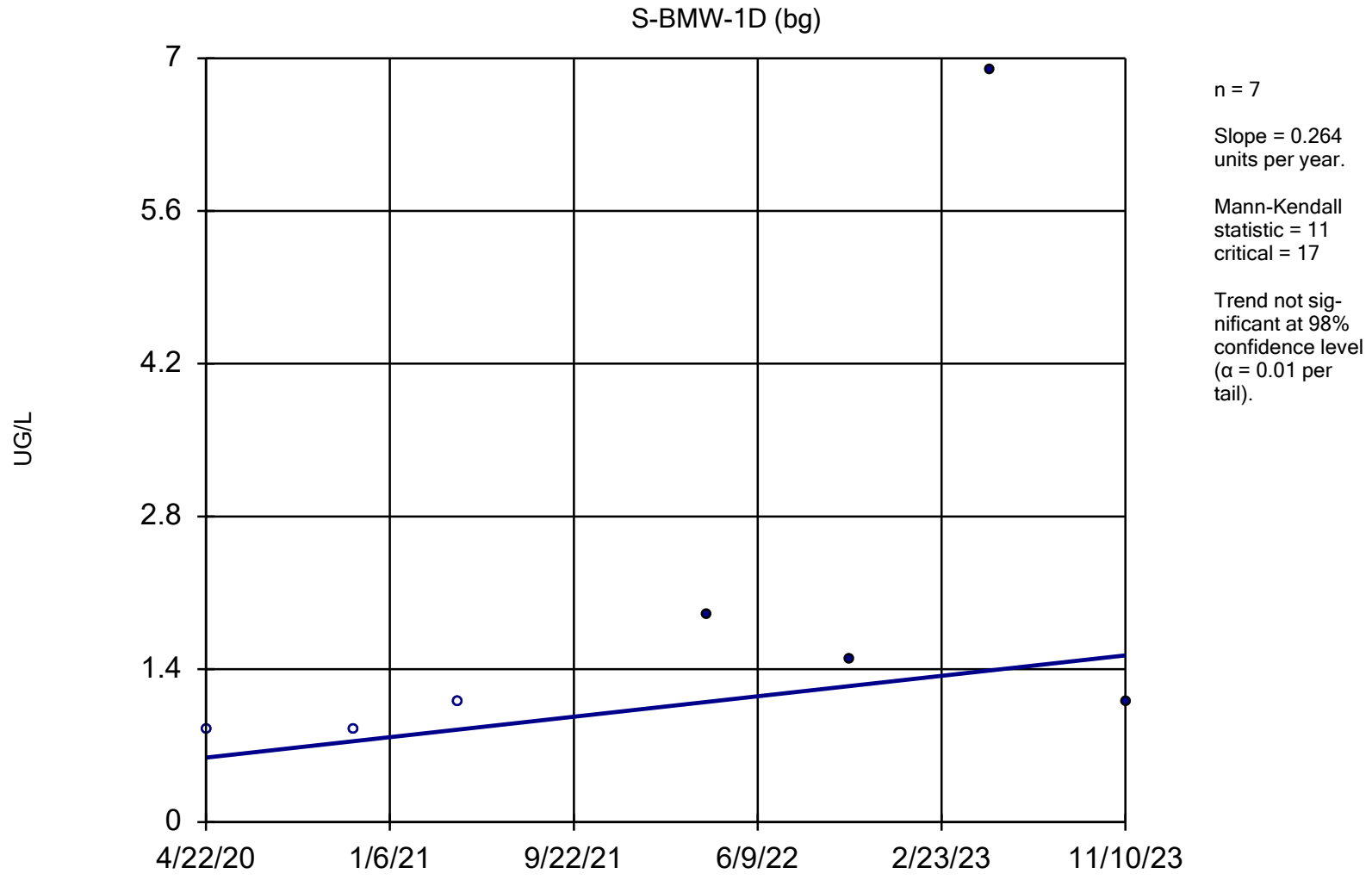


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 3:15 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:31 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

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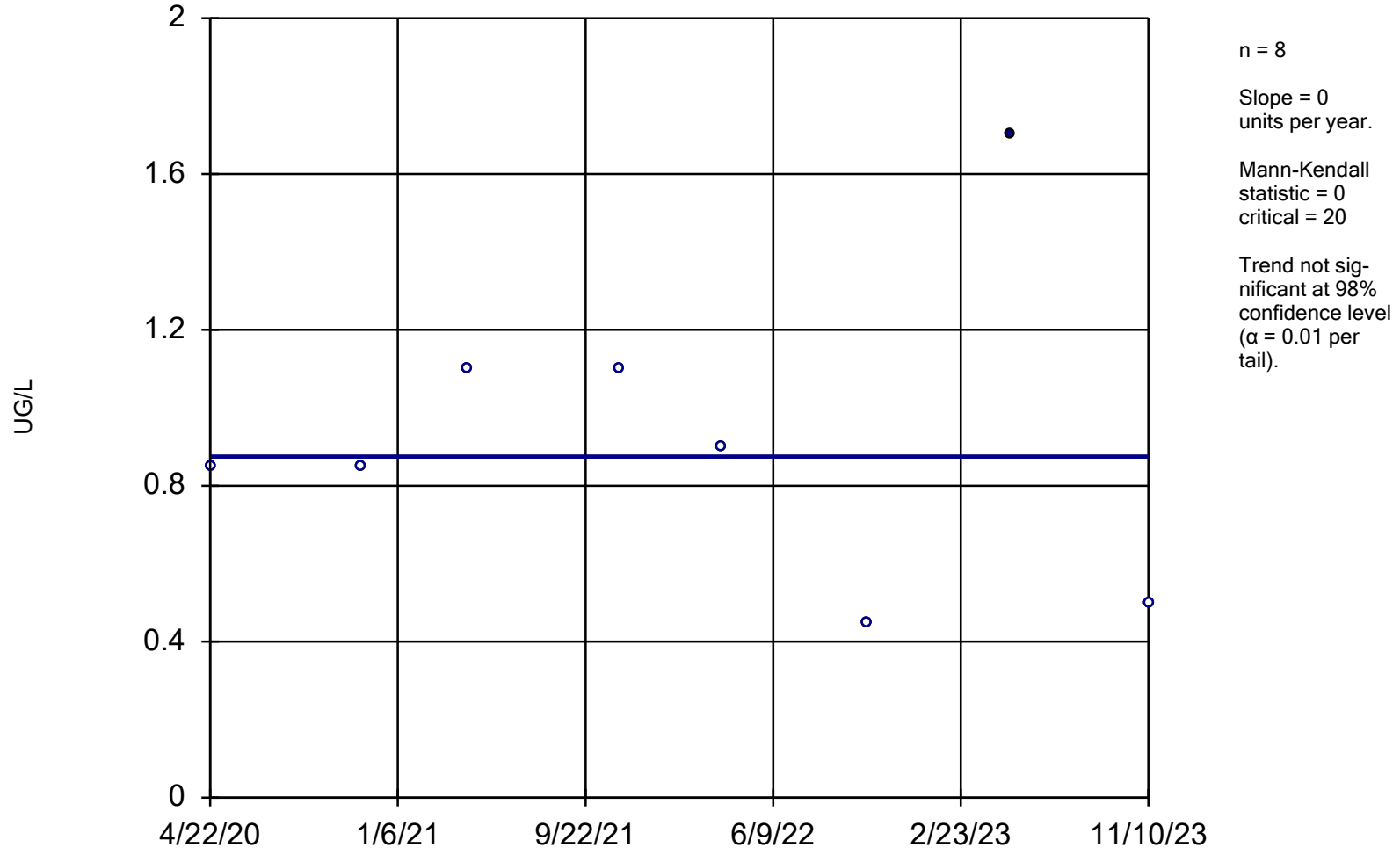
Hollow symbols indicate censored values.

Sen's Slope Estimator

S-BMW-3D (bg)



n = 8

Slope = 0
units per year.

Mann-Kendall
statistic = 0
critical = 20

Trend not sig-
nificant at 98%
confidence level
(α = 0.01 per
tail).

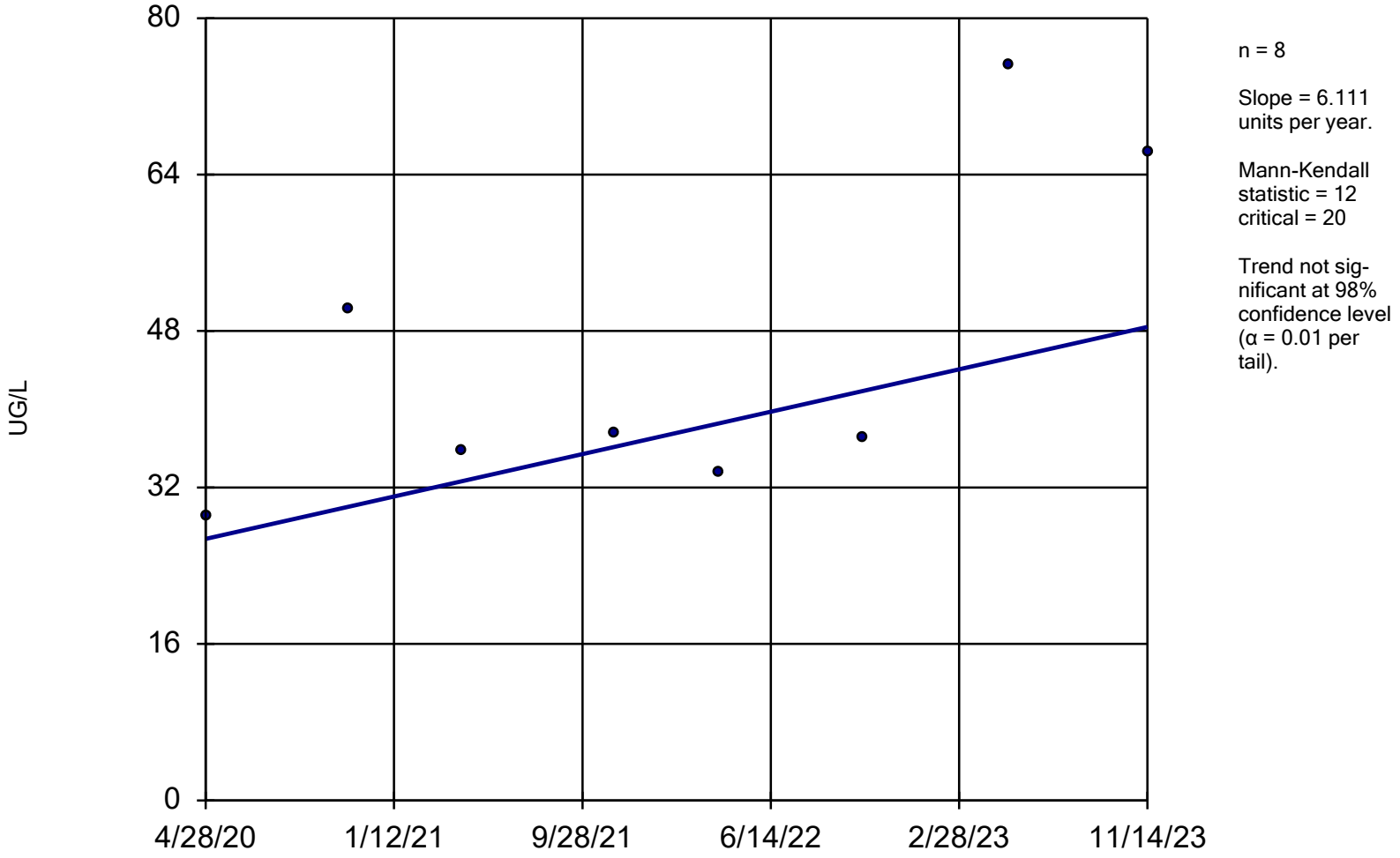
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-UMW-1D



Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

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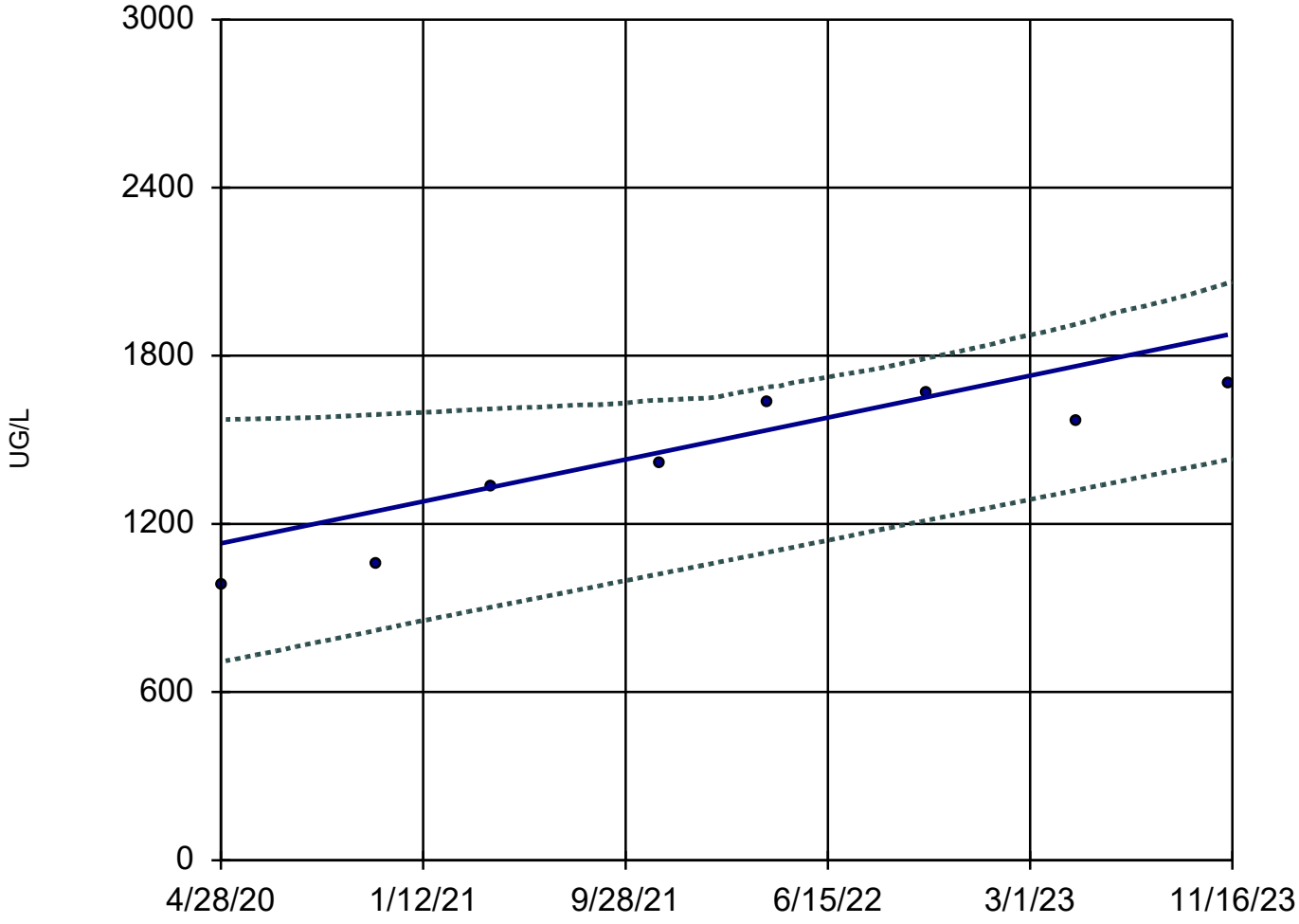
Sen's Slope and 95% Confidence Band

S-UMW-2D



n = 8

Slope = 210.5 units per year.

Mann-Kendall statistic = 24
critical = 20

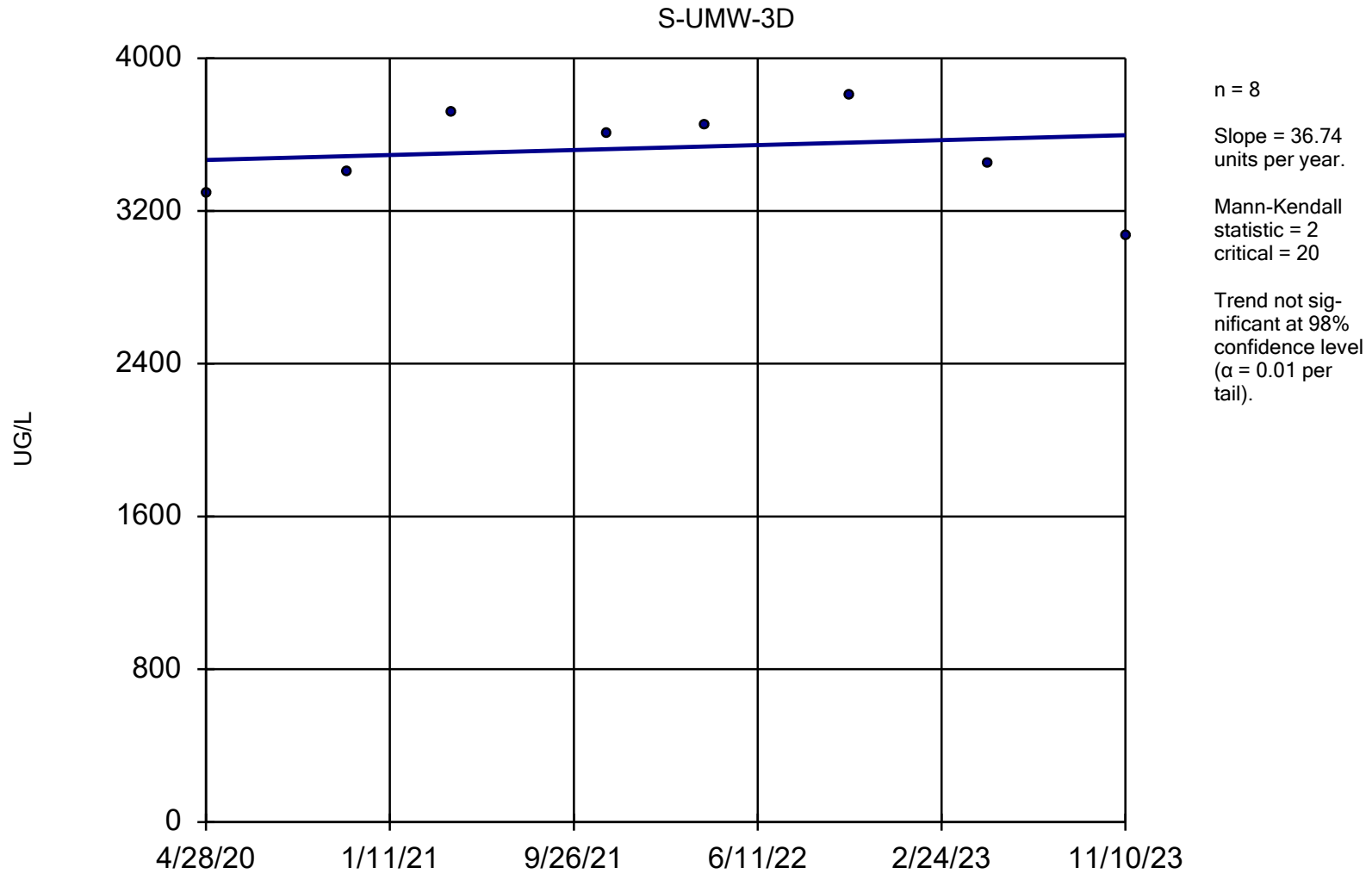
Increasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator



Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

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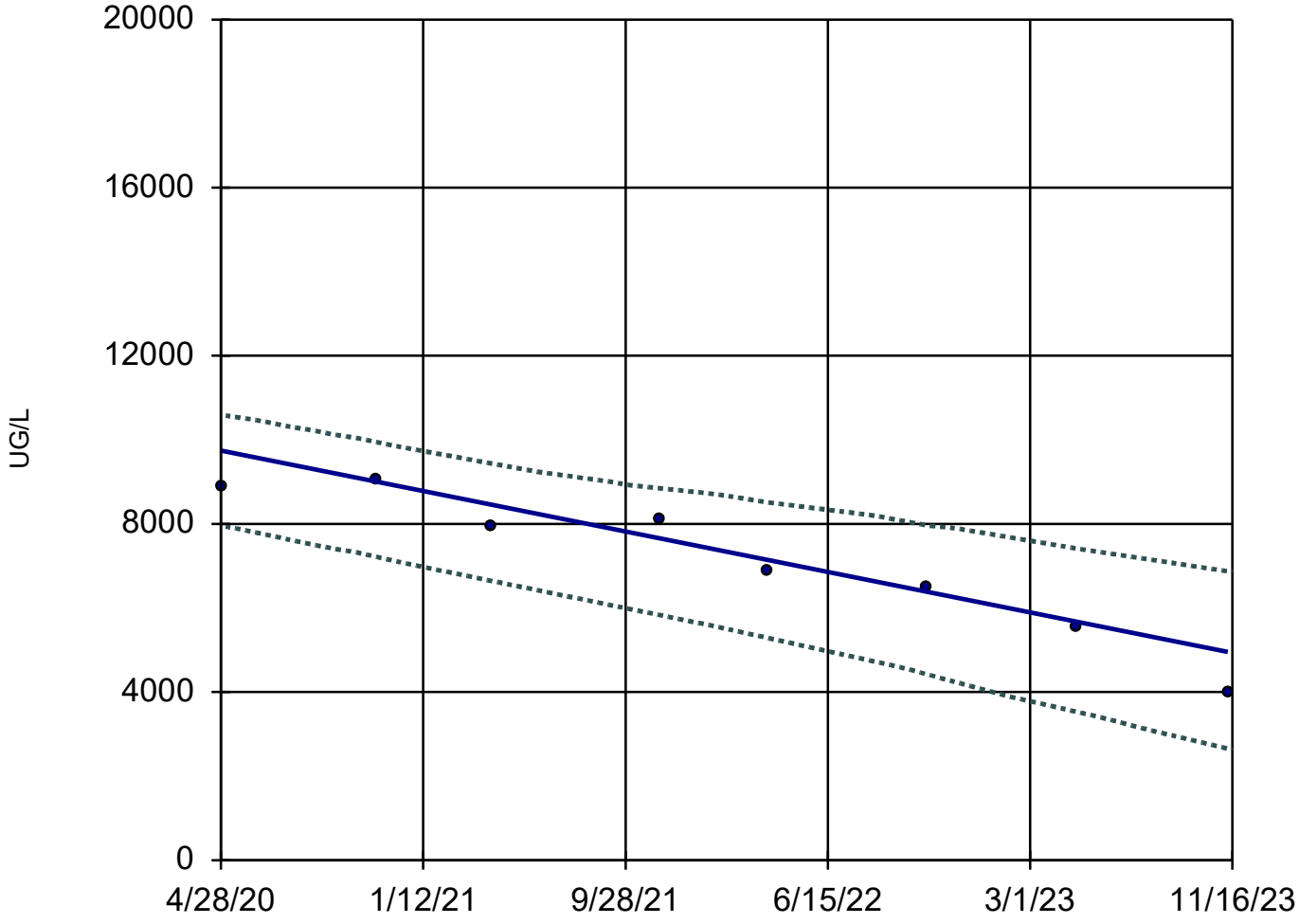
Sen's Slope and 95% Confidence Band

S-UMW-4D



n = 8

Slope = -1354 units per year.

Mann-Kendall statistic = -24 critical = -20

Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

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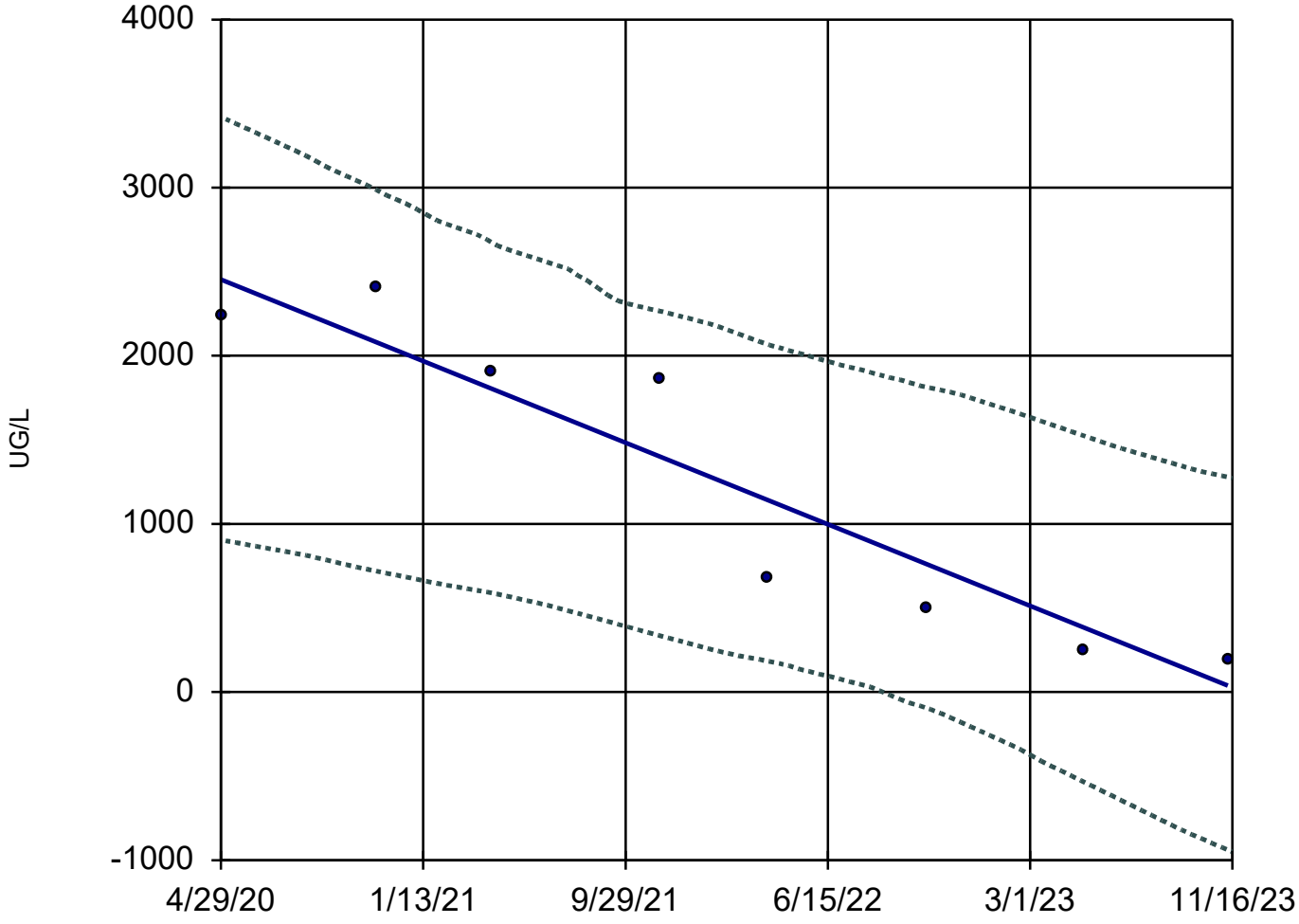
Sen's Slope and 95% Confidence Band

S-UMW-5D



n = 8

Slope = -683.2 units per year.

Mann-Kendall statistic = -26
critical = -20

Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

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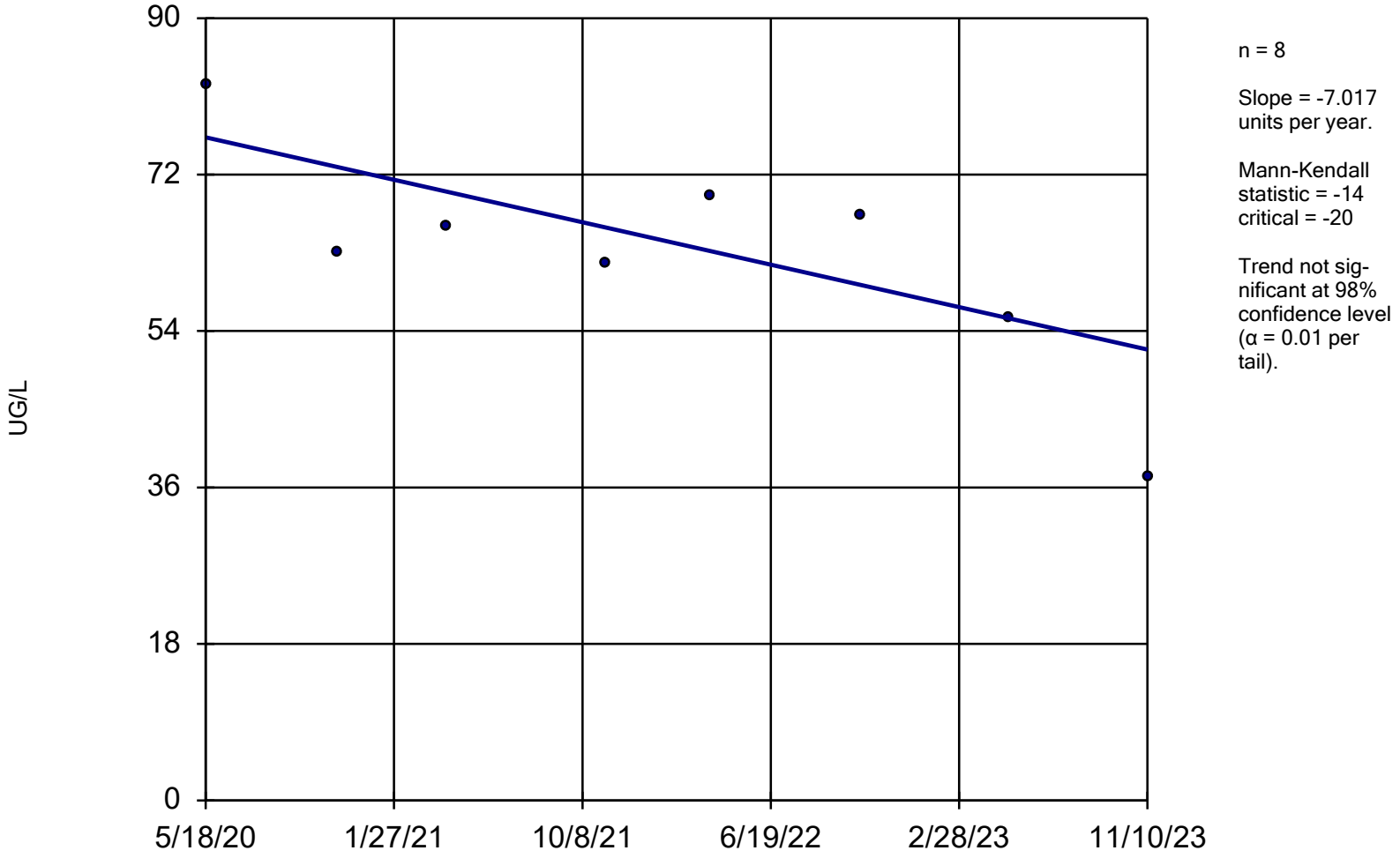
Sen's Slope Estimator

S-UMW-6D



n = 8

Slope = -7.017 units per year.

Mann-Kendall statistic = -14
critical = -20

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

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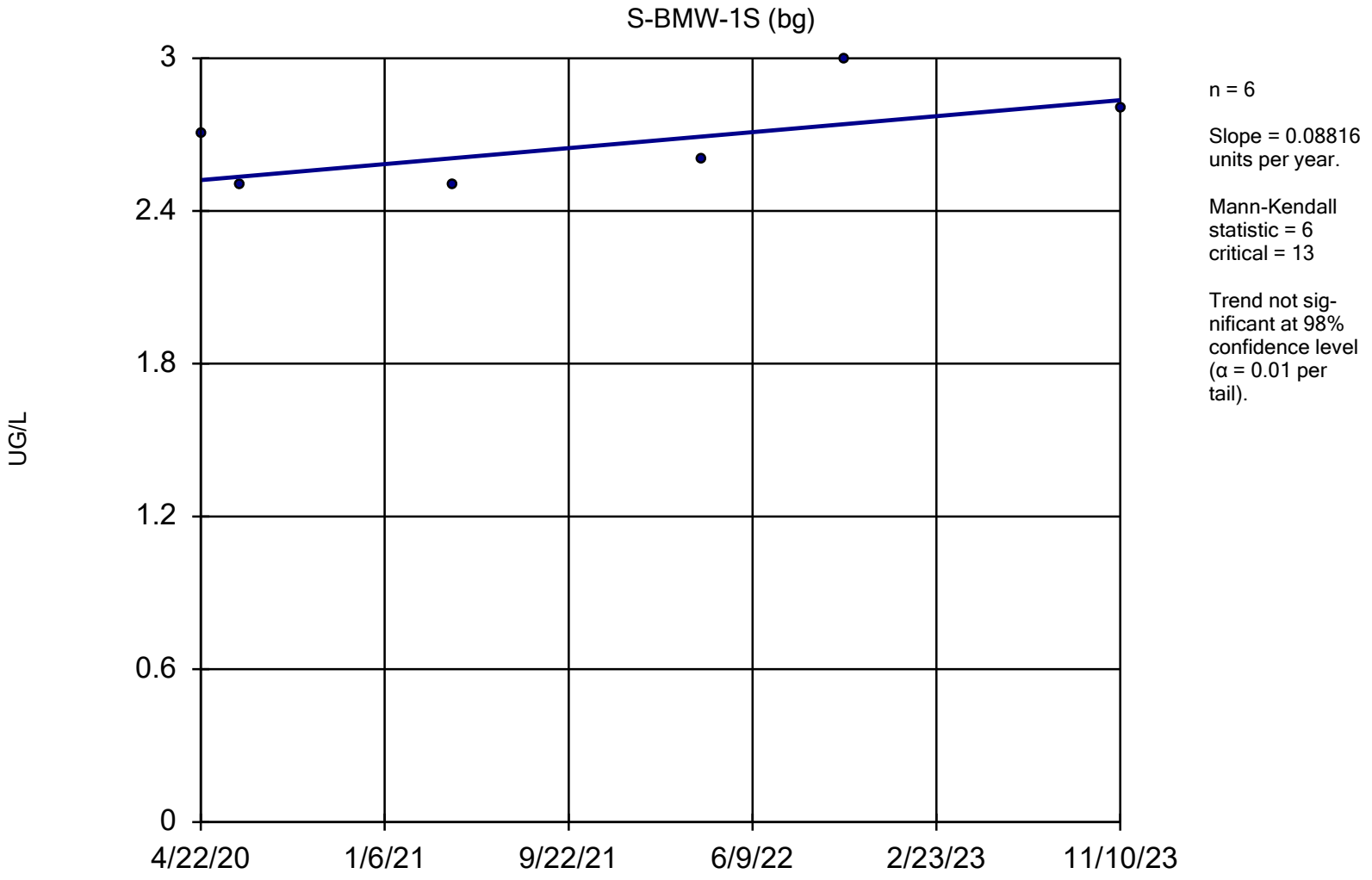
Sen's Slope Estimator



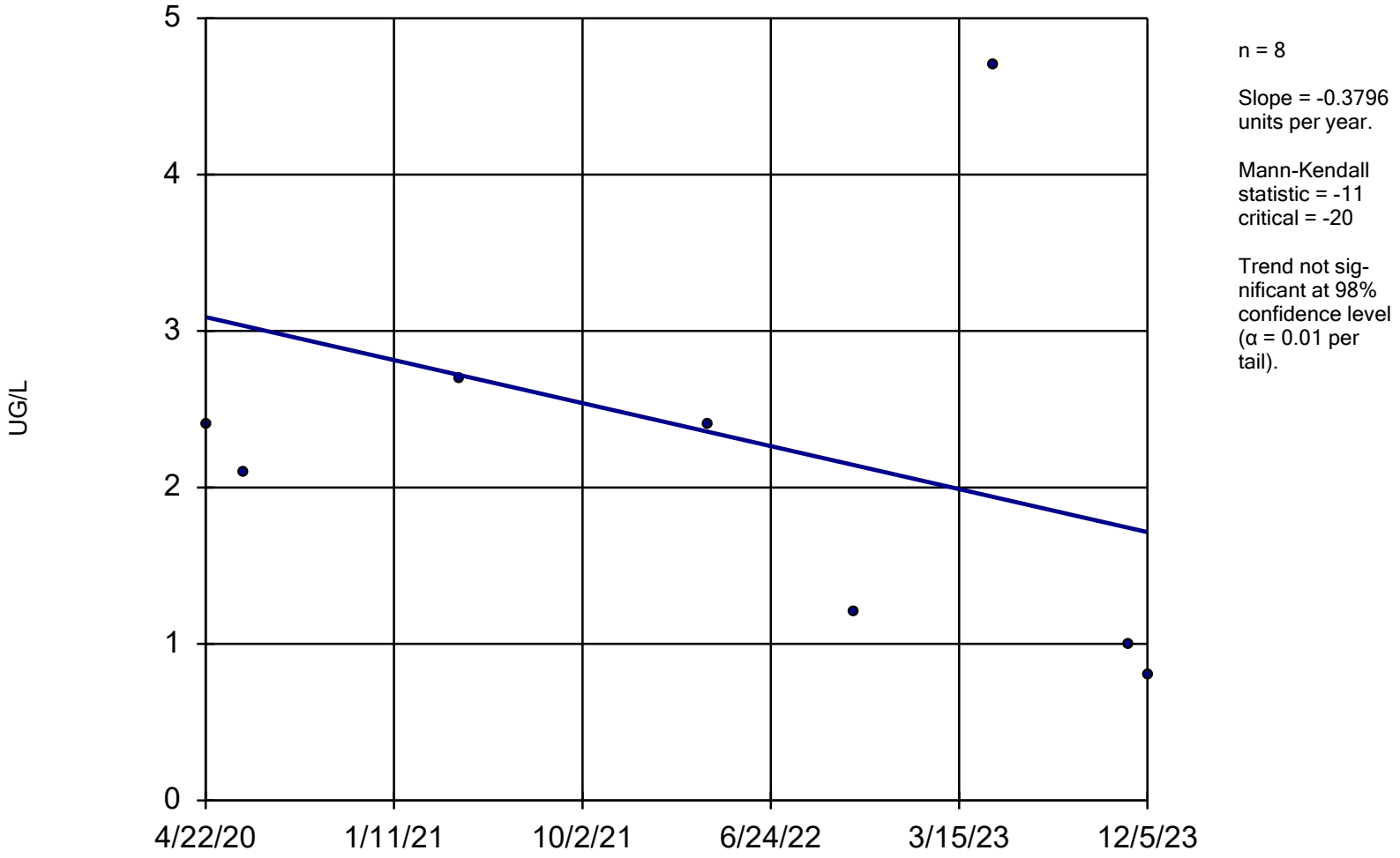
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-BMW-3S (bg)



n = 8

Slope = -0.3796 units per year.

Mann-Kendall statistic = -11
critical = -20

Trend not significant at 98% confidence level (α = 0.01 per tail).

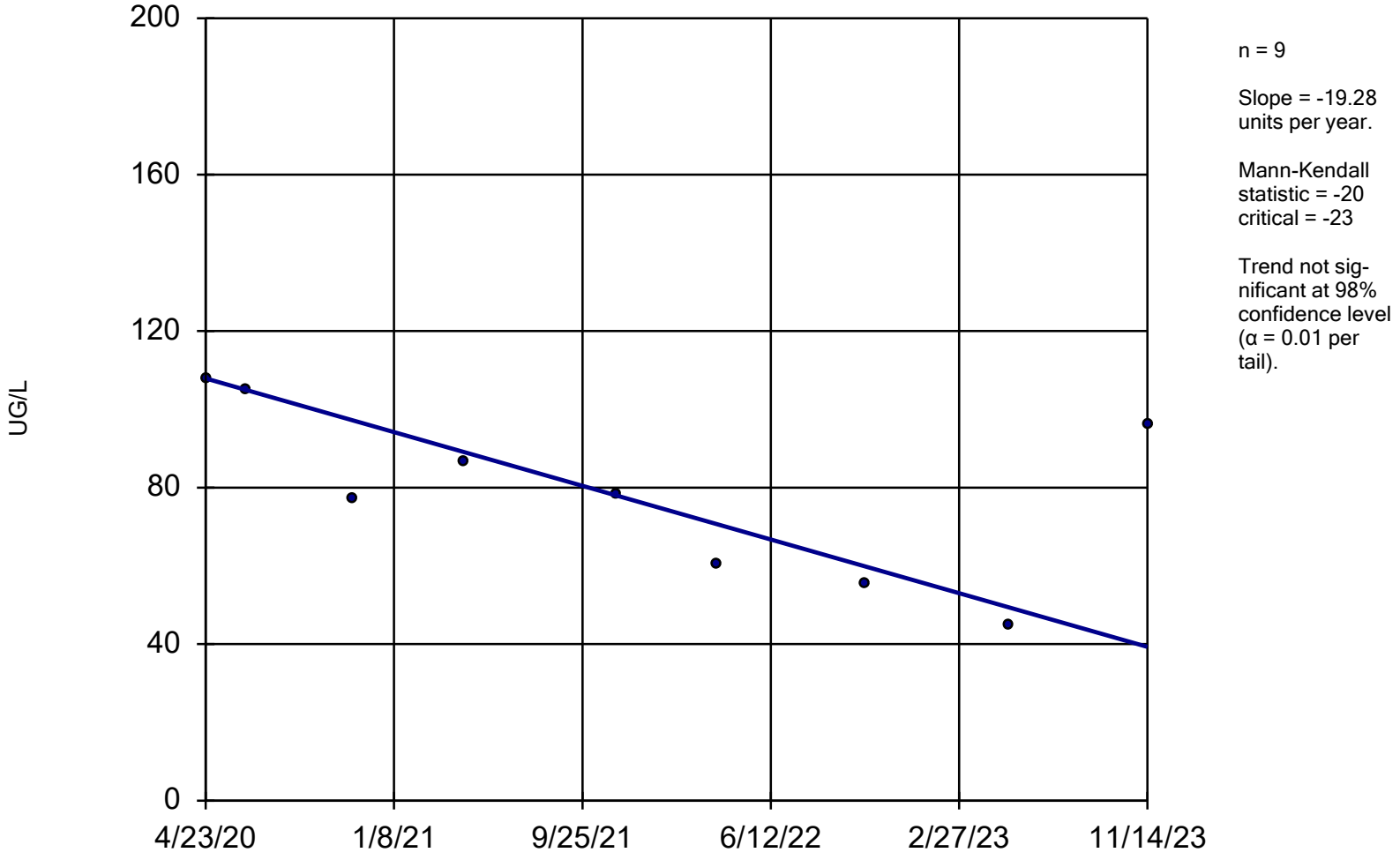
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-LMW-1S



n = 9

Slope = -19.28 units per year.

Mann-Kendall statistic = -20
critical = -23

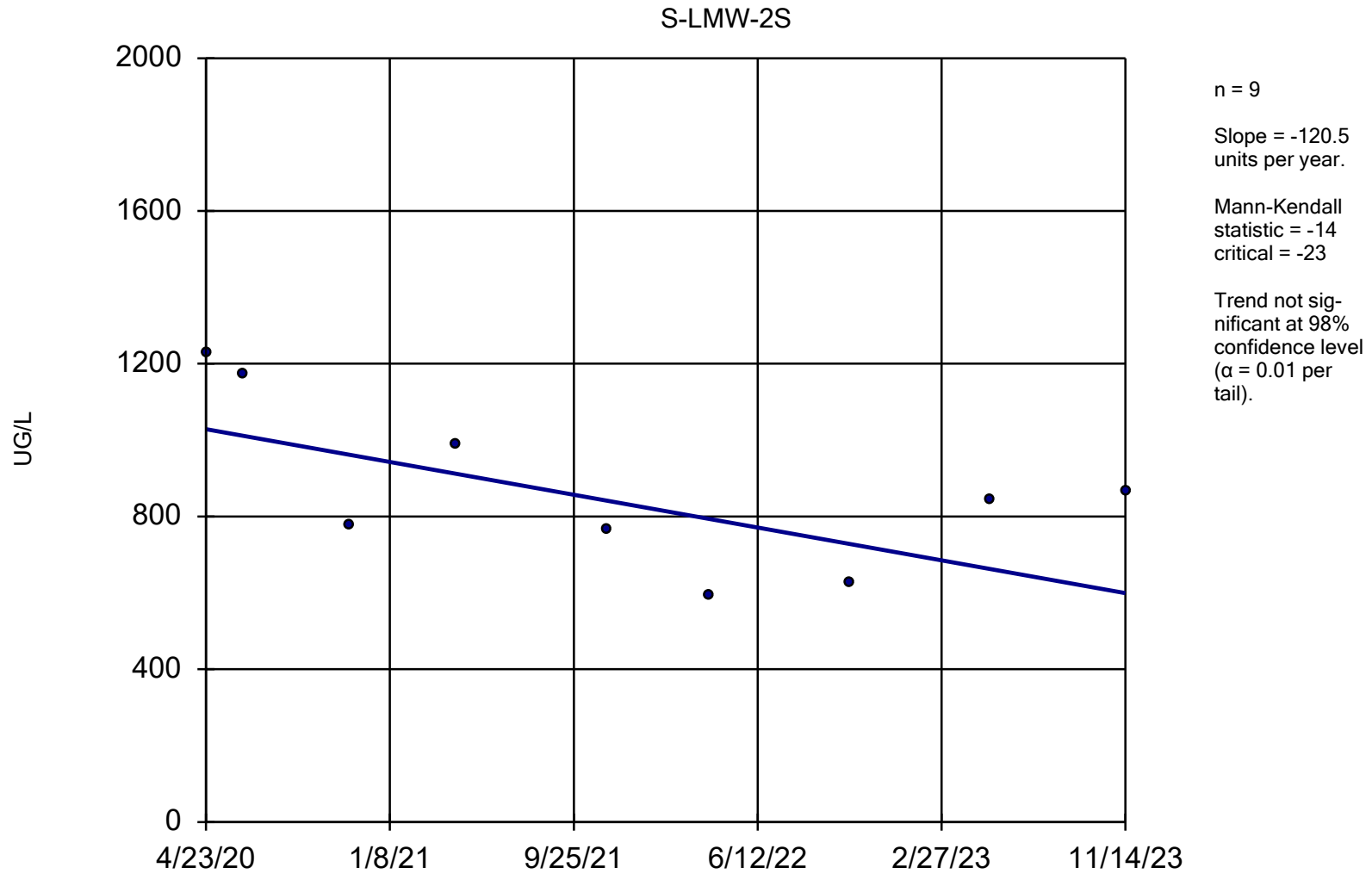
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

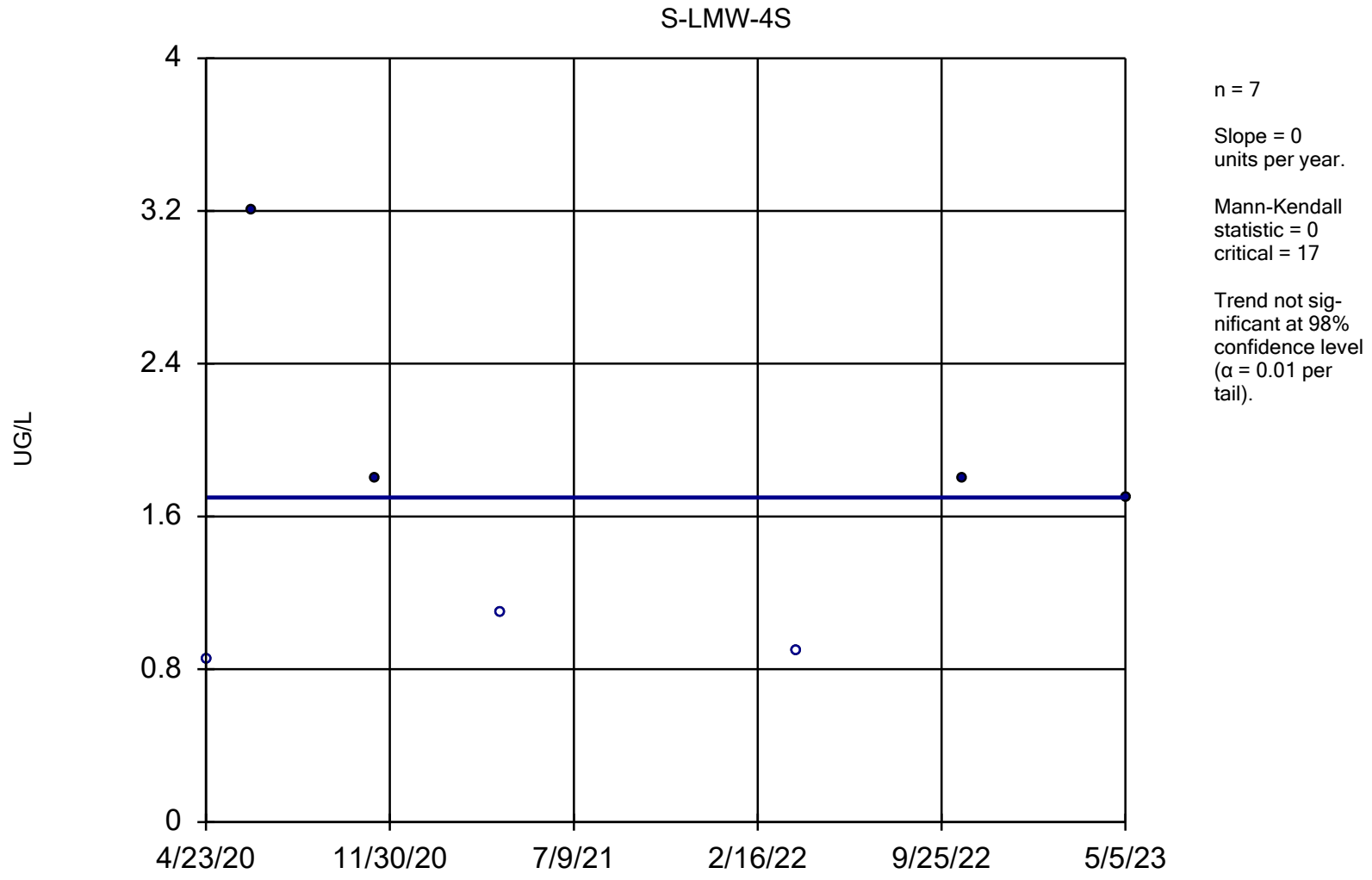


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



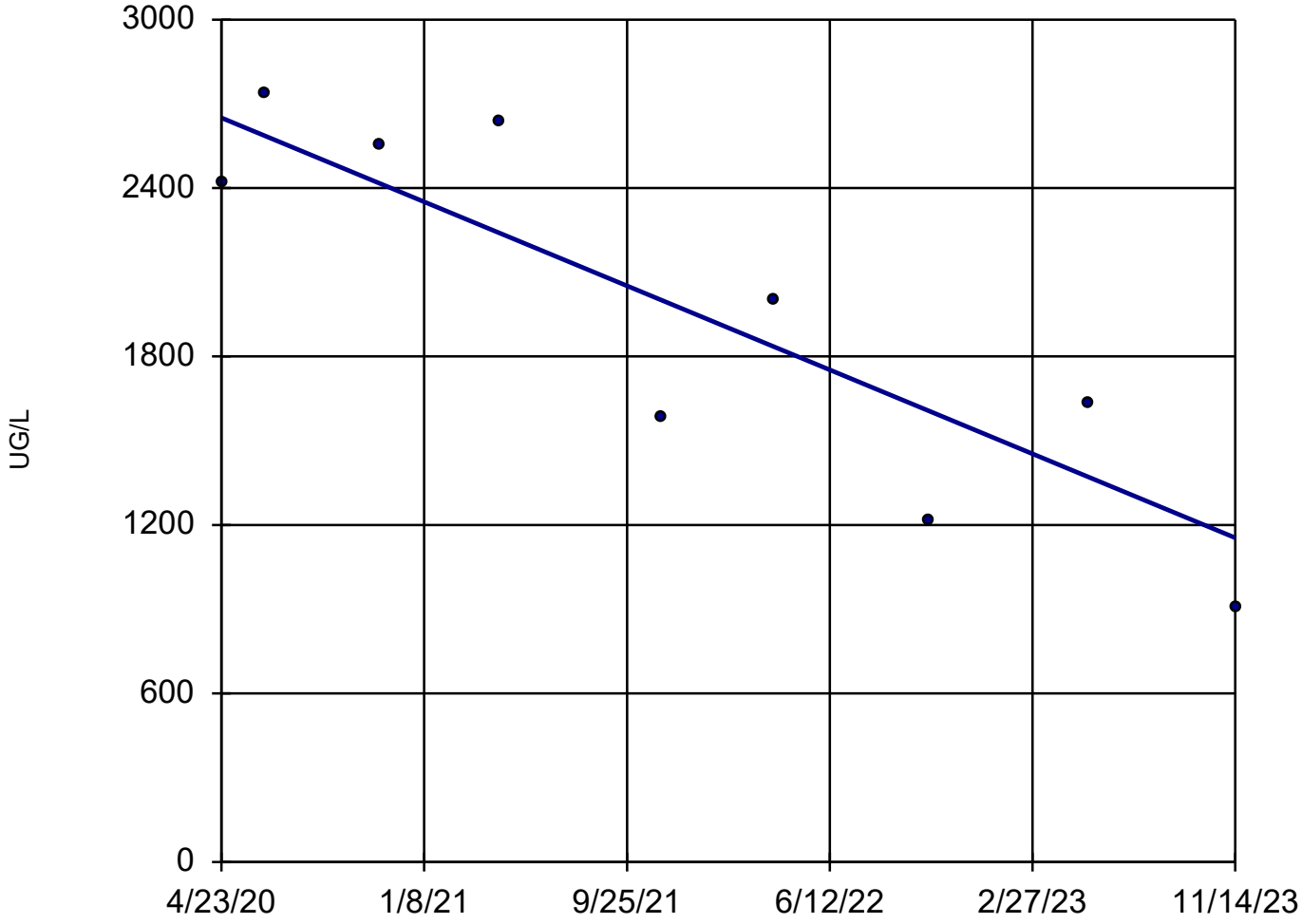
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-LMW-5S



n = 9

Slope = -419.8 units per year.

Mann-Kendall statistic = -22
critical = -23

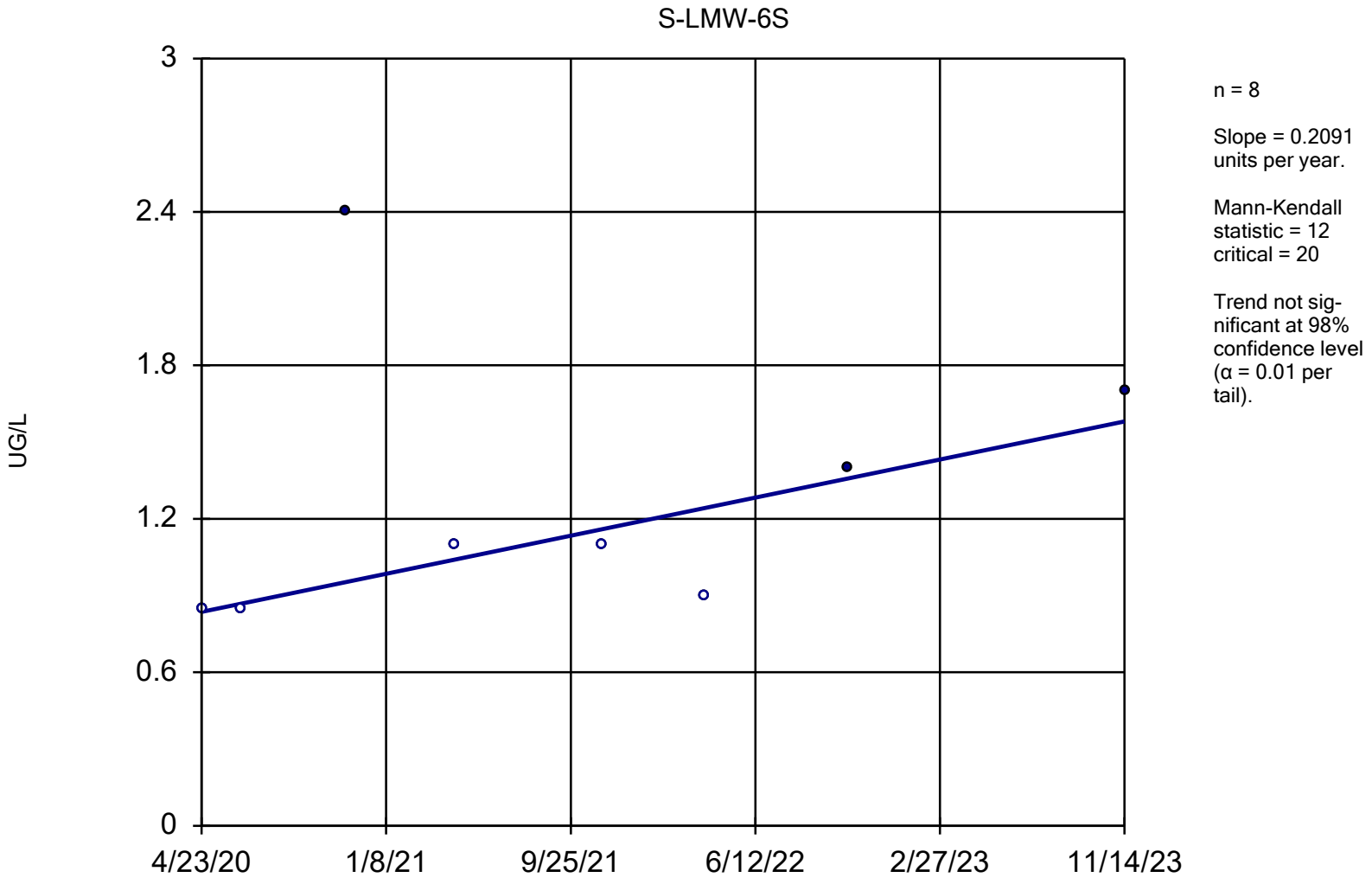
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



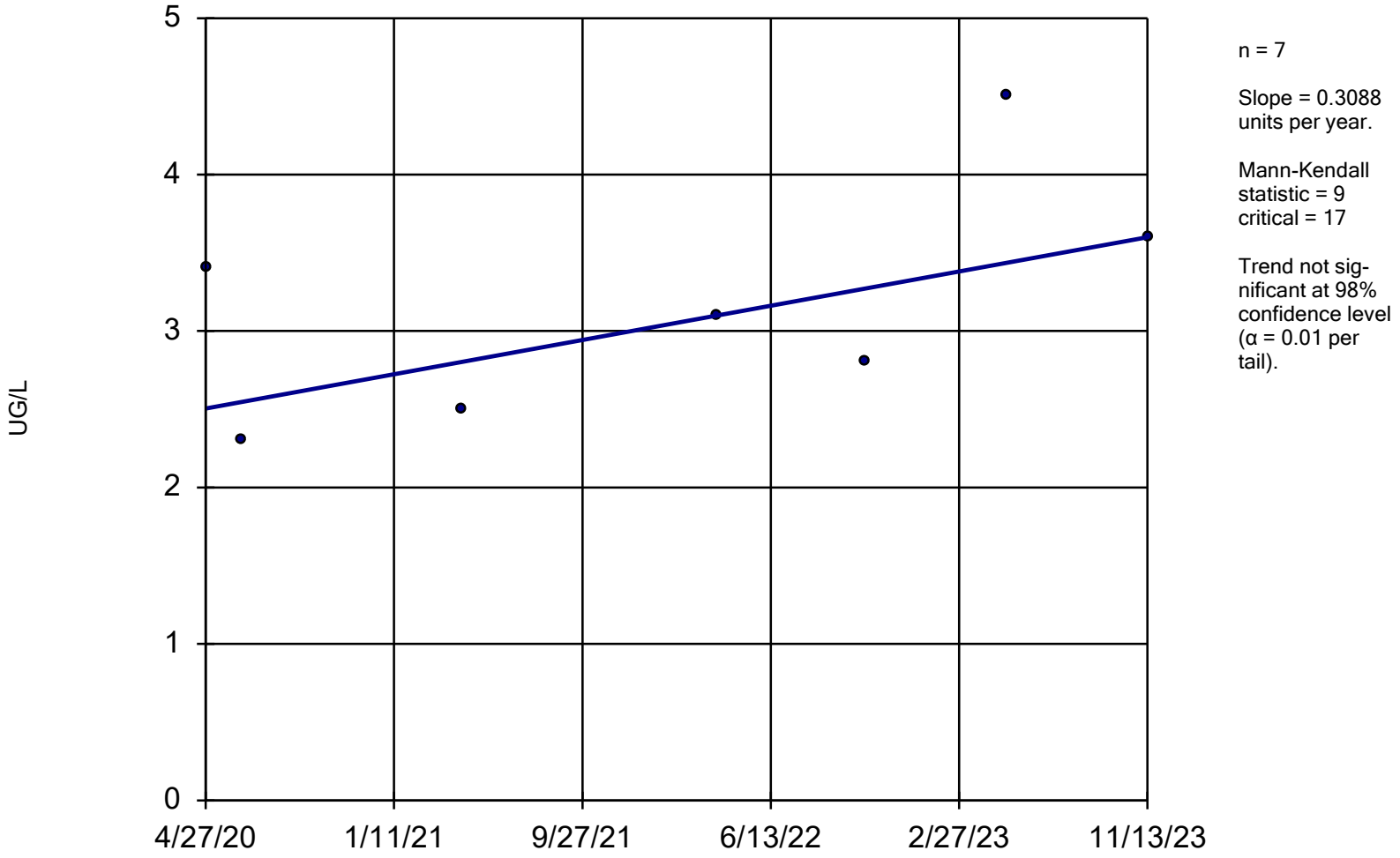
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-UG-3



n = 7

Slope = 0.3088 units per year.

Mann-Kendall statistic = 9
critical = 17

Trend not significant at 98% confidence level (α = 0.01 per tail).

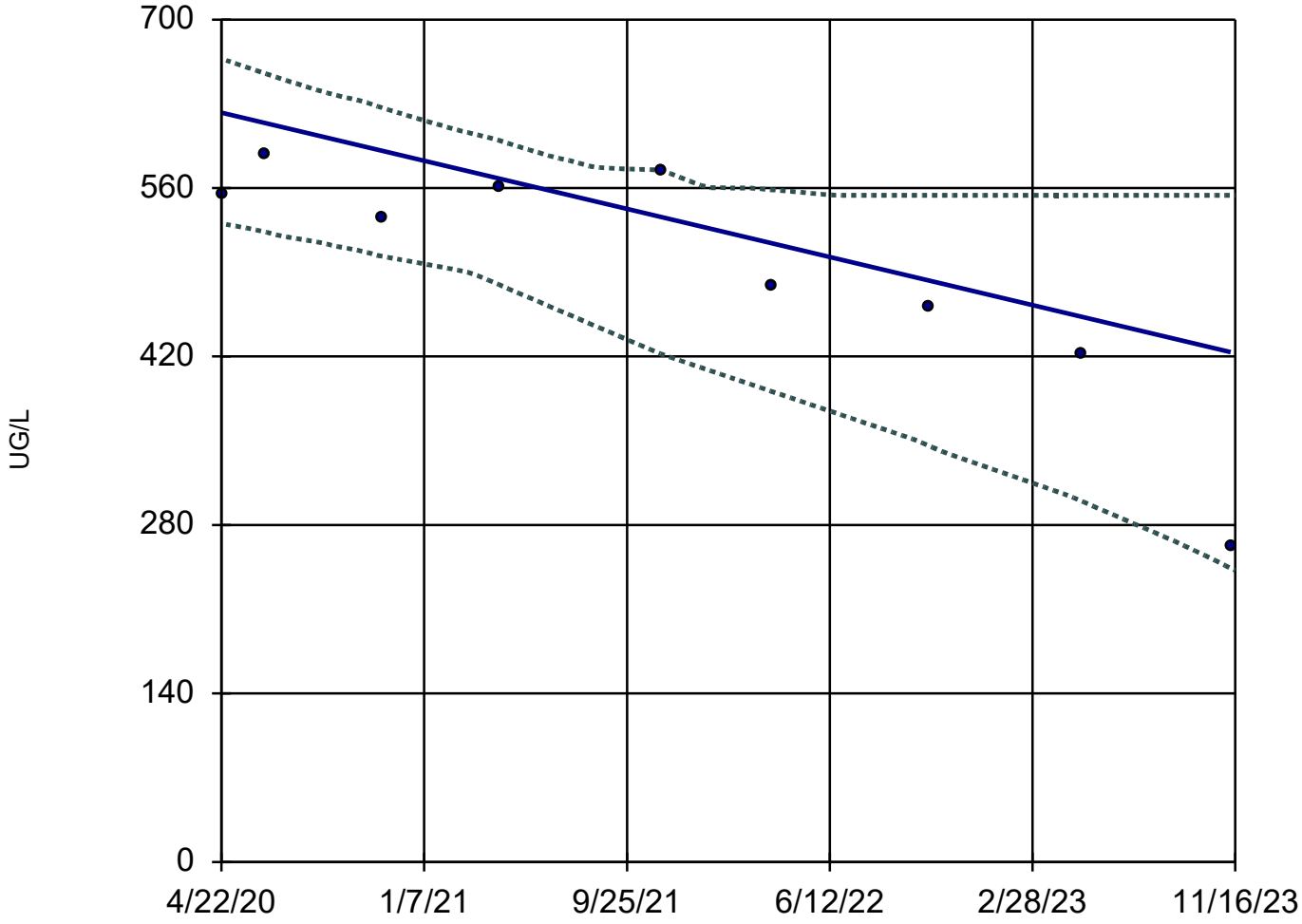
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-AM-1D



n = 9

Slope = -55.99 units per year.

Mann-Kendall statistic = -24
critical = -23

Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

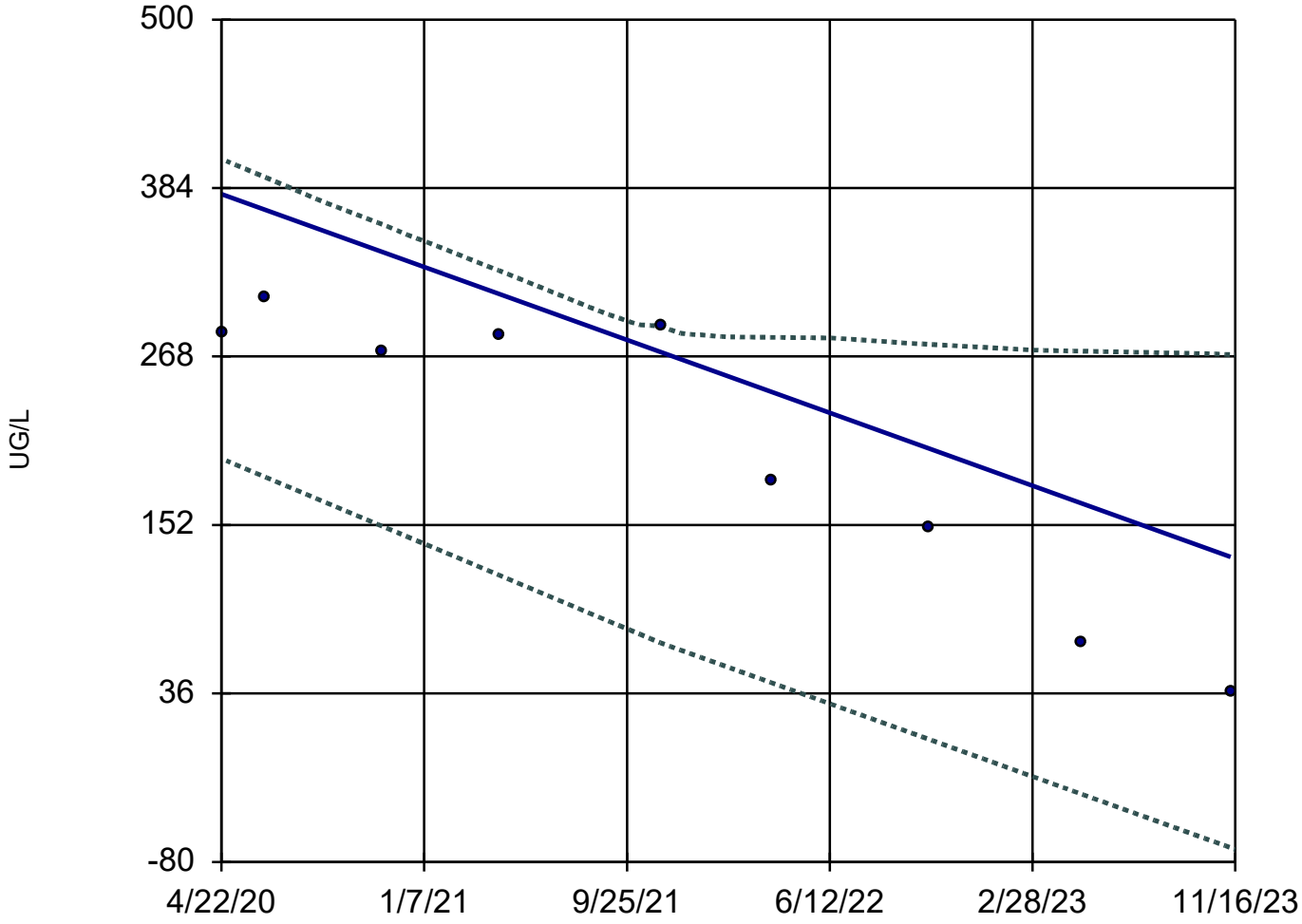
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-AM-1S



n = 9

Slope = -70.27 units per year.

Mann-Kendall statistic = -26
critical = -23

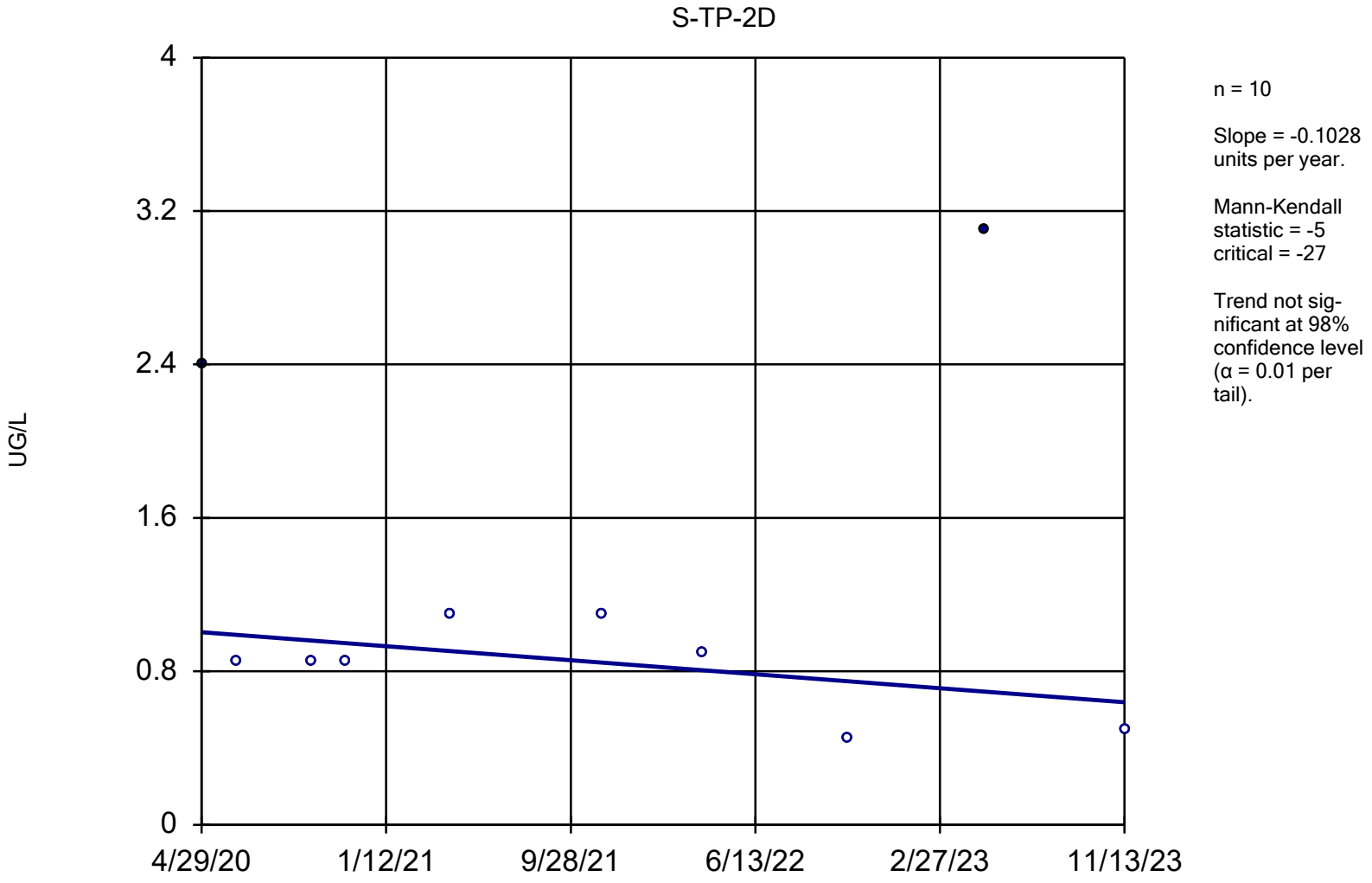
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

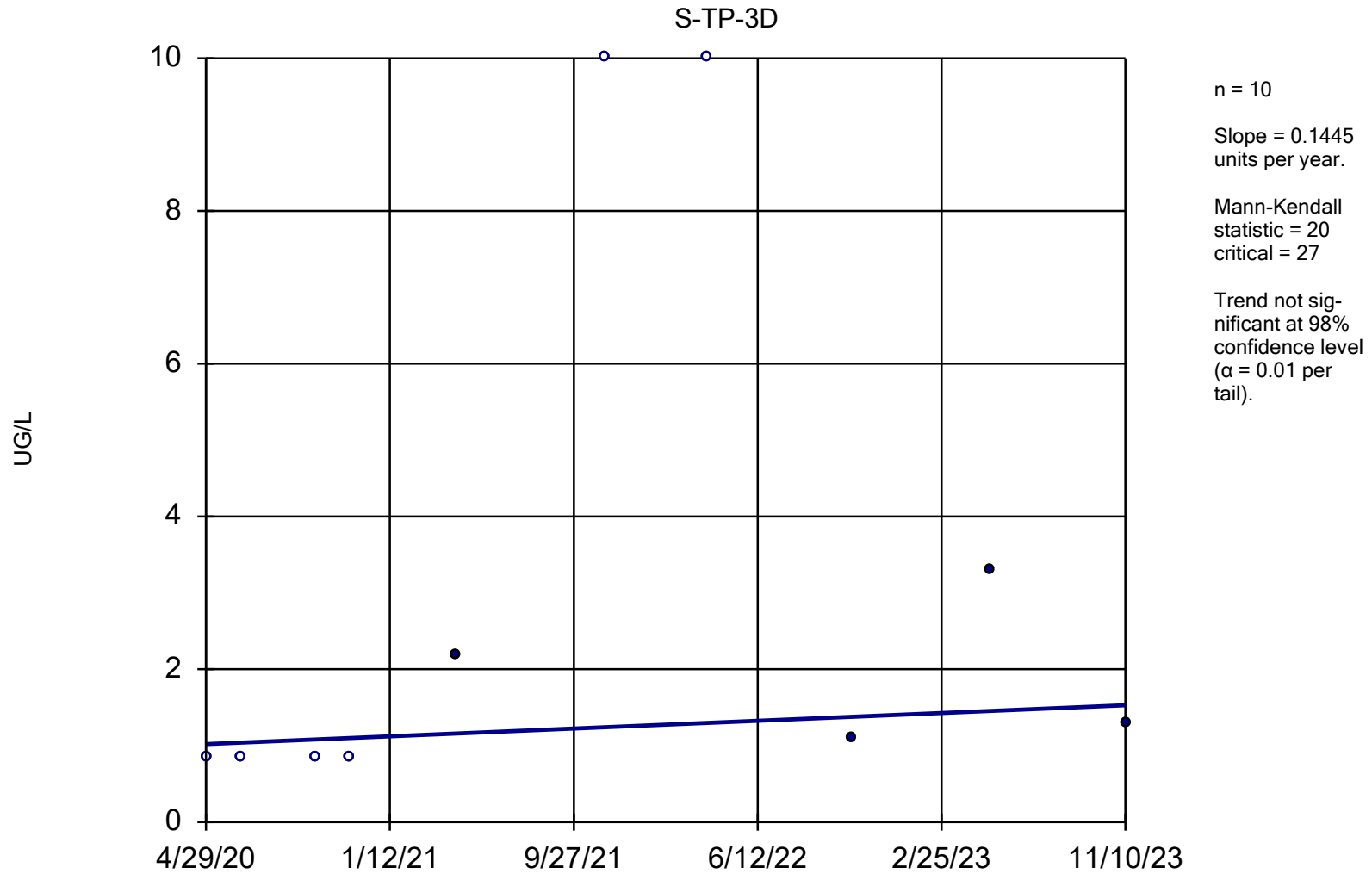


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

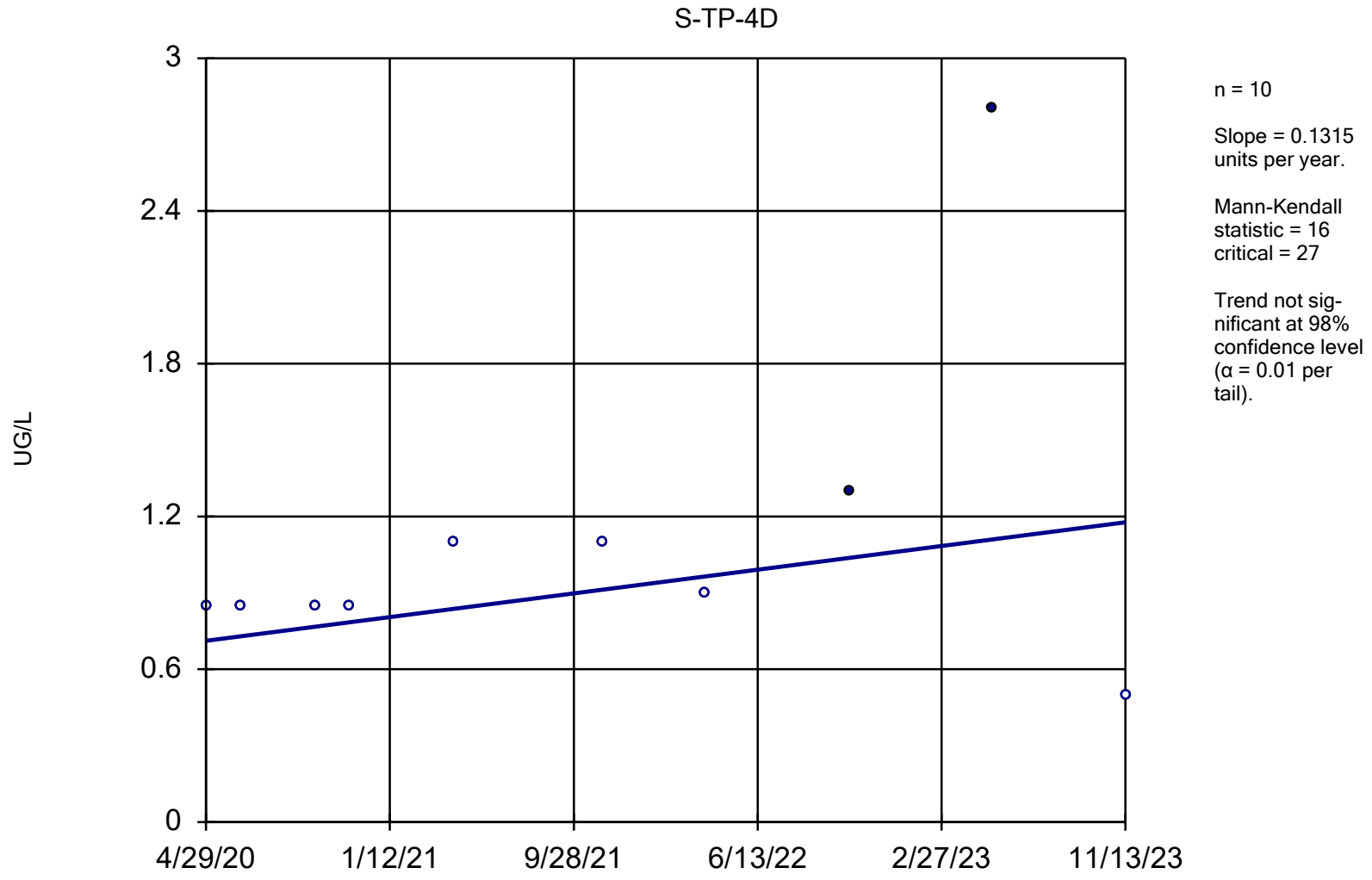


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

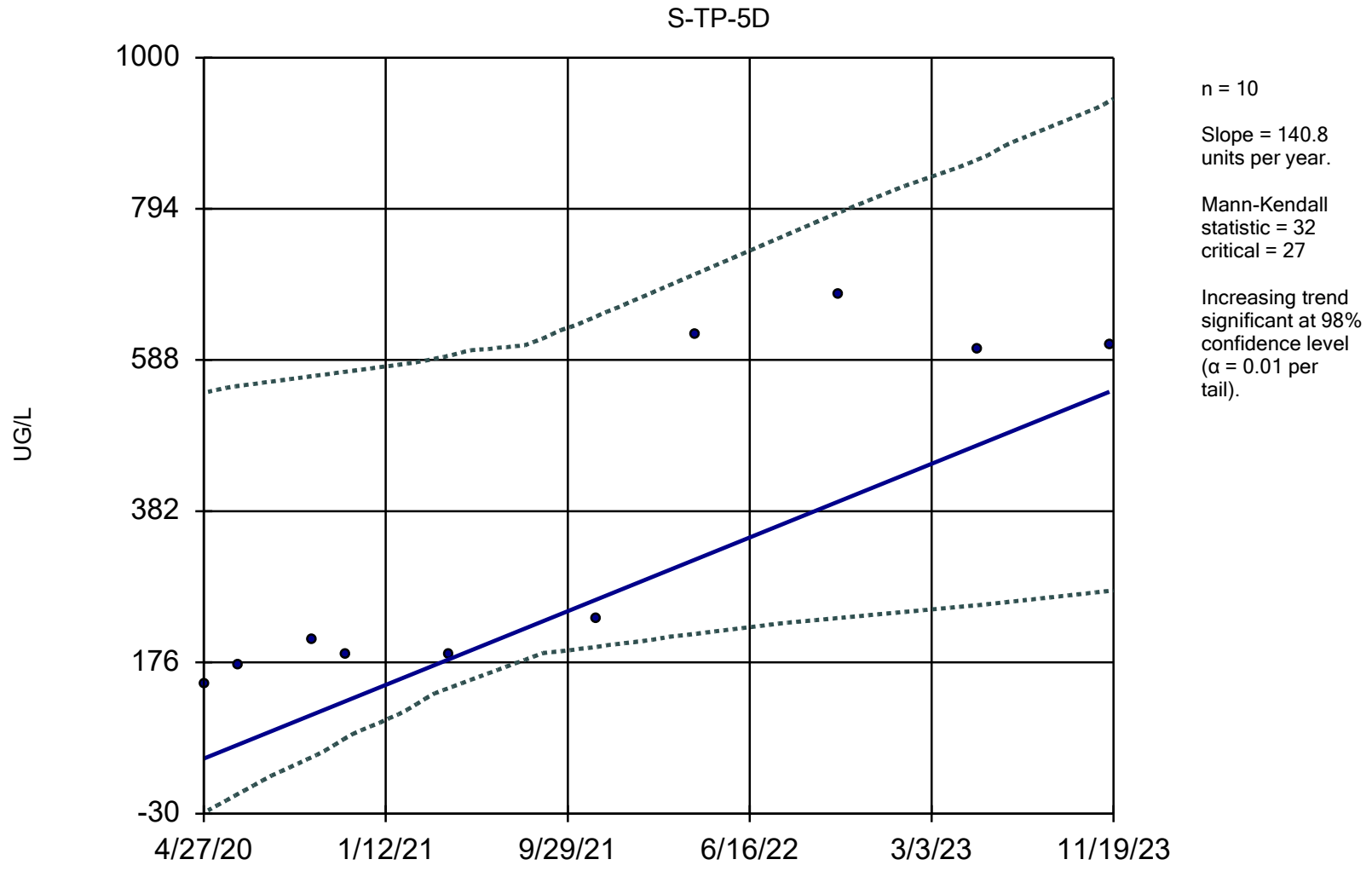


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

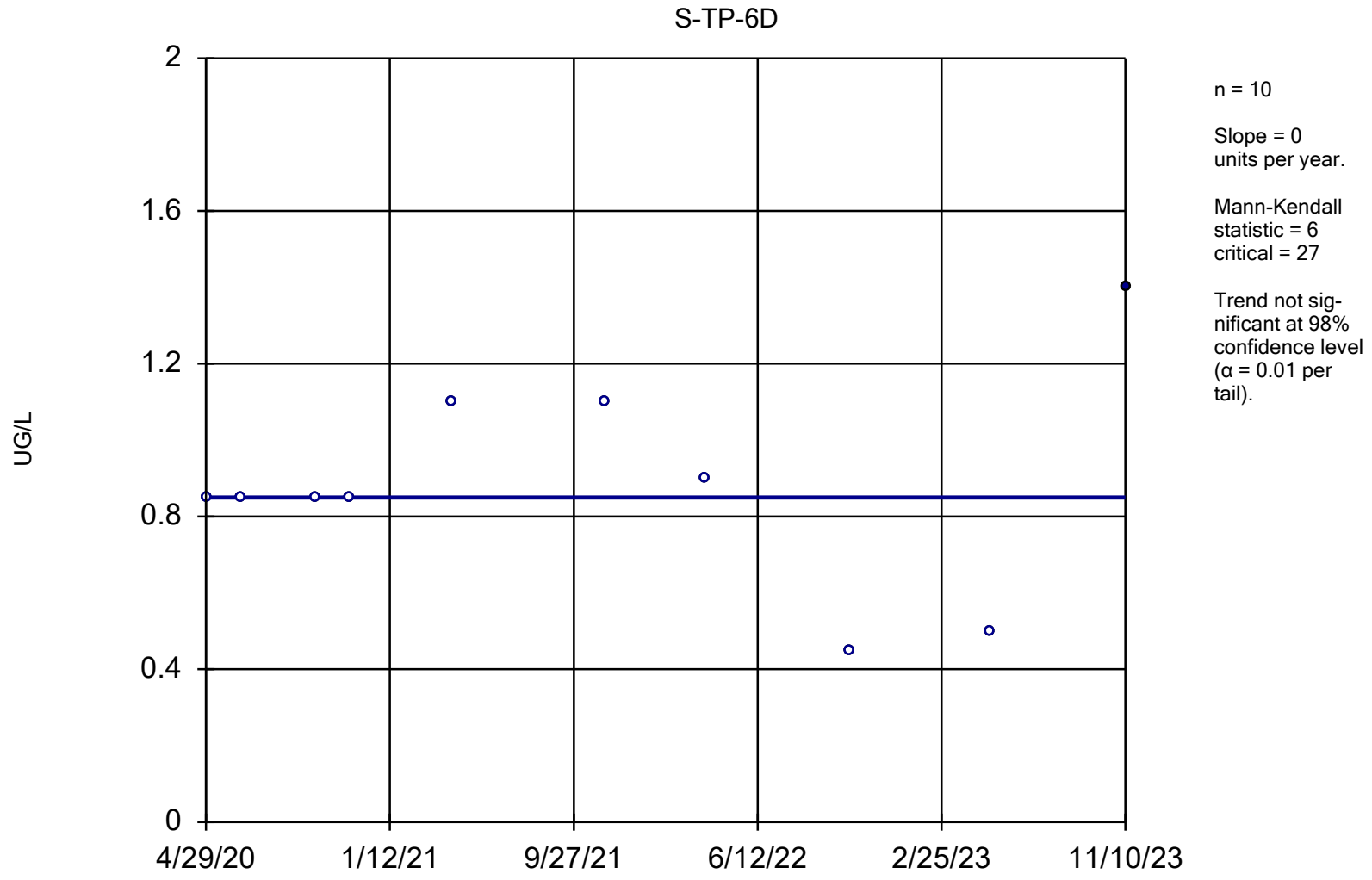


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



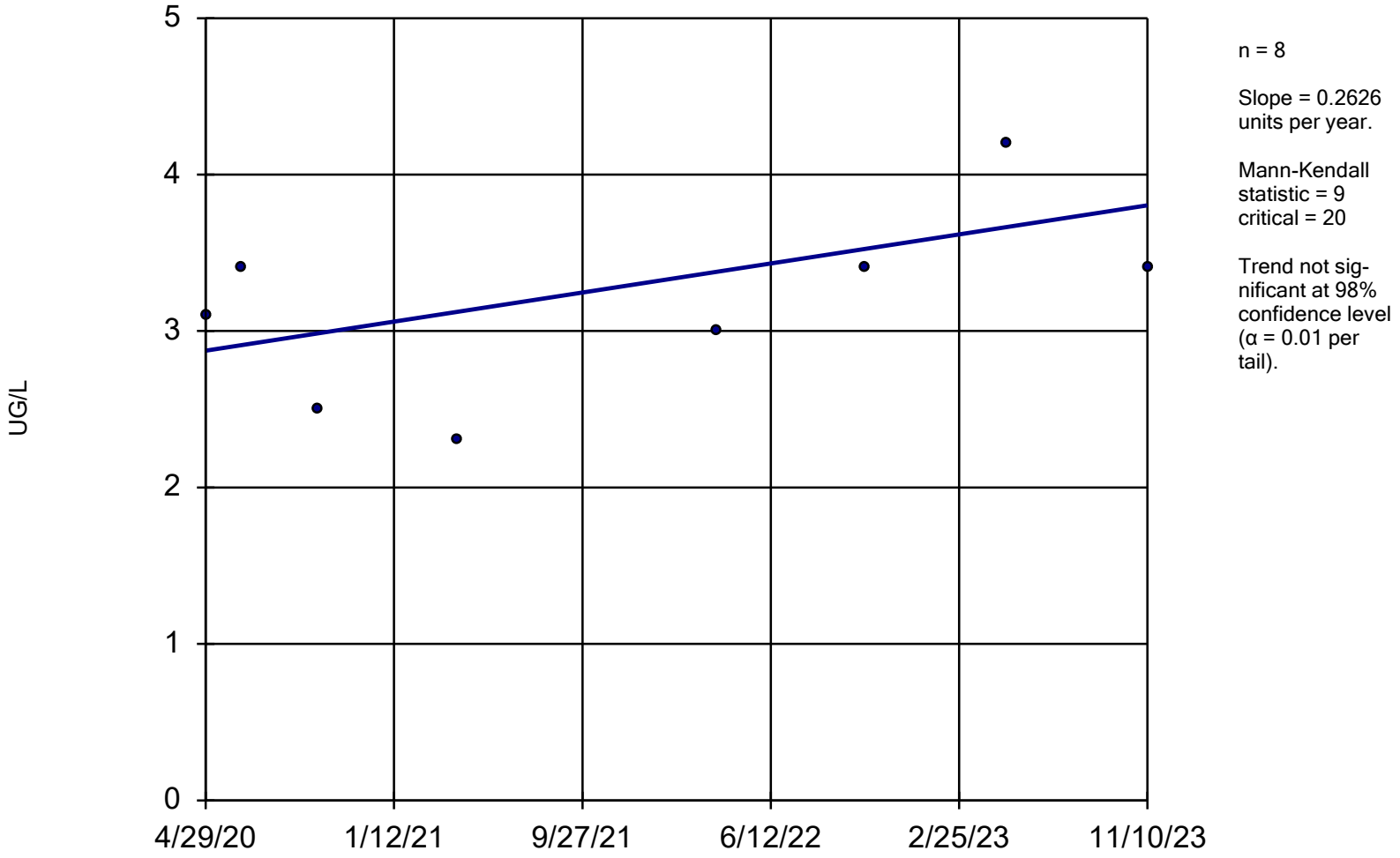
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope Estimator

S-TP-6S



n = 8

Slope = 0.2626 units per year.

Mann-Kendall statistic = 9
critical = 20

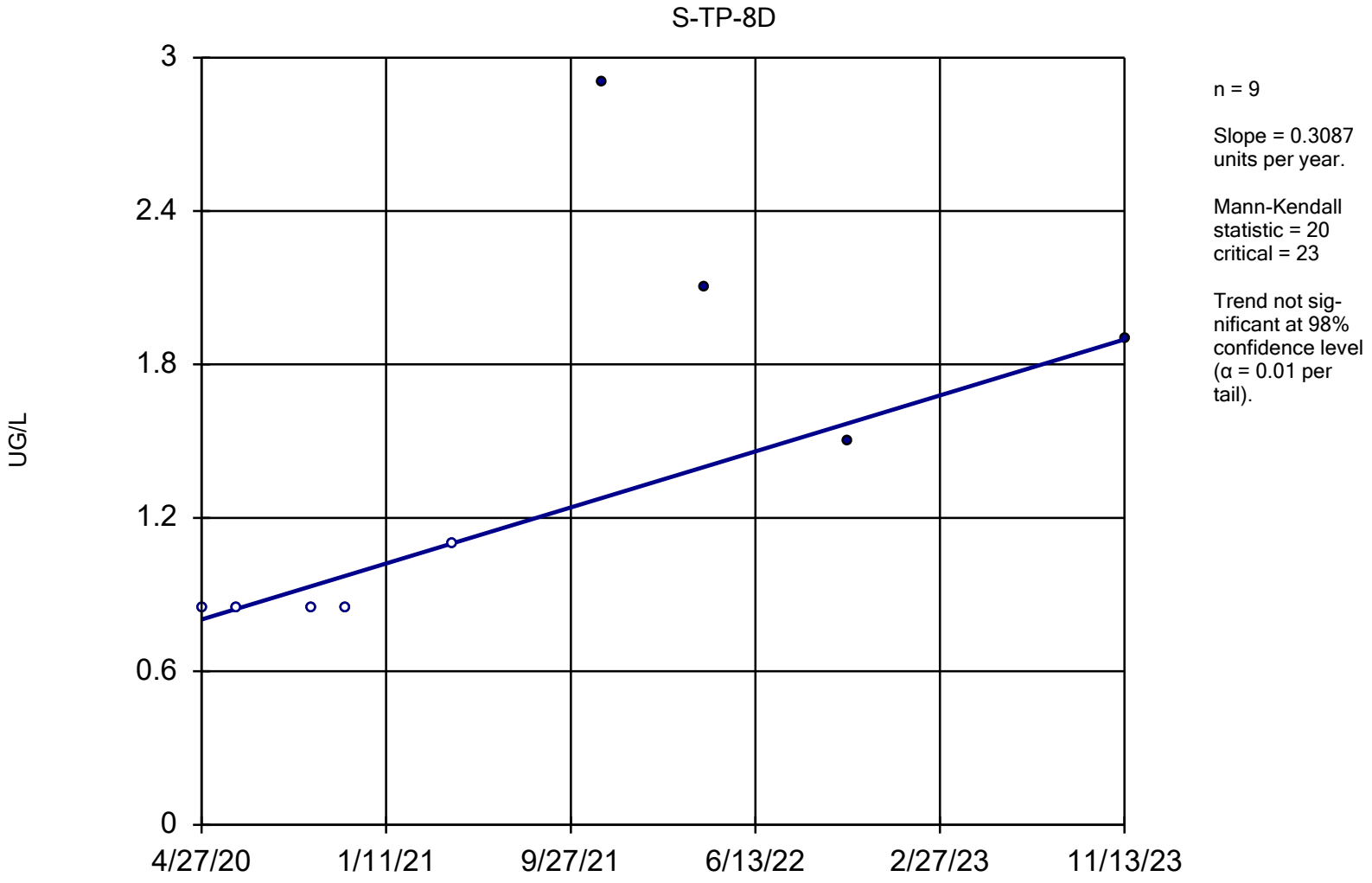
Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

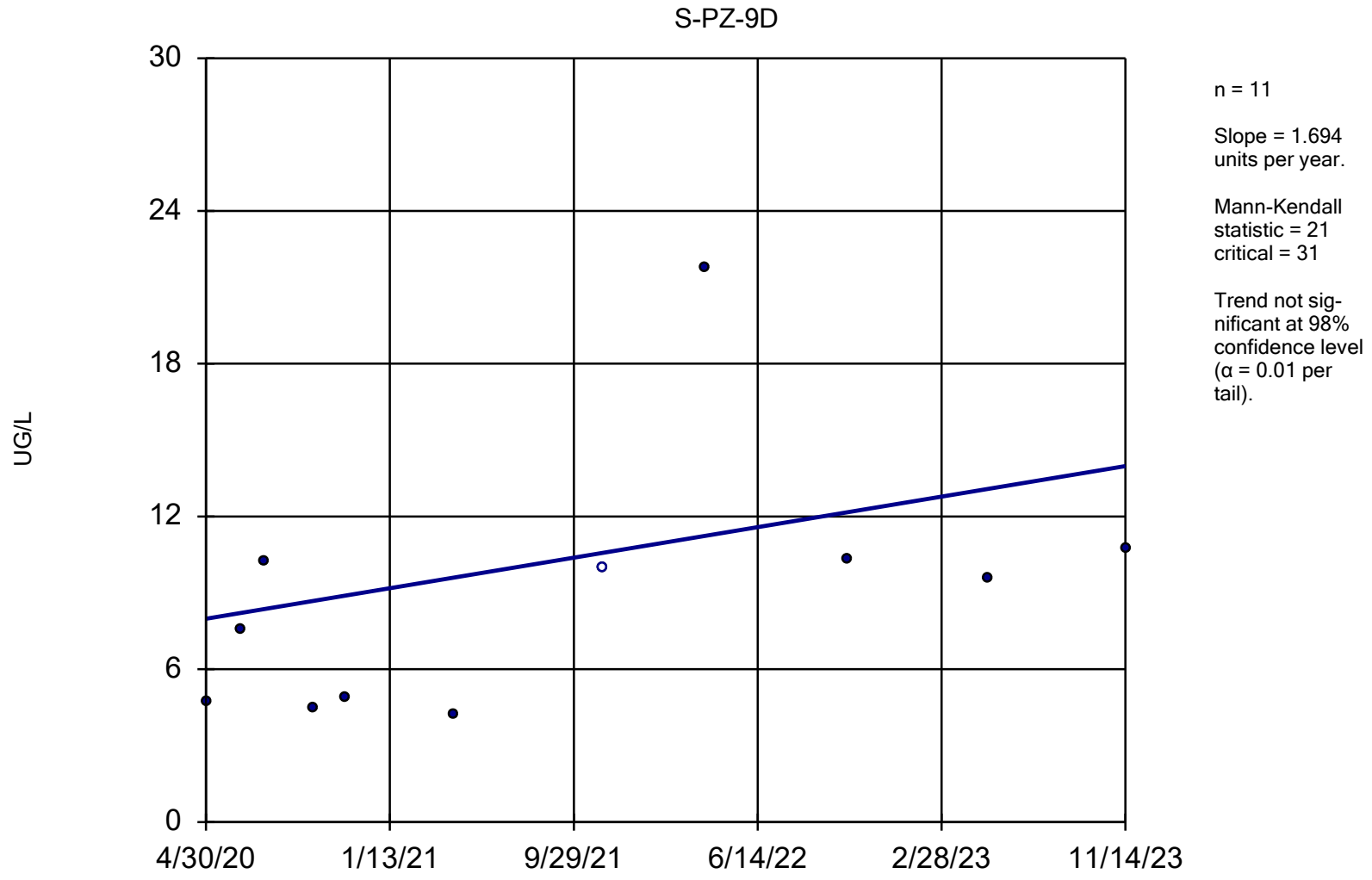


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



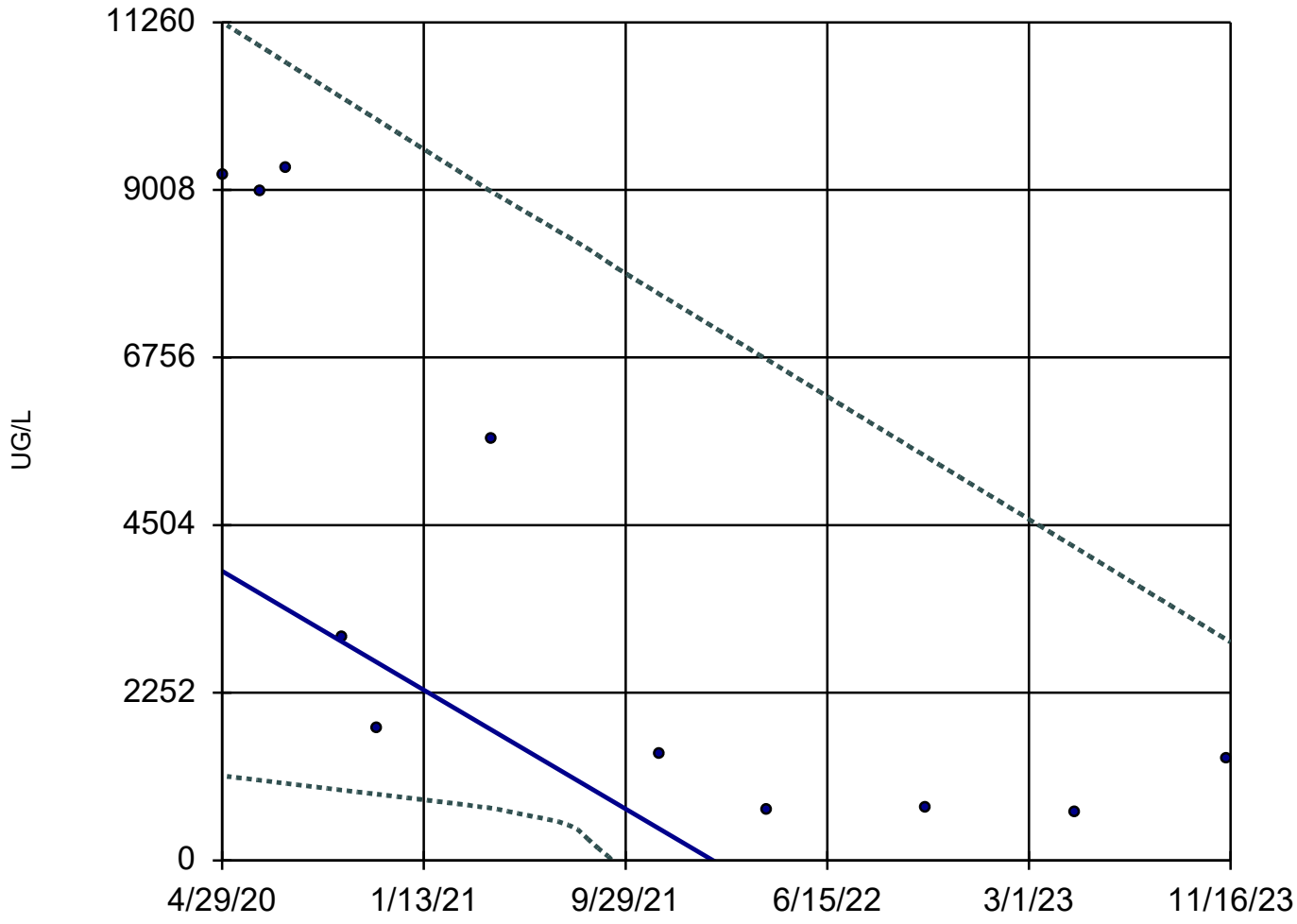
Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG

Sen's Slope and 95% Confidence Band

S-PZ-1S



n = 11

Slope = -2249 units per year.

Mann-Kendall statistic = -39
critical = -31

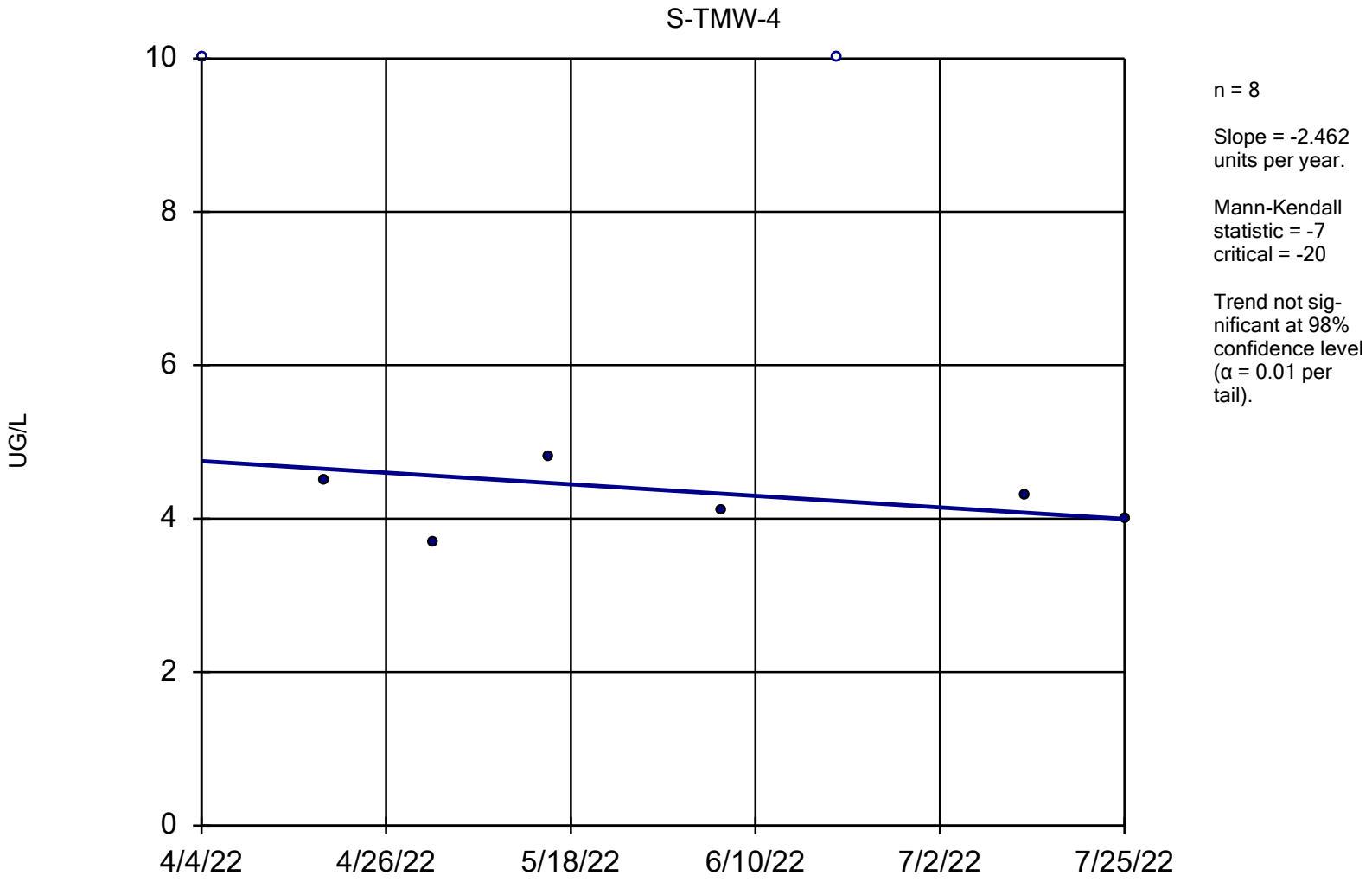
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

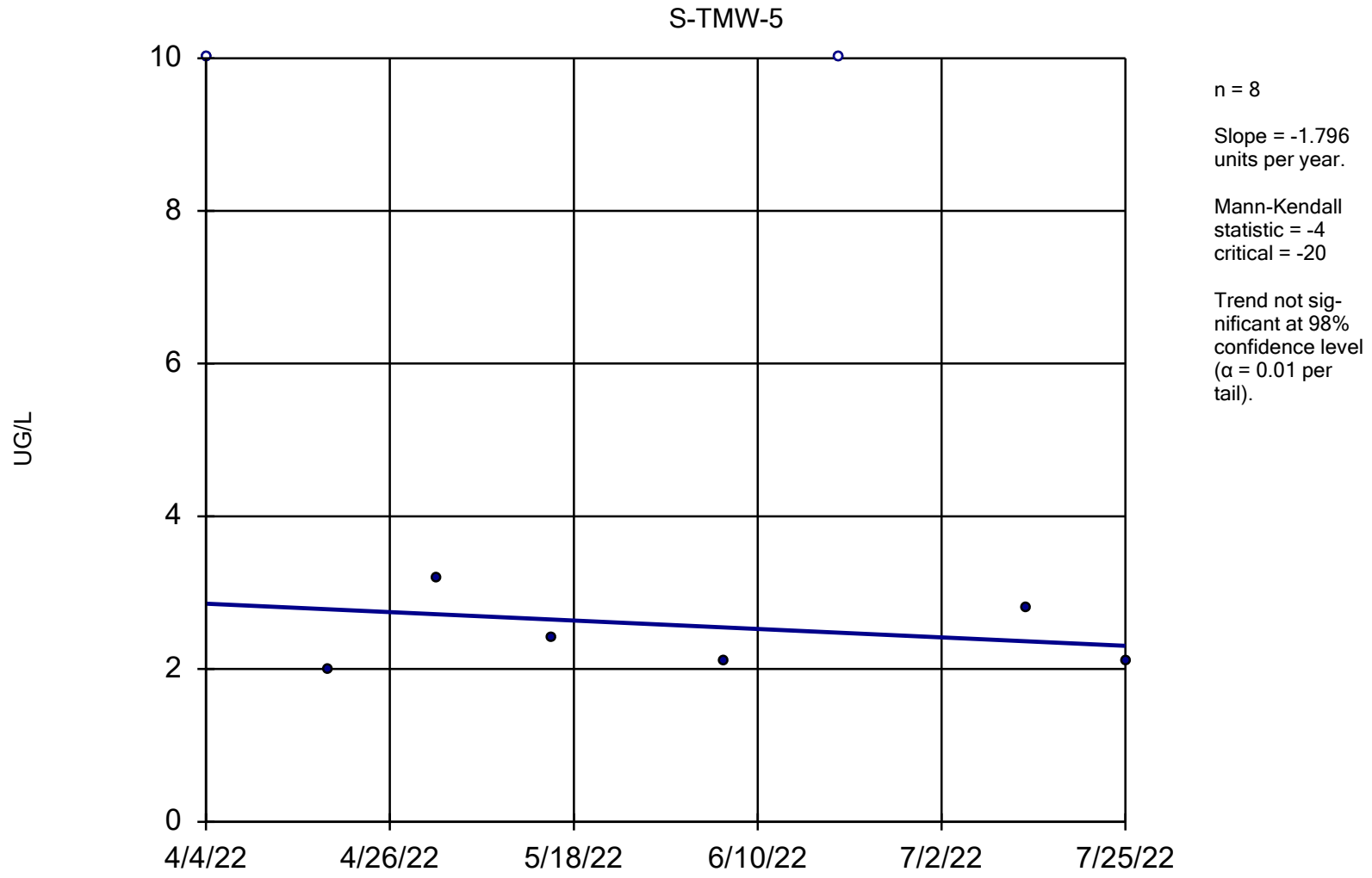


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

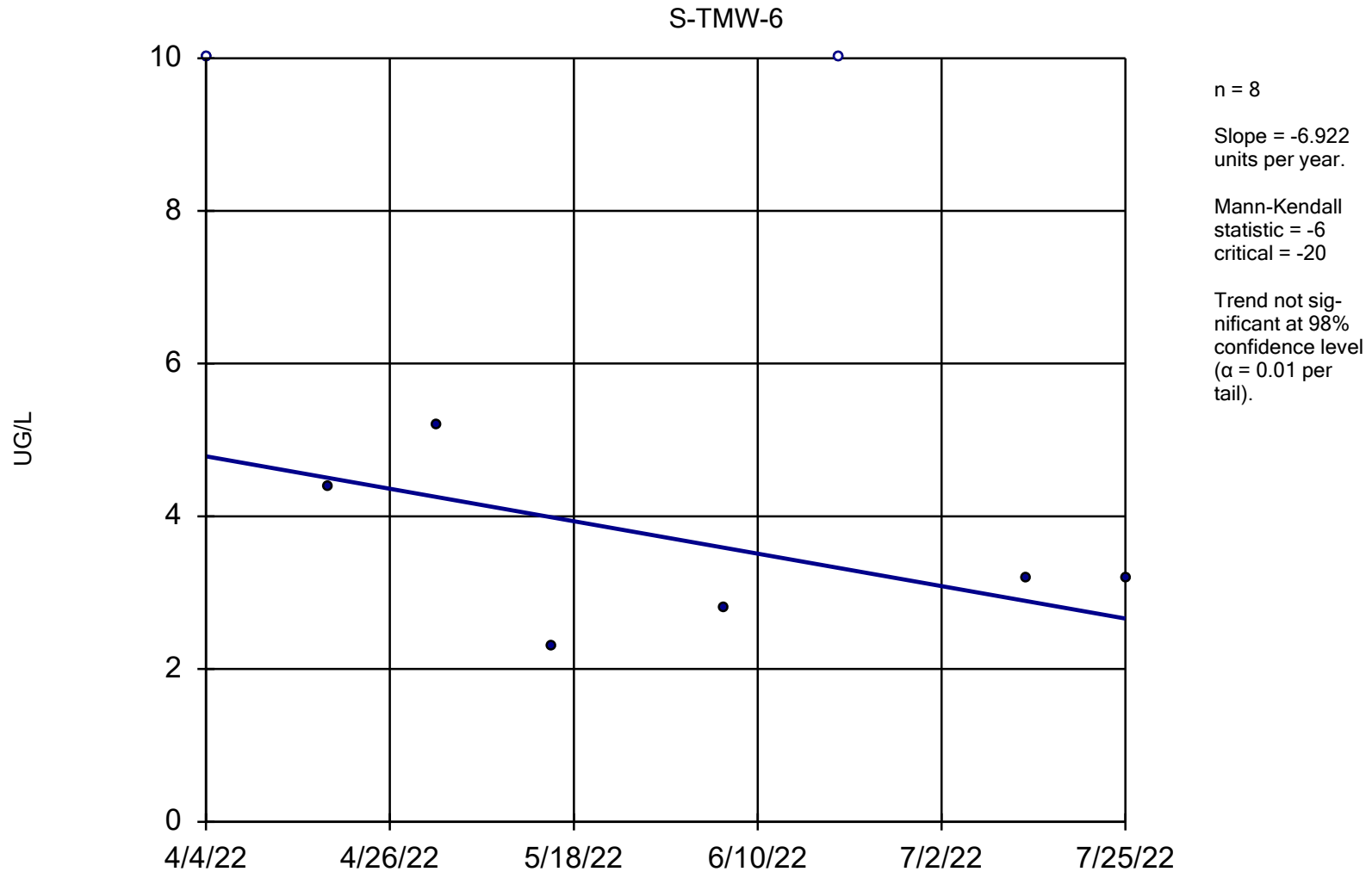


Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

Sanitas™ v.9.6.37 Software licensed to Rocksmith Geoengineering. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator



Constituent: MOLYBDENUM, TOTAL Analysis Run 3/26/2024 4:32 PM View: Detection Monitoring

Sioux E.C. Client: Ameren Data: SEC DATA

APPENDIX B

Mineralogical Analyses Laboratory Report

Quantitative X-Ray Diffraction by Rietveld Refinement

Report Prepared for:	*Golder Associates Inc.*
Project Number/ LIMS No.	*18502-02/MI7006-MAY21*
Sample Receipt:	*May 10, 2021*
Sample Analysis:	*June 7, 2021*
Reporting Date:	*June 30, 2021*

Instrument:	Panalytical X'pert Pro Diffractometer
Test Conditions:	Co radiation, 40 kV, 45 mA Regular Scanning: Step: 0.033°, Step time:0.15s, 2θ range: 6-70°
Interpretations :	PDF2/PDF4 powder diffraction databases issued by the International Center for Diffraction Data (ICDD). DiffracPlus Eva and Topas software.
Detection Limit :	0.5-2%. Strongly dependent on crystallinity.

Contents:

1) Method Summary
2) Quantitative XRD Results
3) XRD Pattern(s)

Ben Eaton, B.Sc.
Junior Mineralogist

Huyun Zhou, Ph.D., P.Geo.
Senior Mineralogist

Method Summary

Mineral Identification and Interpretation:

Mineral identification and interpretation involves matching the diffraction pattern of an unknown material to patterns of single-phase reference materials. The reference patterns are compiled by the Joint Committee on Powder Diffraction Standards - International Center for Diffraction Data (JCPDS-ICDD) database and released on software as Powder Diffraction Files (PDF).

Interpretations do not reflect the presence of non-crystalline and/or amorphous compounds, except when internal standards have been added by request. Mineral proportions may be strongly influenced by crystallinity, crystal structure and preferred orientations. Mineral or compound identification and quantitative analysis results should be accompanied by supporting chemical assay data or other additional tests.

Quantitative Rietveld Analysis:

Quantitative Rietveld Analysis is performed by using Topas 4.2 (Bruker AXS), a graphics based profile analysis program built around a non-linear least squares fitting system, to determine the amount of different phases present in a multicomponent sample. Whole pattern analyses are predicated by the fact that the X-ray diffraction pattern is a total sum of both instrumental and specimen factors. Unlike other peak intensity-based methods, the Rietveld method uses a least squares approach to refine a theoretical line profile until it matches the obtained experimental patterns.

Rietveld refinement is completed with a set of minerals specifically identified for the sample. Zero values indicate that the mineral was included in the refinement calculations, but the calculated concentration was less than 0.05wt%. Minerals not identified by the analyst are not included in refinement calculations for specific samples and are indicated with a dash.

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WARNING: The sample(s) to which the findings recorded herein (the "Findings") relate was(were) drawn and / or provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is/are said to be extracted.

Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	IW-2S MAY7006-01 (wt %)	IW-2M MAY7006-02 (wt %)	IW-2D MAY7006-03 (wt %)	EW-3S MAY7006-04 (wt %)	EW-3M MAY7006-05 (wt %)
Quartz	68.7	63.4	60.7	61.8	66.5
Plagioclase	13.8	17.4	15.6	16.5	12.7
K-Feldspar	7.1	6.8	8.4	10.1	12.6
Muscovite	3.2	3.8	1.8	4.5	3.9
Chlorite	2.1	1.7	3.2	2.1	-
Actinolite	1.4	1.7	2.5	0.8	1.1
Diopside	1.4	2.9	2.6	2.6	2.8
Pyrite	0.1	0.1	-	0.2	-
Hematite	0.6	-	-	-	-
Montmorillonite	1.6	-	-	-	-
Baryte	-	0.2	-	-	-
Rhodochrosite	-	0.4	-	0.6	0.4
Calcite	-	1.7	2.7	1.0	-
Dolomite	-	-	2.5	-	-
Grossular	-	-	-	-	-
Maghemite	-	-	-	-	-
Paragonite	-	-	-	-	-
Anhydrite	-	-	-	-	-
Andalusite	-	-	-	-	-
TOTAL	100	100	100	100	100

Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

Mineral/Compound	EW-3D MAY7006-06 (wt %)	S-BH-01 S MAY7006-08 (wt %)	S-BH-01 M MAY7006-09 (wt %)	S-BH-01 D MAY7006-10 (wt %)	S-BH-01 (93-96) MAY7006-11 (wt %)
Quartz	40.1	72.4	58.2	68.5	60.4
Plagioclase	8.3	13.8	19.6	13.5	15.8
K-Feldspar	7.0	6.5	10.4	5.4	11.1
Muscovite	3.9	2.1	3.6	3.2	2.7
Chlorite	1.6	1.9	2.3	1.9	1.5
Actinolite	1.2	0.8	0.3	1.3	0.6
Diopside	-	1.2	2.5	2.2	3.1
Pyrite	-	0.1	0.3	0.1	-
Hematite	2.7	0.3	0.2	0.3	-
Montmorillonite	-	0.9	1.1	-	-
Baryte	-	-	-	-	-
Rhodochrosite	0.4	-	-	0.6	0.1
Calcite	25.8	-	1.5	3.1	1.9
Dolomite	7.4	-	-	-	2.8
Grossular	1.6	-	-	-	-
Maghemite	-	-	-	-	-
Paragonite	-	-	-	-	-
Anhydrite	-	-	-	-	-
Andalusite	-	-	-	-	-
TOTAL	100	100	100	100	100.0

Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

Sample EW-3-FA (10-17) - MAY7006-07 had visibly high amorphous content in the diffraction pattern and was reported qualitatively.

Mineral/Compound	EW-3-FA (10-17) MAY7006-07 (wt %)*
Quartz	Minor
Plagioclase	Moderate
K-Feldspar	Minor
Muscovite	Moderate
Chlorite	-
Actinolite	-
Diopside	-
Pyrite	-
Hematite	Moderate
Montmorillonite	-
Baryte	-
Rhodochrosite	-
Calcite	Minor
Dolomite	-
Grossular	-
Maghemite	Moderate
Paragonite	Trace
Anhydrite	Minor
Andalusite	Trace
TOTAL	-

The qualitative abundances are: Major (>30% Wt), Moderate (10% -30% Wt), Minor(2% -10% Wt), Trace (<2% Wt).

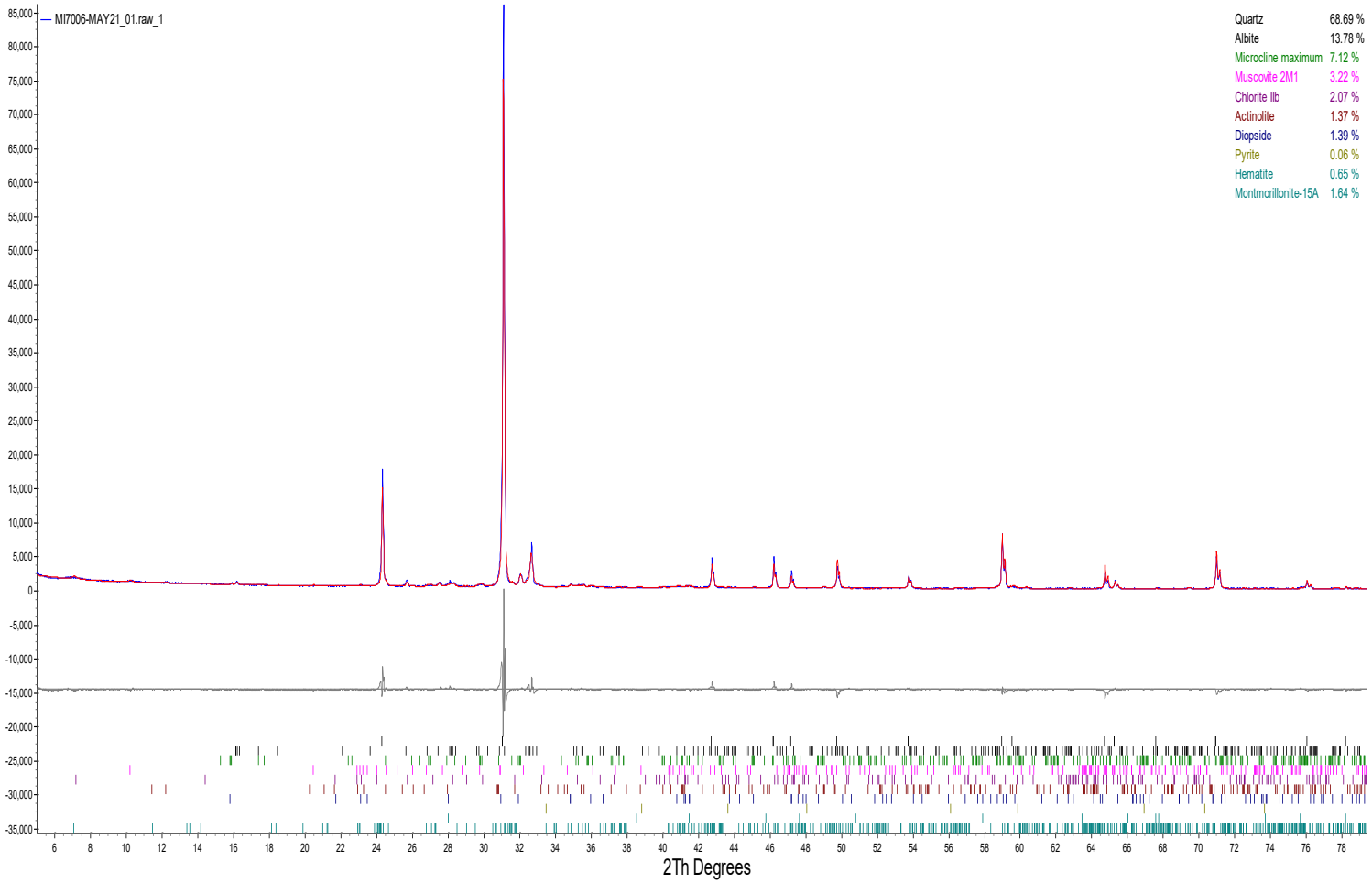
Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

Mineral/Compound	Formula
Quartz	SiO_2
Plagioclase	$(NaSi,CaAl)AlSi_2O_8$
k-Feldsapr	$KAlSi_3O_8$
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$
Diopside	$CaMgSi_2O_6$
Pyrite	FeS_2
Hematite	Fe_2O_3
Montmorillonite	$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot nH_2O$
Baryte	$BaSO_4$
Rhodochrosite	$MnCO_3$
Calcite	$CaCO_3$

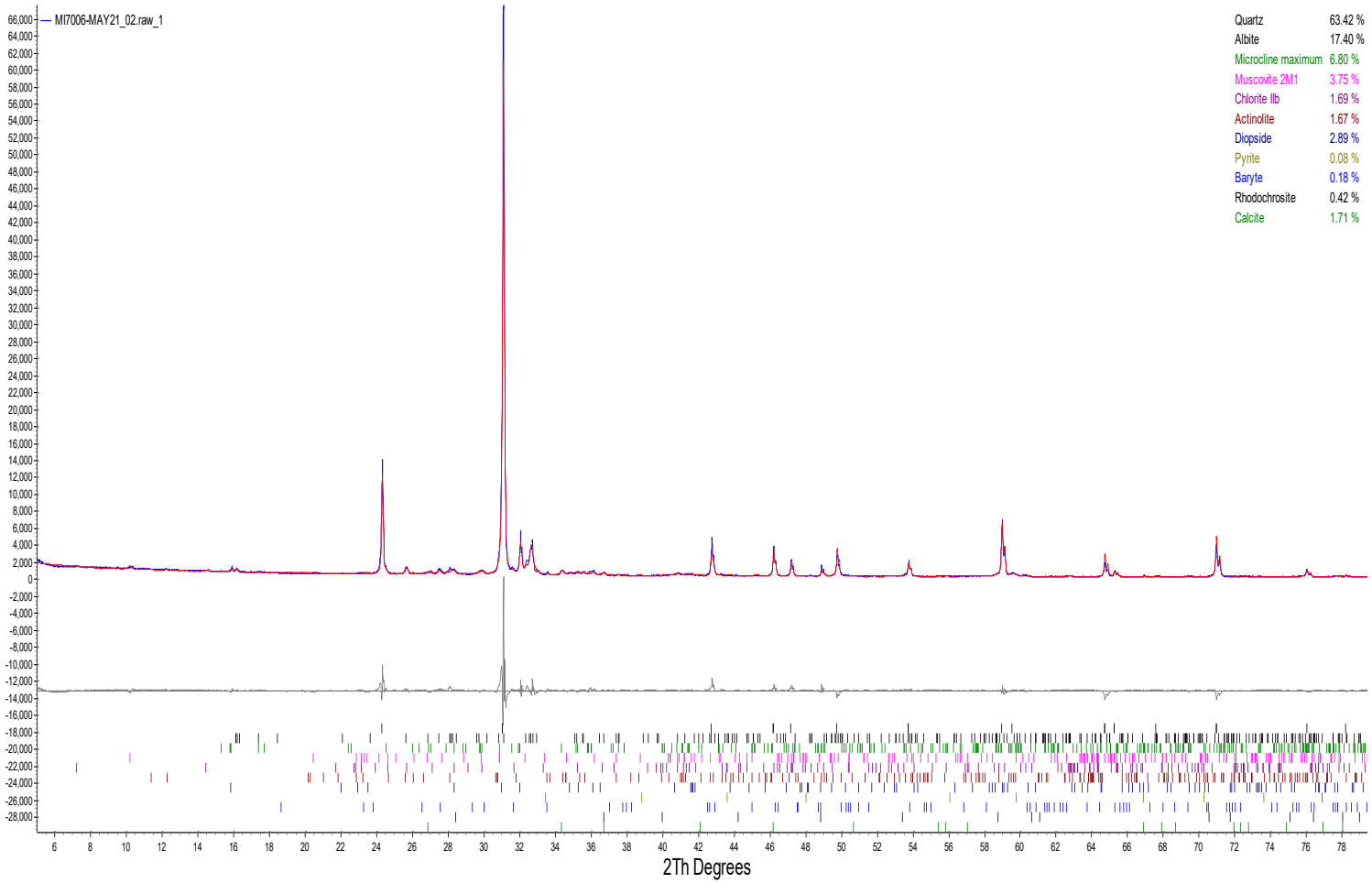
Mineral/ Compound	Formula
Dolomite	$CaMg(CO_3)_2$
Grossular	$Ca_3Al_2Si_3O_{12}$
Maghemite	$\gamma\text{-}Fe_2O_3$
Paragonite	$NaAl_2(AlSi_3O_{10})(OH)_2$
Anhydrite	$CaSO_4$
Andalusite	Al_2SiO_5

IW-2S


MI7006-MAY21_01.raw_1
Quartz 68.69 %
Albite 13.78 %
Microcline maximum 7.12 %
Muscovite 2M1 3.22 %
Chlorite IIb 2.07 %
Actinolite 1.37 %
Diopside 1.39 %
Pyrite 0.06 %
Hematite 0.65 %
Montmorillonite-15A 1.64 %
2Th Degrees

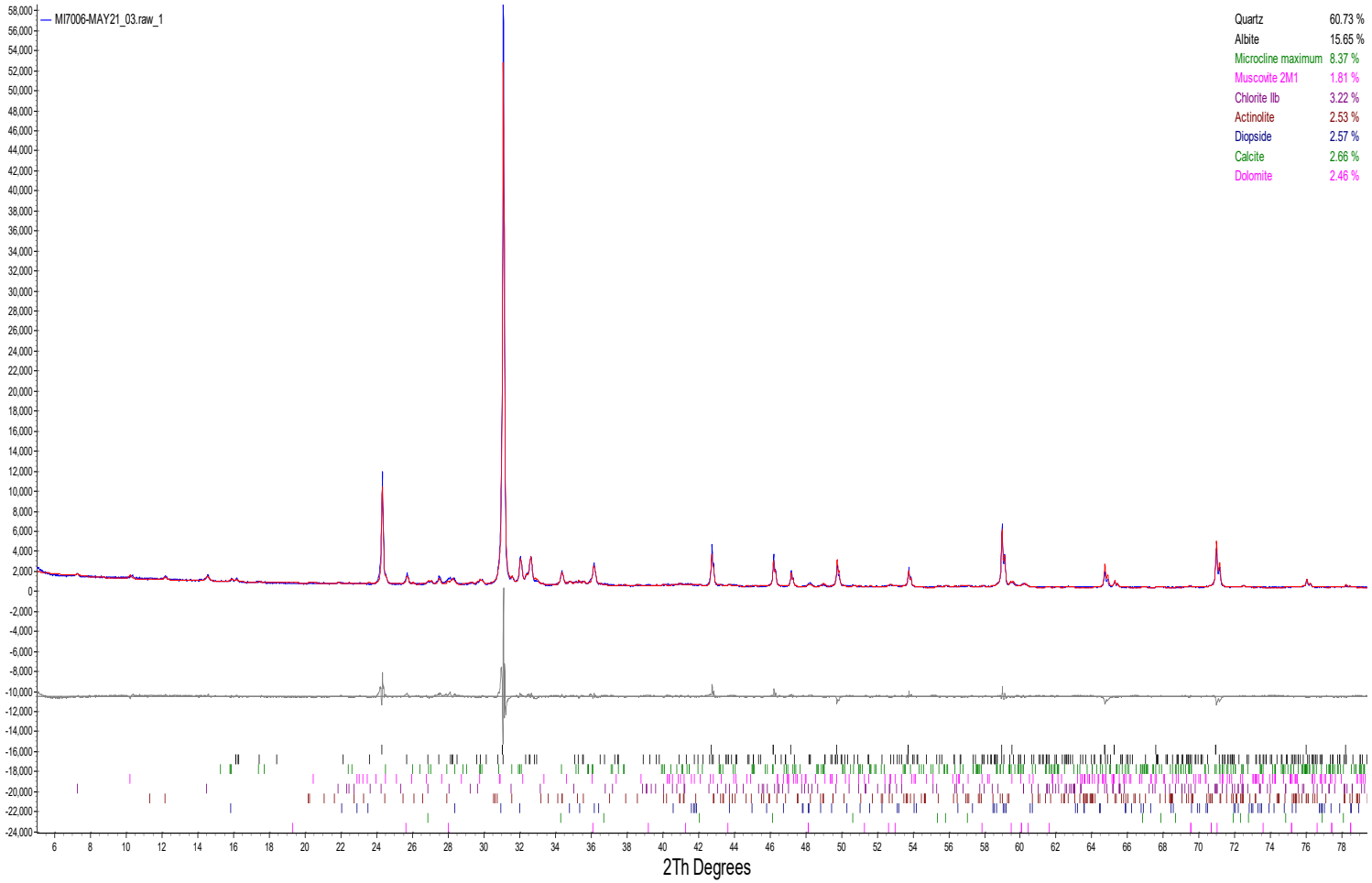
Golder Associates Inc.
18502-02/MI7006-MAY21
06/30/2021

IW-2M



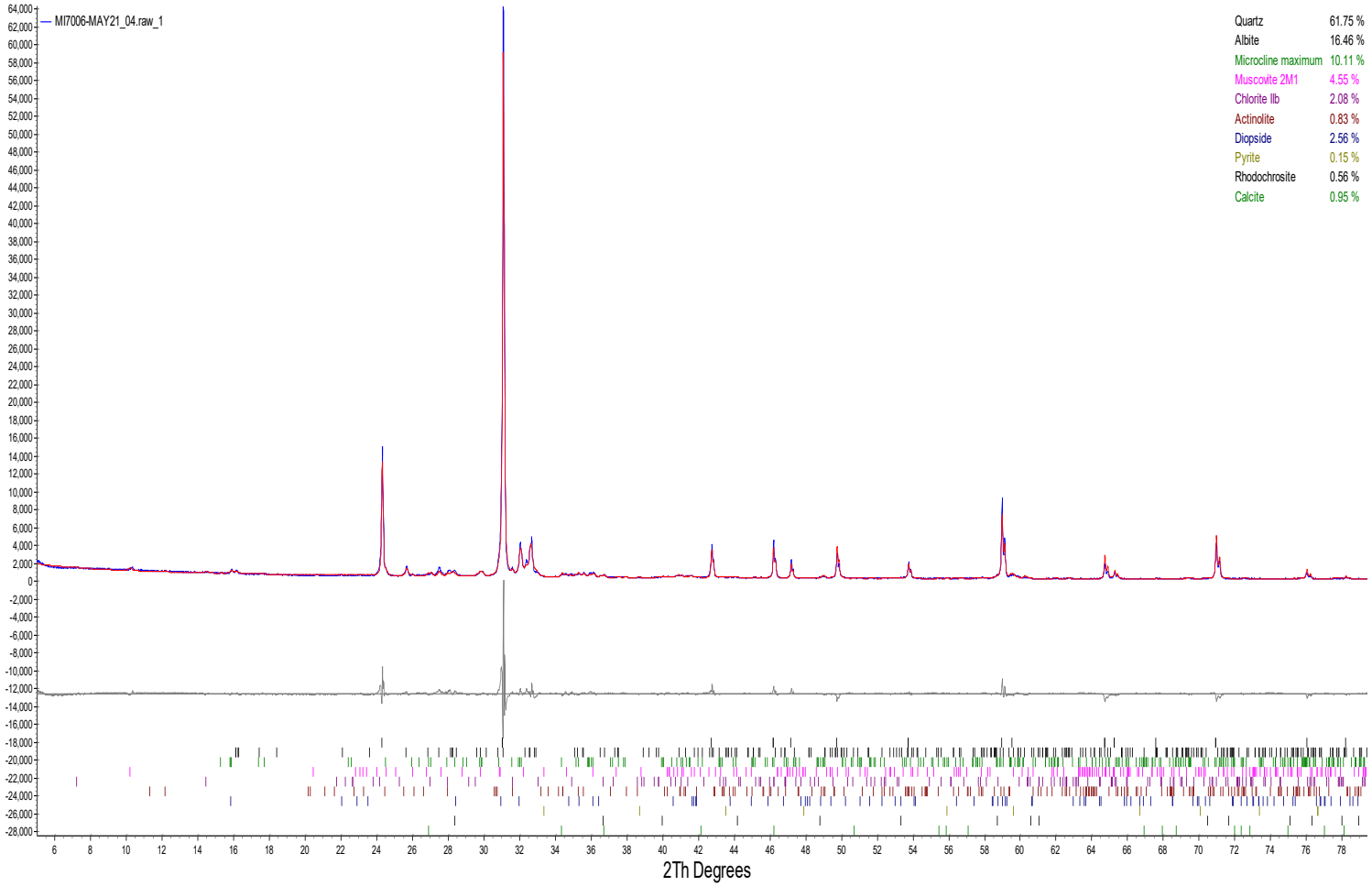
Golder Associates Inc.
18502-02/MI7006-MAY21
06/30/2021

IW-2D

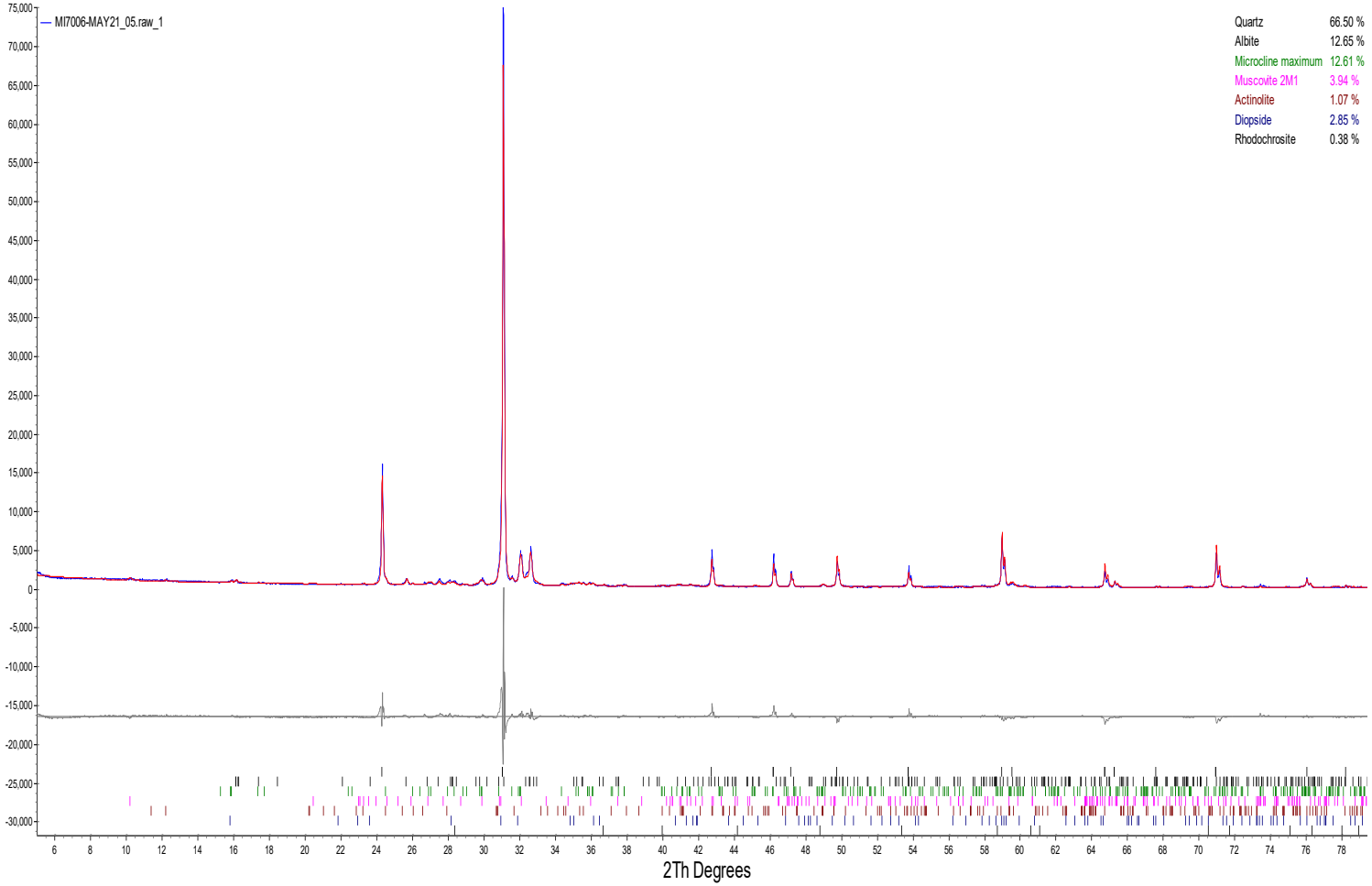


Golder Associates Inc.
18502-02/MI7006-MAY21
06/30/2021

EW-3S

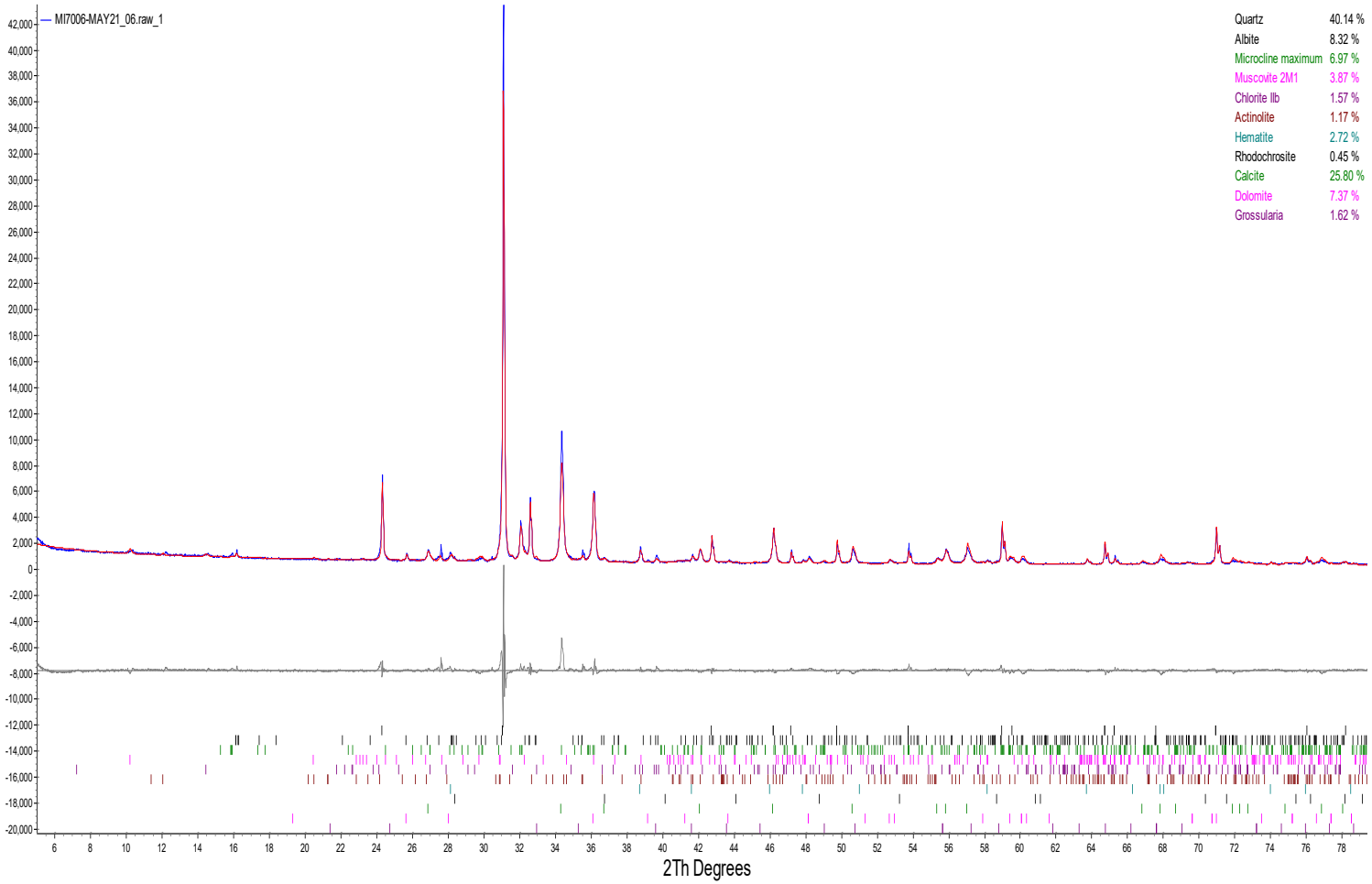


EW-3M


MI7006-MAY21_05.raw_1
Quartz 66.50 %
Albite 12.65 %
Microcline maximum 12.61 %
Muscovite 2M1 3.94 %
Actinolite 1.07 %
Diopside 2.85 %
Rhodochrosite 0.38 %
2Th Degrees

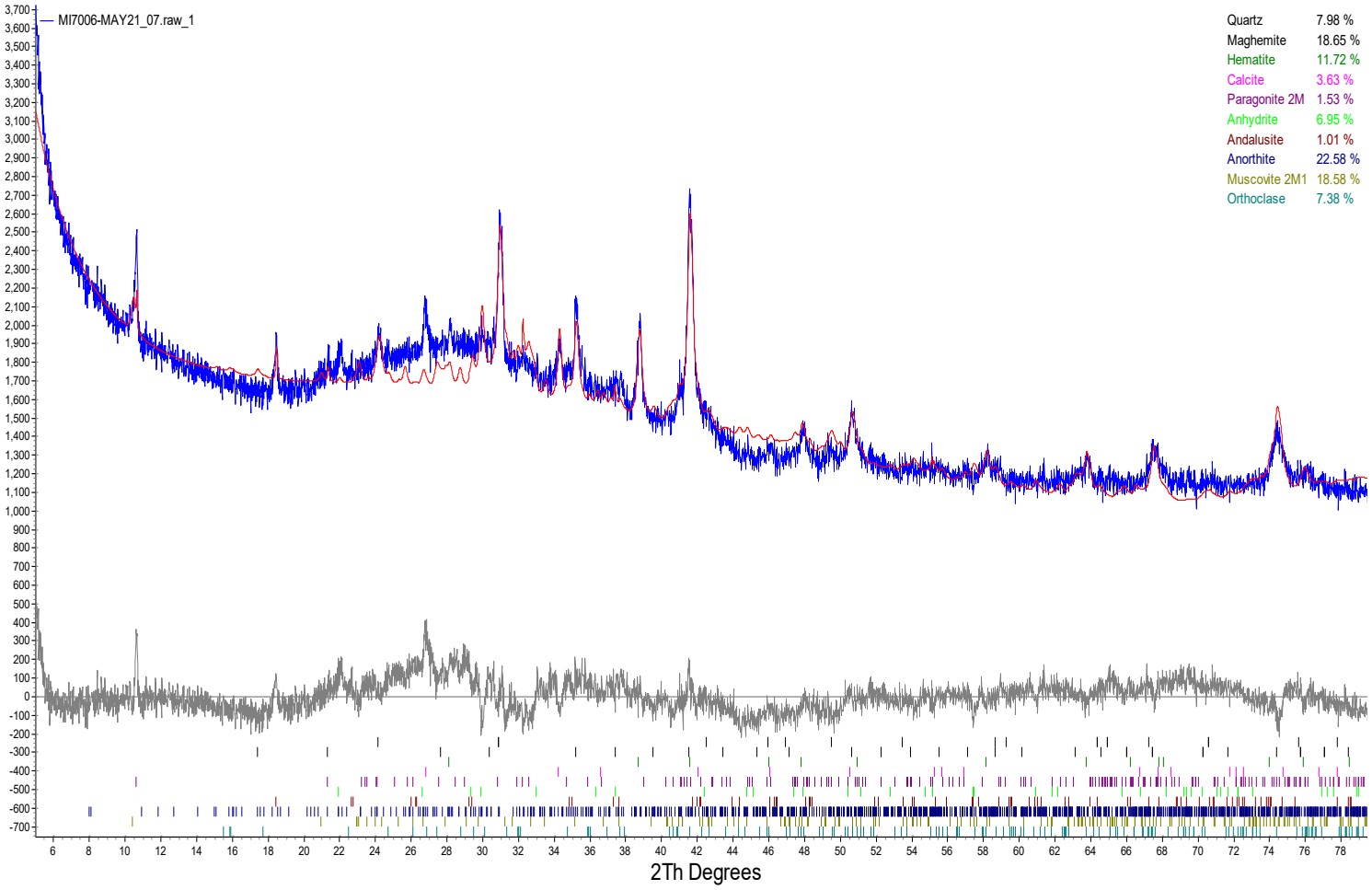
Golder Associates Inc.
18502-02/MI7006-MAY21
06/30/2021

EW-3D



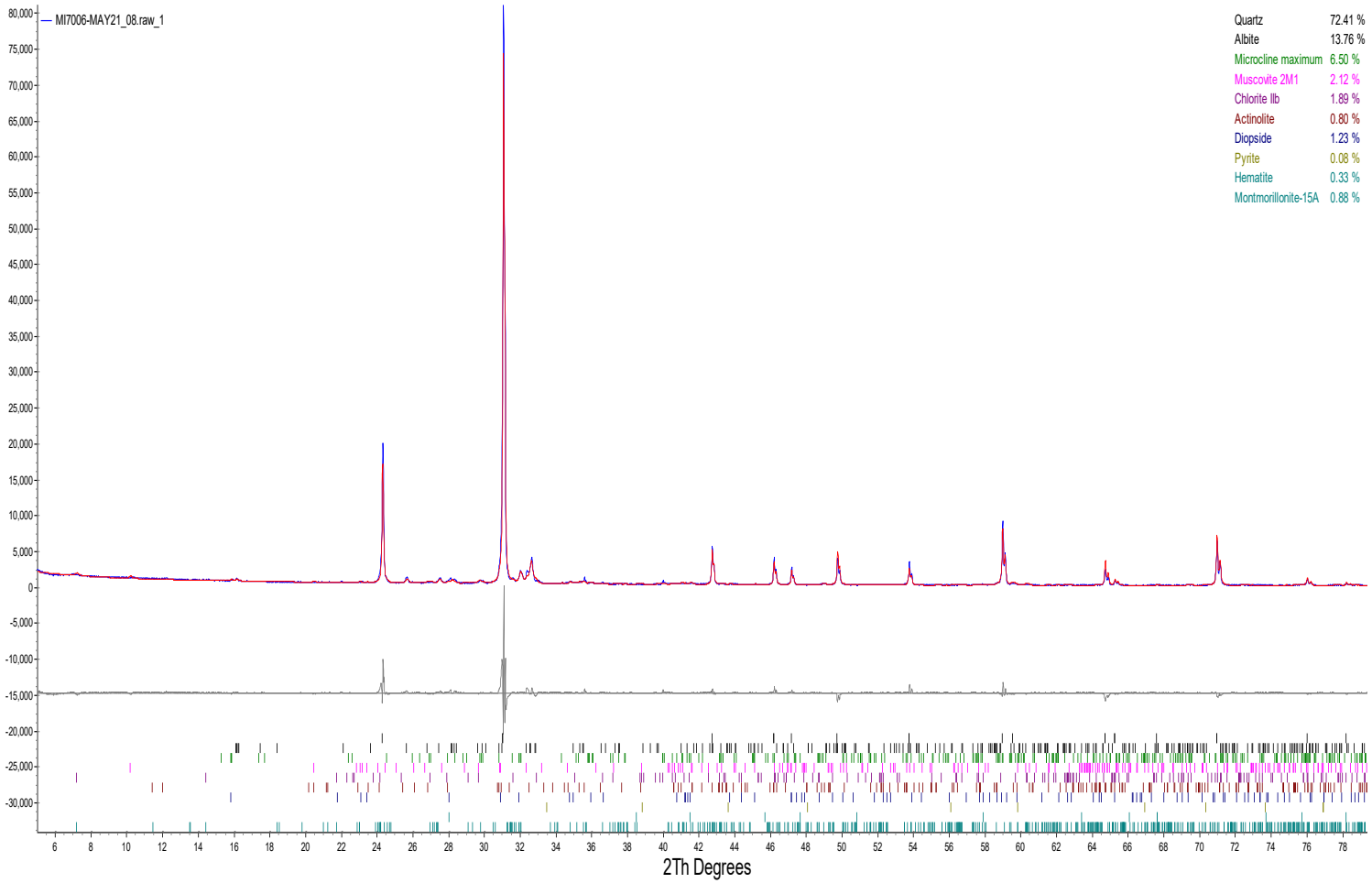
Golder Associates Inc.
18502-02/MI7006-MAY21
06/30/2021

EW-3-FA (10-17)

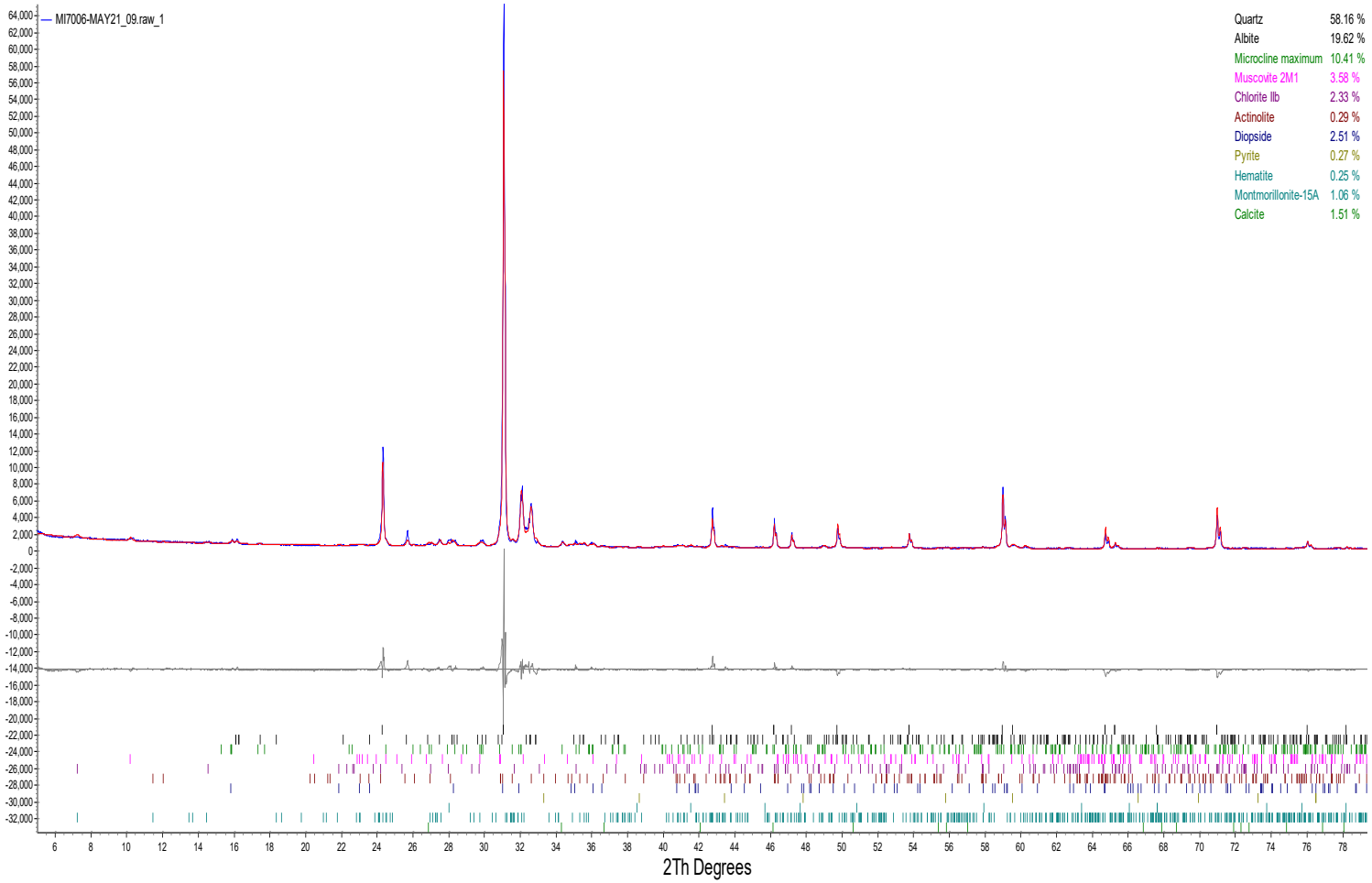


Golder Associates Inc.
18502-02/MI7006-MAY21
06/30/2021

S-BH-01 S



S-BH-01 M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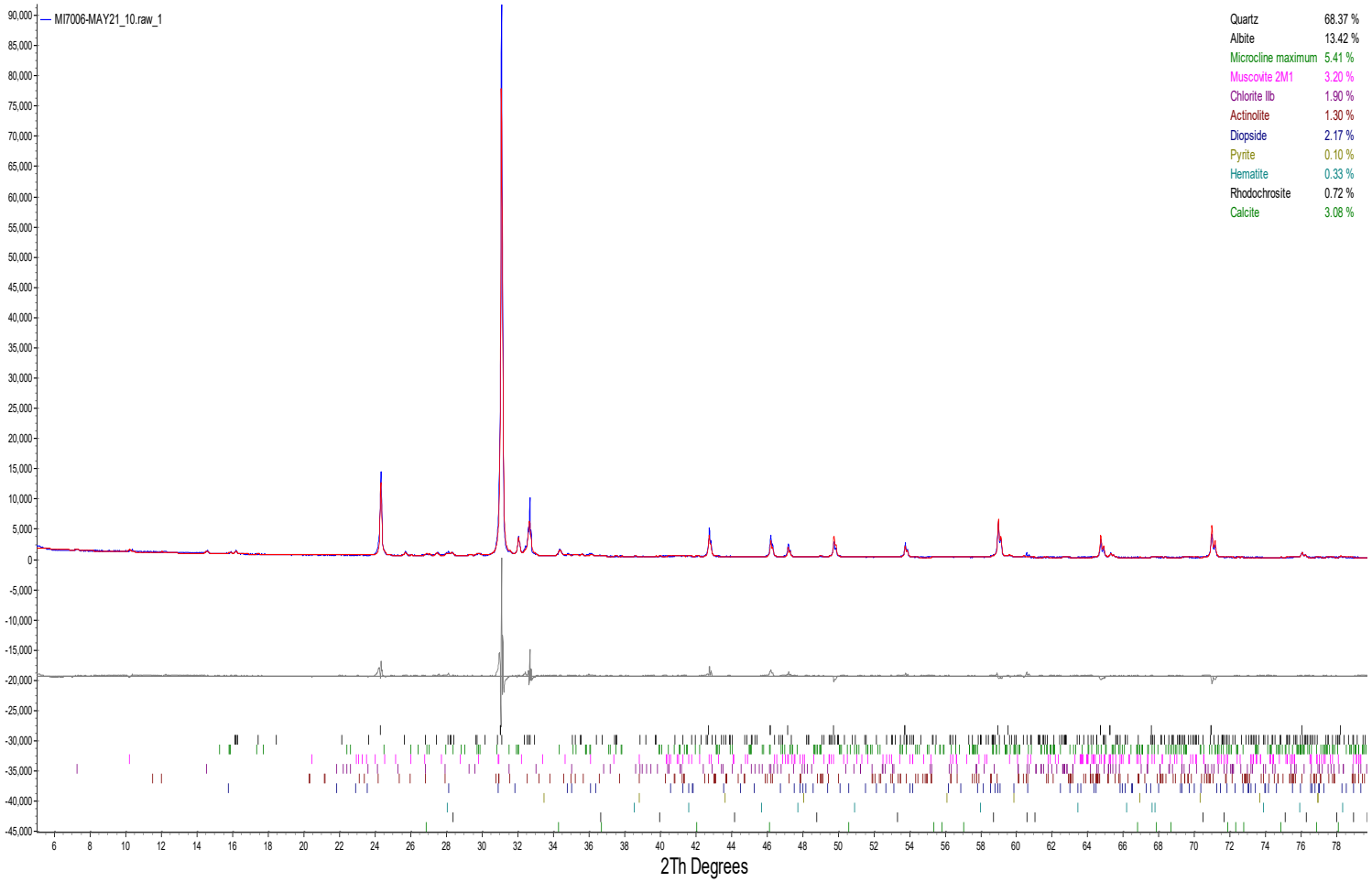
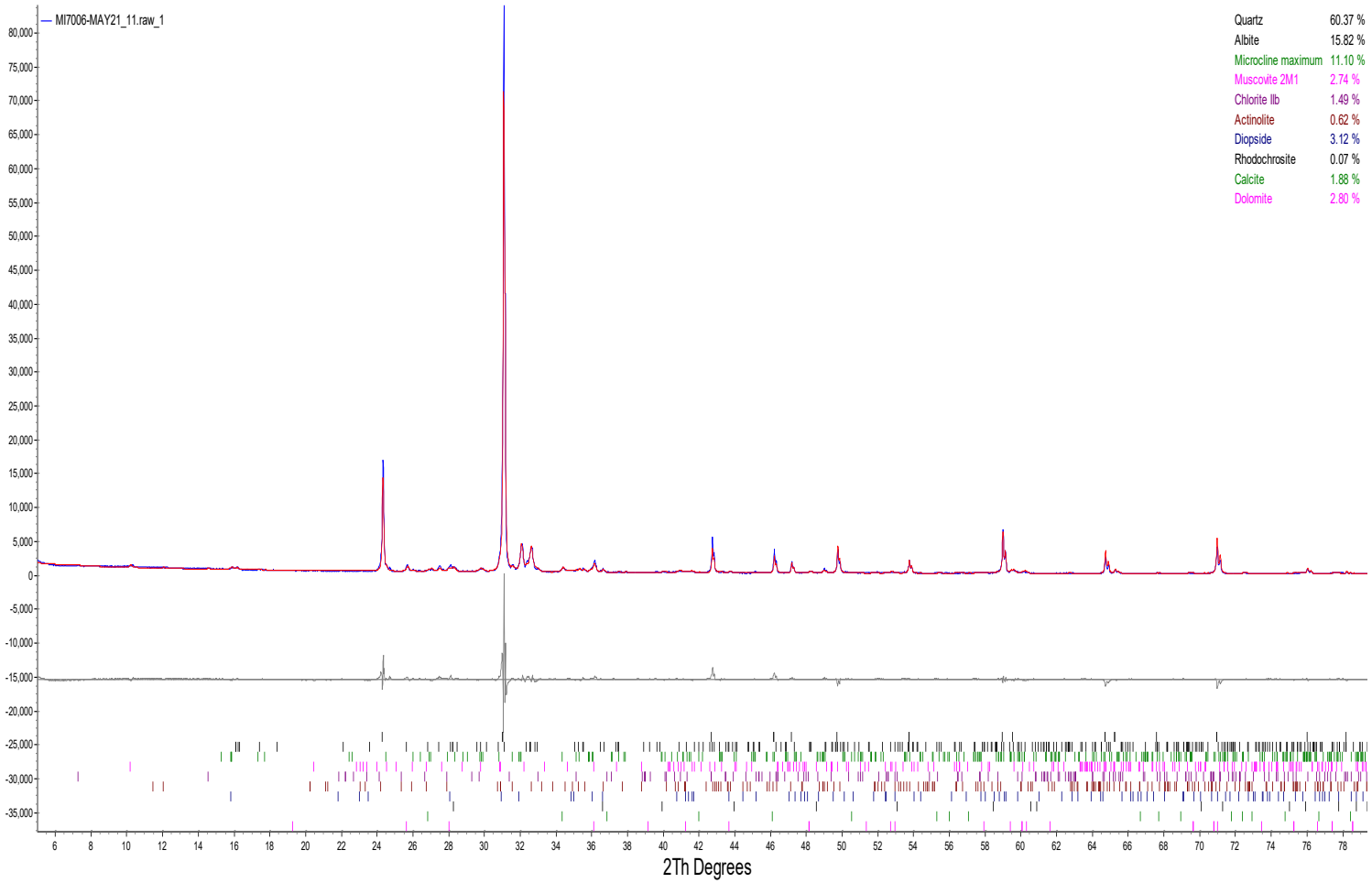
Quartz 58.16 %
Albite 19.62 %
Microcline maximum 10.41 %
Muscovite 2M1 3.58 %
Chlorite IIb 2.33 %
Actinolite 0.29 %
Diopside 2.51 %
Pyrite 0.27 %
Hematite 0.25 %
Montmorillonite-15A 1.06 %
Calcite 1.51 %
2Th Degrees

S-BH-01 D


MI7006-MAY21_10.raw_1
Quartz 68.37 %
Albite 13.42 %
Microcline maximum 5.41 %
Muscovite 2M1 3.20 %
Chlorite IIb 1.90 %
Actinolite 1.30 %
Diopside 2.17 %
Pyrite 0.10 %
Hematite 0.33 %
Rhodochrosite 0.72 %
Calcite 3.08 %
2Th Degrees

S-BH-01 (93-96)


MI7006-MAY21_11.raw_1
Quartz 60.37 %
Albite 15.82 %
Microcline maximum 11.10 %
Muscovite 2M1 2.74 %
Chlorite IIb 1.49 %
Actinolite 0.62 %
Diopside 3.12 %
Rhodochrosite 0.07 %
Calcite 1.88 %
Dolomite 2.80 %
2Th Degrees

APPENDIX C

Sequential Extraction Laboratory Report

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Tel: (865)291-3000

Laboratory Job ID: 140-23289-1
Client Project/Site: Sioux Energy Center

For:
Golder Associates Inc.
13515 Barrett Parkway Drive
Suite 260
Ballwin, Missouri 63021

Attn: Jeffrey Ingram

Ryan Henry

Authorized for release by:
7/30/2021 10:09:48 AM

Ryan Henry, Project Manager I
(865)291-3000
williamr.henry@eurofinset.com

LINKS

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Have a Question? Ask The Expert

Visit us at:
www.eurofinsus.com/Env

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Sample Summary 7
Client Sample Results 8
Default Detection Limits 20
QC Sample Results 24
QC Association Summary 38
Lab Chronicle 44
Certification Summary 57
Method Summary 58
Chain of Custody 59

Definitions/Glossary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Qualifiers

Metals

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
B	Compound was found in the blank and sample.
F1	MS and/or MSD recovery exceeds control limits.
F2	MS/MSD RPD exceeds control limits
F3	Duplicate RPD exceeds the control limit
F5	Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is < the upper reporting limits for both.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 140-23289-1

Laboratory: Eurofins TestAmerica, Knoxville

Narrative

Job Narrative
140-23289-1

Receipt
The samples were received on 5/28/2021 at 10:00am and arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 0.5º C.

Metals
7 Step Sequential Extraction Procedure

These soil samples were prepared and analyzed using Eurofins TestAmerica Knoxville standard operating procedure KNOX-MT-0008, "7 Step Sequential Extraction Procedure". SW-846 Method 6010B as incorporated in Eurofins TestAmerica Knoxville standard operating procedure KNOX-MT-0007 was used to perform the final instrument analyses.

An aliquot of each sample was sequentially extracted using the steps listed below:

· Step 1 - Exchangeable Fraction: A 5 gram aliquot of sample was extracted with 25 mL of 1M magnesium sulfate (MgSO4), centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 2 - Carbonate Fraction: The sample residue from step 1 was extracted with 25 mL of 1M sodium acetate/acetic acid (NaOAc/HOAc) at pH 5, centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 3 - Non-crystalline Materials Fraction: The sample residue from step 2 was extracted with 25 mL of 0.2M ammonium oxalate (pH 3), centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 4 - Metal Hydroxide Fraction: The sample residue from step 3 was extracted with 25 mL of 1M hydroxylamine hydrochloride solution in 25% v/v acetic acid, centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 5 - Organic-bound Fraction: The sample residue from step 4 was extracted three times with 25 mL of 5% sodium hypochlorite (NaClO) at pH 9.5, centrifuged and filtered. The resulting leachates were combined and 5 mL were digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 6 - Acid/Sulfide Fraction: The sample residue from step 5 was extracted with 25 mL of a 3:1:2 v/v solution of HCl-HNO3-H2O, centrifuged and filtered. 5 mL of the resulting leachate was diluted to 50 mL with reagent water and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 7 - Residual Fraction: A 1.0 g aliquot of the sample residue from step 6 was digested using HF, HNO3, HCl and H3BO3. The digestate was analyzed by ICP using method 6010B. Results are reported in mg/kg on a dry weight basis.

In addition, a 1.0 g aliquot of the original sample was digested using HF, HNO3, HCl and H3BO3. The digestate was analyzed by ICP using method 6010B. Total metal results are reported in mg/kg on a dry weight basis.

Results were calculated using the following equation:

Result, µg/g or mg/Kg, dry weight = (C × V × V1 × D) / (W × S × V2)

Where:
C = Concentration from instrument readout, µg/mL
V = Final volume of digestate, mL
D = Instrument dilution factor
V1 = Total volume of leachate, mL
V2 = Volume of leachate digested, mL
W = Wet weight of sample, g
S = Percent solids/100

A method blank, laboratory control sample and laboratory control sample duplicate were prepared and analyzed with each SEP step in

Job ID: 140-23289-1 (Continued)

Laboratory: Eurofins TestAmerica, Knoxville (Continued)

order to provide information about both the presence of elements of interest in the extraction solutions, and the recovery of elements of interest from the extraction solutions. Results outside of laboratory QC limits do not reflect out of control performance, but rather the effect of the extraction solution upon the analyte.

A laboratory sample duplicate was prepared and analyzed with each batch of samples in order to provide information regarding the reproducibility of the procedure.

SEP Report Notes:

The final report lists the results for each step, the result for the total digestion of the sample, and a sum of the results of steps 1 through 7 by element.

Magnesium was not reported for step 1 because the extraction solution for this step (magnesium sulfate) contains high levels of magnesium. Sodium was not reported for steps 2 and 5 since the extraction solutions for these steps contain high levels of sodium. The sum of steps 1 through 7 is much higher than the total result for sodium and magnesium due to the magnesium and sodium introduced by the extraction solutions.

The digestates for steps 1, 2 and 5 were analyzed at a dilution due to instrument problems caused by the high solids content of the digestates. The reporting limits were adjusted accordingly.

Method 6010B: The following samples were diluted due to the nature of the sample matrix: S-BH-01S (140-23289-1), S-BH-01M (140-23289-2), S-BH-01D (140-23289-3) and S-BH-01 (93-96) (140-23289-4). Elevated reporting limits (RLs) are provided for aluminum and calcium.

Method 6010B: The serial dilution performed for the following sample associated with batch 140-52210 was outside control limits: (140-23289-A-2-D SD ^5)

Method 6010B: The sample duplicate (DUP) precision for preparation batch 140-51614 and analytical batch 140-52210 was outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample / laboratory control sample duplicate (LCS/LCSD) precision was within acceptance limits.

Method 6010B: The following samples were diluted to bring the concentration of target analyte, potassium, within the calibration range: S-BH-01S (140-23289-1), S-BH-01M (140-23289-2), S-BH-01D (140-23289-3) and S-BH-01 (93-96) (140-23289-4). Elevated reporting limits (RLs) are provided.

Method 6010B: The following samples were diluted to bring the concentration of target analyte, sodium, within the calibration range: S-BH-01M (140-23289-2) and S-BH-01 (93-96) (140-23289-4). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The sample duplicate (DUP) precision for preparation batch 140-51666 and 140-51707 and analytical batch 140-51972 was outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample / laboratory control sample duplicate (LCS/LCSD) precision was within acceptance limits.

Method 6010B SEP: The following samples were diluted to bring the concentration of target analyte, sodium, within the calibration range: S-BH-01S (140-23289-1), S-BH-01M (140-23289-2), S-BH-01D (140-23289-3) and S-BH-01 (93-96) (140-23289-4). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The serial dilution performed for the following sample associated with batch 140-52062 was outside control limits: (140-23289-A-2-AB SD ^5)

Method 6010B SEP: The following samples were diluted to bring the concentration of target analyte, potassium, within the calibration range: S-BH-01S (140-23289-1), S-BH-01M (140-23289-2), S-BH-01D (140-23289-3) and S-BH-01 (93-96) (140-23289-4). Elevated reporting limits (RLs) are provided.

Job ID: 140-23289-1 (Continued)

Laboratory: Eurofins TestAmerica, Knoxville (Continued)

Method 6010B SEP: The following sample was diluted due to the presence of silicon which interferes with Arsenic and Selenium: S-BH-01 (93-96) (140-23289-4). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following samples were diluted due to the nature of the sample matrix: S-BH-01S (140-23289-1), S-BH-01M (140-23289-2), S-BH-01D (140-23289-3) and S-BH-01 (93-96) (140-23289-4). Elevated reporting limits (RLs) are provided for aluminum and calcium.

Method 6010B SEP: The following sample was diluted to bring the concentration of target analyte, potassium, within the calibration range: S-BH-01 (93-96) (140-23289-4). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
140-23289-1	S-BH-01S	Solid	05/22/21 12:18	05/28/21 10:00
140-23289-2	S-BH-01M	Solid	05/22/21 13:15	05/28/21 10:00
140-23289-3	S-BH-01D	Solid	05/22/21 15:05	05/28/21 10:00
140-23289-4	S-BH-01 (93-96)	Solid	05/22/21 15:05	05/28/21 10:00

Client Sample ID: S-BH-01S

Date Collected: 05/22/21 12:18
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-1

Matrix: Solid
Percent Solids: 80.5

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		50	7.9	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Antimony	ND		15	1.4	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Arsenic	ND		2.5	0.65	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Calcium	**390**	**J B**	1200	9.4	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Cobalt	ND		12	0.22	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Iron	ND		25	14	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Lithium	ND		12	0.75	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Manganese	**0.16**	**J**	3.7	0.15	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Molybdenum	ND		9.9	0.41	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Potassium	ND		1200	130	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Selenium	ND		2.5	0.84	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4
Sodium	ND		1200	650	mg/Kg	☼	07/13/21 08:00	07/21/21 12:23	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		37	6.0	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Antimony	ND		11	1.0	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Arsenic	ND		1.9	0.48	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Calcium	**60**	**J**	930	8.2	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Cobalt	ND		9.3	0.23	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Iron	**13**	**J**	19	11	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Lithium	ND		9.3	0.56	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Manganese	**2.3**	**J**	2.8	1.0	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Molybdenum	ND		7.5	0.31	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Potassium	ND		930	97	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3
Selenium	ND		1.9	0.63	mg/Kg	☼	07/13/21 08:00	07/21/21 14:11	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**38**		12	2.6	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Antimony	ND		3.7	0.35	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Arsenic	**0.24**	**J**	0.62	0.16	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Calcium	**6.8**	**J**	310	1.9	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Cobalt	**0.60**	**J**	3.1	0.056	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Iron	**590**		6.2	3.6	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Lithium	ND		3.1	0.19	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Manganese	**14**	**B**	0.93	0.034	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Molybdenum	ND		2.5	0.10	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Potassium	ND		310	32	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Selenium	ND		0.62	0.21	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1
Sodium	**7000**		310	160	mg/Kg	☼	07/14/21 08:00	07/21/21 16:13	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**530**		12	2.0	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Antimony	ND		3.7	0.56	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Arsenic	**0.30**	**J**	0.62	0.27	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Calcium	**260**	**J**	310	2.7	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Cobalt	**1.5**	**J**	3.1	0.066	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Iron	**2000**		6.2	3.6	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1

Client Sample ID: S-BH-01S
Date Collected: 05/22/21 12:18
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-1
Matrix: Solid
Percent Solids: 80.5

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	0.69	J	3.1	0.19	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Manganese	17		0.93	0.16	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Molybdenum	ND		2.5	0.10	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Potassium	ND		310	32	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Selenium	ND		0.62	0.58	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1
Sodium	400		310	160	mg/Kg	☼	07/15/21 08:00	07/22/21 13:40	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	70	J	190	29	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Antimony	ND		56	5.2	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Arsenic	ND		9.3	2.4	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Calcium	92	J B	4700	14	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Cobalt	ND		47	0.75	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Iron	ND		93	55	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Lithium	ND		47	2.7	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Manganese	ND		14	2.3	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Molybdenum	ND		37	1.6	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Potassium	3300	J B	4700	530	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5
Selenium	ND		9.3	3.2	mg/Kg	☼	07/17/21 08:14	07/22/21 15:25	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	700		12	2.0	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Antimony	ND		3.7	0.35	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Arsenic	0.42	J	0.62	0.19	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Calcium	170	J	310	2.6	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Cobalt	0.82	J	3.1	0.057	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Iron	2600		6.2	3.6	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Lithium	0.65	J	3.1	0.19	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Manganese	17		0.93	0.31	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Molybdenum	ND		2.5	0.12	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Potassium	140	J	310	32	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Selenium	ND		0.62	0.21	mg/Kg	☼	07/16/21 12:00	07/22/21 17:15	1
Sodium	20000		1600	810	mg/Kg	☼	07/16/21 12:00	07/22/21 18:50	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	21000		120	20	mg/Kg	☼	07/20/21 08:00	07/23/21 12:55	10
Antimony	0.31	J	3.7	0.17	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1
Arsenic	0.80		0.62	0.16	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1
Calcium	3600		3100	32	mg/Kg	☼	07/20/21 08:00	07/23/21 12:55	10
Cobalt	0.37	J	3.1	0.032	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1
Iron	2500		6.2	5.1	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1
Lithium	2.9	J	3.1	0.19	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1
Manganese	38		0.93	0.14	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1
Molybdenum	ND		2.5	0.10	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1
Potassium	11000		1600	62	mg/Kg	☼	07/20/21 08:00	07/28/21 14:27	5
Selenium	ND		0.62	0.21	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1
Sodium	8400		310	53	mg/Kg	☼	07/20/21 08:00	07/23/21 14:49	1

Client Sample Results

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01S

Date Collected: 05/22/21 12:18
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-1

Matrix: Solid
Percent Solids: 80.5

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**22000**		10	1.6	mg/Kg			07/29/21 21:02	1
Antimony	**0.31**	**J**	3.0	0.14	mg/Kg			07/29/21 21:02	1
Arsenic	**1.8**		0.50	0.13	mg/Kg			07/29/21 21:02	1
Calcium	**4600**		250	0.74	mg/Kg			07/29/21 21:02	1
Cobalt	**3.3**		2.5	0.023	mg/Kg			07/29/21 21:02	1
Iron	**7700**		5.0	4.1	mg/Kg			07/29/21 21:02	1
Lithium	**4.2**		2.5	0.15	mg/Kg			07/29/21 21:02	1
Manganese	**87**		0.75	0.052	mg/Kg			07/29/21 21:02	1
Molybdenum	ND		2.0	0.082	mg/Kg			07/29/21 21:02	1
Potassium	**15000**		250	26	mg/Kg			07/29/21 21:02	1
Selenium	ND		0.50	0.17	mg/Kg			07/29/21 21:02	1
Sodium	**36000**		250	130	mg/Kg			07/29/21 21:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**1700**		46	5.8	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Antimony	ND		7.0	0.39	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Arsenic	**1.2**	**J**	2.3	0.34	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Calcium	**1100**		580	100	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Cobalt	**3.0**	**J**	5.8	0.056	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Iron	**5300**		23	9.2	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Lithium	**1.7**	**J**	5.8	0.35	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Manganese	**57**		1.7	0.72	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Molybdenum	ND		4.6	0.13	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Potassium	**160**	**J**	580	28	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Selenium	ND		1.7	0.51	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1
Sodium	ND		580	42	mg/Kg	☼	06/10/21 08:00	06/11/21 12:06	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**29000**		120	20	mg/Kg	☼	07/12/21 08:00	07/28/21 17:04	10
Antimony	**0.41**	**J**	3.7	0.17	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1
Arsenic	**2.2**	**B**	0.62	0.16	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1
Calcium	**7300**		3100	32	mg/Kg	☼	07/12/21 08:00	07/28/21 17:04	10
Cobalt	**3.0**	**J**	3.1	0.032	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1
Iron	**7500**		6.2	5.1	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1
Lithium	**4.2**		3.1	0.19	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1
Manganese	**110**		0.93	0.14	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1
Molybdenum	**0.12**	**J**	2.5	0.10	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1
Potassium	**12000**		1600	62	mg/Kg	☼	07/12/21 08:00	07/29/21 13:01	5
Selenium	**0.29**	**J**	0.62	0.21	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1
Sodium	**8600**		310	53	mg/Kg	☼	07/12/21 08:00	07/29/21 11:13	1

Client Sample ID: S-BH-01M

Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2

Matrix: Solid
Percent Solids: 85.7

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		47	7.5	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Antimony	ND		14	1.3	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Arsenic	ND		2.3	0.61	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Calcium	**540**	**J B**	1200	8.9	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Cobalt	ND		12	0.21	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Iron	ND		23	14	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Lithium	ND		12	0.70	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Manganese	**0.78**	**J**	3.5	0.14	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Molybdenum	ND		9.3	0.38	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Potassium	ND		1200	120	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Selenium	ND		2.3	0.79	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4
Sodium	ND		1200	610	mg/Kg	☼	07/13/21 08:00	07/21/21 12:28	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**7.8**	**J**	35	5.6	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Antimony	ND		11	0.98	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Arsenic	ND		1.8	0.46	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Calcium	**1300**		880	7.7	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Cobalt	ND		8.8	0.22	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Iron	**110**		18	10	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Lithium	ND		8.8	0.53	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Manganese	**24**		2.6	0.98	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Molybdenum	ND		7.0	0.29	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Potassium	**100**	**J**	880	91	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3
Selenium	ND		1.8	0.60	mg/Kg	☼	07/13/21 08:00	07/21/21 14:16	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**48**		12	2.5	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Antimony	ND		3.5	0.33	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Arsenic	**0.25**	**J**	0.58	0.15	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Calcium	**5.9**	**J**	290	1.8	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Cobalt	**0.42**	**J**	2.9	0.053	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Iron	**390**		5.8	3.4	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Lithium	ND		2.9	0.18	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Manganese	**11**	**B**	0.88	0.032	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Molybdenum	ND		2.3	0.096	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Potassium	ND		290	30	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Selenium	ND		0.58	0.20	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1
Sodium	**6100**		290	150	mg/Kg	☼	07/14/21 08:00	07/21/21 16:17	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**530**		12	1.9	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Antimony	ND		3.5	0.53	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Arsenic	**0.40**	**J**	0.58	0.26	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Calcium	**950**		290	2.6	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Cobalt	**1.2**	**J**	2.9	0.062	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Iron	**1200**		5.8	3.4	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1

Client Sample ID: S-BH-01M

Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2

Matrix: Solid
Percent Solids: 85.7

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	0.91	J	2.9	0.18	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Manganese	16		0.88	0.15	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Molybdenum	ND		2.3	0.096	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Potassium	67	J	290	30	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Selenium	ND		0.58	0.55	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1
Sodium	330		290	150	mg/Kg	☼	07/15/21 08:00	07/22/21 13:44	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	99	J	180	27	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Antimony	ND		53	4.9	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Arsenic	ND		8.8	2.2	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Calcium	290	J B	4400	13	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Cobalt	ND		44	0.70	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Iron	ND		88	51	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Lithium	ND		44	2.6	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Manganese	ND		13	2.2	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Molybdenum	ND		35	1.5	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Potassium	3200	J B	4400	500	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5
Selenium	ND		8.8	3.0	mg/Kg	☼	07/17/21 08:14	07/22/21 15:31	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	870		12	1.9	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Antimony	ND		3.5	0.33	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Arsenic	0.88		0.58	0.18	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Calcium	260	J	290	2.5	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Cobalt	0.99	J	2.9	0.054	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Iron	2000		5.8	3.4	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Lithium	0.99	J	2.9	0.18	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Manganese	14		0.88	0.29	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Molybdenum	ND		2.3	0.12	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Potassium	220	J	290	30	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Selenium	ND		0.58	0.20	mg/Kg	☼	07/16/21 12:00	07/22/21 17:20	1
Sodium	20000		1500	760	mg/Kg	☼	07/16/21 12:00	07/22/21 18:55	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	30000		120	19	mg/Kg	☼	07/20/21 08:00	07/23/21 13:00	10
Antimony	0.33	J	3.5	0.16	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1
Arsenic	1.1		0.58	0.15	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1
Calcium	3900		2900	30	mg/Kg	☼	07/20/21 08:00	07/23/21 13:00	10
Cobalt	0.57	J	2.9	0.030	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1
Iron	2700		5.8	4.8	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1
Lithium	4.0		2.9	0.18	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1
Manganese	38		0.88	0.13	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1
Molybdenum	ND		2.3	0.096	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1
Potassium	24000		1500	58	mg/Kg	☼	07/20/21 08:00	07/28/21 14:31	5
Selenium	ND		0.58	0.20	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1
Sodium	10000		290	50	mg/Kg	☼	07/20/21 08:00	07/23/21 14:54	1

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01M
Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2
Matrix: Solid
Percent Solids: 85.7

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	31000		10	1.6	mg/Kg			07/29/21 21:02	1
Antimony	0.33	J	3.0	0.14	mg/Kg			07/29/21 21:02	1
Arsenic	2.6		0.50	0.13	mg/Kg			07/29/21 21:02	1
Calcium	7200		250	0.74	mg/Kg			07/29/21 21:02	1
Cobalt	3.2		2.5	0.023	mg/Kg			07/29/21 21:02	1
Iron	6400		5.0	4.1	mg/Kg			07/29/21 21:02	1
Lithium	5.9		2.5	0.15	mg/Kg			07/29/21 21:02	1
Manganese	100		0.75	0.052	mg/Kg			07/29/21 21:02	1
Molybdenum	ND		2.0	0.082	mg/Kg			07/29/21 21:02	1
Potassium	27000		250	26	mg/Kg			07/29/21 21:02	1
Selenium	ND		0.50	0.17	mg/Kg			07/29/21 21:02	1
Sodium	37000		250	130	mg/Kg			07/29/21 21:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	2000		43	5.4	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Antimony	ND		6.5	0.37	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Arsenic	2.6		2.2	0.31	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Calcium	13000	F1	540	95	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Cobalt	3.3	J	5.4	0.052	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Iron	4400		22	8.5	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Lithium	2.8	J	5.4	0.32	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Manganese	250	F2	1.6	0.67	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Molybdenum	ND		4.3	0.12	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Potassium	360	J	540	26	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Selenium	ND		1.6	0.47	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1
Sodium	ND		540	39	mg/Kg	☼	06/10/21 08:00	06/11/21 12:11	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	45000		120	19	mg/Kg	☼	07/12/21 08:00	07/28/21 17:08	10
Antimony	0.43	J	3.5	0.16	mg/Kg	☼	07/12/21 08:00	07/29/21 11:18	1
Arsenic	4.0	B	0.58	0.15	mg/Kg	☼	07/12/21 08:00	07/29/21 11:18	1
Calcium	11000		2900	30	mg/Kg	☼	07/12/21 08:00	07/28/21 17:08	10
Cobalt	3.7		2.9	0.030	mg/Kg	☼	07/12/21 08:00	07/29/21 11:18	1
Iron	7200		5.8	4.8	mg/Kg	☼	07/12/21 08:00	07/29/21 11:18	1
Lithium	8.1		2.9	0.18	mg/Kg	☼	07/12/21 08:00	07/29/21 11:18	1
Manganese	130		0.88	0.13	mg/Kg	☼	07/12/21 08:00	07/29/21 11:18	1
Molybdenum	0.31	J	2.3	0.096	mg/Kg	☼	07/12/21 08:00	07/29/21 11:18	1
Potassium	22000		1500	58	mg/Kg	☼	07/12/21 08:00	07/29/21 13:06	5
Selenium	ND		0.58	0.20	mg/Kg	☼	07/12/21 08:00	07/29/21 11:18	1
Sodium	14000		1500	250	mg/Kg	☼	07/12/21 08:00	07/29/21 13:06	5

Client Sample ID: S-BH-01D

Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-3

Matrix: Solid
Percent Solids: 89.7

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		45	7.1	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Antimony	ND		13	1.2	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Arsenic	ND		2.2	0.58	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Calcium	**300**	**J B**	1100	8.5	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Cobalt	ND		11	0.20	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Iron	ND		22	13	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Lithium	ND		11	0.67	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Manganese	**8.3**		3.3	0.14	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Molybdenum	ND		8.9	0.37	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Potassium	ND		1100	120	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Selenium	ND		2.2	0.76	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4
Sodium	ND		1100	580	mg/Kg	☼	07/13/21 08:00	07/21/21 12:37	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**8.8**	**J**	33	5.4	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Antimony	ND		10	0.94	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Arsenic	ND		1.7	0.43	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Calcium	**2500**		840	7.4	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Cobalt	**0.45**	**J**	8.4	0.21	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Iron	**370**		17	9.7	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Lithium	ND		8.4	0.50	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Manganese	**110**		2.5	0.94	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Molybdenum	ND		6.7	0.27	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Potassium	**89**	**J**	840	87	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3
Selenium	ND		1.7	0.57	mg/Kg	☼	07/13/21 08:00	07/21/21 14:26	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**51**		11	2.3	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Antimony	ND		3.3	0.31	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Arsenic	ND		0.56	0.14	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Calcium	**5.7**	**J**	280	1.7	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Cobalt	**0.53**	**J**	2.8	0.050	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Iron	**1200**		5.6	3.2	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Lithium	ND		2.8	0.17	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Manganese	**43**	**B**	0.84	0.030	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Molybdenum	ND		2.2	0.091	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Potassium	ND		280	29	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Selenium	ND		0.56	0.19	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1
Sodium	**6600**		280	140	mg/Kg	☼	07/14/21 08:00	07/21/21 16:27	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**420**		11	1.8	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Antimony	ND		3.3	0.50	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Arsenic	**0.47**	**J**	0.56	0.25	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Calcium	**1400**		280	2.5	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Cobalt	**1.7**	**J**	2.8	0.059	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Iron	**1300**		5.6	3.2	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1

Client Sample ID: S-BH-01D
Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-3
Matrix: Solid
Percent Solids: 89.7

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	0.67	J	2.8	0.17	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Manganese	30		0.84	0.14	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Molybdenum	ND		2.2	0.091	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Potassium	ND		280	29	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Selenium	ND		0.56	0.52	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1
Sodium	460		280	140	mg/Kg	☼	07/15/21 08:00	07/22/21 13:54	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	76	J	170	26	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Antimony	ND		50	4.7	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Arsenic	ND		8.4	2.1	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Calcium	860	J B	4200	12	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Cobalt	ND		42	0.67	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Iron	ND		84	49	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Lithium	2.7	J	42	2.5	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Manganese	2.4	J	13	2.1	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Molybdenum	ND		33	1.4	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Potassium	2900	J B	4200	470	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5
Selenium	ND		8.4	2.9	mg/Kg	☼	07/17/21 08:14	07/22/21 15:41	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	710		11	1.8	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Antimony	ND		3.3	0.31	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Arsenic	2.7		0.56	0.17	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Calcium	1300		280	2.3	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Cobalt	1.5	J	2.8	0.051	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Iron	2500		5.6	3.2	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Lithium	1.0	J	2.8	0.17	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Manganese	25		0.84	0.28	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Molybdenum	ND		2.2	0.11	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Potassium	130	J	280	29	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Selenium	ND		0.56	0.19	mg/Kg	☼	07/16/21 12:00	07/22/21 17:30	1
Sodium	21000		1400	720	mg/Kg	☼	07/16/21 12:00	07/22/21 19:04	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	21000		110	18	mg/Kg	☼	07/20/21 08:00	07/23/21 13:09	10
Antimony	0.39	J	3.3	0.16	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1
Arsenic	1.1		0.56	0.14	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1
Calcium	6800		2800	29	mg/Kg	☼	07/20/21 08:00	07/23/21 13:09	10
Cobalt	3.4		2.8	0.029	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1
Iron	6200		5.6	4.6	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1
Lithium	3.5		2.8	0.17	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1
Manganese	110		0.84	0.12	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1
Molybdenum	ND		2.2	0.091	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1
Potassium	18000		1400	56	mg/Kg	☼	07/20/21 08:00	07/28/21 14:41	5
Selenium	ND		0.56	0.19	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1
Sodium	9600		280	48	mg/Kg	☼	07/20/21 08:00	07/23/21 15:04	1

Client Sample ID: S-BH-01D

Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-3

Matrix: Solid
Percent Solids: 89.7

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**22000**		10	1.6	mg/Kg			07/29/21 21:02	1
Antimony	**0.39**	**J**	3.0	0.14	mg/Kg			07/29/21 21:02	1
Arsenic	**4.3**		0.50	0.13	mg/Kg			07/29/21 21:02	1
Calcium	**13000**		250	0.74	mg/Kg			07/29/21 21:02	1
Cobalt	**7.5**		2.5	0.023	mg/Kg			07/29/21 21:02	1
Iron	**12000**		5.0	4.1	mg/Kg			07/29/21 21:02	1
Lithium	**7.9**		2.5	0.15	mg/Kg			07/29/21 21:02	1
Manganese	**320**		0.75	0.052	mg/Kg			07/29/21 21:02	1
Molybdenum	ND		2.0	0.082	mg/Kg			07/29/21 21:02	1
Potassium	**21000**		250	26	mg/Kg			07/29/21 21:02	1
Selenium	ND		0.50	0.17	mg/Kg			07/29/21 21:02	1
Sodium	**37000**		250	130	mg/Kg			07/29/21 21:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**1500**		41	5.2	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Antimony	ND		6.2	0.35	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Arsenic	**3.6**		2.1	0.30	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Calcium	**6500**		520	91	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Cobalt	**5.3**		5.2	0.050	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Iron	**6400**		21	8.2	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Lithium	**1.9**	**J**	5.2	0.31	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Manganese	**310**		1.6	0.64	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Molybdenum	ND		4.1	0.11	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Potassium	**180**	**J**	520	25	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Selenium	**0.53**	**J**	1.6	0.46	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1
Sodium	**53**	**J**	520	37	mg/Kg	☼	06/10/21 08:00	06/11/21 12:25	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**30000**		110	18	mg/Kg	☼	07/12/21 08:00	07/28/21 17:18	10
Antimony	**0.31**	**J**	3.3	0.16	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1
Arsenic	**3.5**	**B**	0.56	0.14	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1
Calcium	**10000**		2800	29	mg/Kg	☼	07/12/21 08:00	07/28/21 17:18	10
Cobalt	**6.1**		2.8	0.029	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1
Iron	**10000**		5.6	4.6	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1
Lithium	**7.7**		2.8	0.17	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1
Manganese	**320**		0.84	0.12	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1
Molybdenum	**0.11**	**J**	2.2	0.091	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1
Potassium	**13000**		1400	56	mg/Kg	☼	07/12/21 08:00	07/29/21 13:16	5
Selenium	ND		0.56	0.19	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1
Sodium	**9300**		280	48	mg/Kg	☼	07/12/21 08:00	07/29/21 11:28	1

Client Sample ID: S-BH-01 (93-96)

Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-4

Matrix: Solid
Percent Solids: 90.1

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		44	7.1	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Antimony	ND		13	1.2	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Arsenic	ND		2.2	0.58	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Calcium	**900**	**J B**	1100	8.4	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Cobalt	ND		11	0.20	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Iron	ND		22	13	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Lithium	ND		11	0.67	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Manganese	**9.8**		3.3	0.14	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Molybdenum	ND		8.9	0.36	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Potassium	ND		1100	120	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Selenium	ND		2.2	0.76	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4
Sodium	ND		1100	580	mg/Kg	☼	07/13/21 08:00	07/21/21 12:42	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**19**	**J**	33	5.3	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Antimony	ND		10	0.93	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Arsenic	ND		1.7	0.43	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Calcium	**2500**		830	7.3	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Cobalt	**0.28**	**J**	8.3	0.21	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Iron	**86**		17	9.7	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Lithium	ND		8.3	0.50	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Manganese	**57**		2.5	0.93	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Molybdenum	ND		6.7	0.27	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Potassium	**130**	**J**	830	87	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3
Selenium	ND		1.7	0.57	mg/Kg	☼	07/13/21 08:00	07/21/21 14:31	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**110**		11	2.3	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Antimony	ND		3.3	0.31	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Arsenic	**0.41**	**J**	0.56	0.14	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Calcium	**5.0**	**J**	280	1.7	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Cobalt	**0.75**	**J**	2.8	0.050	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Iron	**800**		5.6	3.2	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Lithium	ND		2.8	0.17	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Manganese	**23**	**B**	0.83	0.030	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Molybdenum	**0.25**	**J**	2.2	0.091	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Potassium	ND		280	29	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Selenium	ND		0.56	0.19	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1
Sodium	**5900**		280	140	mg/Kg	☼	07/14/21 08:00	07/21/21 16:32	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**450**		11	1.8	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Antimony	ND		3.3	0.50	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Arsenic	**0.60**		0.56	0.24	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Calcium	**1300**		280	2.4	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Cobalt	**1.0**	**J**	2.8	0.059	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Iron	**1300**		5.6	3.2	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1

Client Sample ID: S-BH-01 (93-96)

Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-4

Matrix: Solid
Percent Solids: 90.1

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Lithium	0.68	J	2.8	0.17	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Manganese	21		0.83	0.14	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Molybdenum	0.12	J	2.2	0.091	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Potassium	50	J	280	29	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Selenium	ND		0.56	0.52	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1
Sodium	410		280	140	mg/Kg	☼	07/15/21 08:00	07/22/21 13:59	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	44	J	170	26	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Antimony	ND		50	4.7	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Arsenic	ND		8.3	2.1	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Calcium	660	J B	4200	12	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Cobalt	0.67	J	42	0.67	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Iron	ND		83	49	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Lithium	2.4	J	42	2.4	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Manganese	3.6	J	12	2.1	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Molybdenum	ND		33	1.4	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Potassium	2800	J B	4200	470	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5
Selenium	ND		8.3	2.9	mg/Kg	☼	07/17/21 08:14	07/22/21 15:46	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	540		11	1.8	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Antimony	ND		3.3	0.31	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Arsenic	1.0		0.56	0.17	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Calcium	300		280	2.3	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Cobalt	0.65	J	2.8	0.051	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Iron	1400		5.6	3.2	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Lithium	0.76	J	2.8	0.17	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Manganese	12		0.83	0.28	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Molybdenum	ND		2.2	0.11	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Potassium	180	J	280	29	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Selenium	ND		0.56	0.19	mg/Kg	☼	07/16/21 12:00	07/22/21 17:34	1
Sodium	19000		1400	720	mg/Kg	☼	07/16/21 12:00	07/22/21 19:09	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	28000		110	18	mg/Kg	☼	07/20/21 08:00	07/23/21 13:14	10
Antimony	0.18	J	3.3	0.16	mg/Kg	☼	07/20/21 08:00	07/23/21 15:10	1
Arsenic	ND		1.1	0.29	mg/Kg	☼	07/20/21 08:00	07/28/21 14:46	2
Calcium	3400		2800	29	mg/Kg	☼	07/20/21 08:00	07/23/21 13:14	10
Cobalt	ND		2.8	0.029	mg/Kg	☼	07/20/21 08:00	07/23/21 15:10	1
Iron	1300		5.6	4.6	mg/Kg	☼	07/20/21 08:00	07/23/21 15:10	1
Lithium	2.3	J	2.8	0.17	mg/Kg	☼	07/20/21 08:00	07/23/21 15:10	1
Manganese	27		0.83	0.12	mg/Kg	☼	07/20/21 08:00	07/23/21 15:10	1
Molybdenum	0.13	J	2.2	0.091	mg/Kg	☼	07/20/21 08:00	07/23/21 15:10	1
Potassium	16000		1400	56	mg/Kg	☼	07/20/21 08:00	07/28/21 14:51	5
Selenium	ND		1.1	0.38	mg/Kg	☼	07/20/21 08:00	07/28/21 14:46	2
Sodium	8900		280	48	mg/Kg	☼	07/20/21 08:00	07/23/21 15:10	1

Client Sample ID: S-BH-01 (93-96)

Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-4

Matrix: Solid
Percent Solids: 90.1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	30000		10	1.6	mg/Kg			07/29/21 21:02	1
Antimony	0.18	J	3.0	0.14	mg/Kg			07/29/21 21:02	1
Arsenic	2.0		0.50	0.13	mg/Kg			07/29/21 21:02	1
Calcium	9100		250	0.74	mg/Kg			07/29/21 21:02	1
Cobalt	3.4		2.5	0.023	mg/Kg			07/29/21 21:02	1
Iron	4900		5.0	4.1	mg/Kg			07/29/21 21:02	1
Lithium	6.1		2.5	0.15	mg/Kg			07/29/21 21:02	1
Manganese	150		0.75	0.052	mg/Kg			07/29/21 21:02	1
Molybdenum	0.50	J	2.0	0.082	mg/Kg			07/29/21 21:02	1
Potassium	19000		250	26	mg/Kg			07/29/21 21:02	1
Selenium	ND		0.50	0.17	mg/Kg			07/29/21 21:02	1
Sodium	34000		250	130	mg/Kg			07/29/21 21:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	1600		43	5.3	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Antimony	ND		6.4	0.36	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Arsenic	2.8		2.1	0.31	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Calcium	9600		530	94	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Cobalt	4.1	J	5.3	0.051	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Iron	4000		21	8.4	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Lithium	1.7	J	5.3	0.32	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Manganese	250		1.6	0.66	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Molybdenum	0.91	J	4.3	0.12	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Potassium	370	J	530	26	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Selenium	0.50	J	1.6	0.47	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1
Sodium	140	J	530	38	mg/Kg	☼	06/10/21 08:00	06/11/21 12:30	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	41000		110	18	mg/Kg	☼	07/12/21 08:00	07/28/21 17:23	10
Antimony	0.54	J	3.3	0.16	mg/Kg	☼	07/12/21 08:00	07/29/21 11:34	1
Arsenic	4.2	B	0.56	0.14	mg/Kg	☼	07/12/21 08:00	07/29/21 11:34	1
Calcium	11000		2800	29	mg/Kg	☼	07/12/21 08:00	07/28/21 17:23	10
Cobalt	4.7		2.8	0.029	mg/Kg	☼	07/12/21 08:00	07/29/21 11:34	1
Iron	6200		5.6	4.6	mg/Kg	☼	07/12/21 08:00	07/29/21 11:34	1
Lithium	5.0		2.8	0.17	mg/Kg	☼	07/12/21 08:00	07/29/21 11:34	1
Manganese	180		0.83	0.12	mg/Kg	☼	07/12/21 08:00	07/29/21 11:34	1
Molybdenum	0.90	J	2.2	0.091	mg/Kg	☼	07/12/21 08:00	07/29/21 11:34	1
Potassium	23000		1400	56	mg/Kg	☼	07/12/21 08:00	07/29/21 13:20	5
Selenium	0.27	J	0.56	0.19	mg/Kg	☼	07/12/21 08:00	07/29/21 11:34	1
Sodium	14000		1400	240	mg/Kg	☼	07/12/21 08:00	07/29/21 13:20	5

Default Detection Limits

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Prep: 3010A

SEP: Exchangeable

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.28	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	1.9	mg/Kg
Cobalt	2.5	0.045	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.031	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Prep: 3010A

SEP: Carbonate

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.28	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	2.2	mg/Kg
Cobalt	2.5	0.063	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.28	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Prep: 3010A

SEP: Non-Crystalline

Analyte	RL	MDL	Units
Aluminum	10	2.1	mg/Kg
Antimony	3.0	0.28	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	1.5	mg/Kg
Cobalt	2.5	0.045	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.027	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Prep: 3010A

SEP: Metal Hydroxide

Default Detection Limits

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Prep: 3010A

SEP: Metal Hydroxide

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.45	mg/Kg
Arsenic	0.50	0.22	mg/Kg
Calcium	250	2.2	mg/Kg
Cobalt	2.5	0.053	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.13	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.47	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Prep: 3010A

SEP: Organic-Bound

Analyte	RL	MDL	Units
Aluminum	30	4.7	mg/Kg
Antimony	9.0	0.84	mg/Kg
Arsenic	1.5	0.38	mg/Kg
Calcium	750	2.2	mg/Kg
Cobalt	7.5	0.12	mg/Kg
Iron	15	8.8	mg/Kg
Lithium	7.5	0.44	mg/Kg
Manganese	2.3	0.37	mg/Kg
Molybdenum	6.0	0.25	mg/Kg
Potassium	750	85	mg/Kg
Selenium	1.5	0.52	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 6

SEP: Acid/Sulfide

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.28	mg/Kg
Arsenic	0.50	0.15	mg/Kg
Calcium	250	2.1	mg/Kg
Cobalt	2.5	0.046	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.25	mg/Kg
Molybdenum	2.0	0.099	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Prep: Residual

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.14	mg/Kg

Default Detection Limits

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Prep: Residual

Analyte	RL	MDL	Units
Arsenic	0.50	0.13	mg/Kg
Calcium	250	2.6	mg/Kg
Cobalt	2.5	0.026	mg/Kg
Iron	5.0	4.1	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.11	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	10	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	43	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.14	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	0.74	mg/Kg
Cobalt	2.5	0.023	mg/Kg
Iron	5.0	4.1	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.052	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B - Metals (ICP)

Prep: 3050B

Analyte	RL	MDL	Units
Aluminum	40	5.0	mg/Kg
Antimony	6.0	0.34	mg/Kg
Arsenic	2.0	0.29	mg/Kg
Calcium	500	88	mg/Kg
Cobalt	5.0	0.048	mg/Kg
Iron	20	7.9	mg/Kg
Lithium	5.0	0.30	mg/Kg
Manganese	1.5	0.62	mg/Kg
Molybdenum	4.0	0.11	mg/Kg
Potassium	500	24	mg/Kg
Selenium	1.5	0.44	mg/Kg
Sodium	500	36	mg/Kg

Method: 6010B - SEP Metals (ICP) - Total

Prep: Total

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.14	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	2.6	mg/Kg
Cobalt	2.5	0.026	mg/Kg
Iron	5.0	4.1	mg/Kg

Default Detection Limits

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Method: 6010B - SEP Metals (ICP) - Total (Continued)

Prep: Total

Analyte	RL	MDL	Units
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.11	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	10	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	43	mg/Kg

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 140-50632/14-A
Matrix: Solid
Analysis Batch: 50744

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 50632

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		40	5.0	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Antimony	ND		6.0	0.34	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Arsenic	ND		2.0	0.29	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Calcium	ND		500	88	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Cobalt	ND		5.0	0.048	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Iron	ND		20	7.9	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Lithium	ND		5.0	0.30	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Manganese	ND		1.5	0.62	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Molybdenum	ND		4.0	0.11	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Potassium	ND		500	24	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Selenium	ND		1.5	0.44	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Sodium	ND		500	36	mg/Kg		06/10/21 08:00	06/11/21 10:58	1

Lab Sample ID: LCS 140-50632/15-A
Matrix: Solid
Analysis Batch: 50744

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 50632

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	200	203		mg/Kg		102	90 - 110
Antimony	50.0	49.9		mg/Kg		100	90 - 110
Arsenic	10.0	9.86		mg/Kg		99	90 - 110
Calcium	5000	5060		mg/Kg		101	90 - 110
Cobalt	10.0	10.3		mg/Kg		103	90 - 110
Iron	100	104		mg/Kg		104	90 - 113
Lithium	10.0	9.88		mg/Kg		99	80 - 120
Manganese	10.0	10.6		mg/Kg		106	90 - 110
Molybdenum	50.0	51.7		mg/Kg		103	90 - 110
Potassium	5000	4980		mg/Kg		100	90 - 110
Selenium	15.0	14.8		mg/Kg		99	90 - 110
Sodium	5000	5060		mg/Kg		101	87 - 116

Lab Sample ID: 140-23289-2 MS
Matrix: Solid
Analysis Batch: 50744

Client Sample ID: S-BH-01M
Prep Type: Total/NA
Prep Batch: 50632

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	2000		232	4090	4	mg/Kg	☼	885	75 - 125
Antimony	ND		57.9	49.4		mg/Kg	☼	85	75 - 125
Arsenic	2.6		11.6	15.0		mg/Kg	☼	107	75 - 125
Calcium	13000	F1	5790	10400	F1	mg/Kg	☼	-48	75 - 125
Cobalt	3.3	J	11.6	14.6		mg/Kg	☼	97	75 - 125
Iron	4400		116	5400	4	mg/Kg	☼	830	75 - 125
Lithium	2.8	J	11.6	15.2		mg/Kg	☼	107	75 - 125
Manganese	250	F2	11.6	139	4	mg/Kg	☼	-942	75 - 125
Molybdenum	ND		57.9	56.0		mg/Kg	☼	97	75 - 125
Potassium	360	J	5790	6270		mg/Kg	☼	102	75 - 125
Selenium	ND		17.4	16.6		mg/Kg	☼	95	75 - 121
Sodium	ND		5790	5680		mg/Kg	☼	98	75 - 125

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: 140-23289-2 MSD
Matrix: Solid
Analysis Batch: 50744

Client Sample ID: S-BH-01M
Prep Type: Total/NA
Prep Batch: 50632

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	2000		231	4050	4	mg/Kg	☼	869	75 - 125	1	20
Antimony	ND		57.8	48.5		mg/Kg	☼	84	75 - 125	2	20
Arsenic	2.6		11.6	13.2		mg/Kg	☼	92	75 - 125	13	20
Calcium	13000	F1	5780	8940	F1	mg/Kg	☼	-74	75 - 125	15	20
Cobalt	3.3	J	11.6	14.2		mg/Kg	☼	94	75 - 125	3	20
Iron	4400		116	4750	4	mg/Kg	☼	269	75 - 125	13	20
Lithium	2.8	J	11.6	14.1		mg/Kg	☼	98	75 - 125	7	20
Manganese	250	F2	11.6	93.1	4 F2	mg/Kg	☼	-1339	75 - 125	39	20
Molybdenum	ND		57.8	55.2		mg/Kg	☼	96	75 - 125	1	20
Potassium	360	J	5780	6130		mg/Kg	☼	100	75 - 125	2	20
Selenium	ND		17.3	16.3		mg/Kg	☼	94	75 - 121	2	20
Sodium	ND		5780	5590		mg/Kg	☼	97	75 - 125	1	20

Method: 6010B - SEP Metals (ICP) - Total

Lab Sample ID: MB 140-51614/18-A
Matrix: Solid
Analysis Batch: 52192

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 51614

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		07/12/21 08:00	07/28/21 16:44	1
Calcium	ND		250	2.6	mg/Kg		07/12/21 08:00	07/28/21 16:44	1

Lab Sample ID: MB 140-51614/18-A
Matrix: Solid
Analysis Batch: 52210

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 51614

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Antimony	ND		3.0	0.14	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Arsenic	0.134	J	0.50	0.13	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Calcium	ND		250	2.6	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Cobalt	ND		2.5	0.026	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Iron	ND		5.0	4.1	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Lithium	ND		2.5	0.15	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Manganese	ND		0.75	0.11	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Molybdenum	ND		2.0	0.082	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Potassium	ND		250	10	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Selenium	ND		0.50	0.17	mg/Kg		07/12/21 08:00	07/29/21 10:53	1
Sodium	ND		250	43	mg/Kg		07/12/21 08:00	07/29/21 10:53	1

Lab Sample ID: LCS 140-51614/19-A
Matrix: Solid
Analysis Batch: 52192

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 51614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	100		mg/Kg		100	80 - 120
Calcium	2500	2550		mg/Kg		102	80 - 120

Method: 6010B - SEP Metals (ICP) - Total (Continued)

Lab Sample ID: LCS 140-51614/19-A
Matrix: Solid
Analysis Batch: 52210

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 51614

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	103		mg/Kg		103	80 - 120
Antimony	25.0	25.2		mg/Kg		101	80 - 125
Arsenic	5.00	5.16		mg/Kg		103	80 - 120
Calcium	2500	2610		mg/Kg		104	80 - 120
Cobalt	5.00	5.25		mg/Kg		105	80 - 125
Iron	50.0	53.6		mg/Kg		107	80 - 120
Lithium	5.00	5.15		mg/Kg		103	80 - 120
Manganese	5.00	5.42		mg/Kg		108	80 - 120
Molybdenum	25.0	26.6		mg/Kg		106	80 - 125
Potassium	2500	2630		mg/Kg		105	80 - 120
Selenium	7.50	7.51		mg/Kg		100	80 - 120
Sodium	2500	2660		mg/Kg		106	80 - 120

Lab Sample ID: LCSD 140-51614/20-A
Matrix: Solid
Analysis Batch: 52192

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 51614

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	100		mg/Kg		100	80 - 120	0	30
Calcium	2500	2540		mg/Kg		101	80 - 120	1	30

Lab Sample ID: LCSD 140-51614/20-A
Matrix: Solid
Analysis Batch: 52210

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 51614

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	103		mg/Kg		103	80 - 120	0	30
Antimony	25.0	25.3		mg/Kg		101	80 - 125	0	30
Arsenic	5.00	5.15		mg/Kg		103	80 - 120	0	30
Calcium	2500	2590		mg/Kg		103	80 - 120	1	30
Cobalt	5.00	5.24		mg/Kg		105	80 - 125	0	30
Iron	50.0	53.1		mg/Kg		106	80 - 120	1	30
Lithium	5.00	5.04		mg/Kg		101	80 - 120	2	30
Manganese	5.00	5.44		mg/Kg		109	80 - 120	0	30
Molybdenum	25.0	26.5		mg/Kg		106	80 - 125	0	30
Potassium	2500	2610		mg/Kg		104	80 - 120	1	30
Selenium	7.50	7.40		mg/Kg		99	80 - 120	2	30
Sodium	2500	2640		mg/Kg		105	80 - 120	1	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52192

Client Sample ID: S-BH-01M
Prep Type: Total/NA
Prep Batch: 51614

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Aluminum	45000		40200		mg/Kg	☼	12	30
Calcium	11000		10200		mg/Kg	☼	8	30

Method: 6010B - SEP Metals (ICP) - Total (Continued)

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52210

Client Sample ID: S-BH-01M
Prep Type: Total/NA
Prep Batch: 51614

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Antimony	0.43	J	0.466	J	mg/Kg	☼	9	30
Arsenic	4.0	B	4.79		mg/Kg	☼	19	30
Cobalt	3.7		3.99		mg/Kg	☼	7	30
Iron	7200		9190		mg/Kg	☼	24	30
Lithium	8.1		7.80		mg/Kg	☼	4	30
Manganese	130		758	F3	mg/Kg	☼	143	30
Molybdenum	0.31	J	0.256	J	mg/Kg	☼	18	30
Selenium	ND		ND		mg/Kg	☼	NC	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52210

Client Sample ID: S-BH-01M
Prep Type: Total/NA
Prep Batch: 51614

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Potassium	22000		21000		mg/Kg	☼	7	30
Sodium	14000		12000		mg/Kg	☼	17	30

Method: 6010B SEP - SEP Metals (ICP)

Lab Sample ID: MB 140-51615/18-B ^4
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Method Blank
Prep Type: Step 1
Prep Batch: 51654

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		40	6.4	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Antimony	ND		12	1.1	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Arsenic	ND		2.0	0.52	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Calcium	23.2	J	1000	7.6	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Cobalt	ND		10	0.18	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Iron	ND		20	12	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Lithium	ND		10	0.60	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Manganese	ND		3.0	0.12	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Molybdenum	ND		8.0	0.33	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Potassium	ND		1000	100	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Selenium	ND		2.0	0.68	mg/Kg		07/13/21 08:00	07/21/21 12:08	4
Sodium	ND		1000	520	mg/Kg		07/13/21 08:00	07/21/21 12:08	4

Lab Sample ID: LCS 140-51615/19-B ^5
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Lab Control Sample
Prep Type: Step 1
Prep Batch: 51654

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	94.2		mg/Kg		94	80 - 120
Antimony	25.0	23.2		mg/Kg		93	80 - 120
Arsenic	5.00	4.51		mg/Kg		90	80 - 120
Calcium	2500	2330		mg/Kg		93	80 - 120
Cobalt	5.00	4.68	J	mg/Kg		94	80 - 120
Iron	50.0	48.1		mg/Kg		96	80 - 120
Lithium	5.00	4.89	J	mg/Kg		98	80 - 120

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCS 140-51615/19-B ^5
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Lab Control Sample
Prep Type: Step 1
Prep Batch: 51654

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Manganese			5.00	4.95		mg/Kg		99	80 - 120		
Molybdenum			25.0	23.6		mg/Kg		94	80 - 120		
Potassium			2500	2500		mg/Kg		100	80 - 120		
Selenium			7.50	7.36		mg/Kg		98	80 - 120		
Sodium			2500	2450		mg/Kg		98	80 - 120		

Lab Sample ID: LCSD 140-51615/20-B ^5
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 1
Prep Batch: 51654

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	99.7		mg/Kg		100	80 - 120	6	30
Antimony			25.0	23.7		mg/Kg		95	80 - 120	2	30
Arsenic			5.00	4.52		mg/Kg		90	80 - 120	0	30
Calcium			2500	2390		mg/Kg		95	80 - 120	2	30
Cobalt			5.00	4.80	J	mg/Kg		96	80 - 120	3	30
Iron			50.0	49.4		mg/Kg		99	80 - 120	3	30
Lithium			5.00	4.94	J	mg/Kg		99	80 - 120	1	30
Manganese			5.00	5.04		mg/Kg		101	80 - 120	2	30
Molybdenum			25.0	24.1		mg/Kg		96	80 - 120	2	30
Potassium			2500	2550		mg/Kg		102	80 - 120	2	30
Selenium			7.50	7.47		mg/Kg		100	80 - 120	1	30
Sodium			2500	2510		mg/Kg		100	80 - 120	2	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: S-BH-01M
Prep Type: Step 1
Prep Batch: 51654

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	ND			ND		mg/Kg	☼			NC	30
Antimony	ND			ND		mg/Kg	☼			NC	30
Arsenic	ND			ND		mg/Kg	☼			NC	30
Calcium	540	J B		550	J	mg/Kg	☼			2	30
Cobalt	ND			ND		mg/Kg	☼			NC	30
Iron	ND			ND		mg/Kg	☼			NC	30
Lithium	ND			ND		mg/Kg	☼			NC	30
Manganese	0.78	J		0.826	J	mg/Kg	☼			6	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Potassium	ND			ND		mg/Kg	☼			NC	30
Selenium	ND			ND		mg/Kg	☼			NC	30
Sodium	ND			ND		mg/Kg	☼			NC	30

Lab Sample ID: MB 140-51653/15-B ^3
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Method Blank
Prep Type: Step 2
Prep Batch: 51667

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	4.8	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Antimony	ND		9.0	0.84	mg/Kg		07/13/21 08:00	07/21/21 13:55	3

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-51653/15-B ^3
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Method Blank
Prep Type: Step 2
Prep Batch: 51667

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		1.5	0.39	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Calcium	ND		750	6.6	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Cobalt	ND		7.5	0.19	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Iron	ND		15	8.7	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Lithium	ND		7.5	0.45	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Manganese	ND		2.3	0.84	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Molybdenum	ND		6.0	0.25	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Potassium	ND		750	78	mg/Kg		07/13/21 08:00	07/21/21 13:55	3
Selenium	ND		1.5	0.51	mg/Kg		07/13/21 08:00	07/21/21 13:55	3

Lab Sample ID: LCS 140-51653/16-B ^5
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Lab Control Sample
Prep Type: Step 2
Prep Batch: 51667

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	ND		mg/Kg		0.3	
Antimony	25.0	21.2		mg/Kg		85	70 - 120
Arsenic	5.00	3.66		mg/Kg		73	60 - 120
Calcium	2500	659	J	mg/Kg		26	10 - 40
Cobalt	5.00	4.72	J	mg/Kg		94	80 - 120
Iron	50.0	ND		mg/Kg		3	
Lithium	5.00	4.68	J	mg/Kg		94	80 - 120
Manganese	5.00	4.89		mg/Kg		98	80 - 120
Molybdenum	25.0	21.2		mg/Kg		85	70 - 120
Potassium	2500	2550		mg/Kg		102	80 - 120
Selenium	7.50	6.87		mg/Kg		92	70 - 120

Lab Sample ID: LCSD 140-51653/17-B ^5
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 2
Prep Batch: 51667

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	ND		mg/Kg		-2		281	
Antimony	25.0	20.9		mg/Kg		83	70 - 120	2	30
Arsenic	5.00	3.54		mg/Kg		71	60 - 120	3	30
Calcium	2500	641	J	mg/Kg		26	10 - 40	3	30
Cobalt	5.00	4.54	J	mg/Kg		91	80 - 120	4	30
Iron	50.0	ND		mg/Kg		4		35	
Lithium	5.00	4.44	J	mg/Kg		89	80 - 120	5	30
Manganese	5.00	4.69		mg/Kg		94	80 - 120	4	30
Molybdenum	25.0	20.4		mg/Kg		82	70 - 120	4	30
Potassium	2500	2450		mg/Kg		98	80 - 120	4	30
Selenium	7.50	5.97		mg/Kg		80	70 - 120	14	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: S-BH-01M
Prep Type: Step 2
Prep Batch: 51667

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Aluminum	7.8	J	8.01	J	mg/Kg	☼	2	
Antimony	ND		ND		mg/Kg	☼	NC	30
Arsenic	ND		ND		mg/Kg	☼	NC	30
Calcium	1300		1330		mg/Kg	☼	5	30
Cobalt	ND		0.252	J	mg/Kg	☼	NC	30
Iron	110		128		mg/Kg	☼	18	
Lithium	ND		ND		mg/Kg	☼	NC	30
Manganese	24		26.8		mg/Kg	☼	10	30
Molybdenum	ND		ND		mg/Kg	☼	NC	30
Potassium	100	J	107	J	mg/Kg	☼	2	30
Selenium	ND		ND		mg/Kg	☼	NC	30

Lab Sample ID: MB 140-51666/15-B
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Method Blank
Prep Type: Step 3
Prep Batch: 51707

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	2.1	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Antimony	ND		3.0	0.28	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Arsenic	ND		0.50	0.13	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Calcium	ND		250	1.5	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Cobalt	ND		2.5	0.045	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Iron	ND		5.0	2.9	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Lithium	ND		2.5	0.15	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Manganese	0.0895	J	0.75	0.027	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Molybdenum	ND		2.0	0.082	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Potassium	ND		250	26	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Selenium	ND		0.50	0.17	mg/Kg		07/14/21 08:00	07/21/21 15:58	1
Sodium	ND		250	130	mg/Kg		07/14/21 08:00	07/21/21 15:58	1

Lab Sample ID: LCS 140-51666/16-B
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Lab Control Sample
Prep Type: Step 3
Prep Batch: 51707

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	93.0		mg/Kg		93	80 - 120
Antimony	25.0	22.7		mg/Kg		91	80 - 120
Arsenic	5.00	4.51		mg/Kg		90	80 - 120
Calcium	2500	30.3	J	mg/Kg		1	
Cobalt	5.00	4.66		mg/Kg		93	80 - 120
Iron	50.0	48.2		mg/Kg		96	80 - 120
Lithium	5.00	4.55		mg/Kg		91	80 - 120
Manganese	5.00	4.76		mg/Kg		95	80 - 120
Molybdenum	25.0	23.4		mg/Kg		93	80 - 120
Potassium	2500	2350		mg/Kg		94	80 - 120
Selenium	7.50	7.10		mg/Kg		95	80 - 120
Sodium	2500	2330		mg/Kg		93	80 - 120

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCSD 140-51666/17-B
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 3
Prep Batch: 51707

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	94.5		mg/Kg		94	80 - 120	2	30
Antimony			25.0	23.0		mg/Kg		92	80 - 120	1	30
Arsenic			5.00	4.55		mg/Kg		91	80 - 120	1	30
Calcium			2500	31.2	J	mg/Kg		1		3	
Cobalt			5.00	4.71		mg/Kg		94	80 - 120	1	30
Iron			50.0	49.2		mg/Kg		98	80 - 120	2	30
Lithium			5.00	4.57		mg/Kg		91	80 - 120	1	30
Manganese			5.00	4.81		mg/Kg		96	80 - 120	1	30
Molybdenum			25.0	23.6		mg/Kg		94	80 - 120	1	30
Potassium			2500	2370		mg/Kg		95	80 - 120	1	30
Selenium			7.50	7.31		mg/Kg		97	80 - 120	3	30
Sodium			2500	2350		mg/Kg		94	80 - 120	1	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 51972

Client Sample ID: S-BH-01M
Prep Type: Step 3
Prep Batch: 51707

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	48			48.3		mg/Kg	☼			0.3	30
Antimony	ND			ND		mg/Kg	☼			NC	30
Arsenic	0.25	J		0.339	J F5	mg/Kg	☼			31	30
Calcium	5.9	J		7.32	J	mg/Kg	☼			21	
Cobalt	0.42	J		0.464	J	mg/Kg	☼			11	30
Iron	390			438		mg/Kg	☼			10	30
Lithium	ND			ND		mg/Kg	☼			NC	30
Manganese	11	B		14.5		mg/Kg	☼			24	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Potassium	ND			ND		mg/Kg	☼			NC	30
Selenium	ND			ND		mg/Kg	☼			NC	30
Sodium	6100			6340		mg/Kg	☼			5	30

Lab Sample ID: MB 140-51690/15-B
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Method Blank
Prep Type: Step 4
Prep Batch: 51767

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Antimony	ND		3.0	0.45	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Arsenic	ND		0.50	0.22	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Calcium	ND		250	2.2	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Cobalt	ND		2.5	0.053	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Iron	ND		5.0	2.9	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Lithium	ND		2.5	0.15	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Manganese	ND		0.75	0.13	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Molybdenum	ND		2.0	0.082	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Potassium	ND		250	26	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Selenium	ND		0.50	0.47	mg/Kg		07/15/21 08:00	07/22/21 13:25	1
Sodium	ND		250	130	mg/Kg		07/15/21 08:00	07/22/21 13:25	1

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCS 140-51690/16-B
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Lab Control Sample
Prep Type: Step 4
Prep Batch: 51767

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Aluminum			100	94.8		mg/Kg		95	80 - 120		
Antimony			25.0	23.9		mg/Kg		96	80 - 130		
Arsenic			5.00	4.86		mg/Kg		97	80 - 130		
Calcium			2500	2400		mg/Kg		96	80 - 120		
Cobalt			5.00	4.91		mg/Kg		98	80 - 120		
Iron			50.0	48.6		mg/Kg		97	80 - 120		
Lithium			5.00	4.66		mg/Kg		93	80 - 120		
Manganese			5.00	4.90		mg/Kg		98	80 - 120		
Molybdenum			25.0	25.0		mg/Kg		100	80 - 120		
Potassium			2500	2380		mg/Kg		95	80 - 120		
Selenium			7.50	ND		mg/Kg		4			
Sodium			2500	2390		mg/Kg		96	80 - 120		

Lab Sample ID: LCSD 140-51690/17-B
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 4
Prep Batch: 51767

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	94.5		mg/Kg		95	80 - 120	0	30
Antimony			25.0	24.1		mg/Kg		96	80 - 130	1	30
Arsenic			5.00	4.83		mg/Kg		97	80 - 130	1	30
Calcium			2500	2400		mg/Kg		96	80 - 120	0	30
Cobalt			5.00	4.93		mg/Kg		99	80 - 120	0	30
Iron			50.0	49.0		mg/Kg		98	80 - 120	1	30
Lithium			5.00	4.65		mg/Kg		93	80 - 120	0	30
Manganese			5.00	4.92		mg/Kg		98	80 - 120	0	30
Molybdenum			25.0	25.1		mg/Kg		100	80 - 120	0	30
Potassium			2500	2390		mg/Kg		96	80 - 120	0	30
Selenium			7.50	ND		mg/Kg		5		27	
Sodium			2500	2400		mg/Kg		96	80 - 120	0	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: S-BH-01M
Prep Type: Step 4
Prep Batch: 51767

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	530			508		mg/Kg	☼			4	30
Antimony	ND			ND		mg/Kg	☼			NC	30
Arsenic	0.40	J		0.414	J	mg/Kg	☼			5	30
Calcium	950			914		mg/Kg	☼			3	30
Cobalt	1.2	J		1.12	J	mg/Kg	☼			6	30
Iron	1200			1290		mg/Kg	☼			4	30
Lithium	0.91	J		0.933	J	mg/Kg	☼			3	30
Manganese	16			17.8		mg/Kg	☼			11	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Potassium	67	J		65.1	J	mg/Kg	☼			3	30
Selenium	ND			ND		mg/Kg	☼			NC	
Sodium	330			396		mg/Kg	☼			18	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-51761/15-B ^5
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Method Blank
Prep Type: Step 5
Prep Batch: 51837

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		150	24	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Antimony	ND		45	4.2	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Arsenic	ND		7.5	1.9	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Calcium	11.0	J	3800	11	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Cobalt	ND		38	0.60	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Iron	ND		75	44	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Lithium	ND		38	2.2	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Manganese	ND		11	1.9	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Molybdenum	ND		30	1.3	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Potassium	2300	J	3800	430	mg/Kg		07/17/21 08:14	07/22/21 15:11	5
Selenium	ND		7.5	2.6	mg/Kg		07/17/21 08:14	07/22/21 15:11	5

Lab Sample ID: LCS 140-51761/16-B ^5
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Lab Control Sample
Prep Type: Step 5
Prep Batch: 51837

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	300	ND		mg/Kg		4	
Antimony	75.0	69.4		mg/Kg		93	80 - 120
Arsenic	15.0	10.3		mg/Kg		69	60 - 100
Calcium	7500	1890	J	mg/Kg		25	20 - 50
Cobalt	15.0	0.623	J	mg/Kg		4	1 - 60
Iron	150	ND		mg/Kg		-0.8	
Lithium	15.0	15.5	J	mg/Kg		103	80 - 150
Manganese	15.0	ND		mg/Kg		12	1 - 60
Molybdenum	75.0	52.9		mg/Kg		70	60 - 100
Potassium	7500	9720		mg/Kg		130	80 - 180
Selenium	22.5	23.3		mg/Kg		103	80 - 140

Lab Sample ID: LCSD 140-51761/17-B ^5
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 5
Prep Batch: 51837

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	300	ND		mg/Kg		2		62	
Antimony	75.0	68.0		mg/Kg		91	80 - 120	2	30
Arsenic	15.0	10.1		mg/Kg		68	60 - 100	2	30
Calcium	7500	1850	J	mg/Kg		25	20 - 50	2	30
Cobalt	15.0	ND		mg/Kg		4	1 - 60	8	30
Iron	150	ND		mg/Kg		0.5		1094	
Lithium	15.0	15.3	J	mg/Kg		102	80 - 150	2	30
Manganese	15.0	2.38	J	mg/Kg		16	1 - 60	30	30
Molybdenum	75.0	52.5		mg/Kg		70	60 - 100	1	30
Potassium	7500	9510		mg/Kg		127	80 - 180	2	30
Selenium	22.5	23.0		mg/Kg		102	80 - 140	1	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: S-BH-01M
Prep Type: Step 5
Prep Batch: 51837

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Aluminum	99	J	72.8	J	mg/Kg	☼	30	
Antimony	ND		ND		mg/Kg	☼	NC	30
Arsenic	ND		ND		mg/Kg	☼	NC	30
Calcium	290	J B	368	J	mg/Kg	☼	23	30
Cobalt	ND		ND		mg/Kg	☼	NC	30
Iron	ND		ND		mg/Kg	☼	NC	
Lithium	ND		ND		mg/Kg	☼	NC	30
Manganese	ND		ND		mg/Kg	☼	NC	30
Molybdenum	ND		ND		mg/Kg	☼	NC	30
Potassium	3200	J B	3120	J	mg/Kg	☼	3	30
Selenium	ND		ND		mg/Kg	☼	NC	30

Lab Sample ID: MB 140-51802/15-A
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Method Blank
Prep Type: Step 6
Prep Batch: 51802

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Antimony	ND		3.0	0.28	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Arsenic	ND		0.50	0.15	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Calcium	ND		250	2.1	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Cobalt	ND		2.5	0.046	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Iron	ND		5.0	2.9	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Lithium	ND		2.5	0.15	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Manganese	ND		0.75	0.25	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Molybdenum	ND		2.0	0.099	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Potassium	ND		250	26	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Selenium	ND		0.50	0.17	mg/Kg		07/16/21 12:00	07/22/21 17:00	1
Sodium	ND		250	130	mg/Kg		07/16/21 12:00	07/22/21 17:00	1

Lab Sample ID: LCS 140-51802/16-A
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Lab Control Sample
Prep Type: Step 6
Prep Batch: 51802

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	96.6		mg/Kg		97	80 - 120
Antimony	25.0	24.7		mg/Kg		99	80 - 120
Arsenic	5.00	4.73		mg/Kg		95	80 - 120
Calcium	2500	2410		mg/Kg		96	80 - 120
Cobalt	5.00	4.94		mg/Kg		99	80 - 120
Iron	50.0	49.4		mg/Kg		99	80 - 120
Lithium	5.00	4.52		mg/Kg		90	80 - 120
Manganese	5.00	4.94		mg/Kg		99	80 - 120
Molybdenum	25.0	25.1		mg/Kg		100	80 - 120
Potassium	2500	2420		mg/Kg		97	80 - 120
Selenium	7.50	7.56		mg/Kg		101	80 - 120
Sodium	2500	2420		mg/Kg		97	80 - 120

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCSD 140-51802/17-A
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 6
Prep Batch: 51802

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	98.0		mg/Kg		98	80 - 120	1	30
Antimony			25.0	25.0		mg/Kg		100	80 - 120	1	30
Arsenic			5.00	4.84		mg/Kg		97	80 - 120	2	30
Calcium			2500	2450		mg/Kg		98	80 - 120	2	30
Cobalt			5.00	5.02		mg/Kg		100	80 - 120	2	30
Iron			50.0	50.3		mg/Kg		101	80 - 120	2	30
Lithium			5.00	4.64		mg/Kg		93	80 - 120	2	30
Manganese			5.00	5.02		mg/Kg		100	80 - 120	2	30
Molybdenum			25.0	25.5		mg/Kg		102	80 - 120	2	30
Potassium			2500	2470		mg/Kg		99	80 - 120	2	30
Selenium			7.50	7.61		mg/Kg		102	80 - 120	1	30
Sodium			2500	2460		mg/Kg		99	80 - 120	2	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: S-BH-01M
Prep Type: Step 6
Prep Batch: 51802

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	870			959		mg/Kg	☼			9	30
Antimony	ND			ND		mg/Kg	☼			NC	30
Arsenic	0.88			1.11		mg/Kg	☼			23	30
Calcium	260	J		197	J	mg/Kg	☼			29	30
Cobalt	0.99	J		1.21	J	mg/Kg	☼			20	30
Iron	2000			2280		mg/Kg	☼			15	30
Lithium	0.99	J		1.20	J	mg/Kg	☼			19	30
Manganese	14			17.1		mg/Kg	☼			21	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Potassium	220	J		229	J	mg/Kg	☼			2	30
Selenium	ND			ND		mg/Kg	☼			NC	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52038

Client Sample ID: S-BH-01M
Prep Type: Step 6
Prep Batch: 51802

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Sodium	20000			18600		mg/Kg	☼			9	30

Lab Sample ID: MB 140-51862/15-A
Matrix: Solid
Analysis Batch: 52062

Client Sample ID: Method Blank
Prep Type: Step 7
Prep Batch: 51862

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Antimony	ND		3.0	0.14	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Arsenic	ND		0.50	0.13	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Calcium	ND		250	2.6	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Cobalt	ND		2.5	0.026	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Iron	ND		5.0	4.1	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Lithium	ND		2.5	0.15	mg/Kg		07/20/21 08:00	07/23/21 12:35	1

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-51862/15-A
Matrix: Solid
Analysis Batch: 52062

Client Sample ID: Method Blank
Prep Type: Step 7
Prep Batch: 51862

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Manganese	ND		0.75	0.11	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Molybdenum	ND		2.0	0.082	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Potassium	ND		250	10	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Selenium	ND		0.50	0.17	mg/Kg		07/20/21 08:00	07/23/21 12:35	1
Sodium	ND		250	43	mg/Kg		07/20/21 08:00	07/23/21 12:35	1

Lab Sample ID: LCS 140-51862/16-A
Matrix: Solid
Analysis Batch: 52062

Client Sample ID: Lab Control Sample
Prep Type: Step 7
Prep Batch: 51862

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Aluminum			100	98.3		mg/Kg		98	80 - 120		
Antimony			25.0	24.5		mg/Kg		98	80 - 125		
Arsenic			5.00	4.94		mg/Kg		99	80 - 120		
Calcium			2500	2480		mg/Kg		99	80 - 120		
Cobalt			5.00	5.02		mg/Kg		100	80 - 125		
Iron			50.0	51.6		mg/Kg		103	80 - 120		
Lithium			5.00	4.90		mg/Kg		98	80 - 120		
Manganese			5.00	5.18		mg/Kg		104	80 - 120		
Molybdenum			25.0	25.7		mg/Kg		103	80 - 125		
Potassium			2500	2500		mg/Kg		100	80 - 120		
Selenium			7.50	7.19		mg/Kg		96	80 - 120		
Sodium			2500	2520		mg/Kg		101	80 - 120		

Lab Sample ID: LCSD 140-51862/17-A
Matrix: Solid
Analysis Batch: 52062

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 7
Prep Batch: 51862

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	97.4		mg/Kg		97	80 - 120	1	30
Antimony			25.0	24.6		mg/Kg		98	80 - 125	0	30
Arsenic			5.00	4.95		mg/Kg		99	80 - 120	0	30
Calcium			2500	2500		mg/Kg		100	80 - 120	1	30
Cobalt			5.00	5.05		mg/Kg		101	80 - 125	1	30
Iron			50.0	51.8		mg/Kg		104	80 - 120	1	30
Lithium			5.00	4.95		mg/Kg		99	80 - 120	1	30
Manganese			5.00	5.21		mg/Kg		104	80 - 120	1	30
Molybdenum			25.0	25.8		mg/Kg		103	80 - 125	0	30
Potassium			2500	2520		mg/Kg		101	80 - 120	1	30
Selenium			7.50	7.17		mg/Kg		96	80 - 120	0	30
Sodium			2500	2540		mg/Kg		101	80 - 120	0	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52062

Client Sample ID: S-BH-01M
Prep Type: Step 7
Prep Batch: 51862

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	30000			31700		mg/Kg	☼			7	30
Calcium	3900			4210		mg/Kg	☼			8	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52062

Client Sample ID: S-BH-01M
Prep Type: Step 7
Prep Batch: 51862

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Antimony	0.33	J		0.309	J	mg/Kg	☼			7	30
Arsenic	1.1			1.37		mg/Kg	☼			26	30
Cobalt	0.57	J		0.570	J	mg/Kg	☼			0.3	30
Iron	2700			2490		mg/Kg	☼			8	30
Lithium	4.0			3.82		mg/Kg	☼			5	30
Manganese	38			35.6		mg/Kg	☼			6	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Selenium	ND			ND		mg/Kg	☼			NC	30
Sodium	10000			7620		mg/Kg	☼			28	30

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Analysis Batch: 52192

Client Sample ID: S-BH-01M
Prep Type: Step 7
Prep Batch: 51862

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Potassium	24000			26100		mg/Kg	☼			10	30

Metals

Prep Batch: 50632

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Total/NA	Solid	3050B	
140-23289-2	S-BH-01M	Total/NA	Solid	3050B	
140-23289-3	S-BH-01D	Total/NA	Solid	3050B	
140-23289-4	S-BH-01 (93-96)	Total/NA	Solid	3050B	
MB 140-50632/14-A	Method Blank	Total/NA	Solid	3050B	
LCS 140-50632/15-A	Lab Control Sample	Total/NA	Solid	3050B	
140-23289-2 MS	S-BH-01M	Total/NA	Solid	3050B	
140-23289-2 MSD	S-BH-01M	Total/NA	Solid	3050B	

Analysis Batch: 50744

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Total/NA	Solid	6010B	50632
140-23289-2	S-BH-01M	Total/NA	Solid	6010B	50632
140-23289-3	S-BH-01D	Total/NA	Solid	6010B	50632
140-23289-4	S-BH-01 (93-96)	Total/NA	Solid	6010B	50632
MB 140-50632/14-A	Method Blank	Total/NA	Solid	6010B	50632
LCS 140-50632/15-A	Lab Control Sample	Total/NA	Solid	6010B	50632
140-23289-2 MS	S-BH-01M	Total/NA	Solid	6010B	50632
140-23289-2 MSD	S-BH-01M	Total/NA	Solid	6010B	50632

Prep Batch: 51614

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Total/NA	Solid	Total	
140-23289-2	S-BH-01M	Total/NA	Solid	Total	
140-23289-3	S-BH-01D	Total/NA	Solid	Total	
140-23289-4	S-BH-01 (93-96)	Total/NA	Solid	Total	
MB 140-51614/18-A	Method Blank	Total/NA	Solid	Total	
LCS 140-51614/19-A	Lab Control Sample	Total/NA	Solid	Total	
LCSD 140-51614/20-A	Lab Control Sample Dup	Total/NA	Solid	Total	
140-23289-2 DU	S-BH-01M	Total/NA	Solid	Total	

SEP Batch: 51615

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 1	Solid	Exchangeable	
140-23289-2	S-BH-01M	Step 1	Solid	Exchangeable	
140-23289-3	S-BH-01D	Step 1	Solid	Exchangeable	
140-23289-4	S-BH-01 (93-96)	Step 1	Solid	Exchangeable	
MB 140-51615/18-B ^4	Method Blank	Step 1	Solid	Exchangeable	
LCS 140-51615/19-B ^5	Lab Control Sample	Step 1	Solid	Exchangeable	
LCSD 140-51615/20-B ^5	Lab Control Sample Dup	Step 1	Solid	Exchangeable	
140-23289-2 DU	S-BH-01M	Step 1	Solid	Exchangeable	

SEP Batch: 51653

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 2	Solid	Carbonate	
140-23289-2	S-BH-01M	Step 2	Solid	Carbonate	
140-23289-3	S-BH-01D	Step 2	Solid	Carbonate	
140-23289-4	S-BH-01 (93-96)	Step 2	Solid	Carbonate	
MB 140-51653/15-B ^3	Method Blank	Step 2	Solid	Carbonate	
LCS 140-51653/16-B ^5	Lab Control Sample	Step 2	Solid	Carbonate	
LCSD 140-51653/17-B ^5	Lab Control Sample Dup	Step 2	Solid	Carbonate	

Metals (Continued)

SEP Batch: 51653 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-2 DU	S-BH-01M	Step 2	Solid	Carbonate	

Prep Batch: 51654

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 1	Solid	3010A	51615
140-23289-2	S-BH-01M	Step 1	Solid	3010A	51615
140-23289-3	S-BH-01D	Step 1	Solid	3010A	51615
140-23289-4	S-BH-01 (93-96)	Step 1	Solid	3010A	51615
MB 140-51615/18-B ^4	Method Blank	Step 1	Solid	3010A	51615
LCS 140-51615/19-B ^5	Lab Control Sample	Step 1	Solid	3010A	51615
LCSD 140-51615/20-B ^5	Lab Control Sample Dup	Step 1	Solid	3010A	51615
140-23289-2 DU	S-BH-01M	Step 1	Solid	3010A	51615

SEP Batch: 51666

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 3	Solid	Non-Crystalline	
140-23289-2	S-BH-01M	Step 3	Solid	Non-Crystalline	
140-23289-3	S-BH-01D	Step 3	Solid	Non-Crystalline	
140-23289-4	S-BH-01 (93-96)	Step 3	Solid	Non-Crystalline	
MB 140-51666/15-B	Method Blank	Step 3	Solid	Non-Crystalline	
LCS 140-51666/16-B	Lab Control Sample	Step 3	Solid	Non-Crystalline	
LCSD 140-51666/17-B	Lab Control Sample Dup	Step 3	Solid	Non-Crystalline	
140-23289-2 DU	S-BH-01M	Step 3	Solid	Non-Crystalline	

Prep Batch: 51667

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 2	Solid	3010A	51653
140-23289-2	S-BH-01M	Step 2	Solid	3010A	51653
140-23289-3	S-BH-01D	Step 2	Solid	3010A	51653
140-23289-4	S-BH-01 (93-96)	Step 2	Solid	3010A	51653
MB 140-51653/15-B ^3	Method Blank	Step 2	Solid	3010A	51653
LCS 140-51653/16-B ^5	Lab Control Sample	Step 2	Solid	3010A	51653
LCSD 140-51653/17-B ^5	Lab Control Sample Dup	Step 2	Solid	3010A	51653
140-23289-2 DU	S-BH-01M	Step 2	Solid	3010A	51653

SEP Batch: 51690

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 4	Solid	Metal Hydroxide	
140-23289-2	S-BH-01M	Step 4	Solid	Metal Hydroxide	
140-23289-3	S-BH-01D	Step 4	Solid	Metal Hydroxide	
140-23289-4	S-BH-01 (93-96)	Step 4	Solid	Metal Hydroxide	
MB 140-51690/15-B	Method Blank	Step 4	Solid	Metal Hydroxide	
LCS 140-51690/16-B	Lab Control Sample	Step 4	Solid	Metal Hydroxide	
LCSD 140-51690/17-B	Lab Control Sample Dup	Step 4	Solid	Metal Hydroxide	
140-23289-2 DU	S-BH-01M	Step 4	Solid	Metal Hydroxide	

Prep Batch: 51707

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 3	Solid	3010A	51666
140-23289-2	S-BH-01M	Step 3	Solid	3010A	51666
140-23289-3	S-BH-01D	Step 3	Solid	3010A	51666

Metals (Continued)

Prep Batch: 51707 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-4	S-BH-01 (93-96)	Step 3	Solid	3010A	51666
MB 140-51666/15-B	Method Blank	Step 3	Solid	3010A	51666
LCS 140-51666/16-B	Lab Control Sample	Step 3	Solid	3010A	51666
LCSD 140-51666/17-B	Lab Control Sample Dup	Step 3	Solid	3010A	51666
140-23289-2 DU	S-BH-01M	Step 3	Solid	3010A	51666

SEP Batch: 51761

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 5	Solid	Organic-Bound	
140-23289-2	S-BH-01M	Step 5	Solid	Organic-Bound	
140-23289-3	S-BH-01D	Step 5	Solid	Organic-Bound	
140-23289-4	S-BH-01 (93-96)	Step 5	Solid	Organic-Bound	
MB 140-51761/15-B ^5	Method Blank	Step 5	Solid	Organic-Bound	
LCS 140-51761/16-B ^5	Lab Control Sample	Step 5	Solid	Organic-Bound	
LCSD 140-51761/17-B ^5	Lab Control Sample Dup	Step 5	Solid	Organic-Bound	
140-23289-2 DU	S-BH-01M	Step 5	Solid	Organic-Bound	

Prep Batch: 51767

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 4	Solid	3010A	51690
140-23289-2	S-BH-01M	Step 4	Solid	3010A	51690
140-23289-3	S-BH-01D	Step 4	Solid	3010A	51690
140-23289-4	S-BH-01 (93-96)	Step 4	Solid	3010A	51690
MB 140-51690/15-B	Method Blank	Step 4	Solid	3010A	51690
LCS 140-51690/16-B	Lab Control Sample	Step 4	Solid	3010A	51690
LCSD 140-51690/17-B	Lab Control Sample Dup	Step 4	Solid	3010A	51690
140-23289-2 DU	S-BH-01M	Step 4	Solid	3010A	51690

SEP Batch: 51802

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 6	Solid	Acid/Sulfide	
140-23289-2	S-BH-01M	Step 6	Solid	Acid/Sulfide	
140-23289-3	S-BH-01D	Step 6	Solid	Acid/Sulfide	
140-23289-4	S-BH-01 (93-96)	Step 6	Solid	Acid/Sulfide	
MB 140-51802/15-A	Method Blank	Step 6	Solid	Acid/Sulfide	
LCS 140-51802/16-A	Lab Control Sample	Step 6	Solid	Acid/Sulfide	
LCSD 140-51802/17-A	Lab Control Sample Dup	Step 6	Solid	Acid/Sulfide	
140-23289-2 DU	S-BH-01M	Step 6	Solid	Acid/Sulfide	

Prep Batch: 51837

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 5	Solid	3010A	51761
140-23289-2	S-BH-01M	Step 5	Solid	3010A	51761
140-23289-3	S-BH-01D	Step 5	Solid	3010A	51761
140-23289-4	S-BH-01 (93-96)	Step 5	Solid	3010A	51761
MB 140-51761/15-B ^5	Method Blank	Step 5	Solid	3010A	51761
LCS 140-51761/16-B ^5	Lab Control Sample	Step 5	Solid	3010A	51761
LCSD 140-51761/17-B ^5	Lab Control Sample Dup	Step 5	Solid	3010A	51761
140-23289-2 DU	S-BH-01M	Step 5	Solid	3010A	51761

Metals

Prep Batch: 51862

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 7	Solid	Residual	
140-23289-2	S-BH-01M	Step 7	Solid	Residual	
140-23289-3	S-BH-01D	Step 7	Solid	Residual	
140-23289-4	S-BH-01 (93-96)	Step 7	Solid	Residual	
MB 140-51862/15-A	Method Blank	Step 7	Solid	Residual	
LCS 140-51862/16-A	Lab Control Sample	Step 7	Solid	Residual	
LCSD 140-51862/17-A	Lab Control Sample Dup	Step 7	Solid	Residual	
140-23289-2 DU	S-BH-01M	Step 7	Solid	Residual	

Analysis Batch: 51972

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 1	Solid	6010B SEP	51654
140-23289-1	S-BH-01S	Step 2	Solid	6010B SEP	51667
140-23289-1	S-BH-01S	Step 3	Solid	6010B SEP	51707
140-23289-2	S-BH-01M	Step 1	Solid	6010B SEP	51654
140-23289-2	S-BH-01M	Step 2	Solid	6010B SEP	51667
140-23289-2	S-BH-01M	Step 3	Solid	6010B SEP	51707
140-23289-3	S-BH-01D	Step 1	Solid	6010B SEP	51654
140-23289-3	S-BH-01D	Step 2	Solid	6010B SEP	51667
140-23289-3	S-BH-01D	Step 3	Solid	6010B SEP	51707
140-23289-4	S-BH-01 (93-96)	Step 1	Solid	6010B SEP	51654
140-23289-4	S-BH-01 (93-96)	Step 2	Solid	6010B SEP	51667
140-23289-4	S-BH-01 (93-96)	Step 3	Solid	6010B SEP	51707
MB 140-51615/18-B ^4	Method Blank	Step 1	Solid	6010B SEP	51654
MB 140-51653/15-B ^3	Method Blank	Step 2	Solid	6010B SEP	51667
MB 140-51666/15-B	Method Blank	Step 3	Solid	6010B SEP	51707
LCS 140-51615/19-B ^5	Lab Control Sample	Step 1	Solid	6010B SEP	51654
LCS 140-51653/16-B ^5	Lab Control Sample	Step 2	Solid	6010B SEP	51667
LCS 140-51666/16-B	Lab Control Sample	Step 3	Solid	6010B SEP	51707
LCSD 140-51615/20-B ^5	Lab Control Sample Dup	Step 1	Solid	6010B SEP	51654
LCSD 140-51653/17-B ^5	Lab Control Sample Dup	Step 2	Solid	6010B SEP	51667
LCSD 140-51666/17-B	Lab Control Sample Dup	Step 3	Solid	6010B SEP	51707
140-23289-2 DU	S-BH-01M	Step 1	Solid	6010B SEP	51654
140-23289-2 DU	S-BH-01M	Step 2	Solid	6010B SEP	51667
140-23289-2 DU	S-BH-01M	Step 3	Solid	6010B SEP	51707

Analysis Batch: 52038

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 4	Solid	6010B SEP	51767
140-23289-1	S-BH-01S	Step 5	Solid	6010B SEP	51837
140-23289-1	S-BH-01S	Step 6	Solid	6010B SEP	51802
140-23289-1	S-BH-01S	Step 6	Solid	6010B SEP	51802
140-23289-2	S-BH-01M	Step 4	Solid	6010B SEP	51767
140-23289-2	S-BH-01M	Step 5	Solid	6010B SEP	51837
140-23289-2	S-BH-01M	Step 6	Solid	6010B SEP	51802
140-23289-2	S-BH-01M	Step 6	Solid	6010B SEP	51802
140-23289-3	S-BH-01D	Step 4	Solid	6010B SEP	51767
140-23289-3	S-BH-01D	Step 5	Solid	6010B SEP	51837
140-23289-3	S-BH-01D	Step 6	Solid	6010B SEP	51802
140-23289-3	S-BH-01D	Step 6	Solid	6010B SEP	51802
140-23289-4	S-BH-01 (93-96)	Step 4	Solid	6010B SEP	51767

Metals (Continued)

Analysis Batch: 52038 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-4	S-BH-01 (93-96)	Step 5	Solid	6010B SEP	51837
140-23289-4	S-BH-01 (93-96)	Step 6	Solid	6010B SEP	51802
140-23289-4	S-BH-01 (93-96)	Step 6	Solid	6010B SEP	51802
MB 140-51690/15-B	Method Blank	Step 4	Solid	6010B SEP	51767
MB 140-51761/15-B ^5	Method Blank	Step 5	Solid	6010B SEP	51837
MB 140-51802/15-A	Method Blank	Step 6	Solid	6010B SEP	51802
LCS 140-51690/16-B	Lab Control Sample	Step 4	Solid	6010B SEP	51767
LCS 140-51761/16-B ^5	Lab Control Sample	Step 5	Solid	6010B SEP	51837
LCS 140-51802/16-A	Lab Control Sample	Step 6	Solid	6010B SEP	51802
LCSD 140-51690/17-B	Lab Control Sample Dup	Step 4	Solid	6010B SEP	51767
LCSD 140-51761/17-B ^5	Lab Control Sample Dup	Step 5	Solid	6010B SEP	51837
LCSD 140-51802/17-A	Lab Control Sample Dup	Step 6	Solid	6010B SEP	51802
140-23289-2 DU	S-BH-01M	Step 4	Solid	6010B SEP	51767
140-23289-2 DU	S-BH-01M	Step 5	Solid	6010B SEP	51837
140-23289-2 DU	S-BH-01M	Step 6	Solid	6010B SEP	51802
140-23289-2 DU	S-BH-01M	Step 6	Solid	6010B SEP	51802

Analysis Batch: 52062

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 7	Solid	6010B SEP	51862
140-23289-1	S-BH-01S	Step 7	Solid	6010B SEP	51862
140-23289-2	S-BH-01M	Step 7	Solid	6010B SEP	51862
140-23289-2	S-BH-01M	Step 7	Solid	6010B SEP	51862
140-23289-3	S-BH-01D	Step 7	Solid	6010B SEP	51862
140-23289-3	S-BH-01D	Step 7	Solid	6010B SEP	51862
140-23289-4	S-BH-01 (93-96)	Step 7	Solid	6010B SEP	51862
140-23289-4	S-BH-01 (93-96)	Step 7	Solid	6010B SEP	51862
MB 140-51862/15-A	Method Blank	Step 7	Solid	6010B SEP	51862
LCS 140-51862/16-A	Lab Control Sample	Step 7	Solid	6010B SEP	51862
LCSD 140-51862/17-A	Lab Control Sample Dup	Step 7	Solid	6010B SEP	51862
140-23289-2 DU	S-BH-01M	Step 7	Solid	6010B SEP	51862
140-23289-2 DU	S-BH-01M	Step 7	Solid	6010B SEP	51862

Analysis Batch: 52192

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Step 7	Solid	6010B SEP	51862
140-23289-1	S-BH-01S	Total/NA	Solid	6010B	51614
140-23289-2	S-BH-01M	Step 7	Solid	6010B SEP	51862
140-23289-2	S-BH-01M	Total/NA	Solid	6010B	51614
140-23289-3	S-BH-01D	Step 7	Solid	6010B SEP	51862
140-23289-3	S-BH-01D	Total/NA	Solid	6010B	51614
140-23289-4	S-BH-01 (93-96)	Step 7	Solid	6010B SEP	51862
140-23289-4	S-BH-01 (93-96)	Step 7	Solid	6010B SEP	51862
140-23289-4	S-BH-01 (93-96)	Total/NA	Solid	6010B	51614
MB 140-51614/18-A	Method Blank	Total/NA	Solid	6010B	51614
LCS 140-51614/19-A	Lab Control Sample	Total/NA	Solid	6010B	51614
LCSD 140-51614/20-A	Lab Control Sample Dup	Total/NA	Solid	6010B	51614
140-23289-2 DU	S-BH-01M	Step 7	Solid	6010B SEP	51862
140-23289-2 DU	S-BH-01M	Total/NA	Solid	6010B	51614

QC Association Summary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Metals

Analysis Batch: 52210

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Total/NA	Solid	6010B	51614
140-23289-1	S-BH-01S	Total/NA	Solid	6010B	51614
140-23289-2	S-BH-01M	Total/NA	Solid	6010B	51614
140-23289-2	S-BH-01M	Total/NA	Solid	6010B	51614
140-23289-3	S-BH-01D	Total/NA	Solid	6010B	51614
140-23289-3	S-BH-01D	Total/NA	Solid	6010B	51614
140-23289-4	S-BH-01 (93-96)	Total/NA	Solid	6010B	51614
140-23289-4	S-BH-01 (93-96)	Total/NA	Solid	6010B	51614
MB 140-51614/18-A	Method Blank	Total/NA	Solid	6010B	51614
LCS 140-51614/19-A	Lab Control Sample	Total/NA	Solid	6010B	51614
LCSD 140-51614/20-A	Lab Control Sample Dup	Total/NA	Solid	6010B	51614
140-23289-2 DU	S-BH-01M	Total/NA	Solid	6010B	51614
140-23289-2 DU	S-BH-01M	Total/NA	Solid	6010B	51614

Analysis Batch: 52215

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Sum of Steps 1-7	Solid	6010B SEP	
140-23289-2	S-BH-01M	Sum of Steps 1-7	Solid	6010B SEP	
140-23289-3	S-BH-01D	Sum of Steps 1-7	Solid	6010B SEP	
140-23289-4	S-BH-01 (93-96)	Sum of Steps 1-7	Solid	6010B SEP	

General Chemistry

Analysis Batch: 50469

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23289-1	S-BH-01S	Total/NA	Solid	Moisture	
140-23289-2	S-BH-01M	Total/NA	Solid	Moisture	
140-23289-3	S-BH-01D	Total/NA	Solid	Moisture	
140-23289-4	S-BH-01 (93-96)	Total/NA	Solid	Moisture	
140-23289-2 DU	S-BH-01M	Total/NA	Solid	Moisture	

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01S
Date Collected: 05/22/21 12:18
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			52215	07/29/21 21:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: S-BH-01S
Date Collected: 05/22/21 12:18
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-1
Matrix: Solid
Percent Solids: 80.5

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.535 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 12:06	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			52192	07/28/21 17:04	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52210	07/29/21 11:13	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			52210	07/29/21 13:01	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	51615	07/12/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	51654	07/13/21 08:00	JTB	TAL KNX
Step 1	Analysis	6010B SEP		4			51972	07/21/21 12:23	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	51653	07/12/21 12:10	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	51667	07/13/21 08:00	JTB	TAL KNX
Step 2	Analysis	6010B SEP		3			51972	07/21/21 14:11	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	51666	07/13/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	51707	07/14/21 08:00	JTB	TAL KNX
Step 3	Analysis	6010B SEP		1			51972	07/21/21 16:13	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	51690	07/14/21 08:00	JTB	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	51767	07/15/21 08:00	JTB	TAL KNX
Step 4	Analysis	6010B SEP		1			52038	07/22/21 13:40	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	51761	07/15/21 08:00	JTB	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	51837	07/17/21 08:14	KNC	TAL KNX
Step 5	Analysis	6010B SEP		5			52038	07/22/21 15:25	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			52038	07/22/21 17:15	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01S
Date Collected: 05/22/21 12:18
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-1
Matrix: Solid
Percent Solids: 80.5

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			52038	07/22/21 18:50	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			52062	07/23/21 12:55	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			52062	07/23/21 14:49	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			52192	07/28/21 14:27	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: S-BH-01M
Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			52215	07/29/21 21:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: S-BH-01M
Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2
Matrix: Solid
Percent Solids: 85.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.541 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 12:11	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			52192	07/28/21 17:08	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52210	07/29/21 11:18	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			52210	07/29/21 13:06	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	51615	07/12/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	51654	07/13/21 08:00	JTB	TAL KNX
Step 1	Analysis	6010B SEP		4			51972	07/21/21 12:28	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: S-BH-01M

Lab Sample ID: 140-23289-2

Date Collected: 05/22/21 13:15

Matrix: Solid

Date Received: 05/28/21 10:00

Percent Solids: 85.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	51653	07/12/21 12:10	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	51667	07/13/21 08:00	JTB	TAL KNX
Step 2	Analysis	6010B SEP		3			51972	07/21/21 14:16	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	51666	07/13/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	51707	07/14/21 08:00	JTB	TAL KNX
Step 3	Analysis	6010B SEP		1			51972	07/21/21 16:17	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	51690	07/14/21 08:00	JTB	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	51767	07/15/21 08:00	JTB	TAL KNX
Step 4	Analysis	6010B SEP		1			52038	07/22/21 13:44	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	51761	07/15/21 08:00	JTB	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	51837	07/17/21 08:14	KNC	TAL KNX
Step 5	Analysis	6010B SEP		5			52038	07/22/21 15:31	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			52038	07/22/21 17:20	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			52038	07/22/21 18:55	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			52062	07/23/21 13:00	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			52062	07/23/21 14:54	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			52192	07/28/21 14:31	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: S-BH-01D

Lab Sample ID: 140-23289-3

Date Collected: 05/22/21 15:05

Matrix: Solid

Date Received: 05/28/21 10:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			52215	07/29/21 21:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01D

Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-3

Matrix: Solid
Percent Solids: 89.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.539 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 12:25	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			52192	07/28/21 17:18	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52210	07/29/21 11:28	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			52210	07/29/21 13:16	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	51615	07/12/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	51654	07/13/21 08:00	JTB	TAL KNX
Step 1	Analysis	6010B SEP		4			51972	07/21/21 12:37	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	51653	07/12/21 12:10	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	51667	07/13/21 08:00	JTB	TAL KNX
Step 2	Analysis	6010B SEP		3			51972	07/21/21 14:26	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	51666	07/13/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	51707	07/14/21 08:00	JTB	TAL KNX
Step 3	Analysis	6010B SEP		1			51972	07/21/21 16:27	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	51690	07/14/21 08:00	JTB	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	51767	07/15/21 08:00	JTB	TAL KNX
Step 4	Analysis	6010B SEP		1			52038	07/22/21 13:54	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	51761	07/15/21 08:00	JTB	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	51837	07/17/21 08:14	KNC	TAL KNX
Step 5	Analysis	6010B SEP		5			52038	07/22/21 15:41	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			52038	07/22/21 17:30	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			52038	07/22/21 19:04	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			52062	07/23/21 13:09	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			52062	07/23/21 15:04	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01D
Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-3
Matrix: Solid
Percent Solids: 89.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			52192	07/28/21 14:41	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: S-BH-01 (93-96)
Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-4
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			52215	07/29/21 21:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: S-BH-01 (93-96)
Date Collected: 05/22/21 15:05
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-4
Matrix: Solid
Percent Solids: 90.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.521 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 12:30	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			52192	07/28/21 17:23	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52210	07/29/21 11:34	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			52210	07/29/21 13:20	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	51615	07/12/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	51654	07/13/21 08:00	JTB	TAL KNX
Step 1	Analysis	6010B SEP		4			51972	07/21/21 12:42	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	51653	07/12/21 12:10	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	51667	07/13/21 08:00	JTB	TAL KNX
Step 2	Analysis	6010B SEP		3			51972	07/21/21 14:31	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	51666	07/13/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	51707	07/14/21 08:00	JTB	TAL KNX
Step 3	Analysis	6010B SEP		1			51972	07/21/21 16:32	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01 (93-96)

Lab Sample ID: 140-23289-4
Date Collected: 05/22/21 15:05
Matrix: Solid
Date Received: 05/28/21 10:00
Percent Solids: 90.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5 g	25 mL	51690	07/14/21 08:00	JTB	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	51767	07/15/21 08:00	JTB	TAL KNX
Step 4	Analysis	6010B SEP		1			52038	07/22/21 13:59	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	51761	07/15/21 08:00	JTB	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	51837	07/17/21 08:14	KNC	TAL KNX
Step 5	Analysis	6010B SEP		5			52038	07/22/21 15:46	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			52038	07/22/21 17:34	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			52038	07/22/21 19:09	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			52062	07/23/21 13:14	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			52062	07/23/21 15:10	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		2			52192	07/28/21 14:46	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			52192	07/28/21 14:51	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank

Lab Sample ID: MB 140-50632/14-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.500 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 10:58	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank

Lab Sample ID: MB 140-51614/18-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52192	07/28/21 16:44	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: Method Blank
Lab Sample ID: MB 140-51614/18-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52210	07/29/21 10:53	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-51615/18-B ^4
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5 g	25 mL	51615	07/12/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	51654	07/13/21 08:00	JTB	TAL KNX
Step 1	Analysis	6010B SEP		4			51972	07/21/21 12:08	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-51653/15-B ^3
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	51653	07/12/21 12:10	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	51667	07/13/21 08:00	JTB	TAL KNX
Step 2	Analysis	6010B SEP		3			51972	07/21/21 13:55	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-51666/15-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	51666	07/13/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	51707	07/14/21 08:00	JTB	TAL KNX
Step 3	Analysis	6010B SEP		1			51972	07/21/21 15:58	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-51690/15-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5 g	25 mL	51690	07/14/21 08:00	JTB	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	51767	07/15/21 08:00	JTB	TAL KNX
Step 4	Analysis	6010B SEP		1			52038	07/22/21 13:25	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: Method Blank
Lab Sample ID: MB 140-51761/15-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5 g	75 mL	51761	07/15/21 08:00	JTB	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	51837	07/17/21 08:14	KNC	TAL KNX
Step 5	Analysis	6010B SEP		5			52038	07/22/21 15:11	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-51802/15-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			52038	07/22/21 17:00	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-51862/15-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			52062	07/23/21 12:35	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50632/15-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.500 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:03	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-51614/19-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52192	07/28/21 16:49	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52210	07/29/21 10:58	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-51615/19-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5 g	25 mL	51615	07/12/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	51654	07/13/21 08:00	JTB	TAL KNX
Step 1	Analysis	6010B SEP		5			51972	07/21/21 12:13	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-51653/16-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	51653	07/12/21 12:10	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	51667	07/13/21 08:00	JTB	TAL KNX
Step 2	Analysis	6010B SEP		5			51972	07/21/21 14:00	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-51666/16-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	51666	07/13/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	51707	07/14/21 08:00	JTB	TAL KNX
Step 3	Analysis	6010B SEP		1			51972	07/21/21 16:03	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-51690/16-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5 g	25 mL	51690	07/14/21 08:00	JTB	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	51767	07/15/21 08:00	JTB	TAL KNX
Step 4	Analysis	6010B SEP		1			52038	07/22/21 13:30	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-51761/16-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5 g	75 mL	51761	07/15/21 08:00	JTB	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	51837	07/17/21 08:14	KNC	TAL KNX
Step 5	Analysis	6010B SEP		5			52038	07/22/21 15:16	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-51802/16-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			52038	07/22/21 17:05	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-51862/16-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			52062	07/23/21 12:40	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-51614/20-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52192	07/28/21 16:54	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52210	07/29/21 11:03	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-51615/20-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5 g	25 mL	51615	07/12/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	51654	07/13/21 08:00	JTB	TAL KNX
Step 1	Analysis	6010B SEP		5			51972	07/21/21 12:18	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-51653/17-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	51653	07/12/21 12:10	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	51667	07/13/21 08:00	JTB	TAL KNX
Step 2	Analysis	6010B SEP		5			51972	07/21/21 14:05	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-51666/17-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	51666	07/13/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	51707	07/14/21 08:00	JTB	TAL KNX
Step 3	Analysis	6010B SEP		1			51972	07/21/21 16:08	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-51690/17-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5 g	25 mL	51690	07/14/21 08:00	JTB	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	51767	07/15/21 08:00	JTB	TAL KNX
Step 4	Analysis	6010B SEP		1			52038	07/22/21 13:35	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-51761/17-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5 g	75 mL	51761	07/15/21 08:00	JTB	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	51837	07/17/21 08:14	KNC	TAL KNX
Step 5	Analysis	6010B SEP		5			52038	07/22/21 15:21	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-51802/17-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			52038	07/22/21 17:10	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-51862/17-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			52062	07/23/21 12:45	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01M
Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2 MS
Matrix: Solid
Percent Solids: 85.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.504 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 12:16	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: S-BH-01M
Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2 MSD
Matrix: Solid
Percent Solids: 85.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.505 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 12:20	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: S-BH-01M
Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2 DU
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: S-BH-01M
Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2 DU
Matrix: Solid
Percent Solids: 85.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			52192	07/28/21 17:13	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			52210	07/29/21 11:23	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	51614	07/12/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			52210	07/29/21 13:11	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	51615	07/12/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	51654	07/13/21 08:00	JTB	TAL KNX
Step 1	Analysis	6010B SEP		4			51972	07/21/21 12:32	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	51653	07/12/21 12:10	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	51667	07/13/21 08:00	JTB	TAL KNX
Step 2	Analysis	6010B SEP		3			51972	07/21/21 14:21	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Client Sample ID: S-BH-01M

Date Collected: 05/22/21 13:15
Date Received: 05/28/21 10:00

Lab Sample ID: 140-23289-2 DU

Matrix: Solid
Percent Solids: 85.7

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	51666	07/13/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	51707	07/14/21 08:00	JTB	TAL KNX
Step 3	Analysis	6010B SEP		1			51972	07/21/21 16:22	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	51690	07/14/21 08:00	JTB	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	51767	07/15/21 08:00	JTB	TAL KNX
Step 4	Analysis	6010B SEP		1			52038	07/22/21 13:49	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	51761	07/15/21 08:00	JTB	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	51837	07/17/21 08:14	KNC	TAL KNX
Step 5	Analysis	6010B SEP		5			52038	07/22/21 15:36	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			52038	07/22/21 17:25	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5.00 g	250 mL	51802	07/16/21 12:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			52038	07/22/21 19:00	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			52062	07/23/21 13:05	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			52062	07/23/21 14:59	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1.00 g	50 mL	51862	07/20/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			52192	07/28/21 14:36	KNC	TAL KNX
	Instrument ID: DUO									

Laboratory References:
TAL KNX = Eurofins TestAmerica, Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

Accreditation/Certification Summary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Laboratory: Eurofins TestAmerica, Knoxville

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
	AFCEE	N/A	
ANAB	Dept. of Defense ELAP	L2311	02-13-22
ANAB	Dept. of Energy	L2311.01	02-13-22
ANAB	ISO/IEC 17025	L2311	02-13-22
Arkansas DEQ	State	88-0688	06-17-21 *
California	State	2423	06-30-22
Colorado	State	TN00009	02-28-22
Connecticut	State	PH-0223	09-30-21
Florida	NELAP	E87177	06-30-22
Georgia (DW)	State	906	12-11-22
Hawaii	State	NA	12-11-21
Kansas	NELAP	E-10349	10-31-21
Kentucky (DW)	State	90101	12-31-21
Louisiana	NELAP	83979	06-30-22
Louisiana (DW)	State	LA019	12-31-21
Maryland	State	277	03-31-22
Michigan	State	9933	12-11-22
Nevada	State	TN00009	08-01-21
New Hampshire	NELAP	299919	01-17-22
New Jersey	NELAP	TN001	06-30-22
New York	NELAP	10781	03-31-22
North Carolina (DW)	State	21705	07-31-21
North Carolina (WW/SW)	State	64	12-31-21
Ohio VAP	State	CL0059	06-02-23
Oklahoma	State	9415	08-31-21
Oregon	NELAP	TNI0189	01-01-22
Pennsylvania	NELAP	68-00576	12-31-21
Tennessee	State	02014	12-11-22
Texas	NELAP	T104704380-18-12	08-31-21
US Fish & Wildlife	US Federal Programs	058448	07-31-21
USDA	US Federal Programs	P330-19-00236	08-20-22
Utah	NELAP	TN00009	07-31-21
Virginia	NELAP	460176	09-14-21
Washington	State	C593	01-19-22
West Virginia (DW)	State	9955C	01-02-22
West Virginia DEP	State	345	04-30-22
Wisconsin	State	998044300	08-31-21

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Method Summary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23289-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL KNX
6010B	SEP Metals (ICP) - Total	SW846	TAL KNX
6010B SEP	SEP Metals (ICP)	SW846	TAL KNX
Moisture	Percent Moisture	EPA	TAL KNX
3010A	Preparation, Total Metals	SW846	TAL KNX
3050B	Preparation, Metals	SW846	TAL KNX
Acid/Sulfide	Sequential Extraction Procedure, Acid/Sulfide Fraction	TAL-KNOX	TAL KNX
Carbonate	Sequential Extraction Procedure, Carbonate Fraction	TAL-KNOX	TAL KNX
Exchangeable	Sequential Extraction Procedure, Exchangeable Fraction	TAL-KNOX	TAL KNX
Metal Hydroxide	Sequential Extraction Procedure, Metal Hydroxide Fraction	TAL-KNOX	TAL KNX
Non-Crystalline	Sequential Extraction Procedure, Non-crystalline Materials	TAL-KNOX	TAL KNX
Organic-Bound	Sequential Extraction Procedure, Organic Bound Fraction	TAL-KNOX	TAL KNX
Residual	Sequential Extraction Procedure, Residual Fraction	TAL-KNOX	TAL KNX
Total	Preparation, Total Material	TAL-KNOX	TAL KNX

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL-KNOX = TestAmerica Laboratories, Knoxville, Facility Standard Operating Procedure.

Laboratory References:

TAL KNX = Eurofins TestAmerica, Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

Eurofins TestAmerica, Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Phone: 865-291-3000 Fax: 865-584-4315

Chain of Custody Record

eurofins | Environment Testing America

Client Information	Sampler: Brendan Talbert	Lab PM: Henry, Ryan	Carrier Tracking No(s):	COC No: 140-9346-2811.3
Client Contact: Jeffrey Ingram	Phone:	E-Mail: williamr.henry@eurofinset.com	State of Origin:	Page: 1 / 1 Page 8 of 8
Company: Golder Associates Inc.	PWSID:			Job #:
Address: 13515 Barrett Parkway Drive Suite 260	Due Date Requested:			
City: Ballwin	TAT Requested (days):			
State, Zip: MO, 63021	Compliance Project: Δ Yes Δ No			
Phone: 314-984-8800(Tel) 636-724-9323(Fax)	PO #: Purchase Order not required			
Email: Jeffrey_Ingram@golder.com	WO #:			
Project Name: Sioux Energy Center	Project #: 14006318			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	6010B_SEP - SEP Metals	6010B - Total Metals	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N		
S-BH-01S	5-22-21	1218	G	S	N	N	/	/		
S-BH-01M	"	1315	"	"	"	"	/	/		
S-BH-01D	"	1505	"	"	"	"	/	/		
S-BH-01 (93-96)	"	1505	"	"	"	"	/	/		

140-23289 Chain of Custody

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
1	Brendan Talbert	5-27-21 1700	Golder		5-28-21 1000	BTA Fox
2	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
3	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

Ver: 11.01.2020

EUROFINS/TESTAMERICA KNOXVILLE SAMPLE RECEIPT/CONDITION UPON RECEIPT ANOMALY CHECKLIST **Log In Number:**

Review Items	Yes	No	NA	If No, what was the problem?
1. Are the shipping containers intact?	✓		✓	☐ Containers, Broken
2. Were ambient air containers received intact?			✓	☐ Checked in lab
3. The coolers/containers custody seal if present, is it intact?	✓			☐ Yes ☐ NA
4. Is the cooler temperature within limits? (> freezing temp. of water to 6 °C, VOST: 10°C) Thermometer ID: S(7) Correction factor: +0.1°C	✓			☐ Cooler Out of Temp, Client Contacted, Proceed/Cancel ☐ Cooler Out of Temp, Same Day Receipt
5. Were all of the sample containers received intact?	✓			☐ Containers, Broken
6. Were samples received in appropriate containers?	✓			☐ Containers, Improper; Client Contacted; Proceed/Cancel
7. Do sample container labels match COC? (IDs, Dates, Times)	✓			☐ COC & Samples Do Not Match ☐ COC Incorrect/Incomplete ☐ COC Not Received
8. Were all of the samples listed on the COC received?	✓			☐ Sample Received, Not on COC ☐ Sample on COC, Not Received
9. Is the date/time of sample collection noted?	✓			☐ COC; No Date/Time; Client Contacted
10. Was the sampler identified on the COC?	✓			☐ Sampler Not Listed on COC
11. Is the client and project name/# identified?	✓			☐ COC Incorrect/Incomplete
12. Are tests/parameters listed for each sample?	✓			☐ COC No tests on COC
13. Is the matrix of the samples noted?	✓			☐ COC Incorrect/Incomplete
14. Was COC relinquished? (Signed/Dated/Timed)	✓			☐ COC Incorrect/Incomplete
15. Were samples received within holding time?	✓			☐ Holding Time - Receipt
16. Were samples received with correct chemical preservative (excluding Encore)?			✓	☐ pH Adjusted, pH Included (See box 16A) ☐ Incorrect Preservative
17. Were VOA samples received without headspace?			✓	☐ Headspace (VOA only)
18. Did you check for residual chlorine, if necessary? (e.g. 1613B, 1668) Chlorine test strip lot number:			✓	☐ Residual Chlorine
19. For 1613B water samples is pH<9?			✓	☐ If no, notify lab to adjust
20. For rad samples was sample activity info. Provided?			✓	☐ Project missing info

Comments/Actions Taken

CUSTODY SEALS INTACT
RECEIVED AT RT 0.4/CTDS'C
GD 5-28-21
COOLER BOX# 787675067039 PO

Labeling Verified by: **Date:**

pH test strip lot number:

	Box 16A: pH Preservation	Box 18A: Residual Chlorine
Preservative:		
Lot Number:		
Exp Date:		
Analyst:		
Date:		
Time:		

Project #: _____ PM Instructions: _____

Sample Receiving Associate: Nancy Johnson Date: 5-28-21

QA026R32.doc, 062719

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ANALYTICAL REPORT

Eurofins TestAmerica, Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Tel: (865)291-3000

Laboratory Job ID: 140-23062-1
Client Project/Site: Sioux Energy Center

For:
Golder Associates Inc.
13515 Barrett Parkway Drive
Suite 260
Ballwin, Missouri 63021

Attn: Jeffrey Ingram

Ryan Henry

Authorized for release by:
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Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Sample Summary 7
Client Sample Results 8
Default Detection Limits 29
QC Sample Results 32
QC Association Summary 45
Lab Chronicle 53
Certification Summary 70
Method Summary 71
Chain of Custody 72

Definitions/Glossary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Qualifiers

Metals

Qualifier	Qualifier Description
*+	LCS and/or LCSD is outside acceptance limits, high biased.
*1	LCS/LCSD RPD exceeds control limits.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
B	Compound was found in the blank and sample.
F1	MS and/or MSD recovery exceeds control limits.
F3	Duplicate RPD exceeds the control limit
F5	Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is < the upper reporting limits for both.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 140-23062-1

Laboratory: Eurofins TestAmerica, Knoxville

Narrative

Job Narrative
140-23062-1

Receipt
The samples were received on 5/13/2021 at 9:30am and arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 0.5º C.

Metals
7 Step Sequential Extraction Procedure

These soil samples were prepared and analyzed using Eurofins TestAmerica Knoxville standard operating procedure KNOX-MT-0008, "7 Step Sequential Extraction Procedure". SW-846 Method 6010B as incorporated in Eurofins TestAmerica Knoxville standard operating procedure KNOX-MT-0007 was used to perform the final instrument analyses.

An aliquot of each sample was sequentially extracted using the steps listed below:

· Step 1 - Exchangeable Fraction: A 5 gram aliquot of sample was extracted with 25 mL of 1M magnesium sulfate (MgSO4), centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 2 - Carbonate Fraction: The sample residue from step 1 was extracted with 25 mL of 1M sodium acetate/acetic acid (NaOAc/HOAc) at pH 5, centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 3 - Non-crystalline Materials Fraction: The sample residue from step 2 was extracted with 25 mL of 0.2M ammonium oxalate (pH 3), centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 4 - Metal Hydroxide Fraction: The sample residue from step 3 was extracted with 25 mL of 1M hydroxylamine hydrochloride solution in 25% v/v acetic acid, centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 5 - Organic-bound Fraction: The sample residue from step 4 was extracted three times with 25 mL of 5% sodium hypochlorite (NaClO) at pH 9.5, centrifuged and filtered. The resulting leachates were combined and 5 mL were digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 6 - Acid/Sulfide Fraction: The sample residue from step 5 was extracted with 25 mL of a 3:1:2 v/v solution of HCl-HNO3-H2O, centrifuged and filtered. 5 mL of the resulting leachate was diluted to 50 mL with reagent water and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 7 - Residual Fraction: A 1.0 g aliquot of the sample residue from step 6 was digested using HF, HNO3, HCl and H3BO3. The digestate was analyzed by ICP using method 6010B. Results are reported in mg/kg on a dry weight basis.

In addition, a 1.0 g aliquot of the original sample was digested using HF, HNO3, HCl and H3BO3. The digestate was analyzed by ICP using method 6010B. Total metal results are reported in mg/kg on a dry weight basis.

Results were calculated using the following equation:

Result, µg/g or mg/Kg, dry weight = (C × V × V1 × D) / (W × S × V2)

Where:
C = Concentration from instrument readout, µg/mL
V = Final volume of digestate, mL
D = Instrument dilution factor
V1 = Total volume of leachate, mL
V2 = Volume of leachate digested, mL
W = Wet weight of sample, g
S = Percent solids/100

A method blank, laboratory control sample and laboratory control sample duplicate were prepared and analyzed with each SEP step in

Job ID: 140-23062-1 (Continued)

Laboratory: Eurofins TestAmerica, Knoxville (Continued)

order to provide information about both the presence of elements of interest in the extraction solutions, and the recovery of elements of interest from the extraction solutions. Results outside of laboratory QC limits do not reflect out of control performance, but rather the effect of the extraction solution upon the analyte.

A laboratory sample duplicate was prepared and analyzed with each batch of samples in order to provide information regarding the reproducibility of the procedure.

SEP Report Notes:

The final report lists the results for each step, the result for the total digestion of the sample, and a sum of the results of steps 1 through 7 by element.

Magnesium was not reported for step 1 because the extraction solution for this step (magnesium sulfate) contains high levels of magnesium. Sodium was not reported for steps 2 and 5 since the extraction solutions for these steps contain high levels of sodium. The sum of steps 1 through 7 is much higher than the total result for sodium and magnesium due to the magnesium and sodium introduced by the extraction solutions.

The digestates for steps 1, 2 and 5 were analyzed at a dilution due to instrument problems caused by the high solids content of the digestates. The reporting limits were adjusted accordingly.

Method 6010B: The sample duplicate (DUP) precision for preparation batch 140-50176 and analytical batch 140-50709 was outside control limits. Sample non-homogeneity is suspected.

Method 6010B: The serial dilution performed for the following sample associated with batch 140-50709 was outside control limits: (140-23062-A-5-A SD ^5)

Method 6010B: Due to sample matrix effect on the internal standard (ISTD), a dilution was required for the following sample: EW-3-FA (10-17) (140-23062-7).

Method 6010B: The following sample was diluted due to the presence of titanium which interferes with Cobalt: EW-3-FA (10-17) (140-23062-7). Elevated reporting limits (RLs) are provided.

Method 6010B: The following samples were diluted due to the presence of silicon which interferes with Arsenic and Selenium: IW-2S (140-23062-1), IW-2D (140-23062-3), EW-3M (140-23062-5) and (140-23062-A-5-B DU). Elevated reporting limits (RLs) are provided.

Method 6010B: The following sample was diluted due to the presence of Iron which interferes with Arsenic and Selenium: EW-3-FA (10-17) (140-23062-7). Elevated reporting limits (RLs) are provided.

Method 6010B: The following samples were diluted to bring the concentration of target analyte, potassium, within the calibration range: IW-2S (140-23062-1), IW-2M (140-23062-2), IW-2D (140-23062-3), EW-3S (140-23062-4), EW-3M (140-23062-5), EW-3D (140-23062-6), EW-3-FA (10-17) (140-23062-7) and (140-23062-A-5-B DU). Elevated reporting limits (RLs) are provided.

Method 6010B: The following sample was diluted to bring the concentration of target analyte, sodium, within the calibration range: IW-2M (140-23062-2). Elevated reporting limits (RLs) are provided.

Method 6010B: The following samples were diluted due to the nature of the sample matrix: IW-2S (140-23062-1), IW-2M (140-23062-2), IW-2D (140-23062-3), EW-3S (140-23062-4), EW-3M (140-23062-5), EW-3D (140-23062-6), EW-3-FA (10-17) (140-23062-7) and (140-23062-A-5-B DU). Elevated reporting limits (RLs) are provided for aluminum and calcium.

Method 6010B SEP: The following samples were diluted to bring the concentration of target analyte, sodium, within the calibration range: IW-2S (140-23062-1), IW-2M (140-23062-2), IW-2D (140-23062-3), EW-3S (140-23062-4), EW-3M (140-23062-5), EW-3D (140-23062-6), EW-3-FA (10-17) (140-23062-7) and (140-23062-A-5-X DU). Elevated reporting limits (RLs) are provided.

Job ID: 140-23062-1 (Continued)

Laboratory: Eurofins TestAmerica, Knoxville (Continued)

Method 6010B SEP: The following sample was diluted due to the presence of titanium which interferes with Cobalt: EW-3-FA (10-17) (140-23062-7). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The method blank for preparation batch 140-50371 and 140-50451 contained Iron above the reporting limit (RL). None of the samples associated with this method blank contained the target compound; therefore, re-extraction and/or re-analysis of samples were not performed. Results for the samples were either non-detect or an estimated value for iron.

Method 6010B SEP: The serial dilution performed for the following sample associated with batch 140-50529 was outside control limits: (140-23062-A-5-W SD ^5)

Method 6010B SEP: The laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) for preparation batch 140-50371 and 140-50451 and analytical batch 140-50529 recovered outside control limits for the following analyte: Lithium. This analyte was biased high in the LCS and LCSD and was not detected in the associated samples; therefore, the data have been reported. Lithium results for the samples were either non-detect or estimated values.

Method 6010B SEP: The sample duplicate (DUP) precision for preparation batch 140-50497 and analytical batch 140-50662 was outside control limits. Sample non-homogeneity is suspected.

Method 6010B SEP: The following samples were diluted due to the presence of silicon which interferes with Arsenic and Selenium: IW-2S (140-23062-1), EW-3S (140-23062-4), EW-3M (140-23062-5) and (140-23062-A-5-Z DU). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following samples were diluted to bring the concentration of target analyte, potassium, within the calibration range: IW-2S (140-23062-1), IW-2M (140-23062-2), IW-2D (140-23062-3), EW-3S (140-23062-4), EW-3M (140-23062-5), EW-3D (140-23062-6), EW-3-FA (10-17) (140-23062-7) and (140-23062-A-5-Z DU). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following sample was diluted to bring the concentration of target analyte, sodium, within the calibration range: IW-2D (140-23062-3). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following samples were diluted due to the nature of the sample matrix: IW-2S (140-23062-1), IW-2M (140-23062-2), IW-2D (140-23062-3), EW-3S (140-23062-4), EW-3M (140-23062-5), EW-3D (140-23062-6), EW-3-FA (10-17) (140-23062-7) and (140-23062-A-5-Z DU). Elevated reporting limits (RLs) are provided for aluminum and calcium.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
140-23062-1	IW-2S	Solid	05/05/21 09:00	05/13/21 09:30	
140-23062-2	IW-2M	Solid	05/05/21 10:25	05/13/21 09:30	
140-23062-3	IW-2D	Solid	05/05/21 15:30	05/13/21 09:30	
140-23062-4	EW-3S	Solid	05/11/21 10:20	05/13/21 09:30	
140-23062-5	EW-3M	Solid	05/11/21 11:10	05/13/21 09:30	
140-23062-6	EW-3D	Solid	05/11/21 12:25	05/13/21 09:30	
140-23062-7	EW-3-FA (10-17)	Solid	05/11/21 12:00	05/13/21 09:30	

Client Sample ID: IW-2S
Date Collected: 05/05/21 09:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-1
Matrix: Solid
Percent Solids: 81.5

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		49	7.9	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Antimony	ND		15	1.4	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Arsenic	ND		2.5	0.64	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Calcium	**550**	**J B**	1200	9.3	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Cobalt	ND		12	0.22	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Iron	ND		25	14	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Lithium	ND		12	0.74	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Molybdenum	ND		9.8	0.40	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Potassium	ND		1200	130	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Selenium	ND		2.5	0.83	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4
Sodium	ND		1200	640	mg/Kg	☼	05/27/21 08:00	06/02/21 12:01	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**6.1**	**J**	37	5.9	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Antimony	ND		11	1.0	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Arsenic	ND		1.8	0.48	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Calcium	**69**	**J**	920	8.1	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Cobalt	ND		9.2	0.23	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Iron	**14**	**J**	18	11	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Lithium	ND		9.2	0.55	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Molybdenum	ND		7.4	0.30	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Potassium	ND		920	96	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3
Selenium	ND		1.8	0.63	mg/Kg	☼	05/28/21 08:00	06/02/21 13:53	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**55**		12	2.6	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Antimony	ND		3.7	0.34	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Arsenic	**0.56**	**J**	0.61	0.16	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Calcium	**8.5**	**J**	310	1.8	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Cobalt	**0.57**	**J**	3.1	0.055	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Iron	**1400**		6.1	3.6	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Lithium	ND		3.1	0.18	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Molybdenum	**0.35**	**J**	2.5	0.10	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Potassium	ND		310	32	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Selenium	ND		0.61	0.21	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1
Sodium	**6900**		310	160	mg/Kg	☼	06/01/21 08:00	06/02/21 15:46	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**690**		12	2.0	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Antimony	ND		3.7	0.55	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Arsenic	**0.60**	**J B**	0.61	0.27	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Calcium	**230**	**J**	310	2.7	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Cobalt	**2.0**	**J**	3.1	0.065	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Iron	**3200**		6.1	3.6	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Lithium	**1.2**	**J**	3.1	0.18	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Molybdenum	ND		2.5	0.10	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Potassium	**36**	**J**	310	32	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1

Client Sample ID: IW-2S
Date Collected: 05/05/21 09:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-1
Matrix: Solid
Percent Solids: 81.5

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.61	0.58	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1
Sodium	**430**		310	160	mg/Kg	☼	06/02/21 08:00	06/05/21 11:26	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**88**	**J**	180	29	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Antimony	ND		55	5.2	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Arsenic	ND		9.2	2.3	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Calcium	**62**	**J**	4600	14	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Cobalt	ND	*1	46	0.74	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Iron	ND		92	54	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Lithium	**11**	**J B *+**	46	2.7	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Molybdenum	ND		37	1.5	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Potassium	**2900**	**J B**	4600	520	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5
Selenium	ND		9.2	3.2	mg/Kg	☼	06/04/21 08:00	06/05/21 13:19	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**1100**		12	2.0	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Antimony	ND		3.7	0.34	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Arsenic	**0.60**	**J**	0.61	0.18	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Calcium	**180**	**J**	310	2.6	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Cobalt	**0.96**	**J**	3.1	0.056	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Iron	**3800**		6.1	3.6	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Lithium	**1.4**	**J B**	3.1	0.18	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Molybdenum	ND		2.5	0.12	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Potassium	**210**	**J**	310	32	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Selenium	**0.28**	**J**	0.61	0.21	mg/Kg	☼	06/04/21 08:00	06/05/21 15:12	1
Sodium	**25000**		1500	800	mg/Kg	☼	06/04/21 08:00	06/05/21 16:32	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**27000**		120	20	mg/Kg	☼	06/07/21 08:00	06/09/21 12:06	10
Antimony	**0.19**	**J**	3.7	0.17	mg/Kg	☼	06/07/21 08:00	06/09/21 13:43	1
Arsenic	**2.1**	**B**	1.2	0.32	mg/Kg	☼	06/07/21 08:00	06/09/21 14:54	2
Calcium	**4600**		3100	32	mg/Kg	☼	06/07/21 08:00	06/09/21 12:06	10
Cobalt	**0.16**	**J**	3.1	0.032	mg/Kg	☼	06/07/21 08:00	06/09/21 13:43	1
Iron	**3100**		6.1	5.0	mg/Kg	☼	06/07/21 08:00	06/09/21 13:43	1
Lithium	**2.7**	**J**	3.1	0.18	mg/Kg	☼	06/07/21 08:00	06/09/21 13:43	1
Molybdenum	ND		2.5	0.10	mg/Kg	☼	06/07/21 08:00	06/09/21 13:43	1
Potassium	**13000**		1500	61	mg/Kg	☼	06/07/21 08:00	06/09/21 14:59	5
Selenium	ND		1.2	0.42	mg/Kg	☼	06/07/21 08:00	06/09/21 14:54	2
Sodium	**11000**		310	53	mg/Kg	☼	06/07/21 08:00	06/09/21 13:43	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**29000**		10	1.6	mg/Kg			06/13/21 13:02	1
Antimony	**0.19**	**J**	3.0	0.14	mg/Kg			06/13/21 13:02	1
Arsenic	**3.9**		0.50	0.13	mg/Kg			06/13/21 13:02	1
Calcium	**5700**		250	0.74	mg/Kg			06/13/21 13:02	1

Client Sample ID: IW-2S

Date Collected: 05/05/21 09:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-1

Matrix: Solid
Percent Solids: 81.5

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	3.7		2.5	0.023	mg/Kg			06/13/21 13:02	1
Iron	12000		5.0	4.1	mg/Kg			06/13/21 13:02	1
Lithium	16		2.5	0.15	mg/Kg			06/13/21 13:02	1
Molybdenum	0.35	J	2.0	0.082	mg/Kg			06/13/21 13:02	1
Potassium	16000		250	26	mg/Kg			06/13/21 13:02	1
Selenium	0.28	J	0.50	0.17	mg/Kg			06/13/21 13:02	1
Sodium	43000		250	130	mg/Kg			06/13/21 13:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	2100		47	5.8	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Antimony	ND		7.0	0.40	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Arsenic	1.5	J	2.3	0.34	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Calcium	1100		580	100	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Cobalt	3.5	J	5.8	0.056	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Iron	8100		23	9.2	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Lithium	2.3	J	5.8	0.35	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Manganese	52		1.7	0.72	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Molybdenum	0.46	J	4.7	0.13	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Potassium	240	J	580	28	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Selenium	0.70	J	1.7	0.51	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1
Sodium	45	J	580	42	mg/Kg	☼	06/10/21 08:00	06/11/21 11:08	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	31000	B	120	20	mg/Kg	☼	05/27/21 08:00	06/10/21 11:54	10
Antimony	0.56	J	3.7	0.17	mg/Kg	☼	05/27/21 08:00	06/10/21 13:34	1
Arsenic	3.3	B	1.2	0.32	mg/Kg	☼	05/27/21 08:00	06/10/21 14:57	2
Calcium	5800		3100	32	mg/Kg	☼	05/27/21 08:00	06/10/21 11:54	10
Cobalt	3.7		3.1	0.032	mg/Kg	☼	05/27/21 08:00	06/10/21 13:34	1
Iron	11000		6.1	5.0	mg/Kg	☼	05/27/21 08:00	06/10/21 13:34	1
Lithium	5.2		3.1	0.18	mg/Kg	☼	05/27/21 08:00	06/10/21 13:34	1
Molybdenum	0.54	J	2.5	0.10	mg/Kg	☼	05/27/21 08:00	06/10/21 13:34	1
Potassium	13000		1500	61	mg/Kg	☼	05/27/21 08:00	06/10/21 15:02	5
Selenium	ND		1.2	0.42	mg/Kg	☼	05/27/21 08:00	06/10/21 14:57	2
Sodium	8600	B	310	53	mg/Kg	☼	05/27/21 08:00	06/10/21 13:34	1

Client Sample ID: IW-2M
Date Collected: 05/05/21 10:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-2
Matrix: Solid
Percent Solids: 77.0

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		52	8.3	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Antimony	ND		16	1.5	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Arsenic	ND		2.6	0.68	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Calcium	**560**	**J B**	1300	9.9	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Cobalt	ND		13	0.23	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Iron	ND		26	15	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Lithium	ND		13	0.78	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Molybdenum	**0.99**	**J**	10	0.43	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Potassium	ND		1300	140	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Selenium	ND		2.6	0.88	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4
Sodium	ND		1300	680	mg/Kg	☼	05/27/21 08:00	06/02/21 12:06	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**10**	**J**	39	6.2	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Antimony	ND		12	1.1	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Arsenic	ND		1.9	0.51	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Calcium	**1300**		970	8.6	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Cobalt	ND		9.7	0.25	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Iron	**170**		19	11	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Lithium	ND		9.7	0.58	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Molybdenum	ND		7.8	0.32	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Potassium	ND		970	100	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3
Selenium	ND		1.9	0.66	mg/Kg	☼	05/28/21 08:00	06/02/21 13:58	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**49**		13	2.7	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Antimony	ND		3.9	0.36	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Arsenic	**0.29**	**J**	0.65	0.17	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Calcium	**5.1**	**J**	320	1.9	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Cobalt	**0.44**	**J**	3.2	0.058	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Iron	**680**		6.5	3.8	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Lithium	ND		3.2	0.19	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Molybdenum	**0.32**	**J**	2.6	0.11	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Potassium	ND		320	34	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Selenium	ND		0.65	0.22	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1
Sodium	**6700**		320	170	mg/Kg	☼	06/01/21 08:00	06/02/21 15:50	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**470**		13	2.1	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Antimony	ND		3.9	0.58	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Arsenic	**0.79**	**B**	0.65	0.29	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Calcium	**1400**		320	2.9	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Cobalt	**1.2**	**J**	3.2	0.069	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Iron	**1500**		6.5	3.8	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Lithium	**1.0**	**J**	3.2	0.19	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Molybdenum	**0.22**	**J**	2.6	0.11	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Potassium	**38**	**J**	320	34	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1

Client Sample ID: IW-2M
Date Collected: 05/05/21 10:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-2
Matrix: Solid
Percent Solids: 77.0

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.65	0.61	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1
Sodium	**490**		320	170	mg/Kg	☼	06/02/21 08:00	06/05/21 11:31	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**31**	**J**	190	31	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Antimony	ND		58	5.5	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Arsenic	ND		9.7	2.5	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Calcium	**520**	**J**	4900	14	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Cobalt	ND	*1	49	0.78	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Iron	ND		97	57	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Lithium	**9.9**	**J B *+**	49	2.9	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Molybdenum	ND		39	1.6	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Potassium	**3000**	**J B**	4900	550	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5
Selenium	ND		9.7	3.4	mg/Kg	☼	06/04/21 08:00	06/05/21 13:24	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**690**		13	2.1	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Antimony	ND		3.9	0.36	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Arsenic	**1.4**		0.65	0.19	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Calcium	**680**		320	2.7	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Cobalt	**1.0**	**J**	3.2	0.060	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Iron	**2000**		6.5	3.8	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Lithium	**1.3**	**J B**	3.2	0.19	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Molybdenum	ND		2.6	0.13	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Potassium	**180**	**J**	320	34	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Selenium	ND		0.65	0.22	mg/Kg	☼	06/04/21 08:00	06/05/21 15:17	1
Sodium	**21000**		1600	840	mg/Kg	☼	06/04/21 08:00	06/05/21 16:36	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**19000**		130	21	mg/Kg	☼	06/07/21 08:00	06/09/21 12:11	10
Antimony	ND		3.9	0.18	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1
Arsenic	**1.6**	**B**	0.65	0.17	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1
Calcium	**2900**		320	3.4	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1
Cobalt	**0.35**	**J**	3.2	0.034	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1
Iron	**3000**		6.5	5.3	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1
Lithium	**2.9**	**J**	3.2	0.19	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1
Molybdenum	**0.12**	**J**	2.6	0.11	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1
Potassium	**15000**		1600	65	mg/Kg	☼	06/07/21 08:00	06/09/21 15:04	5
Selenium	ND		0.65	0.22	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1
Sodium	**12000**		320	56	mg/Kg	☼	06/07/21 08:00	06/09/21 13:48	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**21000**		10	1.6	mg/Kg			06/13/21 13:02	1
Antimony	ND		3.0	0.14	mg/Kg			06/13/21 13:02	1
Arsenic	**4.1**		0.50	0.13	mg/Kg			06/13/21 13:02	1
Calcium	**7300**		250	0.74	mg/Kg			06/13/21 13:02	1

Client Sample ID: IW-2M
Date Collected: 05/05/21 10:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-2
Matrix: Solid
Percent Solids: 77.0

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	3.0		2.5	0.023	mg/Kg			06/13/21 13:02	1
Iron	7400		5.0	4.1	mg/Kg			06/13/21 13:02	1
Lithium	15		2.5	0.15	mg/Kg			06/13/21 13:02	1
Molybdenum	1.7	J	2.0	0.082	mg/Kg			06/13/21 13:02	1
Potassium	18000		250	26	mg/Kg			06/13/21 13:02	1
Selenium	ND		0.50	0.17	mg/Kg			06/13/21 13:02	1
Sodium	40000		250	130	mg/Kg			06/13/21 13:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	1800		48	6.0	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Antimony	ND		7.2	0.41	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Arsenic	5.1		2.4	0.35	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Calcium	3900		600	110	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Cobalt	4.8	J	6.0	0.057	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Iron	5300		24	9.5	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Lithium	2.7	J	6.0	0.36	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Manganese	98		1.8	0.74	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Molybdenum	2.1	J	4.8	0.13	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Potassium	280	J	600	29	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Selenium	ND		1.8	0.53	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1
Sodium	47	J	600	43	mg/Kg	☼	06/10/21 08:00	06/11/21 11:13	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	37000	B	130	21	mg/Kg	☼	05/27/21 08:00	06/10/21 11:59	10
Antimony	0.64	J	3.9	0.18	mg/Kg	☼	05/27/21 08:00	06/10/21 13:39	1
Arsenic	5.3	B	0.65	0.17	mg/Kg	☼	05/27/21 08:00	06/10/21 13:39	1
Calcium	11000		3200	34	mg/Kg	☼	05/27/21 08:00	06/10/21 11:59	10
Cobalt	3.8		3.2	0.034	mg/Kg	☼	05/27/21 08:00	06/10/21 13:39	1
Iron	7900		6.5	5.3	mg/Kg	☼	05/27/21 08:00	06/10/21 13:39	1
Lithium	6.8		3.2	0.19	mg/Kg	☼	05/27/21 08:00	06/10/21 13:39	1
Molybdenum	2.0	J	2.6	0.11	mg/Kg	☼	05/27/21 08:00	06/10/21 13:39	1
Potassium	16000		1600	65	mg/Kg	☼	05/27/21 08:00	06/10/21 15:06	5
Selenium	0.27	J	0.65	0.22	mg/Kg	☼	05/27/21 08:00	06/10/21 13:39	1
Sodium	15000	B	1600	280	mg/Kg	☼	05/27/21 08:00	06/10/21 15:06	5

Client Sample ID: IW-2D
Date Collected: 05/05/21 15:30
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-3
Matrix: Solid
Percent Solids: 95.5

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		42	6.7	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Antimony	ND		13	1.2	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Arsenic	ND		2.1	0.54	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Calcium	**290**	**J B**	1000	8.0	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Cobalt	ND		10	0.19	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Iron	ND		21	12	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Lithium	ND		10	0.63	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Molybdenum	ND		8.4	0.34	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Potassium	ND		1000	110	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Selenium	ND		2.1	0.71	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4
Sodium	ND		1000	540	mg/Kg	☼	05/27/21 08:00	06/02/21 12:10	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**7.4**	**J**	31	5.0	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Antimony	ND		9.4	0.88	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Arsenic	ND		1.6	0.41	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Calcium	**4600**		790	6.9	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Cobalt	ND		7.9	0.20	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Iron	**300**		16	9.1	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Lithium	ND		7.9	0.47	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Molybdenum	ND		6.3	0.26	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Potassium	ND		790	82	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3
Selenium	ND		1.6	0.53	mg/Kg	☼	05/28/21 08:00	06/02/21 14:03	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**25**		10	2.2	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Antimony	ND		3.1	0.29	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Arsenic	ND		0.52	0.14	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Calcium	**4.9**	**J**	260	1.6	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Cobalt	**0.20**	**J**	2.6	0.047	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Iron	**890**		5.2	3.0	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Lithium	ND		2.6	0.16	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Molybdenum	**0.16**	**J**	2.1	0.086	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Potassium	ND		260	27	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Selenium	ND		0.52	0.18	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1
Sodium	**6500**		260	140	mg/Kg	☼	06/01/21 08:00	06/02/21 15:55	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**270**		10	1.7	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Antimony	ND		3.1	0.47	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Arsenic	**0.51**	**J B**	0.52	0.23	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Calcium	**8300**		260	2.3	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Cobalt	**2.4**	**J**	2.6	0.056	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Iron	**1600**		5.2	3.0	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Lithium	**0.84**	**J**	2.6	0.16	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Molybdenum	ND		2.1	0.086	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Potassium	ND		260	27	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: IW-2D
Date Collected: 05/05/21 15:30
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-3
Matrix: Solid
Percent Solids: 95.5

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.52	0.49	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1
Sodium	**500**		260	140	mg/Kg	☼	06/02/21 08:00	06/05/21 11:46	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**38**	**J**	160	25	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Antimony	ND		47	4.4	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Arsenic	ND		7.9	2.0	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Calcium	**3600**	**J**	3900	12	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Cobalt	ND	*1	39	0.63	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Iron	ND		79	46	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Lithium	**9.3**	**J B *+**	39	2.3	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Molybdenum	ND		31	1.3	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Potassium	**2400**	**J B**	3900	450	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5
Selenium	ND		7.9	2.7	mg/Kg	☼	06/04/21 08:00	06/05/21 13:29	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**1500**		10	1.7	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Antimony	ND		3.1	0.29	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Arsenic	**2.0**		0.52	0.16	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Calcium	**2700**		260	2.2	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Cobalt	**2.5**	**J**	2.6	0.048	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Iron	**5000**		5.2	3.0	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Lithium	**3.4**	**B**	2.6	0.16	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Molybdenum	**0.13**	**J**	2.1	0.10	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Potassium	**170**	**J**	260	27	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Selenium	**0.34**	**J**	0.52	0.18	mg/Kg	☼	06/04/21 08:00	06/05/21 15:22	1
Sodium	**18000**		1300	680	mg/Kg	☼	06/04/21 08:00	06/05/21 16:41	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**29000**		100	17	mg/Kg	☼	06/07/21 08:00	06/09/21 12:15	10
Antimony	ND		3.1	0.15	mg/Kg	☼	06/07/21 08:00	06/09/21 13:53	1
Arsenic	**1.9**	**B**	0.52	0.14	mg/Kg	☼	06/07/21 08:00	06/09/21 13:53	1
Calcium	**4800**		2600	27	mg/Kg	☼	06/07/21 08:00	06/09/21 12:15	10
Cobalt	**1.1**	**J**	2.6	0.027	mg/Kg	☼	06/07/21 08:00	06/09/21 13:53	1
Iron	**3600**		5.2	4.3	mg/Kg	☼	06/07/21 08:00	06/09/21 13:53	1
Lithium	**3.2**		2.6	0.16	mg/Kg	☼	06/07/21 08:00	06/09/21 13:53	1
Molybdenum	ND		2.1	0.086	mg/Kg	☼	06/07/21 08:00	06/09/21 13:53	1
Potassium	**14000**		1300	52	mg/Kg	☼	06/07/21 08:00	06/09/21 15:08	5
Selenium	ND		0.52	0.18	mg/Kg	☼	06/07/21 08:00	06/09/21 13:53	1
Sodium	**13000**		1300	230	mg/Kg	☼	06/07/21 08:00	06/09/21 15:08	5

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**30000**		10	1.6	mg/Kg			06/13/21 13:02	1
Antimony	ND		3.0	0.14	mg/Kg			06/13/21 13:02	1
Arsenic	**4.4**		0.50	0.13	mg/Kg			06/13/21 13:02	1
Calcium	**24000**		250	0.74	mg/Kg			06/13/21 13:02	1

Client Sample ID: IW-2D

Date Collected: 05/05/21 15:30
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-3

Matrix: Solid
Percent Solids: 95.5

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	6.2		2.5	0.023	mg/Kg			06/13/21 13:02	1
Iron	11000		5.0	4.1	mg/Kg			06/13/21 13:02	1
Lithium	17		2.5	0.15	mg/Kg			06/13/21 13:02	1
Molybdenum	0.30	J	2.0	0.082	mg/Kg			06/13/21 13:02	1
Potassium	16000		250	26	mg/Kg			06/13/21 13:02	1
Selenium	0.34	J	0.50	0.17	mg/Kg			06/13/21 13:02	1
Sodium	38000		250	130	mg/Kg			06/13/21 13:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	1200		39	4.8	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Antimony	ND		5.8	0.33	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Arsenic	2.9		1.9	0.28	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Calcium	29000		480	85	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Cobalt	3.9	J	4.8	0.046	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Iron	5500		19	7.6	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Lithium	1.9	J	4.8	0.29	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Manganese	380		1.5	0.60	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Molybdenum	0.47	J	3.9	0.11	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Potassium	130	J	480	23	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Selenium	ND		1.5	0.43	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1
Sodium	44	J	480	35	mg/Kg	☼	06/10/21 08:00	06/11/21 11:17	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	14000	B	100	17	mg/Kg	☼	05/27/21 08:00	06/10/21 12:04	10
Antimony	0.87	J	3.1	0.15	mg/Kg	☼	05/27/21 08:00	06/10/21 13:44	1
Arsenic	7.0	B	1.0	0.27	mg/Kg	☼	05/27/21 08:00	06/10/21 15:11	2
Calcium	70000		2600	27	mg/Kg	☼	05/27/21 08:00	06/10/21 12:04	10
Cobalt	5.2		2.6	0.027	mg/Kg	☼	05/27/21 08:00	06/10/21 13:44	1
Iron	11000		5.2	4.3	mg/Kg	☼	05/27/21 08:00	06/10/21 13:44	1
Lithium	6.5		2.6	0.16	mg/Kg	☼	05/27/21 08:00	06/10/21 13:44	1
Molybdenum	0.37	J	2.1	0.086	mg/Kg	☼	05/27/21 08:00	06/10/21 13:44	1
Potassium	10000		520	21	mg/Kg	☼	05/27/21 08:00	06/10/21 15:11	2
Selenium	ND		1.0	0.36	mg/Kg	☼	05/27/21 08:00	06/10/21 15:11	2
Sodium	7200	B	260	45	mg/Kg	☼	05/27/21 08:00	06/10/21 13:44	1

Client Sample ID: EW-3S
Date Collected: 05/11/21 10:20
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-4
Matrix: Solid
Percent Solids: 80.8

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		50	7.9	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Antimony	ND		15	1.4	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Arsenic	ND		2.5	0.64	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Calcium	**470**	**J B**	1200	9.4	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Cobalt	ND		12	0.22	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Iron	ND		25	14	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Lithium	ND		12	0.74	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Molybdenum	**0.92**	**J**	9.9	0.41	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Potassium	ND		1200	130	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Selenium	ND		2.5	0.84	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4
Sodium	ND		1200	640	mg/Kg	☼	05/27/21 08:00	06/02/21 12:25	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		37	5.9	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Antimony	ND		11	1.0	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Arsenic	ND		1.9	0.48	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Calcium	**1200**		930	8.2	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Cobalt	**0.55**	**J**	9.3	0.23	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Iron	**100**		19	11	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Lithium	ND		9.3	0.56	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Molybdenum	ND		7.4	0.30	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Potassium	ND		930	97	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3
Selenium	ND		1.9	0.63	mg/Kg	☼	05/28/21 08:00	06/02/21 14:18	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**42**		12	2.6	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Antimony	ND		3.7	0.35	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Arsenic	**0.87**		0.62	0.16	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Calcium	**4.7**	**J**	310	1.9	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Cobalt	**1.4**	**J**	3.1	0.056	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Iron	**450**		6.2	3.6	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Lithium	ND		3.1	0.19	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Molybdenum	**0.32**	**J**	2.5	0.10	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Potassium	ND		310	32	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Selenium	ND		0.62	0.21	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1
Sodium	**6100**		310	160	mg/Kg	☼	06/01/21 08:00	06/02/21 16:10	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**520**		12	2.0	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Antimony	ND		3.7	0.56	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Arsenic	**1.0**	**B**	0.62	0.27	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Calcium	**1200**		310	2.7	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Cobalt	**1.9**	**J**	3.1	0.066	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Iron	**1600**		6.2	3.6	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Lithium	**1.2**	**J**	3.1	0.19	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Molybdenum	**0.23**	**J**	2.5	0.10	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Potassium	**54**	**J**	310	32	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1

Client Sample ID: EW-3S
Date Collected: 05/11/21 10:20
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-4
Matrix: Solid
Percent Solids: 80.8

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.62	0.58	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1
Sodium	**380**		310	160	mg/Kg	☼	06/02/21 08:00	06/05/21 11:51	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**40**	**J**	190	29	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Antimony	ND		56	5.2	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Arsenic	ND		9.3	2.4	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Calcium	**290**	**J**	4600	14	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Cobalt	ND	*1	46	0.74	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Iron	ND		93	54	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Lithium	**11**	**J B *+**	46	2.7	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Molybdenum	ND		37	1.5	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Potassium	**2800**	**J B**	4600	530	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5
Selenium	ND		9.3	3.2	mg/Kg	☼	06/04/21 08:00	06/05/21 13:44	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**780**		12	2.0	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Antimony	ND		3.7	0.35	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Arsenic	**1.1**		0.62	0.19	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Calcium	**300**	**J**	310	2.6	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Cobalt	**1.1**	**J**	3.1	0.057	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Iron	**1900**		6.2	3.6	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Lithium	**1.3**	**J B**	3.1	0.19	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Molybdenum	ND		2.5	0.12	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Potassium	**210**	**J**	310	32	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Selenium	ND		0.62	0.21	mg/Kg	☼	06/04/21 08:00	06/05/21 15:38	1
Sodium	**19000**		1500	800	mg/Kg	☼	06/04/21 08:00	06/05/21 16:46	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**30000**		120	20	mg/Kg	☼	06/07/21 08:00	06/09/21 12:20	10
Antimony	**0.18**	**J**	3.7	0.17	mg/Kg	☼	06/07/21 08:00	06/09/21 13:58	1
Arsenic	**1.8**	**B**	1.2	0.32	mg/Kg	☼	06/07/21 08:00	06/09/21 15:13	2
Calcium	**4700**		3100	32	mg/Kg	☼	06/07/21 08:00	06/09/21 12:20	10
Cobalt	**0.85**	**J**	3.1	0.032	mg/Kg	☼	06/07/21 08:00	06/09/21 13:58	1
Iron	**3500**		6.2	5.1	mg/Kg	☼	06/07/21 08:00	06/09/21 13:58	1
Lithium	**2.6**	**J**	3.1	0.19	mg/Kg	☼	06/07/21 08:00	06/09/21 13:58	1
Molybdenum	**0.17**	**J**	2.5	0.10	mg/Kg	☼	06/07/21 08:00	06/09/21 13:58	1
Potassium	**19000**		1500	62	mg/Kg	☼	06/07/21 08:00	06/09/21 15:18	5
Selenium	ND		1.2	0.42	mg/Kg	☼	06/07/21 08:00	06/09/21 15:13	2
Sodium	**10000**		310	53	mg/Kg	☼	06/07/21 08:00	06/09/21 13:58	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**32000**		10	1.6	mg/Kg			06/13/21 13:02	1
Antimony	**0.18**	**J**	3.0	0.14	mg/Kg			06/13/21 13:02	1
Arsenic	**4.8**		0.50	0.13	mg/Kg			06/13/21 13:02	1
Calcium	**8100**		250	0.74	mg/Kg			06/13/21 13:02	1

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: EW-3S
Date Collected: 05/11/21 10:20
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-4
Matrix: Solid
Percent Solids: 80.8

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	5.8		2.5	0.023	mg/Kg			06/13/21 13:02	1
Iron	7500		5.0	4.1	mg/Kg			06/13/21 13:02	1
Lithium	16		2.5	0.15	mg/Kg			06/13/21 13:02	1
Molybdenum	1.6	J	2.0	0.082	mg/Kg			06/13/21 13:02	1
Potassium	22000		250	26	mg/Kg			06/13/21 13:02	1
Selenium	ND		0.50	0.17	mg/Kg			06/13/21 13:02	1
Sodium	36000		250	130	mg/Kg			06/13/21 13:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	1400		49	6.1	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Antimony	ND		7.3	0.41	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Arsenic	4.4		2.4	0.35	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Calcium	4200		610	110	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Cobalt	5.5	J	6.1	0.058	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Iron	3700		24	9.6	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Lithium	1.9	J	6.1	0.37	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Manganese	53		1.8	0.76	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Molybdenum	1.3	J	4.9	0.13	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Potassium	370	J	610	29	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Selenium	ND		1.8	0.54	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1
Sodium	54	J	610	44	mg/Kg	☼	06/10/21 08:00	06/11/21 11:22	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	29000	B	120	20	mg/Kg	☼	05/27/21 08:00	06/10/21 12:09	10
Antimony	0.59	J	3.7	0.17	mg/Kg	☼	05/27/21 08:00	06/10/21 13:50	1
Arsenic	4.3	B	0.62	0.16	mg/Kg	☼	05/27/21 08:00	06/10/21 13:50	1
Calcium	7200		3100	32	mg/Kg	☼	05/27/21 08:00	06/10/21 12:09	10
Cobalt	4.6		3.1	0.032	mg/Kg	☼	05/27/21 08:00	06/10/21 13:50	1
Iron	5700		6.2	5.1	mg/Kg	☼	05/27/21 08:00	06/10/21 13:50	1
Lithium	5.6		3.1	0.19	mg/Kg	☼	05/27/21 08:00	06/10/21 13:50	1
Molybdenum	1.5	J	2.5	0.10	mg/Kg	☼	05/27/21 08:00	06/10/21 13:50	1
Potassium	17000		1500	62	mg/Kg	☼	05/27/21 08:00	06/10/21 15:21	5
Selenium	0.39	J	0.62	0.21	mg/Kg	☼	05/27/21 08:00	06/10/21 13:50	1
Sodium	10000	B	310	53	mg/Kg	☼	05/27/21 08:00	06/10/21 13:50	1

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: EW-3M
Date Collected: 05/11/21 11:10
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-5
Matrix: Solid
Percent Solids: 83.1

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		48	7.7	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Antimony	ND		14	1.3	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Arsenic	ND		2.4	0.63	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Calcium	**350**	**J B**	1200	9.1	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Cobalt	ND		12	0.22	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Iron	ND		24	14	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Lithium	ND		12	0.72	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Molybdenum	**0.86**	**J**	9.6	0.39	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Potassium	ND		1200	130	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Selenium	ND		2.4	0.82	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4
Sodium	ND		1200	630	mg/Kg	☼	05/27/21 08:00	06/02/21 12:30	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**11**	**J**	36	5.8	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Antimony	ND		11	1.0	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Arsenic	ND		1.8	0.47	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Calcium	**670**	**J**	900	7.9	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Cobalt	ND		9.0	0.23	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Iron	**99**		18	10	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Lithium	ND		9.0	0.54	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Molybdenum	ND		7.2	0.30	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Potassium	ND		900	94	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3
Selenium	ND		1.8	0.61	mg/Kg	☼	05/28/21 08:00	06/02/21 14:23	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**30**		12	2.5	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Antimony	ND		3.6	0.34	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Arsenic	**0.31**	**J**	0.60	0.16	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Calcium	**4.6**	**J**	300	1.8	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Cobalt	**0.28**	**J**	3.0	0.054	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Iron	**170**		6.0	3.5	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Lithium	ND		3.0	0.18	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Molybdenum	**0.21**	**J**	2.4	0.099	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Potassium	ND		300	31	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Selenium	ND		0.60	0.20	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1
Sodium	**6900**		300	160	mg/Kg	☼	06/01/21 08:00	06/02/21 16:14	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**330**		12	1.9	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Antimony	ND		3.6	0.54	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Arsenic	**0.91**	**B**	0.60	0.26	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Calcium	**730**		300	2.6	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Cobalt	**0.71**	**J**	3.0	0.064	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Iron	**1000**		6.0	3.5	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Lithium	**0.70**	**J**	3.0	0.18	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Molybdenum	**0.18**	**J**	2.4	0.099	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Potassium	**38**	**J**	300	31	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1

Client Sample ID: EW-3M
Date Collected: 05/11/21 11:10
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-5
Matrix: Solid
Percent Solids: 83.1

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.60	0.57	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1
Sodium	**470**		300	160	mg/Kg	☼	06/02/21 08:00	06/05/21 11:55	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**73**	**J**	180	28	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Antimony	ND		54	5.1	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Arsenic	ND		9.0	2.3	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Calcium	**110**	**J**	4500	13	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Cobalt	ND	*1	45	0.72	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Iron	**84**	**J B**	90	53	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Lithium	**9.3**	**J B *+**	45	2.6	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Molybdenum	ND		36	1.5	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Potassium	**2800**	**J B**	4500	510	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5
Selenium	ND		9.0	3.1	mg/Kg	☼	06/04/21 08:00	06/05/21 13:49	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**300**		12	1.9	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Antimony	ND		3.6	0.34	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Arsenic	**0.72**		0.60	0.18	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Calcium	**100**	**J**	300	2.5	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Cobalt	**0.34**	**J**	3.0	0.055	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Iron	**800**		6.0	3.5	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Lithium	**0.74**	**J B**	3.0	0.18	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Molybdenum	ND		2.4	0.12	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Potassium	**150**	**J**	300	31	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Selenium	ND		0.60	0.20	mg/Kg	☼	06/04/21 08:00	06/05/21 15:42	1
Sodium	**22000**		1500	780	mg/Kg	☼	06/04/21 08:00	06/05/21 16:51	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**24000**		120	19	mg/Kg	☼	06/07/21 08:00	06/09/21 12:25	10
Antimony	ND		3.6	0.17	mg/Kg	☼	06/07/21 08:00	06/09/21 14:03	1
Arsenic	**1.7**	**B**	1.2	0.31	mg/Kg	☼	06/07/21 08:00	06/09/21 15:33	2
Calcium	**3100**		3000	31	mg/Kg	☼	06/07/21 08:00	06/09/21 12:25	10
Cobalt	ND		3.0	0.031	mg/Kg	☼	06/07/21 08:00	06/09/21 14:03	1
Iron	**1000**		6.0	4.9	mg/Kg	☼	06/07/21 08:00	06/09/21 14:03	1
Lithium	**2.2**	**J**	3.0	0.18	mg/Kg	☼	06/07/21 08:00	06/09/21 14:03	1
Molybdenum	ND		2.4	0.099	mg/Kg	☼	06/07/21 08:00	06/09/21 14:03	1
Potassium	**16000**		1500	60	mg/Kg	☼	06/07/21 08:00	06/09/21 15:38	5
Selenium	ND		1.2	0.41	mg/Kg	☼	06/07/21 08:00	06/09/21 15:33	2
Sodium	**9700**		300	52	mg/Kg	☼	06/07/21 08:00	06/09/21 14:03	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**24000**		10	1.6	mg/Kg			06/13/21 13:02	1
Antimony	ND		3.0	0.14	mg/Kg			06/13/21 13:02	1
Arsenic	**3.7**		0.50	0.13	mg/Kg			06/13/21 13:02	1
Calcium	**5100**		250	0.74	mg/Kg			06/13/21 13:02	1

Client Sample ID: EW-3M

Date Collected: 05/11/21 11:10
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-5

Matrix: Solid
Percent Solids: 83.1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	1.3	J	2.5	0.023	mg/Kg			06/13/21 13:02	1
Iron	3200		5.0	4.1	mg/Kg			06/13/21 13:02	1
Lithium	13		2.5	0.15	mg/Kg			06/13/21 13:02	1
Molybdenum	1.2	J	2.0	0.082	mg/Kg			06/13/21 13:02	1
Potassium	19000		250	26	mg/Kg			06/13/21 13:02	1
Selenium	ND		0.50	0.17	mg/Kg			06/13/21 13:02	1
Sodium	39000		250	130	mg/Kg			06/13/21 13:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	900	F1	46	5.7	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Antimony	ND		6.8	0.39	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Arsenic	1.6	J	2.3	0.33	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Calcium	1800		570	100	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Cobalt	1.5	J	5.7	0.055	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Iron	2100		23	9.0	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Lithium	1.1	J	5.7	0.34	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Manganese	32	F1	1.7	0.71	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Molybdenum	1.1	J	4.6	0.13	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Potassium	220	J	570	27	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Selenium	ND		1.7	0.50	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1
Sodium	43	J	570	41	mg/Kg	☼	06/10/21 08:00	06/11/21 11:27	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	28000	B	120	19	mg/Kg	☼	05/27/21 08:00	06/10/21 12:13	10
Antimony	0.82	J	3.6	0.17	mg/Kg	☼	05/27/21 08:00	06/10/21 13:55	1
Arsenic	11	B	1.2	0.31	mg/Kg	☼	05/27/21 08:00	06/10/21 15:26	2
Calcium	6600		3000	31	mg/Kg	☼	05/27/21 08:00	06/10/21 12:13	10
Cobalt	3.6		3.0	0.031	mg/Kg	☼	05/27/21 08:00	06/10/21 13:55	1
Iron	4700		6.0	4.9	mg/Kg	☼	05/27/21 08:00	06/10/21 13:55	1
Lithium	3.7		3.0	0.18	mg/Kg	☼	05/27/21 08:00	06/10/21 13:55	1
Molybdenum	3.1		2.4	0.099	mg/Kg	☼	05/27/21 08:00	06/10/21 13:55	1
Potassium	16000		1500	60	mg/Kg	☼	05/27/21 08:00	06/10/21 15:31	5
Selenium	0.80	J	1.2	0.41	mg/Kg	☼	05/27/21 08:00	06/10/21 15:26	2
Sodium	9300	B	300	52	mg/Kg	☼	05/27/21 08:00	06/10/21 13:55	1

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: EW-3D
Date Collected: 05/11/21 12:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-6
Matrix: Solid
Percent Solids: 93.0

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		43	6.9	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Antimony	ND		13	1.2	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Arsenic	ND		2.1	0.56	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Calcium	**820**	**J B**	1100	8.2	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Cobalt	ND		11	0.19	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Iron	**13**	**J**	21	12	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Lithium	ND		11	0.64	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Molybdenum	ND		8.6	0.35	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Potassium	ND		1100	110	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Selenium	ND		2.1	0.73	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4
Sodium	ND		1100	560	mg/Kg	☼	05/27/21 08:00	06/02/21 12:40	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**19**	**J**	32	5.2	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Antimony	ND		9.7	0.90	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Arsenic	ND		1.6	0.42	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Calcium	**20000**		810	7.1	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Cobalt	**0.32**	**J**	8.1	0.20	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Iron	**290**		16	9.4	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Lithium	ND		8.1	0.48	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Molybdenum	ND		6.4	0.26	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Potassium	ND		810	84	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3
Selenium	ND		1.6	0.55	mg/Kg	☼	05/28/21 08:00	06/02/21 14:33	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**83**		11	2.3	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Antimony	ND		3.2	0.30	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Arsenic	**0.19**	**J**	0.54	0.14	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Calcium	**5.7**	**J**	270	1.6	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Cobalt	**0.47**	**J**	2.7	0.048	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Iron	**1100**		5.4	3.1	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Lithium	ND		2.7	0.16	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Molybdenum	ND		2.1	0.088	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Potassium	ND		270	28	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Selenium	ND		0.54	0.18	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1
Sodium	**5300**		270	140	mg/Kg	☼	06/01/21 08:00	06/02/21 16:24	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**270**		11	1.7	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Antimony	ND		3.2	0.48	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Arsenic	**0.51**	**J B**	0.54	0.24	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Calcium	**18000**		270	2.4	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Cobalt	**1.7**	**J**	2.7	0.057	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Iron	**1700**		5.4	3.1	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Lithium	**1.0**	**J**	2.7	0.16	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Molybdenum	ND		2.1	0.088	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Potassium	ND		270	28	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1

Client Sample ID: EW-3D

Date Collected: 05/11/21 12:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-6

Matrix: Solid
Percent Solids: 93.0

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.54	0.51	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1
Sodium	**460**		270	140	mg/Kg	☼	06/02/21 08:00	06/05/21 12:05	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**100**	**J**	160	25	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Antimony	ND		48	4.5	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Arsenic	ND		8.1	2.0	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Calcium	**6600**		4000	12	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Cobalt	ND	*1	40	0.64	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Iron	ND		81	47	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Lithium	**8.5**	**J B *+**	40	2.4	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Molybdenum	ND		32	1.3	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Potassium	**2500**	**J B**	4000	460	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5
Selenium	ND		8.1	2.8	mg/Kg	☼	06/04/21 08:00	06/05/21 13:59	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**1400**		11	1.7	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Antimony	ND		3.2	0.30	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Arsenic	**2.7**		0.54	0.16	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Calcium	**4200**		270	2.3	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Cobalt	**2.2**	**J**	2.7	0.049	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Iron	**5900**		5.4	3.1	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Lithium	**2.6**	**J B**	2.7	0.16	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Molybdenum	**0.17**	**J**	2.1	0.11	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Potassium	**230**	**J**	270	28	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Selenium	**0.40**	**J**	0.54	0.18	mg/Kg	☼	06/04/21 08:00	06/05/21 15:52	1
Sodium	**16000**		1300	700	mg/Kg	☼	06/04/21 08:00	06/05/21 17:01	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**12000**		110	17	mg/Kg	☼	06/07/21 08:00	06/09/21 12:49	10
Antimony	ND		3.2	0.15	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1
Arsenic	**1.5**	**B**	0.54	0.14	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1
Calcium	**2400**		270	2.8	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1
Cobalt	**1.0**	**J**	2.7	0.028	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1
Iron	**3900**		5.4	4.4	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1
Lithium	**3.9**		2.7	0.16	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1
Molybdenum	ND		2.1	0.088	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1
Potassium	**11000**		1300	54	mg/Kg	☼	06/07/21 08:00	06/09/21 15:52	5
Selenium	ND		0.54	0.18	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1
Sodium	**6700**		270	46	mg/Kg	☼	06/07/21 08:00	06/09/21 14:13	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**14000**		10	1.6	mg/Kg			06/13/21 13:02	1
Antimony	ND		3.0	0.14	mg/Kg			06/13/21 13:02	1
Arsenic	**4.8**		0.50	0.13	mg/Kg			06/13/21 13:02	1
Calcium	**52000**		250	0.74	mg/Kg			06/13/21 13:02	1

Client Sample ID: EW-3D
Date Collected: 05/11/21 12:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-6
Matrix: Solid
Percent Solids: 93.0

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	5.7		2.5	0.023	mg/Kg			06/13/21 13:02	1
Iron	13000		5.0	4.1	mg/Kg			06/13/21 13:02	1
Lithium	16		2.5	0.15	mg/Kg			06/13/21 13:02	1
Molybdenum	0.17	J	2.0	0.082	mg/Kg			06/13/21 13:02	1
Potassium	14000		250	26	mg/Kg			06/13/21 13:02	1
Selenium	0.40	J	0.50	0.17	mg/Kg			06/13/21 13:02	1
Sodium	29000		250	130	mg/Kg			06/13/21 13:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	3200		41	5.1	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Antimony	ND		6.1	0.35	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Arsenic	4.8		2.0	0.30	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Calcium	44000		510	90	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Cobalt	8.0		5.1	0.049	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Iron	9400		20	8.0	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Lithium	5.8		5.1	0.31	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Manganese	680		1.5	0.63	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Molybdenum	0.15	J	4.1	0.11	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Potassium	400	J	510	24	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Selenium	ND		1.5	0.45	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1
Sodium	61	J	510	37	mg/Kg	☼	06/10/21 08:00	06/11/21 11:56	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	22000	B	110	17	mg/Kg	☼	05/27/21 08:00	06/10/21 12:33	10
Antimony	0.70	J	3.2	0.15	mg/Kg	☼	05/27/21 08:00	06/10/21 14:06	1
Arsenic	3.7	B	0.54	0.14	mg/Kg	☼	05/27/21 08:00	06/10/21 14:06	1
Calcium	48000		2700	28	mg/Kg	☼	05/27/21 08:00	06/10/21 12:33	10
Cobalt	5.6		2.7	0.028	mg/Kg	☼	05/27/21 08:00	06/10/21 14:06	1
Iron	10000		5.4	4.4	mg/Kg	☼	05/27/21 08:00	06/10/21 14:06	1
Lithium	8.0		2.7	0.16	mg/Kg	☼	05/27/21 08:00	06/10/21 14:06	1
Molybdenum	0.38	J	2.1	0.088	mg/Kg	☼	05/27/21 08:00	06/10/21 14:06	1
Potassium	17000		1300	54	mg/Kg	☼	05/27/21 08:00	06/10/21 15:55	5
Selenium	ND		0.54	0.18	mg/Kg	☼	05/27/21 08:00	06/10/21 14:06	1
Sodium	7600	B	270	46	mg/Kg	☼	05/27/21 08:00	06/10/21 14:06	1

Client Sample ID: EW-3-FA (10-17)

Date Collected: 05/11/21 12:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-7

Matrix: Solid
Percent Solids: 61.6

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		65	10	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Antimony	ND		19	1.8	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Arsenic	ND		3.2	0.84	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Calcium	**3500**	**B**	1600	12	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Cobalt	ND		16	0.29	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Iron	ND		32	19	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Lithium	ND		16	0.97	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Molybdenum	**2.0**	**J**	13	0.53	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Potassium	ND		1600	170	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Selenium	ND		3.2	1.1	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4
Sodium	ND		1600	840	mg/Kg	☼	05/27/21 08:00	06/02/21 12:44	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**3800**		49	7.8	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Antimony	ND		15	1.4	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Arsenic	**7.7**		2.4	0.63	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Calcium	**16000**		1200	11	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Cobalt	**0.66**	**J**	12	0.31	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Iron	**840**		24	14	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Lithium	**1.3**	**J**	12	0.73	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Molybdenum	**7.3**	**J**	9.7	0.40	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Potassium	**220**	**J**	1200	130	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3
Selenium	**1.0**	**J**	2.4	0.83	mg/Kg	☼	05/28/21 08:00	06/02/21 14:38	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**5300**		16	3.4	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Antimony	**0.68**	**J**	4.9	0.45	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Arsenic	**23**		0.81	0.21	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Calcium	**35**	**J**	410	2.4	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Cobalt	**1.5**	**J**	4.1	0.073	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Iron	**4500**		8.1	4.7	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Lithium	**1.4**	**J**	4.1	0.24	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Molybdenum	**18**		3.2	0.13	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Potassium	**86**	**J**	410	42	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Selenium	**3.5**		0.81	0.28	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1
Sodium	**15000**		410	210	mg/Kg	☼	06/01/21 08:00	06/02/21 16:29	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**7300**		16	2.6	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Antimony	ND		4.9	0.73	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Arsenic	**8.4**	**B**	0.81	0.36	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Calcium	**13000**		410	3.6	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Cobalt	**4.0**	**J**	4.1	0.086	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Iron	**10000**		8.1	4.7	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Lithium	**3.9**	**J**	4.1	0.24	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Molybdenum	**12**		3.2	0.13	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Potassium	**510**		410	42	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: EW-3-FA (10-17)
Date Collected: 05/11/21 12:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-7
Matrix: Solid
Percent Solids: 61.6

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	1.4		0.81	0.76	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1
Sodium	2200		410	210	mg/Kg	☼	06/02/21 08:00	06/05/21 12:10	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	77	J	240	38	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Antimony	ND		73	6.8	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Arsenic	8.2	J	12	3.1	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Calcium	3200	J	6100	18	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Cobalt	ND	*1	61	0.97	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Iron	85	J B	120	71	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Lithium	13	J B *+	61	3.6	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Molybdenum	2.5	J	49	2.0	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Potassium	3700	J B	6100	690	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5
Selenium	8.3	J	12	4.2	mg/Kg	☼	06/04/21 08:00	06/05/21 14:04	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	16000		16	2.6	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Antimony	1.9	J	4.9	0.45	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Arsenic	14		0.81	0.24	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Calcium	6000		410	3.4	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Cobalt	10	J	20	0.37	mg/Kg	☼	06/04/21 08:00	06/05/21 17:05	5
Iron	28000		8.1	4.7	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Lithium	11	B	4.1	0.24	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Molybdenum	2.7	J	3.2	0.16	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Potassium	3100		410	42	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Selenium	2.5		0.81	0.28	mg/Kg	☼	06/04/21 08:00	06/05/21 15:57	1
Sodium	39000		2000	1100	mg/Kg	☼	06/04/21 08:00	06/05/21 17:05	5

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	34000		160	26	mg/Kg	☼	06/07/21 08:00	06/09/21 12:54	10
Antimony	3.1	J	4.9	0.23	mg/Kg	☼	06/07/21 08:00	06/09/21 14:18	1
Arsenic	6.9	B	1.6	0.42	mg/Kg	☼	06/07/21 08:00	06/09/21 15:57	2
Calcium	11000		4100	42	mg/Kg	☼	06/07/21 08:00	06/09/21 12:54	10
Cobalt	23		20	0.21	mg/Kg	☼	06/07/21 08:00	06/09/21 16:02	5
Iron	52000		16	13	mg/Kg	☼	06/07/21 08:00	06/09/21 15:57	2
Lithium	42		4.1	0.24	mg/Kg	☼	06/07/21 08:00	06/09/21 14:18	1
Molybdenum	2.3	J	3.2	0.13	mg/Kg	☼	06/07/21 08:00	06/09/21 14:18	1
Potassium	15000		810	32	mg/Kg	☼	06/07/21 08:00	06/09/21 15:57	2
Selenium	ND		1.6	0.55	mg/Kg	☼	06/07/21 08:00	06/09/21 15:57	2
Sodium	9000		410	70	mg/Kg	☼	06/07/21 08:00	06/09/21 14:18	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	66000		10	1.6	mg/Kg			06/13/21 13:02	1
Antimony	5.7		3.0	0.14	mg/Kg			06/13/21 13:02	1
Arsenic	69		0.50	0.13	mg/Kg			06/13/21 13:02	1
Calcium	52000		250	0.74	mg/Kg			06/13/21 13:02	1

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: EW-3-FA (10-17)
Date Collected: 05/11/21 12:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-7
Matrix: Solid
Percent Solids: 61.6

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	40		2.5	0.023	mg/Kg			06/13/21 13:02	1
Iron	96000		5.0	4.1	mg/Kg			06/13/21 13:02	1
Lithium	72		2.5	0.15	mg/Kg			06/13/21 13:02	1
Molybdenum	46		2.0	0.082	mg/Kg			06/13/21 13:02	1
Potassium	22000		250	26	mg/Kg			06/13/21 13:02	1
Selenium	17		0.50	0.17	mg/Kg			06/13/21 13:02	1
Sodium	65000		250	130	mg/Kg			06/13/21 13:02	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	38000		63	7.9	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Antimony	ND		9.5	0.54	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Arsenic	60		3.2	0.46	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Calcium	41000		790	140	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Cobalt	18		7.9	0.076	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Iron	51000		32	12	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Lithium	19		7.9	0.47	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Manganese	170		2.4	0.98	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Molybdenum	36		6.3	0.17	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Potassium	4800		790	38	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Selenium	17		2.4	0.70	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1
Sodium	3800		790	57	mg/Kg	☼	06/10/21 08:00	06/11/21 12:01	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	67000	B	160	26	mg/Kg	☼	05/27/21 08:00	06/10/21 12:37	10
Antimony	5.0	J	9.7	0.45	mg/Kg	☼	05/27/21 08:00	06/10/21 16:00	2
Arsenic	52	B	1.6	0.42	mg/Kg	☼	05/27/21 08:00	06/10/21 16:00	2
Calcium	60000		4100	42	mg/Kg	☼	05/27/21 08:00	06/10/21 12:37	10
Cobalt	33		20	0.21	mg/Kg	☼	05/27/21 08:00	06/10/21 16:05	5
Iron	67000		16	13	mg/Kg	☼	05/27/21 08:00	06/10/21 16:00	2
Lithium	36		8.1	0.49	mg/Kg	☼	05/27/21 08:00	06/10/21 16:00	2
Molybdenum	41		6.5	0.27	mg/Kg	☼	05/27/21 08:00	06/10/21 16:00	2
Potassium	12000		810	32	mg/Kg	☼	05/27/21 08:00	06/10/21 16:00	2
Selenium	9.8		1.6	0.55	mg/Kg	☼	05/27/21 08:00	06/10/21 16:00	2
Sodium	8300	B	810	140	mg/Kg	☼	05/27/21 08:00	06/10/21 16:00	2

Default Detection Limits

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Prep: 3010A

SEP: Exchangeable

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.28	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	1.9	mg/Kg
Cobalt	2.5	0.045	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Prep: 3010A

SEP: Carbonate

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.28	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	2.2	mg/Kg
Cobalt	2.5	0.063	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Prep: 3010A

SEP: Non-Crystalline

Analyte	RL	MDL	Units
Aluminum	10	2.1	mg/Kg
Antimony	3.0	0.28	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	1.5	mg/Kg
Cobalt	2.5	0.045	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Prep: 3010A

SEP: Metal Hydroxide

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.45	mg/Kg
Arsenic	0.50	0.22	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Prep: 3010A

SEP: Metal Hydroxide

Analyte	RL	MDL	Units
Calcium	250	2.2	mg/Kg
Cobalt	2.5	0.053	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.47	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Prep: 3010A

SEP: Organic-Bound

Analyte	RL	MDL	Units
Aluminum	30	4.7	mg/Kg
Antimony	9.0	0.84	mg/Kg
Arsenic	1.5	0.38	mg/Kg
Calcium	750	2.2	mg/Kg
Cobalt	7.5	0.12	mg/Kg
Iron	15	8.8	mg/Kg
Lithium	7.5	0.44	mg/Kg
Molybdenum	6.0	0.25	mg/Kg
Potassium	750	85	mg/Kg
Selenium	1.5	0.52	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 6

SEP: Acid/Sulfide

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.28	mg/Kg
Arsenic	0.50	0.15	mg/Kg
Calcium	250	2.1	mg/Kg
Cobalt	2.5	0.046	mg/Kg
Iron	5.0	2.9	mg/Kg
Lithium	2.5	0.15	mg/Kg
Molybdenum	2.0	0.099	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Prep: Residual

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.14	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	2.6	mg/Kg
Cobalt	2.5	0.026	mg/Kg
Iron	5.0	4.1	mg/Kg
Lithium	2.5	0.15	mg/Kg
Molybdenum	2.0	0.082	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Prep: Residual

Analyte	RL	MDL	Units
Potassium	250	10	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	43	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.14	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	0.74	mg/Kg
Cobalt	2.5	0.023	mg/Kg
Iron	5.0	4.1	mg/Kg
Lithium	2.5	0.15	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	26	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	130	mg/Kg

Method: 6010B - Metals (ICP)

Prep: 3050B

Analyte	RL	MDL	Units
Aluminum	40	5.0	mg/Kg
Antimony	6.0	0.34	mg/Kg
Arsenic	2.0	0.29	mg/Kg
Calcium	500	88	mg/Kg
Cobalt	5.0	0.048	mg/Kg
Iron	20	7.9	mg/Kg
Lithium	5.0	0.30	mg/Kg
Manganese	1.5	0.62	mg/Kg
Molybdenum	4.0	0.11	mg/Kg
Potassium	500	24	mg/Kg
Selenium	1.5	0.44	mg/Kg
Sodium	500	36	mg/Kg

Method: 6010B - SEP Metals (ICP) - Total

Prep: Total

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Antimony	3.0	0.14	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Calcium	250	2.6	mg/Kg
Cobalt	2.5	0.026	mg/Kg
Iron	5.0	4.1	mg/Kg
Lithium	2.5	0.15	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Potassium	250	10	mg/Kg
Selenium	0.50	0.17	mg/Kg
Sodium	250	43	mg/Kg

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 140-50632/14-A
Matrix: Solid
Analysis Batch: 50744

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 50632

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		40	5.0	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Antimony	ND		6.0	0.34	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Arsenic	ND		2.0	0.29	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Calcium	ND		500	88	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Cobalt	ND		5.0	0.048	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Iron	ND		20	7.9	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Lithium	ND		5.0	0.30	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Manganese	ND		1.5	0.62	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Molybdenum	ND		4.0	0.11	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Potassium	ND		500	24	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Selenium	ND		1.5	0.44	mg/Kg		06/10/21 08:00	06/11/21 10:58	1
Sodium	ND		500	36	mg/Kg		06/10/21 08:00	06/11/21 10:58	1

Lab Sample ID: LCS 140-50632/15-A
Matrix: Solid
Analysis Batch: 50744

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 50632

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	200	203		mg/Kg		102	90 - 110
Antimony	50.0	49.9		mg/Kg		100	90 - 110
Arsenic	10.0	9.86		mg/Kg		99	90 - 110
Calcium	5000	5060		mg/Kg		101	90 - 110
Cobalt	10.0	10.3		mg/Kg		103	90 - 110
Iron	100	104		mg/Kg		104	90 - 113
Lithium	10.0	9.88		mg/Kg		99	80 - 120
Manganese	10.0	10.6		mg/Kg		106	90 - 110
Molybdenum	50.0	51.7		mg/Kg		103	90 - 110
Potassium	5000	4980		mg/Kg		100	90 - 110
Selenium	15.0	14.8		mg/Kg		99	90 - 110
Sodium	5000	5060		mg/Kg		101	87 - 116

Lab Sample ID: 140-23062-5 MS
Matrix: Solid
Analysis Batch: 50744

Client Sample ID: EW-3M
Prep Type: Total/NA
Prep Batch: 50632

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	900	F1	225	1880	F1	mg/Kg	☼	435	75 - 125
Antimony	ND		56.2	50.7		mg/Kg	☼	90	75 - 125
Arsenic	1.6	J	11.2	13.3		mg/Kg	☼	104	75 - 125
Calcium	1800		5620	7640		mg/Kg	☼	103	75 - 125
Cobalt	1.5	J	11.2	12.6		mg/Kg	☼	99	75 - 125
Iron	2100		112	2460	4	mg/Kg	☼	337	75 - 125
Lithium	1.1	J	11.2	12.1		mg/Kg	☼	98	75 - 125
Manganese	32	F1	11.2	48.5	F1	mg/Kg	☼	148	75 - 125
Molybdenum	1.1	J	56.2	55.6		mg/Kg	☼	97	75 - 125
Potassium	220	J	5620	5770		mg/Kg	☼	99	75 - 125
Selenium	ND		16.9	16.0		mg/Kg	☼	95	75 - 121
Sodium	43	J	5620	5550		mg/Kg	☼	98	75 - 125

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: 140-23062-5 MSD
Matrix: Solid
Analysis Batch: 50744

Client Sample ID: EW-3M
Prep Type: Total/NA
Prep Batch: 50632

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	900	F1	237	2050	F1	mg/Kg	☼	488	75 - 125	9	20
Antimony	ND		59.3	53.3		mg/Kg	☼	90	75 - 125	5	20
Arsenic	1.6	J	11.9	13.3		mg/Kg	☼	98	75 - 125	0	20
Calcium	1800		5930	7660		mg/Kg	☼	98	75 - 125	0	20
Cobalt	1.5	J	11.9	13.1		mg/Kg	☼	97	75 - 125	4	20
Iron	2100		119	2590	4	mg/Kg	☼	433	75 - 125	5	20
Lithium	1.1	J	11.9	12.9		mg/Kg	☼	100	75 - 125	6	20
Manganese	32	F1	11.9	50.2	F1	mg/Kg	☼	155	75 - 125	3	20
Molybdenum	1.1	J	59.3	58.6		mg/Kg	☼	97	75 - 125	5	20
Potassium	220	J	5930	6130		mg/Kg	☼	100	75 - 125	6	20
Selenium	ND		17.8	17.1		mg/Kg	☼	96	75 - 121	6	20
Sodium	43	J	5930	5890		mg/Kg	☼	99	75 - 125	6	20

Method: 6010B - SEP Metals (ICP) - Total

Lab Sample ID: MB 140-50176/17-A
Matrix: Solid
Analysis Batch: 50709

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 50176

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	1.76	J	10	1.6	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Antimony	ND		3.0	0.14	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Arsenic	0.240	J	0.50	0.13	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Calcium	ND		250	2.6	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Cobalt	ND		2.5	0.026	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Iron	ND		5.0	4.1	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Lithium	ND		2.5	0.15	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Molybdenum	ND		2.0	0.082	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Potassium	ND		250	10	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Selenium	ND		0.50	0.17	mg/Kg		05/27/21 08:00	06/10/21 11:30	1
Sodium	50.5	J	250	43	mg/Kg		05/27/21 08:00	06/10/21 11:30	1

Lab Sample ID: LCS 140-50176/18-A
Matrix: Solid
Analysis Batch: 50709

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 50176

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	101		mg/Kg		101	80 - 120
Antimony	25.0	24.9		mg/Kg		99	80 - 125
Arsenic	5.00	5.11		mg/Kg		102	80 - 120
Calcium	2500	2590		mg/Kg		104	80 - 120
Cobalt	5.00	5.11		mg/Kg		102	80 - 125
Iron	50.0	53.9		mg/Kg		108	80 - 120
Lithium	5.00	4.95		mg/Kg		99	80 - 120
Molybdenum	25.0	25.7		mg/Kg		103	80 - 125
Potassium	2500	2540		mg/Kg		102	80 - 120
Selenium	7.50	7.21		mg/Kg		96	80 - 120
Sodium	2500	2580		mg/Kg		103	80 - 120

Method: 6010B - SEP Metals (ICP) - Total (Continued)

Lab Sample ID: LCSD 140-50176/19-A
Matrix: Solid
Analysis Batch: 50709

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 50176

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	99.4		mg/Kg		99	80 - 120	1	30
Antimony			25.0	24.3		mg/Kg		97	80 - 125	2	30
Arsenic			5.00	5.02		mg/Kg		100	80 - 120	2	30
Calcium			2500	2540		mg/Kg		102	80 - 120	2	30
Cobalt			5.00	5.01		mg/Kg		100	80 - 125	2	30
Iron			50.0	56.3		mg/Kg		113	80 - 120	4	30
Lithium			5.00	4.86		mg/Kg		97	80 - 120	2	30
Molybdenum			25.0	25.2		mg/Kg		101	80 - 125	2	30
Potassium			2500	2490		mg/Kg		100	80 - 120	2	30
Selenium			7.50	7.17		mg/Kg		96	80 - 120	1	30
Sodium			2500	2520		mg/Kg		101	80 - 120	2	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50709

Client Sample ID: EW-3M
Prep Type: Total/NA
Prep Batch: 50176

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	28000	B		30300		mg/Kg	☼			6	30
Calcium	6600			6720		mg/Kg	☼			2	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50709

Client Sample ID: EW-3M
Prep Type: Total/NA
Prep Batch: 50176

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Antimony	0.82	J		0.448	J F5	mg/Kg	☼			59	30
Cobalt	3.6			1.12	J F5	mg/Kg	☼			106	30
Iron	4700			3370	F3	mg/Kg	☼			33	30
Lithium	3.7			4.01		mg/Kg	☼			9	30
Molybdenum	3.1			1.31	J F5	mg/Kg	☼			80	30
Sodium	9300	B		8440		mg/Kg	☼			9	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50709

Client Sample ID: EW-3M
Prep Type: Total/NA
Prep Batch: 50176

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Arsenic	11	B		3.59	F3	mg/Kg	☼			103	30
Selenium	0.80	J		ND		mg/Kg	☼			NC	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50709

Client Sample ID: EW-3M
Prep Type: Total/NA
Prep Batch: 50176

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Potassium	16000			16000		mg/Kg	☼			3	30

Method: 6010B SEP - SEP Metals (ICP)

Lab Sample ID: MB 140-50177/16-B ^4
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Method Blank
Prep Type: Step 1
Prep Batch: 50219

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		40	6.4	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Antimony	ND		12	1.1	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Arsenic	ND		2.0	0.52	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Calcium	20.9	J	1000	7.6	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Cobalt	ND		10	0.18	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Iron	ND		20	12	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Lithium	ND		10	0.60	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Molybdenum	ND		8.0	0.33	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Potassium	ND		1000	100	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Selenium	ND		2.0	0.68	mg/Kg		05/27/21 08:00	06/02/21 11:27	4
Sodium	ND		1000	520	mg/Kg		05/27/21 08:00	06/02/21 11:27	4

Lab Sample ID: LCS 140-50177/17-B ^5
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Lab Control Sample
Prep Type: Step 1
Prep Batch: 50219

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	92.9		mg/Kg		93	80 - 120
Antimony	25.0	24.3		mg/Kg		97	80 - 120
Arsenic	5.00	4.85		mg/Kg		97	80 - 120
Calcium	2500	2380		mg/Kg		95	80 - 120
Cobalt	5.00	4.80	J	mg/Kg		96	80 - 120
Iron	50.0	51.1		mg/Kg		102	80 - 120
Lithium	5.00	4.95	J	mg/Kg		99	80 - 120
Molybdenum	25.0	24.3		mg/Kg		97	80 - 120
Potassium	2500	2410		mg/Kg		96	80 - 120
Selenium	7.50	7.44		mg/Kg		99	80 - 120
Sodium	2500	2400		mg/Kg		96	80 - 120

Lab Sample ID: LCSD 140-50177/18-B ^5
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 1
Prep Batch: 50219

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	95.7		mg/Kg		96	80 - 120	3	30
Antimony	25.0	24.3		mg/Kg		97	80 - 120	0	30
Arsenic	5.00	4.83		mg/Kg		97	80 - 120	0	30
Calcium	2500	2470		mg/Kg		99	80 - 120	4	30
Cobalt	5.00	4.94	J	mg/Kg		99	80 - 120	3	30
Iron	50.0	49.6		mg/Kg		99	80 - 120	3	30
Lithium	5.00	4.67	J	mg/Kg		93	80 - 120	6	30
Molybdenum	25.0	24.6		mg/Kg		99	80 - 120	1	30
Potassium	2500	2540		mg/Kg		102	80 - 120	5	30
Selenium	7.50	7.31		mg/Kg		97	80 - 120	2	30
Sodium	2500	2510		mg/Kg		100	80 - 120	4	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: EW-3M
Prep Type: Step 1
Prep Batch: 50219

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	ND			ND		mg/Kg	☼			NC	30
Antimony	ND			ND		mg/Kg	☼			NC	30
Arsenic	ND			ND		mg/Kg	☼			NC	30
Calcium	350	J B		337	J	mg/Kg	☼			3	30
Cobalt	ND			ND		mg/Kg	☼			NC	30
Iron	ND			ND		mg/Kg	☼			NC	30
Lithium	ND			ND		mg/Kg	☼			NC	30
Molybdenum	0.86	J		0.761	J	mg/Kg	☼			12	30
Potassium	ND			ND		mg/Kg	☼			NC	30
Selenium	ND			ND		mg/Kg	☼			NC	30
Sodium	ND			ND		mg/Kg	☼			NC	30

Lab Sample ID: MB 140-50220/16-B ^3
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Method Blank
Prep Type: Step 2
Prep Batch: 50254

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	4.8	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Antimony	ND		9.0	0.84	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Arsenic	ND		1.5	0.39	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Calcium	ND		750	6.6	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Cobalt	ND		7.5	0.19	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Iron	ND		15	8.7	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Lithium	ND		7.5	0.45	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Molybdenum	ND		6.0	0.25	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Potassium	ND		750	78	mg/Kg		05/28/21 08:00	06/02/21 13:18	3
Selenium	ND		1.5	0.51	mg/Kg		05/28/21 08:00	06/02/21 13:18	3

Lab Sample ID: LCS 140-50220/17-B ^5
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Lab Control Sample
Prep Type: Step 2
Prep Batch: 50254

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Aluminum			100	ND		mg/Kg		5			
Antimony			25.0	20.7		mg/Kg		83	70 - 120		
Arsenic			5.00	4.29		mg/Kg		86	60 - 120		
Calcium			2500	679	J	mg/Kg		27	10 - 40		
Cobalt			5.00	4.72	J	mg/Kg		94	80 - 120		
Iron			50.0	ND		mg/Kg		7			
Lithium			5.00	4.91	J	mg/Kg		98	80 - 120		
Molybdenum			25.0	20.8		mg/Kg		83	70 - 120		
Potassium			2500	2440		mg/Kg		97	80 - 120		
Selenium			7.50	5.95		mg/Kg		79	70 - 120		

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCSD 140-50220/18-B ^5
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 2
Prep Batch: 50254

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	ND		mg/Kg		-1		326	
Antimony			25.0	21.1		mg/Kg		85	70 - 120	2	30
Arsenic			5.00	3.95		mg/Kg		79	60 - 120	8	30
Calcium			2500	687	J	mg/Kg		27	10 - 40	1	30
Cobalt			5.00	4.71	J	mg/Kg		94	80 - 120	0	30
Iron			50.0	ND		mg/Kg		21		97	
Lithium			5.00	4.53	J	mg/Kg		91	80 - 120	8	30
Molybdenum			25.0	21.1		mg/Kg		84	70 - 120	2	30
Potassium			2500	2500		mg/Kg		100	80 - 120	3	30
Selenium			7.50	6.15		mg/Kg		82	70 - 120	3	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: EW-3M
Prep Type: Step 2
Prep Batch: 50254

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	11	J		13.7	J	mg/Kg	☼			22	
Antimony	ND			ND		mg/Kg	☼			NC	30
Arsenic	ND			ND		mg/Kg	☼			NC	30
Calcium	670	J		704	J	mg/Kg	☼			5	30
Cobalt	ND			ND		mg/Kg	☼			NC	30
Iron	99			69.2		mg/Kg	☼			36	
Lithium	ND			ND		mg/Kg	☼			NC	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Potassium	ND			ND		mg/Kg	☼			NC	30
Selenium	ND			ND		mg/Kg	☼			NC	30

Lab Sample ID: MB 140-50257/16-B
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Method Blank
Prep Type: Step 3
Prep Batch: 50291

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	2.1	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Antimony	ND		3.0	0.28	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Arsenic	ND		0.50	0.13	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Calcium	ND		250	1.5	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Cobalt	ND		2.5	0.045	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Iron	ND		5.0	2.9	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Lithium	ND		2.5	0.15	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Molybdenum	ND		2.0	0.082	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Potassium	ND		250	26	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Selenium	ND		0.50	0.17	mg/Kg		06/01/21 08:00	06/02/21 15:12	1
Sodium	ND		250	130	mg/Kg		06/01/21 08:00	06/02/21 15:12	1

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCS 140-50257/17-B
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Lab Control Sample
Prep Type: Step 3
Prep Batch: 50291

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	101		mg/Kg		101	80 - 120
Antimony	25.0	24.4		mg/Kg		98	80 - 120
Arsenic	5.00	4.85		mg/Kg		97	80 - 120
Calcium	2500	38.0	J	mg/Kg		2	
Cobalt	5.00	5.10		mg/Kg		102	80 - 120
Iron	50.0	51.9		mg/Kg		104	80 - 120
Lithium	5.00	4.89		mg/Kg		98	80 - 120
Molybdenum	25.0	25.3		mg/Kg		101	80 - 120
Potassium	2500	2460		mg/Kg		98	80 - 120
Selenium	7.50	7.50		mg/Kg		100	80 - 120
Sodium	2500	2430		mg/Kg		97	80 - 120

Lab Sample ID: LCSD 140-50257/18-B
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 3
Prep Batch: 50291

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	102		mg/Kg		102	80 - 120	1	30
Antimony	25.0	24.7		mg/Kg		99	80 - 120	1	30
Arsenic	5.00	4.91		mg/Kg		98	80 - 120	1	30
Calcium	2500	38.1	J	mg/Kg		2		0	
Cobalt	5.00	5.18		mg/Kg		104	80 - 120	2	30
Iron	50.0	52.3		mg/Kg		105	80 - 120	1	30
Lithium	5.00	4.93		mg/Kg		99	80 - 120	1	30
Molybdenum	25.0	25.5		mg/Kg		102	80 - 120	1	30
Potassium	2500	2480		mg/Kg		99	80 - 120	1	30
Selenium	7.50	7.60		mg/Kg		101	80 - 120	1	30
Sodium	2500	2460		mg/Kg		98	80 - 120	1	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50418

Client Sample ID: EW-3M
Prep Type: Step 3
Prep Batch: 50291

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Aluminum	30		28.2		mg/Kg	☼	5	30
Antimony	ND		ND		mg/Kg	☼	NC	30
Arsenic	0.31	J	0.322	J	mg/Kg	☼	4	30
Calcium	4.6	J	4.54	J	mg/Kg	☼	0.6	
Cobalt	0.28	J	0.268	J	mg/Kg	☼	3	30
Iron	170		167		mg/Kg	☼	2	30
Lithium	ND		ND		mg/Kg	☼	NC	30
Molybdenum	0.21	J	0.200	J	mg/Kg	☼	3	30
Potassium	ND		ND		mg/Kg	☼	NC	30
Selenium	ND		ND		mg/Kg	☼	NC	30
Sodium	6900		7320		mg/Kg	☼	5	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-50292/16-B
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Method Blank
Prep Type: Step 4
Prep Batch: 50364

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Antimony	ND		3.0	0.45	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Arsenic	0.259	J	0.50	0.22	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Calcium	ND		250	2.2	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Cobalt	ND		2.5	0.053	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Iron	ND		5.0	2.9	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Lithium	ND		2.5	0.15	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Molybdenum	ND		2.0	0.082	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Potassium	ND		250	26	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Selenium	ND		0.50	0.47	mg/Kg		06/02/21 08:00	06/05/21 10:52	1
Sodium	ND		250	130	mg/Kg		06/02/21 08:00	06/05/21 10:52	1

Lab Sample ID: LCS 140-50292/17-B
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Lab Control Sample
Prep Type: Step 4
Prep Batch: 50364

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	103		mg/Kg		103	80 - 120
Antimony	25.0	25.3		mg/Kg		101	80 - 130
Arsenic	5.00	5.39		mg/Kg		108	80 - 130
Calcium	2500	2570		mg/Kg		103	80 - 120
Cobalt	5.00	5.15		mg/Kg		103	80 - 120
Iron	50.0	52.6		mg/Kg		105	80 - 120
Lithium	5.00	5.22		mg/Kg		104	80 - 120
Molybdenum	25.0	26.3		mg/Kg		105	80 - 120
Potassium	2500	2550		mg/Kg		102	80 - 120
Selenium	7.50	0.499	J	mg/Kg		7	
Sodium	2500	2580		mg/Kg		103	80 - 120

Lab Sample ID: LCSD 140-50292/18-B
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 4
Prep Batch: 50364

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	99.9		mg/Kg		100	80 - 120	3	30
Antimony	25.0	24.7		mg/Kg		99	80 - 130	2	30
Arsenic	5.00	5.27		mg/Kg		105	80 - 130	2	30
Calcium	2500	2500		mg/Kg		100	80 - 120	3	30
Cobalt	5.00	5.02		mg/Kg		100	80 - 120	3	30
Iron	50.0	51.3		mg/Kg		103	80 - 120	2	30
Lithium	5.00	5.08		mg/Kg		102	80 - 120	3	30
Molybdenum	25.0	25.7		mg/Kg		103	80 - 120	2	30
Potassium	2500	2480		mg/Kg		99	80 - 120	2	30
Selenium	7.50	ND		mg/Kg		6		16	
Sodium	2500	2520		mg/Kg		101	80 - 120	2	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: EW-3M
Prep Type: Step 4
Prep Batch: 50364

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Aluminum	330		320		mg/Kg	☼	3	30
Antimony	ND		ND		mg/Kg	☼	NC	30
Arsenic	0.91	B	0.979		mg/Kg	☼	7	30
Calcium	730		671		mg/Kg	☼	8	30
Cobalt	0.71	J	0.724	J	mg/Kg	☼	2	30
Iron	1000		1010		mg/Kg	☼	3	30
Lithium	0.70	J	0.672	J	mg/Kg	☼	4	30
Molybdenum	0.18	J	0.182	J	mg/Kg	☼	1	30
Potassium	38	J	38.2	J	mg/Kg	☼	1	30
Selenium	ND		ND		mg/Kg	☼	NC	
Sodium	470		565		mg/Kg	☼	19	30

Lab Sample ID: MB 140-50371/16-B ^5
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Method Blank
Prep Type: Step 5
Prep Batch: 50451

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		150	24	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Antimony	ND		45	4.2	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Arsenic	ND		7.5	1.9	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Calcium	ND		3800	11	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Cobalt	ND		38	0.60	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Iron	333		75	44	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Lithium	8.12	J	38	2.2	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Molybdenum	ND		30	1.3	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Potassium	2100	J	3800	430	mg/Kg		06/04/21 08:00	06/05/21 12:44	5
Selenium	ND		7.5	2.6	mg/Kg		06/04/21 08:00	06/05/21 12:44	5

Lab Sample ID: LCS 140-50371/17-B ^5
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Lab Control Sample
Prep Type: Step 5
Prep Batch: 50451

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	300	ND		mg/Kg		4	
Antimony	75.0	73.2		mg/Kg		98	80 - 120
Arsenic	15.0	11.3		mg/Kg		76	60 - 100
Calcium	7500	1970	J	mg/Kg		26	20 - 50
Cobalt	15.0	0.720	J	mg/Kg		5	1 - 60
Iron	150	87.9		mg/Kg		59	
Lithium	15.0	23.9	J *+	mg/Kg		159	80 - 150
Molybdenum	75.0	54.0		mg/Kg		72	60 - 100
Potassium	7500	9550		mg/Kg		127	80 - 180
Selenium	22.5	24.2		mg/Kg		108	80 - 140

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCSD 140-50371/18-B ^5
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 5
Prep Batch: 50451

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			300	ND		mg/Kg		5		14	
Antimony			75.0	73.8		mg/Kg		98	80 - 120	1	30
Arsenic			15.0	12.3		mg/Kg		82	60 - 100	8	30
Calcium			7500	2040	J	mg/Kg		27	20 - 50	4	30
Cobalt			15.0	1.05	J *1	mg/Kg		7	1 - 60	37	30
Iron			150	ND		mg/Kg		4		174	
Lithium			15.0	25.3	J *+	mg/Kg		169	80 - 150	6	30
Molybdenum			75.0	54.3		mg/Kg		72	60 - 100	1	30
Potassium			7500	9710		mg/Kg		129	80 - 180	2	30
Selenium			22.5	24.8		mg/Kg		110	80 - 140	2	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: EW-3M
Prep Type: Step 5
Prep Batch: 50451

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	73	J		57.6	J	mg/Kg	☼			24	
Antimony	ND			ND		mg/Kg	☼			NC	30
Arsenic	ND			ND		mg/Kg	☼			NC	30
Calcium	110	J		126	J	mg/Kg	☼			10	30
Cobalt	ND	*1		ND	*1	mg/Kg	☼			NC	30
Iron	84	J B		ND		mg/Kg	☼			NC	
Lithium	9.3	J B *+		9.85	J *+	mg/Kg	☼			5	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Potassium	2800	J B		2750	J	mg/Kg	☼			0.6	30
Selenium	ND			ND		mg/Kg	☼			NC	30

Lab Sample ID: MB 140-50452/16-A
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Method Blank
Prep Type: Step 6
Prep Batch: 50452

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Antimony	ND		3.0	0.28	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Arsenic	ND		0.50	0.15	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Calcium	ND		250	2.1	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Cobalt	ND		2.5	0.046	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Iron	ND		5.0	2.9	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Lithium	0.159	J	2.5	0.15	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Molybdenum	ND		2.0	0.099	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Potassium	ND		250	26	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Selenium	ND		0.50	0.17	mg/Kg		06/04/21 08:00	06/05/21 14:39	1
Sodium	ND		250	130	mg/Kg		06/04/21 08:00	06/05/21 14:39	1

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCS 140-50452/17-A
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Lab Control Sample
Prep Type: Step 6
Prep Batch: 50452

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Aluminum			100	98.3		mg/Kg		98	80 - 120		
Antimony			25.0	24.4		mg/Kg		98	80 - 120		
Arsenic			5.00	4.92		mg/Kg		98	80 - 120		
Calcium			2500	2450		mg/Kg		98	80 - 120		
Cobalt			5.00	4.94		mg/Kg		99	80 - 120		
Iron			50.0	48.8		mg/Kg		98	80 - 120		
Lithium			5.00	4.88		mg/Kg		98	80 - 120		
Molybdenum			25.0	24.8		mg/Kg		99	80 - 120		
Potassium			2500	2430		mg/Kg		97	80 - 120		
Selenium			7.50	7.46		mg/Kg		99	80 - 120		
Sodium			2500	2450		mg/Kg		98	80 - 120		

Lab Sample ID: LCSD 140-50452/18-A
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 6
Prep Batch: 50452

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	95.6		mg/Kg		96	80 - 120	3	30
Antimony			25.0	24.1		mg/Kg		96	80 - 120	1	30
Arsenic			5.00	4.85		mg/Kg		97	80 - 120	2	30
Calcium			2500	2410		mg/Kg		96	80 - 120	2	30
Cobalt			5.00	4.88		mg/Kg		98	80 - 120	1	30
Iron			50.0	48.0		mg/Kg		96	80 - 120	2	30
Lithium			5.00	4.92		mg/Kg		98	80 - 120	1	30
Molybdenum			25.0	24.5		mg/Kg		98	80 - 120	1	30
Potassium			2500	2390		mg/Kg		96	80 - 120	2	30
Selenium			7.50	7.36		mg/Kg		98	80 - 120	1	30
Sodium			2500	2400		mg/Kg		96	80 - 120	2	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: EW-3M
Prep Type: Step 6
Prep Batch: 50452

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	300			320		mg/Kg	☼			8	30
Antimony	ND			ND		mg/Kg	☼			NC	30
Arsenic	0.72			0.825		mg/Kg	☼			13	30
Calcium	100	J		115	J	mg/Kg	☼			13	30
Cobalt	0.34	J		0.390	J	mg/Kg	☼			14	30
Iron	800			936		mg/Kg	☼			16	30
Lithium	0.74	J B		0.822	J	mg/Kg	☼			11	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Potassium	150	J		159	J	mg/Kg	☼			8	30
Selenium	ND			ND		mg/Kg	☼			NC	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50529

Client Sample ID: EW-3M
Prep Type: Step 6
Prep Batch: 50452

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Sodium	22000		21900		mg/Kg	☼	2	30

Lab Sample ID: MB 140-50497/16-A
Matrix: Solid
Analysis Batch: 50662

Client Sample ID: Method Blank
Prep Type: Step 7
Prep Batch: 50497

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Antimony	ND		3.0	0.14	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Arsenic	0.213	J	0.50	0.13	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Calcium	ND		250	2.6	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Cobalt	ND		2.5	0.026	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Iron	ND		5.0	4.1	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Lithium	ND		2.5	0.15	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Molybdenum	ND		2.0	0.082	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Potassium	ND		250	10	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Selenium	ND		0.50	0.17	mg/Kg		06/07/21 08:00	06/09/21 11:46	1
Sodium	ND		250	43	mg/Kg		06/07/21 08:00	06/09/21 11:46	1

Lab Sample ID: LCS 140-50497/17-A
Matrix: Solid
Analysis Batch: 50662

Client Sample ID: Lab Control Sample
Prep Type: Step 7
Prep Batch: 50497

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	99.9		mg/Kg		100	80 - 120
Antimony	25.0	25.0		mg/Kg		100	80 - 125
Arsenic	5.00	5.16		mg/Kg		103	80 - 120
Calcium	2500	2570		mg/Kg		103	80 - 120
Cobalt	5.00	5.17		mg/Kg		103	80 - 125
Iron	50.0	53.1		mg/Kg		106	80 - 120
Lithium	5.00	4.98		mg/Kg		100	80 - 120
Molybdenum	25.0	26.1		mg/Kg		104	80 - 125
Potassium	2500	2570		mg/Kg		103	80 - 120
Selenium	7.50	7.37		mg/Kg		98	80 - 120
Sodium	2500	2600		mg/Kg		104	80 - 120

Lab Sample ID: LCSD 140-50497/18-A
Matrix: Solid
Analysis Batch: 50662

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 7
Prep Batch: 50497

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	99.4		mg/Kg		99	80 - 120	1	30
Antimony	25.0	24.9		mg/Kg		100	80 - 125	1	30
Arsenic	5.00	5.12		mg/Kg		102	80 - 120	1	30
Calcium	2500	2550		mg/Kg		102	80 - 120	1	30
Cobalt	5.00	5.13		mg/Kg		103	80 - 125	1	30
Iron	50.0	52.5		mg/Kg		105	80 - 120	1	30
Lithium	5.00	4.89		mg/Kg		98	80 - 120	2	30
Molybdenum	25.0	25.8		mg/Kg		103	80 - 125	1	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCSD 140-50497/18-A
Matrix: Solid
Analysis Batch: 50662

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 7
Prep Batch: 50497

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Potassium			2500	2530		mg/Kg		101	80 - 120	1	30
Selenium			7.50	7.38		mg/Kg		98	80 - 120	0	30
Sodium			2500	2570		mg/Kg		103	80 - 120	1	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50662

Client Sample ID: EW-3M
Prep Type: Step 7
Prep Batch: 50497

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	24000			17300	F3	mg/Kg	☼			31	30
Calcium	3100			2860	J	mg/Kg	☼			8	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50662

Client Sample ID: EW-3M
Prep Type: Step 7
Prep Batch: 50497

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Antimony	ND			ND		mg/Kg	☼			NC	30
Cobalt	ND			ND		mg/Kg	☼			NC	30
Iron	1000			1440	F3	mg/Kg	☼			32	30
Lithium	2.2	J		2.38	J	mg/Kg	☼			6	30
Molybdenum	ND			0.104	J	mg/Kg	☼			NC	30
Sodium	9700			9110		mg/Kg	☼			6	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50662

Client Sample ID: EW-3M
Prep Type: Step 7
Prep Batch: 50497

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Arsenic	1.7	B		1.72		mg/Kg	☼			0.4	30
Selenium	ND			ND		mg/Kg	☼			NC	30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Analysis Batch: 50662

Client Sample ID: EW-3M
Prep Type: Step 7
Prep Batch: 50497

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Potassium	16000			13300		mg/Kg	☼			21	30

Metals

Prep Batch: 50176

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Total/NA	Solid	Total	
140-23062-2	IW-2M	Total/NA	Solid	Total	
140-23062-3	IW-2D	Total/NA	Solid	Total	
140-23062-4	EW-3S	Total/NA	Solid	Total	
140-23062-5	EW-3M	Total/NA	Solid	Total	
140-23062-6	EW-3D	Total/NA	Solid	Total	
140-23062-7	EW-3-FA (10-17)	Total/NA	Solid	Total	
MB 140-50176/17-A	Method Blank	Total/NA	Solid	Total	
LCS 140-50176/18-A	Lab Control Sample	Total/NA	Solid	Total	
LCSD 140-50176/19-A	Lab Control Sample Dup	Total/NA	Solid	Total	
140-23062-5 DU	EW-3M	Total/NA	Solid	Total	

SEP Batch: 50177

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 1	Solid	Exchangeable	
140-23062-2	IW-2M	Step 1	Solid	Exchangeable	
140-23062-3	IW-2D	Step 1	Solid	Exchangeable	
140-23062-4	EW-3S	Step 1	Solid	Exchangeable	
140-23062-5	EW-3M	Step 1	Solid	Exchangeable	
140-23062-6	EW-3D	Step 1	Solid	Exchangeable	
140-23062-7	EW-3-FA (10-17)	Step 1	Solid	Exchangeable	
MB 140-50177/16-B ^4	Method Blank	Step 1	Solid	Exchangeable	
LCS 140-50177/17-B ^5	Lab Control Sample	Step 1	Solid	Exchangeable	
LCSD 140-50177/18-B ^5	Lab Control Sample Dup	Step 1	Solid	Exchangeable	
140-23062-5 DU	EW-3M	Step 1	Solid	Exchangeable	

Prep Batch: 50219

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 1	Solid	3010A	50177
140-23062-2	IW-2M	Step 1	Solid	3010A	50177
140-23062-3	IW-2D	Step 1	Solid	3010A	50177
140-23062-4	EW-3S	Step 1	Solid	3010A	50177
140-23062-5	EW-3M	Step 1	Solid	3010A	50177
140-23062-6	EW-3D	Step 1	Solid	3010A	50177
140-23062-7	EW-3-FA (10-17)	Step 1	Solid	3010A	50177
MB 140-50177/16-B ^4	Method Blank	Step 1	Solid	3010A	50177
LCS 140-50177/17-B ^5	Lab Control Sample	Step 1	Solid	3010A	50177
LCSD 140-50177/18-B ^5	Lab Control Sample Dup	Step 1	Solid	3010A	50177
140-23062-5 DU	EW-3M	Step 1	Solid	3010A	50177

SEP Batch: 50220

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 2	Solid	Carbonate	
140-23062-2	IW-2M	Step 2	Solid	Carbonate	
140-23062-3	IW-2D	Step 2	Solid	Carbonate	
140-23062-4	EW-3S	Step 2	Solid	Carbonate	
140-23062-5	EW-3M	Step 2	Solid	Carbonate	
140-23062-6	EW-3D	Step 2	Solid	Carbonate	
140-23062-7	EW-3-FA (10-17)	Step 2	Solid	Carbonate	
MB 140-50220/16-B ^3	Method Blank	Step 2	Solid	Carbonate	
LCS 140-50220/17-B ^5	Lab Control Sample	Step 2	Solid	Carbonate	

Metals (Continued)

SEP Batch: 50220 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCSD 140-50220/18-B ^5	Lab Control Sample Dup	Step 2	Solid	Carbonate	
140-23062-5 DU	EW-3M	Step 2	Solid	Carbonate	

Prep Batch: 50254

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 2	Solid	3010A	50220
140-23062-2	IW-2M	Step 2	Solid	3010A	50220
140-23062-3	IW-2D	Step 2	Solid	3010A	50220
140-23062-4	EW-3S	Step 2	Solid	3010A	50220
140-23062-5	EW-3M	Step 2	Solid	3010A	50220
140-23062-6	EW-3D	Step 2	Solid	3010A	50220
140-23062-7	EW-3-FA (10-17)	Step 2	Solid	3010A	50220
MB 140-50220/16-B ^3	Method Blank	Step 2	Solid	3010A	50220
LCS 140-50220/17-B ^5	Lab Control Sample	Step 2	Solid	3010A	50220
LCSD 140-50220/18-B ^5	Lab Control Sample Dup	Step 2	Solid	3010A	50220
140-23062-5 DU	EW-3M	Step 2	Solid	3010A	50220

SEP Batch: 50257

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 3	Solid	Non-Crystalline	
140-23062-2	IW-2M	Step 3	Solid	Non-Crystalline	
140-23062-3	IW-2D	Step 3	Solid	Non-Crystalline	
140-23062-4	EW-3S	Step 3	Solid	Non-Crystalline	
140-23062-5	EW-3M	Step 3	Solid	Non-Crystalline	
140-23062-6	EW-3D	Step 3	Solid	Non-Crystalline	
140-23062-7	EW-3-FA (10-17)	Step 3	Solid	Non-Crystalline	
MB 140-50257/16-B	Method Blank	Step 3	Solid	Non-Crystalline	
LCS 140-50257/17-B	Lab Control Sample	Step 3	Solid	Non-Crystalline	
LCSD 140-50257/18-B	Lab Control Sample Dup	Step 3	Solid	Non-Crystalline	
140-23062-5 DU	EW-3M	Step 3	Solid	Non-Crystalline	

Prep Batch: 50291

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 3	Solid	3010A	50257
140-23062-2	IW-2M	Step 3	Solid	3010A	50257
140-23062-3	IW-2D	Step 3	Solid	3010A	50257
140-23062-4	EW-3S	Step 3	Solid	3010A	50257
140-23062-5	EW-3M	Step 3	Solid	3010A	50257
140-23062-6	EW-3D	Step 3	Solid	3010A	50257
140-23062-7	EW-3-FA (10-17)	Step 3	Solid	3010A	50257
MB 140-50257/16-B	Method Blank	Step 3	Solid	3010A	50257
LCS 140-50257/17-B	Lab Control Sample	Step 3	Solid	3010A	50257
LCSD 140-50257/18-B	Lab Control Sample Dup	Step 3	Solid	3010A	50257
140-23062-5 DU	EW-3M	Step 3	Solid	3010A	50257

SEP Batch: 50292

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 4	Solid	Metal Hydroxide	
140-23062-2	IW-2M	Step 4	Solid	Metal Hydroxide	
140-23062-3	IW-2D	Step 4	Solid	Metal Hydroxide	
140-23062-4	EW-3S	Step 4	Solid	Metal Hydroxide	

Metals (Continued)

SEP Batch: 50292 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-5	EW-3M	Step 4	Solid	Metal Hydroxide	
140-23062-6	EW-3D	Step 4	Solid	Metal Hydroxide	
140-23062-7	EW-3-FA (10-17)	Step 4	Solid	Metal Hydroxide	
MB 140-50292/16-B	Method Blank	Step 4	Solid	Metal Hydroxide	
LCS 140-50292/17-B	Lab Control Sample	Step 4	Solid	Metal Hydroxide	
LCSD 140-50292/18-B	Lab Control Sample Dup	Step 4	Solid	Metal Hydroxide	
140-23062-5 DU	EW-3M	Step 4	Solid	Metal Hydroxide	

Prep Batch: 50364

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 4	Solid	3010A	50292
140-23062-2	IW-2M	Step 4	Solid	3010A	50292
140-23062-3	IW-2D	Step 4	Solid	3010A	50292
140-23062-4	EW-3S	Step 4	Solid	3010A	50292
140-23062-5	EW-3M	Step 4	Solid	3010A	50292
140-23062-6	EW-3D	Step 4	Solid	3010A	50292
140-23062-7	EW-3-FA (10-17)	Step 4	Solid	3010A	50292
MB 140-50292/16-B	Method Blank	Step 4	Solid	3010A	50292
LCS 140-50292/17-B	Lab Control Sample	Step 4	Solid	3010A	50292
LCSD 140-50292/18-B	Lab Control Sample Dup	Step 4	Solid	3010A	50292
140-23062-5 DU	EW-3M	Step 4	Solid	3010A	50292

SEP Batch: 50371

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 5	Solid	Organic-Bound	
140-23062-2	IW-2M	Step 5	Solid	Organic-Bound	
140-23062-3	IW-2D	Step 5	Solid	Organic-Bound	
140-23062-4	EW-3S	Step 5	Solid	Organic-Bound	
140-23062-5	EW-3M	Step 5	Solid	Organic-Bound	
140-23062-6	EW-3D	Step 5	Solid	Organic-Bound	
140-23062-7	EW-3-FA (10-17)	Step 5	Solid	Organic-Bound	
MB 140-50371/16-B ^5	Method Blank	Step 5	Solid	Organic-Bound	
LCS 140-50371/17-B ^5	Lab Control Sample	Step 5	Solid	Organic-Bound	
LCSD 140-50371/18-B ^5	Lab Control Sample Dup	Step 5	Solid	Organic-Bound	
140-23062-5 DU	EW-3M	Step 5	Solid	Organic-Bound	

Analysis Batch: 50418

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 1	Solid	6010B SEP	50219
140-23062-1	IW-2S	Step 2	Solid	6010B SEP	50254
140-23062-1	IW-2S	Step 3	Solid	6010B SEP	50291
140-23062-2	IW-2M	Step 1	Solid	6010B SEP	50219
140-23062-2	IW-2M	Step 2	Solid	6010B SEP	50254
140-23062-2	IW-2M	Step 3	Solid	6010B SEP	50291
140-23062-3	IW-2D	Step 1	Solid	6010B SEP	50219
140-23062-3	IW-2D	Step 2	Solid	6010B SEP	50254
140-23062-3	IW-2D	Step 3	Solid	6010B SEP	50291
140-23062-4	EW-3S	Step 1	Solid	6010B SEP	50219
140-23062-4	EW-3S	Step 2	Solid	6010B SEP	50254
140-23062-4	EW-3S	Step 3	Solid	6010B SEP	50291
140-23062-5	EW-3M	Step 1	Solid	6010B SEP	50219

Metals (Continued)

Analysis Batch: 50418 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-5	EW-3M	Step 2	Solid	6010B SEP	50254
140-23062-5	EW-3M	Step 3	Solid	6010B SEP	50291
140-23062-6	EW-3D	Step 1	Solid	6010B SEP	50219
140-23062-6	EW-3D	Step 2	Solid	6010B SEP	50254
140-23062-6	EW-3D	Step 3	Solid	6010B SEP	50291
140-23062-7	EW-3-FA (10-17)	Step 1	Solid	6010B SEP	50219
140-23062-7	EW-3-FA (10-17)	Step 2	Solid	6010B SEP	50254
140-23062-7	EW-3-FA (10-17)	Step 3	Solid	6010B SEP	50291
MB 140-50177/16-B ^4	Method Blank	Step 1	Solid	6010B SEP	50219
MB 140-50220/16-B ^3	Method Blank	Step 2	Solid	6010B SEP	50254
MB 140-50257/16-B	Method Blank	Step 3	Solid	6010B SEP	50291
LCS 140-50177/17-B ^5	Lab Control Sample	Step 1	Solid	6010B SEP	50219
LCS 140-50220/17-B ^5	Lab Control Sample	Step 2	Solid	6010B SEP	50254
LCS 140-50257/17-B	Lab Control Sample	Step 3	Solid	6010B SEP	50291
LCSD 140-50177/18-B ^5	Lab Control Sample Dup	Step 1	Solid	6010B SEP	50219
LCSD 140-50220/18-B ^5	Lab Control Sample Dup	Step 2	Solid	6010B SEP	50254
LCSD 140-50257/18-B	Lab Control Sample Dup	Step 3	Solid	6010B SEP	50291
140-23062-5 DU	EW-3M	Step 1	Solid	6010B SEP	50219
140-23062-5 DU	EW-3M	Step 2	Solid	6010B SEP	50254
140-23062-5 DU	EW-3M	Step 3	Solid	6010B SEP	50291

Prep Batch: 50451

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 5	Solid	3010A	50371
140-23062-2	IW-2M	Step 5	Solid	3010A	50371
140-23062-3	IW-2D	Step 5	Solid	3010A	50371
140-23062-4	EW-3S	Step 5	Solid	3010A	50371
140-23062-5	EW-3M	Step 5	Solid	3010A	50371
140-23062-6	EW-3D	Step 5	Solid	3010A	50371
140-23062-7	EW-3-FA (10-17)	Step 5	Solid	3010A	50371
MB 140-50371/16-B ^5	Method Blank	Step 5	Solid	3010A	50371
LCS 140-50371/17-B ^5	Lab Control Sample	Step 5	Solid	3010A	50371
LCSD 140-50371/18-B ^5	Lab Control Sample Dup	Step 5	Solid	3010A	50371
140-23062-5 DU	EW-3M	Step 5	Solid	3010A	50371

SEP Batch: 50452

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 6	Solid	Acid/Sulfide	
140-23062-2	IW-2M	Step 6	Solid	Acid/Sulfide	
140-23062-3	IW-2D	Step 6	Solid	Acid/Sulfide	
140-23062-4	EW-3S	Step 6	Solid	Acid/Sulfide	
140-23062-5	EW-3M	Step 6	Solid	Acid/Sulfide	
140-23062-6	EW-3D	Step 6	Solid	Acid/Sulfide	
140-23062-7	EW-3-FA (10-17)	Step 6	Solid	Acid/Sulfide	
MB 140-50452/16-A	Method Blank	Step 6	Solid	Acid/Sulfide	
LCS 140-50452/17-A	Lab Control Sample	Step 6	Solid	Acid/Sulfide	
LCSD 140-50452/18-A	Lab Control Sample Dup	Step 6	Solid	Acid/Sulfide	
140-23062-5 DU	EW-3M	Step 6	Solid	Acid/Sulfide	

Metals

Prep Batch: 50497

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 7	Solid	Residual	
140-23062-2	IW-2M	Step 7	Solid	Residual	
140-23062-3	IW-2D	Step 7	Solid	Residual	
140-23062-4	EW-3S	Step 7	Solid	Residual	
140-23062-5	EW-3M	Step 7	Solid	Residual	
140-23062-6	EW-3D	Step 7	Solid	Residual	
140-23062-7	EW-3-FA (10-17)	Step 7	Solid	Residual	
MB 140-50497/16-A	Method Blank	Step 7	Solid	Residual	
LCS 140-50497/17-A	Lab Control Sample	Step 7	Solid	Residual	
LCSD 140-50497/18-A	Lab Control Sample Dup	Step 7	Solid	Residual	
140-23062-5 DU	EW-3M	Step 7	Solid	Residual	

Analysis Batch: 50529

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 4	Solid	6010B SEP	50364
140-23062-1	IW-2S	Step 5	Solid	6010B SEP	50451
140-23062-1	IW-2S	Step 6	Solid	6010B SEP	50452
140-23062-1	IW-2S	Step 6	Solid	6010B SEP	50452
140-23062-2	IW-2M	Step 4	Solid	6010B SEP	50364
140-23062-2	IW-2M	Step 5	Solid	6010B SEP	50451
140-23062-2	IW-2M	Step 6	Solid	6010B SEP	50452
140-23062-2	IW-2M	Step 6	Solid	6010B SEP	50452
140-23062-3	IW-2D	Step 4	Solid	6010B SEP	50364
140-23062-3	IW-2D	Step 5	Solid	6010B SEP	50451
140-23062-3	IW-2D	Step 6	Solid	6010B SEP	50452
140-23062-3	IW-2D	Step 6	Solid	6010B SEP	50452
140-23062-4	EW-3S	Step 4	Solid	6010B SEP	50364
140-23062-4	EW-3S	Step 5	Solid	6010B SEP	50451
140-23062-4	EW-3S	Step 6	Solid	6010B SEP	50452
140-23062-4	EW-3S	Step 6	Solid	6010B SEP	50452
140-23062-5	EW-3M	Step 4	Solid	6010B SEP	50364
140-23062-5	EW-3M	Step 5	Solid	6010B SEP	50451
140-23062-5	EW-3M	Step 6	Solid	6010B SEP	50452
140-23062-5	EW-3M	Step 6	Solid	6010B SEP	50452
140-23062-6	EW-3D	Step 4	Solid	6010B SEP	50364
140-23062-6	EW-3D	Step 5	Solid	6010B SEP	50451
140-23062-6	EW-3D	Step 6	Solid	6010B SEP	50452
140-23062-6	EW-3D	Step 6	Solid	6010B SEP	50452
140-23062-7	EW-3-FA (10-17)	Step 4	Solid	6010B SEP	50364
140-23062-7	EW-3-FA (10-17)	Step 5	Solid	6010B SEP	50451
140-23062-7	EW-3-FA (10-17)	Step 6	Solid	6010B SEP	50452
140-23062-7	EW-3-FA (10-17)	Step 6	Solid	6010B SEP	50452
MB 140-50292/16-B	Method Blank	Step 4	Solid	6010B SEP	50364
MB 140-50371/16-B ^5	Method Blank	Step 5	Solid	6010B SEP	50451
MB 140-50452/16-A	Method Blank	Step 6	Solid	6010B SEP	50452
LCS 140-50292/17-B	Lab Control Sample	Step 4	Solid	6010B SEP	50364
LCS 140-50371/17-B ^5	Lab Control Sample	Step 5	Solid	6010B SEP	50451
LCS 140-50452/17-A	Lab Control Sample	Step 6	Solid	6010B SEP	50452
LCSD 140-50292/18-B	Lab Control Sample Dup	Step 4	Solid	6010B SEP	50364
LCSD 140-50371/18-B ^5	Lab Control Sample Dup	Step 5	Solid	6010B SEP	50451
LCSD 140-50452/18-A	Lab Control Sample Dup	Step 6	Solid	6010B SEP	50452

Metals (Continued)

Analysis Batch: 50529 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-5 DU	EW-3M	Step 4	Solid	6010B SEP	50364
140-23062-5 DU	EW-3M	Step 5	Solid	6010B SEP	50451
140-23062-5 DU	EW-3M	Step 6	Solid	6010B SEP	50452
140-23062-5 DU	EW-3M	Step 6	Solid	6010B SEP	50452

Prep Batch: 50632

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Total/NA	Solid	3050B	
140-23062-2	IW-2M	Total/NA	Solid	3050B	
140-23062-3	IW-2D	Total/NA	Solid	3050B	
140-23062-4	EW-3S	Total/NA	Solid	3050B	
140-23062-5	EW-3M	Total/NA	Solid	3050B	
140-23062-6	EW-3D	Total/NA	Solid	3050B	
140-23062-7	EW-3-FA (10-17)	Total/NA	Solid	3050B	
MB 140-50632/14-A	Method Blank	Total/NA	Solid	3050B	
LCS 140-50632/15-A	Lab Control Sample	Total/NA	Solid	3050B	
140-23062-5 MS	EW-3M	Total/NA	Solid	3050B	
140-23062-5 MSD	EW-3M	Total/NA	Solid	3050B	

Analysis Batch: 50662

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Step 7	Solid	6010B SEP	50497
140-23062-1	IW-2S	Step 7	Solid	6010B SEP	50497
140-23062-1	IW-2S	Step 7	Solid	6010B SEP	50497
140-23062-1	IW-2S	Step 7	Solid	6010B SEP	50497
140-23062-2	IW-2M	Step 7	Solid	6010B SEP	50497
140-23062-2	IW-2M	Step 7	Solid	6010B SEP	50497
140-23062-2	IW-2M	Step 7	Solid	6010B SEP	50497
140-23062-3	IW-2D	Step 7	Solid	6010B SEP	50497
140-23062-3	IW-2D	Step 7	Solid	6010B SEP	50497
140-23062-3	IW-2D	Step 7	Solid	6010B SEP	50497
140-23062-4	EW-3S	Step 7	Solid	6010B SEP	50497
140-23062-4	EW-3S	Step 7	Solid	6010B SEP	50497
140-23062-4	EW-3S	Step 7	Solid	6010B SEP	50497
140-23062-4	EW-3S	Step 7	Solid	6010B SEP	50497
140-23062-5	EW-3M	Step 7	Solid	6010B SEP	50497
140-23062-5	EW-3M	Step 7	Solid	6010B SEP	50497
140-23062-5	EW-3M	Step 7	Solid	6010B SEP	50497
140-23062-5	EW-3M	Step 7	Solid	6010B SEP	50497
140-23062-6	EW-3D	Step 7	Solid	6010B SEP	50497
140-23062-6	EW-3D	Step 7	Solid	6010B SEP	50497
140-23062-6	EW-3D	Step 7	Solid	6010B SEP	50497
140-23062-7	EW-3-FA (10-17)	Step 7	Solid	6010B SEP	50497
140-23062-7	EW-3-FA (10-17)	Step 7	Solid	6010B SEP	50497
140-23062-7	EW-3-FA (10-17)	Step 7	Solid	6010B SEP	50497
140-23062-7	EW-3-FA (10-17)	Step 7	Solid	6010B SEP	50497
MB 140-50497/16-A	Method Blank	Step 7	Solid	6010B SEP	50497
LCS 140-50497/17-A	Lab Control Sample	Step 7	Solid	6010B SEP	50497
LCSD 140-50497/18-A	Lab Control Sample Dup	Step 7	Solid	6010B SEP	50497
140-23062-5 DU	EW-3M	Step 7	Solid	6010B SEP	50497
140-23062-5 DU	EW-3M	Step 7	Solid	6010B SEP	50497

Metals (Continued)

Analysis Batch: 50662 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-5 DU	EW-3M	Step 7	Solid	6010B SEP	50497
140-23062-5 DU	EW-3M	Step 7	Solid	6010B SEP	50497

Analysis Batch: 50709

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Total/NA	Solid	6010B	50176
140-23062-1	IW-2S	Total/NA	Solid	6010B	50176
140-23062-1	IW-2S	Total/NA	Solid	6010B	50176
140-23062-1	IW-2S	Total/NA	Solid	6010B	50176
140-23062-2	IW-2M	Total/NA	Solid	6010B	50176
140-23062-2	IW-2M	Total/NA	Solid	6010B	50176
140-23062-2	IW-2M	Total/NA	Solid	6010B	50176
140-23062-3	IW-2D	Total/NA	Solid	6010B	50176
140-23062-3	IW-2D	Total/NA	Solid	6010B	50176
140-23062-3	IW-2D	Total/NA	Solid	6010B	50176
140-23062-4	EW-3S	Total/NA	Solid	6010B	50176
140-23062-4	EW-3S	Total/NA	Solid	6010B	50176
140-23062-4	EW-3S	Total/NA	Solid	6010B	50176
140-23062-5	EW-3M	Total/NA	Solid	6010B	50176
140-23062-5	EW-3M	Total/NA	Solid	6010B	50176
140-23062-5	EW-3M	Total/NA	Solid	6010B	50176
140-23062-5	EW-3M	Total/NA	Solid	6010B	50176
140-23062-6	EW-3D	Total/NA	Solid	6010B	50176
140-23062-6	EW-3D	Total/NA	Solid	6010B	50176
140-23062-6	EW-3D	Total/NA	Solid	6010B	50176
140-23062-7	EW-3-FA (10-17)	Total/NA	Solid	6010B	50176
140-23062-7	EW-3-FA (10-17)	Total/NA	Solid	6010B	50176
140-23062-7	EW-3-FA (10-17)	Total/NA	Solid	6010B	50176
MB 140-50176/17-A	Method Blank	Total/NA	Solid	6010B	50176
LCS 140-50176/18-A	Lab Control Sample	Total/NA	Solid	6010B	50176
LCSD 140-50176/19-A	Lab Control Sample Dup	Total/NA	Solid	6010B	50176
140-23062-5 DU	EW-3M	Total/NA	Solid	6010B	50176
140-23062-5 DU	EW-3M	Total/NA	Solid	6010B	50176
140-23062-5 DU	EW-3M	Total/NA	Solid	6010B	50176
140-23062-5 DU	EW-3M	Total/NA	Solid	6010B	50176

Analysis Batch: 50744

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Total/NA	Solid	6010B	50632
140-23062-2	IW-2M	Total/NA	Solid	6010B	50632
140-23062-3	IW-2D	Total/NA	Solid	6010B	50632
140-23062-4	EW-3S	Total/NA	Solid	6010B	50632
140-23062-5	EW-3M	Total/NA	Solid	6010B	50632
140-23062-6	EW-3D	Total/NA	Solid	6010B	50632
140-23062-7	EW-3-FA (10-17)	Total/NA	Solid	6010B	50632
MB 140-50632/14-A	Method Blank	Total/NA	Solid	6010B	50632
LCS 140-50632/15-A	Lab Control Sample	Total/NA	Solid	6010B	50632
140-23062-5 MS	EW-3M	Total/NA	Solid	6010B	50632
140-23062-5 MSD	EW-3M	Total/NA	Solid	6010B	50632

QC Association Summary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Metals

Analysis Batch: 50771

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Sum of Steps 1-7	Solid	6010B SEP	
140-23062-2	IW-2M	Sum of Steps 1-7	Solid	6010B SEP	
140-23062-3	IW-2D	Sum of Steps 1-7	Solid	6010B SEP	
140-23062-4	EW-3S	Sum of Steps 1-7	Solid	6010B SEP	
140-23062-5	EW-3M	Sum of Steps 1-7	Solid	6010B SEP	
140-23062-6	EW-3D	Sum of Steps 1-7	Solid	6010B SEP	
140-23062-7	EW-3-FA (10-17)	Sum of Steps 1-7	Solid	6010B SEP	

General Chemistry

Analysis Batch: 50469

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-23062-1	IW-2S	Total/NA	Solid	Moisture	
140-23062-2	IW-2M	Total/NA	Solid	Moisture	
140-23062-3	IW-2D	Total/NA	Solid	Moisture	
140-23062-4	EW-3S	Total/NA	Solid	Moisture	
140-23062-5	EW-3M	Total/NA	Solid	Moisture	
140-23062-6	EW-3D	Total/NA	Solid	Moisture	
140-23062-7	EW-3-FA (10-17)	Total/NA	Solid	Moisture	

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: IW-2S
Date Collected: 05/05/21 09:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-1
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			50771	06/13/21 13:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: IW-2S
Date Collected: 05/05/21 09:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-1
Matrix: Solid
Percent Solids: 81.5

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			50709	06/10/21 11:54	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 13:34	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		2			50709	06/10/21 14:57	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			50709	06/10/21 15:02	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	3050B			0.528 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:08	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 12:01	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 13:53	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 15:46	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 11:26	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 13:19	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: IW-2S
Date Collected: 05/05/21 09:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-1
Matrix: Solid
Percent Solids: 81.5

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 15:12	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			50529	06/05/21 16:32	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			50662	06/09/21 12:06	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 13:43	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		2			50662	06/09/21 14:54	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			50662	06/09/21 14:59	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: IW-2M
Date Collected: 05/05/21 10:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-2
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			50771	06/13/21 13:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: IW-2M
Date Collected: 05/05/21 10:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-2
Matrix: Solid
Percent Solids: 77.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			50709	06/10/21 11:59	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 13:39	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			50709	06/10/21 15:06	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	3050B			0.542 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:13	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: IW-2M

Date Collected: 05/05/21 10:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-2

Matrix: Solid
Percent Solids: 77.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 12:06	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 13:58	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 15:50	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 11:31	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 13:24	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 15:17	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			50529	06/05/21 16:36	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			50662	06/09/21 12:11	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 13:48	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			50662	06/09/21 15:04	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: IW-2D

Date Collected: 05/05/21 15:30
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-3

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			50771	06/13/21 13:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: IW-2D

Date Collected: 05/05/21 15:30
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-3

Matrix: Solid
Percent Solids: 95.5

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			50709	06/10/21 12:04	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 13:44	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		2			50709	06/10/21 15:11	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	3050B			0.541 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:17	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 12:10	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 14:03	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 15:55	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 11:46	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 13:29	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 15:22	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			50529	06/05/21 16:41	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			50662	06/09/21 12:15	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 13:53	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: IW-2D
Date Collected: 05/05/21 15:30
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-3
Matrix: Solid
Percent Solids: 95.5

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			50662	06/09/21 15:08	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3S
Date Collected: 05/11/21 10:20
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-4
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			50771	06/13/21 13:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: EW-3S
Date Collected: 05/11/21 10:20
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-4
Matrix: Solid
Percent Solids: 80.8

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			50709	06/10/21 12:09	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 13:50	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			50709	06/10/21 15:21	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	3050B			0.508 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:22	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 12:25	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 14:18	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 16:10	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3S
Date Collected: 05/11/21 10:20
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-4
Matrix: Solid
Percent Solids: 80.8

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 11:51	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 13:44	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 15:38	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			50529	06/05/21 16:46	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			50662	06/09/21 12:20	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 13:58	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		2			50662	06/09/21 15:13	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			50662	06/09/21 15:18	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3M
Date Collected: 05/11/21 11:10
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-5
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			50771	06/13/21 13:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: EW-3M
Date Collected: 05/11/21 11:10
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-5
Matrix: Solid
Percent Solids: 83.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			50709	06/10/21 12:13	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3M

Date Collected: 05/11/21 11:10
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-5

Matrix: Solid
Percent Solids: 83.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 13:55	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		2			50709	06/10/21 15:26	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			50709	06/10/21 15:31	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	3050B			0.528 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:27	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 12:30	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 14:23	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 16:14	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 11:55	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 13:49	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 15:42	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			50529	06/05/21 16:51	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			50662	06/09/21 12:25	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 14:03	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: EW-3M
Date Collected: 05/11/21 11:10
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-5
Matrix: Solid
Percent Solids: 83.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		2			50662	06/09/21 15:33	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			50662	06/09/21 15:38	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3D
Date Collected: 05/11/21 12:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-6
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			50771	06/13/21 13:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: EW-3D
Date Collected: 05/11/21 12:25
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-6
Matrix: Solid
Percent Solids: 93.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			50709	06/10/21 12:33	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 14:06	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			50709	06/10/21 15:55	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	3050B			0.528 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:56	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 12:40	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 14:33	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 16:24	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3D

Lab Sample ID: 140-23062-6

Date Collected: 05/11/21 12:25
Date Received: 05/13/21 09:30

Matrix: Solid
Percent Solids: 93.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 12:05	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 13:59	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 15:52	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			50529	06/05/21 17:01	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			50662	06/09/21 12:49	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 14:13	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			50662	06/09/21 15:52	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3-FA (10-17)

Lab Sample ID: 140-23062-7

Date Collected: 05/11/21 12:00
Date Received: 05/13/21 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			50771	06/13/21 13:02	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			50469	06/04/21 07:47	BKD	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: EW-3-FA (10-17)

Lab Sample ID: 140-23062-7

Date Collected: 05/11/21 12:00
Date Received: 05/13/21 09:30

Matrix: Solid
Percent Solids: 61.6

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			50709	06/10/21 12:37	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		2			50709	06/10/21 16:00	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: EW-3-FA (10-17)

Date Collected: 05/11/21 12:00
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-7

Matrix: Solid
Percent Solids: 61.6

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			50709	06/10/21 16:05	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	3050B			0.513 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 12:01	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 12:44	KNC	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 14:38	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 16:29	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 12:10	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 14:04	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 15:57	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			50529	06/05/21 17:05	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			50662	06/09/21 12:54	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 14:18	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		2			50662	06/09/21 15:57	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			50662	06/09/21 16:02	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50176/17-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 11:30	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50177/16-B ^4
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 11:27	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50220/16-B ^3
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 13:18	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50257/16-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 15:12	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50292/16-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 10:52	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50371/16-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 12:44	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50452/16-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 14:39	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50497/16-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 11:46	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-50632/14-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.500 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 10:58	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50176/18-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 11:35	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50177/17-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		5			50418	06/02/21 17:24	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50220/17-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		5			50418	06/02/21 13:23	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50257/17-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 15:17	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50292/17-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 10:57	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50371/17-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 12:49	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50452/17-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 14:43	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50497/17-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 11:51	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-50632/15-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.500 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:03	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-50176/19-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 11:40	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-50177/18-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		5			50418	06/02/21 11:37	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-50220/18-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		5			50418	06/02/21 13:28	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-50257/18-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 15:21	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-50292/18-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 11:02	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-50371/18-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 12:54	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-50452/18-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 14:48	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-50497/18-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 11:56	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3M
Lab Sample ID: 140-23062-5 MS
Date Collected: 05/11/21 11:10
Matrix: Solid
Date Received: 05/13/21 09:30
Percent Solids: 83.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.535 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:32	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3M
Lab Sample ID: 140-23062-5 MSD
Date Collected: 05/11/21 11:10
Matrix: Solid
Date Received: 05/13/21 09:30
Percent Solids: 83.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			0.507 g	50 mL	50632	06/10/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50744	06/11/21 11:37	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: EW-3M
Lab Sample ID: 140-23062-5 DU
Date Collected: 05/11/21 11:10
Matrix: Solid
Date Received: 05/13/21 09:30
Percent Solids: 83.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		10			50709	06/10/21 12:28	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		1			50709	06/10/21 14:00	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		2			50709	06/10/21 15:45	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1.000 g	50 mL	50176	05/27/21 08:00	JTB	TAL KNX
Total/NA	Analysis	6010B		5			50709	06/10/21 15:50	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5.000 g	25 mL	50177	05/26/21 08:00	JTB	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	50219	05/27/21 08:00	KNC	TAL KNX
Step 1	Analysis	6010B SEP		4			50418	06/02/21 12:35	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Client Sample ID: EW-3M
Date Collected: 05/11/21 11:10
Date Received: 05/13/21 09:30

Lab Sample ID: 140-23062-5 DU
Matrix: Solid
Percent Solids: 83.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	50220	05/27/21 08:00	JTB	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	50254	05/28/21 08:00	KNC	TAL KNX
Step 2	Analysis	6010B SEP		3			50418	06/02/21 14:28	KNC	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	50257	05/28/21 08:00	JTB	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	50291	06/01/21 08:00	KNC	TAL KNX
Step 3	Analysis	6010B SEP		1			50418	06/02/21 16:19	KNC	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5.000 g	25 mL	50292	06/01/21 08:00	KNC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	50364	06/02/21 08:00	KNC	TAL KNX
Step 4	Analysis	6010B SEP		1			50529	06/05/21 12:00	KNC	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5.000 g	75 mL	50371	06/02/21 08:00	KNC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	50451	06/04/21 08:00	JTB	TAL KNX
Step 5	Analysis	6010B SEP		5			50529	06/05/21 13:54	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		1			50529	06/05/21 15:47	KNC	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	50452	06/04/21 08:00	JTB	TAL KNX
Step 6	Analysis	6010B SEP		5			50529	06/05/21 16:56	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		10			50662	06/09/21 12:44	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		1			50662	06/09/21 14:08	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		2			50662	06/09/21 15:42	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	50497	06/07/21 08:00	JTB	TAL KNX
Step 7	Analysis	6010B SEP		5			50662	06/09/21 15:47	KNC	TAL KNX
	Instrument ID: DUO									

Laboratory References:
TAL KNX = Eurofins TestAmerica, Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

Accreditation/Certification Summary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Laboratory: Eurofins TestAmerica, Knoxville

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
	AFCEE	N/A	
ANAB	Dept. of Defense ELAP	L2311	02-13-22
ANAB	Dept. of Energy	L2311.01	02-13-22
ANAB	ISO/IEC 17025	L2311	02-13-22
Arkansas DEQ	State	88-0688	06-17-21
California	State	2423	06-30-22
Colorado	State	TN00009	02-28-22
Connecticut	State	PH-0223	09-30-21
Florida	NELAP	E87177	07-01-21
Georgia (DW)	State	906	12-11-22
Hawaii	State	NA	12-11-21
Kansas	NELAP	E-10349	10-31-21
Kentucky (DW)	State	90101	12-31-21
Louisiana	NELAP	83979	06-30-21
Louisiana (DW)	State	LA019	12-31-21
Maryland	State	277	03-31-22
Michigan	State	9933	12-11-22
Nevada	State	TN00009	07-31-21
New Hampshire	NELAP	299919	01-17-22
New Jersey	NELAP	TN001	07-01-21
New York	NELAP	10781	03-31-22
North Carolina (DW)	State	21705	07-31-21
North Carolina (WW/SW)	State	64	12-31-21
Ohio VAP	State	CL0059	06-02-23
Oklahoma	State	9415	08-31-21
Oregon	NELAP	TNI0189	01-01-22
Pennsylvania	NELAP	68-00576	12-31-21
Tennessee	State	02014	12-11-22
Texas	NELAP	T104704380-18-12	08-31-21
US Fish & Wildlife	US Federal Programs	058448	07-31-21
USDA	US Federal Programs	P330-19-00236	08-20-22
Utah	NELAP	TN00009	07-31-21
Virginia	NELAP	460176	09-14-21
Washington	State	C593	01-19-22
West Virginia (DW)	State	9955C	01-02-22
West Virginia DEP	State	345	04-30-22
Wisconsin	State	998044300	08-31-21

Method Summary

Client: Golder Associates Inc.
Project/Site: Sioux Energy Center

Job ID: 140-23062-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL KNX
6010B	SEP Metals (ICP) - Total	SW846	TAL KNX
6010B SEP	SEP Metals (ICP)	SW846	TAL KNX
Moisture	Percent Moisture	EPA	TAL KNX
3010A	Preparation, Total Metals	SW846	TAL KNX
3050B	Preparation, Metals	SW846	TAL KNX
Acid/Sulfide	Sequential Extraction Procedure, Acid/Sulfide Fraction	TAL-KNOX	TAL KNX
Carbonate	Sequential Extraction Procedure, Carbonate Fraction	TAL-KNOX	TAL KNX
Exchangeable	Sequential Extraction Procedure, Exchangeable Fraction	TAL-KNOX	TAL KNX
Metal Hydroxide	Sequential Extraction Procedure, Metal Hydroxide Fraction	TAL-KNOX	TAL KNX
Non-Crystalline	Sequential Extraction Procedure, Non-crystalline Materials	TAL-KNOX	TAL KNX
Organic-Bound	Sequential Extraction Procedure, Organic Bound Fraction	TAL-KNOX	TAL KNX
Residual	Sequential Extraction Procedure, Residual Fraction	TAL-KNOX	TAL KNX
Total	Preparation, Total Material	TAL-KNOX	TAL KNX

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL-KNOX = TestAmerica Laboratories, Knoxville, Facility Standard Operating Procedure.

Laboratory References:

TAL KNX = Eurofins TestAmerica, Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

Eurofins TestAmerica, Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Phone: 865-291-3000 Fax: 865-584-4315

Chain of Custody Record

eurofins | Environment Testing America

Client Information	Sampler: Brendan Talbert	Lab PM: Henry, Ryan	Carrier Tracking No(s):	COC No: 140-9346-2811.1
Client Contact: Jeffrey Ingram	Phone:	E-Mail: williamr.henry@eurofinset.com	State of Origin: MO	Page: Page 1 of 1
Company: Golder Associates Inc.	PWSID:			Job #:
Address: 13515 Barrett Parkway Drive Suite 260	Due Date Requested:			
City: Ballwin	TAT Requested (days):			
State, Zip: MO, 63021	Compliance Project: Δ Yes Δ No			
Phone: 314-984-8800(Tel) 636-724-9323(Fax)	PO #: Purchase Order not required			
Email: Jeffrey_Ingram@golder.com	WO #:			
Project Name: Sioux Energy Center	Project #: 14006318			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	6010B_SEP - SEP Metals	6010B - Total Metals	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N		
IW-2S	5-5-21	0900	G	S	N	N	1	1		
IW-2M	"	1025	"	"	"	"	1	1		
IW-2D	"	1530	"	"	"	"	1	1		
EW-3S	5-11-21	1020	"	"	"	"	1	1		
EW-3M	"	1110	"	"	"	"	1	1		
EW-3D	"	1225	"	"	"	"	1	1		
EW-3-FA (10-17)	"	1200	"	"	"	"	1	1		
~~EW-3-FA~~										

140-23062 Chain of Custody

RT CT
REC. @ 0.4°C 0.5°C
CUSTODY SEAL INTACT
1 COOLER RH 5/13/21
FED EX# 789095387939

Possible Hazard Identification
☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☑ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Brendan Talbert	5-11-21 1630	Golder	Ryan Henry	5/13/21 0930	TA KNX
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

Ver: 11/01/2020

Loc: 140
23062

EUROFINS/TESTAMERICA KNOXVILLE SAMPLE RECEIPT/CONDITION UPON RECEIPT ANOMALY CHECKLIST **Log In Number:**

Review Items	Yes	No	NA	If No, what was the problem?
1. Are the shipping containers intact?	✓			☐ **Containers, Broken**
2. Were ambient air containers received intact?			✓	☐ Checked in lab
3. The coolers/containers custody seal if present, is it intact?	✓			☐ Yes ☐ NA
4. Is the cooler temperature within limits? (> freezing temp. of water to 6 °C, VOST: 10°C) Thermometer ID : SC71 Correction factor: +0.1	✓			☐ **Cooler Out of Temp, Client Contacted, Proceed/Cancel** ☐ **Cooler Out of Temp, Same Day Receipt**
5. Were all of the sample containers received intact?	✓			☐ **Containers, Broken**
6. Were samples received in appropriate containers?	✓			☐ **Containers, Improper; Client Contacted; Proceed/Cancel**
7. Do sample container labels match COC? (IDs, Dates, Times)	✓			☐ **COC & Samples Do Not Match** ☐ **COC Incorrect/Incomplete** ☐ **COC Not Received**
8. Were all of the samples listed on the COC received?	✓			☐ **Sample Received, Not on COC** ☐ **Sample on COC, Not Received**
9. Is the date/time of sample collection noted?	✓			☐ **COC; No Date/Time; Client Contacted**
10. Was the sampler identified on the COC?	✓			☐ **Sampler Not Listed on COC**
11. Is the client and project name/# identified?	✓			☐ **COC Incorrect/Incomplete**
12. Are tests/parameters listed for each sample?	✓			☐ **COC No tests on COC**
13. Is the matrix of the samples noted?	✓			☐ **COC Incorrect/Incomplete**
14. Was COC relinquished? (Signed/Dated/Timed)	✓			☐ **COC Incorrect/Incomplete**
15. Were samples received within holding time?	✓			☐ **Holding Time - Receipt**
16. Were samples received with correct chemical preservative (excluding Encore)?			✓	☐ **pH Adjusted, pH Included (See box 16A)** ☐ **Incorrect Preservative**
17. Were VOA samples received without headspace?			✓	☐ **Headspace (VOA only)**
18. Did you check for residual chlorine, if necessary? (e.g. 1613B, 1668) Chlorine test strip lot number:			✓	☐ **Residual Chlorine**
19. For 1613B water samples is pH<9?			✓	☐ If no, notify lab to adjust
20. For rad samples was sample activity info. Provided?			✓	☐ Project missing info

Comments/Actions Taken

Labeling Verified by: **Date:**

pH test strip lot number:

	Box 16A: pH Preservation	Box 18A: Residual Chlorine
Preservative:		
Lot Number:		
Exp Date:		
Analyst:		
Date:		
Time:		

Project #: 14006318 PM Instructions:

Sample Receiving Associate: Ryan Henry Date: 5/13/21

QA026R32.doc, 062719

6/21/2021

wsp.com

APPENDIX G
2018 Risk Assessment Report

HALEY ALDRICH

www.haleyaldrich.com

REPORT ON

HUMAN HEALTH AND ECOLOGICAL ASSESSMENT OF THE SIOUX ENERGY CENTER

AMEREN MISSOURI
ST. LOUIS, MISSOURI

by Haley & Aldrich, Inc.
Boston, Massachusetts

for Ameren Missouri
St. Louis, Missouri

File No. 130182-004
February 2018

1. Introduction

The Sioux Energy Center (SEC) is a 1008 MW coal-fueled steam electrical power generating facility located near the confluence of the Mississippi and Missouri Rivers in St. Charles County, Missouri and is surrounded by agricultural fields. The facility began operations in 1967 and coal ash is managed in two (2) on-site surface impoundments. SCPA is an unlined impoundment, and SCPB is lined with high-density polyethylene (HDPE). In 2010, Ameren Missouri permitted a utility waste landfill in the areas designated SCPC and SCL4A. Figure 1 shows the location of the facility, and the locations of SCPA, SCPB, SCPC, and SCL4A.

The U.S. Environmental Protection Agency (USEPA) issued a final rule for "Disposal of Coal Combustion Residuals from Electric Utilities" in 2015 (the CCR Rule). One of the requirements in the CCR Rule is that utilities monitor groundwater at coal ash management facilities, and that the data be reported publicly. Ameren Missouri is complying with the CCR Rule, and has posted the required information on their publicly-available website: *https://www.ameren.com/Environment/ccr-rule-compliance*.

This Haley & Aldrich report is a companion document to the recently published 2017 Annual Groundwater Monitoring Report prepared by Golder Associates Inc. ("Golder") to provide interested reviewers with the information needed to interpret and meaningfully understand the groundwater monitoring data. Beyond the specific monitoring requirements of the CCR Rule, Ameren Missouri has also voluntarily taken the additional steps to determine if there has been any off-site impact to surface waters from the operation of the SCPA, SCPB, SCPC, and SCL4A. In this report, Haley & Aldrich examines the groundwater data reported under the CCR Rule, and the results of surface water samples collected from the Mississippi River, Missouri River, and an area referred to here as the Mississippi Offshoot, which border the Sioux Energy Center.

Ameren Missouri's comprehensive evaluation demonstrates that there are no adverse impacts resulting from coal ash management practices at the Sioux Energy Center on human health or the environment from either surface water or groundwater uses. In fact, as described in Sections 6 and 7, concentration levels of constituents detected in the groundwater would need to be multiple orders of magnitude higher before such a risk could exist. Details about the evaluation are provided below.

2. Approach

The analysis presented in this report was conducted by evaluating the environmental setting of the Sioux Energy Center, including its location and where ash management has occurred at the facility. Information on where groundwater is located at the facility, the rate(s) of groundwater flow, the direction(s) of groundwater flow, and where waterbodies may intercept groundwater flow was prepared by Golder, and is reviewed and summarized here.

A conceptual model was developed based on this physical setting information, and the model was used to identify what human populations could contact groundwater and/or surface water in the area of the facility. This information was also used to identify where ecological populations could come into contact with surface water. This conceptual model approach was used to identify where to collect surface water samples to allow evaluation of potential impact to the environment. Groundwater and surface water data are evaluated on a human health risk basis and an ecological risk basis.

Human health risk assessment is a process used to estimate the chance that contact with constituents in the environment may result in harm to people. Generally, there are four components to the process: (1) Hazard Identification, (2) Toxicity Assessment, (3) Exposure Assessment, and (4) Risk Characterization.

The USEPA develops "screening levels" of constituent concentrations in groundwater (and other media) that are considered to be protective of specific human exposures. These screening levels are referred to as "Risk-Based Screening Levels" or RSLs, and are published by USEPA and updated twice yearly[1]. In developing the screening levels, USEPA uses a specific target risk level (component 4) combined with an assumed exposure scenario (component 3) and toxicity information from USEPA (component 2) to derive an estimate of a concentration of a constituent in an environmental medium, for example groundwater, (component 1) that is protective of a person in that exposure scenario (for example, drinking water). Similarly, ecological screening levels for surface water are developed by Federal and State agencies to be protective of the wide range of potential aquatic ecological resources, or receptors.

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a receptor (human or ecological) can be exposed without experiencing adverse health effects. Due to the conservative methods used to derive risk-based screening levels, it can be assumed with reasonable certainty that concentrations below screening levels will not result in adverse health effects, and that no further evaluation is necessary. Concentrations above conservative risk-based screening levels do not indicate that a potential risk exists, but only indicate that further evaluation may be warranted.

The surface water and groundwater data were evaluated using human health risk-based and ecological risk-based screening levels drawn from Federal and State sources. The screening levels are used to determine if the concentration levels of constituents could pose a risk to human health or the environment. The evaluation also considers whether constituents are present in groundwater and surface water above screening levels, and if so, if the results could be due to the ash management operations.

Conceptual Site Model

A conceptual site model is used to evaluate the potential for human or ecological exposure to constituents that may have been released to the environment. Some of the questions posed during the CSM evaluation include:

> What is the source? How can constituents be released from the source? What environmental media may be affected by constituent release? How and where do constituents travel within a medium? Is there a point where a receptor (human or ecological) could contact the constituents in the medium? Are the constituent concentrations high enough to potentially exert a toxic effect?

For the evaluation of the ash management operations at the Sioux Energy Center, the coal ash stored in SCPA, SCPB, SCPC, and SCL4A is the potential source. Constituents present in the coal ash can be dissolved into infiltrating water (either from precipitation or from groundwater intrusion) and those constituents may then be present in shallow groundwater, also referred to as the alluvial aquifer. Constituents could move with groundwater as it flows, usually in a downgradient/downhill direction.

[1] USEPA Risk-Based Screening Levels (November 2017). http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

Constituents derived from the coal ash present in groundwater could be introduced to adjacent surface water bodies; here, that could be the Mississippi River, Missouri River, and/or Mississippi Offshoot. Figure 1 shows the facility location and layout, and identifies direction of groundwater flow and the adjacent surface water bodies. Thus, the environmental media of interest for this evaluation are:

- Groundwater on the facility;
- Mississippi River;
- Missouri River; and
- Mississippi Offshoot.

The facility is located between the Mississippi and Missouri Rivers near their confluence, in a largely agricultural area that is provided with municipal water. The direction of groundwater flow has been cataloged for many years at the SEC. Figure 1 shows that the direction of groundwater flow in the northern portion of the site is north towards the Mississippi River, and in the southern portion of the site flow is south towards the Missouri River. It is important to note that groundwater flow within the confluence region is influenced by the flow stage of the Missouri and Mississippi Rivers. If surface water flow in the Mississippi River is higher, then groundwater flow within the confluence is southwest towards the Missouri River. In contrast, if the Missouri River is at a higher stage, then groundwater flow will be more towards the northeast and towards the Mississippi River. Based on their location, groundwater flow at ponds SCPA and SCPB is mainly towards the Mississippi River, but can vary.

The Mississippi Offshoot refers to a channelized area of the Mississippi River immediately adjacent to the SEC. One part of the offshoot is located to the west of the facility's cooling water intake channel. The other part of the offshoot is to the east of the facility's cooling water discharge channel. While these areas can be free-flowing during high river stages, at the time of the sampling of the Mississippi Offshoot (see below), the Mississippi River was in a low flow condition and water within the Offshoot was shallow and not free flowing.

According to a well survey database maintained by the Missouri Department of Natural Resources (MDNR), there are two private wells recorded within a one-mile radius of the facility, as shown on Figure 2. One is located at the facility and is not in service. The Sioux Energy Center obtains its drinking water from the City of Portage Des Sioux's public water supply, located upstream from the facility. The second private well is a deep well, screened in the bedrock aquifer and is located near the northern bank of the Missouri River. Thus, with respect to the shallow aquifer, there are no users of the groundwater from that aquifer.

The Mississippi River is a source of drinking water for the City of Alton, Illinois. The drinking water intake is located approximately 4.5 miles downstream from the SEC. Both the Mississippi and Missouri Rivers are also drinking water sources for the City of St. Louis. The Howard Bend drinking water intake is on the Missouri River well upstream of the Sioux Energy Center. The Chain of Rocks drinking water intake is on the Mississippi River approximately 15 miles downstream from the SEC. The Mississippi Offshoot does not serve as a source of drinking water.

The Mississippi and Missouri Rivers can be used for human recreation – wading, swimming, boating, fishing. Mississippi Offshoot is small in size and would be limited mostly to wading.

Both the rivers serve as habitat for aquatic species – fish, amphibians, etc.

A depiction of the conceptual site model is shown in Figure 3.

Based on this conceptual site model, samples have been collected from each of these environmental media – groundwater, Mississippi River, Missouri River and Mississippi Offshoot. The samples have been analyzed for constituents that are commonly associated with coal ash, as discussed below. However, it is recognized by the USEPA that all of these constituents are naturally occurring and can be found in rocks, soils, water, and sediments; thus, the challenge is to understand what the naturally occurring background levels are for these constituents. [See Attachment A for a more detailed discussion of the constituents present in coal ash and in our natural environment.] The CCR Rule requires sampling and analysis of upgradient and/or background groundwater just for this reason. The same reasoning applies to the surface water, thus, when sampling surface waters for this evaluation, samples for both rivers were collected upstream to assess background conditions, and downstream to assess whether the facility may be having an impact on surface water quality. The sampling is detailed in the next section.

To answer the question, "Are the constituent concentrations high enough to potentially exert a toxic effect?" health risk-based screening levels from Federal and State sources are used for comparison to the data. To be conservative, all data are compared to risk-based drinking water screening level levels, even though the closest downgradient drinking water intake is 4.5 miles downstream in the Mississippi River. All of the surface water data is compared to risk-based human recreational screening levels, and to ecological screening levels.

Thus, this conceptual site model has guided the sample collection, sample analysis, and the risk-based sample results evaluation that are provided in the following sections.

3. Sample Collection

Alluvial Aquifer Groundwater

Eight (8) groundwater monitoring wells were installed to evaluate shallow alluvial groundwater at the SCPA under the CCR Rule, as shown on Figure 1. Six (6) monitoring wells were installed around the perimeter of the SCPA to assess groundwater conditions at the ash management area (UMW-1D through UMW-6D), and two (2) monitoring wells were installed west of the facility to assess background groundwater conditions (S-BMW-1D and S-BMW-3D).

Eleven (11) groundwater monitoring wells were installed to evaluate shallow alluvial groundwater at the SCPB under the CCR Rule, as shown on Figure 1. Nine (9) monitoring wells were installed around the perimeter of the SCPB to assess groundwater conditions at the ash management area (LMW-1S through LMW-9S), and two (2) monitoring wells were installed west of the facility to assess background groundwater conditions (BMW-1S and BMW-3S).

Eight (8) groundwater monitoring wells were installed to evaluate shallow alluvial groundwater at the SCPC under the CCR Rule, as shown on Figure 1. Six (6) monitoring wells were installed around the perimeter of the SCPC to assess groundwater conditions at the ash management area (DG-1 through DG-4 and UG-1A and UG-2), and two (2) of the monitoring wells installed west of the facility are used to assess background groundwater conditions (BMW-1S and BMW-3S).

Six (6) groundwater monitoring wells were installed to evaluate shallow alluvial groundwater at the SCL4A under the CCR Rule, as shown on Figure 1. Four (4) monitoring wells were installed around the perimeter of the SCL4A to assess groundwater conditions at the ash management area (TMW-1 through

TMW-3 and UG-3), and two (2) of the monitoring wells installed west of the facility are used to assess background groundwater conditions (BMW-1S and BMW-3S).

Each groundwater monitoring well was sampled nine (9) times in 2016 and 2017[2].

Mississippi River

In September 2017, Golder collected surface water samples from twelve (12) locations in the Mississippi River (this sampling is not required under the CCR Rule). These locations are shown on Figure 4. At each sample location, shallow samples were collected near the surface of the river. Where the depth of water was greater than four (4) feet, a second sample was collected mid-depth in the river. For the Mississippi River, a total of twenty (20) samples were collected.

To assess water conditions unaffected by facility operations, Golder sampled the Mississippi River at three (3) locations approximately 0.25 miles upstream of the facility (S-MIR-10S through S-MIR-12S). Samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MIR-10S), shallow depth;
- Midstream (S-MIR-12S/D), shallow depth, and deep depth; and
- Near midstream (S-MIR-11S/D), shallow depth, and deep depth.

Golder also sampled the Mississippi River at six (6) locations adjacent to the facility (S-MIR-4S through S-MIR-9S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MIR-4S and S-MIR-7S), shallow depth;
- Midstream (S-MIR-6S/D and S-MIR-9S/D), shallow depth, and deep depth; and
- Near midstream (S-MIR-5S/D and S-MIR-8S/D), shallow depth, and mid-depth.

In addition, Golder sampled three (3) locations approximately 0.25 miles downstream of the facility (S-MIR-1S through S-MIR-3S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MIR-1S), shallow depth;
- Midstream (S-MIR-3S/D), shallow depth, and deep depth; and
- Near midstream (S-MIR-2S/D), shallow depth, and deep depth.

Thus, a total of twenty (20) samples were collected from the Mississippi River.

[2] The CCR Rule requires eight (8) rounds of sampling events to establish baseline conditions in each well. Under the CCR Rule, the ninth sampling round is defined as the "Detection" sampling round.

Missouri River

The southern border of the Sioux Energy Center is near the Missouri River. Golder collected surface water samples from twelve (12) locations in the river in September 2017 (this sampling is not required under the CCR Rule).

Three (3) locations are approximately 0.25 miles upstream of the facility (S-MO-10S through S-MO-12S) and represent water conditions unaffected by facility operations. Golder collected samples to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MO-10S), shallow depth;
- Midstream (S-MO-12S/D), shallow depth, and deep depth; and
- Near midstream (S-MO-11S/D), shallow depth, and deep depth.

Six (6) locations are adjacent to the facility (S-MO-4S through S-MO-9S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MO-4S and S-MO-7S), shallow depth;
- Midstream (S-MO-6S/D and S-MO-9S/D), shallow depth, and deep depth; and
- Near midstream (S-MO-5S/D and S-MO-8S/D), shallow depth, and mid-depth.

Golder collected samples from three (3) locations approximately 0.25 miles downstream of the facility (S-MO-1S through S-MO-3S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MO-1S), shallow depth;
- Midstream (S-MO-3S/D), shallow depth, and deep depth; and
- Near midstream (S-MO-2S/D), shallow depth, and deep depth.

Thus, a total of twenty (20) samples were collected from the Missouri River.

Mississippi Offshoot

The northern border of the Sioux Energy Center is adjacent to a backwater area referred to here as the Mississippi Offshoot. As discussed above, water depth in this area can vary and was not freely flowing at the time of sampling. Golder collected surface water samples from six locations (S-MIO-1 through S-MIO-18) in September 2017. These locations are shown on Figure 4. Samples were collected along the offshoot adjacent to the facility:

- Twelve (12) shallow surface water samples were collected from the area west of the SEC raw water intake (S-MIO-7 through S-MIO-18); and
- Eight (8) surface water samples were collected from the area east of the SEC raw water intake (S-MIO-1 through S-MIO-6). At locations S-MIO-5 and S-MIO-6, the water was deep enough to collect a deep water sample from each location.

Thus, a total of twenty (20) samples were collected from the Mississippi Offshoot area.

4. Sample Analysis

The CCR Rule identifies the constituents that are included for groundwater testing; these are:

Boron	Antimony	Lead
Calcium	Arsenic	Lithium
Chloride	Barium	Mercury
pH	Beryllium	Molybdenum
Sulfate	Cadmium	Selenium
TDS	Chromium	Thallium
Fluoride	Cobalt	Radium 226/228

The CCR Rule requires eight (8) rounds of groundwater sampling and analysis – this was conducted for all wells to provide a baseline for current conditions. All eight rounds of groundwater samples collected through June 2017 were analyzed for all constituents. The samples from an additional ninth round from November 2017 were analyzed for the constituents listed in the first column above (these are the Appendix III constituents under the CCR Rule – the remaining are referred to as Appendix IV constituents). The CCR Rule requires statistical methods be used to determine whether a statistically significant increase (SSI) above background exists for the first column constituents. If so, additional assessment monitoring could be required.

So as to create an appropriate dataset for comparison, the above parameters were also used for the surface water sample analysis except for pH, TDS, and radium 226/228[3]. Two sets of analyses were conducted on the surface water samples. The samples were analyzed for the list above (referred to as the "total (unfiltered)" results), and then an aliquot of each sample was filtered to remove sediments/particulates and then analyzed (referred to as the "dissolved (filtered)" results). This is an important step for the analysis of surface water samples for two reasons:

- Surface water, especially in large rivers, can carry a large sediment load – the total (unfiltered results) include constituent concentrations that are associated with the sediment and not the water; and
- Some of the ecological screening levels used to evaluate the results apply only to dissolved (filtered) data.

The surface water samples were also analyzed for hardness, as some of the ecological screening levels are calculated based on site-specific hardness levels.

5. Risk-Based Screening Levels

A comprehensive set of risk-based screening levels have been compiled for this evaluation for the three types of potential exposures identified in the conceptual site model discussion above:

- Human health drinking water consumption;
- Human health recreational use of surface water; and
- Aquatic ecological receptors for surface water.

[3] As discussed in Section 6, radium was not included in the surface water sampling as it was not detected in the facility's CCR monitoring wells. pH was not outside of the drinking water screening level range in the CCR monitoring wells.

Table 1 provides the human health drinking water and recreational screening levels available from the State of Missouri sources and from Federal sources. Table 2 provides the ecological screening levels.

Drinking Water Screening Levels

The Missouri State drinking water supply levels are essentially the same as the Federal primary drinking water standards, also known as Maximum Contaminant Levels or MCLs. The Missouri State groundwater screening levels provide some additional screening levels not included on their list of drinking water screening levels.

In addition to the MCLs that are enforceable for municipal drinking water supplies, there are Federal secondary MCLs, or SMCLs, that are generally based on aesthetics (taste, color) and are not risk-based. The USEPA also provides risk-based screening levels (RSLs) for tapwater (drinking water).

The selected screening levels used to evaluate potential drinking water exposures are shown on Table 1. Missouri drinking water supply screening levels were used and supplemented with Federal MCLs, then the USEPA risk-based levels for tapwater (RSLs), and finally the Federal SMCLs.

It is important to note that the CCR Rule limits the evaluation of groundwater monitoring data of ash management areas to Federal MCLs or to a comparison with site-specific background. That comparison and evaluation is provided in the CCR Rule Groundwater Monitoring Report prepared by Golder, which this report supplements. The use of a more comprehensive set of screening levels in this evaluation provides a broader risk-based evaluation of the groundwater data than is provided by the CCR Rule requirements.

Recreational Screening Levels

Table 1 provides the State of Missouri human health recreational screening levels, based on fish consumption. The Federal Ambient Water Quality Criteria (AWQC) for consumption of organisms are also provided. Both sources were used to identify the screening levels used in this analysis, as listed on Table 1. The drinking water screening levels used to evaluate surface water are protective for other recreational uses of the river such as swimming, wading, and boating. Note that this evaluation of surface water and its potential uses is above and beyond the requirements of the CCR Rule.

Ecological Screening Levels

The ecological risk-based screening levels for surface water are provided in Tables 2. As noted above, some of the screening levels are based on the hardness of the water. Because the hardness of the Mississippi and Missouri Rivers are similar, Table 2 provides one set of ecological screening levels for the Mississippi and Missouri Rivers based on their combined hardness data. Note that this ecological evaluation of surface water is above and beyond the requirements of the CCR Rule.

6. Results

The level of analysis and comparison to risk-based screening levels presented below is above and beyond the requirements of the CCR Rule. The analysis of the groundwater results required by the CCR Rule is presented in the 2017 Groundwater Monitoring Annual Report: *https://www.ameren.com/Environment/managing-ccrs/ash-pond-closure*. This report serves to supplement that report by providing the risk-based analysis of groundwater and surface water, so that the groundwater results can be understood in their broader environmental context.

Groundwater – CCR Rule Evaluation

Ameren Missouri has filed on its website reports and notification required by the federal CCR Rule, as noted above, and additional reports will be prepared and posted on Ameren's website per the CCR Rule. The statistical analysis of the data has indicated an SSI for samples collected from the following monitoring wells (see Figure 1):

- SCPA – UMW-1D, UMW-2D, UMW-3D, UMW-4D, UMW-5D, UMW-6D
- SCPB – LMW-1S, LMW-2S, LMW-3S, LMW-4S, LMW-5S, LMW-6S, LMW-7S, LMW-8S, LMW-9S
- SCPC – UG-2
- SLC4A – none

Analytes exhibiting an SSI include pH, boron, calcium, chloride, fluoride, sulfate, and TDS.

The SSI values reflect a statistical evaluation that compares mathematically the results of the various rounds of samples to background water quality as required under the CCR rule. However, such values without further evaluation do not establish that there is an actual adverse impact to human health or the environment. The CSM process and screening analysis described in this report provides the relevant context for such groundwater monitoring results and whether the surface impoundments pose a true risk to human health and the environment. As explained in the remaining sections of this report, based upon surface water sampling data and the application of risk assessment principles uniformly adopted by USEPA and state environmental regulators including the Missouri Department of Natural Resources (MDNR), no such risk exists.

Groundwater – Risk-Based Evaluation

Groundwater data from all nine (9) rounds of groundwater monitoring were compared to the human health risk-based drinking water screening levels. Figure 1 shows that the monitoring wells are all located at the edges of the SCPA, SCPB, SCPC, and SCL4A and, therefore, provide worst-case groundwater results.

Tables 3 through 6 provide a summary of the results. Analytical results greater than the risk-based drinking water screening levels are provided; analytical results below the risk-based drinking water screening levels or not detected are indicated by "<". The vast majority of the results are below the human health risk-based drinking water screening levels.

UMW-2D, -3D, and -4D, along the perimeter of the SCPA, have the most results above the screening levels: these are for boron, sulfate, TDS, lithium (UMW-4D only), and molybdenum.

LMW-5S and LMW-8S, along the perimeter of the SCPB, have the most results above the screening levels: these are for LMW-5S – boron, sulfate, TDS, lithium, and molybdenum; and for LMW-8S – boron, sulfate, TDS, cobalt, and molybdenum. LMW-2S, -6S, and -9S also have results above screening levels for some of these constituents.

DG-1, DG-2, and DG-4, associated with the SCPC, are the only wells with a result above a screening level other than for TDS: these are for lithium only.

Only one well (UG-3) associated with the SCL4A, has a result above a screening level: these are for TDS and one result for cobalt.

The striking aspect of the analysis shown in Tables 3 through 6 is how few results are above a conservative risk-based drinking water screening level for human health, given that the wells are immediately adjacent to each of the ash management areas[4]. Even for the very few results that may be above screening values for some of the sampling events, including the SSI results identified under the CCR Rule, there is no complete drinking water exposure pathway to groundwater. Where there is no exposure, there is no risk.

Mississippi River

The comparison to risk-based screening levels of the analytical results for the Mississippi River are presented in Tables 7 through 9.

- Table 7 – Comparison to drinking water screening levels – No results are above risk-based screening levels.
- Table 8 – Comparison to human health recreational screening levels – Only total and dissolved concentrations of arsenic are above their screening levels. The arsenic results upstream and downstream are similar, thus, indicative of normal river conditions.
- Table 9 – Comparison to ecological screening levels – No results are above risk-based screening levels.

There are no analytical results for the Mississippi River that above drinking water screening or ecological levels. While arsenic concentrations in the river are slightly above the human health recreational screening levels, the concentrations are similar upstream and downstream and, therefore, not likely attributable to the ash impoundments. In fact, the concentrations of arsenic in all of the rivers sampled by Ameren for this evaluation (the Mississippi River at Sioux, Meramec, and Rush Island; the Missouri River at Labadie and Sioux; and the Meramec River at Meramec) are all very similar with total results ranging from 0.0012 to 0.005 mg/L. This underscores the fact that arsenic is naturally occurring in our environment, as discussed in more detail in Attachment A.

Thus, the Mississippi River sampling results do not show evidence of adverse impact of constituents derived from the ash management at SEC. This is important in that the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

Missouri River

The comparison to risk-based screening levels of the analytical results for the Missouri River are presented in Tables 10 through 12.

- Table 10 – Comparison to drinking water screening levels – Only total and dissolved concentrations of lithium are above their screening levels. The lithium results upstream and downstream are similar, thus, indicative of normal river conditions.
- Table 11 – Comparison to human health recreational screening levels – Only total and dissolved concentrations of arsenic are above their screening levels. The arsenic results upstream and downstream are similar, thus, indicative of normal river conditions.

[4] Out of the 5453 groundwater analyses conducted, only 420 results are above a drinking water screening level (see Tables 3 through 6). Put another way, approximately 92% of the groundwater results for the CCR Rule monitoring wells located at the edge of the SEC impoundments are below drinking water screening levels.

- Table 12 – Comparison to ecological screening levels – No results are above risk-based screening levels.

Lithium concentrations are above drinking water screening levels and arsenic concentrations are above human recreational screening levels in the Missouri River. However, the concentrations of both constituents are similar upstream and downstream and, therefore, not likely attributable to the ash impoundments.

Thus, the Missouri River sampling results do not show evidence of adverse impact of constituents derived from of ash management at the SEC. This is important in that the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

Mississippi Offshoot

The comparison to risk-based screening levels of the analytical results for the area referred to here as the Mississippi Offshoot are presented in Tables 13 through 15.

- Table 13 – Comparison to drinking water screening levels – No results are above risk-based screening levels.
- Table 14 – Comparison to human health recreational screening levels – Only total and dissolved concentrations of arsenic are above their screening levels. Concentrations seen in the Mississippi Offshoot are very low and similar to those seen in the samples collected from the Mississippi River, as discussed above. As such, these results are indicative of normal conditions.
- Table 15 – Comparison to ecological screening levels - Only total and dissolved concentrations of selenium are above screening levels. Selenium was detected above the ecological screening level of 5 ug/L in only 6 of the 20 total surface water analyses, and in only 4 of the 20 dissolved surface water analyses. Selenium was detected above the ecological screening level of 5 ug/L in only 10 of the 294 groundwater samples collected from CCR Rule monitoring wells. Selenium concentrations in these 10 samples ranged from 5.5 to 15.1 ug/L. Thus, it is unlikely that groundwater from the coal ash management areas at the facility is the source of selenium in the Mississippi Offshoot.

There are no analytical results for the Mississippi Offshoot that above drinking water screening levels. While arsenic concentrations in the Offshoot are slightly above the human health recreational screening levels, these concentrations are similar to background concentrations found in the Mississippi River. Selenium concentrations are slightly above ecological screening levels in some of the Mississippi Offshoot samples, but groundwater is unlikely to be the source of the selenium as only 10 of the 294 groundwater samples collected from CCR Rule monitoring wells are above the ecological screening level.

Thus, the Mississippi Offshoot sampling results do not show evidence of adverse impact of constituents derived from the ash management operations at SEC.

NPDES Outfall WET Testing Results

There are two permitted outfalls under the National Pollutant Discharge Elimination System (NPDES) program that are associated with impoundment operations: Outfall 002 and Outfall 006. The effluent water is tested for toxicity on a periodic basis, as required by the permit, for these two outfalls as well as Outfall 001, which is associated with facility non-contact cooling water. WET (whole effluent toxicity) testing involves mixing the effluent water from the outfalls with Mississippi River water collected

upstream to simulate mixing of the effluent upon discharge to the river. Tests are also conducted on the upstream Mississippi River water and on laboratory control water. If the effluent treatment results are not statistically different from the control results, then the effluent is considered to have passed the WET test.

Table 16 shows the results of the direct aquatic organism toxicity testing that is conducted using the effluent from each of the three outfalls. The results indicate no evidence of aquatic toxicity of the outfall effluents. This is a direct biological measure demonstrating the lack of toxicity of the Outfalls 002 and 006 effluents.

7. Derivation of Risk-Based Screening Levels for Groundwater

The results presented here demonstrate that the 51-year history of ash management activities at the surface impoundments have not had an adverse effect on human health or the environment. While some groundwater results are above drinking water screening levels, there is no pathway of exposure to the on-site groundwater (i.e., the shallow alluvial groundwater is not used as a source of drinking water). For those waters where a theoretical pathway of exposure exists (i.e., the Mississippi River and the Missouri River), with the exception of a few results for selenium in the Mississippi Offshoot, there is no evidence of impact and samples are either below screening levels or consistent with background.

Ameren's facilities are located on major river systems with a massive and rapid fiver flow. In this section, we have attempted to illustrate how the groundwater – which is a fraction of the volume and flow rate of the river – may interact with a surface body under an assumed set of criteria and conditions (see Attachment B). Such an exercise in assumptions can help put in context whether a theoretical risk to public water supplies exists, particularly where, as here, actual surface water samples have been collected and evaluated.

However, impacts to groundwater does not mean that surface waters are impaired. The degree of interface between groundwater and surface waters is variable and complex and dependent upon a variety of factors including gradient and flow rate. It is possible, however, to determine the maximum concentration level that would need to be present on-site in groundwater and still be protective of the surface water environment, assuming gradient and flow rates are such that groundwater flows into the surface water. Groundwater and surface waters flow at very different rates and volumes. The Mississippi River is the largest river system in North America and as depicted on Table 17 and Attachment B, when compared to groundwater, its dilution factor is greater than 90,000. The dilution factor for the Missouri River, one of the longest rivers in North America, is greater than 100,000 as shown in Table 18.

It is possible to calculate a protective screening level for groundwater based upon the amount of dilution that occurs under the above assumption. This calculated risk-based screening level for groundwater can be used to determine whether an on-site groundwater concentration level is protective of the river. Stated differently, at what concentration level does groundwater entering the river system pose a human health or ecological risk?

Table 17 for the Mississippi River and Table 18 for the Missouri River are summarized below and show the application of the dilution factor to calculate alternative risk-based screening levels for the following parameters: boron, sulfate, TDS, cobalt, lithium, and molybdenum. These constituents have one or more monitoring well concentrations above the drinking water screening levels, as shown in Tables 3 through 6. For each constituent, the human health drinking water and recreational screening levels are

presented as well as the ecological screening level. The lowest of the three screening levels is then identified for surface water. The dilution factor is then applied to this lowest screening level for surface water to result in the groundwater alternative risk-based screening level, which is what is shown in the table below.

This evaluation is not limited to only those constituents for which SSIs have been identified. The constituents listed here are those for which there is one or more groundwater result above a risk-based screening level[5].

DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSISSIPPI RIVER (see Table 17)

	Estimated Dilution Factor (d)	90,000			
Constituents*	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level** (mg/L)**	**Maximum SEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum SEC Groundwater Concentration**
Boron***	2	180000	31.2	S-UMW-4D	>5700
Sulfate***	250	22500000	1100	S-LMW-5S	>20000
TDS***	500	45000000	1760	S-LMW-5S	>25000
Cobalt	0.006	540	0.0122	S-LMW-9S	>44000
Lithium	0.04	3600	0.0623	S-LMW-5S	>57000
Molybdenum	0.1	9000	8.3	S-UMW-4D	>1000

DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSOURI RIVER (see Table 18)

	Estimated Dilution Factor (d)	100,000			
Constituents*	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level** (mg/L)**	**Maximum SEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum SEC Groundwater Concentration**
Boron***	2	200000	31.2	S-UMW-4D	>6400
Sulfate***	250	25000000	1100	S-LMW-5S	>22000
TDS***	500	50000000	1760	S-LMW-5S	>28000
Cobalt	0.006	600	0.0122	S-LMW-9S	>49000
Lithium	0.04	4000	0.0623	S-LMW-5S	>64000
Molybdenum	0.1	10000	8.3	S-UMW-4D	>1200

*** A dilution factor is not directly applicable to pH, thus it is not included in this analysis.**
**** Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.**
***** Constituents for which an SSI has been identified. Note that although an SSI was identified for boron, sulfate, and TDS for SCPA and SCPB, these constituents are not present in surface water at concentrations above the risk-based screening levels. Also note that although an SSI has been identified for chloride and fluoride for SCPA and SCPB, and fluoride for one well at SCPC, these constituents are not present in groundwater at concentrations above risk-based screening levels.**

[5] Note that under the CCR Rule, statistically significant levels of Appendix IV constituents are determined after Assessment Monitoring has been conducted.

The screening levels depicted above are calculated in units of milligrams of constituent per liter of water (mg/L). One mg/L is equivalent to one million parts per million.[6,7]

The tables above identify the maximum groundwater concentration of each constituent detected in the SEC monitoring wells. The comparison between the target levels and the maximum concentrations indicates that there is a wide margin of safety between the two values. This margin is shown in the last column of the table. To illustrate, concentration levels of molybdenum and lithium would need to be more than 1,000 and 64,000 times higher, respectively, than currently measured levels before an adverse impact in the Missouri River could occur.

This evaluation indicates that not only do the present concentrations of constituents in groundwater at the Sioux Energy Center not pose a risk to human health or the environment, but even much higher concentrations would not be harmful.

8. Closure of the SCPA, SCPB, SCPC, SCL4A

Current plans for the facility are to convert to dry ash handling and to close the surface impoundments[8]. Following the scheduled completion of dry ash conversion projects in 2020, the ash impoundment system will be removed from service. Closure of the surface impoundments is expected to be completed by early 2022. Closure is estimated to reduce the movement of CCR constituents from the surface impoundments discharge (or flux) of water into the alluvial aquifer to groundwater by 90% or more. This reduction is the result of several factors: closure will cease the flow of water and ash to the surface impoundments, a cap will be installed that will limit infiltration of precipitation, and the closure plan includes stormwater run-on and run-off controls to route stormwater off of the capped area and away from the surface impoundments. It is likely that concentrations of constituents in groundwater at the surface impoundments will decrease post-closure.

9. Summary

This comprehensive evaluation demonstrates that there are no adverse impacts on human health from either surface water or groundwater uses resulting from coal ash management practices at the Sioux Energy Center.

[6] Note that because the target level calculation is a mathematical exercise, certain results may not be applicable in the real world. For example, the result for sulfate is 22.5 million parts per million, which is not physically possible. However, what this means is that there is no level of sulfate that could be present in the groundwater at the SEC that could result in a risk of harm to human health or the environment.

[7] A million parts per million is equivalent to 1 penny in $10,000 worth of pennies, 1 second in 11.5 days, or 1 inch in 15.8 miles.

[8] Importantly, the CCR Rule promulgated by USEPA in 2015 is both under appeal [Utility Solid Waste Activities, et al v. EPA, Docket No. 15-01219, DC Circuit Court of Appeals Sept 13, 2017, Letter from Pruitt to reconsider.] and is being reconsidered by the current Administration. Notwithstanding any proposed changes to the federal CCR Rule, Ameren Missouri intends to implement its closure plan and schedule.

10. Attachments

TABLES

1 HUMAN HEALTH SCREENING LEVELS

2 ECOLOGICAL SCREENING LEVELS

3 SUMMARY OF SCPA SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS

4 SUMMARY OF SCPB SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS

5 SUMMARY OF SCPC UTILITY WASTE LANDFILL CELL 1 GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS

6 SUMMARY OF SCL4A UTILITY WASTE LANDFILL CELL 4A GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS

7 SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS

8 SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS

9 SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS

10 SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS

11 SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVEL

12 SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS

13 SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS

14 SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS

15 SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS

16 SUMMARY OF WHOLE EFFLUENT TOXICITY TESTING RESULTS FOR NPDES OUTFALL 001, 002, AND 006

17 DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSISSIPPI RIVER

18 DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSOURI RIVER

FIGURES

1 ESTIMATED LENGTH OF DISCHARGE AND EXAMPLE GROUNDWATER FLOW MAP

2 SIOUX PLANT WELL LOCATIONS

3 CONCEPTUAL SITE MODEL

4 SURFACE WATER SAMPLING LOCATIONS SIOUX ENERGY CENTER (still says Draft)

ATTACHMENTS

ATTACHMENT A – CONSTITUENTS PRESENT IN COAL ASH AND IN OUR NATURAL ENVIRONMENT

ATTACHMENT B – SIOUX ENERGY CENTER DILUTION FACTOR CALCULATIONS

TABLES

TABLE 1
HUMAN HEALTH SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

			Missouri State Water Quality Screening Levels (mg/L)			Federal Water Quality Screening Levels (mg/L)				Selected Screening Level (mg/L)	
Constituent	Abbreviation	CASRN	Human Health Fish Consumption (a)	Drinking Water Supply (a)	Groundwater (a)	USEPA AWQC Human Health Consumption of Organism Only (b)	MCLs (c)	SMCLs (c)	November 2017 USEPA Tapwater RSLs (d)	Drinking Water (e)	Recreational Use (f)
Antimony	Sb	7440-36-0	4.3	0.006	0.006	0.64	0.006	NA	0.0078 (m)	0.006	4.3
Arsenic	As	7440-38-2	NA	0.05	0.05	0.00014 (i)	0.01	NA	0.000052	0.05	0.00014
Barium	Ba	7440-39-3	NA	2	2	NA	2	NA	3.8	2	NA
Beryllium	Be	7440-41-7	NA	0.004	0.004	NA	0.004	NA	0.025	0.004	NA
Boron	B	7440-42-8	NA	NA	2	NA	NA	NA	4	4 (q)	NA
Cadmium	Cd	7440-43-9	NA	0.005	0.005	NA	0.005	NA	0.0092	0.005	NA
Calcium	Ca	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	Cl	7647-14-5	NA	250	NA	NA	NA	250	NA	250	NA
Chromium	Cr	16065-83-1 (g)	NA	0.1	0.1	NA	0.1 (j)	NA	22 (n)	0.1	NA
Cobalt	Co	7440-48-4	NA	NA	1	NA	NA	NA	0.006	0.006	NA
Fluoride	Fl	16984-48-8	NA	4	4	NA	4	2	0.8	4	NA
Lead	Pb	7439-92-1	NA	0.015	0.015	NA	0.015 (k)	NA	0.015	0.015	NA
Lithium	Li	7439-93-2	NA	NA	NA	NA	NA	NA	0.04	0.04	NA
Mercury	Hg	7487-94-7 (h)	NA	0.002	0.002	NA	0.002 (l)	NA	0.0057 (o)	0.002	NA
Molybdenum	Mo	7439-98-7	NA	NA	NA	NA	NA	NA	0.1	0.1	NA
Radium 226/228 (pCi/L)	Ra 226/228	RADIUM226228	NA	NA	NA	NA	5	NA	NA	5	NA
Selenium	Se	7782-49-2	NA	0.05	0.05	4.2	0.05	NA	0.1	0.05	4.2
Sulfate	SO4	7757-82-6	NA	250	NA	NA	NA	250	NA	250	NA
Thallium	Tl	7440-28-0	0.0063	0.002	0.002	0.00047	0.002	NA	0.0002 (p)	0.002	0.0063
Total Dissolved Solids	TDS	TDS	NA	NA	NA	NA	NA	500	NA	500	NA
pH (std)	--	PHFLD	NA	NA	NA	NA	NA	6.5 - 8.5	NA	6.5 - 8.5	NA

Notes:

AWQC - Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Registry Number.
HI - Hazard Index (noncancer child).
MCL - Maximum Contaminant Level.
mg/L - microgram per liter.
NA - not available.
pCi/L - picoCurie per liter.
RSL - Risk-based Screening Levels (USEPA).
TR - Target Risk (carcinogenic).
USEPA - United States Environmental Protection Agency.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. Updated January 29, 2014. Per 10 CSR 20-7.031(4)(B)(2), the criteria for Human Protection Fish Consumption apply to dissolved metals data. All other criteria apply to total concentrations.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012.
http://water.epa.gov/drink/contaminants/index.cfm
(d) - USEPA Risk-Based Screening Levels (November 2017). Values for tapwater. HI = 1.0, TR = 1E-06.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(e) - The hierachy for selecting the Human Health Screening Level for Drinking Water is: Missouri State Water Quality Criteria for Drinking Water Supply (a); Federal USEPA MCL for Drinking Water (c); Federal June 2017 USEPA Tapwater RSL (d); Federal USEPA SMCL for Drinking Water (c).
(f) - The hierachy for selecting the Human Health Screening Level for Recreational Use is: Missouri State Water Quality Criteria for Human Health Fish Consumption (a); Federal USEPA AWQC for Human Health Consumption of Organism Only (b).
(g) - CAS number for Trivalent Chromium.
(h) - CAS number for Mercuric Chloride.
(i) - Value applies to inorganic form of arsenic only.
(j) - Value for Total Chromium.
(k) - Lead Treatment Technology Action Level is 0.015 mg/L.
(l) - Value for Inorganic Mercury.
(m) - RSL for Antimony (metallic) used for Antimony.
(n) - RSL for Chromium (III), Insoluble Salts used for Chromium.
(o) - RSL for Mercuric Chloride used for Mercury.
(p) - RSL for Thallium (Soluble Salts) used for Thallium.
(q) - RSL selected for Boron as the Missouri State Water Quality Groundwater screening level is based on irrigation.

TABLE 2
ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Missouri State Water Quality Criteria (mg/L)						Federal Water Quality Criteria (mg/L)					
		Site-Specific Protection of Aquatic Life Acute (a)		Site-Specific Protection of Aquatic Life Chronic (a)		Irrigation (a)	Livestock Wildlife Watering (a)	Site-Specific USEPA Aquatic Life AWQC Freshwater Acute (b)		Site-Specific USEPA Aquatic Life AWQC Freshwater Chronic (b)			
Constituent	**CASRN**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Total**	**Total**	**Dissolved**	**Total**	**Dissolved**
Antimony (c)	7440-36-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	7440-38-2	NA	NA	NA	0.02	0.1	NA	0.34	0.34	0.15	0.15
Barium (c)	7440-39-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7440-41-7	NA	NA	NA	0.005	0.1	NA	NA	NA	NA	NA
Boron	7440-42-8	NA	NA	NA	NA	2	NA	NA	NA	NA	NA
Cadmium	7440-43-9	0.013	0.011	0.00053	0.0005	NA	NA	0.0046 (f)	0.0042 (g)	0.0016 (f)	0.0014 (g)
Calcium (c)	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	16887-00-6	NA	NA	NA	NA	NA	NA	860	NA	230	NA
Chromium	7440-47-3	3.8	1.2	0.18	0.16	0.1 (e)	NA	3.8 (e,f)	1.2 (e,g)	0.18 (e,f)	0.16 (e,g)
Cobalt	7440-48-4	NA	NA	NA	NA	NA	1	NA	NA	NA	NA
Fluoride	16984-48-8	NA	NA	NA	NA	NA	4	NA	NA	NA	NA
Lead	7439-92-1	0.26	0.17	0.0101	0.0066	NA	NA	0.26 (f)	0.17 (g)	0.0101 (f)	0.0066 (g)
Lithium (c)	7439-93-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	0.0024	0.0024	0.0005	0.0005	NA	NA	0.0016	0.0014	0.00091	0.00077
Molybdenum (c)	7439-98-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	NA	NA	NA	0.005	NA	NA	0.013 (d)	0.013 (d)	0.005 (d)	0.005 (d)
Sulfate	14808-79-8	NA	NA	1690 (f,h)	NA	NA	NA	NA	NA	NA	NA
Thallium (c)	7440-28-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (c)	TDS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

AWQC - USEPA Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Registry Number.
CMC - Criterion Maximum Concentration.
mg/L - milligram per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. January 29, 2014.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf. Total values provided.
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results

(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed December 2014.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (f).
USEPA provides AWQC for both total and dissolved results.

(c) - Water quality criteria from the presented sources are not available for this constituent.

(d) - Acute AWQC is equal to 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 ug/L and 12.82 ug/L, respectively. Calculated assuming that all selenium is present as selenate, a likely overly conservative assumption.

(e) - Value for trivalent chromium used.

(f) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Mississippi and Missouri River of 247 mg/L as $CaCO_3$ used.

(g) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Mississippi and Missouri River of 247 mg/L as $CaCO_3$ used.

(h) - Chloride dependent value (default chloride value of 25 mg/L is assumed) for Missouri River and Mississippi River.
When chloride is greater than or equal to 25 and less than or equal to 500 mg/L and hardness is between 100 and 500 mg/L,
sulfate limit in mg/L = [1276.7 + 5.508 (hardness) − 1.457 (chloride)] * 0.65.

TABLE 3
SUMMARY OF SCPA SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-BMW-1D (b)	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	506	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-BMW-3D (b)	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Dec-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Feb-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Apr-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 1)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 2)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-1D	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	588	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	551	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-2D	Mar-16	15.1	<	<	<	524	1010	<	<	<	<	<	<	<	<	<	<	<	<	1.31	<	<
	May-16	18.8	<	<	<	641	1110	<	<	<	<	<	<	<	<	<	<	<	<	1.44	<	<
	Jul-16	16.8	<	<	<	594	1090	<	<	<	<	<	<	<	<	<	<	<	<	1.36	<	<
	Sep-16	14.7	<	<	<	528	1010	<	<	<	<	<	<	<	<	<	<	<	<	1.27	<	<
	Nov-16	10.6	<	<	<	444	823	<	<	<	<	<	<	<	<	<	<	<	<	0.989	<	<
	Jan-17	14.5	<	<	<	477	885	<	<	<	<	<	<	<	<	<	<	<	<	1.31	<	<
	Mar-17	25.2	<	<	<	738	1380	<	<	<	<	<	<	<	<	<	<	<	<	1.88	<	<
	Jun-17	24.2	<	<	<	784	1220	<	<	<	<	<	<	<	<	<	<	<	<	2.17	<	<
	Nov-17	22.1	<	<	NA	722	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-3D	Mar-16	30.2	<	<	<	833	1450	<	<	<	<	<	<	<	<	<	<	<	<	4.8	<	<
	May-16	26.1	<	<	<	663	1210	<	<	<	<	<	<	<	<	<	<	<	<	4.25	<	<
	Jul-16	24	<	<	<	565	1150	<	<	<	<	<	<	<	<	<	<	<	<	3.77	<	<
	Sep-16	25.2	<	<	<	684	1170	<	<	<	<	<	<	<	<	<	<	<	<	4.28	<	<
	Nov-16	26.4	<	<	<	810	1120	<	<	<	<	<	<	<	<	<	<	<	<	4.23	<	<
	Jan-17	21.3	<	<	<	531	1020	<	<	<	<	<	<	<	<	<	<	<	<	3.43	<	<
	Mar-17	25	<	<	<	603	1090	<	<	<	<	<	<	<	<	<	<	<	<	4.12	<	<
	Jun-17	24.2	<	<	<	664	1130	<	<	<	<	<	<	<	<	<	<	<	<	3.92	<	<
	Nov-17	24.1	<	<	NA	710	1150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-4D	Mar-16	31.2	<	<	<	511	1100	<	<	<	<	<	<	<	<	<	<	<	<	8.3	<	<
	May-16	26.3	<	<	<	397	1000	<	<	<	<	<	<	<	<	<	<	<	<	7.22	<	<
	Jul-16	26.5	<	<	<	522	1100	<	<	<	<	<	<	<	<	<	<	<	<	7.55	<	<
	Sep-16	24.1	<	<	<	624	1110	<	<	<	<	<	<	<	<	<	<	<	<	7.2	<	<
	Nov-16	24.6	<	<	<	600	1020	<	<	<	<	<	<	<	<	<	<	0.0413	<	7.19	<	<
	Jan-17	28.6	<	<	<	550	1120	<	<	<	<	<	<	<	<	<	<	0.0442	<	7.83	<	<
	Mar-17	23	<	<	<	484	1010	<	<	<	<	<	<	<	<	<	<	<	<	6.48	<	<
	Jun-17	21.6	<	<	<	439	947	<	<	<	<	<	<	<	<	<	<	<	<	6.12	<	<
	Nov-17	27	<	<	NA	544	1010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-5D	Mar-16	10.8	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.264	<	<
	May-16	11.8	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.271	<	<
	Jul-16	12.9	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.28	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.112	<	<
	Nov-16	12.4	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.253	<	<
	Jan-17	5.97	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.254	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.242	<	<
	Jun-17	7.24	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.27	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3
SUMMARY OF SCPA SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-UMW-6D	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.106	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.109	<	<	<
	Sep-16	11.4	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.259	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.114	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.11	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.108	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.115	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summary Ratio of # Results above the SL : Total # Results		34:72	0:72	0:72	0:64	27:72	30:72	0:64	0:64	0:64	0:64	0:64	0:64	0:64	0:64	0:64	2:64	0:64	39:64	0:64	0:64	0:64

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not applicable/Not Analyzed.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background wells.

TABLE 4
SUMMARY OF SCPB SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-BMW-1S (b)	Mar-16	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	517	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	526	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	565	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	540	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	532	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	526	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-BMW-3S (b)	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Dec-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Feb-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Apr-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 1)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 2)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-1S	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	431	915	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	307	865	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-2S	Mar-16	13.3	<	<	<	338	945	<	<	<	<	<	<	<	<	<	<	<	1.4	<	<	<
	May-16	12.7	<	<	<	371	915	<	<	<	<	<	<	<	<	<	<	<	1.47	<	<	<
	Jul-16	12.2	<	<	<	260	980	<	<	<	<	<	<	<	<	<	<	<	1.5	<	<	<
	Sep-16	11	<	<	<	<	1040	<	<	<	<	<	<	<	<	<	<	<	1.16	<	<	<
	Nov-16	10.7	<	<	<	<	987	<	<	<	<	<	<	<	<	<	<	<	1.04	<	<	<
	Jan-17	8.86	<	<	<	<	1100	<	<	<	<	<	<	<	<	<	<	<	0.861	<	<	<
	Mar-17	8.15	<	<	<	<	1180	<	<	<	<	<	<	<	<	<	<	<	0.798	<	<	<
	Jun-17	9.66	<	<	<	265	1090	<	<	<	<	<	<	<	<	<	<	<	1.07	<	<	<
	Nov-17	11.6	<	<	NA	268	958	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-3S	Mar-16	<	<	<	<	<	536	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	512	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	512	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	516	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	581	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	572	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	545	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-4S	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	626	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	593	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	542	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	525	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	527	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	592	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	604	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	544	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-5S	Mar-16	11.9	<	<	<	842	1610	<	<	<	<	<	<	<	<	<	<	0.0623	<	0.318	<	<
	May-16	11	<	<	<	812	1760	<	<	<	<	<	<	<	<	<	<	0.0595	<	0.373	<	<
	Jul-16	11.8	<	<	<	790	1620	<	<	<	<	<	<	<	<	<	<	0.0608	<	0.497	<	<
	Sep-16	13.8	<	<	<	968	1730	<	<	<	<	<	<	<	<	<	<	0.0604	<	0.753	<	<
	Nov-16	14.2	<	<	<	1100	1720	<	<	<	<	<	<	<	<	<	<	0.0604	<	0.872	<	<
	Jan-17	10.8	<	<	<	749	1390	<	<	<	<	<	<	<	<	<	<	0.0574	<	0.668	<	<
	Mar-17	11.1	<	<	<	713	1390	<	<	<	<	<	<	<	<	<	<	0.053	<	0.714	<	<
	Jun-17	12.6	<	<	<	771	1550	<	<	<	<	<	<	<	<	<	<	0.0555	<	0.87	<	<
	Nov-17	8.22	<	<	NA	585	1180	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4
SUMMARY OF SCPB SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																			
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-LMW-6S	Mar-16	13.3	<	<	<	991	1750	<	<	<	<	<	<	<	0.0061	<	<	<	<	<	<	<
	May-16	13.9	<	<	<	880	1680	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	13.4	<	<	<	858	1680	<	<	<	<	<	<	<	0.0069	<	<	<	<	<	<	<
	Sep-16	13.4	<	<	<	842	1610	<	<	<	<	<	<	<	0.0075	<	<	<	<	<	<	<
	Nov-16	13.9	<	<	<	823	1560	<	<	<	<	<	<	<	0.0072	<	<	<	<	<	<	<
	Jan-17	15.6	<	<	<	856	1650	<	<	<	<	<	<	<	0.008	<	<	<	<	<	<	<
	Mar-17	16.2	<	<	<	1030	1720	<	<	<	<	<	<	<	0.0085	<	<	<	<	<	<	<
	Jun-17	14.5	<	<	<	774	1590	<	<	<	<	<	<	<	0.0072	<	<	<	<	<	<	<
	Nov-17	18	<	<	NA	792	1500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-7S	Mar-16	<	<	<	<	337	940	<	<	<	<	<	<	<	0.0065	<	<	<	<	<	<	<
	May-16	<	<	<	<	301	1030	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	313	1020	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	293	979	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	335	1050	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	371	1070	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	443	1090	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	426	1180	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	519	1140	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-8S	Mar-16	5.78	<	<	<	396	807	<	<	<	<	<	<	<	0.0076	<	<	<	<	<	<	<
	May-16	4.9	<	<	<	368	826	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	4.81	<	<	<	361	877	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	5.66	<	<	<	386	822	<	<	<	<	<	<	<	<	<	<	<	0.124	<	<	<
	Nov-16	5.89	<	<	<	386	823	<	<	<	<	<	<	<	<	<	<	<	0.148	<	<	<
	Jan-17	6.06	<	<	<	402	773	<	<	<	<	<	<	<	0.0066	<	<	<	0.169	<	<	<
	Mar-17	5.88	<	<	<	417	860	<	<	<	<	<	<	<	0.0089	<	<	<	0.173	<	<	<
	Jun-17	6.5	<	<	<	422	976	<	<	<	<	<	<	<	0.0061	<	<	<	0.346	<	<	<
	Nov-17	6.88	<	<	NA	463	941	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-9S	Mar-16	<	<	<	<	316	1040	<	<	<	<	<	<	<	0.0122	<	0.0446	<	<	<	<	<
	May-16	<	<	<	<	328	1160	<	<	<	<	<	<	<	0.0101	<	0.0451	<	<	<	<	<
	Jul-16	<	<	<	<	320	1220	<	<	<	<	<	<	<	0.0103	<	0.0456	<	<	<	<	<
	Sep-16	<	<	<	<	303	1170	<	<	<	<	<	<	<	0.0115	<	0.0487	<	<	<	<	<
	Nov-16	<	<	<	<	310	1150	<	<	<	<	<	<	<	0.0097	<	0.051	<	<	<	<	<
	Jan-17	<	<	<	<	286	1090	<	<	<	<	<	<	<	0.0094	<	0.054	<	<	<	<	<
	Mar-17	<	<	<	<	282	1110	<	<	<	<	<	<	<	0.0093	<	0.0481	<	<	<	<	<
	Jun-17	<	<	<	<	287	1090	<	<	<	<	<	<	<	<	<	0.0417	<	<	<	<	<
	Nov-17	<	<	<	NA	302	997	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summary Ratio of # Results above the SL : Total # Results		36:99	0:99	0:99	0:88	52:99	79:99	0:88	0:88	0:88	0:88	0:88	0:88	0:88	19:88	0:88	16:88	0:88	21:88	0:88	0:88	0:88

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not applicable/Not Analyzed.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background monitoring well also associated with SCPC and SCL4A.

TABLE 5
SUMMARY OF SCPC UTILITY WASTE LANDFILL CELL 1 GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-BMW-1S (b)	Mar-16	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	517	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	526	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	565	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	540	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	532	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	526	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-BMW-3S (b)	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Dec-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Feb-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Apr-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 1)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 2)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-DG-1	May-16	<	<	<	<	<	526	<	<	<	<	<	<	<	<	<	<	0.0413	<	<	<	<
	Jun-16	<	<	<	<	<	530	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	518	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-DG-2	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	504	<	<	<	<	<	<	<	<	<	<	0.0404	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-DG-3	May-16	<	<	<	<	<	540	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	557	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	531	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	580	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	535	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	528	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	545	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	532	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	521	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-DG-4	May-16	<	<	<	<	<	551	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	564	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	543	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	637	<	<	<	<	<	<	<	<	<	<	0.0419	<	<	<	<
	Nov-16	<	<	<	<	<	563	<	<	<	<	<	<	<	<	<	<	0.0414	<	<	<	<
	Jan-17	<	<	<	<	<	587	<	<	<	<	<	<	<	<	<	<	0.0422	<	<	<	<
	Mar-17	<	<	<	<	<	637	<	<	<	<	<	<	<	<	<	<	0.0433	<	<	<	<
	Jun-17	<	<	<	<	<	624	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	528	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UG-1A	May-16	<	<	<	<	<	678	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	665	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	576	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	688	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	599	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	503	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	632	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	515	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5
SUMMARY OF SCPC UTILITY WASTE LANDFILL CELL 1 GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-UG-2	May-16	<	<	<	<	<	519	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	522	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	521	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	584	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	565	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summary Ratio of # Results above the SL : Total # Results		0:72	0:72	0:72	0:64	0:72	43:72	0:64	0:64	0:64	0:64	0:64	0:64	0:64	0:64	0:64	6:64	0:64	0:64	0:64	0:64	0:64

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not applicable/Not Analyzed.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background monitoring well also associated with SCPB and SCL4A.

TABLE 6
SUMMARY OF SCL4A UTILITY WASTE LANDFILL CELL 4A GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-BMW-1S (b)	Mar-16	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	517	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	526	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	565	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	540	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	532	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	526	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-BMW-3S (b)	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Dec-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Feb-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Apr-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 1)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 2)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-TMW-1	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<	NA
S-TMW-2	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<	NA
S-TMW-3	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<	NA
S-UG-3	May-16	<	<	<	<	<	515	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	553	<	<	<	<	<	<	<	0.0103	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	506	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	0.0061	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	570	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	585	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	521	NA	NA	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<	NA
Summary Ratio of # Results above the SL : Total # Results		0:54	0:54	0:54	0:48	0:54	14:54	0:48	0:48	0:52	0:48	0:48	0:48	0:48	2:48	0:48	0:48	0:48	0:48	0:48	0:52	0:48

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not applicable/Not Analyzed.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background monitoring well also associated with SCPB and SCPC.

TABLE 7
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH DW SL**	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
LocationI ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
S-MIR-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
S-MIR-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MIR-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 7
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	HH DW SL	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
Location ID	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
S-MIR-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MIR-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MIR-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 8
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH REC SL**	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
S-MIR-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
S-MIR-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0018	0.0016	<	<	<	<	<	<	<	<
S-MIR-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0016	0.0015	<	<	<	<	<	<	<	<
S-MIR-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0017	<	<	<	<	<	<	<	<
S-MIR-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
ADJACENT																						
S-MIR-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0021	0.0017	<	<	<	<	<	<	<	<
S-MIR-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0018	0.0015	<	<	<	<	<	<	<	<
S-MIR-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0017	0.0015	<	<	<	<	<	<	<	<
S-MIR-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0021	0.0018	<	<	<	<	<	<	<	<
S-MIR-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0018	<	<	<	<	<	<	<	<
S-MIR-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
S-MIR-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0014	<	<	<	<	<	<	<	<
S-MIR-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0017	0.0016	<	<	<	<	<	<	<	<
S-MIR-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0016	<	<	<	<	<	<	<	<
S-MIR-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MIR-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0017	<	<	<	<	<	<	<	<
S-MIR-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
S-MIR-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0018	0.0016	<	<	<	<	<	<	<	<
S-MIR-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0022	0.0018	<	<	<	<	<	<	<	<
S-MIR-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0022	0.0018	<	<	<	<	<	<	<	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 8
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH REC SL**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
S-MIR-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MIR-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MIR-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 9
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**ECO SL**	2	2	NA	NA	230	6.5-8.5	1690	NA	4	NA	NA	0.15	0.02	NA	NA	0.1	0.005	0.0005	0.0005	0.181	0.155
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
S-MIR-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
S-MIR-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MIR-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 9
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**ECO SL**	1	1	0.0101	0.0066	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
S-MIR-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MIR-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MIR-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 10
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH DW SL**	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
S-MO-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
S-MO-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MO-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 10
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	HH DW SL	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
Location ID	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
S-MO-10S	Sep-17	<	<	<	<	0.0435	0.0422	<	<	<	<	<	<	<	<	NA	<
S-MO-11D	Sep-17	<	<	<	<	0.044	0.0423	<	<	<	<	<	<	<	<	NA	<
S-MO-11S	Sep-17	<	<	<	<	0.0429	0.0435	<	<	<	<	<	<	<	<	NA	<
S-MO-12D	Sep-17	<	<	<	<	0.0441	0.0423	<	<	<	<	<	<	<	<	NA	<
S-MO-12S	Sep-17	<	<	<	<	0.0436	0.0417	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MO-4S	Sep-17	<	<	<	<	0.0442	0.0422	<	<	<	<	<	<	<	<	NA	<
S-MO-5D	Sep-17	<	<	<	<	0.0444	0.0422	<	<	<	<	<	<	<	<	NA	<
S-MO-5S	Sep-17	<	<	<	<	0.0422	0.0428	<	<	<	<	<	<	<	<	NA	<
S-MO-6D	Sep-17	<	<	<	<	0.0427	0.0412	<	<	<	<	<	<	<	<	NA	<
S-MO-6S	Sep-17	<	<	<	<	0.0431	0.0421	<	<	<	<	<	<	<	<	NA	<
S-MO-7S	Sep-17	<	<	<	<	0.042	0.0432	<	<	<	<	<	<	<	<	NA	<
S-MO-8D	Sep-17	<	<	<	<	0.0428	0.0424	<	<	<	<	<	<	<	<	NA	<
S-MO-8S	Sep-17	<	<	<	<	0.0449	0.044	<	<	<	<	<	<	<	<	NA	<
S-MO-9D	Sep-17	<	<	<	<	0.042	0.042	<	<	<	<	<	<	<	<	NA	<
S-MO-9S	Sep-17	<	<	<	<	0.0423	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MO-1S	Sep-17	<	<	<	<	0.042	0.0441	<	<	<	<	<	<	<	<	NA	<
S-MO-2D	Sep-17	<	<	<	<	0.0431	0.0421	<	<	<	<	<	<	<	<	NA	<
S-MO-2S	Sep-17	<	<	<	<	0.0427	0.0446	<	<	<	<	<	<	<	<	NA	<
S-MO-3D	Sep-17	<	<	<	<	0.0434	0.0405	<	<	<	<	<	<	<	<	NA	<
S-MO-3S	Sep-17	<	<	<	<	0.0435	0.0437	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 11
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH REC SL**	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
S-MO-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0034	<	<	<	<	<	<	<	<
S-MO-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0034	<	<	<	<	<	<	<	<
S-MO-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0032	<	<	<	<	<	<	<	<
S-MO-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<
S-MO-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0033	<	<	<	<	<	<	<	<
ADJACENT																						
S-MO-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<
S-MO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0034	<	<	<	<	<	<	<	<
S-MO-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0033	<	<	<	<	<	<	<	<
S-MO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0032	<	<	<	<	<	<	<	<
S-MO-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<
S-MO-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0034	0.0032	<	<	<	<	<	<	<	<
S-MO-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0033	<	<	<	<	<	<	<	<
S-MO-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<
S-MO-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0034	<	<	<	<	<	<	<	<
S-MO-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0032	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MO-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0034	0.0033	<	<	<	<	<	<	<	<
S-MO-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0034	<	<	<	<	<	<	<	<
S-MO-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0034	0.0033	<	<	<	<	<	<	<	<
S-MO-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0032	<	<	<	<	<	<	<	<
S-MO-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 11
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH REC SL**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
S-MO-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MO-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MO-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 12
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**ECO SL**	2	2	NA	NA	230	6.5-8.5	1690	NA	4	NA	NA	0.15	0.02	NA	NA	0.1	0.005	0.0005	0.0005	0.181	0.155
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
UPSTREAM																						
S-MO-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
S-MO-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MO-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 12
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	ECO SL	1	1	0.0101	0.0066	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Location ID	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
UPSTREAM																	
S-MO-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MO-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MO-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 13
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH DW SL**	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
Locationl ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-17	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-16	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-15	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-14	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-13	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-12	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-11	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-10	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-9	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-8	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-7	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-6	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-5	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-4	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 13
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH DW SL**	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-17	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-16	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-15	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-14	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-13	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-12	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-11	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-10	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-9	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-8	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-7	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-4	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 14
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH REC SL**	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0066	0.0053	<	<	<	<	<	<	<	<
S-MIO-17	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0062	0.0053	<	<	<	<	<	<	<	<
S-MIO-16	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0064	0.0055	<	<	<	<	<	<	<	<
S-MIO-15	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0067	0.0057	<	<	<	<	<	<	<	<
S-MIO-14	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.006	0.0053	<	<	<	<	<	<	<	<
S-MIO-13	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0066	0.0052	<	<	<	<	<	<	<	<
S-MIO-12	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0077	0.0065	<	<	<	<	<	<	<	<
S-MIO-11	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0078	0.0071	<	<	<	<	<	<	<	<
S-MIO-10	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0077	0.0072	<	<	<	<	<	<	<	<
S-MIO-9	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0062	0.0056	<	<	<	<	<	<	<	<
S-MIO-8	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0069	0.0061	<	<	<	<	<	<	<	<
S-MIO-7	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0072	0.0064	<	<	<	<	<	<	<	<
S-MIO-6	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0017	<	<	<	<	<	<	<	<
S-MIO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0021	0.0017	<	<	<	<	<	<	<	<
S-MIO-5	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0017	<	<	<	<	<	<	<	<
S-MIO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0016	<	<	<	<	<	<	<	<
S-MIO-4	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0025	0.0021	<	<	<	<	<	<	<	<
S-MIO-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0023	0.0021	<	<	<	<	<	<	<	<
S-MIO-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0024	0.002	<	<	<	<	<	<	<	<
S-MIO-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0024	0.0021	<	<	<	<	<	<	<	<

Notes:

< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 14
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH REC SL**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-17	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-16	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-15	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-14	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-13	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-12	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-11	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-10	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-9	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-8	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-7	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-4	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 15
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**ECO SL**	2	2	NA	NA	230	6.5-8.5	1690	NA	4	NA	NA	0.15	0.02	NA	NA	0.1	0.005	0.0005	0.0005	0.181	0.155
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-17	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-16	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-15	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-14	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-13	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-12	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-11	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-10	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-9	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-8	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-7	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-6	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-5	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-4	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:
< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

Qualifiers:
J - Value is estimated.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 15
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**ECO SL**	1	1	0.0101	0.0066	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-17	Sep-17	<	<	<	<	<	<	<	<	<	<	<	0.0061 J	<	<	NA	<
S-MIO-16	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-15	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-14	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-13	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-12	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0067 J	0.0062 J	<	<	NA	<
S-MIO-11	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0069 J	0.0091 J	<	<	NA	<
S-MIO-10	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0077 J	0.0052 J	<	<	NA	<
S-MIO-9	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0055 J	<	<	<	NA	<
S-MIO-8	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0054 J	<	<	<	NA	<
S-MIO-7	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0093 J	<	<	<	NA	<
S-MIO-6	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-4	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

Qualifiers:
J - Value is estimated.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 16
SUMMARY OF WHOLE EFFLUENT TOXICITY TESTING RESULTS FOR NPDES OUTFALL 001, 002, AND 006
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

Sampling Event	Treatment	Percent Survival at 48 hours	
		Pimephales promelas	***Ceriodaphnia dubia***
Outfall 001 (Non Contact Cooling Water)			
June 2005	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
Outfall 002 (Ash Pond #1)			
June 2005	10% Effluent	100%	100%
	Reconstituted Control	98%	100%
	Upstream Control	100%	100%
July 2017	Whole Effluent Dilution Series: 100, 50, 25, 7, 3.5%	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
Outfall 006 (Ash Pond #2)			
June 2005	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%

Notes:
NPDES - Natual Pollutant Discharge Elimination System.

No statistically significant difference (alpha = 0.05) between effluent and control survival data for the above tests. July 2017 also saw no significant effect on growth or survival of fathead minnows in all dilution series after a 7-day exposure.
Effluent passes in all tests conducted from 2005 through 2017.
10% Effluent - Outfall 001, 002, and 006 effluent mixed with Mississippi River water.
Reconstituted Control - Laboratory reconstituted water.
Upstream Control - Mississippi River water.

TABLE 17
DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSISSIPPI RIVER
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

				Estimated Dilution Factor (d) =	90,000			
Constituents	**HH DW SL (a) (mg/L)**	**HH REC SL (b) (mg/L)**	**ECO SL (c) (mg/L)**	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum SEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum SEC Groundwater Concentration**
Boron	4	NA	2	2	180000	31.2	S-UMW-4D	>5700
Sulfate	250	NA	1690	250	22500000	1100	S-LMW-5S	>20000
TDS	500	NA	NA	500	45000000	1760	S-LMW-5S	>25000
Cobalt	0.006	NA	1	0.006	540	0.0122	S-LMW-9S	>44000
Lithium	0.04	NA	NA	0.04	3600	0.0623	S-LMW-5S	>57000
Molybdenum	0.1	NA	NA	0.1	9000	8.3	S-UMW-4D	>1000

Notes:
* Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.
ECO SL - Ecological Screening Level.
HH DW SL - Human Health Drinking Water Screening Level.
HH REC SL - Human Health Recreational Use Screening Level.
mg/L - milligram per liter.
NA - Not Available.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

(b) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

(c) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

(d) - Estimated value, see text and Attachment B for derivation.

TABLE 18
DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSOURI RIVER
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

				Estimated Dilution Factor (d) =	100,000			
Constituents	**HH DW SL (a) (mg/L)**	**HH REC SL (b) (mg/L)**	**ECO SL (c) (mg/L)**	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum SEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum SEC Groundwater Concentration**
Boron	4	NA	2	2	200000	31.2	S-UMW-4D	>6400
Sulfate	250	NA	1690	250	25000000	1100	S-LMW-5S	>22000
TDS	500	NA	NA	500	50000000	1760	S-LMW-5S	>28000
Cobalt	0.006	NA	1	0.006	600	0.0122	S-LMW-9S	>49000
Lithium	0.04	NA	NA	0.04	4000	0.0623	S-LMW-5S	>64000
Molybdenum	0.1	NA	NA	0.1	10000	8.3	S-UMW-4D	>1200

Notes:
* Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.
ECO SL - Ecological Screening Level.
HH DW SL - Human Health Drinking Water Screening Level.
HH REC SL - Human Health Recreational Use Screening Level.
mg/L - milligram per liter.
NA - Not Available.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

(b) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

(c) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

(d) - Estimated value, see text and Attachment B for derivation.

FIGURES

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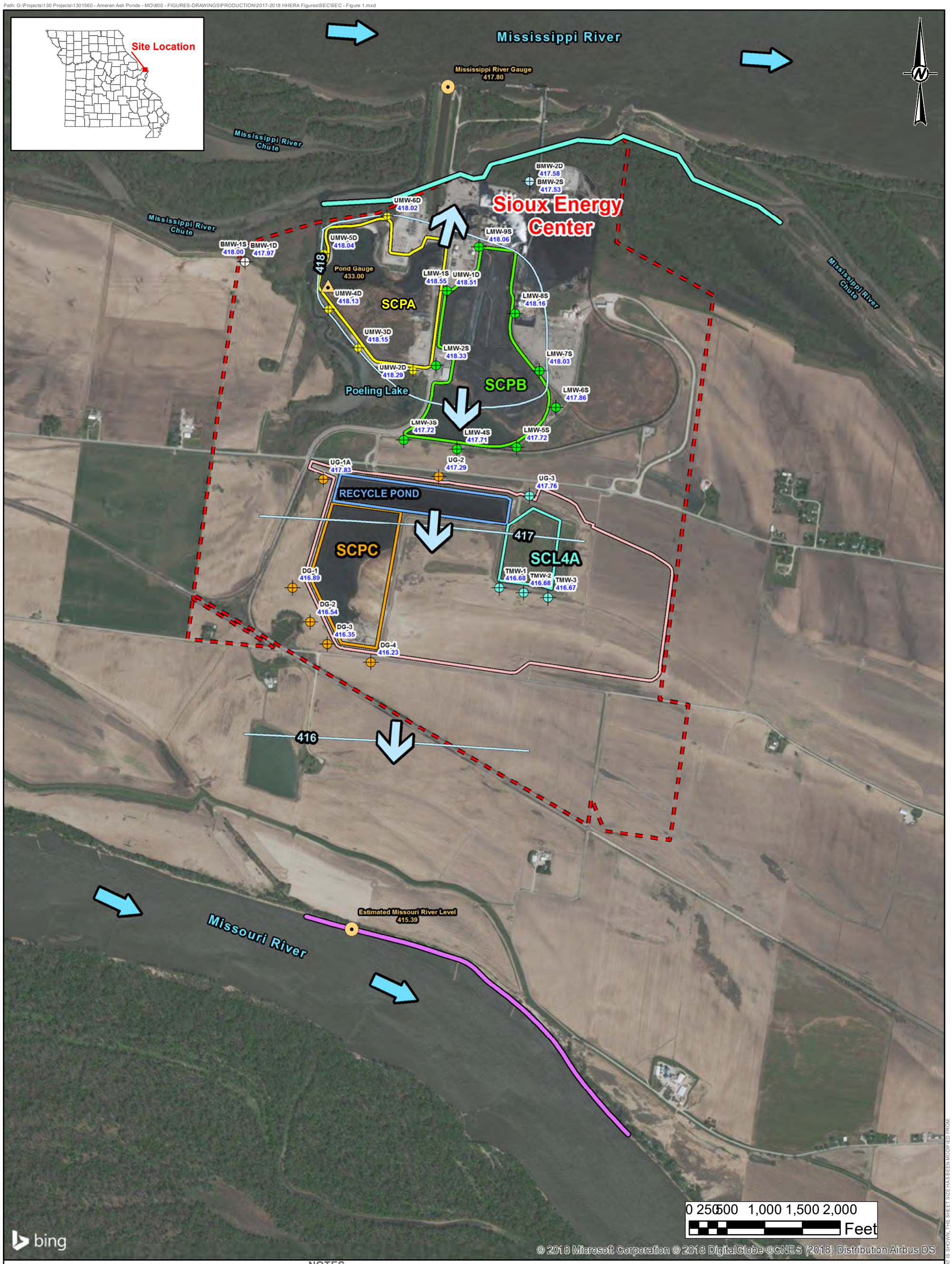


LEGEND

- Sioux Energy Center Property Boundary
- Length of Groundwater Discharge Used in the Mississippi River Dilution Factor Calculation
- Length of Groundwater Discharge Used in the Missouri River Dilution Factor Calculation
- Groundwater Flow Direction
- Surface Water Flow Direction

Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)
- Inferred Groundwater Elevation Contour (FT MSL)

Surface Impoundments

- SCPA - Bottom Ash Surface Impoundment
- SCPB - Fly Ash Surface Impoundment

Utility Waste Landfill (UWL)

- Active Dry CCR Disposal Area
- Active WFGD Disposal Area
- Active Water Recycle Pond
- UWL Perimeter Fence

Ground/Surface Water Measurement

- Background Monitoring Well
- SCPA - Bottom Ash Surface Impoundment Monitoring Well
- SCL4A - UWL Cell 4A Monitoring Well
- Groundwater Elevation Piezometer
- SCPB - Fly Ash Surface Impoundment Monitoring Well
- SCPC - WFGD Surface Impoundment Monitoring Well
- SPCA Pond Gauge
- River Elevation

NOTES

1.) ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2.) GOLDER GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON JANUARY 14, APRIL 29, AND DECEMBER 8, 2016.
3.) GROUNDWATER AND SURFACE WATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
4.) GROUNDWATER AND POND GAUGE MEASUREMENTS OBTAINED BY GOLDER ON NOV. 7, 2016.
5.) MISSOURI RIVER ELEVATION ESTIMATED BASED ON NEARBY USGS (UNITED STATES GEOLOGICAL SURVEY) RIVER GAUGING LOCATIONS.
6.) MISSISSIPPI RIVER ELEVATION PROVIDED BY AMEREN MISSOURI.
7.) UWL BOUNDARIES, DESIGNATIONS AND STATE MONITORING WELL LOCATIONS BASED ON DRAWINGS IN THE UWL PROPOSED LANDFILL PERMIT (#0918301).
8.) WFGD - WET FLUE GAS DESULFURIZATION.

REFERENCE

1.) AMEREN MISSOURI SIOUX ENERGY CENTER, SIOUX PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.
3.) USGS NATIONAL WATER INFORMATION SYSTEM, USGS GAUGES 06935965 (ST. CHARLES), 07010000 (ST. LOUIS), 05587498 (ALTON), GRAFTON (05587450).
4.) AMEREN MISSOURI SIOUX POWER PLANT UTILITY WASTE LANDFILL PROPOSED CONSTRUCTION PERMIT MODIFICATION (#0918301), AUGUST 2014.

CLIENT
AMEREN MISSOURI
SIOUX ENERGY CENTER

PROJECT
HYDROGEOLOGICAL CONSULTING

TITLE
ESTIMATED LENGTH OF DISCHARGE AND EXAMPLE GROUNDWATER FLOW MAP

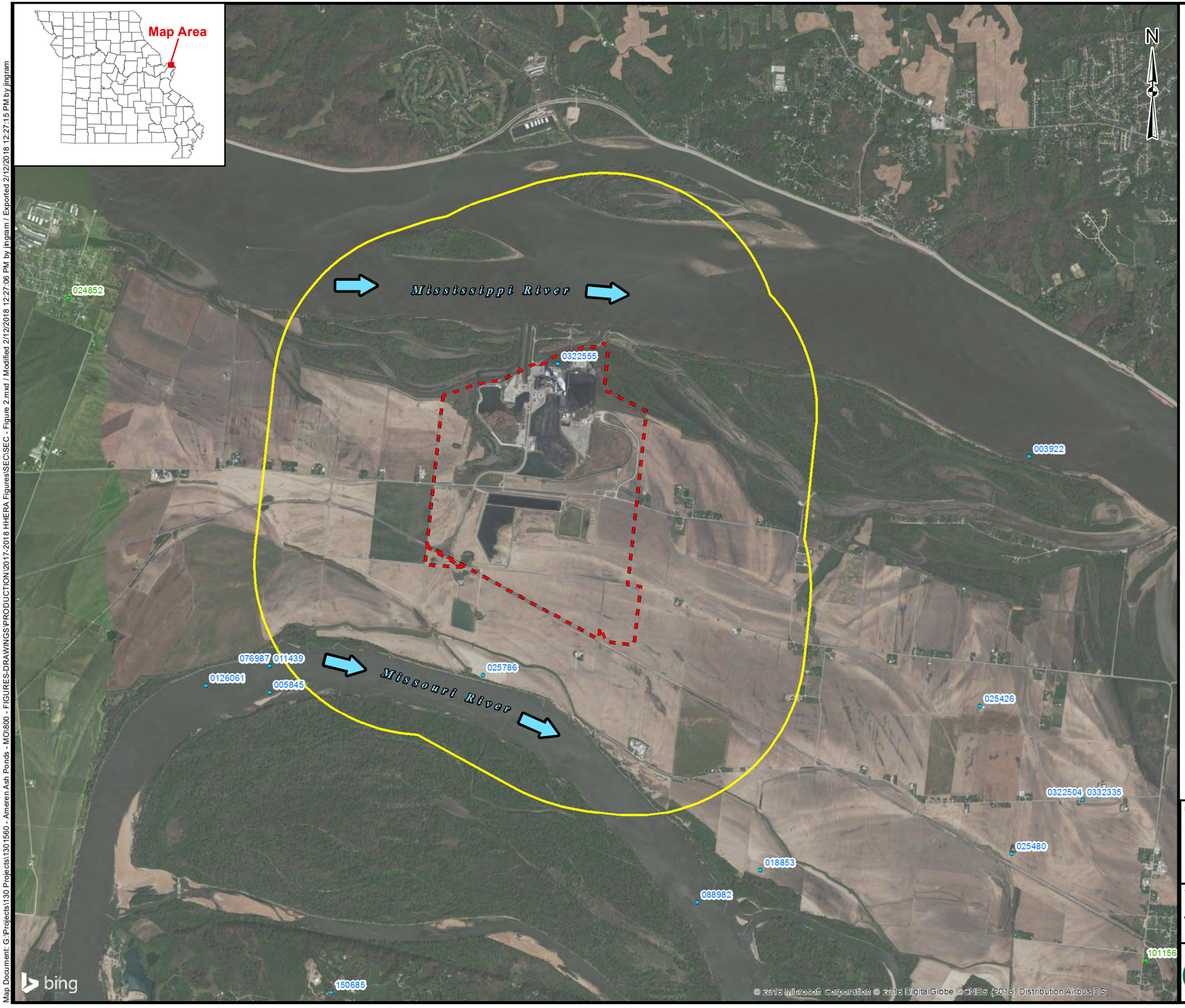
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-12-19
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.
130-1560

FIGURE
1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 1 in 0



LEGEND

- Sioux Property Boundary
- Approximate 1-Mile Radius
- Private Well
- Public Well
- Surface Water Flow Direction

NOTES

1.) Wells are labeled with state issued reference number or log ID.
2.) Search radius is approximately one mile beyond the Ameren property boundary line.
3.) See Table 1 for details on wells listed on the map.
4.) Locations of wells 0126061, 076987, 011439, 005845, 003922 and 088982 appear to be listed incorrectly in MDNR Wellhead Protection Database.
5.) Wells in Illinois are not shown.

REFERENCES

1.) MDNR - Missouri Department of Natural Resources
2.) MSDIS - Missouri Spatial Data Information Service
3.) University of Missouri - Columbia - Department of Geography - MSDIS Database
4.) Missouri Department of Natural Resources - Water Resources Center - Geologic Well Logs
5.) Missouri Environmental Geology Atlas 2007 (MEGA)
6.) MDNR Wellhead Protection Program
7.) COORDINATE SYSTEM: NAD 1983 UTM Zone 15N

0 3,000 6,000 Feet

PROJECT

Ameren

AMEREN MISSOURI COAL FIRED POWER PLANTS
ST. CHARLES COUNTY, MISSOURI

TITLE

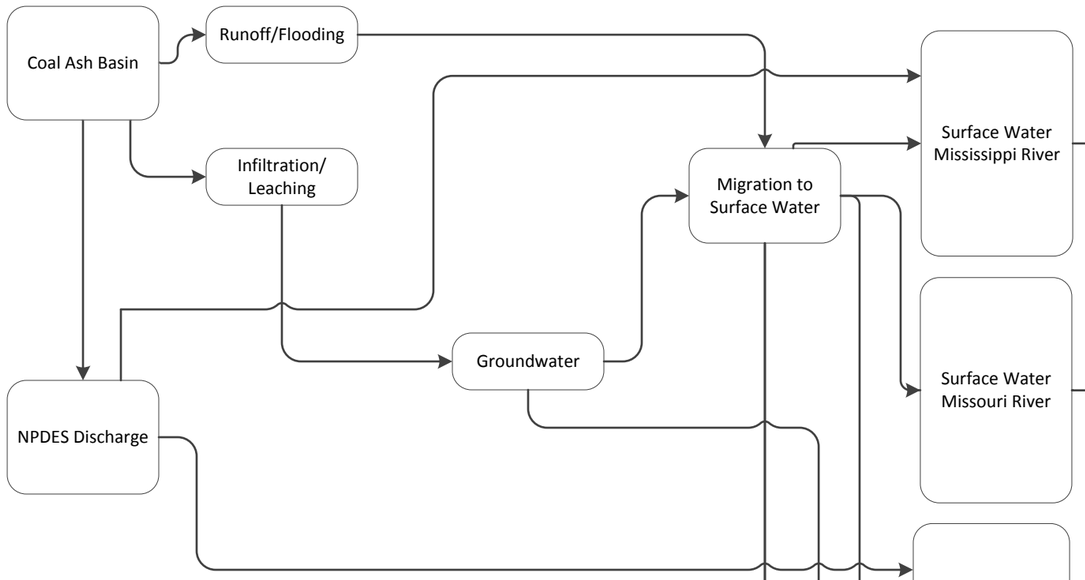
PRIVATE WELL LOCATIONS WITHIN 1-MILE RADIUS OF THE FACILITY BOUNDARY

Golder Associates

PROJECT No. 130-1560			FILE No.	SEC - Figure 2.mxd
DESIGN	-	-	SCALE: AS SHOWN	REV. 0
GIS	JSI	2/12/2018	FIGURE 2	
CHECK	MWD	2/12/2018		
REVIEW	MNH	2/12/2018		

Map Document: G:\Projects\130 Projects\1301560 - Ameren Ash Ponds - MO\800 - FIGURES-DRAWINGS\PRODUCTION\2017-2018 HHERA Figures\SEC\SEC - Figure 2.mxd / Modified 2/12/2018 12:27:06 PM by jingram / Exported 2/12/2018 12:27:15 PM by jingram

FIGURE 3
CONCEPTUAL SITE MODEL
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI



	Potential Human Health Receptors					Potential Ecological Receptors
Potential Exposure Route	**Current/Future Off-Site Resident Adult/Child**	**Current/Future Off-Site Recreational Swimmer**	**Current/Future Off-Site Recreational Wader**	**Current/Future Off-Site Recreational Boater**	**Current/Future Off-Site Recreational Fisher**	**Aquatic Receptors**
Surface Water Mississippi River						
Drinking Water Use	⊙ (a)	O	O	O	O	NA
Incidental Ingestion	O	⊙	⊙	⊙	⊙	NA
Dermal Contact	O	⊙	⊙	⊙	⊙	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Surface Water Missouri River						
Drinking Water Use	⊙ (b)	O	O	O	O	NA
Incidental Ingestion	O	⊙	⊙	⊙	⊙	NA
Dermal Contact	O	⊙	⊙	⊙	⊙	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Surface Water Mississippi River Offshoot						
Drinking Water Use	O	O	O	O	O	NA
Incidental Ingestion	O	⊙	⊙	⊙	⊙	NA
Dermal Contact	O	⊙	⊙	⊙	⊙	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Fish Tissue Mississippi River						
Ingestion	O	O	O	O	●	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Fish Tissue Missouri River						
Ingestion	O	O	O	O	●	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Groundwater						
Drinking Water Use	O (e)	O	O	O	O	NA
Aquatic Exposure	NA	NA	NA	NA	NA	O (f)

Notes:

● Pathway potentially complete

⊙ Pathway potentially complete, but insignificant.

O Pathway evaluated and found incomplete.

(a) The Mississippi River is used as a source of drinking water; the nearest downstream drinking water intake is 4.5 miles downstream at Alton, IL. All detected constituent concentrations are below drinking water screening levels.

(b) The Missouri River is used as a source of drinking water; however, all intakes are upstream of the facility. All detected constituent concentrations in the Missouri River are below drinking water screening levels.

(c) Mississippi River Offshoot is not used as a source of drinking water.

(d) The size of Mississippi River Offshoot precludes swimming, fishing and boating activities.

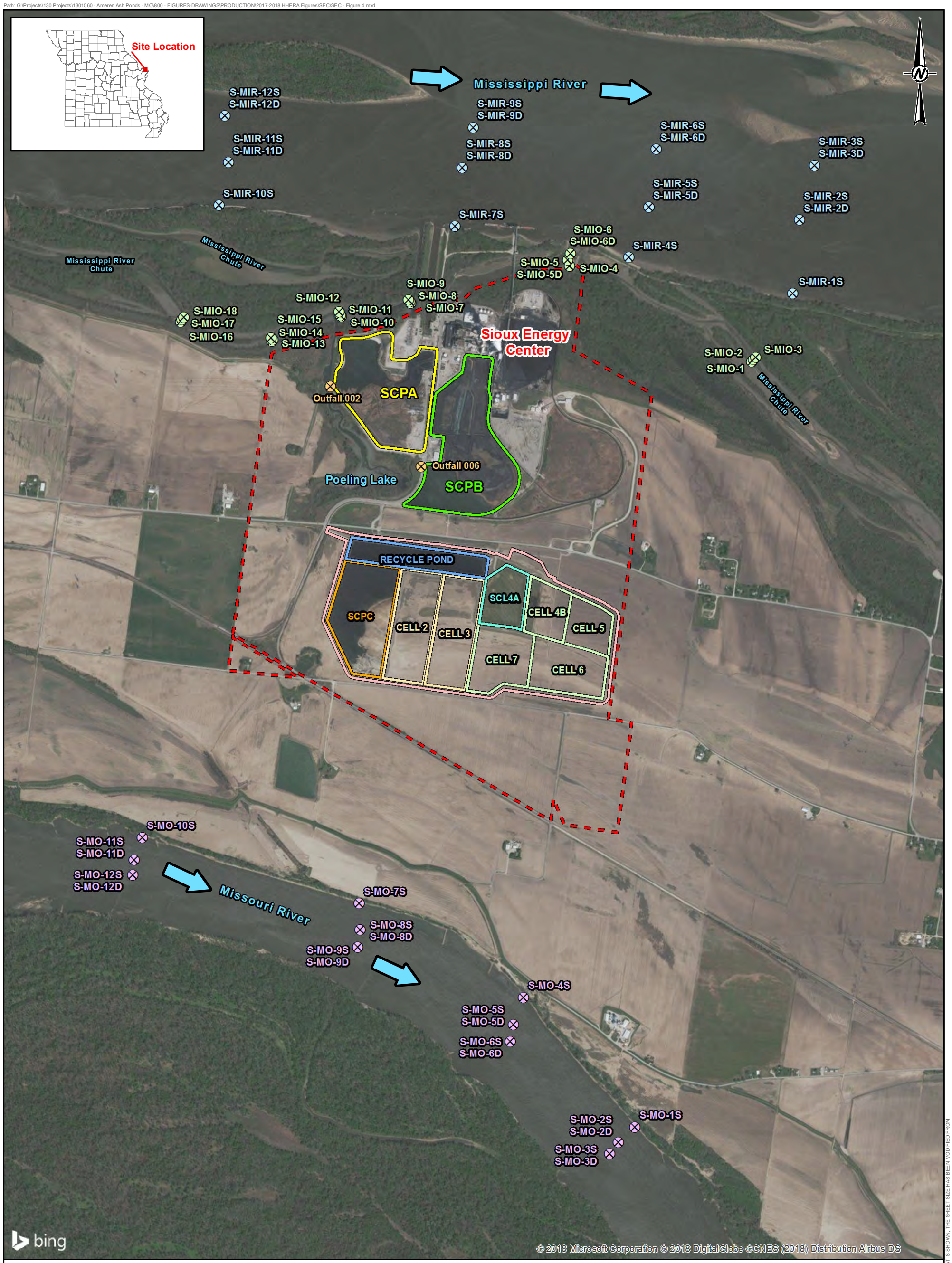
(e) The shallow alluvial aquifer in the vicinity of the coal ash management area is not used for drinking water purposes.

(f) Ecological receptors are not exposed to groundwater.

NPDES - National Pollutant Discharge Elimination System

HALEY ALDRICH

Path: G:\Projects\130 Projects\1301560 - Ameren Ash Ponds - MO\800 - FIGURES-DRAWINGS\PRODUCTION\2017-2018 HHERA Figures\SEC\SEC - Figure 4.mxd



LEGEND

- Sioux Energy Center Property Boundary
- NPDES Outfalls
- Surface Water Flow Direction

Surface Impoundments

- SCPB - Fly Ash Surface Impoundment
- SCPA - Bottom Ash Surface Impoundment

Utility Waste Landfill (UWL)

- Active Dry CCR Disposal Area
- Active WFGD Disposal
- Active Water Recycle Pond
- Proposed Dry CCR Disposal Area
- Proposed WFGD Disposal Area
- UWL Perimeter Fence

Surface Water Sampling Locations

- Missouri River Sample
- Mississippi River Sample
- Mississippi River Offshoot Sample

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. NPDES - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM.
3. OUTFALL LOCATIONS BASED ON MISSOURI SPATIAL DATA INFORMATION SERVICE (MSDIS) 2015 NPDES OUTFALL MAP WITH DATA FROM THE MISSOURI DEPARTMENT OF NATURAL RESOURCES'S (MDNR) MISSOURI CLEAN WATER INFORMATION SYSTEM (MOCWIS).
4. SAMPLE LOCATIONS BASED ON HANDHELD TRIMBLE GPS MEASUREMENTS. SAMPLE LOCATION REPRESENTS CENTERPOINT BETWEEN SAMPLE STARTING AND ENDING LOCATION.

REFERENCE

1.) AMEREN MISSOURI SIOUX ENERGY CENTER, SIOUX PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.
3.) MSDIS INLAND WATER RESOURCES MO 2015 NPDES OUTFALL SHAPEFILE.

0 500 1,000 2,000 3,000 4,000 Feet

CLIENT
AMEREN MISSOURI
SIOUX ENERGY CENTER

PROJECT
AMEREN HYDROGEOLOGICAL CONSULTING

TITLE
SURFACE WATER SAMPLING LOCATIONS
SIOUX ENERGY CENTER

CONSULTANT
Golder Associates

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DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No. 130-1560
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FIGURE 4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
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ATTACHMENT A

Constituents Present in Coal Ash and in Our Natural Environment

Attachment A

Constituents Present in Coal Ash and in Our Natural Environment

It is important to understand what constituents are present in coal ash, which can be released to the environment, and to understand the natural occurrence of these constituents in our environment.

Coal is a type of sedimentary rock that is a natural component of the earth's crust and the inorganic minerals and elements it contains are also naturally occurring. It is the organic component of coal that burns and produces energy, and it is the inorganic minerals and elements that remain after combustion the make up the coal ash, or coal combustion products (CCPs).

A.1 Major, Minor and Trace Constituents in Coal Ash

All of the inorganic minerals and elements that are present in coal ash are also present in our natural environment. This is one fact that that the public seems either not to understand or will not acknowledge. **Figure A-1** shows the major and minor components of fly ash, bottom ash, volcanic ash, and shale. It is important to understand that the constituents that are the focus of many of the concerns expressed by the public about the toxicity of coal ash (e.g., lead, arsenic, mercury, cadmium, selenium, etc.) are trace elements, so called because they are present in such low concentrations (in the mg/kg or part per million (ppm) range). Together, the trace elements generally make up less than 1 percent of the total mass of these materials. To put these concentrations into context, a mg/kg or ppm is equivalent to:

- 1 penny in a large container holding $10,000 worth of pennies, or
- 1 second in 11.5 days, or
- 1 inch in 15.8 miles

These trace elements have been referred to by the public and even in the popular press as "toxic"—without any context provided for what this means. Moreover, claims have been made that there is no safe level of exposure to any of these elements.

This is simply not true, and there are two important facts that must be understood to put this in context. The first relates to background levels of constituents in our environment and the second relates to toxicity.

A.2 Background Levels in Soils

The first fact that must be understood is that all of the constituents present in coal ash occur naturally in our environment. U.S. Geological Survey (USGS) data demonstrate the presence of these constituents in the soils across the U.S. Prime examples include arsenic, lead, mercury and selenium. With respect to arsenic, **Figure A-2** shows the range of background levels of arsenic in soils across the U.S., as published by the USGS. The USGS is conducting a "national geochemical survey" to identify background levels of elements in soils in the U.S. (USGS, 2013). **Figures A-3 – A-6** provide maps prepared by the USGS demonstrating the naturally-occurring presence of other trace elements in soils in the U.S., including aluminum and copper (**Figure A-3**), iron and lead (**Figure A-4**), manganese and mercury (**Figure A-5**), and selenium and zinc (**Figure A-6**).

These soils are found in our backyards, schools, parks, etc., and because of their presence in soil, these constituents are also present in the foods we eat. Some of these constituents are present in

our vitamins, such as manganese and selenium. Thus, we are exposed to these trace elements in our natural environment every day, and in many ways.

A.3 Toxicity and Risk

The second fact is that all constituents and materials that we encounter in our natural environment can be toxic, but what determines whether a toxic effect actually occurs is how one is exposed to the constituent, the amount of material to which one may be exposed, and the timing and duration of that exposure. Without sufficient exposure the science tells us that there are no toxic effects. Put another way, when a toxic effect is demonstrated by a particular constituent, it is generally caused by high levels of exposure over a long-term duration. The fundamental principles here are:

- All constituents can exert toxic effects (from aspirin[1] to table salt to water to minerals).
- For such toxic effects to occur, exposure must occur at a sufficiently high level for a sufficiently long period of time.
- If there is no exposure, there is no risk.

A.4 Risk-Based Screening Levels

The U.S. Environmental Protection Agency (USEPA) uses information on the potential toxicity of constituents to identify concentrations of trace elements in soil in a residential setting that are considered by USEPA to be protective for humans (including sensitive groups) over a lifetime (USEPA, 2014c). Specifically, residential soil screening levels are levels that are protective of a child and adult's daily exposure to constituents present in soil or a solid matrix over a residential lifetime. In the context of regulatory decision making, at sites where constituent concentrations fall below these screening levels, no further action or study is warranted under the federal Superfund program. Missouri Department of Natural Resources also applies this concept to the development of screening levels in its Risk-Based Corrective Action program (MDNR, 2006).

Figure A-7 shows USEPA's residential soil screening levels for a variety of trace elements that are present in coal ash. USEPA considers it to be safe for children to be exposed to these concentrations of each of these trace elements in soils on a daily basis, throughout their lifetime. What this tells us is that by developing these residential soil screening levels, USEPA considers the presence of these levels of these constituents in soils to be safe for humans, even for exposure on a daily basis. It is, therefore, simply not true that there are no safe levels of exposure to these constituents.

A.5 Comparison of Coal Ash Constituent Concentrations to Risk-Based Screening Levels and Background

A comparison of constituent concentrations in coal ash, as reported by the USGS (USGS, 2011a) to USEPA's risk-based screening levels for residential soil indicates that with only a few exceptions, constituent concentrations in coal ash are below screening levels developed by the USEPA for residential soils, and are similar in concentration to background U.S. soils. Details of this evaluation are provided in the report titled "Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS

[1] For example, if one takes two aspirin every four hours as directed, aspirin is not toxic. If one takes the entire bottle at once, the aspirin is very toxic.

Coal Ash Data from Five US Power Plants" (AECOM, 2012). The study is available at: http://www.acaa-usa.org/associations/8003/files/ACAA_CoalAshMaterialSafety_June2012.pdf.

Figure A-8 is an updated chart from this study comparing ranges of trace element concentrations in fly ash produced from coal from the Powder River Basin in Wyoming (the same type of coal used at Rush Island Energy Center) to USEPA screening levels, and to background levels in soils in the U.S. The USEPA screening levels for residential soils (USEPA, 2014c) are shown as the green vertical bars, the ranges for the Wyoming coal fly ash are shown in purple on top of the green vertical bars, and the ranges of background levels in U.S. soils are shown in the grey bars. What this figure shows is that all but one of the constituents are present in the Wyoming fly ash at concentrations that are below the USEPA residential soil screening levels; and for cobalt, the concentration range is only marginally above the screening level. As noted in detail in the report itself, the toxicity value upon which the USEPA soil screening level for cobalt is based is two levels of magnitude lower than what has been derived by other regulatory agencies; thus a much higher health protective soil screening level for cobalt exists. What the data also show is that constituent concentrations in coal ash are not that different from concentrations in soils in the U.S.

The results are similar for all of the coal ashes evaluated in the report (AECOM, 2012). The evaluation in the report included not only the simple comparison of constituent concentrations in coal ash to USEPA screening levels, but also provided a detailed cumulative risk screen for each coal ash data set to account for potential additive effects of combined exposures to the trace elements in coal ash. The results confirm the simple screening results, which indicate that no significant risk would be posed by direct exposure to coal ash in a residential setting.

Thus, by considering the levels of trace elements in coal ash in comparison to the background levels in soils in the U.S., and in comparison to the USEPA screening levels for these constituents in residential soil, screening levels that are protective of daily exposure to soils by children and adults, including sensitive subgroups, it is concluded that even daily direct contact to trace elements in coal ash would not pose a significant risk to human health.

A.6 Background Levels in Groundwater

Because these constituents are naturally present in soils and rocks, they are also naturally present in our groundwaters and surface waters. The USGS has published a report titled "Trace Elements and Radon in Groundwater Across the United States" (USGS, 2011b). Just as for soil, it is important to understand that there are background levels of constituents in groundwater. Constituent concentrations in groundwater that is upgradient of a source represent background conditions. To demonstrate a release to groundwater by a source, concentrations downgradient of the source must be greater than the background/upgradient concentrations at a statistically significant level for a consistent period of time.

The same concept applies to surface water. These same constituents are naturally present in surface water due to discharge of groundwater to surface water and the effect of erosion of soil into our surface waters. To demonstrate an effect of a source on surface water, the concentrations downgradient/downstream of the source must be greater than the background/upstream concentrations at a statistically significant level for a consistent period of time.

Constituents in groundwater and surface water can be in a dissolved form, or they can be adhered to or part of a soil or sediment particle. Movement of these particles in groundwater is generally more difficult because of the presence of the soil and rock that the groundwater must move through. Surface water is constantly impacted by erosion of soils, thus in surface water, it is much more

common for constituents to be bound to particles rather than dissolved in the water. For this reason, it is important to evaluate both total concentrations of constituents in water (which represents constituents dissolved in the water and as part of a soil or sediment particle) and the dissolved component (by filtering out the soil/sediment particles).

A.7 Toxicity Evaluation for Cobalt and Chromium

A.7.1 Cobalt

Cobalt is the only constituent in the Powder River Basin coal ash (the coal that is used at the Rush Island Energy Center) with concentrations above the USEPA screening level for residential soils. There is much uncertainty associated with the USEPA dose-response value for cobalt, and with the resulting screening level for residential soil. The World Health Organization (WHO) indicates that "there are no suitable data with which to derive a tolerable intake for chronic ingestion of cobalt" (WHO, 2006). Agency for Toxic Substances and Disease Registry (ATSDR, 2004) states that "adequate chronic studies of the oral toxicity of cobalt or cobalt compounds in humans and animals are not presently available." However, using a short-term study in six human volunteers, ATSDR (2004) derived an intermediate-term (15–364 days) minimal risk level (MRL) of 0.05 mg/kg-day. The "adverse" effect was identified as increased red blood cell count, although it is also noted that cobalt is used as a treatment for anemia (low red blood cell count). ATSDR also notes that "Since cobalt is naturally found in the environment, people cannot avoid being exposed to it. However, the relatively low concentrations present do not warrant any immediate steps to reduce exposure." WHO notes that the largest source of exposure to cobalt for the general population is the food supply; the estimated intake from food is 5–40 ug/day, most of which is inorganic cobalt (WHO, 2006). Expressed on a mg/kg-day basis, this is 0.00007–0.0005 mg/kg-day from the diet.

USEPA however has derived a Provisional Peer-Reviewed Toxicity Value (PPRTV) for cobalt of 0.0003 mg/kg-day, this is two orders of magnitude lower than the ATSDR intermediate term MRL, and is higher that most dietary intake estimates. Thus the RSL for cobalt for residential soil is much lower than values derived by other regulatory bodies.

A.7.2 Hexavalent Chromium

The data provided by USGS (2011a) for chromium is for total chromium in the samples; the Ameren data for groundwater and surface water are also based on analysis of total chromium. Many metals can exist in different oxidation states; for some metals, the oxidation state can have different toxicities. This is the case for chromium. Chromium exists in two common oxidation states: trivalent chromium (chromium-3, Cr(III) or Cr+3), and hexavalent chromium (chromium-6, Cr(VI) or Cr+6). Trivalent chromium is essentially nontoxic, as evidenced by its RSL of 120,000 mg/kg. It can be bought over-the-counter as a supplement, and is included in most vitamins. Hexavalent chromium has been concluded to be a human carcinogen by the inhalation route of exposure (USEPA, 2014a).

Currently on USEPA's toxicity database, the Integrated Risk Information System (IRIS) (USEPA, 2014a), the primary source of dose-response information for risk assessment and for the RSL tables, an oral reference dose is available for trivalent chromium, and IRIS provides an inhalation IUR for potential inhalation carcinogenic effects and an oral reference dose and inhalation reference concentration for hexavalent chromium. The oral noncancer dose-response value for hexavalent chromium is based on a study where no adverse effects were reported; thus the target endpoint is identified as "none reported."

Recent studies by the National Toxicology Program (NTP) have shown that when present in high concentrations in drinking water, hexavalent chromium can cause gastrointestinal tract tumors in mice (NTP, 2008). IRIS does not present an oral CSF for hexavalent chromium; a value developed by the New Jersey Department of Environmental Protection (NJDEP, 2009) was used in the development of the RSLs. USEPA developed a draft oral cancer dose-response value for hexavalent chromium, based on the same study and was the same as the NJDEP value. However, it should be noted that USEPA's Science Advisory Board (SAB) provided comments in July 2011 on the draft USEPA derivation of the oral CSF for hexavalent chromium and indicated many reservations with the assumptions of mode of action, and in the derivation itself. The SAB review can be accessed at http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=221433. Thus, the value used to develop the RSLs for hexavalent chromium has been called into question by USEPA's peer review panel. Currently there is much scientific debate about whether the mode of action of hexavalent chromium in very high concentrations in drinking water is relevant to the low concentrations most likely to be encountered in environmental situations (Proctor, et al., 2012).

Therefore, for this evaluation of chromium in the Powder River Basin coal ash, total chromium is evaluated assuming the total concentration is hexavalent chromium and using RSLs calculated using USEPA's on-line RSL calculator (USEPA, 2014b), based on the primary dose-response values provided in the IRIS database (USEPA, 2014a) for both potential carcinogenic and noncarcinogenic endpoints.

The assumption that all chromium in CCPs is in the hexavalent form is very conservative, and in fact unrealistic. Data for the Alaska Power Plant indicate that hexavalent chromium comprises 0.25% of the total chromium concentration in the combined fly ash/bottom ash material from that facility. Literature data for analyses of CCPs from US coals (total CCPs) indicate that hexavalent chromium can comprise up to 5% of the total chromium (Huggins, et al., 1999); thus over 95% of the total chromium is present in the nontoxic trivalent form. This is consistent with data from USEPA, though there are some single higher results (USEPA, 2009).

A.8 Summary

Constituents present in coal ash are also present in our natural environment, and we are exposed to them every day, in the soils that we contact and the food that we eat. All of these constituents have USEPA-derived risk-based screening levels for residential soils. The constituent concentrations in coal ash from the Powder River Basin, the source of the coal used at the Rush Island Energy Center, are below risk-based screening levels for residential soils (with one exception) and the concentrations are similar to background levels in U.S. soils.

A.9 References

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Huggins, FE, M Najih, and GP Huffman. 1999. Direct speciation of chromium in coal combustion by-products by X-ray absorption fine-structure spectroscopy. Fuel 78:233–242.

MDNR. 2006. Missouri Risk-Based Correction Action (MRBCA) Technical Guidance. April, 2006. Available at: http://www.dnr.mo.gov/env/hwp/mrbca/docs/mrbca-sections6-06.pdf

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USEPA. 2014c. USEPA Regional Screening Levels. May 2014. U.S. Environmental Protection Agency. Available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

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USGS. 2011b. Trace Elements and Radon in Groundwater Across the United States. U.S. Geological Survey. Scientific Investigations Report 2011-5059. Authors: Ayotte, J.D. Gronberg, J.M., and Apodaca, L.E. Available at: http://pubs.usgs.gov/sir/2011/5059/pdf/sir2011-5059_report-covers_508.pdf

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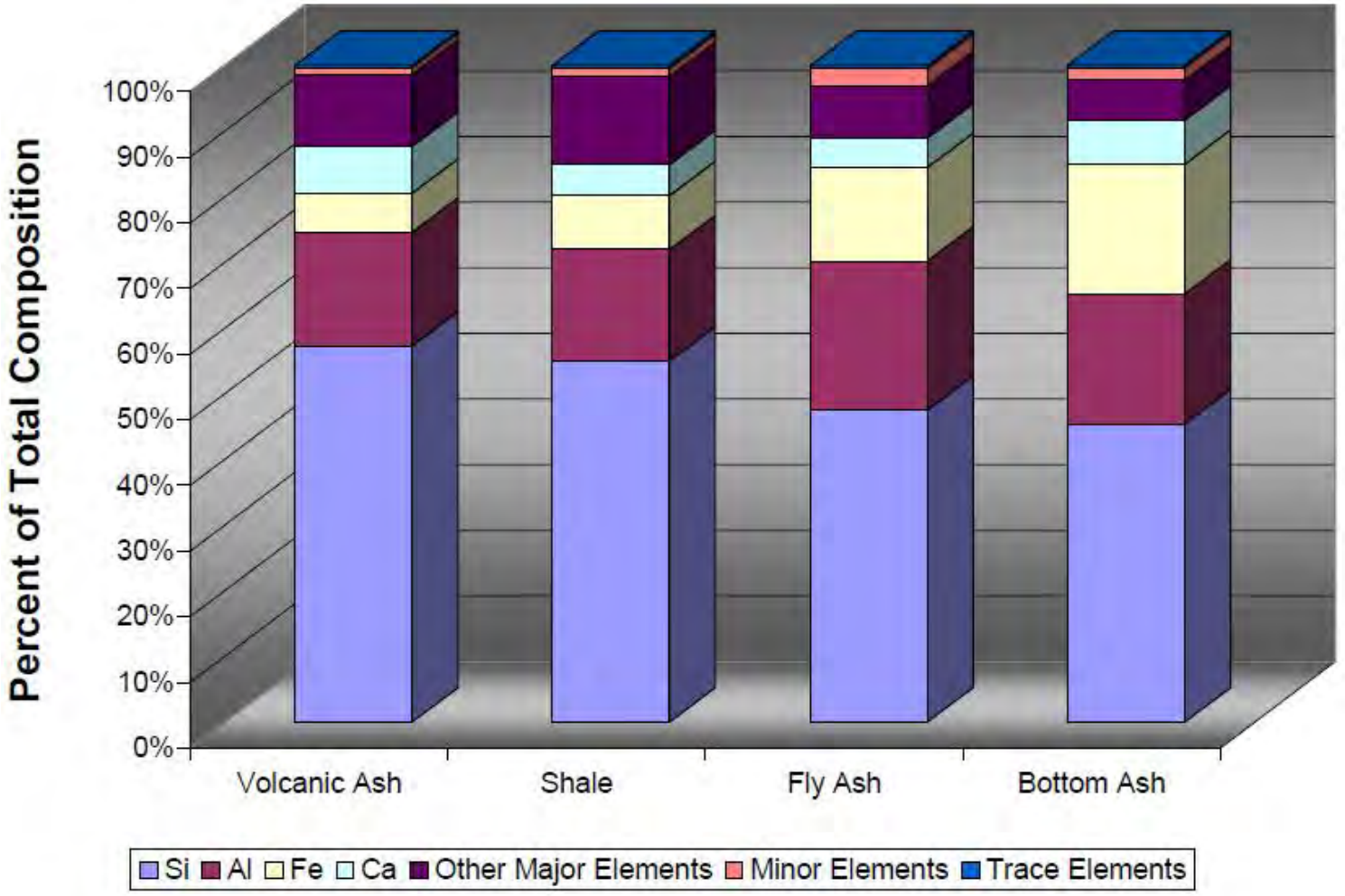
WHO. 2006. Cobalt and Inorganic Cobalt Compounds. Concise International Chemical Assessment Document 69. World Health Organization.

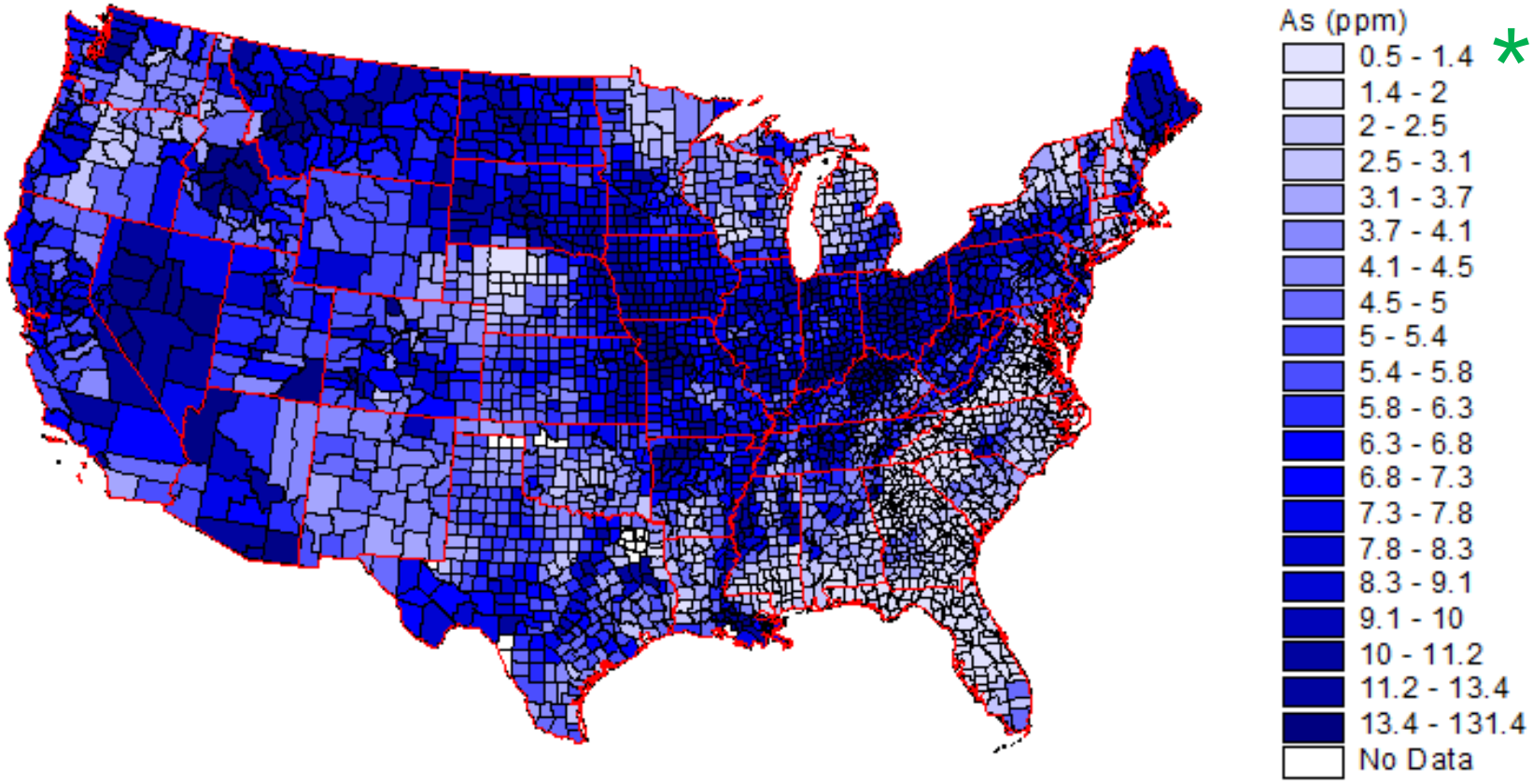
Attachment A – Figures

Figure A-1
Composition of Coal Ash and Other Natural Materials



Source: EPRI. 2010. Comparison of Coal Combustion Products to Other Common Materials – Chemical Characteristics. Report No. 1020556. Available for download at www.epri.com.

Figure A-2
Arsenic is Present in our Natural Environment –
Background Levels in Soils in the U.S.

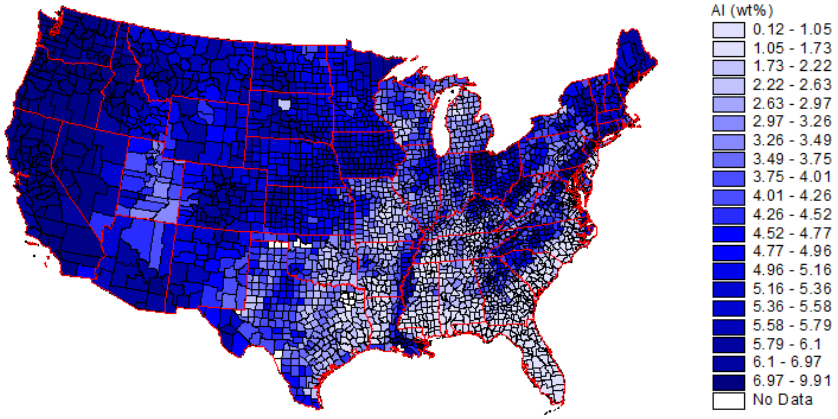


***The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.67 mg/kg. USEPA. 2014c.** http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
Thus the arsenic concentration in the majority of the soils in the U.S. are above the one in one million risk level.

Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

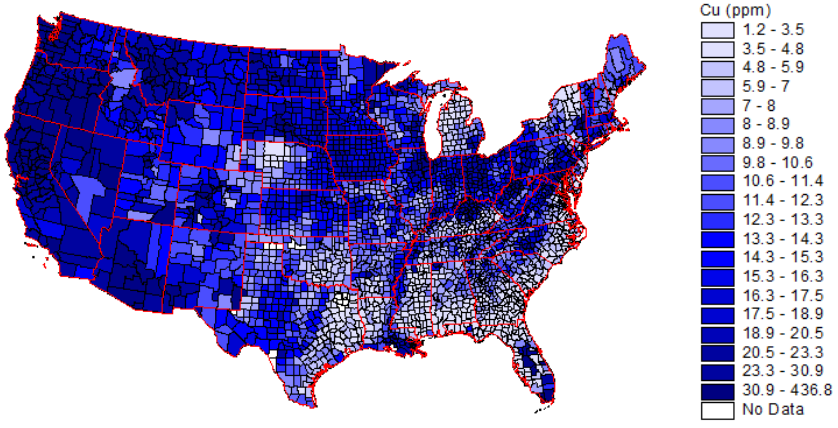
Figure A-3

Aluminum is Present in our Natural Environment –
Background Levels in Soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

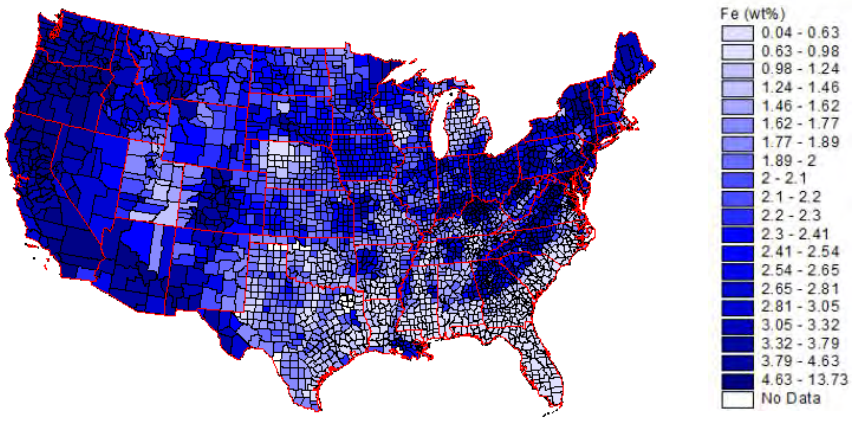
Copper is Present in our Natural Environment –
Background Levels in Soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

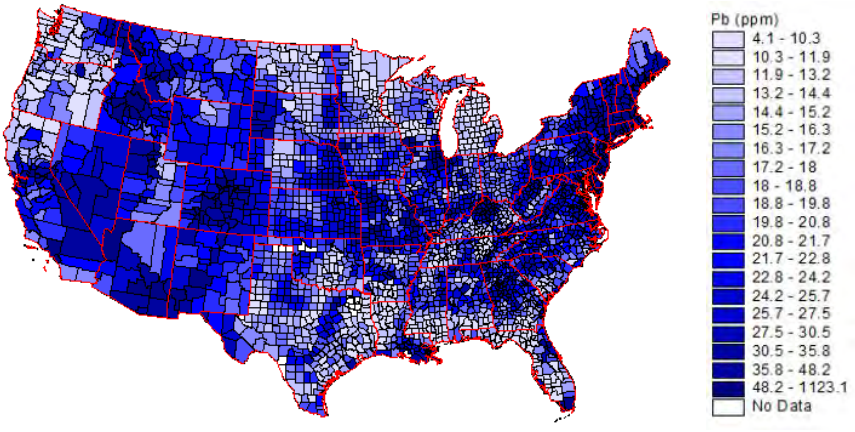
Figure A-4

Iron is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

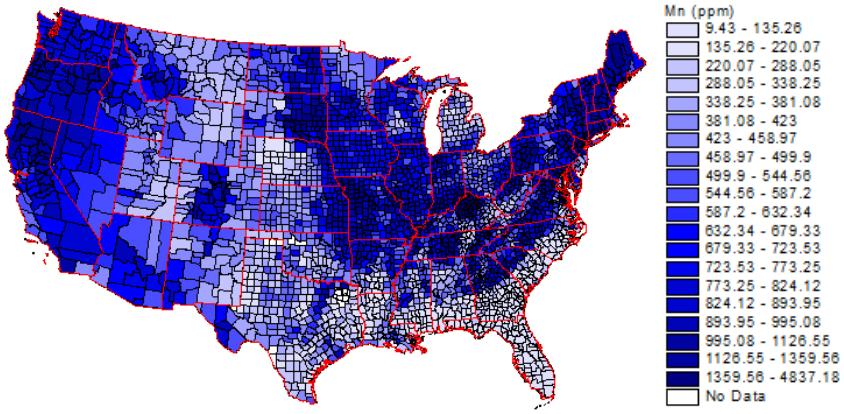
Lead is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

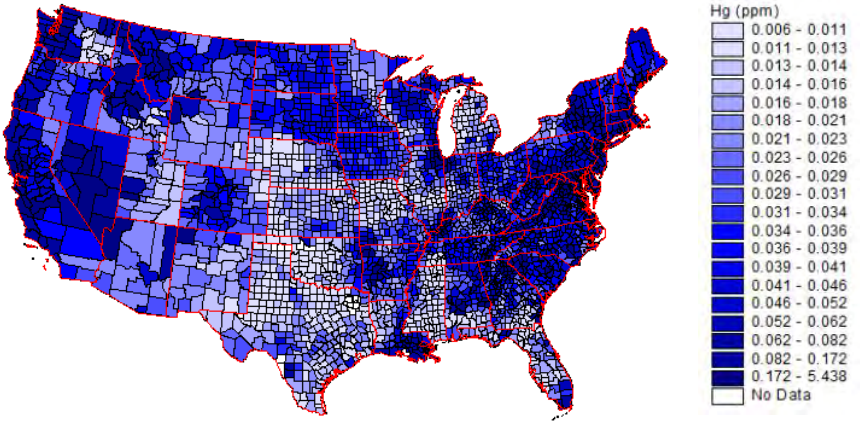
Figure A-5

Manganese is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

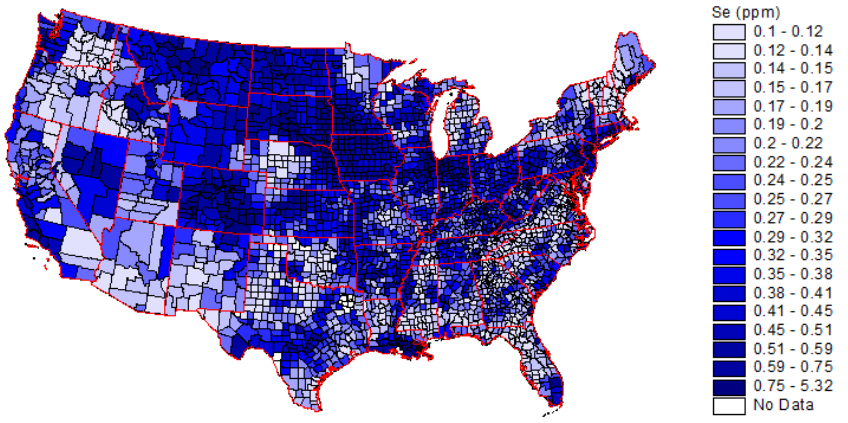
Mercury is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

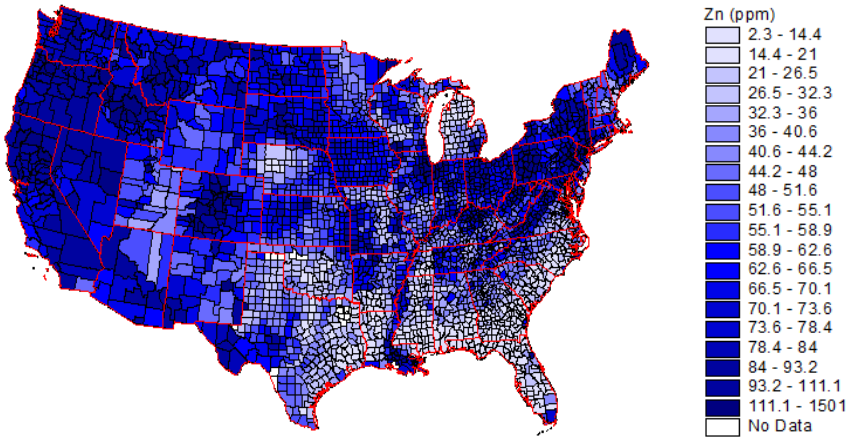
Figure A-6

Selenium is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

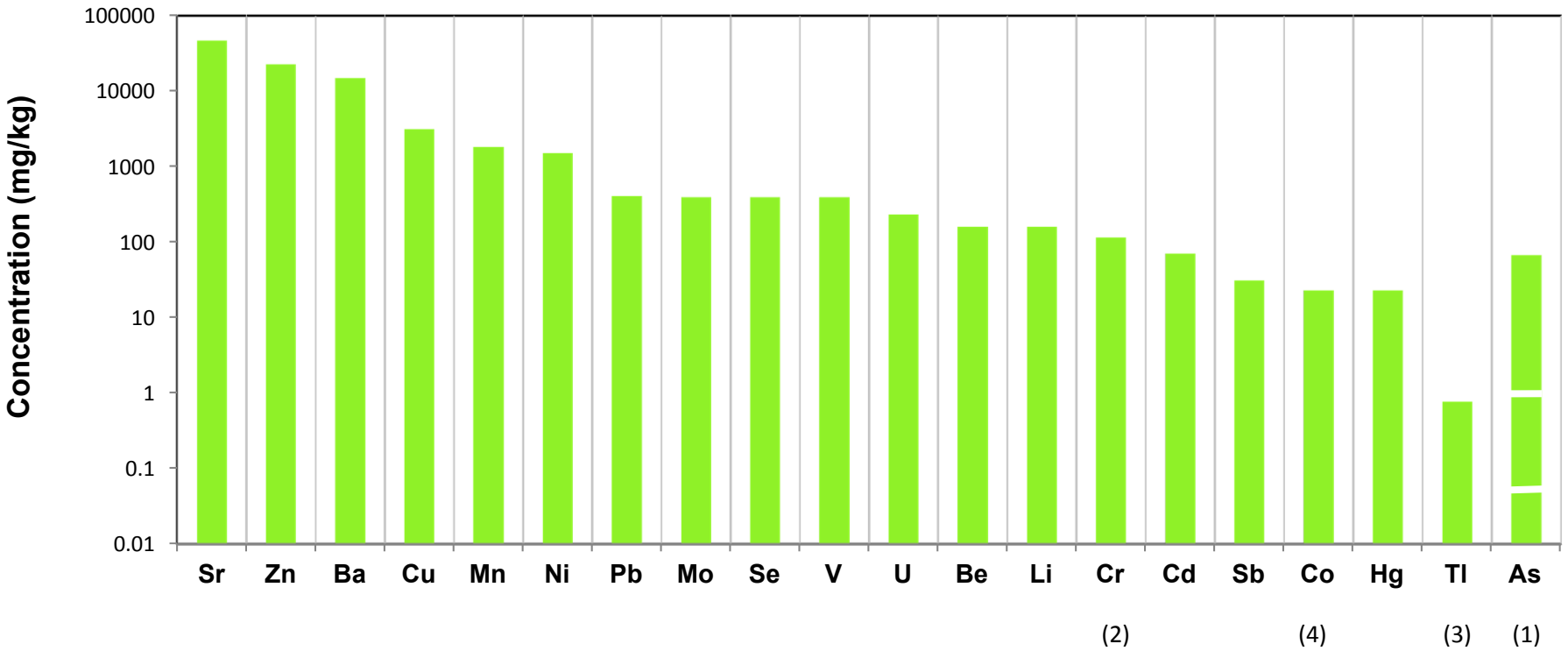
Zinc is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Figure A-7

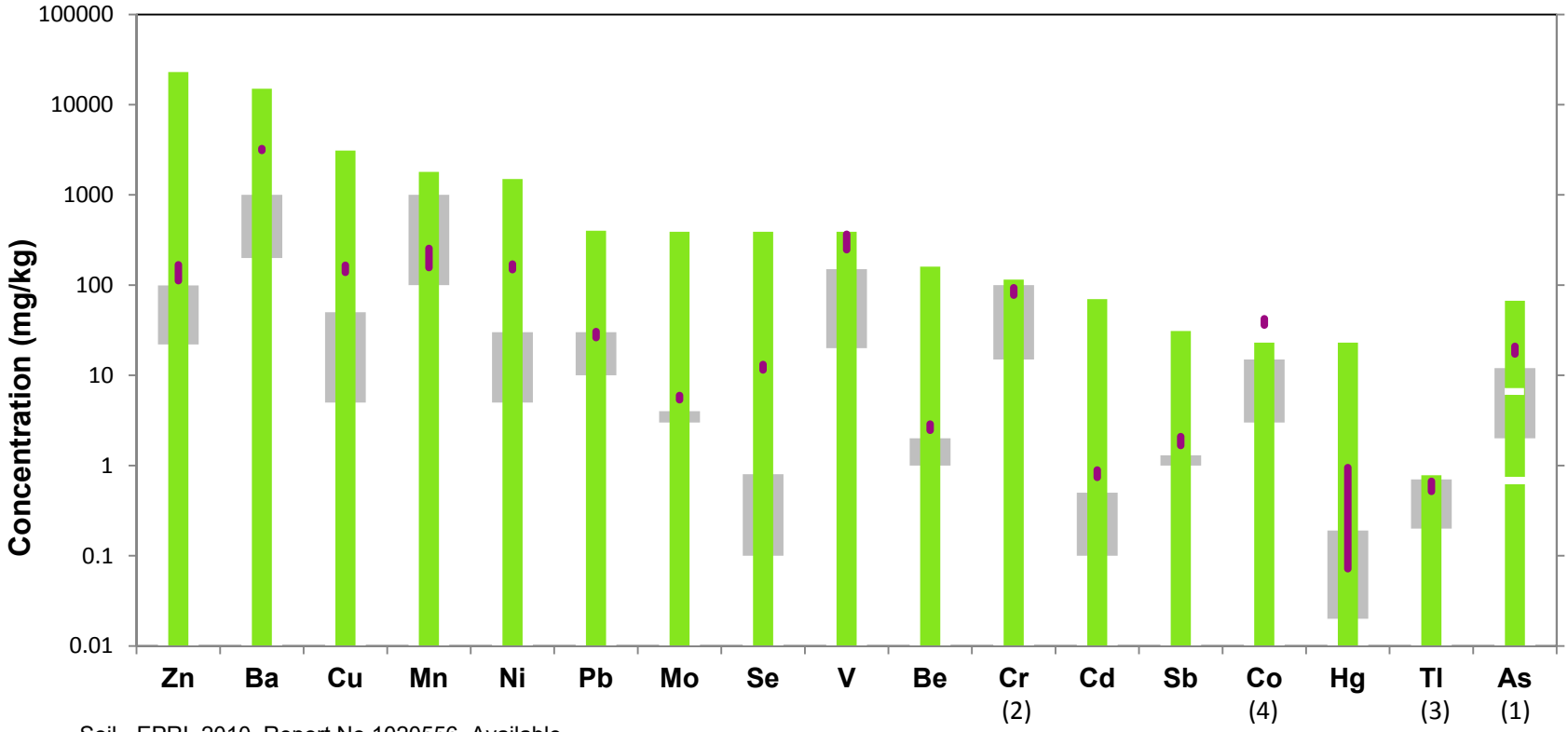
USEPA Regional Screening Levels for Residential Soils - Coal Ash Constituents



Top of bar corresponds to the USEPA Regional Screening Level (RSL) - Residential Soil (May 2014)
http://www.epa.gov/region9/superfund//prg/index.html

Notes:
(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar.
(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.
(3) The RSL for thallium is identified by USEPA as a "provisional value" of "limited usefulness" that was developed for information purposes although USEPA states "it is inappropriate to derive a provisional subchronic or chronic [toxicity value] for thallium" [http://hhpprtv.ornl.gov/issue_papers/ThalliumandCompounds.pdf]
(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

Figure A-8 **Comparison of 10th and 90th percentile USGS Database Constituent Concentrations in Fly Ash from the Wyoming Coal Power Plant and Background Levels in US Soils to the USEPA Regional Screening Levels for Residential Soils**



Soil - EPRI, 2010. Report No.1020556. Available for download at www.epri.com.

USEPA Regional Screening Level (RSL) - Residential Soil (May 2014)
http://www.epa.gov/region9/superfund//prg/index.html

Concentration Range (10th - 90th Percentile) in Wyoming Fly Ash; USGS, 2011.
http://pubs.usgs.gov/ds/635/

Notes:
(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar).
(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.
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(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

ATTACHMENT B

Sioux Energy Center Dilution Factor Calculations

Golder Associates

CALCULATIONS

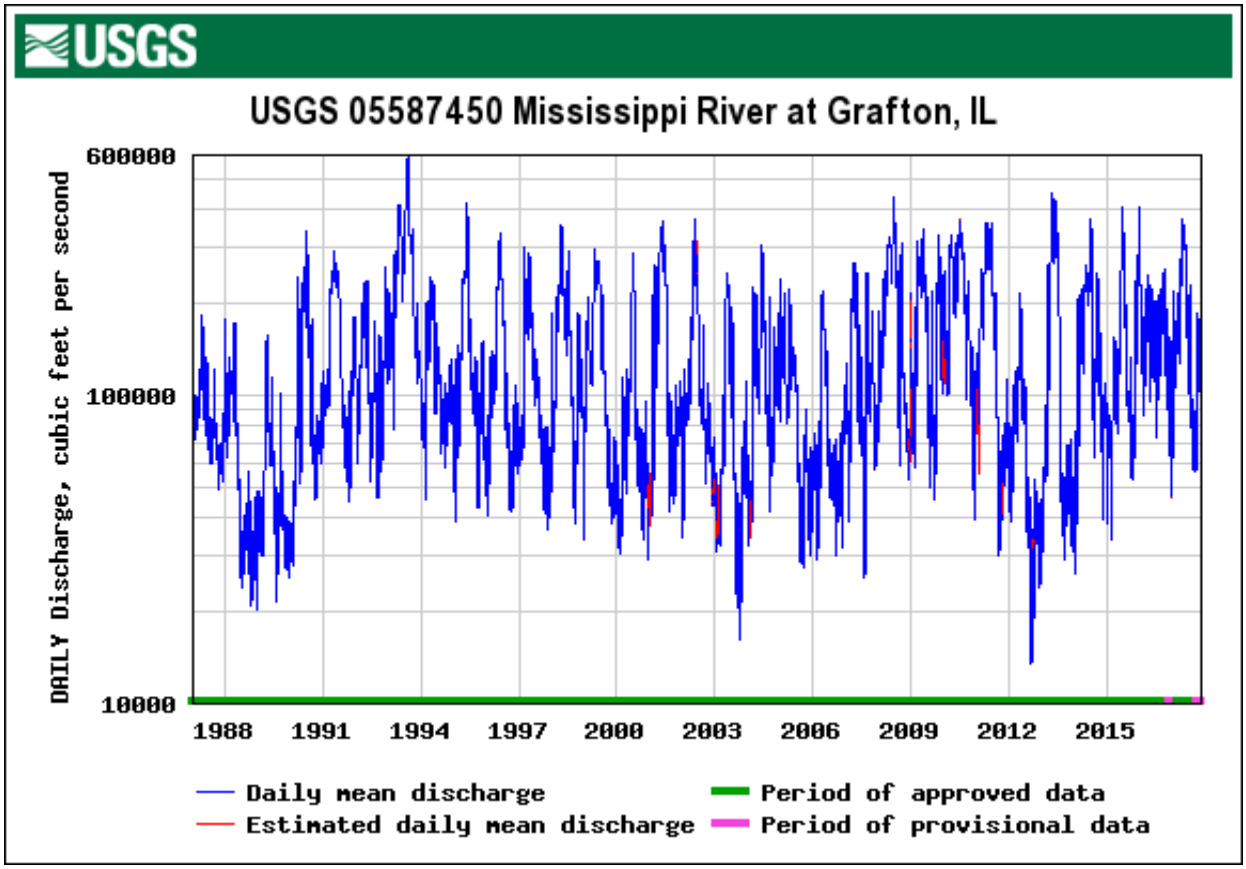
Date: February 8, 2018		**Made by:**	J. Ingram
Project No.: 130-1560		**Checked by:**	E. Kidner
Subject: Sioux Energy Center Dilution Factor Calculations		**Reviewed by:**	M.Haddock

1.0 Introduction

The Mississippi River is a large, flowing water body and daily flow at the Sioux Energy Center is estimated to range between 8 and 385 billion gallons per day, depending upon the river stage. In contrast, during low river flow conditions, average daily groundwater flow into the river is a fraction (estimated to be 92,000 gallons or 0.001%) of the receiving water body. This ratio of flow is referred to as a "dilution factor" and is useful when assessing the relationship between smaller and larger water bodies. Set forth below is a calculation of a dilution factor based on specific criteria and assumptions delineated in Section 1.6.

1.1 Low Discharge Conditions

The Mississippi River at the Sioux Energy Center lies between two lock and dam systems. These lock and dam systems effect the gradient and velocity of the Mississippi River and low river conditions do not always reflect the lowest discharge. Therefore, for this calculation, the lowest discharge is the most conservative value and was used.



Notes:
1) Discharge data for Grafton available at https://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=05587450.
2) Minimum Discharge is 13,400 cubic feet per second on 9/12/2012.

Golder Associates

CALCULATIONS

Date: February 8, 2018 **Made by:** J. Ingram

Project No.: 130-1560 **Checked by:** E. Kidner

Subject: Sioux Energy Center Dilution Factor Calculations **Reviewed by:** M.Haddock

1.2 Low River Conditions

Date	Grafton Gauge Height	Grafton Gauge Elevation	Mississippi River Elevation at the Grafton Gauge	Winfield Gauge Height	Winfield Gauge Elevation	Mississippi River Elevation at the Winfield Gauge
Units	FT Above Gauge	FT MSL	FT MSL	FT Above Gauge	FT MSL	FT MSL
9/12/2012	15.51	403.79	419.3	12.65	407.00	419.7

Notes:
1) FT MSL - feet above mean sea level.
2) Information on the Grafton Gauge available at https://waterdata.usgs.gov/nwis/uv?05587450.
3) Information on the Winfield Gauge available at https://www.weather.gov/lsx/archive_river and http://water.weather.gov/ahps2/hydrograph.php?wfo=lsx&gage=CAGM7.

Mississippi River Elevation at the Grafton Gauge	Mississippi River Elevation at the Winfield Gauge	Distance Between Grafton and Winfield Gauges	Estimated Mississippi River Gradient	Distance from Grafton Gauge to SEC	Estimated Mississippi River Elevation at SEC
FT MSL	FT MSL	River Miles	feet/feet	River Miles	FT MSL
419.3	419.7	22.5	0.000003	7.9	419.2

Notes
1) Estimated Mississippi River level calculated by subtracting the gradient of the Mississippi River multiplied by the distance from the Grafton Gauge (in river feet) from the Grafton Gauge Mississippi River elevation.

1.3 Aquifer Discharge Length and Area

Description	Value	Units
Estimated length of discharge zone	6,045	feet
Estimated top of discharge zone (river level)	419	feet above mean sea level
Estimated bottom of discharge zone (Bedrock)	310	feet above mean sea level
Estimated thickness of discharge zone (Top - Bottom)	109	feet
Estimated area of discharge zone (length x thickness)	658,905	$feet^2$

1.3 Groundwater Properties

Description	Symbol	Value	Units
Average Hydraulic Conductivity (CCR Rule Monitoring Wells)	K	49	feet/day
Average Groundwater Gradient (from GMP)	I	0.0004	feet/feet
Effective Porosity (from GMP)	n	35	%
Average linear groundwater velocity (V=KI/n)	*V*	0.05	feet/day

Golder Associates

CALCULATIONS

Date: February 8, 2018 | **Made by:** J. Ingram

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1.4 Groundwater Discharge

Description	*Symbol*	Value	Units
Average linear groundwater velocity	*V*	0.05	feet/day
Estimated Discharge zone area	*A*	658,905	$feet^2$
Effective Porosity (from GMP)	*n*	35	%
Estimated total GW Discharge (Q=V*A*n)	*Q*	12,269	$feet^3$/day

1.5 Mississippi River Flow

Description	*Value*	Units
Estimated low Missouri River Conditions (9/12/2012)	419	feet above mean sea level
Corresponding Discharge from Grafton Gauge (9/12/2012)	13,400	$feet^3$/sec
Seconds per Day	86,400	seconds/day
Estimated low Flow Daily Discharge (Average Discharge * seconds per day)	1,157,760,000	$feet^3$/day

1.5 Dilution Factor

Description	Values	Units
Estimated Daily Groundwater Discharge	12,269	$feet^3$/day
Estimated Daily Groundwater Discharge	91,777	gallons/day
Estimated Daily River Flow	1,157,760,000	$feet^3$/day
Estimated Daily River Flow	8,660,646,835	gallons/day
Estimated Dilution Factor (River / GW)	**94,366 or >90,000**	Unitless

1.6 List of Conservative Assumptions Used

1) Calculations are based on estimated flow rates and discharge under low flow river conditions. As an example, low flow values used for Sioux Energy Center are from September 12, 2012 which is the lowest discharge value since 1988 according to publically available United States Geological Survey (USGS) data. Using river flow averages would greatly increase the dilution by an order of magnitude. Mississippi River data is available at https://waterdata.usgs.gov/nwis/uv?05587450.
2) To simplify the calculations, the alluvial aquifer was assumed to consist of higher permeability sands, resulting in conservative (higher) estimates of groundwater discharge.
3) The calculations do not take into account any dilution from the alluvial aquifer itself. The river locally recharges the aquifer at varying rates depending on river stage. In addition, on a near continuous basis, groundwater flows from the bedrock aquifer into the shallow alluvial aquifer. All of these sources increase dilution within the alluvial aquifer.

Although these calculations use conservative assumptions which would serve to increase the dilution factor ratio, the calculated value for the dilution factor has been rounded down. This dilution factor ratio represents a worst case scenario and actual dilution factors are likely greater.

CALCULATIONS

Date: February 12, 2018 | **Made by:** J. Ingram

Project No.: 130-1560 | **Checked by:** R. Feldmann

Subject: Sioux Energy Center Dilution Factor Calculations - Missouri River | **Reviewed by:** M. Haddock

1.0 Introduction

The Sioux Energy Center in St. Charles County, Missouri lies between the Mississippi and Missouri Rivers. Groundwater gradients are low, and groundwater can flow both to the north and south depending on river levels in the adjacent Mississippi and Missouri Rivers. The Missouri River is a large, flowing water body south of the facility and daily flow at the Sioux Energy Center is estimated to range between 18 and 333 billion gallons per day, depending upon the river stage. In contrast, during low river flow conditions, average daily groundwater flow into the river is a fraction (estimated to be 71,000 gallons or 0.0004%) of the receiving water body. This ratio of flow is referred to as a "dilution factor" and is useful when assessing the relationship between smaller and larger water bodies. Set forth below is a calculation of a dilution factor based on specific criteria and assumptions delineated in Section 1.6.

1.1 Low River Conditions

Date	Washington Gauge Height (Feet Above Gauge)	Washington Gauge Elevation (Feet Above Mean Sea Level)	Missouri River Elevation at the Washington Gauge (feet MSL)	St. Charles Gauge Height (Feet Above Gauge)	St. Charles Gauge Elevation (Feet Above Mean Sea Level)	Missouri River Elevation at the St. Charles Gauge (feet MSL)
1/25/2013	-1.19	457.27	456.08	5.06	413.47	418.53

Notes:
1) feet MSL - feet above mean sea level.
2) Information on the Washington Gauge available at https://waterdata.usgs.gov/usa/nwis/uv?06935450.
3) Information on the St. Charles Gauge available at https://waterdata.usgs.gov/mo/nwis/uv?site_no=06935965.
4) 5.06 is the lowest gauge height for the St. Charles Gauge on the Missouri River since October, 2007. This date is used because prior to this date no publicly available flow data was collected at the St. Charles Gauge.

Missouri River Elevation at the Washington Gauge (feet MSL)	St. Charles Gauge Elevation (Feet Above Mean Sea Level)	Distance Between Washington and St. Charles Gauges (River Miles)	Missouri River Gradient (feet/feet)	Distance from St. Charles Gauge to SEC (River Miles)	Estimated Missouri River Elevation at SEC (feet MSL)
456.08	418.53	39.1	0.00018	13.9	405

Notes:
1) Estimated Missouri River level calculated by subtracting the gradient of the Missouri River multiplied by the distance from the St. Charles Gauge (in river feet) from the St. Charles Gauge elevation.

1.2 Aquifer Discharge Length and Area

Description	Value	Units
Estimated length of discharge zone	5,400	feet
Estimated top of discharge zone (low river level)	405	feet above mean sea level
Estimated bottom of discharge zone (bedrock)	310	feet above mean sea level
Estimated thickness of discharge zone (top - bottom)	95	feet
Estimated area of discharge zone (length x thickness)	513,000	$feet^2$

Date: February 12, 2018 **Made by:** J. Ingram

Project No.: 130-1560 **Checked by:** R. Feldmann

Subject: Sioux Energy Center Dilution Factor Calculations - Missouri River **Reviewed by:** M. Haddock

1.3 Groundwater Properties

Description	Symbol	Value	Units
Average Hydraulic Conductivity (CCR Rule Monitoring Wells)	K	49	feet/day
Average Groundwater Gradient (from GMP)	I	0.0004	feet/feet
Effective Porosity (from GMP)	n	35	%
Average linear groundwater velocity (V=KI/n)	*V*	0.05	feet/day

1.4 Groundwater Discharge

Description	Symbol	Value	Units
Average linear groundwater velocity	*V*	0.05	feet/day
Estimated Discharge zone area	*A*	513,000	$feet^2$
Effective Porosity (from GMP)	*n*	35	%
Estimated total GW Discharge (Q=V*A*n)	*Q*	9,552	$feet^3$/day

1.5 Missouri River Flow

Description	Value	Units
Estimated low Missouri River Conditions (1/25/13)	405	feet above mean sea level
Corresponding Discharge from St. Charles Gauge (1/25/13)	27,800	$feet^3$/sec
Seconds per Day	86,400	seconds/day
Estimated low Flow Daily Discharge (Average Discharge * seconds per day)	2,401,920,000	$feet^3$/day

1.5 Dilution Factor

Description	Values	Units
Estimated Daily Groundwater Discharge	9,552	$feet^3$/day
Estimated Daily Groundwater Discharge	71,454	gallons/day
Estimated Daily River Flow	2,401,920,000	$feet^3$/day
Estimated Daily River Flow	17,967,610,598	gallons/day
Estimated Dilution Factor (River / GW)	**251,456 or >100,000**	Unitless

1.6 List of Conservative Assumptions Used

1) Calculations are based on estimated flow rates and discharge under low flow river conditions. As an example, low flow values used for Sioux Energy Center are from January 25, 2013, which is the lowest discharge value since October 2007 according to publicly available United States Geological Survey (USGS) data. Using river flow averages would greatly increase the dilution by an order of magnitude. Missouri River data is available at https://waterdata.usgs.gov/usa/nwis/uv?06935965.

2) To simplify the calculations, the alluvial aquifer was assumed to consist of higher permeability sands, resulting in conservative (higher) estimates of groundwater discharge.
3) The calculations do not take into account any dilution from the alluvial aquifer itself. The river locally recharges the aquifer at varying rates depending on river stage which increases dilution within the alluvial aquifer.

Although these calculations use conservative assumptions which would serve to increase the dilution factor ratio, the calculated value for the dilution factor has been rounded down. This dilution factor ratio represents a worst case scenario and actual dilution factors are likely greater.