



# Moab UMTRA Project Groundwater and Surface Water Monitoring Report July through December 2022

Revision 0

April 2023



U.S. Department  
of Energy

## Office of Environmental Management

**Moab UMTRA Project  
Groundwater and Surface Water Monitoring Report July through December 2022**

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**Revision 0**

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## Revision History

Revision	Date	Reason for Revision
0	April 2023	Initial issue.

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## Acronyms and Abbreviations

bgs	below ground surface
CF	configuration
CFR	Code of Federal Regulations
cm	centimeter
COC	chain-of-custody
DOE	U.S. Department of Energy
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ft	feet or foot
IDL	instrument detection limit
MB	method blank
MDL	method detection limit
MESa	Moab Environmental Sampling Database
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
RIN	report identification number
RL	reporting limit
RPD	relative percent difference
SDG	sample data group
UMTRA	Uranium Mill Tailings Remedial Action
yr	year

## **1.0 Introduction**

### **1.1 Purpose**

The purpose of this semi-annual report is to present the results and provide interpretation of the data associated with groundwater and surface water samples collected from the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site during the second half of calendar year 2022. The results of the data validation process are also presented.

The first event included the collection of samples in July 2022 from the Interim Action Well Field (Configuration (CF) 4 monitoring wells, CF5 groundwater extraction wells). These locations are shown on Figure 1.

The second event included samples from Crescent Junction monitoring wells 0202 and 0205 in December 2022. These locations are shown in Figure 2.

### **1.2 Scope**

This report presents a summary of sampling events and data assessments, including a summary of the anomalous data generated by the validation process and results for these events. Sampling and analyses were conducted in accordance with the *Moab UMTRA Project Surface Water/Groundwater Sampling and Analysis Plan* (DOE-EM/GJRAC1830). All data validation follows criteria in the *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJRAC1855). The CF4 and 5 and Crescent Junction sampling events were validated to Level 2.

Appendix A includes the Water Sampling Field Activities Verification and the trip report associated with the CF4 and CF5 and sampling event. Appendix B provides similar documentation for the Crescent Junction sampling event.

The Minimums and Maximums analyses were generated by the Moab Environmental Sampling (MESa) database to determine if the applicable data were within a normal statistical range. The new data set was compared to the historical data to determine if the new data fall outside the historical range. The results are not considered anomalous if: (1) identified low concentrations are the result of low detection limits, (2) the concentration detected is less or more than 50 percent of historical minimum or maximum values, or (3) there were fewer than five historical samples for comparison. Anomalous results are provided in tables in the “Data Assessment” section for each sampling event.

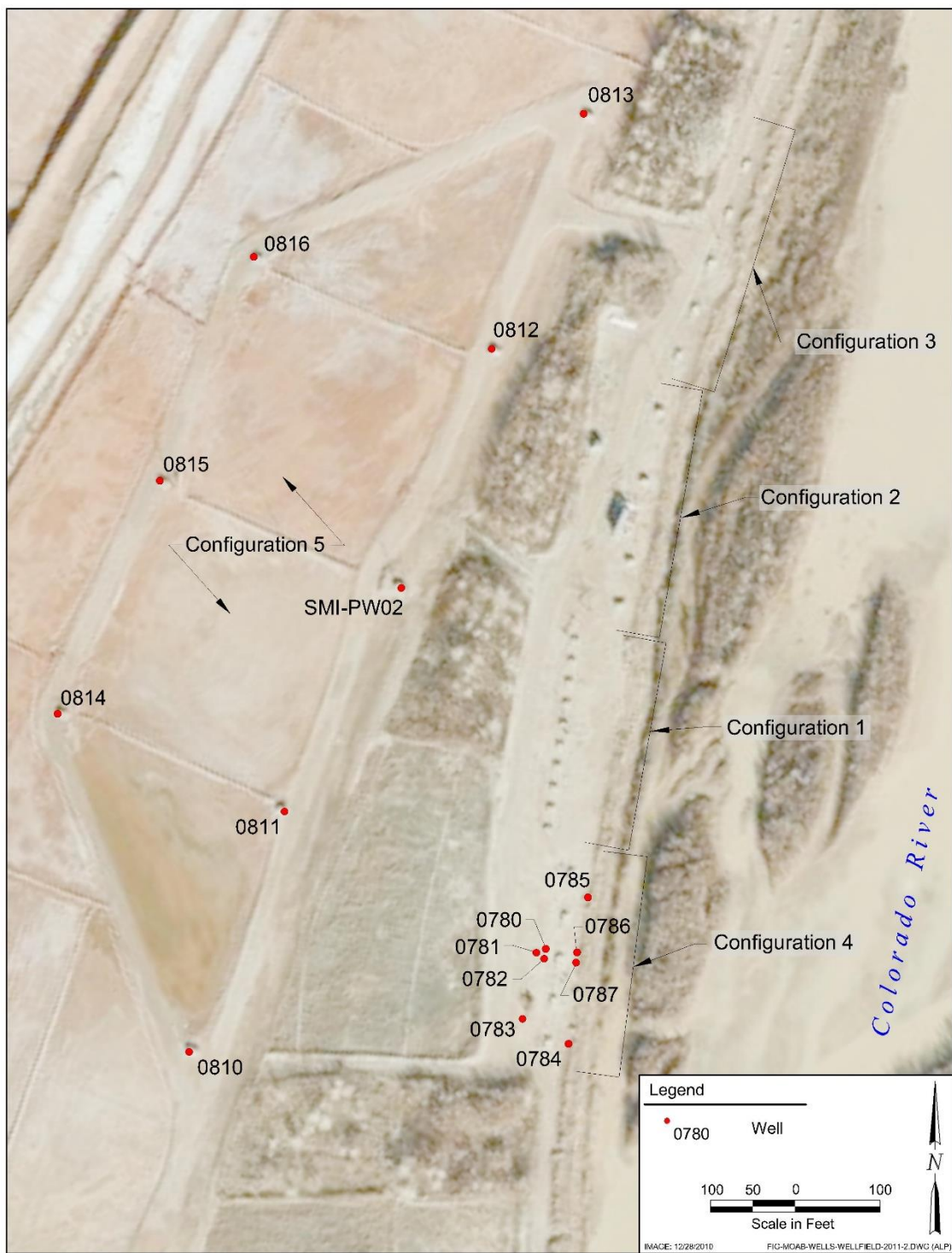


Figure 1. Second Half of 2022 CF4 and CF5 Groundwater Sampling Locations



Figure 2. Crescent Junction Sampling Locations (0202 and 0205)

### 1.3 Data Validation Definitions

The following definitions are associated with the data validation process. Data validation details are provided in the following sections of this report for the individual sampling events.

#### Method and Calibration Blanks

Method blanks (MBs) are analyzed to assess any contamination that may have occurred during sample preparation. Both initial calibration blanks and continuing calibration blanks are analyzed to assess instrument contamination before and during sample analysis. Depending on method requirements, detected sample results greater than the method detection limit (MDL) or instrument detection limit (IDL) are qualified “J” when the detections are less than five times the blank concentration. Non-detects are not qualified.

#### Matrix Spike and Replicate Analysis

Matrix Spike (MS) sample analysis, performed at a frequency of one per 20 samples unless otherwise noted, is a measure of the ability to recover analytes in a particular matrix. The MS sample results are required to be within the recovery limits.

#### Laboratory Replicate Analysis

The laboratory replicated results demonstrate acceptable laboratory precision. The relative percent difference (RPD) values for the reported matrix spike duplicate (MSD) results for all other analytes should be less than 20 percent for results greater than five times the reporting limit (RL).

## Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of the overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory replicates, which measure only laboratory performance. The duplicate results must meet the U.S. Environmental Protection Agency (EPA)-recommended laboratory duplicate criteria of less than 20 RPD for results that are greater than five times the reporting limit (RL).

## 2.0 July 2022 CF4 and CF5 Sampling Event

### 2.1 Summary

Groundwater samples were collected from seven CF5 extraction wells to determine mass removal calculations for ammonia and uranium concentrations and to assess well field performance. Extraction well 0814 was not sampled due to a submersible pump issue.

Groundwater samples were also collected from the eight CF4 monitoring wells to determine the impact of the freshwater injection system on the shallow aquifer. These ground water samples were collected to determine how the freshwater injection system impacts shallow zone ammonia concentrations, particularly downgradient of the CF4 injection wells.

### 2.2 July 2022 CF4 and CF5 Data Assessment

#### 2.2.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 2, Data Deliverables Examination. All analyses were successfully completed.

#### General Information and Validation Results

RIN 2207137  
Laboratory: ALS Analytics, Fort Collins, Colorado  
SDG Number: 2207335  
Analysis: Metals and Inorganics  
Validator: Thomas Prichard  
Review Date: January 2023

The samples were prepared and analyzed using accepted procedures as shown in Table 1.

Table 1. July 2022 CF4 and CF5 Sampling Event, Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH <sub>3</sub> -N	EPA 350.1	EPA 350.1
Uranium	SW-846- 3005A	SW-846 6020A

#### Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to Table 3 for an explanation of the data qualifiers applied.

Table 2. July 2022 CF4 and CF5 Sampling Event, Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
SDG 2207335-1 thru -16	All in SDG 2207335	Uranium	J	MS-1, MSD-1
SDG 2207335-3MS	0782	Ammonia as N	J	MS-2

Notes: "J" indicates results are estimated; it becomes "UJ" for analytical results lower than the detection limit.

Table 3. July 2022 CF4 and CF5 Sampling Event, Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
MS-1	J	UJ	The MS sample chosen was from another client.
MS-2	J	UJ	The native sample was flagged for ammonia as N. The laboratory control samples indicate the procedure was in control.
MSD-1	J	UJ	No MSD data was included in the narrative.

Notes: "J" indicates results are estimated; it becomes "UJ" for analytical results lower than the detection limit. U indicates the result is below the detection limit.

### Sample Shipping/Receiving

ALS Analytics in Fort Collins, Colorado received a total of 32 samples from 15 locations for report identification number (RIN) 2207137 in one shipment; tracking number 1Z5W1Y510197533982 on July 16, 2022.

The sample data group (SDG) was accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all the samples were listed on the form with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt.

### Preservation and Holding Times

SDG 2207335 was received intact with a temperature of 3.6°C. All samples were received in the correct container types and all samples were analyzed within the applicable holding times.

### Case Narratives

The case narratives were reviewed, and all detects were found to be within quality-control procedures except for the following:

### Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory replicates, which measure only laboratory performance. A duplicate sample (2207335-12 and -13) was collected from location 0813. The ammonia as N concentration for sample 2207335-13 was reported as 2.6 mg/L, an anomalously low value. The paired sample (2207335-12) had a reported ammonia concentration of 290 mg/L. Reviewing the dilution factors listed in the report indicates the result for 2207335-13 should be 260 mg/L. This data was amended in MESa.

### Matrix Spike and Replicate Analysis

For the uranium analyses, the selected quality control samples were from another client and not

included in the narrative. As a result, there was not an MSD or an SD sample analysis. Therefore, all uranium data are flagged “J” for reasons MS-1, MSD-1. Additionally, sample 2207335-3MS was flagged “J” for reason MS-2. Per the case narrative:

*Matrix spikes (MS) were prepared and analyzed with the ammonia as N batch. All guidance criteria or precision and accuracy were met with the following exception:*

<u>Analyte</u>	<u>Sample ID</u>
Ammonia as N	2207335-3MS

*The native sample result is flagged for ammonia as N. The laboratory control samples indicate that the sample was in control.*

## Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

## Electronic Data Deliverable Files

The Electronic Data Deliverable (EDD) files for SDG 2207335 were received on July 29, 2022. The contents of the EDD were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

### 2.2.2 Minimums and Maximums Report and Anomalous Data Review

Based on the results, most concentrations are within the historical range. Table 4 shows the sample results that were greater than 10% from the historical range.

*Table 4. Anomalous Data Associated with the CF4 and CF5 Sampling Event*

Location	Sample Date	Analyte	Concentration (mg/L)	Historical Minimum (mg/L)	Historical Maximum (mg/L)	Disposition
0783	7/06/2022	Uranium	0.03	0.037	3.7	These concentrations are less than the historical values. These locations will continue to be monitored to determine the general trend in concentration.
SMI-PW02	7/12/2022	Ammonia Total as N	330	370	4400	

## 2.3 July 2022 CF4 and CF5 Sampling Event Results

### CF4 Sampling

Injection operations had been nearly continuous throughout the year, excluding two weeks in May during high river flow.

The CF4 injection wells are screened and deliver fresh water into the subsurface from 15 to 35 feet (ft) below ground surface (bgs). July 2022 ammonia concentrations are presented in Table 5.

Baseline concentrations represent sample results from January 2019, when limited freshwater was injected (less than 750,000 gal) for the six months leading up to the sample collection.

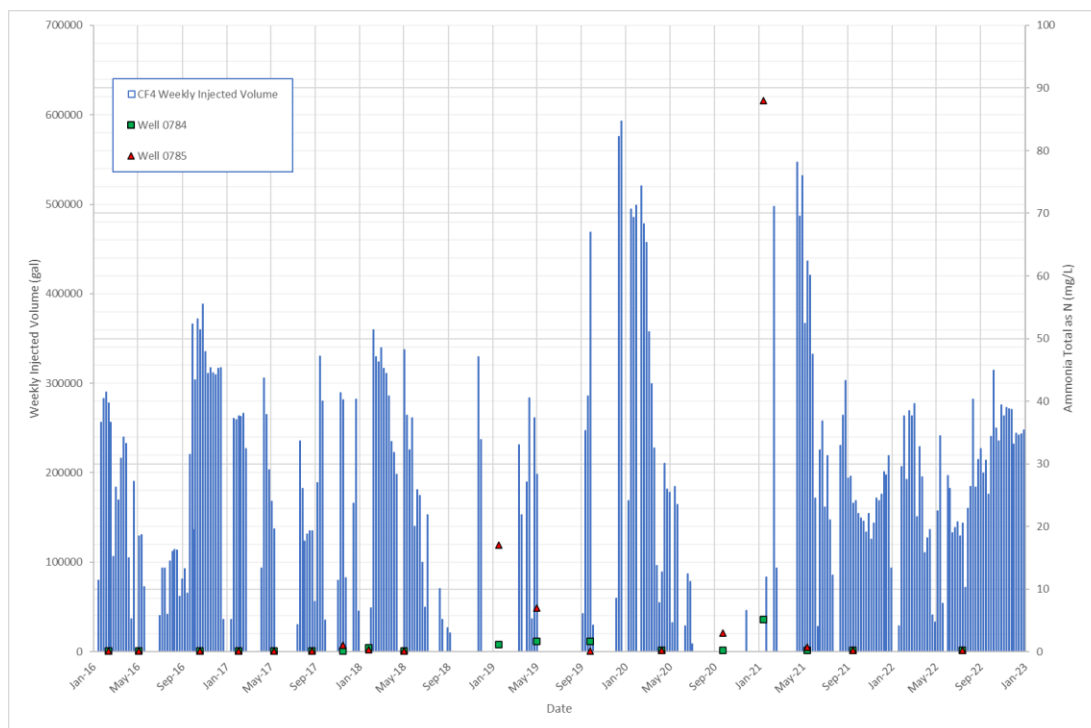
July 2022 ammonia concentrations (Table 5) in shallow wells (less than 30 ft bgs) were all at non-detect levels both up- and downgradient. The deepest well (0781, 46ft bgs) had the highest concentration at 1000 mg/L, similar to 2021. Wells 0782 and 0787 (33 and 36 ft bgs, respectively) had moderate concentrations at 8.2 and 20 mg/L, respectively.

*Table 5. CF4 Monitoring Well Ammonia Concentrations, July 2022*

Location	Sample Depth (ft bgs)	Upgradient or Downgradient of Injection Wells	Baseline* Concentration (mg/L)	July 2022 Ammonia Concentration (mg/L)
0780	28	Upgradient	330	0.2 (ND)
0781	46	Upgradient	1,900	1000
0782	33	Upgradient	1,100	8.2
0784	18	Downgradient	1.1	0.2 (ND)*
0785	18	Downgradient	17	0.2 (ND)*
0786	28	Downgradient	480	0.2 (ND)
0787	36	Downgradient	2,100	20

Notes: \* = Baseline concentrations taken from samples collected August 2010, prior to when the CF4 wells were used exclusively for injection purposes. (ND)= non-detect or at detection limit of 0.2 mg/L.

Figure 3 displays the ammonia concentrations in samples collected down gradient from a depth of 18 ft bgs (wells 0784 and 0785) since 2016, along with the CF4 weekly injected volume. As the plot displays, consistent injection continues to significantly decrease the shallow groundwater system ammonia concentrations downgradient of the injection wells.



*Figure 3. January 2016 through January 2023 CF4 Shallow Zone Ammonia Groundwater Concentrations in Response to Freshwater Injection*

## CF5 Sampling

Groundwater samples were also collected from the CF5 extraction wells (locations shown on Figure 1) in July 2022. The extraction system had been consistently operational for approximately three months prior to the sample collection, with more than 3.4 mil gal of groundwater removed from the groundwater system during that time. CF5 extraction well ammonia and uranium concentrations associated with this sampling event are displayed in Table 6.

Time versus concentration plots (Figures 4 through 7) were also generated to display the CF5 extraction well ammonia and uranium concentrations measured since July 2010. This nearly covers the timeframe these wells have been utilized to extract groundwater (they were brought online starting in April 2010). Trend lines are also included in these plots.

Table 6. CF5 Extraction Well Analytical Results

Location	Sample Date	Ammonia (mg/L)	Uranium (mg/L)
0810	07/12/2022	250	2.8
0811		310	2.4
0812		340	2.1
0813		290	1.9
0814		NA	NA
0815		100	2.9
0816		110	2.6
PW02		330	2.9

Table 7 provides the geometric mean, standard deviation, 95% confidence interval, and the change in ammonia concentration based on the linear trend line for the CF5 extraction wells since 2010. The trend lines applied to data collected since June 2010 from CF5 extraction wells indicate that, except for the samples collected from well 0813, on average the ammonia concentrations are decreasing at a rate ranging from 5.7 to 20.9 mg/L/yr. As of 2022, the CF5 extraction well geometric mean ammonia concentrations range from 149 to 454 mg/L.

Table 7. Statistical Data for CF5 Extraction Well Ammonia Data, 2010 through 2022

Ammonia Concentrations (2010 – 2022)	CF5 Extraction Well							
	0810	0811	0812	0813	0814	0815	0816	PW02
Geometric Mean (mg/L)	322.9	391.3	424.8	348.2	229.6	199.4	148.7	453.7
Standard Deviation (mg/L)	47.4	68.1	70.9	82.5	191.1	81.8	59.5	64.0
95% Confidence Interval (mg/L)	16.7	24.2	24.6	26.9	65.2	28.8	20.6	22.9
Change in Concentration (mg/L/yr)	-5.7	-13.1	-6.1	2.0	-12.6	-20.9	-14.5	-14.5

The trend line associated with data collected from well 0813 indicates concentrations have been increasing over the past 12 years, at a rate of 2.0 mg/L/yr. This increase is a function of the historical low concentrations (measured after the 2011 flooding event) impacting the data set.

Considering the ammonia analytical results since 2013, the concentrations decrease on average 9.0 mg/L/yr.

Statistical data for the uranium results since 2010 are presented in Table 8. Trend lines applied to the uranium results over the past 12 years for all CF5 wells indicate six wells on average are decreasing as much as 0.04 mg/L/yr, one well is increasing at up to 0.06 mg/L/yr, and one well has not changed. The well associated with the highest increases is well 0813, which increased on average 0.07 mg/L/yr, located at the northern end of CF5. This minimal increase in uranium is associated with the periodic influx of oxygenated water and its impact on the subsurface geochemical conditions.

*Table 8. Statistical Data for CF5 Extraction Well Uranium Data, 2010 through 2022*

Uranium Concentrations (2010 – 2022)	CF5 Extraction Well							
	0810	0811	0812	0813	0814	0815	0816	PW02
Geometric Mean (mg/L)	3.02	2.59	2.20	1.69	2.73	3.26	2.44	3.14
Standard Deviation (mg/L)	0.55	0.37	0.44	0.48	0.23	0.47	0.49	0.54
95% Confidence Interval (mg/L)	0.19	0.13	0.15	0.16	0.08	0.16	0.17	0.19
Change in Concentration (mg/L/yr)	-0.04	-0.01	0.00	+0.07	-0.01	-0.02	-0.01	-0.04

Figure 4 is the time versus ammonia concentration plot for extraction wells 0810 through 0813 and SMI-PW02, all of which are located along the CF5 southeastern boundary. Figure 5 displays a time versus uranium concentration plot for the same set of wells. Figures 6 and 7 are the time versus ammonia and uranium concentration plots, respectively, for CF5 wells 0814 through 0816 (which are located closer to the base of the tailings pile).

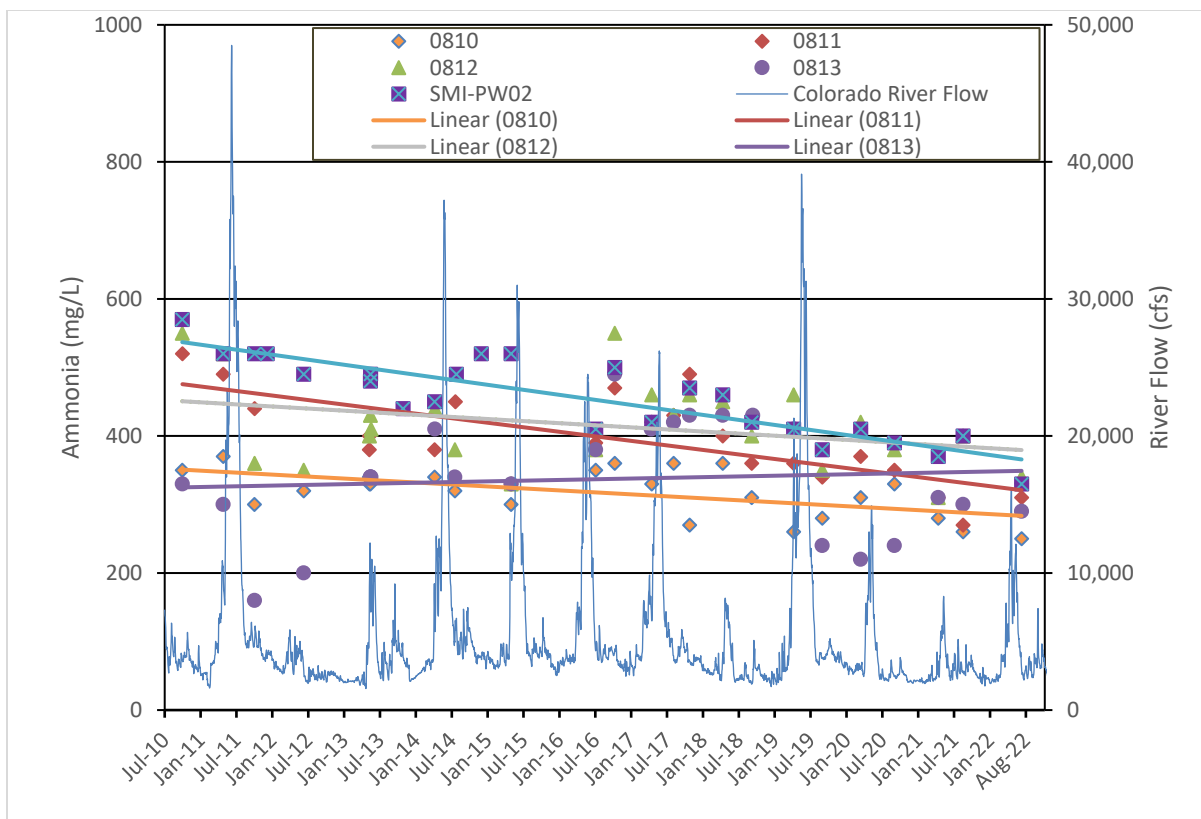


Figure 4. CF5 Extraction Wells 0810, 0811, 0812, 0813, and SMI-PW02 Time versus Ammonia Concentration Plot

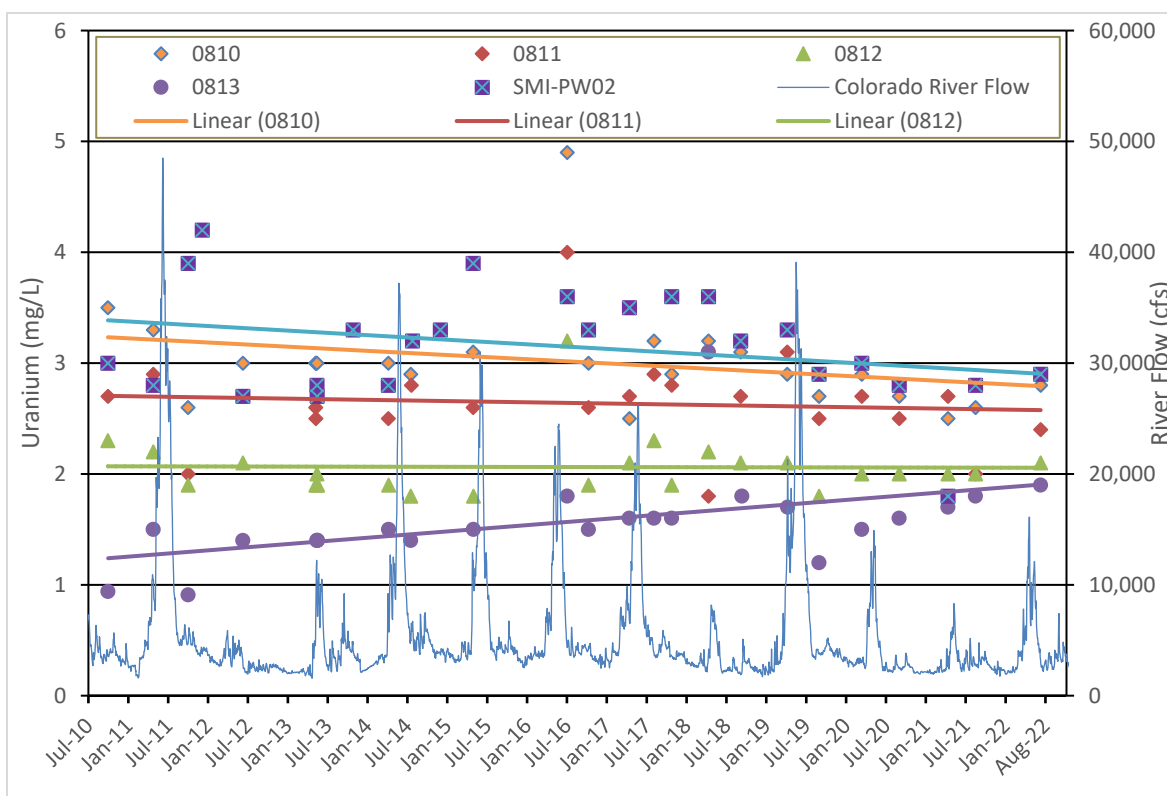


Figure 5. CF5 Extraction Wells 0810, 0811, 0812, 0813, and SMI-PW02 Time versus Uranium Concentration Plot

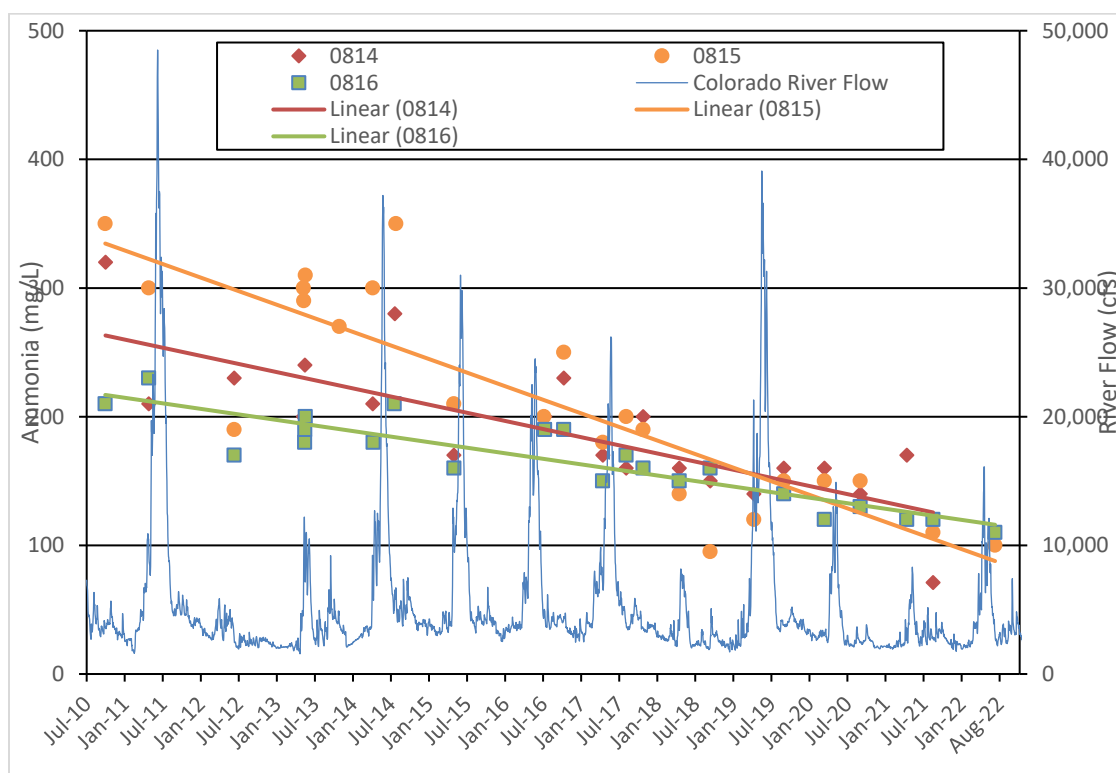


Figure 6. CF5 Extraction Wells 0814, 0815, and 0816  
Time versus Ammonia Concentration Plot

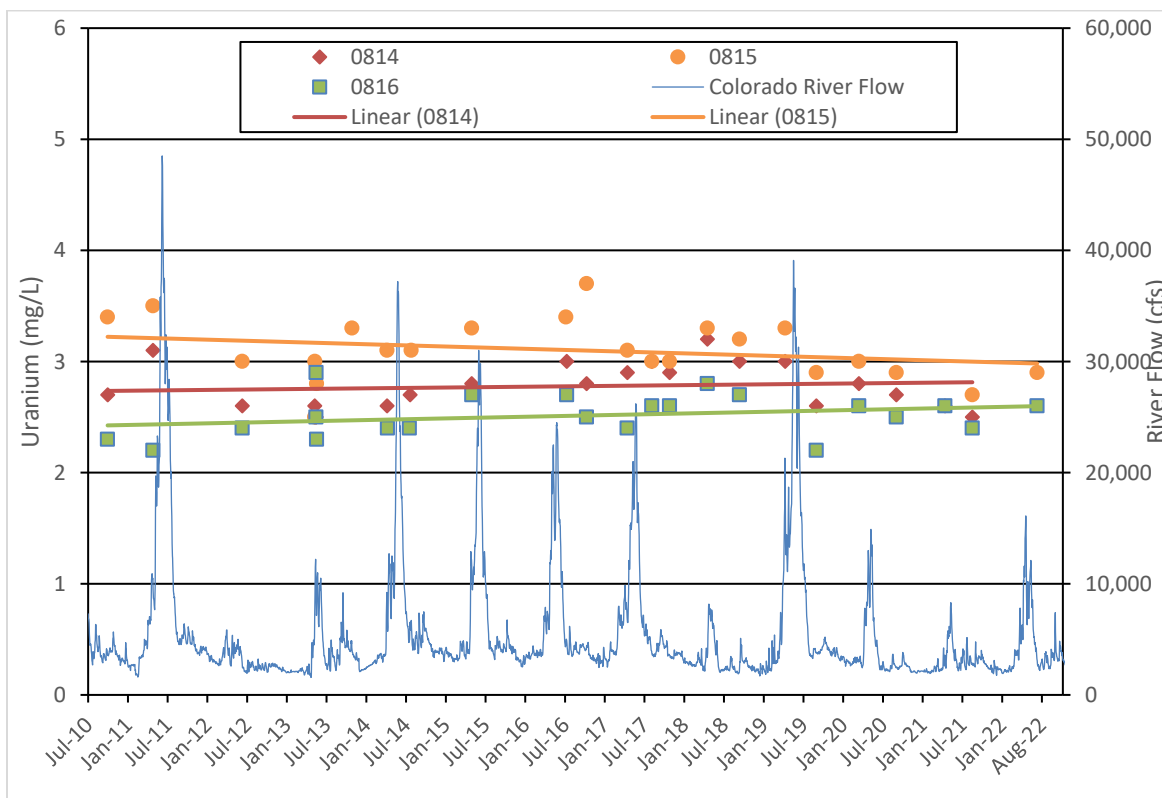


Figure 7. CF5 Extraction Wells 0814, 0815, and 0816  
Time versus Uranium Concentration Plot

### 3.0 December 2022 Crescent Junction Sampling Event

#### 3.1 Summary

Groundwater samples were collected from wells 0202 and 0205 at Crescent Junction as part of the quarterly monitoring at the Crescent Junction Site. If water is present in any of the four monitoring wells during a monitoring event, a sample is typically collected. Samples were analyzed for metals, inorganics, and isotopic uranium.

#### 3.2 December 2022 Crescent Junction Data Assessment

##### 3.2.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 2, Data Deliverables Examination. All analyses were successfully completed.

##### General Information and Validation Results

RIN 2212139  
Laboratory: Gel Laboratories LLC, Charleston, South Carolina  
SDG Numbers: 603142, 604481  
Analysis: Inorganics, Metals, Isotopic Uranium  
Validator: Thomas Prichard  
Review Date: January 2023

The samples were prepared and analyzed using accepted procedures as shown in Table 9.

Table 9. December 2022 Crescent Junction Sampling Event, Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH <sub>3</sub> -N	EPA 350.1	EPA 350.1
Alkalinity	EPA 310.1	EPA 310.1
Bicarbonate	EPA 310.1	EPA 310.1
Carbonate	EPA 310.1	EPA 310.1
Nitrate/Nitrite as N	EPA 353.2	EPA 353.2
Bromide	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Chloride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Fluoride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Sulfate	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Potassium, Selenium, Silver, Sodium	SW-6010B	EPA 6010B
Uranium	SW-846 3005A	SW-846 6020A
Total Dissolved Solids	EPA 160.1	540 C
Isotopic Uranium	SOP 776/778	SOP 714

### Data Qualifier Summary

None of the data associated with this sampling event required a data qualifier.

### Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received twelve samples for RIN 2212139 in two shipments. The first shipment (SDG 603142, 4 samples) was received on December 7, 2022. The temperature of the cooler was 3°C (tracking number 770695275110). The second shipment (SDG 604481, 8 samples) was received on December 16, 2022. The temperature of the cooler was 2°C (tracking number 770795737387).

The COC forms were checked to confirm that all the samples were listed on the form with sample collection dates and times, and signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

### Preservation and Holding Times

The samples were received in the correct container types and had been preserved correctly for the requested analyses.

### Case Narratives

The case narratives were reviewed, and all detects were found to be within quality-control procedures.

Both SDGs passed all checks for level two validation.

### Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

### Electronic Data Deliverable File

The EDD files arrived on December 22, 2022, and January 9, 2023. The contents of the EDD were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

### 3.2.2 Minimums and Maximums Report and Anomalous Data Review

There were four anomalous data points that lay outside of the historical result range (Table 10).

*Table 10. Anomalous Data Associated with the December 2022 Crescent Junction Sampling Event*

Location	Sample Date	Analyte	Concentration (mg/L)	Historical Minimum (mg/L)	Historical Maximum (mg/L)	Disposition
0202	12/05/2022	Selenium	0.0847	0.0054	0.051	These values are above the historical maximum. There are a limited number of samples for this location and the maximum and minimum are still being established.
		Magnesium	1670	94	810	
		Total Dissolved Solids	45,100	22,000	40,000	
		Sodium	23,500	8,800	12,000	

### 3.3 December 2022 Crescent Junction Sampling Event Results

The rationale for collecting the groundwater sample from Crescent Junction monitoring well 0202 was to determine if the source of the water that recharges this location is the same as that which recharges well 0205. The sample collected from well 0205 was collected to determine if there were any changes to the source of the groundwater recharging this location. Both samples collected in December were part of the quarterly monitoring for the fourth quarter of 2022 (Table 11). In addition to the standard analytes, the samples were also analyzed for bicarbonate as  $\text{CaCO}_3$ , carbonate as  $\text{CaCO}_3$ , total alkalinity as  $\text{CaCO}_3$ , uranium-234, uranium-235, and uranium-238. The analyte concentrations in the samples collected from wells 0202 and 0205 are similar, however, the nitrate/nitrite as N and sulfate sample results vary greatly between well 0202 and 0205. Monitoring will continue to determine if the groundwater in the wells is from the same source.

Table 11. Analytical Results from Crescent Junction Wells 0202 and 0205 in December 2022

Analyte	Location	Result (mg/L)
Bicarbonate as $\text{CaCO}_3$	0202	1,060
	0205	942
Total Alkalinity as $\text{CaCO}_3$	0202	1,060
	0205	942
Ammonia as N	0202	10.3
	0205	13.9
Nitrate/Nitrite as N	0202	456
	0205	550
Total Dissolved Solids	0202	45,100
	0205	34,500
Chloride	0202	6,570
	0205	3,050
Bromide	0202	59.1
	0205	9.6
Sulfate	0202	16,800
	0205	16,500
Arsenic	0202	0.0207
	0205	0.025
Barium	0202	0.0165
	0205	0.0123
Calcium	0202	432
	0205	357
Chromium	0202	0.00389
	0205	0.00380
Cobalt	0202	0.00375
	0205	0.00221
Copper	0202	0.0128
	0205	0.00907
Lead	0202	0.0105
	0205	0.00382
Magnesium	0202	1,670
	0205	748
Manganese	0202	0.6
	0205	0.325

Table 11. Analytical Results from Crescent Junction Wells 0202 and 0205 in December 2022 (continued)

Analyte	Location	Result (mg/L)
Selenium	0202	0.0847
	0205	2.830
Sodium	0202	23,500
	0205	9,450
Uranium	0202	0.0218
	0205	0.0339

\*Only analytes above the detection limit are listed

## 4.0 Conclusions

### 4.1 July 2022 CF4 and CF5 Sampling Event

Ground water samples were collected from the CF4 injection wells, CF4 observation wells, and the CF5 extraction wells in July 2022. Sample results were lower than or consistent with previous results. In general, the ammonia and uranium concentrations are decreasing in most of the extraction wells. Extraction well 0813 has ammonia and uranium concentrations that are slightly increasing.

Analytical results show that the injection system is effective at lowering the ammonia and uranium concentrations, especially in downgradient monitoring wells.

### 4.2 December 2022 Crescent Junction Sampling Event

The groundwater in wells 0202 and 0205 have a similar geochemistry and will continue to be monitored on a quarterly basis for fluctuations in analyte concentrations.

## 5.0 References

40 CFR 192A (Code of Federal Regulations) Subpart A, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites."

DOE (U.S. Department of Energy), *Characterization of Groundwater Brine Zones at the Moab Project Site (Phase I)* (GJO-2002-333-TAR, GJO-MOA 19.1.2-3).

DOE (U.S. Department of Energy), *Moab UMTRA Project Surface Water/Groundwater Sampling and Analysis Plan* (DOE-EM/GJRAC1830).

DOE (U.S. Department of Energy), *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJRAC1855).

**Appendix A.**  
**July 2022 CF4 and CF5 Sampling Event**  
**Water Sampling Field Activities Verification**  
**Water Quality Data**  
**Trip Report**

## Appendix A. July 2022 CF4 and CF5 Sampling Event

### Water Sampling Field Activities Verification

Sampling Event/RIN	July 2022 CF4/CF5 Sampling Event /2207137		Date(s) of Water Sampling	July 6 -12, 2022
Date(s) of Verification	03/15/2023		Name of Verifier	Thomas Prichard
	Response (Yes, No, NA)	Comments		
1. Is the Sampling Analysis Plan (SAP) the primary document directing field procedures? List other documents, standard operating procedures, instructions.	Yes			
	NA			
2. Were the sampling locations specified in the planning documents sampled?	Yes			
3. Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes			
4. Was an operational check of the field equipment conducted in accordance with the SAP?	Yes			
Did the operational checks meet criteria?	Yes			
5. Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.		
6. Was the category of the well documented?	Yes			
7. Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged before sampling?	Yes			
Did the water level stabilize before sampling?	Yes			
Did pH, specific conductance, and turbidity measurements stabilize before sampling?	Yes			
Was the flow rate less than 500 milliliters per minute?	Yes			
If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	Yes			
8. Were the following conditions met when purging a Category II well: Was the flow rate less than 500 milliliters per minute?	Yes			
Was one pump/tubing volume removed before sampling?	Yes			
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	One duplicate sample was collected for 14 samples (location 0813)		

**Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (continued)**  
**Water Sampling Field Activities Verification (continued)**

<b>Sampling Event/RIN</b>	July 2022 CF4/CF5 Sampling Event /2207137	<b>Date(s) of Water Sampling</b>	July 6-12, 2022
<b>Date(s) of Verification</b>	03/15/2023	<b>Name of Verifier</b>	Thomas Prichard
		<b>Response (Yes, No, NA)</b>	<b>Comments</b>
10. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?		NA	All samples were collected using dedicated equipment.
11. Were trip blanks prepared and included with each shipment of volatile organic compound samples?		NA	
12. Were quality-control samples assigned a fictitious site identification number?		Yes	Duplicate for 0813 was given location 2000
13. Was the true identity of the samples recorded on the quality assurance sample log?		Yes	
14. Were samples collected in the containers specified?		Yes	
15. Were samples filtered and preserved as specified?		Yes	
16. Were the number and types of samples collected as specified?		Yes	
17. Were COC records completed, and was sample custody maintained?		Yes	
18. Are field data sheets signed and dated by both team members?		Yes	
19. Was all other pertinent information documented on the field data sheets?		Yes	
20. Was the presence or absence of ice in the cooler documented at every sample location?		Yes	
21. Were water levels measured at the locations specified in the planning documents?		Yes	

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (*continued*)

### Water Sampling Field Activities Verification (*continued*)

Date: December 7, 2022  
To: Elizabeth Moran  
From: James Ritchey  
Subject: July 2022 Sampling Event

**Site:** Moab –Sampling Event – July 2022

**Date of Sampling Event:** July 6 – 12, 2021

**Team Members:** T. Prichard, J. Ritchey

**RIN Number Assigned:** All samples were assigned to RIN 2207137.

**Sample Shipment:** One sample cooler was shipped overnight UPS to ALS Laboratory from Moab, Utah on July 14, 2022 (Tracking number 1Z5W1Y510197533982).

### July 2022 Configuration 4 Sampling

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**Number of Locations Sampled:** Eight observation wells (0780, 0781, 0782, 0783, 0784, 0785, 0786, and 0787) were sampled during the July 2022 Sampling Event.

**Locations Not Sampled:** None.

**Field Variance:** None.

**Quality Control Sample Cross Reference:** None.

**Location Specific Information – Observation Wells:** All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing. Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Sample Depth (ft bgs)
0780	7/6/2022	13:45	15.40	28
0781	7/6/2022	14:00	15.32	46
0782	7/6/2022	14:10	15.40	32
0783	7/6/2022	14:30	13.51	18
0784	7/11/2022	10:45	16.33	18
0785	7/11/2022	11:05	15.90	18
0786	7/11/2022	11:20	15.45	28
0787	7/11/2022	11:40	15.66	36

### July 2022 Configuration 5 Sampling

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**Number of Locations Sampled:** Seven extraction wells (0810, 0811, 0812, 0813, 0815, 0816, and SMI-PW02) and one duplicate were sampled during the July 2022 Monthly Sampling Event.

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (*continued*)

### Water Sampling Field Activities Verification (*continued*)

**Locations Not Sampled:** Well 0814 was not sampled due to an inoperable submersible pump.

**Field Variance:** None.

**Quality Control Sample Cross Reference:** Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Associated Matrix	Ticket Number
2000	0813	Duplicate from 14.4 - 44.4 ft bgs	Ground Water	JUL 014

**Location Specific Information – Extraction Wells:** Extraction wells were sampled using dedicated submersible pumps. Samples were filtered and collected into open containers using dedicated flexible tubing. Sample depths and water levels for each extraction well are listed below.

Well No.	Date	Time	Pump Intake Depth (ft bgs)
0810	7/12/2022	10:45	10.4 – 40.4
0811	7/12/2022	11:00	8.6 – 38.6
0812	7/12/2022	11:25	14.2 – 44.2
0813	7/12/2022	11:40	14.4 – 44.4
0815	7/12/2022	12:15	21.7 – 51.7
0816	7/12/2022	12:05	20.9 – 70.9
SMI-PW02	7/12/2022	12:05	20.0 – 60.0

\*Depths to water were not collected for wells.

**Site Issues:** According to the USGS Cisco Gaging Station (Station No. 09180700), the mean daily Colorado River flows during this sampling event are provided below:

Date	Daily Mean Flow (cfs)
7/6/2022	3,940
7/7/2022	3,890
7/8/2022	4,220
7/9/2022	3,860
7/10/2022	3,440
7/11/2022	3,230
7/12/2022	3,060

**Equipment Issues:** None.

**Corrective Action Required/Taken:** None.

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (continued)

### Water Sampling Field Activities Verification (continued)

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0780 <well> Configuration 4

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/06/2022	0001	28.00	0.2	U	0.2	-
Oxidation Reduction Potential	mV	07/06/2022	N001	28.00	122		-	-
pH	s.u.	07/06/2022	N001	28.00	7.38		-	-
Specific Conductance	umhos/cm	07/06/2022	N001	28.00	655		-	-
Temperature	C	07/06/2022	N001	28.00	18.28		-	-
Turbidity	NTU	07/06/2022	N001	28.00	1.52		-	-
Uranium	mg/L	07/06/2022	0001	28.00	0.0074		1.2E-05	-

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0781 <well> Configuration 4

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/06/2022	0001	44.75 - 54.52	1000		100	-
Oxidation Reduction Potential	mV	07/06/2022	N001	44.75 - 54.52	99		-	-
pH	s.u.	07/06/2022	N001	44.75 - 54.52	6.77		-	-
Specific Conductance	umhos/cm	07/06/2022	N001	44.75 - 54.52	62508		-	-
Temperature	C	07/06/2022	N001	44.75 - 54.52	17.16		-	-
Turbidity	NTU	07/06/2022	N001	44.75 - 54.52	1.82		-	-
Uranium	mg/L	07/06/2022	0001	44.75 - 54.52	3.200		0.00012	-

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (continued)

### Water Sampling Field Activities Verification (continued)

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0782 <well> Configuration 4

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/06/2022	0001	33.00	8.2	N	1	-
Oxidation Reduction Potential	mV	07/06/2022	N001	33.00	43		-	-
pH	s.u.	07/06/2022	N001	33.00	7.67		-	-
Specific Conductance	umhos/cm	07/06/2022	N001	33.00	1298		-	-
Temperature	C	07/06/2022	N001	33.00	19.13		-	-
Turbidity	NTU	07/06/2022	N001	33.00	1.37		-	-
Uranium	mg/L	07/06/2022	0001	33.00	0.051		1.2E-05	-

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0783 <well> Configuration 4

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/06/2022	0001	8.60 - 18.60	0.2	U	0.2	-
Oxidation Reduction Potential	mV	07/06/2022	N001	8.60 - 18.60	-205		-	-
pH	s.u.	07/06/2022	N001	8.60 - 18.60	7.40		-	-
Specific Conductance	umhos/cm	07/06/2022	N001	8.60 - 18.60	1314		-	-
Temperature	C	07/06/2022	N001	8.60 - 18.60	14.80		-	-
Turbidity	NTU	07/06/2022	N001	8.60 - 18.60	2.35		-	-
Uranium	mg/L	07/06/2022	0001	8.60 - 18.60	0.030		1.2E-05	-

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (continued)

### Water Sampling Field Activities Verification (continued)

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0784 <well> Configuration 4

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/11/2022	0001	18.00	0.2	U	0.2	-
Oxidation Reduction Potential	mV	07/11/2022	N001	18.00	59		-	-
pH	s.u.	07/11/2022	N001	18.00	7.28		-	-
Specific Conductance	umhos/cm	07/11/2022	N001	18.00	743		-	-
Temperature	C	07/11/2022	N001	18.00	23.04		-	-
Turbidity	NTU	07/11/2022	N001	18.00	1.11		-	-
Uranium	mg/L	07/11/2022	0001	18.00	0.0041		1.2E-05	-

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0785 <well> Configuration 4

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/11/2022	0001	18.00	0.2	U	0.2	-
Oxidation Reduction Potential	mV	07/11/2022	N001	18.00	32		-	-
pH	s.u.	07/11/2022	N001	18.00	6.91		-	-
Specific Conductance	umhos/cm	07/11/2022	N001	18.00	747		-	-
Temperature	C	07/11/2022	N001	18.00	20.78		-	-
Turbidity	NTU	07/11/2022	N001	18.00	2.43		-	-
Uranium	mg/L	07/11/2022	0001	18.00	0.012		1.2E-05	-

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (continued)

### Water Sampling Field Activities Verification (continued)

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0786 <well> Configuration 4

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/11/2022	0001	20.49 - 30.26	0.2	U	0.2	-
Oxidation Reduction Potential	mV	07/11/2022	N001	20.49 - 30.26	16		-	-
pH	s.u.	07/11/2022	N001	20.49 - 30.26	7.25		-	-
Specific Conductance	umhos/cm	07/11/2022	N001	20.49 - 30.26	715		-	-
Temperature	C	07/11/2022	N001	20.49 - 30.26	19.44		-	-
Turbidity	NTU	07/11/2022	N001	20.49 - 30.26	1.34		-	-
Uranium	mg/L	07/11/2022	0001	20.49 - 30.26	0.0076		1.2E-05	-

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0787 <well> Configuration 4

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIER S: LAB DATA QA	DETECTION LIMIT	UN- CERTAINT Y
Ammonia Total as N	mg/L	07/11/2022	0001	36.00	470		20	-
Oxidation Reduction Potential	mV	07/11/2022	N001	36.00	23		-	-
pH	s.u.	07/11/2022	N001	36.00	7.13		-	-
Specific Conductance	umhos/cm	07/11/2022	N001	36.00	31696		-	-
Temperature	C	07/11/2022	N001	36.00	21.38		-	-
Turbidity	NTU	07/11/2022	N001	36.00	2.43		-	-
Uranium	mg/L	07/11/2022	0001	36.00	1.700		1.2E-05	-

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (continued)

### Water Sampling Field Activities Verification (continued)

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0810 <well, extraction well> Configuration 5

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/12/2022	0001	10.40 - 40.40	250		20	-
Oxidation Reduction Potential	mV	07/12/2022	N001	10.40 - 40.40	87		-	-
pH	s.u.	07/12/2022	N001	10.40 - 40.40	6.63		-	-
Specific Conductance	umhos/cm	07/12/2022	N001	10.40 - 40.40	28529		-	-
Temperature	C	07/12/2022	N001	10.40 - 40.40	17.14		-	-
Turbidity	NTU	07/12/2022	N001	10.40 - 40.40	19.70		-	-
Uranium	mg/L	07/12/2022	0001	10.40 - 40.40	2.800		0.00012	-

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0811 <well, extraction well> Configuration 5

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/12/2022	0001	8.60 - 38.60	310		20	-
Oxidation Reduction Potential	mV	07/12/2022	N001	8.60 - 38.60	57		-	-
pH	s.u.	07/12/2022	N001	8.60 - 38.60	6.74		-	-
Specific Conductance	umhos/cm	07/12/2022	N001	8.60 - 38.60	21662		-	-
Temperature	C	07/12/2022	N001	8.60 - 38.60	20.96		-	-
Turbidity	NTU	07/12/2022	N001	8.60 - 38.60	10.20		-	-
Uranium	mg/L	07/12/2022	0001	8.60 - 38.60	2.400		0.00012	-

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (*continued*)

### Water Sampling Field Activities Verification (*continued*)

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0812 <well, extraction well> Configuration 5

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/12/2022	0001	14.20 - 44.20	340		20	-
Oxidation Reduction Potential	mV	07/12/2022	N001	14.20 - 44.20	42		-	-
pH	s.u.	07/12/2022	N001	14.20 - 44.20	6.77		-	-
Specific Conductance	umhos/cm	07/12/2022	N001	14.20 - 44.20	18344		-	-
Temperature	C	07/12/2022	N001	14.20 - 44.20	15.25		-	-
Turbidity	NTU	07/12/2022	N001	14.20 - 44.20	0.89		-	-
Uranium	mg/L	07/12/2022	0001	14.20 - 44.20	2.100		0.00012	-

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0813 <well, extraction well> Configuration 5

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/12/2022	0001	14.40 - 44.40	290		20	-
	mg/L	07/12/2022	0002	14.40 - 44.40	2.6		0.2	-
Oxidation Reduction Potential	mV	07/12/2022	N001	14.40 - 44.40	42		-	-
pH	s.u.	07/12/2022	N001	14.40 - 44.40	6.81		-	-
Specific Conductance	umhos/cm	07/12/2022	N001	14.40 - 44.40	13		-	-
Temperature	C	07/12/2022	N001	14.40 - 44.40	16.83		-	-
Turbidity	NTU	07/12/2022	N001	14.40 - 44.40	1.34		-	-
Uranium	mg/L	07/12/2022	0001	14.40 - 44.40	1.900		1.2E-05	-
	mg/L	07/12/2022	0002	14.40 - 44.40	1.800		1.2E-05	-

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (continued)

### Water Sampling Field Activities Verification (continued)

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0815 <well, extraction well> Configuration 5

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/12/2022	0001	21.70 - 51.70	100		10	-
Oxidation Reduction Potential	mV	07/12/2022	N001	21.70 - 51.70	41		-	-
pH	s.u.	07/12/2022	N001	21.70 - 51.70	7.00		-	-
Specific Conductance	umhos/cm	07/12/2022	N001	21.70 - 51.70	18260		-	-
Temperature	C	07/12/2022	N001	21.70 - 51.70	17.04		-	-
Turbidity	NTU	07/12/2022	N001	21.70 - 51.70	1.84		-	-
Uranium	mg/L	07/12/2022	0001	21.70 - 51.70	2.900		0.00012	-

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: 0816 <well, extraction well> Configuration 5

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/12/2022	0001	20.90 - 50.90	110		10	-
Oxidation Reduction Potential	mV	07/12/2022	N001	20.90 - 50.90	50		-	-
pH	s.u.	07/12/2022	N001	20.90 - 50.90	6.96		-	-
Specific Conductance	umhos/cm	07/12/2022	N001	20.90 - 50.90	21330		-	-
Temperature	C	07/12/2022	N001	20.90 - 50.90	16.82		-	-
Turbidity	NTU	07/12/2022	N001	20.90 - 50.90			-	-
Uranium	mg/L	07/12/2022	0001	20.90 - 50.90	2.600		0.00012	-

**Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (continued)**  
**Water Sampling Field Activities Verification (continued)**

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE MOA01, Moab Site

LOCATION: SMI-PW02 <well>

REPORT DATE: 3/15/2023 3:48 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	07/12/2022	0001	20.04 - 60.04	330		20	-
Oxidation Reduction Potential	mV	07/12/2022	N001	20.04 - 60.04	52		-	-
pH	s.u.	07/12/2022	N001	20.04 - 60.04	6.81		-	-
Specific Conductance	umhos/cm	07/12/2022	N001	20.04 - 60.04	29234		-	-
Temperature	C	07/12/2022	N001	20.04 - 60.04	16.61		-	-
Turbidity	NTU	07/12/2022	N001	20.04 - 60.04	4.04		-	-
Uranium	mg/L	07/12/2022	0001	20.04 - 60.04	2.900		0.00012	-

## Appendix A. July 2022 CF4 and CF5 Sampling Event Sampling Event (*continued*)

### Water Sampling Field Activities Verification (*continued*)

RECORDS: SELECTED FROM USEE105 WHERE RIN = '2207137' AND (DataValidationQualifiers IS NULL OR (DataValidationQualifiers NOT LIKE '%N%' AND DataValidationQualifiers NOT LIKE '%R%' AND DataValidationQualifiers NOT LIKE '%X%'))

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

#### LAB QUALIFIERS:

- \* Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- M GFAA duplicate injection precision not met.
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Y Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Z Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

#### DATA QUALIFIERS:

- |  |  |  |
|--|--|--|
| F Low flow sampling method used.                     | G Possible grout contamination, pH > 9.  | J Estimated value.                             |
| L Less than 3 bore volumes purged prior to sampling. | N Presumptive evidence that analyte is present. The analyte is "tentatively identified". | Q Qualitative result due to sampling technique |
| R Unusable result.                                   | U Parameter analyzed for but was not detected.   | X Location is undefined.                       |

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

**Appendix B.**  
**December 2022 Crescent Junction Sampling Event**

**Water Sampling Field Activities Verification**  
**Water Quality Data**  
**Trip Report**

## Appendix B. December 2022 Crescent Junction Sampling Event

### Water Sampling Field Activities Verification

<b>Sampling Event/RIN</b>	December 2022 CJ Sampling Event/RIN 2212139	<b>Date(s) of Water Sampling</b>	December 5, 2022
<b>Date(s) of Verification</b>	03/15/2023	<b>Name of Verifier</b>	Thomas Prichard
		<b>Response (Yes, No, NA)</b>	<b>Comments</b>
1. Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?		Yes	
2. List other documents, standard operating procedures, instructions.		NA	
3. Were the sampling locations specified in the planning documents sampled?		Yes	
4. Was a pre-trip calibration conducted as specified in the aforementioned documents?		Yes	
5. Was an operational check of the field equipment conducted in accordance with the SAP?		Yes	
6. Did the operational checks meet criteria?		Yes	
7. Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?		Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
8. Was the category of the well documented?		Yes	
9. Were the following conditions met when purging a Category I well:			
Was one pump/tubing volume purged before sampling?		NA	
Did the water level stabilize before sampling?		NA	
Did pH, specific conductance, and turbidity measurements stabilize before sampling?		NA	
Was the flow rate less than 500 milliliters per minute?		NA	
If a portable pump was used, was there a 4-hour delay between pump installation and sampling?		NA	

<b>Sampling Event/RIN</b>	December 2022 CJ Sampling Event/RIN 2212139	<b>Date(s) of Water Sampling</b>	December 5, 2022
<b>Date(s) of Verification</b>	03/15/2023	<b>Name of Verifier</b>	Thomas Prichard
		<b>Response (Yes, No, NA)</b>	<b>Comments</b>
10. Were the following conditions met when purging a Category II well:			
Was the flow rate less than 500 milliliters per minute?		Yes	
Was one pump/tubing volume removed before sampling?		Yes	
<hr/>			
11. Were duplicates taken at a frequency of one per 20 samples?		NA	Only 2 samples were collected during this event.

**Appendix B. December 2022 Crescent Junction Sampling Event (*continued*)**  
**Water Sampling Field Activities Verification (*continued*)**

<b>Sampling Event/RIN</b>	December 2022 CJ Sampling Event/RIN 2212139	<b>Date(s) of Water Sampling</b>	December 5, 2022
<b>Date(s) of Verification</b>	03/15/2023	<b>Name of Verifier</b>	Thomas Prichard
		<b>Response (Yes, No, NA)</b>	<b>Comments</b>
12. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?		NA	The samples were collected using the same bladder pump, and was thoroughly cleaned between locations.
13. Were trip blanks prepared and included with each shipment of volatile organic compound samples?		NA	
14. Were quality-control samples assigned a fictitious site identification number?		NA	
Was the true identity of the samples recorded on the quality assurance sample log?		NA	
15. Were samples collected in the containers specified?		Yes	
16. Were samples filtered and preserved as specified?		Yes	
17. Were the number and types of samples collected as specified?		NA	
18. Were COC records completed, and was sample custody maintained?		Yes	
19. Are field data sheets signed and dated by both team members?		Yes	
20. Was all other pertinent information documented on the field data sheets?		NA	
21. Was the presence or absence of ice in the cooler documented at every sample location?		Yes	
22. Were water levels measured at the locations specified in the planning documents?		Yes	

## Appendix B. December 2022 Crescent Junction Sampling Event (continued)

### Water Sampling Field Activities Verification (continued)

## Appendix B. December 2022 Crescent Junction Sampling Event (continued)

### Water Sampling Field Activities Verification (continued)

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE CRJ01, Crescent Junction Site

LOCATION: 0202 <well>

REPORT DATE: 3/15/2023 4:00 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	12/05/2022	0001	60.00	10.3		0.17	-
Arsenic	mg/L	12/05/2022	0001	60.00	0.0207	B	0.005	-
Barium	mg/L	12/05/2022	0001	60.00	0.0165		0.001	-
BICARBONATE AS CaCO3	mg/L	12/05/2022	0001	60.00	1060		1.45	-
Bromide	mg/L	12/05/2022	0001	60.00	59.1		1.34	-
Cadmium	mg/L	12/05/2022	0001	60.00	0.00100	U	0.001	-
Calcium	mg/L	12/05/2022	0001	60.00	432.000		0.05	-
CARBONATE AS CaCO3	mg/L	12/05/2022	0001	60.00	1.45	U	1.45	-
Chloride	mg/L	12/05/2022	0001	60.00	6570		134	-
Chromium	mg/L	12/05/2022	0001	60.00	0.00389	B	0.001	-
Cobalt	mg/L	12/05/2022	0001	60.00	0.00375	B	0.001	-
Copper	mg/L	12/05/2022	0001	60.00	0.0128	B	0.003	-
Fluoride	mg/L	12/05/2022	0001	60.00	0.660	U	0.66	-
Iron	mg/L	12/05/2022	0001	60.00	0.0300	U	0.03	-
Lead	mg/L	12/05/2022	0001	60.00	0.0105	B	0.0033	-
Magnesium	mg/L	12/05/2022	0001	60.00	1670.000		11	-
Manganese	mg/L	12/05/2022	0001	60.00	0.600		0.002	-
MOLYBDENUM	ug/L	12/05/2022	0001	60.00	2.00	U	2	-
Nitrate + Nitrite as Nitrogen	mg/L	12/05/2022	0001	60.00	456		8.5	-
Oxidation Reduction Potential	mV	12/05/2022	N001	60.00			-	-
	mV	12/05/2022	N001	60.00			-	-
pH	s.u.	12/05/2022	N001	60.00	6.87		-	-
	s.u.	12/05/2022	N001	60.00	6.87		-	-
Selenium	mg/L	12/05/2022	0001	60.00	0.0847		0.006	-
Sodium	mg/L	12/05/2022	0001	60.00	23500.000		10	-
Specific Conductance	umhos/cm	12/05/2022	N001	60.00	4594		-	-
	umhos/cm	12/05/2022	N001	60.00	4594		-	-

## Appendix B. December 2022 Crescent Junction Sampling Event *(continued)*

### Water Sampling Field Activities Verification *(continued)*

Sulfate	mg/L	12/05/2022 0001	60.00	16800		266	-
Temperature	C	12/05/2022 N001	60.00	13.40		-	-
	C	12/05/2022 N001	60.00	13.40		-	-
TOTAL ALKALINITY AS CaCO <sub>3</sub>	mg/L	12/05/2022 0001	60.00	1060		1.45	-
Total Dissolved Solids	mg/L	12/05/2022 0001	60.00	45100		23.8	-
Turbidity	NTU	12/05/2022 N001	60.00	5.78		-	-
	NTU	12/05/2022 N001	60.00	5.78		-	-
Uranium	mg/L	12/05/2022 0001	60.00	0.0218		0.000335	-
Uranium-234	pCi/L	12/05/2022 0001	60.00	36.9		1.56	±5.65
Uranium-235	pCi/L	12/05/2022 0001	60.00	1.32	U	1.32	±1.09
Uranium-238	pCi/L	12/05/2022 0001	60.00	10.8		1.07	±3.09

## Appendix B. December 2022 Crescent Junction Sampling Event *(continued)*

### Water Sampling Field Activities Verification *(continued)*

GENERAL WATER QUALITY DATA BY LOCATION (USEE105) FOR SITE CRJ01, Crescent Junction Site

LOCATION: 0205 <well>

REPORT DATE: 3/15/2023 4:00 PM

PARAMETER	UNITS	SAMPLE: DATE	ID	DEPTH RANGE (FT BLS)	RESULT	QUALIFIERS: LAB DATA QA	DETECTION LIMIT	UN- CERTAINTY
Ammonia Total as N	mg/L	12/05/2022	0001	68.00	13.9		0.17	-
Arsenic	mg/L	12/05/2022	0001	68.00	0.0250	B	0.005	-
Barium	mg/L	12/05/2022	0001	68.00	0.0123		0.001	-
BICARBONATE AS CaCO <sub>3</sub>	mg/L	12/05/2022	0001	68.00	942		2.42	-
Bromide	mg/L	12/05/2022	0001	68.00	9.60	J	3.35	-
Cadmium	mg/L	12/05/2022	0001	68.00	0.00100	U	0.001	-
Calcium	mg/L	12/05/2022	0001	68.00	357.000		0.05	-
CARBONATE AS CaCO <sub>3</sub>	mg/L	12/05/2022	0001	68.00	2.42	U	2.42	-
Chloride	mg/L	12/05/2022	0001	68.00	3050		335	-
Chromium	mg/L	12/05/2022	0001	68.00	0.00380	B	0.001	-
Cobalt	mg/L	12/05/2022	0001	68.00	0.00221	B	0.001	-
Copper	mg/L	12/05/2022	0001	68.00	0.00907	B	0.003	-
Fluoride	mg/L	12/05/2022	0001	68.00	1.65	U	1.65	-
Iron	mg/L	12/05/2022	0001	68.00	0.0300	U	0.03	-
Lead	mg/L	12/05/2022	0001	68.00	0.00382	B	0.0033	-
Magnesium	mg/L	12/05/2022	0001	68.00	748.000		11	-
Manganese	mg/L	12/05/2022	0001	68.00	0.325		0.002	-
MOLYBDENUM	ug/L	12/05/2022	0001	68.00	2.00	U	2	-
Nitrate + Nitrite as Nitrogen	mg/L	12/05/2022	0001	68.00	550		8.5	-
Oxidation Reduction Potential	mV	12/05/2022	N001	68.00			-	-
	mV	12/05/2022	N001	68.00			-	-
pH	s.u.	12/05/2022	N001	68.00	7.04		-	-
	s.u.	12/05/2022	N001	68.00	7.04		-	-
Selenium	mg/L	12/05/2022	0001	68.00	2.830		0.006	-
Sodium	mg/L	12/05/2022	0001	68.00	9450.000		10	-
Specific Conductance	umhos/cm	12/05/2022	N001	68.00	31086		-	-
	umhos/cm	12/05/2022	N001	68.00	31086		-	-
Sulfate	mg/L	12/05/2022	0001	68.00	16500		665	-
Temperature	C	12/05/2022	N001	68.00	14.20		-	-
	C	12/05/2022	N001	68.00	14.20		-	-

## Appendix B. December 2022 Crescent Junction Sampling Event *(continued)*

### Water Sampling Field Activities Verification *(continued)*

TOTAL ALKALINITY AS CaCO <sub>3</sub>	mg/L	12/05/2022 0001	68.00	942	2.42	-
Total Dissolved Solids	mg/L	12/05/2022 0001	68.00	34500	23.8	-
Turbidity	NTU	12/05/2022 N001	68.00	15.30	-	-
	NTU	12/05/2022 N001	68.00	15.30	-	-
Uranium	mg/L	12/05/2022 0001	68.00	0.0339	0.000335	-
Uranium-234	pCi/L	12/05/2022 0001	68.00	36.7	0.731	±3.55
Uranium-235	pCi/L	12/05/2022 0001	68.00	0.438	0.328	±0.48
Uranium-238	pCi/L	12/05/2022 0001	68.00	13.4	0.621	±2.15

RECORDS: SELECTED FROM USEE105 WHERE RIN = '2212139' AND (DataValidationQualifiers IS NULL OR (DataValidationQualifiers NOT LIKE '%N%' AND DataValidationQualifiers NOT LIKE '%R%' AND DataValidationQualifiers NOT LIKE '%X%'))

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

#### LAB QUALIFIERS:

- \* Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- M GFAA duplicate injection precision not met.
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Y Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Z Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

#### DATA QUALIFIERS:

- |  |  |  |
|--|--|--|
| F Low flow sampling method used.                     | G Possible grout contamination, pH > 9.  | J Estimated value.                             |
| L Less than 3 bore volumes purged prior to sampling. | N Presumptive evidence that analyte is present. The analyte is "tentatively identified". | Q Qualitative result due to sampling technique |
| R Unusable result.                                   | U Parameter analyzed for but was not detected.   | X Location is undefined.                       |

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

## Appendix B. December 2022 Crescent Junction Sampling Event (*continued*)

### Water Sampling Field Activities Verification (*continued*)

Date: January 9, 2023  
To: Elizabeth Moran  
From: James Ritchey  
Subject: December 2022 CJ Sampling Event

**Site:** Crescent Junction – Well 0202 and 0205 Sampling Event – December 2022

**Date of Sampling Event:** December 5, 2022

**Team Members:** T. Prichard, J. Ritchey

**RIN Number Assigned:** All samples were assigned to RIN 2212139.

**Sample Shipment:** Samples were shipped overnight Fedex to GEL Laboratory from Moab, Utah in two coolers on December 6 and 15 of 2022 (Tracking numbers: 770695275110 and 770795737387).

**Number of Locations Sampled:** One sample was collected from both well 0202 and well 0205 during the December 2022 CJ sampling event.

**Locations Not Sampled/Reason:** None.

**Field Variance:** None.

**Quality Control Sample Cross Reference:** None.

**Location Specific Information:** Wells 0202 and 0205 were sampled using a non-dedicated submersible pump with non-dedicated tubing. The table below provides additional information:

Location	Date	Sample Depth (ft btoc)	Depth to Water (ft btoc)	Comments
0202	12/5/2022	60	49.73	Flow rate ~0.5L/min.
0205	12/5/2022	68	45.98	WL=45.62 after installing pump. Purged almost 2 gal. Purged another 13 gal during recover test.

Notes: ft btoc = feet below top of casing.

**Well Inspection Summary:** A well inspection was not conducted.

**Equipment:** None.

**Regulatory:** None.

**Site Issues:** None.

**Corrective Action Required/Taken:** None.