

*Office of Environmental Management – Grand Junction*



Moab UMTRA Project  
Ground Water and Surface Water  
Monitoring July through December 2012

Revision 0

April 2013



U.S. Department  
of Energy

**Office of Environmental Management**

**Moab UMTRA Project  
Ground Water and Surface Water Monitoring  
July through December 2012**

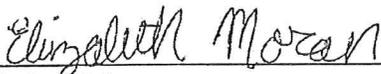
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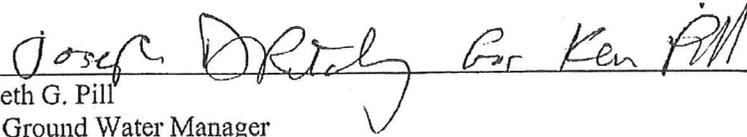
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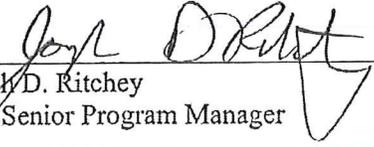
Moab UMTRA Project  
Ground Water and Surface Water Monitoring  
July through December 2012

Revision 0

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## Revision History

<b>Revision No.</b>	<b>Date</b>	<b>Reason/Basis for Revision</b>
0	April 2013	Initial issue.

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**Appendix**

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Water Level Data	
Trip Report	

## Acronyms and Abbreviations

ALS	ALS Environmental
°C	degrees Centigrade
CCB	continuing calibration blank
CCV	continuing calibration verification
CFR	Code of Federal Regulations
COC	chain of custody
CRI	reporting limit verification
DOE	U.S. Department of Energy
EB	equipment blank
EDD	electronic data deliverable
ICB	initial calibration blank
ICP-MS	inductively coupled plasma
ICV	initial calibration verification
IDL	instrument detection limit
LCS	laboratory control sample
MB	method blank
MDL	method detection limit or minimum detection limit
mg/L	milligrams per liter
MS	matrix spike or mass spectroscopy
MSD	matrix spike duplicate
r <sup>2</sup>	correlation coefficient
RIN	report identification number
RL	reporting limit
SD	serial dilution
SDG	sample data group
UMTRA	Uranium Mill Tailings Remedial Action
USGS	U.S. Geological Survey

## 1.0 Introduction

### 1.1 Purpose

The purpose of this semi-annual report is to summarize the results associated with ground water and surface water samples collected from the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) site during the second half of 2012. The results of the data validation process are also presented. One sampling event was completed during November/December 2012, with samples collected from a variety of site-wide ground water and surface water locations. All ground water sample locations are shown on Figure 1; surface water locations are shown on Figure 2.

Surface water sampling was conducted to assess surface water quality adjacent to the site compared to the upstream and downstream water quality. Site-wide ground water sampling was conducted to assess any changes and trends in water quality. Thirteen of the upgradient wells typically sampled during the site-wide events were not sampled as they have consistently contained below applicable detection limits.

### 1.2 Scope

This document presents the Summary of Sampling Events and Data Assessments, including a summary of the anomalous data generated by the validation process, and results for this event. Sampling and analyses were conducted in accordance with the *Moab UMTRA Project Operations and Maintenance Manual* (DOE-EM/GJTAC1973) and the *Moab UMTRA Project Surface Water/Ground Water Sampling and Analysis Plan* (DOE-EM/GJTAC1830), and all data validation follows the criteria according to the *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJTAC1855). The trip report is also provided in Appendix A. All Colorado River flow discussed in this document is measured from the U.S. Geological Survey (USGS) Cisco gaging station number 09180500. River elevation data were collected on site.

A Minimums and Maximums Report was generated (by the Sample Management System and the SEEPro database) to determine if the applicable data are within a normal statistical range. The new data set was compared to the historical data to determine if these data fall outside the historical data 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.

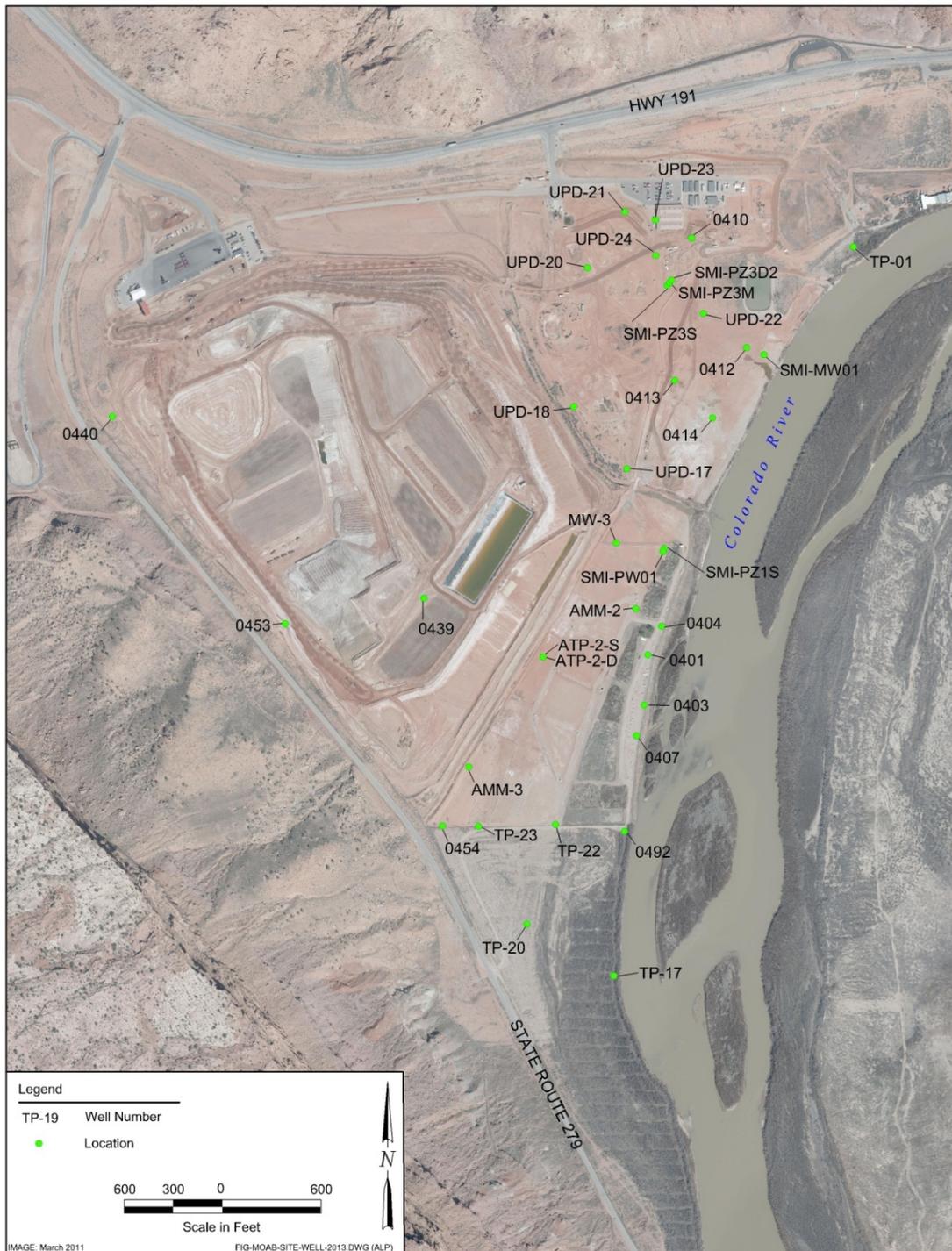


Figure 1. November/December 2012 Site-wide Ground Water Sampling Locations



Figure 2. November/December 2012 Site-wide Surface Water Sampling Locations

## 2.0 Summary of Sampling Event

Forty-three ground water and surface water samples were collected between November 27 and December 13 as part of the site-wide event. This event corresponds to the time frame when the Colorado River flows are generally experiencing base-flow conditions. All ground water sample locations are shown on Figure 1.

These ground water samples were collected from a variety of downgradient and cross-gradient locations at various depths. Also included were the locations in the vicinity of the northeastern uranium plume, including wells UPD-18 through 24. All samples were analyzed for ammonia using a HACH sension 2 portable pH/ISE probe and meter. Approximately one-half of these samples were also submitted to ALS Environmental, Inc. (ALS), laboratory for ammonia analysis. All samples were analyzed by ALS for uranium.

The six surface water samples were collected upstream, downstream, and adjacent to the site during this event. These surface water locations are presented on Figure 2.

## 3.0 Data Assessment

### 3.1 November/December 2012 Site-wide Sampling Event

#### 3.1.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory*. The procedure was applied at Level 3, Data Deliverables Examination. All analyses were successfully completed.

#### General Information and Validation Results

Report Identification Number (RIN): 1211065 (see bottom next page)  
Laboratory: ALS, Fort Collins, Colorado  
Sample Date Group (SDG) Numbers: 212098, 1212185 (see bottom next page)  
Analysis: Inorganics and Metals  
Validator: Elizabeth Moran  
Review Date: February 26, 2013

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

Table 1. November/December 2012 Site-wide Sampling Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia	EPA 350.1	EPA 350.1
Uranium	SW-846 3005A	SW-846 6020A

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

*Table 2. November/December 2012 Site-wide Sampling Data Qualifiers*

Sample Number	Location	Analyte	Flag	Reason
All	All locations	Uranium	J	MS-1
All	All locations	Ammonia	J	MS-2
1212185-1 through 1212185-22	All in SDG 1212185	Uranium	J	SD-1

J indicates results are estimated and becomes a U for analytical results below the detection limit.

*Table 3. November/December 2012 Site-wide Sampling Reason Codes for Data Flags*

Reason Code	Qualifier (Detects)	Qualifier (Non-Detects)	Explanation
MS-1	J	U	Results for the affected analyte(s) are regarded as estimated (J) because the matrix spike sample was (a) from another client, (b) of dissimilar matrix, (c) a field blank or equipment blank, or (d) not analyzed at the proper frequency as stated in the appropriate analytical method.
MS-2	J	U	Results for the affected analyte is regarded as estimated because no matrix spike duplicate was analyzed.
SD-1	J	N/A	Frequency requirements for serial dilution were not met.

### **Sample Shipping/Receiving**

ALS in Fort Collins, Colorado, received a total of 43 samples for RIN 1211065 in two shipments of one cooler each. SDG 1212098 consisted of 22 samples that arrived on December 7, 2012 (UPS tracking number 1Z5W1Y510196131480). SDG 1212185 consisted of 21 samples and arrived on December 14, 2012 (UPS tracking number 1Z5W1Y510194008340). Both of the SDGs were accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of 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. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

### **Preservation and Holding Times**

SDG 1212098, packed in one cooler, was received intact with a temperature of 1.6 degrees Centigrade (°C), which complies with all requirements. SDG 1212185 was also packed in one cooler and was received intact with the temperature in the cooler at 2.2°C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

## **Case Narratives**

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

### **Laboratory Instrument Calibration**

Compliance requirements for satisfactory instrument calibration are established to ensure the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. Calibration standards were prepared from independent sources. For ICP-mass spectrometry (ICP-MS) analytes (uranium), instrument tuning and performance criteria are checked for mass calibration and resolution verifications. Also, for ICP-MS analyte uranium, internal standards are analyzed to indicate stability of the instruments.

### **Method SW-846 6020A, Uranium**

The calibration for the uranium analyses for SDG 1212098 was performed on December 13, 2012, and the calibration for SDG 1212185 was performed on December 20, 2012. The initial calibrations were both performed using five calibration standards and one blank, resulting in calibration curves with correlation coefficient ( $r^2$ ) values greater than 0.995. The values of the calibration curve intercepts for uranium were positive and less than 3 times the instrument detection limit (IDL).

Initial calibration verification (ICV) and continuing calibration verification (CCV) checks were made at the required frequency. All calibration checks met the acceptance criteria. CRIs were made at the required frequency to verify the linearity of the calibration curve near the reporting limit (RL). The CRIs were within the acceptance criteria range for all SDGs. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

### **Method EPA 350.1, Ammonia as N**

Initial calibrations for ammonia as N (for both SDGs 1212098 and 1212185) were performed using seven calibration standards and a blank on December 12, 2012 and December 19, 2012, respectively. The calibration curve had an  $r^2$  value greater than 0.995 and an intercept less than three times the method detection limit (MDL). ICV and CCV checks were made at the required frequency. All calibration check results for all SDGs were within the acceptance criteria.

### **Method and Calibration Blanks**

Method blanks (MBs) are analyzed to assess any contamination that may have occurred during sample preparation. Both initial calibration blanks (ICB) and continuing calibration blanks (CCBs) are analyzed to assess instrument contamination prior to and during sample analysis. Detected sample results associated with blanks results greater than the MDL or IDL (depending on method requirements) were "U" qualified when the detections were less than five times the blank concentration. Non-detects were not qualified.

Two of the uranium CCB results were greater than the uranium IDL; however, all associated uranium results were greater than five times the highest associated blank's concentration, so no results needed to be qualified.

One ammonia CCB had a result that was greater than the ammonia MDL (CCB4 on SDG 1212098). Three associated ammonia sample results (1212098-14, 1212098-15, and 1212098-16) were less than five times the highest blank's concentration; however, these sample locations were less than the RL (surface water locations) and, as a result, were not flagged.

### **Equipment Blanks**

An equipment blank (EB) is a sample of analyte-free media collected from a rinse of non-dedicated sampling equipment used to sample surface water. EBs are collected to document adequate decontamination of non-dedicated equipment. One EB should be prepared with each preparation batch. Dedicated sampling equipment was used on all locations, so no EBs were collected or analyzed.

### **Matrix Spike Analysis**

Matrix spike (MS) samples were prepared and analyzed for all analytes as a measure of method performance in the sample matrix. Laboratory spike standards are prepared from independent sources. The spike recoveries met the recovery and precision criteria for all analytes. For ammonia as N analysis, only two MSs were analyzed for the 26 total ammonia samples. There were 12 ammonia samples with SDG 1212185 and 14 samples with SDG 1212098. EPA Method 350.1 requires MSs to be analyzed for at least 10 percent of the samples; therefore, all of the ammonia samples have been flagged J for reason MS-1.

### **Laboratory Replicate Analysis**

The laboratory replicate results demonstrate acceptable laboratory precision. The relative percent difference values for the reported matrix spike duplicate (MSD) results for all other analytes should be less than 20 percent for results greater than 5 times the RL. No MSDs were run during the uranium analysis on either of the SDGs. As a result, all of the uranium analyses have been flagged J for reason MS-2.

### **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 was collected from locations 0454 (1212098-8), SMI-PZ3D2 (1212185-13), and 0414 (1212185-4). The duplicate results met the U.S. Environmental Protection Agency recommended laboratory duplicate criteria of less than 20 percent relative difference for results that are greater than five times the RL.

### **Laboratory Control Sample**

Laboratory control samples (LCS) provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. LCS results were acceptable for ammonia analyses. LCSs were not reported for uranium. Per national environmental laboratory accreditation requirements provided by the NELAC Institute, an MS may be used in place of an LCS provided the acceptance criteria are as stringent.

### Metals Serial Dilution

Serial dilution (SD) samples were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. ICP-MS SD data are evaluated when the concentration of the undiluted sample is greater than 100 times the RL. All evaluated SD data were acceptable with the following exception.

For SDG 1212185, the SD sample 1212185\_L1 did not meet the acceptance criteria; therefore, all of the uranium data in this SDG is flagged J for reason SD-1.

### Detection Limits/Dilutions

Dilutions were prepared in a consistent and acceptable manner when dilutions were required. The required detection limits were achieved for all analytes.

### Completeness

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

### Electronic Data Deliverable File

The Electronic Data Deliverable (EDD) files arrived on December 21 and 28, 2012. 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.

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

The Minimums and Maximums Report for this sampling event is located in Appendix A. Based on the results, there were three anomalous data points (from two different locations), all of which were more than 50 percent above the historical maximum, as shown in Table 4.

Table 4. Anomalous Data Associated With the November/December 2012 Sampling Event

Location	Sample Date	Analyte	Concentration (mg/L)	Historical Maximum (mg/L)	Disposition
0218	11/27/2012	Ammonia	0.036	0.014	Result may be associated with prolonged, abnormally low river stage.
0413	12/12/2012	Ammonia	51	13	First time well sampled since May 2011. Results may be impacted due to the fact that this well had to be replaced after flood damage.
0413	12/12/2012	Uranium	3.3	1.73	First time well sampled since May 2011. Results may be impacted due to the fact that this well had to be replaced after flood damage.

mg/L = milligrams per liter

## 4.0 Results

As previously mentioned, all samples collected during this event were analyzed for uranium, and approximately one-half were analyzed for ammonia by ALS.

Table 5 presents the locations (and associated concentrations) that exceeded the 0.044 milligrams per liter (mg/L) uranium ground water standard. The uranium standard is based on Table 1 in Title 40 Code of Federal Regulations Part 192, Subpart A (40 CFR 192A), "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In Situ Leaching Processing Facilities," assuming uranium-234 and uranium-238 activities are in equilibrium.

*Table 5. November/December 2012 Site-wide Locations Exceeding the 0.044 mg/L Uranium Ground Water Standard*

<b>Well Number</b>	<b>Date</b>	<b>Location</b>	<b>Sample Depth (ft bgs)</b>	<b>Uranium Concentration (mg/L)</b>
0401	11/27/2012	CF2 Vicinity	18	1.8
0403	11/27/2012	CF1 Vicinity	18	0.94
0404	11/27/2012	CF3 Vicinity	18	1.6
0407	11/27/2012	CF1 Vicinity	17	0.36
0410	12/3/2012	NE Uranium Plume Area	25	0.67
0412	11/28/2012	NE Uranium Plume Area	10.5	3.4
0439	12/3/2012	NE Uranium Plume Area	118	0.81
0453	12/3/2012	Along SW Site Boundary	80	2.6
0454	11/30/2012	Along S Site Boundary	13	2.6
0492	12/6/2012	Along S Site Boundary	18	0.19
AMM-2	11/29/2012	Near Base of Tailings Pile	48	1.9
AMM-3	11/30/2012	Near Base of Tailings Pile	48	1.2
SMI-MW01	11/28/2012	NE Uranium Plume Area	16	3.8
SMI-PZ1S	11/29/2012	CF5 Vicinity	18	1.4
SMI-PZ3D2	12/4/2012	NE Uranium Plume Area	78	1.1
SMI-PZ3M	12/4/2012	NE Uranium Plume Area	59	0.89
SMI-PZ3S	12/4/2012	NE Uranium Plume Area	25	1.4
TP-01	11/28/2012	NE Uranium Plume Area	22	0.054
TP-22	11/29/2012	NE Uranium Plume Area	17	0.21
TP-23	11/30/2012	NE Uranium Plume Area	25	3.7
UPD-17	12/12/2012	NE Uranium Plume Area	14	1.2
UPD-18	12/3/2012	NE Uranium Plume Area	13	0.9
UPD-20	12/4/2012	NE Uranium Plume Area	17	0.095
UPD-21	12/4/2012	NE Uranium Plume Area	25	9.6
UPD-22	11/29/2012	NE Uranium Plume Area	9	2.6
UPD-23	12/12/2012	NE Uranium Plume Area	26	0.81
UPD-24	12/12/2012	NE Uranium Plume Area	27	8.6

CF = Configuration; ft bgs = feet below ground surface, S = southern; SW = southwestern; NE = northeastern

## 4.1 Ground Water Quality Trends

To present the trends observed in the water chemistry for the site-wide locations, the site was divided into six areas. These include the northeastern base of the tailings pile, northeastern uranium plume (which includes the PW03 cluster), the southeastern base of the tailings pile, along the southwestern boundary, along the Colorado River bank, and south of the site. All results are also plotted against the Colorado River flow to determine if the river stage may impact the concentrations. Results based on analysis using the ammonia probe are also displayed.

## 4.2 Northeastern Base of the Tailings Pile

Wells UPD-17 through UPD-19 were installed in the vicinity of the northeastern base of the tailings in spring 2011 and were first sampled in October 2011. Figures 3 and 4 are time versus ammonia and uranium concentration plots, respectively, for these locations. It was not possible to collect a sample from Well UPD-19 in November/December 2012.

The first four samples collected from these locations suggest ammonia concentrations in samples collected from UPD-17 and -18 are between 200 and 300 mg/L (Figure 3), and uranium concentrations were below 1.5 mg/L (Figure 4). While there appears to be an increasing trend in the ammonia concentrations and a decreasing trend in the uranium concentrations in samples collected from these locations, there are too few data points to determine if clear trends are evident.

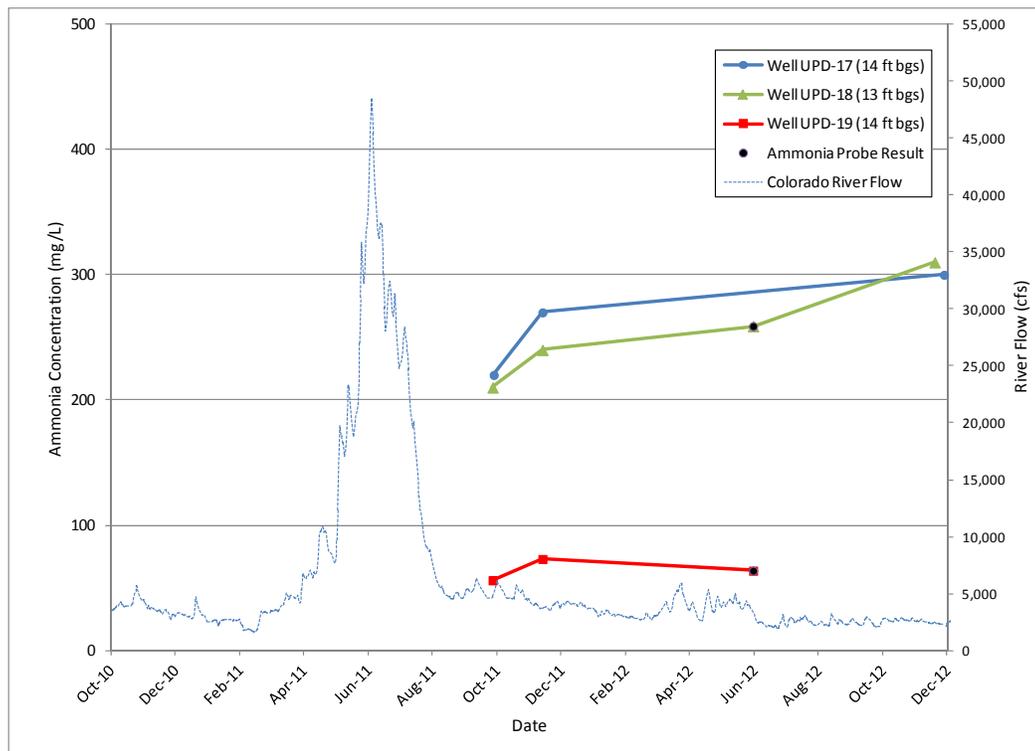


Figure 3. Wells UPD-17, UPD-18, and UPD-19  
Time Versus Ammonia Concentration Plot

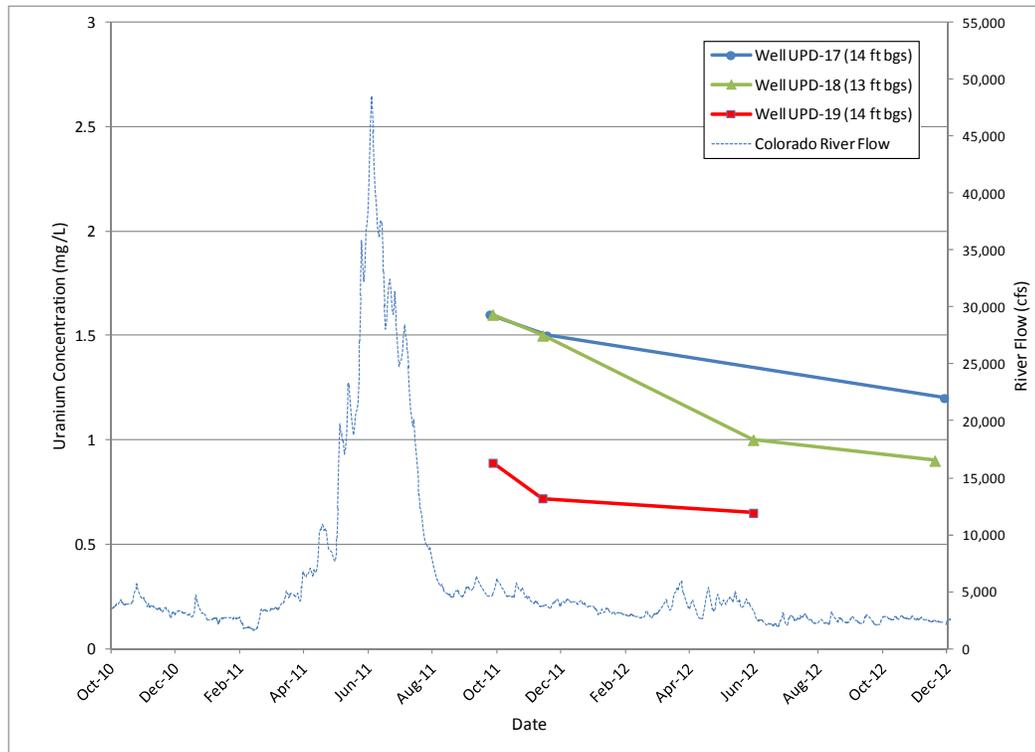


Figure 4. Wells UPD-17, UPD-18, and UPD-19  
Time Versus Uranium Concentration Plot

### 4.3 Northeastern Uranium Plume Area

Due to the number of wells associated with the northeastern uranium plume, this area of the site was further divided into three subareas: the center of the plume, the vicinity of the Atlas building, and the northeastern edge of the plume area.

#### 4.3.1 Center of the Northeastern Uranium Plume Area

Figures 5 and 6 are the time versus ammonia and uranium concentration plots, respectively, for the center of the northeastern uranium plume area, which includes locations 0411, 0413, 0414, and UPD-20. As displayed in Figure 5, the ammonia concentrations have remained consistent below 10 mg/L (wells UPD-20 and 0411) or increased significantly since June 2011. During this time frame the concentration in the sample collected from well 0413 increased from 7 to 51 mg/L and in well 0414 the concentration increased from 11 to 30 mg/L. Additional samples will determine if these increasing trends will continue. As displayed in Figure 6, there are definitive trends associated with the uranium concentrations in the samples collected from these same locations.

#### 4.3.2 Atlas Building Vicinity

The ammonia and uranium concentrations associated with samples collected from locations in the vicinity of the Atlas building are displayed in Figures 7 and 8, respectively. These wells include 0410, UPD-21, UPD-23, and UPD-24. Wells UPD-23 and UPD-24 were installed in the winter of 2012 for purposes of better defining the extent of the elevated uranium concentrations detected in the samples collected from well UPD-21. This sampling event represents the first time these new wells were sampled.

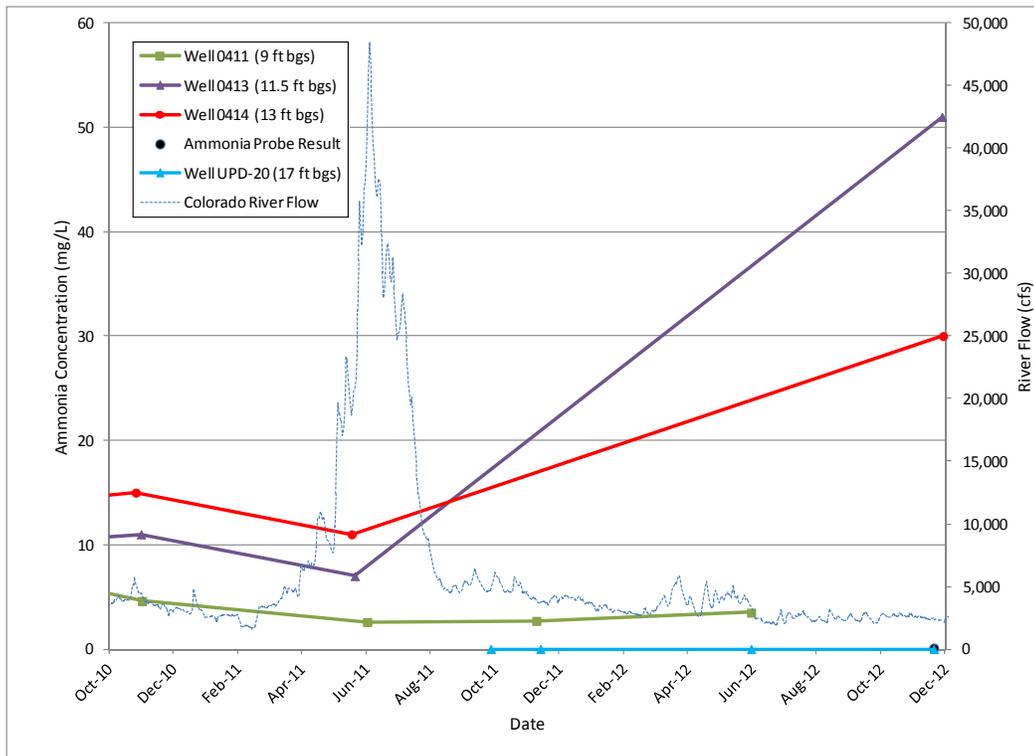


Figure 5. Center of the Northeastern Uranium Plume Area Observation Wells 0411, 0413, 0414, and UPD-20 Time Versus Ammonia Concentration Plot

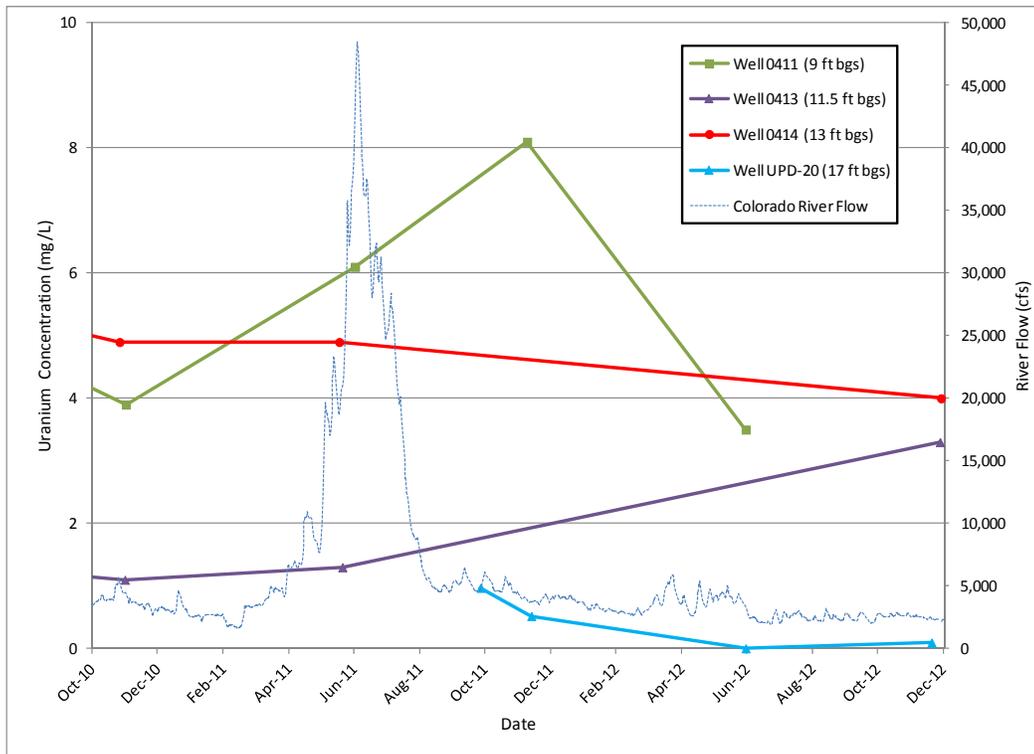


Figure 6. Center of the Northeastern Uranium Plume Area Observation Wells 0411, 0413, 0414, and UPD-20 Time Versus Uranium Concentration Plot

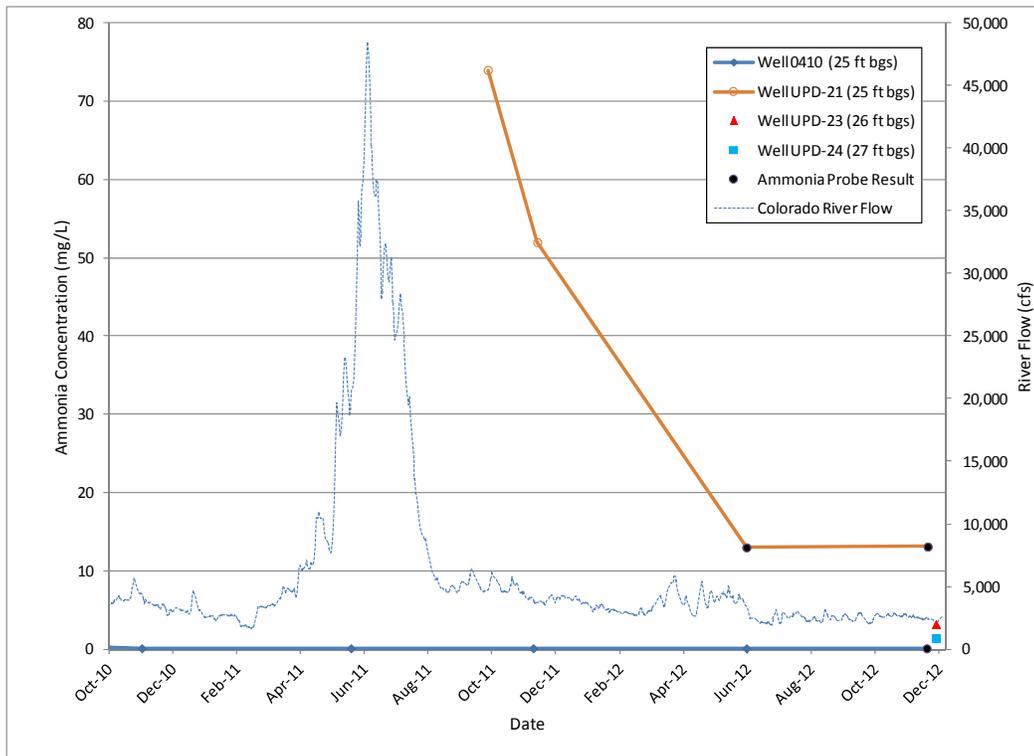


Figure 7. Vicinity of the Atlas Building Observation Wells 0410, UPD-21, UPD-23, and UPD-24 Time Versus Ammonia Concentration Plot

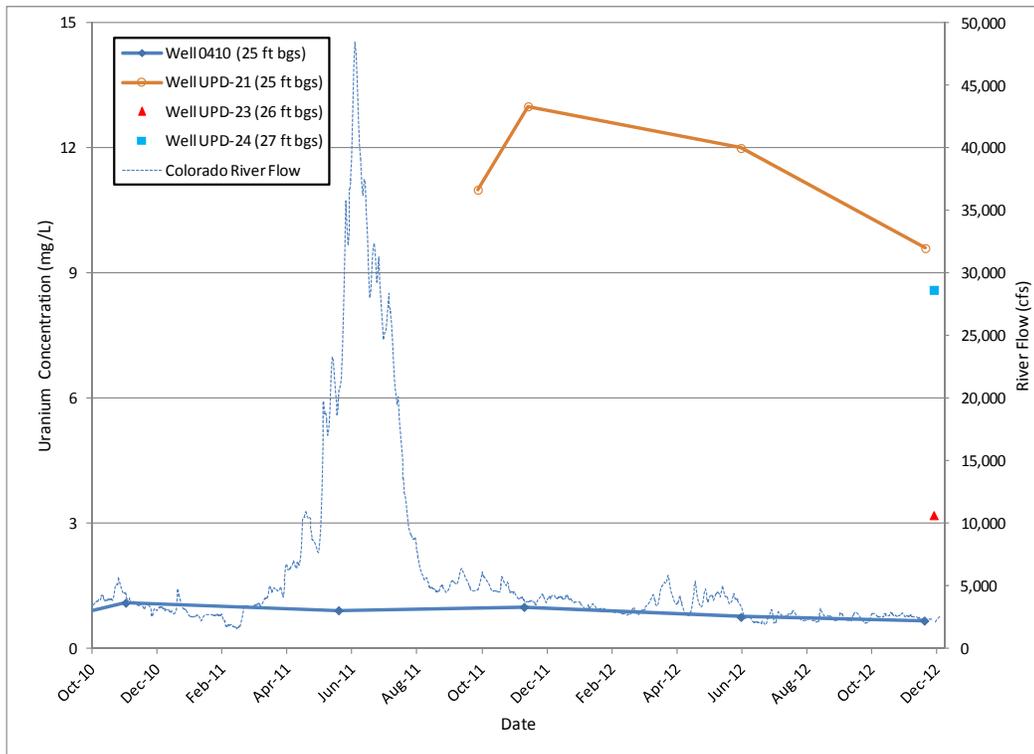


Figure 8. Vicinity of the Atlas Building Observation Wells 0410, UPD-21, UPD-23, and UPD-24 Time Versus Uranium Concentration Plot

As shown in Figure 7, the ammonia concentrations in the samples collected from wells 0410, UPD-23, and UPD-24 were all less than 5 mg/L, and the concentration in the samples collected from UPD-21 have significantly decreased since October 2011. Figure 8 displays that the uranium concentrations in samples collected from well 0410 remain below 1 mg/L, while the sample collected from well UPD-21 has gradually decreased since November 2011 (from 13 to 9.6 mg/L). The first samples collected from wells UPD-23 and UPD-24 had concentrations of 3.2 and 8.6 mg/L, respectively.

### 4.3.3 Northeastern Edge of the Uranium Plume Area

Figures 9 and 10 display comparable data for the wells located in the vicinity of the northeastern edge of the plume area (wells 0412, UPD-22, SMI-MW01, and SMI-PZ3S). As Figure 9 exhibits, the ammonia concentrations have gradually increased since November 2011 for the samples collected from wells UPD-22, SMI-MW01, and SMI-PZ3S, but are still below 10 mg/L. The concentrations measured in the sample collected from well 0412 remains below the detection limit. The uranium concentrations (Figure 10) in general have decreased for the samples collected from these locations to less than 4 mg/L.

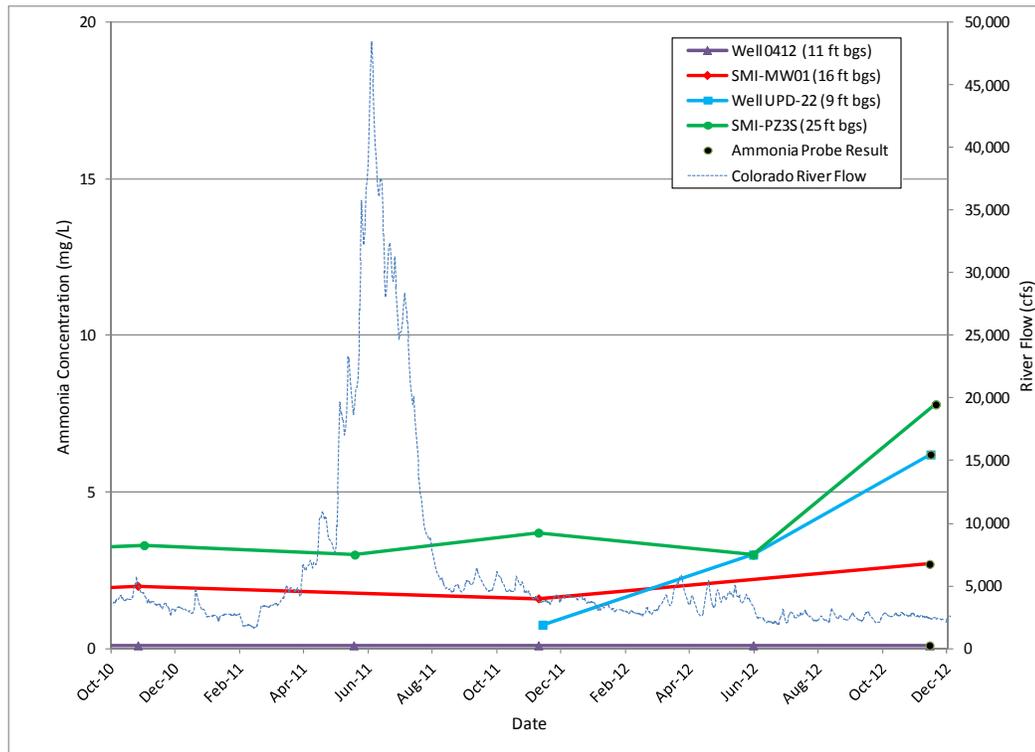


Figure 9. Northeastern Edge of the Uranium Area Observation Wells 0412, SMI-MW01, SMI-PZ3S, and UPD-22 Time Versus Ammonia Concentration Plot

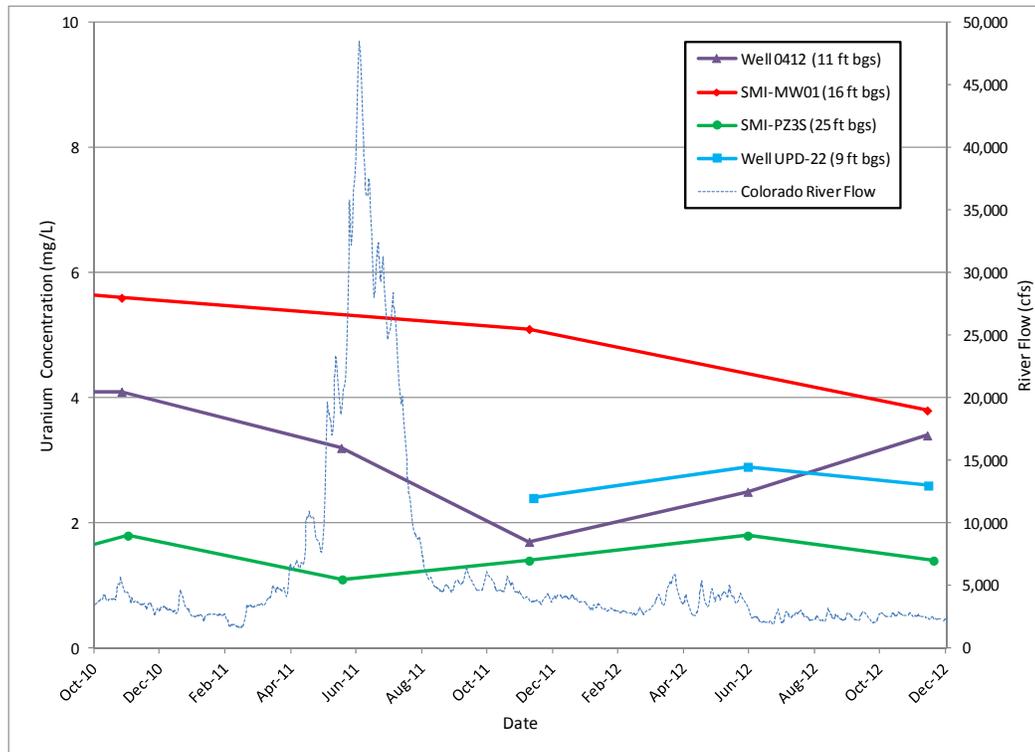


Figure 10. Northeastern Edge of the Uranium Area Observation Wells 0412, SMI-MW01, SMI-PZ3S, and UPD-22 Time Versus Uranium Concentration Plot

#### 4.4 Base of the Tailings Pile

The time versus ammonia and uranium concentration plots for the area near the base of the tailings pile are presented in Figures 11 and 12. As Figure 11 exhibits, the ammonia concentrations have generally fluctuated independent of the river flow in the samples collected from wells AMM-3, ATP-2-S, ATP-2-D, and AMM-2 (listed from south to north). The data suggest the ammonia concentrations have leveled off since the area was flooded, starting in May 2011. Uranium concentrations (Figure 12) have been consistent since November 2011, and the ATP wells have consistently been below 0.1 mg/L during the past 2 years.

#### 4.5 Southwestern Boundary

Figures 13 and 14 display the time versus concentration plots for the locations along the southwestern boundary (Figure 2), presented in the upgradient to downgradient direction. Both ammonia and uranium concentrations in the samples collected from wells 0453 and 0454 have increased since June 2012. Ammonia concentrations remain below historical high concentrations, and the uranium concentrations in the samples collected from both locations increased to 2.6 mg/L.

The sample collected from well 0440 continued having ammonia concentrations below the detection limit and uranium concentrations below the 0.044 mg/L UMTRA standard.

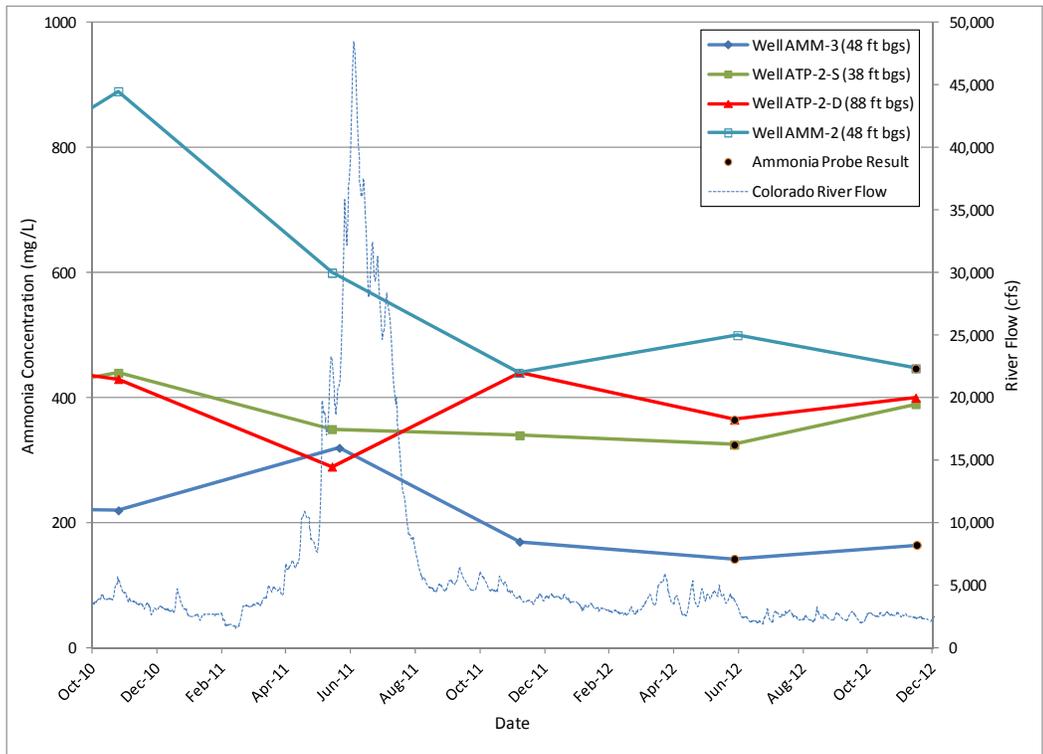


Figure 11. Base of Tailings Pile Observation Wells AMM-3, ATP-2-S, ATP-2-D, and AMM-2 Time Versus Ammonia Concentration Plot

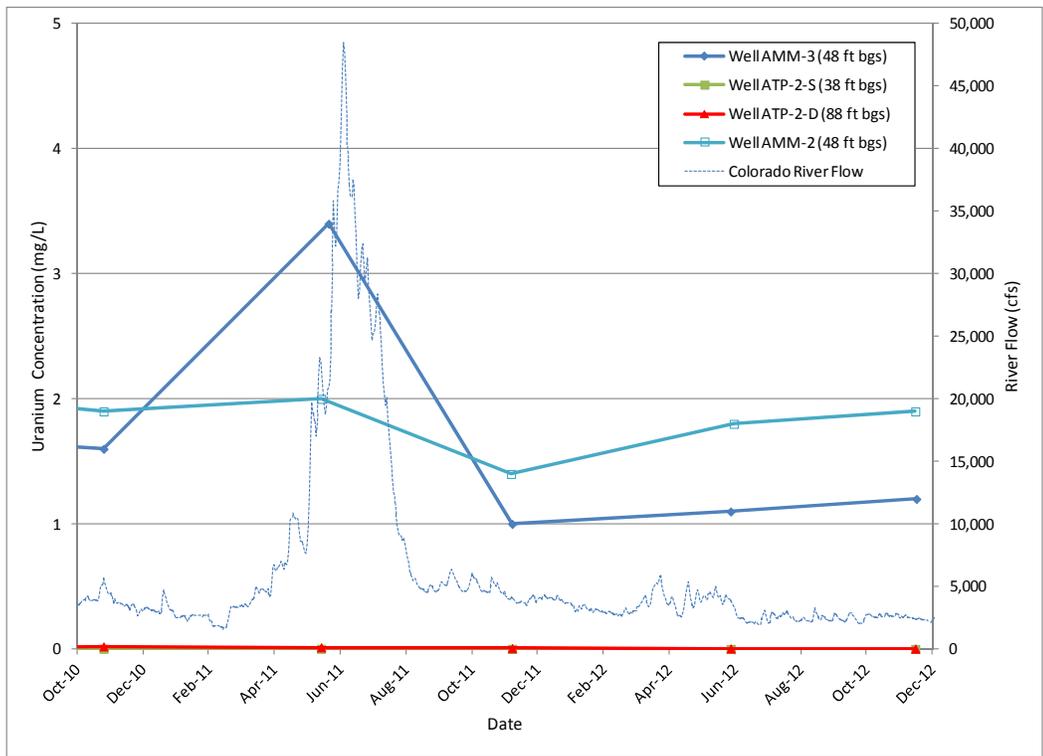


Figure 12. Base of Tailings Pile Observation Wells AMM-3, ATP-2-S, ATP-2-D, and AMM-2 Time Versus Uranium Concentration Plot

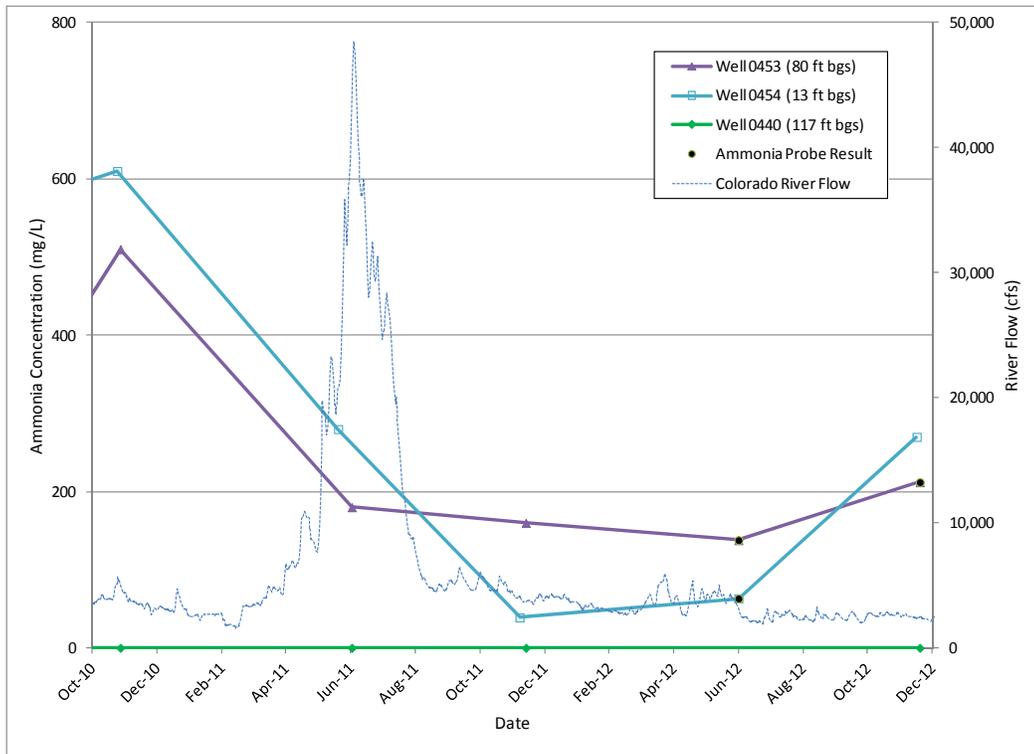


Figure 13. Southwestern Boundary Observation Wells 0453, 0454, and 0440 Time Versus Ammonia Concentration Plot

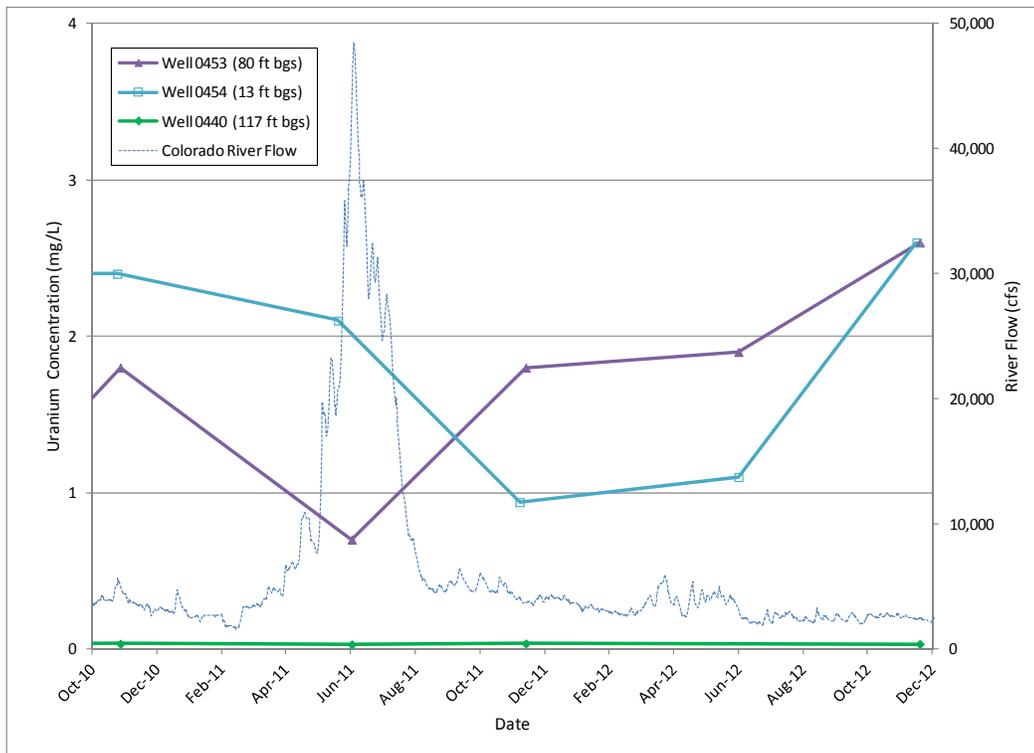


Figure 14. Southwestern Boundary Observation Wells 0453, 0454, and 0440 Time Versus Uranium Concentration Plot

## 4.6 Riverbank Area

Figures 15 and 16 are the time versus ammonia and uranium concentration plots, respectively, for the locations sampled along the riverbank, presented from south to north. Ammonia concentrations are low at the southern and northern ends of the site and increase near the middle. This plot also demonstrates how significant an impact the higher river flows result in lower ground water concentrations, as expected. As of November/December 2012, ammonia concentrations have not rebounded to pre-2011 flood levels in wells 0401 and 0404. Uranium concentrations (Figure 16) have remained consistent in wells 0401 and TP-01, gradually increased since November 2011 in the samples collected from wells 0404, and significantly decreased in the sample collected from 0492 during the same timeframe.

## 4.7 Southern and Off-site Areas

Figures 17 and 18 are the plots for the three locations sampled to the south of the site. Wells TP-17 and TP-19 are located along the riverbank, and TP-20 is located approximately 600 feet off the bank. Due to access issues, it was not possible to collect a sample from location TP-19 during this sampling event.

Ammonia concentrations (Figure 17) in samples collected from TP-17 and TP-19 have remained below 4 mg/L since October 2010, but increased to 6.6 and 4.2 mg/L since June 2012. The uranium concentrations (Figure 18) have consistently been below the 0.044 mg/L UMTRA standard during the same time frame.

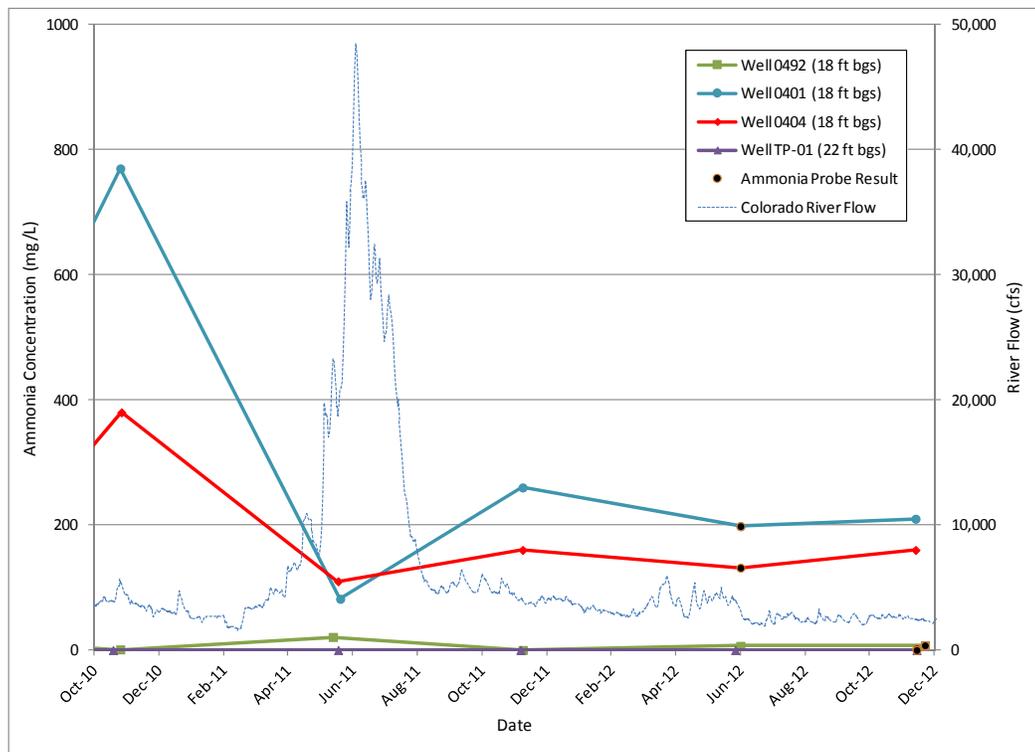


Figure 15. Riverbank Observation Wells 0492, 0401, 0404, and TP-01 Time Versus Ammonia Concentration Plot

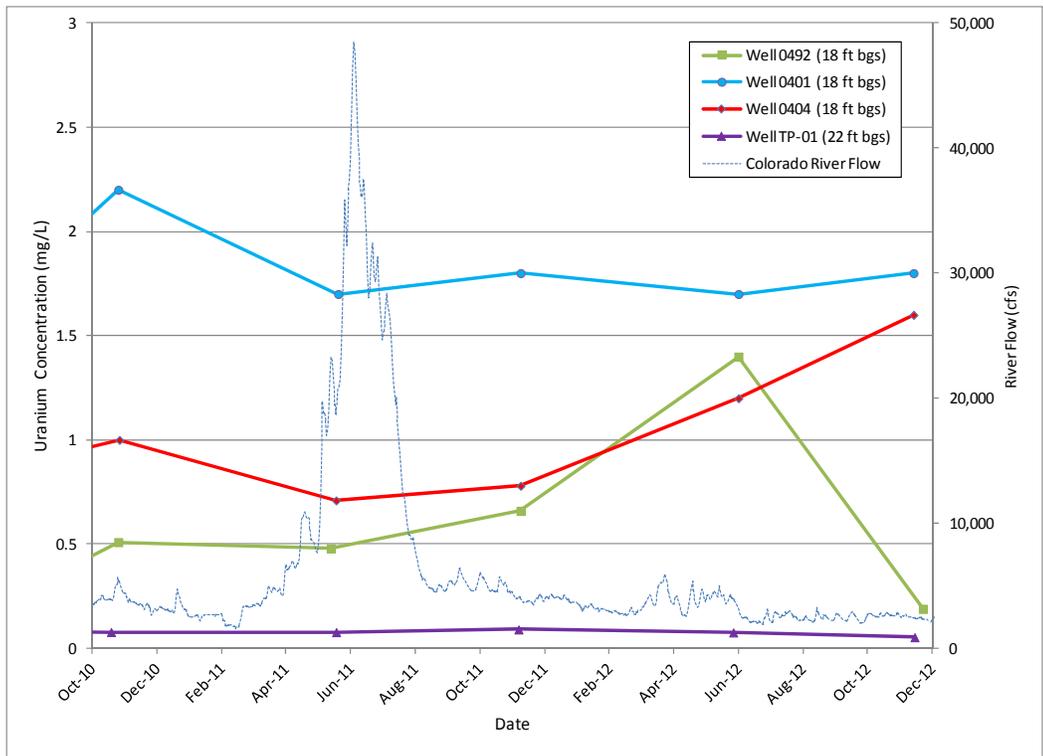


Figure 16. Riverbank Observation Wells 0492, 0401, 0404, and TP-01 Time Versus Uranium Concentration Plot

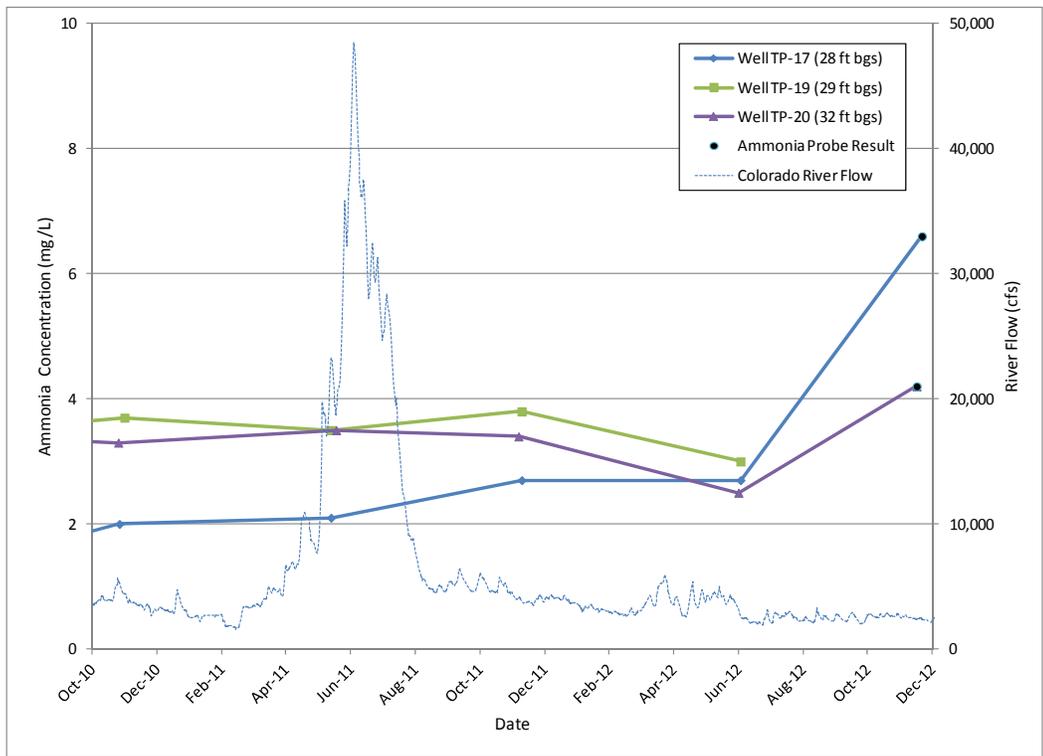


Figure 17. South of the Site Observation Wells TP-17, TP-19, and TP-20 Time Versus Ammonia Concentration Plot

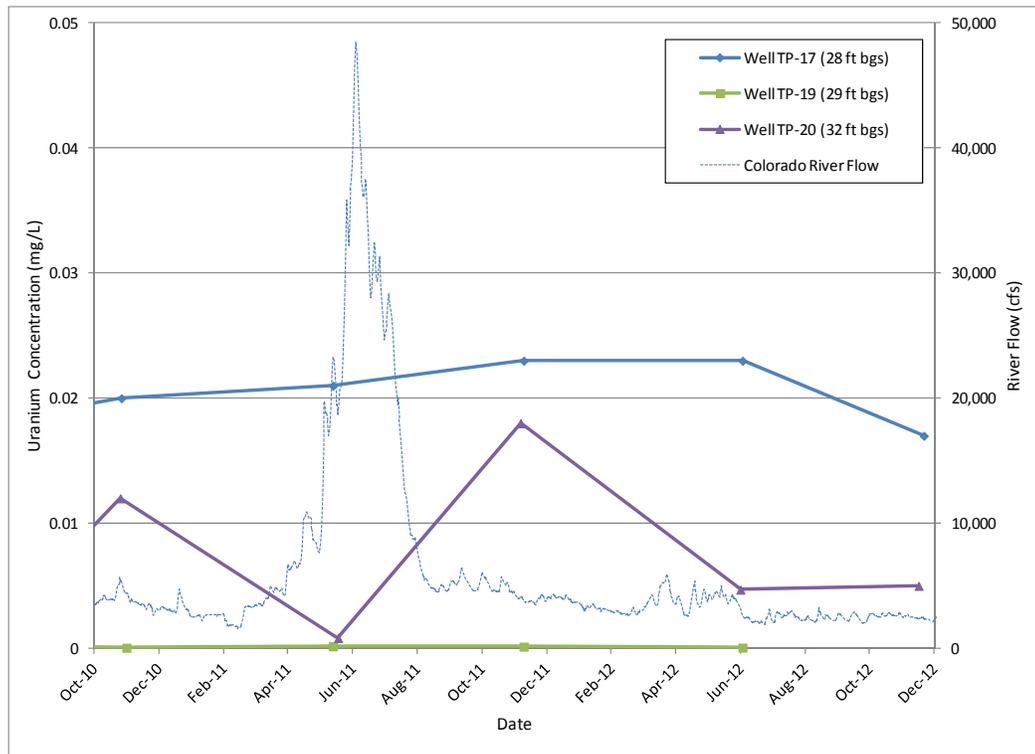


Figure 18. South of the Site Observation Wells TP-17, TP-19, and TP-20 Time Versus Uranium Concentration Plot

#### 4.8 Surface Water Sampling

Table 6 presents the ammonia results from the surface water sampling conducted in November/December 2012 from locations 0218, 0226, CR1, CR2, CR3, and CR5 (as shown on Figure 2). The ammonia concentrations and comparisons to the applicable state of Utah and federal criteria for both acute and chronic concentrations (along with the temperature and pH data used to calculate these concentrations) are also shown in Table 6.

Table 6. Surface Water Ammonia Concentrations and Comparisons to State of Utah and Federal Criteria

Location	Date	Temp (°C)	pH	Ammonia as N (mg/L)	State/Federal AWQC-Acute Total as N (mg/L) <sup>1</sup>	State/Federal AWQC-Chronic Total as N (mg/L) <sup>2</sup>
0218	11/27/12	7.13	8.49	0.1	2.14	1.09
0226	12/5/12	9.20	8.68	0.1	1.47	0.778
CR1	11/27/12	5.61	8.32	0.1	3.15	1.52
CR2	11/28/12	6.54	8.44	0.1	2.59	1.29
CR3	12/6/12	8.19	8.31	0.4	3.15	1.79
CR5	11/27/12	5.66	8.49	0.1	2.14	1.09

Loc = location, Temp = temperature, AWQC = ambient water quality criteria

Notes:

(1) State of Utah, Standards of Quality for Waters of the State (Effective May 1, 2008), Rule R317-2, Table 2.14.2, 1-Hour Average (Acute) Concentration of Total Ammonia as N (mg/L)

(2) State of Utah, Standards of Quality for Waters of the State (Effective May 1, 2008), Rule R317-2, Table 2.14.2, 30-Day Average (Chronic) Concentration of Total Ammonia as N (mg/L), Fish Early Life Stages Present

With the exception of the sample collected from location CR3, the ammonia concentrations were below the detection limit of 0.1 mg/L. As shown in the table, the ammonia concentrations detected in the samples collected from all six locations were below both the acute and chronic criteria.

#### 4.9 Ammonia Probe Analysis Results

All samples collected were analyzed for ammonia using a portable HACH ammonia probe meter. For approximately one-half of the samples, sample splits were collected and submitted to ALS for ammonia analysis to determine how the measured concentrations compare to each other. Table 7 provides the results measured by both ALS and the field method. As the table displays, the results are comparable.

*Table 7. Ammonia Field Analysis Results Compared to Analytical Laboratory Results*

Well Number	Date	Ammonia Concentration (mg/L)	
		Analytical Laboratory Results	Field Results
0401	11/27/2012	201	180
0403	11/27/2012	69	62.5
0404	11/27/2012	160	152
0407	11/27/2012	43	41.3
0410	12/3/2012	NA	<1
0412	11/28/2012	NA	<1
0413	12/12/2012	51	47.2
0414	12/13/2012	30	28.6
0439	12/3/2012	NA	12.4
0440	12/3/2012	0.1	<1
0453	12/3/2012	NA	212
0454	11/30/2012	270	210
0492	12/6/2012	NA	7.74
AMM-2	11/29/2012	NA	447
AMM-3	11/30/2012	NA	165
ATP-2-D	11/29/2012	400	353
ATP-2-S	11/29/2012	390	303
SMI-MW01	11/28/2012	NA	2.71
SMI-PZ1S	11/29/2012	210	195
SMI-PZ3D2	12/4/2012	400	540
SMI-PZ3M	12/4/2012	NA	51.6
SMI-PZ3S	12/4/2012	NA	7.82
TP-01	11/28/2012	NA	<1
TP-17	12/5/2012	NA	6.58
TP-20	11/30/2012	NA	4.15
TP-22	11/29/2012	NA	<1
TP-23	11/30/2012	NA	173
UPD-17	12/12/2012	300	304

Table 7. Ammonia Field Analysis Results Compared to Analytical Laboratory Results (continued)

Well Number	Date	Ammonia Concentration (mg/L)	
		Analytical Laboratory Results	Field Results
UPD-18	12/3/2012	310	403
UPD-20	12/4/2012	NA	<1
UPD-21	12/4/2012	NA	13.1
UPD-22	11/29/2012	NA	6.22
UPD-23	12/12/2012	3.2	3.67
UPD-24	12/12/2012	1.4	1.78

NA = not applicable (sample not analyzed)

Field results measured using HACH sension 2 portable pH/ISE probe and meter.

Analytical laboratory results provided by ALS.

The plot below (Figure 19) is a graphical representation displaying the comparison between the ammonia results generated from the analytical laboratory and the ammonia probe. As shown, when ammonia concentrations are below 200 mg/L, the analytical laboratory and the ammonia probe provide nearly identical results. Above 200 mg/L, the probe still provides comparable results. Overall, the trendline has an  $r^2$  value of 0.9, which confirms the ammonia probe does generate reliable results.

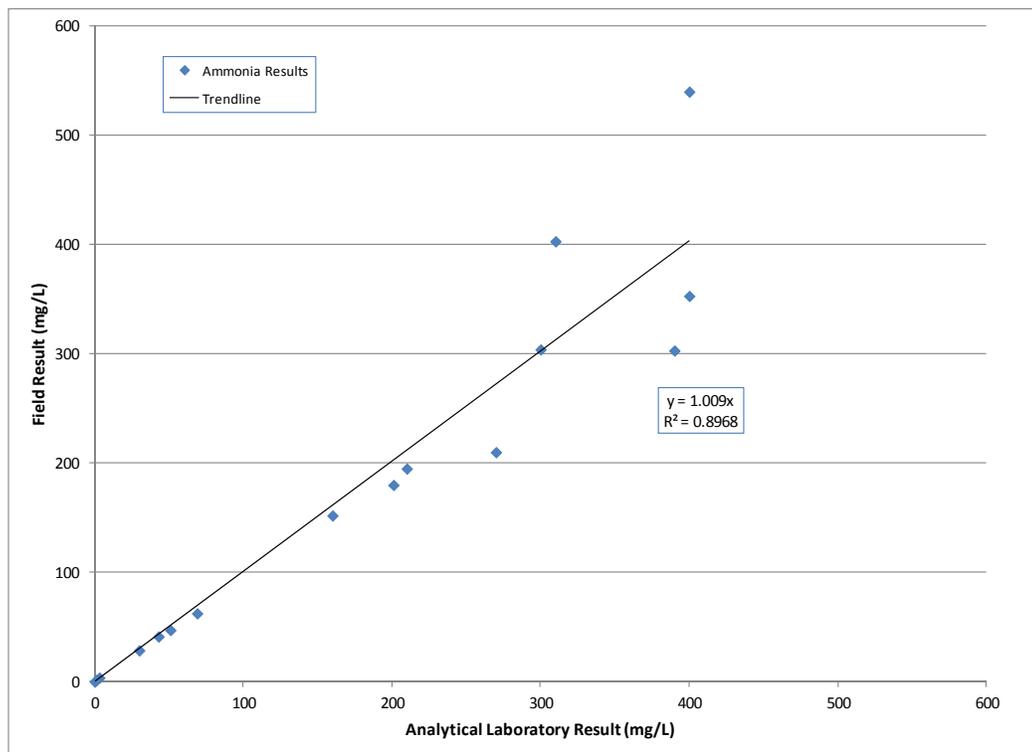


Figure 19. Graphical Comparison of the Ammonia Results Generated from the Analytical Laboratory and the Ammonia Field Analyses

#### 4.10 Ground Water Surface

Figure 20 is a ground water surface contour map for the site in November/December 2012. All water level data were collected from the alluvial soils screened across the vadose zone and saturated zone interface and exhibit a ground water flow direction towards the Colorado River.

#### 4.11 Contaminant Distribution

Figures 21 and 22 are maps showing shallow ground water ammonia and uranium plumes (respectively) using data collected during the November/December 2012 site-wide event. Contaminant distribution is generally comparable to previous plume maps during river base-flow conditions.

While Figure 22 displays the result associated with well ATP-2-S, this concentration was not taken into consideration for the contour line location. This well is screened over a deeper interval in this shallow zone, and is not representative of the uranium concentration in the most shallow ground water.

Extraction well 0815 is located within 50 ft southeast of ATP-2-S, and was last sampled during the June 2012 event. As shown in the uranium plume map presented in the *Moab UMTRA Project Ground Water and Surface Water Monitoring January through June 2012* (DOE-EM/GJTAC2062), the uranium concentration near the ground water surface is assumed to be considerably higher than the 0.001 mg/L measured in the sample collected from ATP-2-S in November 2012.

### 5.0 Conclusions

The rationale for conducting the November/December site-wide sampling event was to collect data during river base-flow conditions and assess any changes and trends in the ground water system water chemistry. Surface water sampling was also conducted to assess surface water quality adjacent to the site compared to the upstream and downstream water quality.

The following conclusions can be made from the November/December 2012 site-wide sampling event:

- In general, the ammonia and uranium concentrations did not significantly change since the previous site-wide sampling event in June 2012. Concentrations associated with locations impacted by the river stage in particular did not change in November/December compared to the previous events, because the river flows remained low. In general, all contaminant concentrations were comparable to historical river base-flow conditions.
- With the exception of the ammonia and uranium concentrations detected in well 0413 and the uranium result from surface water location 0218, all ammonia and uranium concentrations in the site-wide wells were within historical ranges during this sampling event.
- All surface water samples collected during this sampling event had ammonia concentrations that were below the applicable state of Utah and federal criteria for both acute and chronic concentrations.

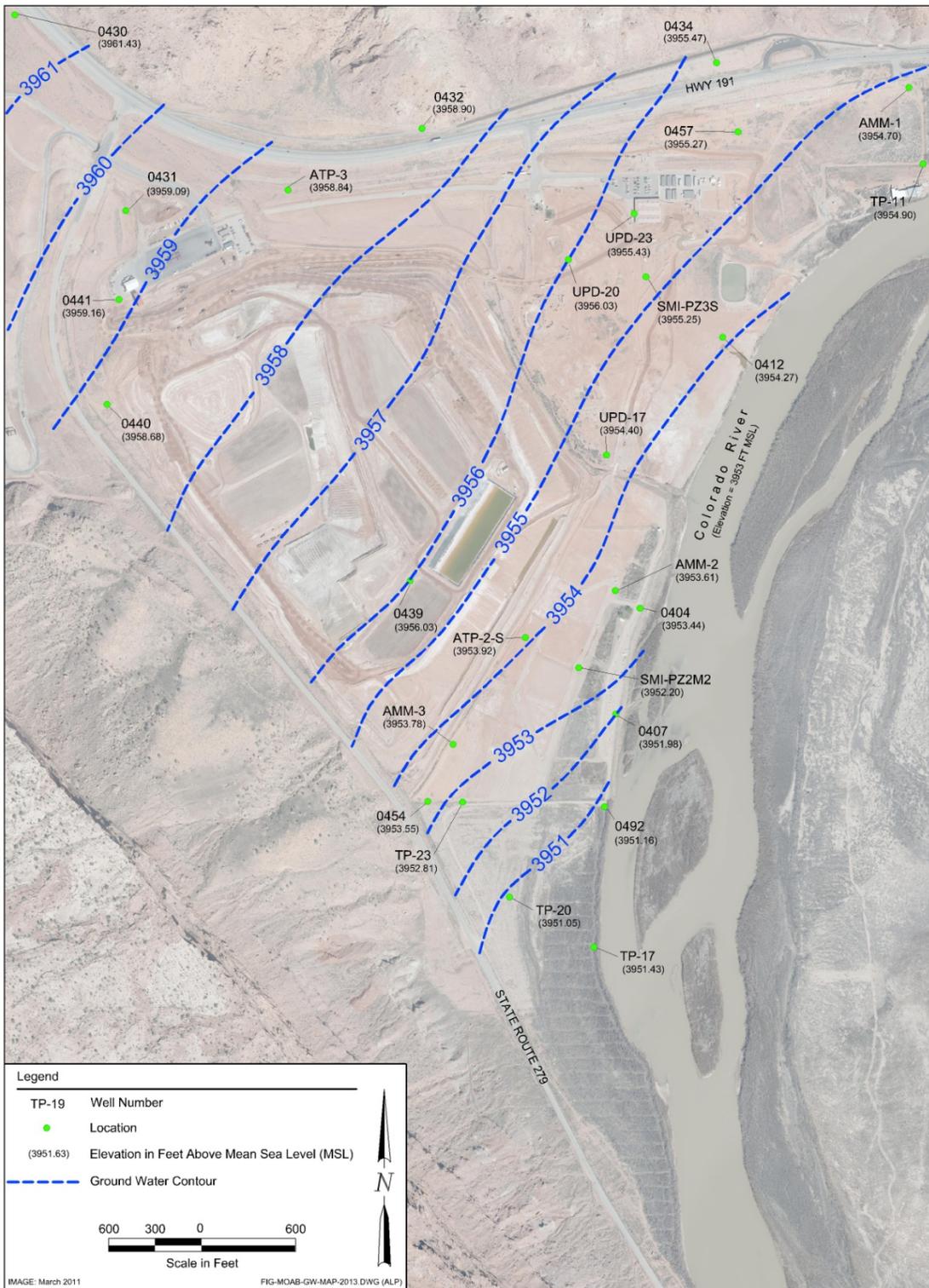


Figure 20. Site-wide Ground Water Surface Contour Map, November/December 2012

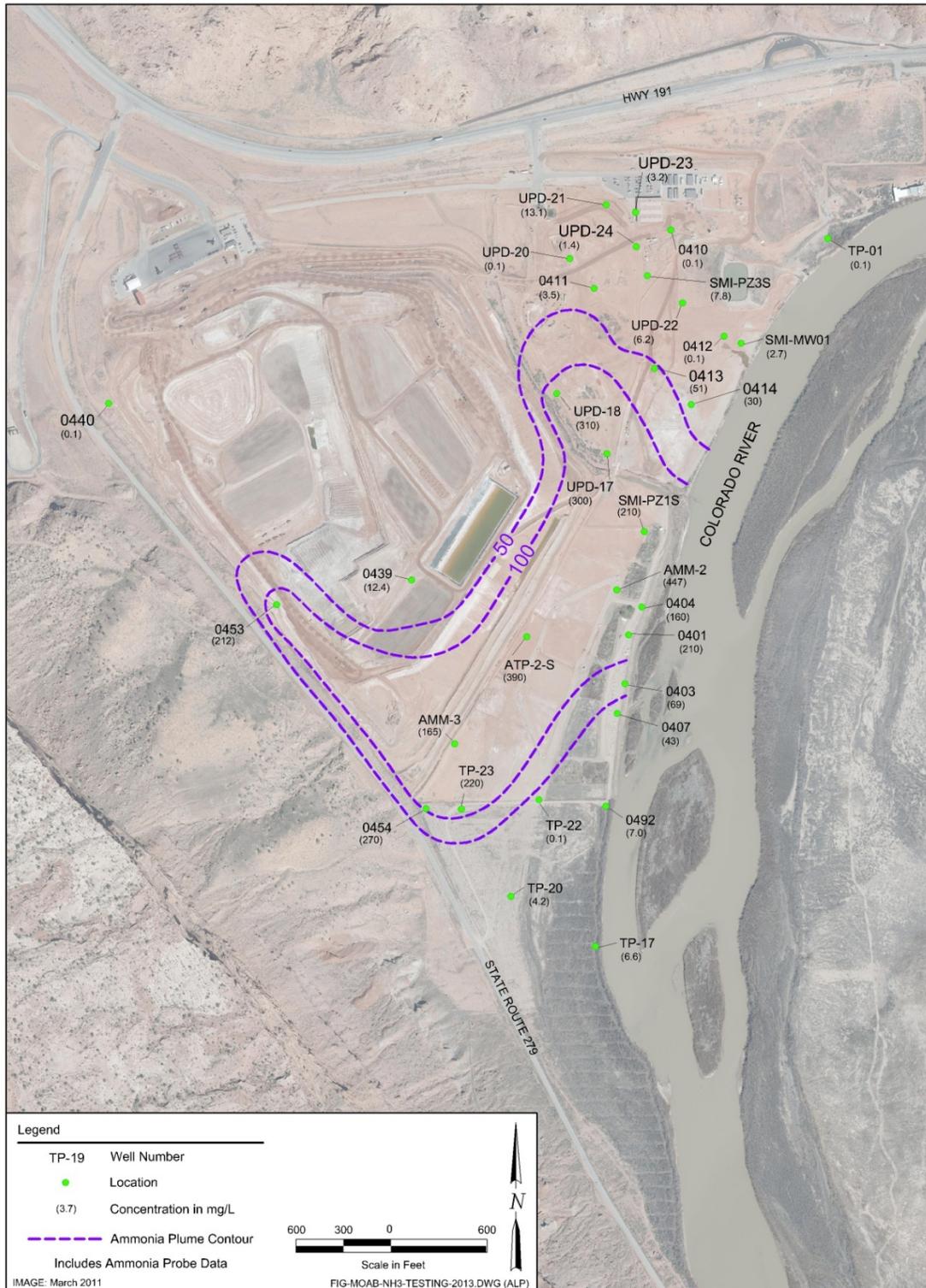


Figure 21. Location of Ammonia Plume in Shallow Ground Water, November/December 2012

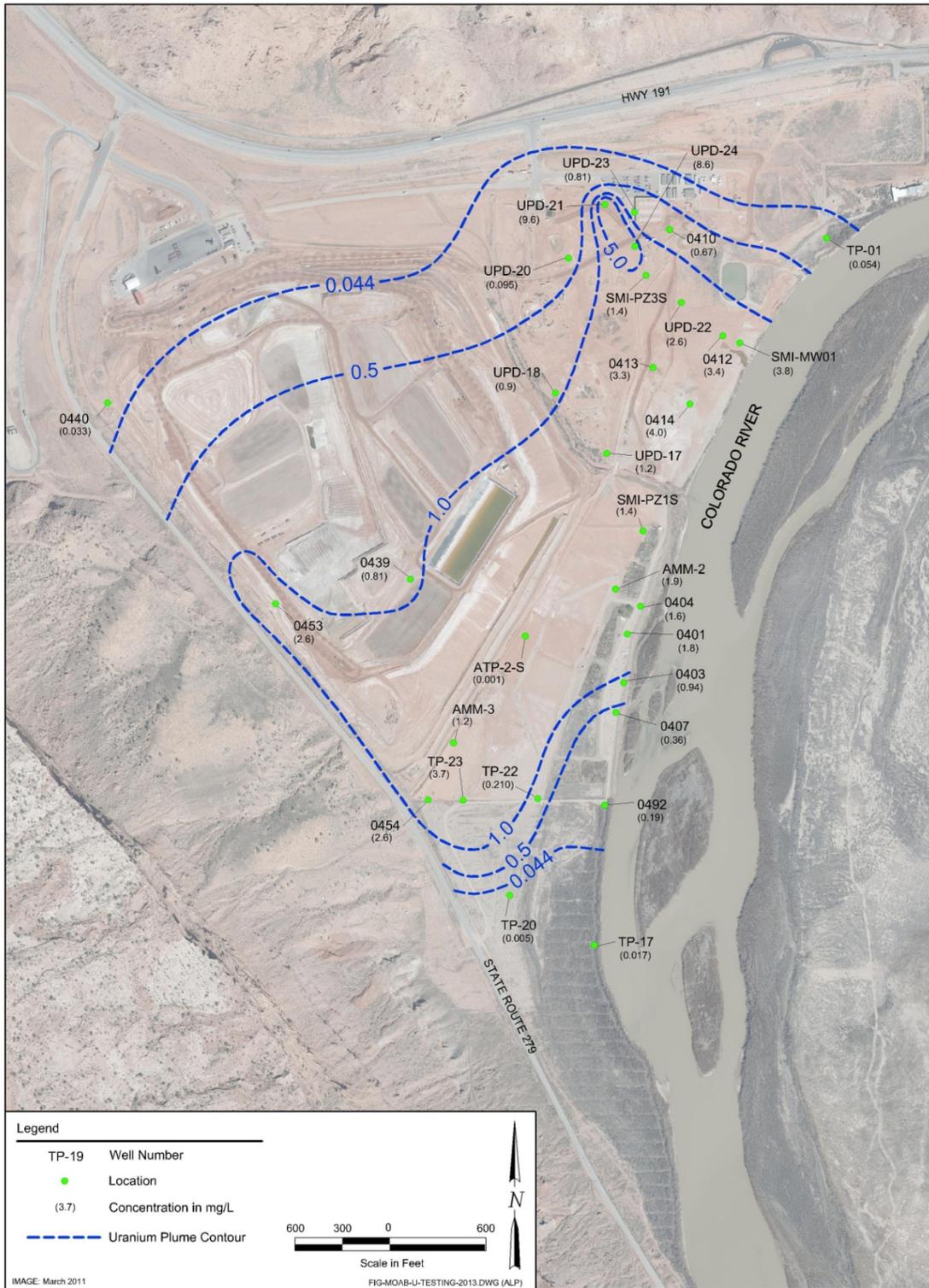


Figure 22. Location of Uranium Plume in Shallow Ground Water, November/December 2012

## 6.0 References

40 CFR 192A (Code of Federal Regulations), “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings and Uranium In Situ Leaching Processing Facilities.”

DOE (U.S. Department of Energy), *Moab UMTRA Project Operations and Maintenance Manual* (DOE-EM/GJTAC1973), October 2012.

DOE (U.S. Department of Energy), *Moab UMTRA Project Ground Water and Surface Water Monitoring January through June 2012* (DOE-EM/GJTAC2062), October 2012.

DOE (U.S. Department of Energy), *Moab UMTRA Project Surface Water/Ground Water Sampling and Analysis Plan* (DOE-EM/GJTAC1830), July 2012.

DOE (U.S. Department of Energy), *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJTAC1855), September 2011.

**Appendix A.**  
**November/December 2012 Site-wide Sampling Event**  
**Water Sampling Field Activities Verification**  
**Minimums and Maximums Report**  
**Water Quality Data**  
**Water Level Data**  
**Trip Report**



## Appendix A. Water Sampling Field Activities Verification

Sampling Event/RIN	November/December 2012 Site-wide Sampling Event/1211065	Date(s) of Water Sampling	November 27 through December 13, 2012
Date(s) of Verification	January 16, 2013	Name of Verifier	Ken Pill
		Response (Yes, No, NA)	Comments
1.	Is the Sampling Analysis Plan 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?	No	The following wells were not sampled: UPD-19 (well damaged), TP-19 (access issues), and 0411 (well dewatered and did not recharge).
3.	Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
4.	Was an operational check of the field equipment conducted twice daily?  Did the operational checks meet criteria?	Yes	
		Yes	
5.	Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, dissolved oxygen, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, dissolved oxygen, 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?  Did the water level stabilize before sampling? Did pH, specific conductance, and turbidity measurements stabilize before sampling?  Was the flow rate less than 500 milliliters per minute? If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	Yes	
		Yes	
		Yes	
		NA	
		NA	
8.	Were the following conditions met when purging a Category II well:  Was the flow rate less than 500 milliliters per minute? Was one pump/tubing volume removed before sampling?	Yes	
		Yes	
9.	Were duplicates taken at a frequency of one per 20 samples?	Yes	Three duplicates were collected for 40 samples.
10.	Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected on dedicated equipment.

## Appendix A. Water Sampling Field Activities Verification (continued)

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
Was the true identity of the samples recorded on the quality assurance sample log?	Yes
13. Were samples collected in the containers specified?	Yes
14. Were samples filtered and preserved as specified?	Yes
	Samples with turbidity over 10 nephelometric turbidity units were filtered.
15. Were the number and types of samples collected as specified?	NA
16. Were COC records completed, and was sample custody maintained?	Yes
17. Are field data sheets signed and dated by both team members?	Yes
18. Was all other pertinent information documented on the field data sheets?	NA
19. Was the presence or absence of ice in the cooler documented at every sample location?	Yes
20. Were water levels measured at the locations specified in the planning documents?	NA

NA = not applicable

## Appendix A. Minimums and Maximums Report

### Data Validation Minimums and Maximums Report - No Field Parameters

Laboratory: ALS  
 RIN: 1211065  
 Comparison: All Historical Data  
 Report Date: 3/11/2013

Site Code	Location Code	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Count	
				Result	Qualifiers Lab Data	Result	Qualifiers Lab Data	Result	Qualifiers Lab Data	N	N Below Detect		
MOA01	0218	11/27/2012	Uranium	0.036		0.014			0.0012			10	0
MOA01	0413	12/12/2012	Ammonia Total as N	51		13			7			11	0
MOA01	0413	12/12/2012	Uranium	3.3		1.73	LQ		1.1			10	0
MOA01	0453	12/03/2012	Uranium	2.6		2.3			0.7			7	0
MOA01	0454	11/30/2012	Uranium	2.8		2.4			0.94			5	0
MOA01	0454	11/30/2012	Uranium	2.6		2.4			0.94			5	0
MOA01	ATP-2-D	11/29/2012	Uranium	0.0031		8.64			0.0035			59	0
MOA01	ATP-2-S	11/29/2012	Uranium	0.001		28			0.0011			88	0
MOA01	SMI-MW01	11/28/2012	Uranium	3.8		17.6			4.4	J		11	0
MOA01	SMI-PZ3D2	12/04/2012	Uranium	1.1		4.68			1.2			15	0
MOA01	TP-01	11/28/2012	Uranium	0.054		0.41			0.077			20	0

Analyte concentrations presented in blue text represent the historical minimum or maximum value exceeded by the concentration presented in red, which is associated with this current sampling event.

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

#### LAB QUALIFIERS:

- \* Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: 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
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).

## Appendix A. Minimums and Maximums Report (continued)

P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.  
U Analytical result below detection limit.  
W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.  
X,Y,Z Laboratory defined 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.
Q	Qualitative result due to sampling technique	R	Unusable result.
U	Parameter analyzed for but was not detected.	X	Location is undefined.

## Appendix A. Water Quality Data

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
								Lab	Data	QA		
Ammonia Total as N	mg/L	0218	SL	11/27/2012	0001	0 - 0	0.1	U	J	#	0.1	
Ammonia Total as N	mg/L	0226	SL	12/05/2012	0001	0 - 0	0.1	U	J	#	0.1	
Ammonia Total as N	mg/L	0401	WL	11/27/2012	0001	18 -	210		J	#	10	
Ammonia Total as N	mg/L	0403	WL	11/27/2012	0001	18 -	69		J	#	2	
Ammonia Total as N	mg/L	0404	WL	11/27/2012	0001	18 -	160		J	#	10	
Ammonia Total as N	mg/L	0407	WL	11/27/2012	0001	17 -	43		J	#	2	
Ammonia Total as N	mg/L	0413	WL	12/12/2012	0001	11.5 -	51		J	#	2	
Ammonia Total as N	mg/L	0414	WL	12/13/2012	0001	13 -	30		J	#	2	
Ammonia Total as N	mg/L	0414	WL	12/13/2012	0002	13 -	31		J	#	2	
Ammonia Total as N	mg/L	0440	WL	12/03/2012	0001	117 -	0.1	U	J	#	0.1	
Ammonia Total as N	mg/L	0454	WL	11/30/2012	0001	13 -	270		J	#	10	
Ammonia Total as N	mg/L	0454	WL	11/30/2012	0002	13 -	270		J	#	10	
Ammonia Total as N	mg/L	ATP-2-D	WL	11/29/2012	0001	88 -	400		J	#	10	
Ammonia Total as N	mg/L	ATP-2-S	WL	11/29/2012	0001	25 -	390		J	#	10	
Ammonia Total as N	mg/L	CR1	SL	11/27/2012	0001	0 - 0	0.1	U	J	#	0.1	
Ammonia Total as N	mg/L	CR2	SL	11/28/2012	0001	0 - 0	0.1	U	J	#	0.1	
Ammonia Total as N	mg/L	CR3	SL	12/06/2012	0001	0 - 0	0.4		J	#	0.1	
Ammonia Total as N	mg/L	CR5	SL	11/27/2012	0001	0 - 0	0.1	U	J	#	0.1	
Ammonia Total as N	mg/L	SMI-PZ1S	WL	11/29/2012	0001	18 -	210		J	#	10	
Ammonia Total as N	mg/L	SMI-PZ3D2	WL	12/04/2012	0001	78 -	400		J	#	10	
Ammonia Total as N	mg/L	SMI-PZ3D2	WL	12/04/2012	0002	78 -	390		J	#	10	
Ammonia Total as N	mg/L	TP-23	WL	11/30/2012	0001	25 -	220		J	#	10	
Ammonia Total as N	mg/L	UPD-17	WL	12/12/2012	0001	14.5 -	300		J	#	10	
Ammonia Total as N	mg/L	UPD-18	WL	12/03/2012	0001	0 - 0	310		J	#	10	

## Appendix A. Water Quality Data (continued)

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
										Lab	Data	QA		
Ammonia Total as N	mg/L	UPD-23	WL	12/12/2012	0001	26	-		3.2	J	#		0.1	
Ammonia Total as N	mg/L	UPD-24	WL	12/12/2012	0001	27	-		1.4	J	#		0.1	
Dissolved Oxygen	mg/L	0218	SL	11/27/2012	0001	0	-	0	11.59		#			
Dissolved Oxygen	mg/L	0226	SL	12/05/2012	0001	0	-	0	6.96		#			
Dissolved Oxygen	mg/L	0401	WL	11/27/2012	N001	18	-		4.07		#			
Dissolved Oxygen	mg/L	0403	WL	11/27/2012	N001	18	-		5.34		#			
Dissolved Oxygen	mg/L	0404	WL	11/27/2012	N001	18	-		4		#			
Dissolved Oxygen	mg/L	0407	WL	11/27/2012	N001	17	-		5.27		#			
Dissolved Oxygen	mg/L	0410	WL	12/03/2012	0001	27	-		6.85		#			
Dissolved Oxygen	mg/L	0412	WL	11/28/2012	0001	10.5	-		6.47		#			
Dissolved Oxygen	mg/L	0413	WL	12/12/2012	N001	11.5	-		2.92		#			
Dissolved Oxygen	mg/L	0414	WL	12/13/2012	N001	13	-		3.66		#			
Dissolved Oxygen	mg/L	0439	WL	12/03/2012	0001	118	-		2.79		#			
Dissolved Oxygen	mg/L	0440	WL	12/03/2012	0001	117	-		3.18		#			
Dissolved Oxygen	mg/L	0453	WL	12/03/2012	N001	80	-		2.21		#			
Dissolved Oxygen	mg/L	0454	WL	11/30/2012	N001	13	-		1.69		#			
Dissolved Oxygen	mg/L	0492	WL	12/06/2012	N001	18	-		3.25		#			
Dissolved Oxygen	mg/L	AMM-2	WL	11/29/2012	0001	48	-		2.41		#			
Dissolved Oxygen	mg/L	AMM-3	WL	11/30/2012	N001	48	-		2.67		#			
Dissolved Oxygen	mg/L	ATP-2-D	WL	11/29/2012	0001	88	-		1.16		#			
Dissolved Oxygen	mg/L	ATP-2-S	WL	11/29/2012	N001	25	-		3.3		#			
Dissolved Oxygen	mg/L	CR1	SL	11/27/2012	0001	0	-	0	11.92		#			
Dissolved Oxygen	mg/L	CR2	SL	11/28/2012	0001	0	-	0	10.25		#			
Dissolved Oxygen	mg/L	CR3	SL	12/06/2012	0001	0	-	0	10.95		#			
Dissolved Oxygen	mg/L	CR5	SL	11/27/2012	0001	0	-	0	10.18		#			
Dissolved Oxygen	mg/L	SMI-MW01	WL	11/28/2012	0001	16	-		3.68		#			
Dissolved Oxygen	mg/L	SMI-PZ1S	WL	11/29/2012	0001	18	-		2.57		#			
Dissolved Oxygen	mg/L	SMI-PZ3D2	WL	12/04/2012	0001	78	-		2.16		#			

## Appendix A. Water Quality Data (continued)

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
									Lab	Data	QA		
Dissolved Oxygen	mg/L	SMI-PZ3M	WL	12/04/2012	N001	59	-	2.96			#		
Dissolved Oxygen	mg/L	SMI-PZ3S	WL	12/04/2012	N001	25	-	3.73			#		
Dissolved Oxygen	mg/L	TP-01	WL	11/28/2012	N001	22	-	6.35			#		
Dissolved Oxygen	mg/L	TP-17	WL	12/05/2012	0001	28	-	1.42			#		
Dissolved Oxygen	mg/L	TP-20	WL	11/30/2012	N001	32	-	1.1			#		
Dissolved Oxygen	mg/L	TP-22	WL	11/29/2012	0001	17	-	3.3			#		
Dissolved Oxygen	mg/L	TP-23	WL	11/30/2012	0001	25	-	2.04			#		
Dissolved Oxygen	mg/L	UPD-17	WL	12/12/2012	N001	14.5	-	4.02			#		
Dissolved Oxygen	mg/L	UPD-18	WL	12/03/2012	0001	0	- 0	3.34			#		
Dissolved Oxygen	mg/L	UPD-20	WL	12/04/2012	0001	17	-	3.99			#		
Dissolved Oxygen	mg/L	UPD-21	WL	12/04/2012	N001	25	-	3.3			#		
Dissolved Oxygen	mg/L	UPD-22	WL	11/29/2012	N001	9	-	5.3			#		
Dissolved Oxygen	mg/L	UPD-23	WL	12/12/2012	0001	26	-	5.82			#		
Dissolved Oxygen	mg/L	UPD-24	WL	12/12/2012	N001	27	-	3.38			#		
Oxidation Reduction Potential	mV	0218	SL	11/27/2012	0001	0	- 0	138			#		
Oxidation Reduction Potential	mV	0226	SL	12/05/2012	0001	0	- 0	-42			#		
Oxidation Reduction Potential	mV	0401	WL	11/27/2012	N001	18	-	207			#		
Oxidation Reduction Potential	mV	0403	WL	11/27/2012	N001	18	-	224			#		
Oxidation Reduction Potential	mV	0404	WL	11/27/2012	N001	18	-	206			#		
Oxidation Reduction Potential	mV	0407	WL	11/27/2012	N001	17	-	229			#		
Oxidation Reduction Potential	mV	0410	WL	12/03/2012	0001	27	-	197.9			#		
Oxidation Reduction Potential	mV	0412	WL	11/28/2012	0001	10.5	-	99			#		
Oxidation Reduction Potential	mV	0413	WL	12/12/2012	N001	11.5	-	-96			#		
Oxidation Reduction Potential	mV	0414	WL	12/13/2012	N001	13	-	-28			#		
Oxidation Reduction Potential	mV	0439	WL	12/03/2012	0001	118	-	238.3			#		

## Appendix A. Water Quality Data (continued)

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)			Result	Qualifiers		Detection Limit	Uncertainty
										Lab	Data		
Oxidation Reduction Potential	mV	0440	WL	12/03/2012	0001	117	-		189.9			#	
Oxidation Reduction Potential	mV	0453	WL	12/03/2012	N001	80	-		212			#	
Oxidation Reduction Potential	mV	0454	WL	11/30/2012	N001	13	-		-22			#	
Oxidation Reduction Potential	mV	0492	WL	12/06/2012	N001	18	-		104			#	
Oxidation Reduction Potential	mV	AMM-2	WL	11/29/2012	0001	48	-		248			#	
Oxidation Reduction Potential	mV	AMM-3	WL	11/30/2012	N001	48	-		-102			#	
Oxidation Reduction Potential	mV	ATP-2-D	WL	11/29/2012	0001	88	-		-272			#	
Oxidation Reduction Potential	mV	ATP-2-S	WL	11/29/2012	N001	25	-		-19			#	
Oxidation Reduction Potential	mV	CR1	SL	11/27/2012	0001	0	-	0	220			#	
Oxidation Reduction Potential	mV	CR2	SL	11/28/2012	0001	0	-	0	135			#	
Oxidation Reduction Potential	mV	CR3	SL	12/06/2012	0001	0	-	0	170			#	
Oxidation Reduction Potential	mV	CR5	SL	11/27/2012	0001	0	-	0	174			#	
Oxidation Reduction Potential	mV	SMI-MW01	WL	11/28/2012	0001	16	-		25			#	
Oxidation Reduction Potential	mV	SMI-PZ1S	WL	11/29/2012	0001	18	-		148			#	
Oxidation Reduction Potential	mV	SMI-PZ3D2	WL	12/04/2012	0001	78	-		110.2			#	
Oxidation Reduction Potential	mV	SMI-PZ3M	WL	12/04/2012	N001	59	-		20.2			#	
Oxidation Reduction Potential	mV	SMI-PZ3S	WL	12/04/2012	N001	25	-		189.8			#	
Oxidation Reduction Potential	mV	TP-01	WL	11/28/2012	N001	22	-		8			#	
Oxidation Reduction Potential	mV	TP-17	WL	12/05/2012	0001	28	-		-141			#	
Oxidation Reduction Potential	mV	TP-20	WL	11/30/2012	N001	32	-		-162			#	
Oxidation Reduction Potential	mV	TP-22	WL	11/29/2012	0001	17	-		122			#	
Oxidation Reduction Potential	mV	TP-23	WL	11/30/2012	0001	25	-		70			#	
Oxidation Reduction Potential	mV	UPD-17	WL	12/12/2012	N001	14.5	-		70			#	

## Appendix A. Water Quality Data (continued)

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
										Lab	Data	QA		
Oxidation Reduction Potential	mV	UPD-18	WL	12/03/2012	0001	0	-	0	174.4				#	
Oxidation Reduction Potential	mV	UPD-20	WL	12/04/2012	0001	17	-		-64.5				#	
Oxidation Reduction Potential	mV	UPD-21	WL	12/04/2012	N001	25	-		120.7				#	
Oxidation Reduction Potential	mV	UPD-22	WL	11/29/2012	N001	9	-		119				#	
Oxidation Reduction Potential	mV	UPD-23	WL	12/12/2012	0001	26	-		164				#	
Oxidation Reduction Potential	mV	UPD-24	WL	12/12/2012	N001	27	-		-58.4				#	
pH	s.u.	0218	SL	11/27/2012	0001	0	-	0	8.49				#	
pH	s.u.	0226	SL	12/05/2012	0001	0	-	0	8.68				#	
pH	s.u.	0401	WL	11/27/2012	N001	18	-		6.72				#	
pH	s.u.	0403	WL	11/27/2012	N001	18	-		6.77				#	
pH	s.u.	0404	WL	11/27/2012	N001	18	-		6.83				#	
pH	s.u.	0407	WL	11/27/2012	N001	17	-		6.92				#	
pH	s.u.	0410	WL	12/03/2012	0001	27	-		7.01				#	
pH	s.u.	0412	WL	11/28/2012	0001	10.5	-		7.59				#	
pH	s.u.	0413	WL	12/12/2012	N001	11.5	-		7.61				#	
pH	s.u.	0414	WL	12/13/2012	N001	13	-		7.22				#	
pH	s.u.	0439	WL	12/03/2012	0001	118	-		6.83				#	
pH	s.u.	0440	WL	12/03/2012	0001	117	-		7.08				#	
pH	s.u.	0453	WL	12/03/2012	N001	80	-		6.97				#	
pH	s.u.	0454	WL	11/30/2012	N001	13	-		7.05				#	
pH	s.u.	0492	WL	12/06/2012	N001	18	-		6.88				#	
pH	s.u.	AMM-2	WL	11/29/2012	0001	48	-		6.86				#	
pH	s.u.	AMM-3	WL	11/30/2012	N001	48	-		7				#	
pH	s.u.	ATP-2-D	WL	11/29/2012	0001	88	-		8.23				#	
pH	s.u.	ATP-2-S	WL	11/29/2012	N001	25	-		8.85				#	
pH	s.u.	CR1	SL	11/27/2012	0001	0	-	0	8.32				#	
pH	s.u.	CR2	SL	11/28/2012	0001	0	-	0	8.44				#	

## Appendix A. Water Quality Data (continued)

General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)			Result	Qualifiers		Detection Limit	Uncertainty
										Lab	Data		
pH	s.u.	CR3	SL	12/06/2012	0001	0	-	0	8.31			#	
pH	s.u.	CR5	SL	11/27/2012	0001	0	-	0	8.49			#	
pH	s.u.	SMI-MW01	WL	11/28/2012	0001	16	-		7.34			#	
pH	s.u.	SMI-PZ1S	WL	11/29/2012	0001	18	-		6.83			#	
pH	s.u.	SMI-PZ3D2	WL	12/04/2012	0001	78	-		7.04			#	
pH	s.u.	SMI-PZ3M	WL	12/04/2012	N001	59	-		7.34			#	
pH	s.u.	SMI-PZ3S	WL	12/04/2012	N001	25	-		8.1			#	
pH	s.u.	TP-01	WL	11/28/2012	N001	22	-		7.6			#	
pH	s.u.	TP-17	WL	12/05/2012	0001	28	-		7.1			#	
pH	s.u.	TP-20	WL	11/30/2012	N001	32	-		7.16			#	
pH	s.u.	TP-22	WL	11/29/2012	0001	17	-		6.73			#	
pH	s.u.	TP-23	WL	11/30/2012	0001	25	-		6.8			#	
pH	s.u.	UPD-17	WL	12/12/2012	N001	14.5	-		6.91			#	
pH	s.u.	UPD-18	WL	12/03/2012	0001	0	-	0	6.96			#	
pH	s.u.	UPD-20	WL	12/04/2012	0001	17	-		7.43			#	
pH	s.u.	UPD-21	WL	12/04/2012	N001	25	-		7.35			#	
pH	s.u.	UPD-22	WL	11/29/2012	N001	9	-		7.65			#	
pH	s.u.	UPD-23	WL	12/12/2012	0001	26	-		7.54			#	
pH	s.u.	UPD-24	WL	12/12/2012	N001	27	-		7.58			#	
Specific Conductance	umhos/cm	0218	SL	11/27/2012	0001	0	-	0	1624			#	
Specific Conductance	umhos/cm	0226	SL	12/05/2012	0001	0	-	0	4312			#	
Specific Conductance	umhos/cm	0401	WL	11/27/2012	N001	18	-		12415			#	
Specific Conductance	umhos/cm	0403	WL	11/27/2012	N001	18	-		8286			#	
Specific Conductance	umhos/cm	0404	WL	11/27/2012	N001	18	-		10771			#	
Specific Conductance	umhos/cm	0407	WL	11/27/2012	N001	17	-		3332			#	
Specific Conductance	umhos/cm	0410	WL	12/03/2012	0001	27	-		3650			#	

## Appendix A. Water Quality Data (continued)

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)		Result	Qualifiers		Detection Limit	Uncertainty
									Lab	Data QA		
Specific Conductance	umhos /cm	0412	WL	11/28/2012	0001	10.5	-	3935		#		
Specific Conductance	umhos /cm	0413	WL	12/12/2012	N001	11.5	-	5242		#		
Specific Conductance	umhos /cm	0414	WL	12/13/2012	N001	13	-	9152		#		
Specific Conductance	umhos /cm	0439	WL	12/03/2012	0001	118	-	9866		#		
Specific Conductance	umhos /cm	0440	WL	12/03/2012	0001	117	-	8505		#		
Specific Conductance	umhos /cm	0453	WL	12/03/2012	N001	80	-	26993		#		
Specific Conductance	umhos /cm	0454	WL	11/30/2012	N001	13	-	41388		#		
Specific Conductance	umhos /cm	0492	WL	12/06/2012	N001	18	-	3981		#		
Specific Conductance	umhos /cm	AMM-2	WL	11/29/2012	0001	48	-	17741		#		
Specific Conductance	umhos /cm	AMM-3	WL	11/30/2012	N001	48	-	18818		#		
Specific Conductance	umhos /cm	ATP-2-D	WL	11/29/2012	0001	88	-	126450		#		
Specific Conductance	umhos /cm	ATP-2-S	WL	11/29/2012	N001	25	-	17485		#		
Specific Conductance	umhos /cm	CR1	SL	11/27/2012	0001	0	- 0	1619		#		
Specific Conductance	umhos /cm	CR2	SL	11/28/2012	0001	0	- 0	1670		#		
Specific Conductance	umhos /cm	CR3	SL	12/06/2012	0001	0	- 0	1805		#		
Specific Conductance	umhos /cm	CR5	SL	11/27/2012	0001	0	- 0	1633		#		
Specific Conductance	umhos /cm	SMI-MW01	WL	11/28/2012	0001	16	-	4749		#		
Specific Conductance	umhos /cm	SMI-PZ1S	WL	11/29/2012	0001	18	-	12410		#		
Specific Conductance	umhos /cm	SMI-PZ3D2	WL	12/04/2012	0001	78	-	21837		#		
Specific Conductance	umhos /cm	SMI-PZ3M	WL	12/04/2012	N001	59	-	9403		#		
Specific Conductance	umhos /cm	SMI-PZ3S	WL	12/04/2012	N001	25	-	4869		#		
Specific Conductance	umhos /cm	TP-01	WL	11/28/2012	N001	22	-	6907		#		
Specific Conductance	umhos /cm	TP-17	WL	12/05/2012	0001	28	-	115433		#		

## Appendix A. Water Quality Data (continued)

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)		Result	Qualifiers		Detection Limit	Uncertainty
									Lab	Data QA		
Specific Conductance	umhos/cm	TP-20	WL	11/30/2012	N001	32	-	134716		#		
Specific Conductance	umhos/cm	TP-22	WL	11/29/2012	0001	17	-	25038		#		
Specific Conductance	umhos/cm	TP-23	WL	11/30/2012	0001	25	-	52852		#		
Specific Conductance	umhos/cm	UPD-17	WL	12/12/2012	N001	14.5	-	11626		#		
Specific Conductance	umhos/cm	UPD-18	WL	12/03/2012	0001	0	- 0	10062		#		
Specific Conductance	umhos/cm	UPD-20	WL	12/04/2012	0001	17	-	3200		#		
Specific Conductance	umhos/cm	UPD-21	WL	12/04/2012	N001	25	-	3420		#		
Specific Conductance	umhos/cm	UPD-22	WL	11/29/2012	N001	9	-	3218		#		
Specific Conductance	umhos/cm	UPD-23	WL	12/12/2012	0001	26	-	4384		#		
Specific Conductance	umhos/cm	UPD-24	WL	12/12/2012	N001	27	-	4795		#		
Temperature	C	0218	SL	11/27/2012	0001	0	- 0	7.13		#		
Temperature	C	0226	SL	12/05/2012	0001	0	- 0	9.2		#		
Temperature	C	0401	WL	11/27/2012	N001	18	-	18.42		#		
Temperature	C	0403	WL	11/27/2012	N001	18	-	18.29		#		
Temperature	C	0404	WL	11/27/2012	N001	18	-	17.73		#		
Temperature	C	0407	WL	11/27/2012	N001	17	-	18.53		#		
Temperature	C	0410	WL	12/03/2012	0001	27	-	17.71		#		
Temperature	C	0412	WL	11/28/2012	0001	10.5	-	16.29		#		
Temperature	C	0413	WL	12/12/2012	N001	11.5	-	15.89		#		
Temperature	C	0414	WL	12/13/2012	N001	13	-	15.49		#		
Temperature	C	0439	WL	12/03/2012	0001	118	-	16.2		#		
Temperature	C	0440	WL	12/03/2012	0001	117	-	18.03		#		
Temperature	C	0453	WL	12/03/2012	N001	80	-	16.28		#		
Temperature	C	0454	WL	11/30/2012	N001	13	-	18.7		#		
Temperature	C	0492	WL	12/06/2012	N001	18	-	17.3		#		
Temperature	C	AMM-2	WL	11/29/2012	0001	48	-	16.6		#		

## Appendix A. Water Quality Data (continued)

General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
									Lab	Data	QA		
Temperature	C	AMM-3	WL	11/30/2012	N001	48	-	19.36			#		
Temperature	C	ATP-2-D	WL	11/29/2012	0001	88	-	17.04			#		
Temperature	C	ATP-2-S	WL	11/29/2012	N001	25	-	17.17			#		
Temperature	C	CR1	SL	11/27/2012	0001	0	- 0	5.61			#		
Temperature	C	CR2	SL	11/28/2012	0001	0	- 0	6.54			#		
Temperature	C	CR3	SL	12/06/2012	0001	0	- 0	8.19			#		
Temperature	C	CR5	SL	11/27/2012	0001	0	- 0	5.66			#		
Temperature	C	SMI-MW01	WL	11/28/2012	0001	16	-	17.45			#		
Temperature	C	SMI-PZ1S	WL	11/29/2012	0001	18	-	17.23			#		
Temperature	C	SMI-PZ3D2	WL	12/04/2012	0001	78	-	17.76			#		
Temperature	C	SMI-PZ3M	WL	12/04/2012	N001	59	-	17.82			#		
Temperature	C	SMI-PZ3S	WL	12/04/2012	N001	25	-	18.19			#		
Temperature	C	TP-01	WL	11/28/2012	N001	22	-	17.04			#		
Temperature	C	TP-17	WL	12/05/2012	0001	28	-	14.05			#		
Temperature	C	TP-20	WL	11/30/2012	N001	32	-	17.75			#		
Temperature	C	TP-22	WL	11/29/2012	0001	17	-	18.85			#		
Temperature	C	TP-23	WL	11/30/2012	0001	25	-	19.14			#		
Temperature	C	UPD-17	WL	12/12/2012	N001	14.5	-	17.52			#		
Temperature	C	UPD-18	WL	12/03/2012	0001	0	- 0	18.69			#		
Temperature	C	UPD-20	WL	12/04/2012	0001	17	-	18.33			#		
Temperature	C	UPD-21	WL	12/04/2012	N001	25	-	18.55			#		
Temperature	C	UPD-22	WL	11/29/2012	N001	9	-	18.64			#		
Temperature	C	UPD-23	WL	12/12/2012	0001	26	-	16.47			#		
Temperature	C	UPD-24	WL	12/12/2012	N001	27	-	17.94			#		
Turbidity	NTU	0218	SL	11/27/2012	0001	0	- 0	160			#		
Turbidity	NTU	0226	SL	12/05/2012	0001	0	- 0	13			#		
Turbidity	NTU	0401	WL	11/27/2012	N001	18	-	1.23			#		

## Appendix A. Water Quality Data (continued)

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
										Lab	Data	QA		
Turbidity	NTU	0403	WL	11/27/2012	N001	18	-		3.15			#		
Turbidity	NTU	0404	WL	11/27/2012	N001	18	-		2.22			#		
Turbidity	NTU	0407	WL	11/27/2012	N001	17	-		1.44			#		
Turbidity	NTU	0410	WL	12/03/2012	0001	27	-		71.9			#		
Turbidity	NTU	0413	WL	12/12/2012	N001	11.5	-		9.98			#		
Turbidity	NTU	0414	WL	12/13/2012	N001	13	-		9.59			#		
Turbidity	NTU	0439	WL	12/03/2012	0001	118	-		18.6			#		
Turbidity	NTU	0440	WL	12/03/2012	0001	117	-		75.7			#		
Turbidity	NTU	0453	WL	12/03/2012	N001	80	-		4.91			#		
Turbidity	NTU	0454	WL	11/30/2012	N001	13	-		7.59			#		
Turbidity	NTU	0492	WL	12/06/2012	N001	18	-		3.82			#		
Turbidity	NTU	AMM-2	WL	11/29/2012	0001	48	-		21.3			#		
Turbidity	NTU	AMM-3	WL	11/30/2012	N001	48	-		6.72			#		
Turbidity	NTU	ATP-2-D	WL	11/29/2012	0001	88	-		16.1			#		
Turbidity	NTU	ATP-2-S	WL	11/29/2012	N001	25	-		10			#		
Turbidity	NTU	CR1	SL	11/27/2012	0001	0	-	0	14.4			#		
Turbidity	NTU	CR2	SL	11/28/2012	0001	0	-	0	63			#		
Turbidity	NTU	CR3	SL	12/06/2012	0001	0	-	0	13.6			#		
Turbidity	NTU	CR5	SL	11/27/2012	0001	0	-	0	13.8			#		
Turbidity	NTU	SMI-MW01	WL	11/28/2012	0001	16	-		19.9			#		
Turbidity	NTU	SMI-PZ1S	WL	11/29/2012	0001	18	-		57.1			#		
Turbidity	NTU	SMI-PZ3D2	WL	12/04/2012	0001	78	-		24.3			#		
Turbidity	NTU	SMI-PZ3M	WL	12/04/2012	N001	59	-		1.81			#		
Turbidity	NTU	SMI-PZ3S	WL	12/04/2012	N001	25	-		1.46			#		
Turbidity	NTU	TP-01	WL	11/28/2012	N001	22	-		2.69			#		
Turbidity	NTU	TP-17	WL	12/05/2012	0001	28	-		32.3			#		
Turbidity	NTU	TP-20	WL	11/30/2012	N001	32	-		7.02			#		

## Appendix A. Water Quality Data (continued)

General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)			Result	Qualifiers		Detection Limit	Uncertainty
										Lab	Data		
Turbidity	NTU	TP-22	WL	11/29/2012	0001	17	-		83.2		#		
Turbidity	NTU	TP-23	WL	11/30/2012	0001	25	-		270		#		
Turbidity	NTU	UPD-17	WL	12/12/2012	N001	14.5	-		3.59		#		
Turbidity	NTU	UPD-18	WL	12/03/2012	0001	0	-	0	19.5		#		
Turbidity	NTU	UPD-20	WL	12/04/2012	0001	17	-		58.2		#		
Turbidity	NTU	UPD-21	WL	12/04/2012	N001	25	-		7.68		#		
Turbidity	NTU	UPD-22	WL	11/29/2012	N001	9	-		4.44		#		
Turbidity	NTU	UPD-23	WL	12/12/2012	0001	26	-		110		#		
Turbidity	NTU	UPD-24	WL	12/12/2012	N001	27	-		8.66		#		
Uranium	mg/L	0218	SL	11/27/2012	0001	0	-	0	0.036		J	#	2.9E-005
Uranium	mg/L	0226	SL	12/05/2012	0001	0	-	0	0.0086	E	J	#	2.9E-005
Uranium	mg/L	0401	WL	11/27/2012	0001	18	-		1.8		J	#	0.00015
Uranium	mg/L	0403	WL	11/27/2012	0001	18	-		0.94		J	#	0.00015
Uranium	mg/L	0404	WL	11/27/2012	0001	18	-		1.6		J	#	0.00015
Uranium	mg/L	0407	WL	11/27/2012	0001	17	-		0.36		J	#	2.9E-005
Uranium	mg/L	0410	WL	12/03/2012	0001	27	-		0.67		J	#	0.00029
Uranium	mg/L	0412	WL	11/28/2012	0001	10.5	-		3.4		J	#	0.00029
Uranium	mg/L	0413	WL	12/12/2012	0001	11.5	-		3.3		J	#	0.00058
Uranium	mg/L	0414	WL	12/13/2012	0001	13	-		4		J	#	0.00058
Uranium	mg/L	0414	WL	12/13/2012	0002	13	-		4.1		J	#	0.00058
Uranium	mg/L	0439	WL	12/03/2012	0001	118	-		0.81		J	#	0.00029
Uranium	mg/L	0440	WL	12/03/2012	0001	117	-		0.033		J	#	2.9E-005
Uranium	mg/L	0453	WL	12/03/2012	0001	80	-		2.6		J	#	0.00058
Uranium	mg/L	0454	WL	11/30/2012	0001	13	-		2.6		J	#	0.00029
Uranium	mg/L	0454	WL	11/30/2012	0002	13	-		2.8		J	#	0.00015
Uranium	mg/L	0492	WL	12/06/2012	0001	18	-		0.19		J	#	2.9E-005
Uranium	mg/L	AMM-2	WL	11/29/2012	0001	48	-		1.9		J	#	0.00015
Uranium	mg/L	AMM-3	WL	11/30/2012	0001	48	-		1.2		J	#	0.00029

## Appendix A. Water Quality Data (continued)

### General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site

REPORT DATE: 3/11/2013

Parameter	Units	Location ID	Location Type	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
								Lab	Data	QA		
Uranium	mg/L	ATP-2-D	WL	11/29/2012	0001	88 -	0.0031	J	#		2.9E-005	
Uranium	mg/L	ATP-2-S	WL	11/29/2012	0001	25 -	0.001	J	#		2.9E-005	
Uranium	mg/L	CR1	SL	11/27/2012	0001	0 - 0	0.0061	J	#		2.9E-005	
Uranium	mg/L	CR2	SL	11/28/2012	0001	0 - 0	0.012	J	#		2.9E-005	
Uranium	mg/L	CR3	SL	12/06/2012	0001	0 - 0	0.013	J	#		2.9E-005	
Uranium	mg/L	CR5	SL	11/27/2012	0001	0 - 0	0.0075	J	#		2.9E-005	
Uranium	mg/L	SMI-MW01	WL	11/28/2012	0001	16 -	3.8	J	#		0.00029	
Uranium	mg/L	SMI-PZ1S	WL	11/29/2012	0001	18 -	1.4	J	#		0.00015	
Uranium	mg/L	SMI-PZ3D2	WL	12/04/2012	0001	78 -	1.1	J	#		0.00029	
Uranium	mg/L	SMI-PZ3D2	WL	12/04/2012	0002	78 -	1.1	J	#		0.00029	
Uranium	mg/L	SMI-PZ3M	WL	12/04/2012	0001	59 -	0.89	J	#		0.00029	
Uranium	mg/L	SMI-PZ3S	WL	12/04/2012	0001	25 -	1.4	J	#		0.00029	
Uranium	mg/L	TP-01	WL	11/28/2012	0001	22 -	0.054	J	#		2.9E-005	
Uranium	mg/L	TP-17	WL	12/05/2012	0001	28 -	0.017	J	#		2.9E-005	
Uranium	mg/L	TP-20	WL	11/30/2012	0001	32 -	0.005	J	#		2.9E-005	
Uranium	mg/L	TP-22	WL	11/29/2012	0001	17 -	0.21	J	#		2.9E-005	
Uranium	mg/L	TP-23	WL	11/30/2012	0001	25 -	3.7	J	#		0.00015	
Uranium	mg/L	UPD-17	WL	12/12/2012	0001	14.5 -	1.2	J	#		0.00029	
Uranium	mg/L	UPD-18	WL	12/03/2012	0001	0 - 0	0.9	J	#		0.00029	
Uranium	mg/L	UPD-20	WL	12/04/2012	0001	17 -	0.095	J	#		2.9E-005	
Uranium	mg/L	UPD-21	WL	12/04/2012	0001	25 -	9.6	J	#		0.0029	
Uranium	mg/L	UPD-22	WL	11/29/2012	0001	9 -	2.6	J	#		0.00058	
Uranium	mg/L	UPD-23	WL	12/12/2012	0001	26 -	0.81	J	#		0.00029	
Uranium	mg/L	UPD-24	WL	12/12/2012	0001	27 -	8.6	J	#		0.0029	

BLS = below land surface;  $\mu$ mhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well

## Appendix A. Water Quality Data (continued)

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

### LAB QUALIFIERS:

\* Replicate analysis not within control limits.  
> Result above upper detection limit.  
A Tentatively identified compound is a suspected aldol-condensation product.  
B Inorganic: Result is between the instrument detection limit and contract-required detection limit. Organic: Analyte also found in method blank.  
D Analyte determined in diluted sample.  
E Inorganic: Estimate value because of interference; see case narrative.  
H Holding time expired; value suspect.  
I Increased detection limit due to required dilution.  
J Estimated.  
N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound.  
P > 25% difference in detected pesticide or Aroclor concentrations between two columns.  
U Analytical result below detection limit.

### LAB QUALIFIERS (continued):

W Postdigestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.  
X,Y,Z Laboratory defined 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.
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 A. Water Level Data

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**STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site**

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REPORT DATE: 3/13/2013

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
0401	O	3969.60	11/27/2012		14.35	3955.25	
0403	O	3968.95	11/27/2012		16.55	3952.40	
0404	O	3968.3	11/27/2012		14.86	3953.44	
0407	O	3969.09	11/27/2012		17.11	3951.98	
0410	O	3981.05	12/03/2012		25.7	3955.35	
0411	O	3962.43	11/28/2012		9.13	3953.3	
0412	O	3962.48	12/12/2012		8.21	3954.27	
0413	O	3963.19	12/13/2012		8.65	3954.54	
0414	O	3959.20	11/27/2012		5.24	3953.96	
0439	O	4055.27	12/03/2012		99.14	3956.13	
0440	O	4070.71	12/03/2012		112.03	3958.68	
0454		3966.53	12/03/2012		12.98	3953.55	
0492		3967.56	12/06/2012		16.4	3951.16	
AMM-2	O	3964.09	11/29/2012		10.48	3953.61	
AMM-3	O	3962.9	11/30/2012		9.12	3953.78	
ATP-2-D	O	3962.17	11/29/2012		8.25	3953.92	
ATP-2-S	O	3962.17	11/29/2012		13.27	3948.9	
SMI-MW01	O	3960.22	11/28/2012		6.35	3953.87	
SMI-PZ1S	O	3964.13	11/29/2012		10.38	3953.75	
SMI-PZ3D2	O	3975.13	12/04/2012		20.07	3955.06	
SMI-PZ3M	O	3975.23	12/04/2012		20.02	3955.21	
SMI-PZ3S	O	3975.03	12/04/2012		19.78	3955.25	

## Appendix A. Water Level Data (continued)

**STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site**  
**REPORT DATE: 9/27/2012**

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
TP-17	D	3963.69	12/05/2012		12.26	3951.43	
TP-20	D	3967.55	11/30/2012		16.50	3951.05	
TP-22		3966.51	11/29/2012		14.11	3952.40	
TP-23		3962.6	11/30/2012		9.79	3952.81	
UPD-17		3970.71	12/12/2012		16.31	3954.4	
UPD-18		3968.74	12/03/2012		13.41	3955.33	
UPD-20		3978.73	12/04/2012		22.7	3956.03	
UPD-21		3981.45	12/04/2012		25.7	3955.75	
UPD-22		3966.20	11/29/2012		11.23	3954.97	
UPD-23		3982.38	12/12/2012		26.95	3955.43	
UPD-24		3977.1	12/12/2012		21.76	3955.34	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

## Appendix A. Trip Report



Date: January 04, 2013  
To: Ken Pill  
From: James Ritchey  
Subject: November 2012 Site Wide

**Event:** Moab Site-wide Sampling Event

**Date of Sampling Event:** November 27 – December 13, 2012

**Team Members:** E. Moran, K. Pill, and James Ritchey

**RIN Number Assigned:** All samples were assigned to RIN 1211065.

**Sample Shipment:** Two coolers were shipped overnight UPS to ALS from Moab, Utah, on December 6 and 13, 2012 (UPS tracking numbers 0196131480 and 0194008340).

**Number of Locations Sampled:** The purpose of the site-wide sampling event was to update contaminant plume maps. A total of 34 well locations and six surface water locations were sampled during this event. Five wells were recently installed and were sampled for the first time. Wells UPD- 23 and UPD-24 were newly installed and sampled during this event. Well UPD-17 was replaced and sampled after it had been broken. Wells 0413 and 0414 were replaced after they were damaged from the flooding of 2011. Including three duplicates, a total of 43 samples were collected during the November 2012 site-wide sampling event.

**Locations Not Sampled/Reason:** Well TP-19 and surface water location 0228 were inaccessible due to overgrown vegetation. Well 0411 dewatered with too little water to collect parameters and did not recharge. UPD-19 was blocked by sediment and could not be sampled.

**Field Variance:** To minimize costs, samples were generally not filtered if the turbidity was below 10 nephelometric turbidity units, and some samples were not submitted to the laboratory for ammonia analysis. All ground water samples were analyzed on site with the ammonia probe. See the Location-specific Information section for details concerning filtering and lab analysis.

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

False ID	True ID	Sample Type	Associated matrix
2000	0454	Duplicate from 13 ft bgs	Ground Water
2001	SMI-PZ3D2	Duplicate from 78 ft bgs	Ground Water
2002	0414	Duplicate from 13 ft bgs	Ground Water

ft bgs = feet below ground surface; ID = identification

## Appendix A. Trip Report (continued)

**Location-specific Information:** All of the locations were sampled using a peristaltic pump and dedicated tubing unless otherwise noted. The table below provides additional information:

Location	Date	Sample Depth (ft bgs)	Filtered	Ammonia Lab Analysis	Comments
0218	11/27/2012	NA	Yes	Yes	Water is ~3" deep, rocky substrate.
0226	12/05/2012	NA	Yes	Yes	Sandy substrate, 4" deep, 1' from bank.
0401	11/27/2012	18	No	Yes	
0403	11/27/2012	18	No	Yes	
0404	11/27/2012	18	No	Yes	
0407	11/27/2012	17	No	Yes	
0410	12/03/2012	27	Yes	No	De-watered at 0.5L, dropped tubing down 2 ft.
0412	11/28/2012	10.5	Yes	No	De-watered at 0.25L. Type II well. Had to sample near total depth.
0413	12/12/2012	11.5	No	Yes	
0414	12/13/2012	13	No	Yes	Sulfur odor. Duplicate.
0439	12/03/2012	118	Yes	No	Sampled with dedicated bladder pump.
0440	12/03/2012	117	Yes	Yes	Sampled with dedicated bladder pump.
0453	12/03/2012	80	No	No	Sampled with dedicated bladder pump. Depth to water was below pump, Depth to water > 75 ft btoc.
0454	11/30/2012	13	No	Yes	
0492	12/06/2012	18	No	No	
AMM-2	11/29/2012	48	Yes	No	
AMM-3	11/30/2012	48	No	No	
ATP-2-D	11/29/2012	88	Yes	Yes	
ATP-2-S	11/29/2012	25	No	Yes	Type II well.
CR1	11/27/2012	NA	Yes	Yes	Water is ~6" deep
CR2	11/28/2012	NA	Yes	Yes	Rocky substrate. Moderate flow. Water is 3" deep.
CR3	12/06/2012	NA	Yes	Yes	~4" deep, ~1' off bank, stagnant.
CR5	11/27/2012	NA	Yes	Yes	Water is ~6" deep
SMI-MW01	11/28/2012	16	Yes	No	
SMI-PZ1S	11/29/2012	18	Yes	Yes	
SMI-PZ3D2	12/04/2012	78	Yes	Yes	Duplicate
SMI-PZ3M	12/04/2012	59	No	No	Sulfur odor
SMI-PZ3S	12/04/2012	25	No	No	
TP-01	11/28/2012	22	No	No	Cannot obtain water level due to casing. Sulfur odor.
TP-17	12/05/2012	28	Yes	Yes	Black floaties noted in water.
TP-20	11/30/2012	32	No	No	Sulfur odor.
TP-22	11/29/2012	17	Yes	No	Type II, Well de-waters.
TP-23	11/30/2012	25	Yes	Yes	Type II well
UPD-17	12/12/2012	14.5	No	Yes	
UPD-18	12/03/2012	13	Yes	Yes	Well damaged, broken casing at ground surface. Tubing lowered 2 ft below line.
UPD-20	12/04/2012	17	Yes	No	
UPD-21	12/04/2012	26*	No	No	Dropped tubing down 1 ft from original sample depth.
UPD-22	11/29/2012	9	No	No	
UPD-23	12/12/2012	26	Yes	Yes	
UPD-24	12/12/2012	27	No	Yes	

ft = feet; ft bgs = feet below ground surface; ft btoc = feet below top of casing

## Appendix A. Trip Report (continued)

**Water Level Measurements:** Water level data are provided in the table below. These data represent depth to water (feet below top of casing) measurements. Water levels were not obtainable at locations TP-01 and UPD-19 due to broken and blocked casings. Well TP-19 was inaccessible due to vegetation overgrowth. In well 0453, the water level was below the bladder pump and the indicator could not fit below the pump. The top of the pump was measured at 75 feet below top of casing.

Well No.	Depth to Water (ft btoc)
0401	14.35
0403	16.55
0404	14.86
0407	17.11
0410	25.70
0411	9.13
0412	8.21
0413	8.65
0414	5.24
0439	99.14
0440	112.03
0453	>75
0454	12.98
0492	16.40
AMM-2	10.48
AMM-3	9.12
ATP-2-D	8.25
ATP-2-S	13.27
SMI-MW01	6.35
SMI-PZ1S	10.38
SMI-PZ3D2	20.07
SMI-PZ3M	20.02
SMI-PZ3S	19.78
TP-01	NA
TP-17	12.26
TP-19	NA
TP-20	16.50
TP-22	14.11
TP-23	9.79
UPD-17	16.31
UPD-18	13.41
UPD-19	NA
UPD-20	22.70
UPD-21	25.70
UPD-22	11.23
UPD-23	26.95
UPD-24	21.76

ft btoc = feet below top of casing

## Appendix A. Trip Report (continued)



*Surface Water Location CR1*



*Surface Water Location CR2*

## Appendix A. Trip Report (continued)



*Surface Water Location CR3*



*Surface Water Location CR5*

## Appendix A. Trip Report (continued)



*Surface Water Location 0218*



*Surface Water Location 0226*

## Appendix A. Trip Report (continued)

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

**Equipment:** None.

**Regulatory:** None.

**Site Issues:** USGS Cisco Gaging station number 09180500 mean daily Colorado River flows during this sampling event are provided below.

Date	Daily Mean Flow (cfs)
11/27/2012	2,430
11/28/2012	2,440
11/29/2012	2,380
11/30/2012	2,340
12/01/2012	2,380
12/02/2012	2,430
12/03/2012	2,500
12/04/2012	2,480
12/05/2012	2,340
12/06/2012	2,370
12/07/2012	2,340
12/08/2012	2,340
12/09/2012	2,350
12/10/2012	2,320
12/11/2012	2,280
12/12/2012	Ice*
12/13/2012	Ice*

cfs = cubic feet per second

\*Ice accumulates at measurement point; no flow data collected.

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