

Office of Environmental Management – Grand Junction



Moab UMTRA Project
Validation Data Package for
Performance Assessment of the First
Quarter 2011 Sampling for the Ground
Water Interim Action

June 2011



U.S. Department
of Energy

Office of Environmental Management

**Moab UMTRA Project
Validation Data Package for Performance Assessment of the
First Quarter 2011 Sampling for the
Ground Water Interim Action**

June 2011

**Moab UMTRA Project
First Quarter 2011 Ground Water Sampling Event**

Revision 0

Review and Approval

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6/13/11

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Revision No.	Date	Reason/Basis for Revision
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Attachment 1. First Quarter 2011 IA Well Field Monthly Sampling Trip Report

Acronyms and Abbreviations

bgs	below ground surface
CCB	continuing calibration blank
CCV	continuing calibration verification
CF	Configuration
cfs	cubic feet per second
COC	chain of custody
CRI	reporting limit verification
DUP	duplicate
EB	equipment blank
EDD	electronic data deliverable
EPA	Environmental Protection Agency
ft	feet
IA	interim action
ICB	initial calibration blank
ICP	inductively coupled plasma
IDL	instrument detection level
ICSA	interference check sample
ICSAB	interference check sample
ICV	initial calibration verification
LCS	laboratory control sample
MB	method blank
MDL	method detection limit
MS	matrix spike or mass spectrometry
MSD	matrix spike duplicate
r^2	correlation coefficient
RIN	report identification number
RL	reporting limit
RPD	relative percent difference
SD	serial dilution
SDG	sample data group
TDS	total dissolved solids
UMTRA	Uranium Mill Tailings Remedial Action
USGS	U.S. Geological Survey
VDP	validation data package

1.0 Introduction

The purpose of this document is to summarize the results of the data validation process associated with ground water and/or surface water samples collected between January and March 2011 from the Moab Uranium Mill Tailings Remedial Action (UMTRA) site. Only one sampling event, report Identification Number (RIN) 1102055 was completed during the first quarter of 2011. This data validation follows the criteria according to the *Moab UMTRA Project Surface Water/Ground Water Sampling and Analysis Plan* (DOE-EM/GJTAC1830) and the *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJTAC1855).

As part of the scope of this document, the complete results of this data validation process are provided. Section 1 presents the Summary Criteria, the Sampling Event Summary, and the Sampling and Analysis. Section 2 provides the Data Assessment Summaries, including the Field Activity Verification, Laboratory Performance Assessment, Field Analyses/Activities description, and the Certification. All flagged data, and the reasons for the applicable flags, are also presented in Section 2. The Data Presentation is contained in Section 3, which includes a summary of the anomalous data generated by the validation process. Various appendices contain the Water Sampling Field Activities Verification, Water Quality Data, Water Level Data, and the Minimums and Maximums Report table. Attachment 1 contains the trip report. All Colorado River flow discussed in this document is measured from the U.S. Geological Survey (USGS) Cisco gauging station No. 09180500.

This validation data package (VDP) presents the results of the first quarter 2011 sampling event completed February 24, 2011, in which ground water samples were collected from each of the Configuration (CF) 4 observation wells and three well points located in the river bed. The locations were sampled to collect baseline data prior to the initiation of freshwater injection in the CF4 remediation wells. The side channel off CF4 has the highest probability of developing into habitat. Section 1.0 contains the Summary Criteria, with a sample location map (Section 1.1), the Sampling Event Summary (Section 1.2), and the Sampling and Analyses (Section 1.3) for this first quarter 2011 sampling event.

1.1 Summary Criteria

Sampling Period: February 24, 2011

The purpose of this sampling was to collect data from the CF4 observation wells and well points prior to the instigation of freshwater injection into the CF4 remediation wells to protect the adjacent habitat area. This data will eventually provide information to evaluate the performance of freshwater injection into the subsurface in the vicinity of CF4 and the effectiveness of preventing ground water contaminants from discharging into the adjacent Colorado River side channel. All sampling locations are shown on Figure 1.

1. As a result of this sampling event, is there any indication of anomalous data that may be related to well field pump rate changes, river flow, or other known causes?

Yes. Of the locations sampled during this event, only the sample collected from observation well 0782 (which had historically high ammonia) was considered to be anomalous based on the criteria presented in Section 3.0. However, there is no indication this anomalous data point is related to pumping rate or river flow changes.

2. Were all interim action (IA) well field pumps operating within the planned parameters?

No ground water extraction or fresh water injection occurred while this event took place.

3. Was the evaporation pond functioning properly?

Yes. The pond level was 8.4 feet (ft) on February 24, 2011.

4. Were all proposed well (ground water) and surface water locations sampled during this event?

Yes.

5. Were there any site activities that have impacted or may impact the IA system?

No.

1.2 Sampling Event Summary

This VDP presents the validated data associated with the only sampling event completed during the first quarter of 2011 from the former uranium tailings processing site in Moab, Utah. This VDP includes a discussion of the data validation process in Section 2.0, with a description of how these data are qualified based on field and laboratory verification assessments (Sections 2.1 and 2.2). Attachment 1 contains the trip report detailing the field events associated with this sampling event. In addition, time versus analyte concentration plots are provided where applicable.

A list of flagged data is presented in Table 2 in Section 2.2. No data were rejected (flagged as “R”) as a result of this validation process. A Minimums and Maximums Report (presented in Section 3.1) was generated to determine if the applicable data are within a normal statistical range. Based on the results of this Minimums and Maximums Report, there was one anomalous data point associated with this sampling event (see Anomalous Data Review in Section 3.2).

CF4 Upgradient Observation Wells 0780, 0781, 0782, and 0783

Figures 2, 3, and 4 are the time versus ammonia, total dissolved solids (TDS), and uranium concentration (respectively) plots for CF4 upgradient observation wells 0780 through 0783. Ground water samples were collected from a depth of 28 ft below ground surface (bgs) from well 0780, 46 ft bgs from 0781, 33 ft bgs from 0782, and 18 ft bgs from 0783 during this event. Subsequent samples will be collected from these same depths after freshwater injection has been initiated to determine the vertical extent of freshwater injection into the CF4 remediation wells.

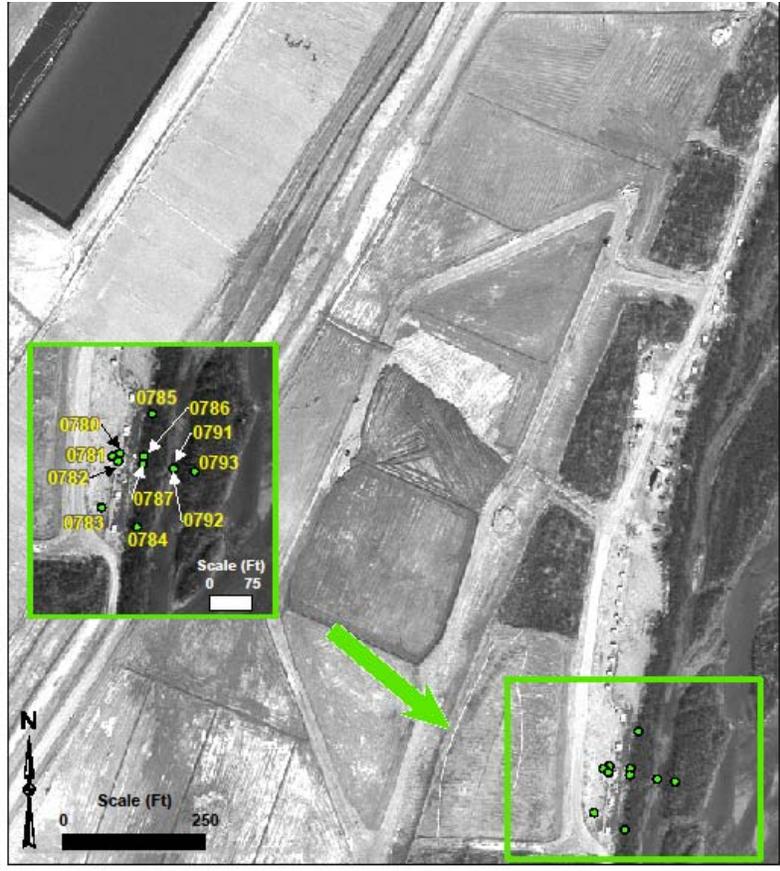


Figure 1. Map of Sample Locations for the First Quarter 2011 Sampling Event

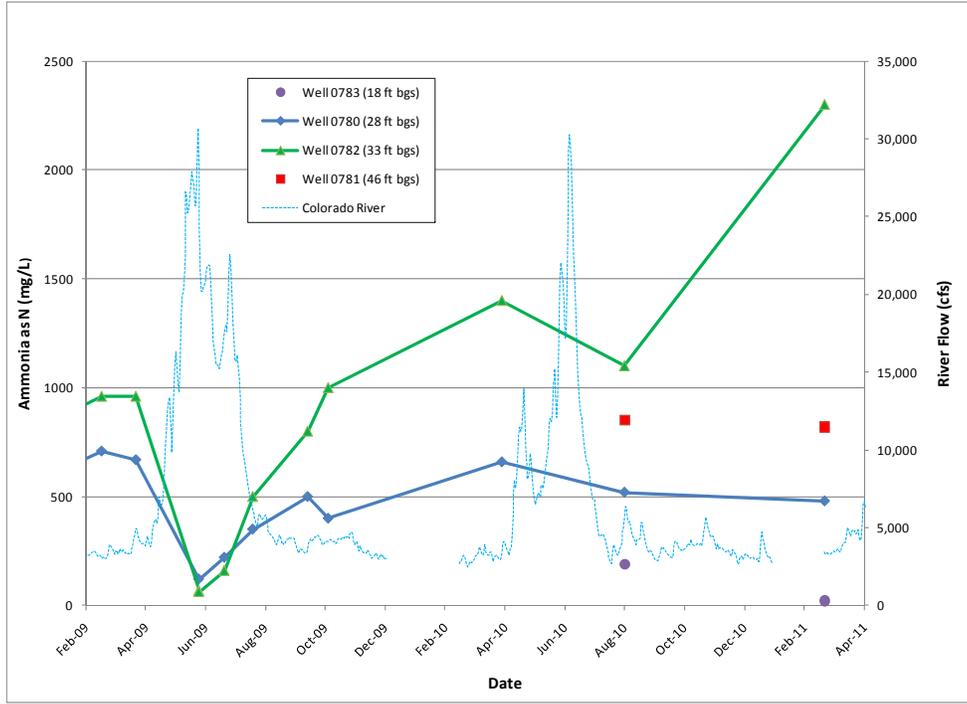


Figure 2. CF4 Upgradient Observation Wells 0780, 0781, 0782, and 0783 Time Versus Ammonia Total as N Concentration Plot

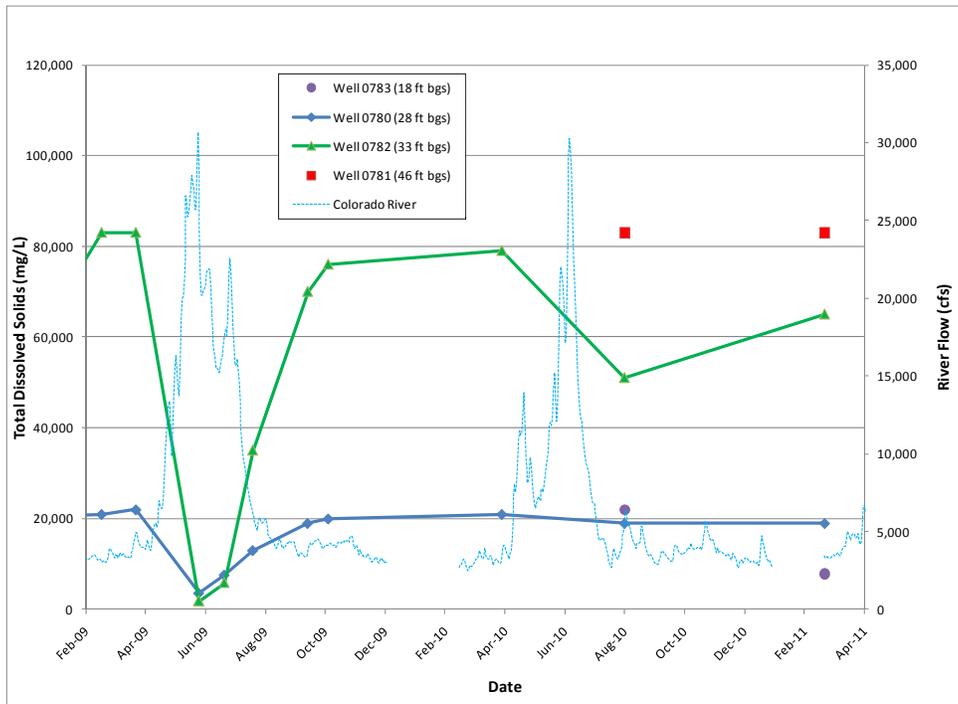


Figure 3. CF4 Upgradient Observation Wells 0780, 0781, 0782, and 0783 Time Versus TDS Concentration Plot

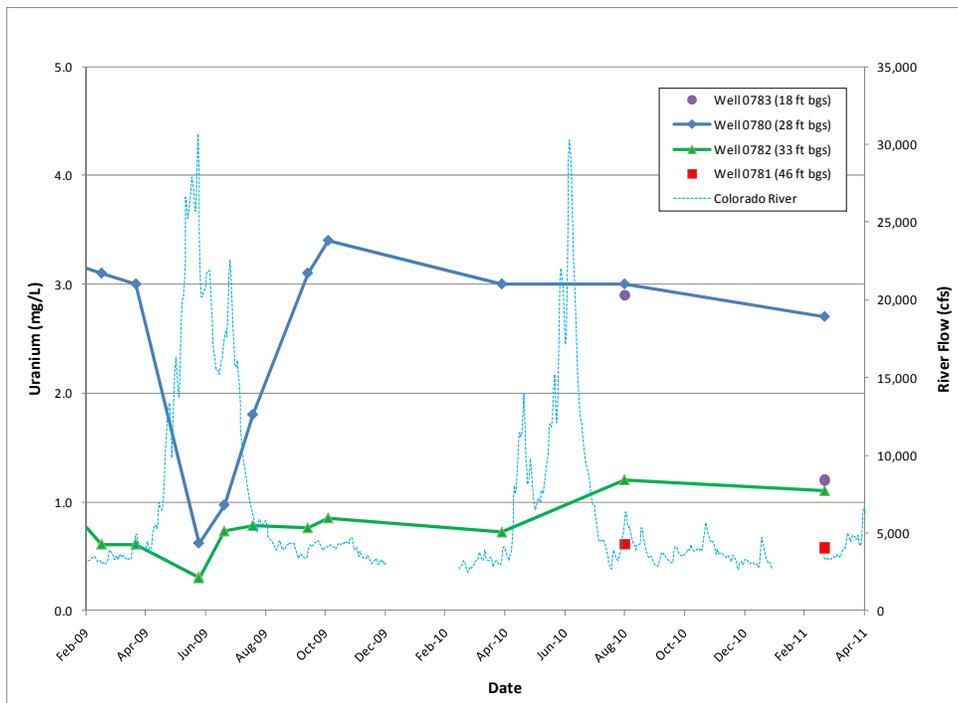


Figure 4. CF4 Upgradient Observation Wells 0780, 0781, 0782, and 0783 Time Versus Uranium Concentration Plot

CF4 Downgradient Observation Wells 0784, 0785, 0786, and 0787

The ammonia, TDS, and uranium concentration versus time plots are presented as Figures 5, 6, and 7 for CF4 downgradient observation wells 0784 through 0787. Ground water samples were collected from a depth of 18 ft bgs from wells 0784 and 0785, 28 ft bgs from 0786, and 36 ft bgs from 0787 during this event. Again, subsequent samples after freshwater injection has been initiated will be collected from these same depths to determine the subsurface impact of freshwater injection into the CF4 remediation wells.

Historically, samples have been frequently collected from wells 0786 and 0787; the samples indicate the analyte concentrations significantly decrease downgradient of CF4 in response to the Colorado River spring runoff. The lack of sampling during peak runoff does not allow any interpretations to be made about the propagation of the freshwater lens inland from the river this year. During the February 2011 sampling period, concentrations appear to be consistent with the concentrations measured during the previous event.

CF4 Well Points 0791 and 0792

The ammonia, TDS, and uranium concentration versus time plots are presented as Figures 8, 9, and 10 for CF4 well points 0791 and 0792. Well point 0791 is screened from 4.3 to 5.3 ft bgs, and 0792 is screened from 9.3 to 10.3 ft bgs. As the plots exhibit, the samples collected at depth are indicative of concentrations in ground water that discharges to the river .

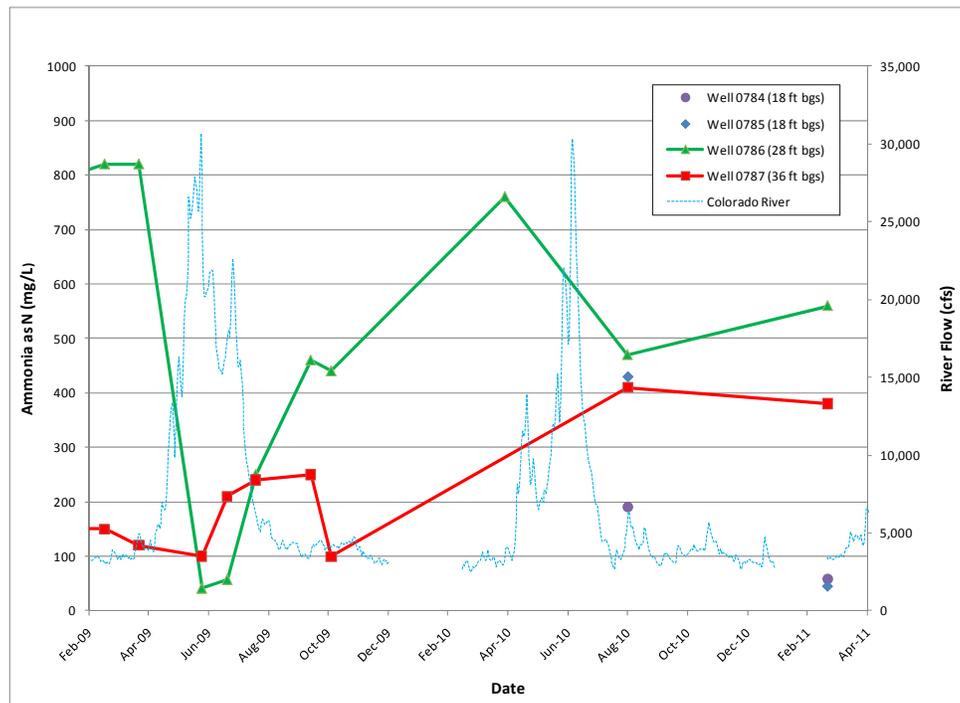


Figure 5. CF4 Downgradient Observation Wells 0784, 0785, 0786, and 0787 Time Versus Ammonia Total as N Concentration Plot

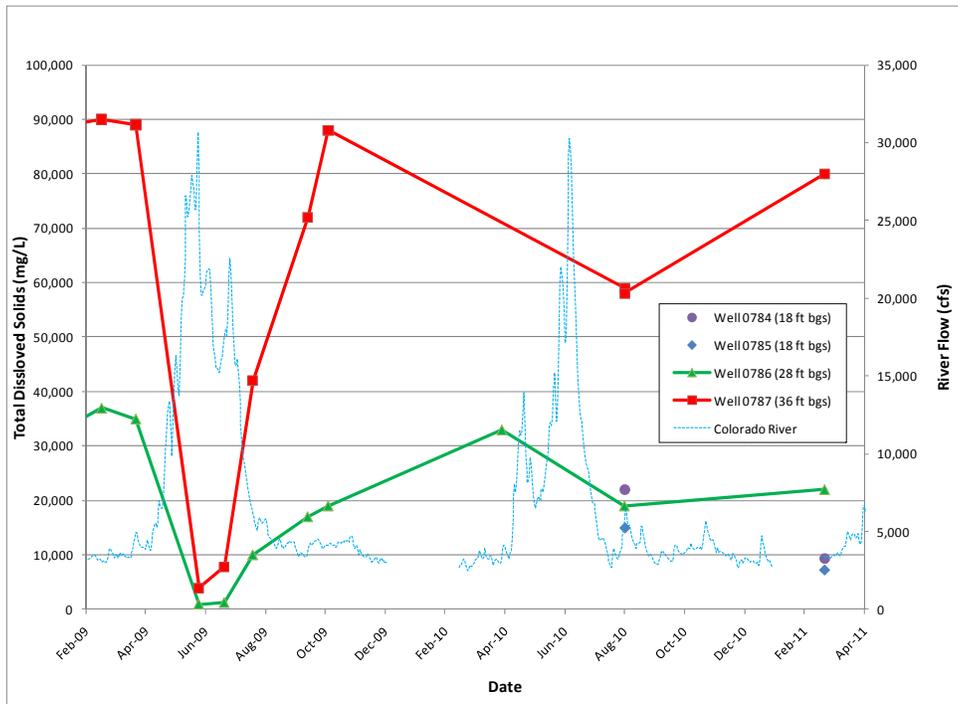


Figure 6. CF4 Downgradient Observation Wells 0784, 0785, 0786, and 0787 Time Versus TDS Concentration Plot

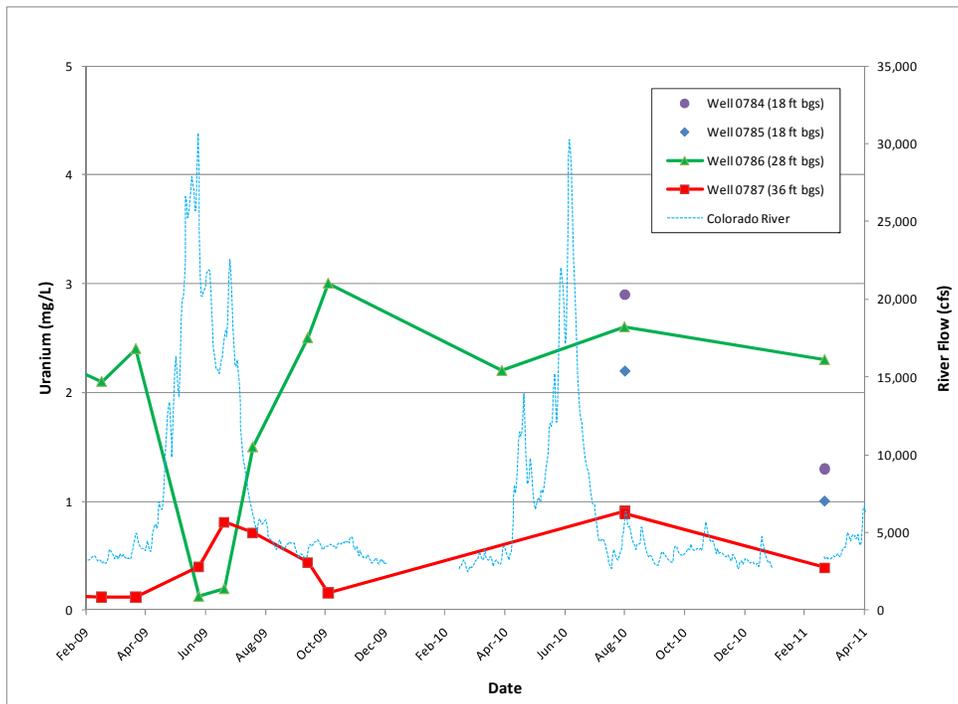


Figure 7. CF4 Downgradient Observation Wells 0784, 0785, 0786, and 0787 Time Versus Uranium Concentration Plot

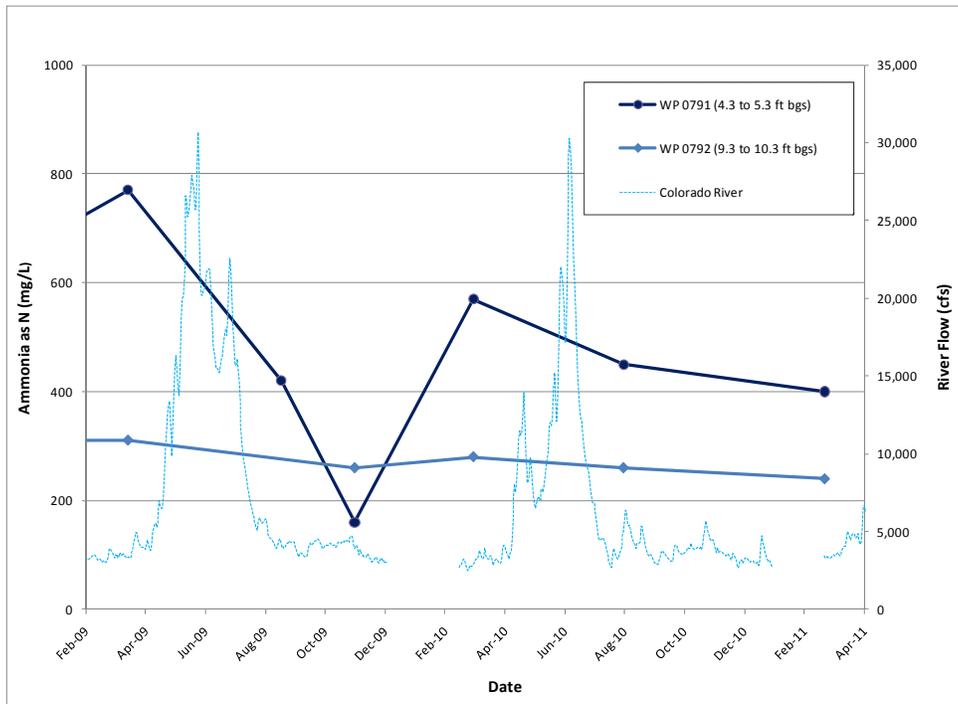


Figure 8. CF4 Well Points 0791 and 0792 Time Versus Ammonia Total as N Concentration Plot

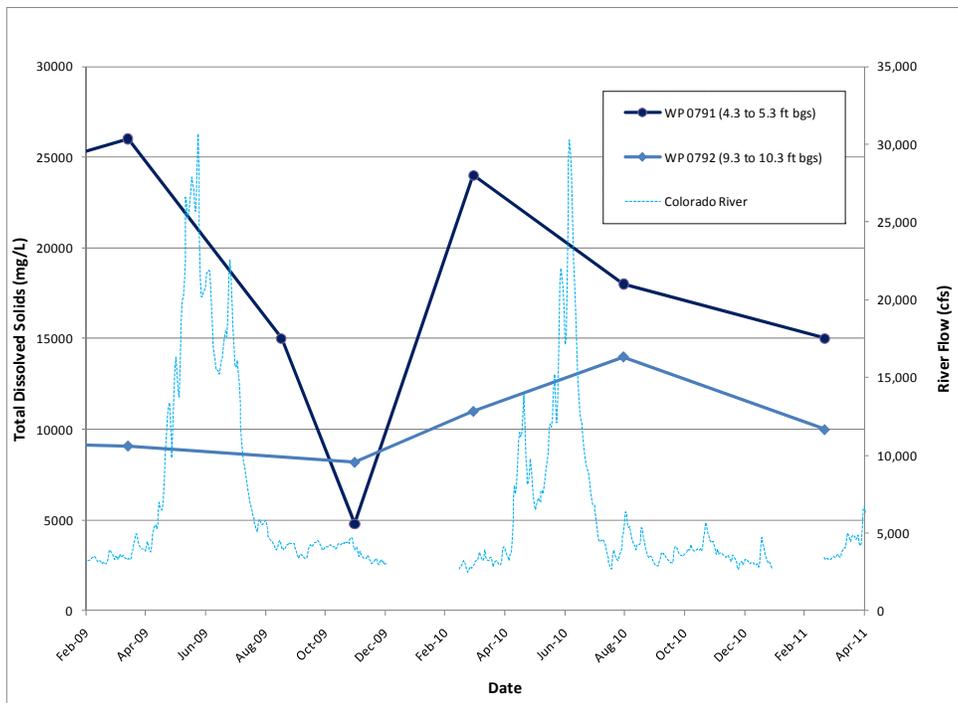


Figure 9. CF4 Well Points 0791 and 0792 Time Versus TDS Concentration Plot

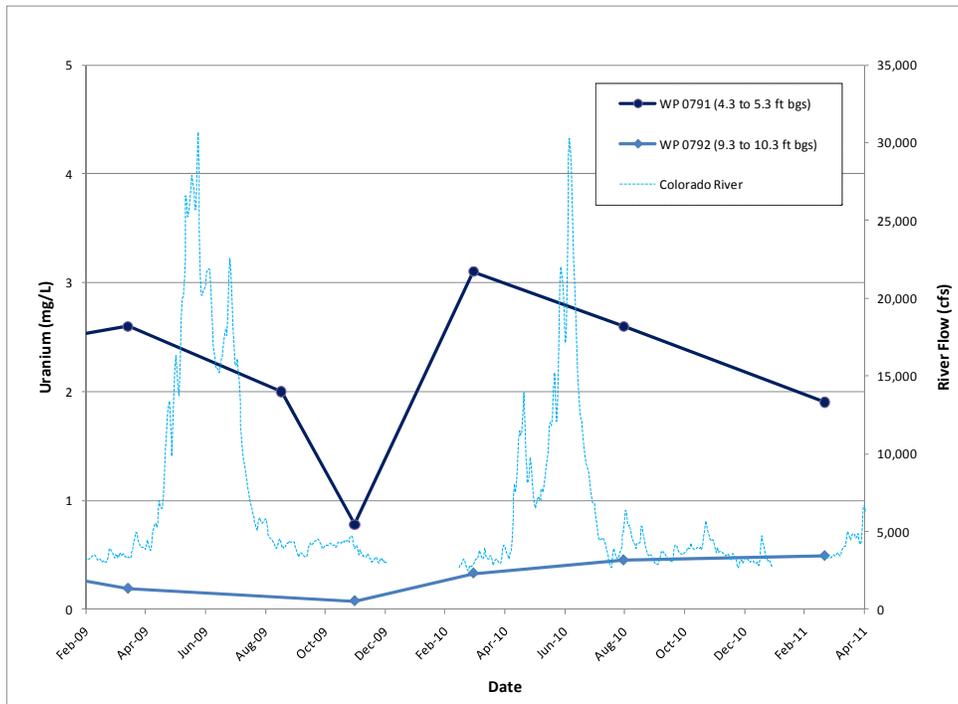


Figure 10. CF4 Well Points 079 and 0792 Time Versus Uranium Concentration Plot

Surface Water Sampling Results

There were no surface water locations sampled during this sampling event.

1.3 Sampling and Analyses

Sampling and analyses were conducted in accordance with the *Operations, Maintenance, and Performance Monitoring Plan for the Interim Action Ground Water Treatment System*, (DOE-EM/GJ1220). Please refer to the attached trip report (Attachment 1) for specific sampled locations.

The data validations indicate that the data meet the quality-control criteria specified for this project. An adequate number of duplicates (DUPS) were collected, and all samples were collected using dedicated equipment; therefore, no equipment blanks (EBs) were required. All samples were analyzed within their prescribed holding times. No significant discrepancies were noted regarding chain of custody (COC), case narratives, presence of field and sample identifications, holding times, preservation, and cooler receipts, except as qualified or noted in the Laboratory Performance Assessment (Section 2.2).

There was one anomalous data point associated with this sampling event. According to the USGS Cisco gauging station, the mean daily Colorado River flow rate was 3,310 cubic feet per second (cfs).

2.0 Data Assessment Summaries

This section contains the Water Sampling Field Activities Verification (Section 2.1), the Laboratory Performance Assessment (Section 2.2), the Field Analyses/Activities (Section 2.3), and Certification (Section 2.4).

2.1 Water Sampling Field Activities Verification

The field activities verification process for this sampling event was documented using the checklist in Appendix A. As the checklist exhibits, all sampling was conducted following the applicable procedures. Please see Appendix A for the field activities verification checklist.

2.2 Laboratory Performance Assessment

General Information

Report Identification Number (RIN): 1102055
Sample Event: February 2011 Interim Action Well Field Monthly
Site(s): Moab, Utah
Laboratory: ALS Laboratory Group, Fort Collins, Colorado
Sample Data Group (SDG) No.: 1102284
Analysis: Metals and Inorganics
Validator: Rachel Cowan
Review Date: May 22, 2011

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 3, Data Deliverables Examination, on all the samples. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Preparation Method	Analytical Method
Ammonia as N, NH ₃ -N	WCH-A-005	EPA 350.1	EPA 350.1
Manganese	G17	SW-846 3005A	SW-846 6010B
Selenium	G14	SW-846 3005A	SW-846 6020A
TDS	WIC-A-033	EPA 160.1	EPA 160.1
Uranium	G1	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. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
All SDG 1102055 samples	All SDG 1102055 locations	Selenium, Uranium	J	ICS1, LCS1, MS1, SD1
All SDG 1102055 samples	All SDG 1102055 locations	Selenium	J	RS1

Notes: J indicates results are estimated and becomes a UJ for analytical results below the detection limit.

Table 3. Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-Detects)	Explanation
ICS1	J	U or not qualified	An interference control sample was not analyzed.
LCS1	J	U	A laboratory control samples was not analyzed.
MS1	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 EB, or (d) not analyzed at the proper frequency as stated in the appropriate analytical method.
RS1	J	J or R	Results for the affected analyte(s) are regarded as estimated (J) because replicate samples were not analyzed at the frequency stated in the procedure.
SD1	J	N/A	Frequency requirements for serial dilution were not met.

Sample Shipping/Receiving

ALS Environmental in Fort Collins, Colorado, received a total of 13 samples for RIN 1102055 in one shipment. Thirteen SDG 1102284 samples arrived on March 1, 2011 (UPS tracking number 1Z5W1Y514497165497). The SDG was accompanied by a 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 form and the sample tickets, had no errors or omissions, except for the following discrepancy: The TDS sample bottle for sample 1102284-10 (location 0790) had a time label of 9:55, although the sample was actually collected at 10:10.

Preservation and Holding Times

SDG 1102284 (packed in one cooler) was received intact with the temperatures in the cooler at 1.4 degrees Centigrade, 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.

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 that 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. In addition, for inductively coupled plasma (ICP) analytes (selenium and uranium), reporting limit verifications (CRIs) verify the linearity of the calibration curve near the reporting limit (RL). For ICP-mass spectrometry (ICP-MS) analytes (selenium and uranium), instrument tuning and performance criteria are checked for mass calibration and resolution verifications. And also for ICP-MS analytes selenium and uranium, internal standards are analyzed to indicate stability of the instruments.

Method SW-846 6010B, Manganese

The calibration for the manganese analyses was performed on March 8, 2011. The initial calibration was performed using seven calibration standards and one blank, resulting in a calibration curve with a correlation coefficient (r^2) value greater than 0.995. The absolute value of the calibration curve intercept for manganese was positive and less than three 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 RL. The CRIs were within the acceptance criteria range. Internal standard recoveries were stable and within acceptable ranges for all SDGs.

Method SW-846 6020A, Selenium and Uranium

The calibration for the uranium and selenium analyses was performed on March 4, 2011. The initial calibrations for both analytes were performed using eight calibration standards and one blank, resulting in calibration curves with r^2 values greater than 0.995. The absolute values of the calibration curve intercepts for selenium and uranium were positive and less than three times the IDL.

ICV and 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 RL for all SDGs.

The CRI verifications were within the acceptance criteria range for both selenium and uranium. Mass calibration and resolution verifications were performed at the beginning of each of the analytical run in accordance with the analytical procedure for ICP-MS. Internal standard recoveries were stable and within acceptable ranges.

Method EPA 350.1, Ammonia as N

Initial calibrations for ammonia as N were performed using six calibration standards and a blank on March 3, 2011. The calibration curves had r^2 values greater than 0.995 and intercepts 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 EPA 160.1, TDS

There is no initial or continuing calibration requirement associated with the determination of TDS.

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 (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. Nondetects were not qualified.

All manganese, selenium, and uranium CCB results were greater than their respective IDLs. All ammonia CCBs had results that were greater than the ammonia MDL.

Equipment Blanks

An 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.

All samples were collected using dedicated equipment. Therefore, no EBs were collected and analyzed.

ICP Interference Check Sample Analysis

ICP interference check samples (ICSA and ICSAB) are analyzed to verify the instrument inter-element and background correction factors.

The manganese ISCA results for calcium, magnesium, aluminum, and iron were all greater than any sample’s calcium, magnesium, aluminum, and iron results, so no associated manganese results were flagged. The percent recoveries of the ICSAB samples were provided and were acceptable for all manganese analyses.

No sample from the SDG was chosen as the selenium and uranium quality control sample, so there was no selenium or uranium ICSA or ICSAB. All uranium and selenium results for all locations were flagged “J” for ISC1.

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 MS standards are prepared from independent sources. The spike recoveries met the recovery and precision criteria for all analytes, with the following exception:

- No sample from the SDG was chosen as the selenium and uranium quality control sample, and so there was no selenium or uranium MS. All uranium and selenium results for all locations were flagged for reason MS1.

Laboratory Replicate Analysis

The laboratory replicate results demonstrate acceptable laboratory precision. Laboratory replicate samples are either DUP samples for TDS, or matrix spike duplicates (MSDs) for the other analytes. The 5 relative percent difference (RPD) values for the reported DUP and the MSD results for all other analytes were less than 20 percent for results greater than five times the RL with the following exception:

- No sample from the SDG was chosen as the selenium and uranium quality control sample, so there was no selenium or uranium MSD. However, only the selenium results for all locations were flagged “J” for reason RS1, because there was a replicate sample for uranium in the form of a field duplicate, which passed criteria.

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 field duplicate sample was collected from location 0483 (1102284-1) in this sampling event. The duplicate results met the EPA-recommended laboratory duplicate criteria of less than 20 RPD for results that are greater than five times the RL.

Laboratory Control Samples

Laboratory Control Samples (LCSs) provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. LCS results were acceptable for all analyses with the following exceptions:

- LCSs were not reported for selenium or uranium. As a standard practice, ALS Laboratory Group does not prepare LCSs for samples that were field-filtered and acidified and run directly on the instrument without any additional sample preparation. 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. Because there was no selenium or uranium MSs, all selenium and uranium results are flagged “J” for reason LCS1.

Metals Serial Dilution

Serial dilution (SD) samples were prepared and analyzed for the ICP-MS 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 serial dilution data were acceptable with the following exception:

- No sample from the SDG was chosen as the selenium and uranium quality control sample, so there was no selenium or uranium SD. All the selenium and uranium results for all locations were flagged “J” for SD1.

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 March 12, 2011. The contents of the EDD files were manually examined to ensure all and only the requested data are delivered in compliance with requirements and that the sample results accurately reflect the data contained in the sample data package

2.3 Field Analyses/Activities

The following information summarizes the field analyses and activities for the first quarter 2011 sampling event.

Field Activities

All monitor wells were purged and sampled using the low-flow sampling method; this method was not used for the evaporation pond sample collection. One duplicate sample was collected. There are no established regulatory criteria for the evaluation of field duplicate samples; therefore, EPA guidance for laboratory duplicates (which is conservative for field duplicates) was used to assess the precision of the field duplicates. All results met the criteria of ± 20 RPD and are considered acceptable.

2.4 Certification

Results were reported in correct units for all analytes requested. Appropriate contract-required laboratory qualifiers and target analyte lists were used. The RLs were met. All analytical quality-control criteria were met except as qualified on the Ground Water Quality Data by Parameter, Surface Water Quality by Parameter, or equipment/trip blank database printouts. The meaning of data qualifiers is defined on the database printouts or defined in the EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media Multi-Concentration*, (ILMO2.0). All data in this package are considered validated and may be treated as final results.

3.0 Data Presentation

This section contains the Minimums and Maximums Report (Section 3.1), the Anomalous Data Review Check Sheet (Section 3.2), tables containing the Water Quality and Water Level Data (Sections 3.3 and 3.4, respectively), and the Blanks Report (Section 3.5).

3.1 Minimums and Maximums Report

The Minimums and Maximums Report (see Appendix B) is generated by the Sample Management System used to query the SEEPro database. The DataVal program compares the new data set with historical data and lists all new data that fall outside the historical data range. Values listed in the reports are further screened, and 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.

3.2 Anomalous Data Review

There was one anomalous data point based on the Minimums and Maximums Report, as listed below.

Loc. No.	Analyte	Type of Anomaly	Disposition
0782	Ammonia	High	Continue monitoring location.

3.3 Water Quality Data

All water quality data are presented in Appendix C.

3.4 Water Level Data

All water level data are presented in Appendix D.

3.5 Blanks Report

Since all the samples were collected using dedicated equipment, it was not necessary to collect an EB during this sampling event.

Appendix A.
Water Sampling Field Activities Verification

Appendix A. Water Sampling Field Activities Verification

Sampling Event / RIN	2011 1st Quarter Sampling/ RIN 1102055	Date(s) of Water Sampling	February 24, 2011
Date(s) of Verification	April 16, 2011	Name of Verifier	Rachel Cowan
		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?	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 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	The field measurements of temperature, pH, turbidity, dissolved oxygen, oxidation reduction potential, and conductivity measurements 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 prior to sampling? Did the water level stabilize prior to sampling? Did pH, specific conductance, and turbidity measurements stabilize prior to 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 prior to sampling?	NA	
		Yes	
9.	Were duplicates taken at a frequency of one per 20 samples?	Yes	There were a total of 13 samples collected, including one duplicate.
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 sampling equipment; it was not necessary to collect an EB.

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 |
| 15. Were the number and types of samples collected as specified? | Yes |
| 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? | Yes |
| 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? | Yes |

Appendix B.
Minimums and Maximums Report

Appendix B. Minimums and Maximums Report (continued)

Data Validation Minimums and Maximums Report - No Field Parameters

Laboratory: ALS

RIN: 1102055

Comparison: All Historical Data

Report Date: 5/20/2011

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	0782	02/24/2011	Ammonia Total as N	2300		1400		J	63		33	0	
MOA01	0783	02/24/2011	Ammonia Total as N	22		380		F	26		10	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 micrometer); 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 the 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.
- 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 three 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 C.
Water Quality Data

Appendix C. Water Quality Data

General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site
REPORT DATE: 6/7/2011

Parameter	Units	Location ID	Location Type	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers		Detection Limit	Uncertainty
						Lab	Data	QA					
Ammonia Total as N	mg/L	0483	WL	02/24/2011	0001	18	-	18	110		#	5	
Ammonia Total as N	mg/L	0483	WL	02/24/2011	0002	18	-	18	100		#	5	
Ammonia Total as N	mg/L	0780	WL	02/24/2011	0001	28	-	28	480		#	20	
Ammonia Total as N	mg/L	0781	WL	02/24/2011	0001	48	-	48	820		#	20	
Ammonia Total as N	mg/L	0782	WL	02/24/2011	0001	33	-	33	2300		#	50	
Ammonia Total as N	mg/L	0783	WL	02/24/2011	0001	18	-	18	22		#	1	
Ammonia Total as N	mg/L	0784	WL	02/24/2011	0001	18	-	18	58		#	2	
Ammonia Total as N	mg/L	0785	WL	02/24/2011	0001	18	-	18	44		#	1	
Ammonia Total as N	mg/L	0786	WL	02/24/2011	0001	28	-	28	560		#	20	
Ammonia Total as N	mg/L	0787	WL	02/24/2011	0001	36	-	36	380		#	20	
Ammonia Total as N	mg/L	0790	WL	02/24/2011	0001	2	-	3	120		#	5	
Ammonia Total as N	mg/L	0791	WL	02/24/2011	0001	4.3	-	5.3	400		#	20	
Ammonia Total as N	mg/L	0792	WL	02/24/2011	0001	9.3	-	10.3	240		#	20	
Dissolved Oxygen	mg/L	0483	WL	02/24/2011	0001	18	-	18	10.86		#		
Dissolved Oxygen	mg/L	0780	WL	02/24/2011	0001	28	-	28	0.54		#		
Dissolved Oxygen	mg/L	0781	WL	02/24/2011	0001	48	-	48	0.3		#		
Dissolved Oxygen	mg/L	0782	WL	02/24/2011	0001	33	-	33	0.32		#		
Dissolved Oxygen	mg/L	0783	WL	02/24/2011	0001	18	-	18	0.58		#		
Dissolved Oxygen	mg/L	0784	WL	02/24/2011	0001	18	-	18	0.54		#		
Dissolved Oxygen	mg/L	0785	WL	02/24/2011	0001	18	-	18	0.61		#		
Dissolved Oxygen	mg/L	0786	WL	02/24/2011	0001	28	-	28	0.71		#		
Dissolved Oxygen	mg/L	0787	WL	02/24/2011	0001	36	-	36	0.25		#		
Dissolved Oxygen	mg/L	0790	WL	02/24/2011	0001	2	-	3	5.48		#		
Dissolved Oxygen	mg/L	0791	WL	02/24/2011	0001	4.3	-	5.3	6.62		#		
Dissolved Oxygen	mg/L	0792	WL	02/24/2011	0001	9.3	-	10.3	3.07		#		

Appendix C. Water Quality Data (continued)

General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site
 REPORT DATE: 6/7/2011

Parameter	Units	Location ID	Location Type	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers		Detection Limit	Uncertainty
						Lab	Data	QA					
Manganese	mg/L	0483	WL	02/24/2011	0001	18	-	18	2.6		#	0.0057	
Manganese	mg/L	0483	WL	02/24/2011	0002	18	-	18	2.5		#	0.0057	
Manganese	mg/L	0780	WL	02/24/2011	0001	28	-	28	5.2		#	0.0057	
Manganese	mg/L	0781	WL	02/24/2011	0001	48	-	48	7.2		#	0.0057	
Manganese	mg/L	0782	WL	02/24/2011	0001	33	-	33	8.9		#	0.0057	
Manganese	mg/L	0783	WL	02/24/2011	0001	18	-	18	2.2		#	0.0057	
Manganese	mg/L	0784	WL	02/24/2011	0001	18	-	18	2.8		#	0.0057	
Manganese	mg/L	0785	WL	02/24/2011	0001	18	-	18	1.7		#	0.0057	
Manganese	mg/L	0786	WL	02/24/2011	0001	28	-	28	5.4		#	0.0057	
Manganese	mg/L	0787	WL	02/24/2011	0001	36	-	36	6.5		#	0.0057	
Manganese	mg/L	0790	WL	02/24/2011	0001	2	-	3	3.2		#	0.0057	
Manganese	mg/L	0791	WL	02/24/2011	0001	4.3	-	5.3	4		#	0.0057	
Manganese	mg/L	0792	WL	02/24/2011	0001	9.3	-	10.3	1.1		#	0.0057	
Oxidation Reduction Potential	mV	0483	WL	02/24/2011	0001	18	-	18	116		#		
Oxidation Reduction Potential	mV	0780	WL	02/24/2011	0001	28	-	28	114		#		
Oxidation Reduction Potential	mV	0781	WL	02/24/2011	0001	48	-	48	124		#		
Oxidation Reduction Potential	mV	0782	WL	02/24/2011	0001	33	-	33	124		#		
Oxidation Reduction Potential	mV	0783	WL	02/24/2011	0001	18	-	18	171		#		
Oxidation Reduction Potential	mV	0784	WL	02/24/2011	0001	18	-	18	48		#		
Oxidation Reduction Potential	mV	0785	WL	02/24/2011	0001	18	-	18	16		#		
Oxidation Reduction Potential	mV	0786	WL	02/24/2011	0001	28	-	28	48		#		
Oxidation Reduction Potential	mV	0787	WL	02/24/2011	0001	36	-	36	56		#		
Oxidation Reduction Potential	mV	0790	WL	02/24/2011	0001	2	-	3	-223		#		
Oxidation Reduction Potential	mV	0791	WL	02/24/2011	0001	4.3	-	5.3	-115		#		
Oxidation Reduction Potential	mV	0792	WL	02/24/2011	0001	9.3	-	10.3	-293		#		

Appendix C. Water Quality Data (continued)

General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site
 REPORT DATE: 6/7/2011

Parameter	Units	Location ID	Location Type	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA						
pH	s.u.	0483	WL	02/24/2011	0001	18	-	18	6.83			#		
pH	s.u.	0780	WL	02/24/2011	0001	28	-	28	6.91			#		
pH	s.u.	0781	WL	02/24/2011	0001	48	-	48	6.81			#		
pH	s.u.	0782	WL	02/24/2011	0001	33	-	33	6.75			#		
pH	s.u.	0783	WL	02/24/2011	0001	18	-	18	6.88			#		
pH	s.u.	0784	WL	02/24/2011	0001	18	-	18	6.97			#		
pH	s.u.	0785	WL	02/24/2011	0001	18	-	18	6.96			#		
pH	s.u.	0786	WL	02/24/2011	0001	28	-	28	6.88			#		
pH	s.u.	0787	WL	02/24/2011	0001	36	-	36	6.9			#		
pH	s.u.	0790	WL	02/24/2011	0001	2	-	3	7.45			#		
pH	s.u.	0791	WL	02/24/2011	0001	4.3	-	5.3	8.65			#		
pH	s.u.	0792	WL	02/24/2011	0001	9.3	-	10.3	9.13			#		
Selenium	mg/L	0792	WL	02/24/2011	0001	9.3	-	10.3	0.0002	B	J	#	6.5E-005	
Specific Conductance	µmhos/cm	0483	WL	02/24/2011	0001	18	-	18	4935			#		
Specific Conductance	µmhos/cm	0780	WL	02/24/2011	0001	28	-	28	22102			#		
Specific Conductance	µmhos/cm	0781	WL	02/24/2011	0001	48	-	48	104234			#		
Specific Conductance	µmhos/cm	0782	WL	02/24/2011	0001	33	-	33	92588			#		
Specific Conductance	µmhos/cm	0783	WL	02/24/2011	0001	18	-	18	8576			#		
Specific Conductance	µmhos/cm	0784	WL	02/24/2011	0001	18	-	18	10800			#		
Specific Conductance	µmhos/cm	0785	WL	02/24/2011	0001	18	-	18	7826			#		
Specific Conductance	µmhos/cm	0786	WL	02/24/2011	0001	28	-	28	26036			#		
Specific Conductance	µmhos/cm	0787	WL	02/24/2011	0001	36	-	36	101669			#		
Specific Conductance	µmhos/cm	0790	WL	02/24/2011	0001	2	-	3	13900			#		
Specific Conductance	µmhos/cm	0791	WL	02/24/2011	0001	4.3	-	5.3	9312			#		
Specific Conductance	µmhos/cm	0792	WL	02/24/2011	0001	9.3	-	10.3	17600			#		

Appendix C. Water Quality Data (continued)

General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site
REPORT DATE: 6/7/2011

Parameter	Units	Location ID	Location Type	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers		Detection Limit	Uncertainty
						Lab	Data	QA					
Temperature	C	0483	WL	02/24/2011	0001	18	-	18	15.34		#		
Temperature	C	0780	WL	02/24/2011	0001	28	-	28	15.59		#		
Temperature	C	0781	WL	02/24/2011	0001	48	-	48	14.82		#		
Temperature	C	0782	WL	02/24/2011	0001	33	-	33	14.81		#		
Temperature	C	0783	WL	02/24/2011	0001	18	-	18	15.29		#		
Temperature	C	0784	WL	02/24/2011	0001	18	-	18	13.66		#		
Temperature	C	0785	WL	02/24/2011	0001	18	-	18	13.73		#		
Temperature	C	0786	WL	02/24/2011	0001	28	-	28	14.61		#		
Temperature	C	0787	WL	02/24/2011	0001	36	-	36	14.63		#		
Temperature	C	0790	WL	02/24/2011	0001	2	-	3	12.09		#		
Temperature	C	0791	WL	02/24/2011	0001	4.3	-	5.3	12.5		#		
Temperature	C	0792	WL	02/24/2011	0001	9.3	-	10.3	12.86		#		
Total Dissolved Solids	mg/L	0483	WL	02/24/2011	0001	18	-	18	4000		#	80	
Total Dissolved Solids	mg/L	0483	WL	02/24/2011	0002	18	-	18	3700		#	80	
Total Dissolved Solids	mg/L	0780	WL	02/24/2011	0001	28	-	28	19000		#	400	
Total Dissolved Solids	mg/L	0781	WL	02/24/2011	0001	48	-	48	83000		#	2000	
Total Dissolved Solids	mg/L	0782	WL	02/24/2011	0001	33	-	33	65000		#	2000	
Total Dissolved Solids	mg/L	0783	WL	02/24/2011	0001	18	-	18	7800		#	200	
Total Dissolved Solids	mg/L	0784	WL	02/24/2011	0001	18	-	18	9300		#	200	
Total Dissolved Solids	mg/L	0785	WL	02/24/2011	0001	18	-	18	7200		#	200	
Total Dissolved Solids	mg/L	0786	WL	02/24/2011	0001	28	-	28	22000		#	400	
Total Dissolved Solids	mg/L	0787	WL	02/24/2011	0001	36	-	36	80000		#	2000	
Total Dissolved Solids	mg/L	0790	WL	02/24/2011	0001	2	-	3	12000		#	400	
Total Dissolved Solids	mg/L	0791	WL	02/24/2011	0001	4.3	-	5.3	15000		#	400	
Total Dissolved Solids	mg/L	0792	WL	02/24/2011	0001	9.3	-	10.3	10000		#	400	

Appendix C. Water Quality Data (continued)

General Water Quality Data by Parameter (USEE205) FOR SITE MOA01, Moab Site
REPORT DATE: 6/7/2011

Parameter	Units	Location ID	Location Type	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA						
Turbidity	NTU	0483	WL	02/24/2011	0001	18	-	18	1.28			#		
Turbidity	NTU	0780	WL	02/24/2011	0001	28	-	28	1.48			#		
Turbidity	NTU	0781	WL	02/24/2011	0001	48	-	48	0.97			#		
Turbidity	NTU	0782	WL	02/24/2011	0001	33	-	33	1.92			#		
Turbidity	NTU	0783	WL	02/24/2011	0001	18	-	18	0.79			#		
Turbidity	NTU	0784	WL	02/24/2011	0001	18	-	18	0.86			#		
Turbidity	NTU	0785	WL	02/24/2011	0001	18	-	18	2.89			#		
Turbidity	NTU	0786	WL	02/24/2011	0001	28	-	28	1.46			#		
Turbidity	NTU	0787	WL	02/24/2011	0001	36	-	36	1.1			#		
Turbidity	NTU	0790	WL	02/24/2011	0001	2	-	3	4.17			#		
Turbidity	NTU	0791	WL	02/24/2011	0001	4.3	-	5.3	116			#		
Uranium	mg/L	0483	WL	02/24/2011	0001	18	-	18	0.69	J		#	0.00015	
Uranium	mg/L	0483	WL	02/24/2011	0002	18	-	18	0.64	J		#	0.00015	
Uranium	mg/L	0780	WL	02/24/2011	0001	28	-	28	2.7	J		#	0.00029	
Uranium	mg/L	0781	WL	02/24/2011	0001	48	-	48	0.58	J		#	0.00015	
Uranium	mg/L	0782	WL	02/24/2011	0001	33	-	33	1.1	J		#	0.00015	
Uranium	mg/L	0783	WL	02/24/2011	0001	18	-	18	1.2	J		#	0.00015	
Uranium	mg/L	0784	WL	02/24/2011	0001	18	-	18	1.3	J		#	0.00015	
Uranium	mg/L	0785	WL	02/24/2011	0001	18	-	18	1	J		#	0.00015	
Uranium	mg/L	0786	WL	02/24/2011	0001	28	-	28	2.3	J		#	0.00029	
Uranium	mg/L	0787	WL	02/24/2011	0001	36	-	36	0.39	J		#	0.00015	
Uranium	mg/L	0790	WL	02/24/2011	0001	2	-	3	1.7	J		#	0.00029	
Uranium	mg/L	0791	WL	02/24/2011	0001	4.3	-	5.3	1.9	J		#	0.00029	
Uranium	mg/L	0792	WL	02/24/2011	0001	9.3	-	10.3	0.49	J		#	2.9E-005	

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

Appendix C. 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.
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 three 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 D.
Water Level Data

Appendix D. Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site
REPORT DATE: 6/8/2011

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Time	Depth From Top of Casing (Ft)	Water Elevation (Ft)	Water Level Flag
0483		3968.9	02/24/2011		15.59	3953.31	
0780		3968.45	02/24/2011		16.05	3952.4	
0781		3968.56	02/24/2011		15.2	3953.36	
0782		3968.46	02/24/2011		15.97	3952.49	
0783		3968.82	02/24/2011		16.65	3952.17	
0784		3968.73	02/24/2011		16.75	3951.98	
0785		3969.24	02/24/2011		16.5	3952.74	
0786		3968.14	02/24/2011		15.96	3952.18	
0787		3968.43	02/24/2011		15.74	3952.69	
0790		3955.2	02/24/2011		6.37	3948.83	
0791		3954.76	02/24/2011		5.96	3948.8	
0792		3954.84	02/24/2011		6.78	3948.06	

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

Attachment 1.
First Quarter 2011 IA Well Field Monthly Sampling Trip Report

Attachment 1.
First Quarter 2011 Well Field Monthly Sampling Trip Report (continued)



DATE: March 23, 2010
TO: K. Pill
FROM: James Ritchey
SUBJECT: February 2011 Interim Action Well Field Monthly Sampling Trip Report
Site: Moab, Utah

Date of Sampling Event: February 24, 2011

Team Members: Elizabeth Glowiak, James Ritchey

RIN Number Assigned: All samples were assigned to RIN 1102055.

Sample Shipment: All samples were shipped in one cooler overnight UPS to ALS Laboratory Group from Moab, Utah, on February 25, 2010 (Tracking No. 4497165497).

February 2011 CF1 Sampling

Number of Locations Sampled: One observation well (0483) was sampled during the February 2011 sampling event.

Locations Not Sampled: None.

Field Variance: None.

Quality-control Sample Cross Reference: False identifications assigned to the quality control samples are shown below:

False ID	True ID	Sample Type	Associated Matrix	Ticket Number
2000	0483	Duplicate at 18 ft	Ground Water	FEB 013

Attachment 1.

First Quarter 2011 Well Field Monthly Sampling Trip Report (continued)

Location-specific Information – Observation Wells: All observation wells were sampled using micropurge 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)
0483	02/24/2011	14:16	15.59	18

btoc = below top of casing

February 2011 CF4 Sampling

Number of Locations Sampled: Eight observation wells (0780, 0781, 0782, 0783, 0784, 0785, 0786, and 0787) and three well points (0790, 0791, and 0792) were sampled during the February 2011 sampling event.

Locations Not Sampled: Three well points (0793, 0794, and 0795) were not sampled due to inaccessibility and time limitation.

Field Variance: None.

Location-specific Information – Observation Wells: All observation wells were sampled using micropurge 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	02/24/2011	14:00	16.05	28
0781	02/24/2011	13:30	15.20	48
0782	02/24/2011	13:46	15.97	33
0783	02/24/2011	13:17	16.65	18
0784	02/24/2011	11:15	16.75	18
0785	02/24/2011	10:31	16.50	18
0786	02/24/2011	10:48	15.96	28
0787	02/24/2011	11:01	15.74	36

Location-specific Information – Well Point Sampling: The table below presents the water level, stick up height, and depth to the river surface prior to the initial purge.

WP No.	Date	Time	Depth to Water (ft btoc)	Stick Up Height (ft)	Depth to River Surface (ft btoc)
0790	02/24/2011	10:05	6.37	2.52	Dry
0791	02/24/2011	09:51	5.96	2.48	Dry
0792	02/24/2011	09:57	6.78	2.45	Dry

btoc = below top of casing

Attachment 1.

First Quarter 2011 Well Field Monthly Sampling Trip Report (continued)

Site Issues: The mean daily Colorado River flows during this sampling event, according to the USGS Cisco gauging station (Station No. 09180500), are provided below:

Date	Daily Mean Flow (cfs)
02/24/2011	3,310

Equipment Issues: None.

Corrective Action Required/Taken: None.