LMS/AMB/S01116

Data Validation Package

November 2016 Groundwater Sampling at the Ambrosia Lake, New Mexico, Disposal Site

April 2017

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Sampling Event Summary

Site: Ambrosia Lake, New Mexico, Disposal Site

Sampling Period: November 16, 2016

The *Long-Term Surveillance Plan for the Ambrosia Lake, New Mexico, Disposal Site* does not require groundwater monitoring because groundwater in the uppermost aquifer is of limited use, and supplemental standards have been applied to the aquifer. However, at the request of the New Mexico Environment Department, the U.S. Department of Energy conducts annual monitoring at three locations: monitoring wells 0409, 0675, and 0678. Monitoring locations are shown in Attachment 1, Sampling and Analysis Work Order.

Sampling and analyses were conducted as specified in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, continually updated). Monitoring well 0409 was not sampled during this event because it was dry. Water levels were measured at each sampled well. One duplicate sample was collected from location 0675. See Attachment 2, Trip Report for additional details.

Groundwater samples from the two sampled wells were analyzed for the constituents listed in Table 1. Time-concentration graphs for selected analytes are included in Attachment 3, Data Presentation. An assessment of anomalous data is included in Attachment 4.

Molybdenum and uranium concentrations in well 0675 were lower than the previous two sampling events. The high concentrations during those events are attributed to a change in the sample intake depth; the intake was inadvertently lowered into the sump below the well screen. For the 2016 sampling event, the sample intake was raised back into the middle of the screened interval (the sampling depth through 2013) and fixed at that location to prevent future sampling errors (see Attachment 2, Trip Report).

Table 1. 2016 Groundwater Monitoring Analytical Results at the Ambrosia Lake, New Mexico, Site

Analyte	Well 0675 mg/L	Well 0675 (Field Duplicate) mg/L	Well 0678 mg/L
Arsenic	0.00067	0.00092	0.00085
Calcium	470	470	410
Chloride	230	220	320
Magnesium	250	240	530
Molybdenum	0.26	0.25	0.0063
Nitrate + Nitrite as Nitrogen	25	27	220
Potassium	7.6	7.8	33
Selenium	0.83	0.80	0.0075
Sodium	900	910	3000
Sulfate	3500	3400	8200
Total Dissolved Solids	5200	5200	13000
Uranium	0.85	0.82	0.054

mg/L = milligrams per liter

Richard K. Johnson, Site Lead
Navarro Research and Engineering, Inc.

4/19/17
Date

Data Assessment Summary

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Water Sampling Field Activities Verification Checklist

Project	Ambrosia Lake, New Mexico	**Date(s) of Water Sampling**	November 16, 2016
Date(s) of Verification	January 19, 2016	**Name of Verifier**	Gretchen Baer

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures?	Yes	
List any Program Directives or other documents, SOPs, instructions.		Work Order letter dated October 4, 2016.
2. Were the sampling locations specified in the planning documents sampled?	No	Location 0409 was dry and not sampled.
3. Were field equipment calibrations conducted as specified in the above-named documents?	Yes	
4. Was an operational check of the field equipment conducted daily?	Yes	
Did the operational checks meet criteria?	Yes	
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	Yes	
6. Were wells categorized correctly?	Yes	
7. Were the following conditions met when purging a Category I well:		
Was one pump/tubing volume purged prior to sampling?	Yes	
Did the water level stabilize prior to sampling?	Yes	
Did pH, specific conductance, and turbidity measurements meet criteria prior to sampling?	Yes	
Was the flow rate less than 500 mL/min?	Yes	

Water Sampling Field Activities Verification Checklist (continued)

	Response (Yes, No, NA)	Comments
8. Were the following conditions met when purging a Category II well:		
Was the flow rate less than 500 mL/min?	Yes	
Was one pump/tubing volume removed prior to sampling?	Yes	
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	One duplicate was collected at 0675.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected with dedicated equipment.
11. Were trip blanks prepared and included with each shipment of VOC samples?	NA	No VOC samples were collected.
12. Were the true identities of the QC samples documented?	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 chain of custody records completed and was sample custody maintained?	Yes	
17. Was all pertinent information documented on the field data sheets?	Yes	
18. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
19. Were water levels measured at the locations specified in the planning documents?	Yes	Water levels were measured in all sampled wells.

Laboratory Performance Assessment

General Information

Report Number (RIN):	16118137
Sample Event:	November 16, 2016
Site(s):	Ambrosia Lake, New Mexico Disposal Site
Laboratory:	ALS Laboratory Group, Fort Collins, Colorado
Work Order No.:	1611352
Analysis:	Metals and Wet Chemistry
Validator:	Gretchen Baer
Review Date:	January 19, 2017

This validation was performed according "Standard Practice for Validation of Environmental Data" found in Appendix A of the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/ PRO/S04351, continually updated, http://energy.gov/lm/downloads/sampling-and-analysis-plan-us-department-energy-office-legacy-management-sites). The procedure was applied at Level 3, Data Validation.

This validation includes the evaluation of data quality indicators (DQIs) associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy; duplicates and replicates to assess precision; and interference check samples to assess bias (see Figure 1 through Figure 3, Data Validation Worksheets). The comparability, completeness, and sensitivity of the DQIs are also evaluated in the sections to follow.

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 2.

Table 2. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Arsenic, Molybdenum, Selenium, Uranium	LMM-02	SW-846 3005A	SW-846 6020A
Calcium, Magnesium, Potassium, Sodium	LMM-01	SW-846 3005A	SW-846 6010B
Chloride, Sulfate	MIS-A-045	SW-846 9056	SW-846 9056
Nitrate + Nitrite as N	WCH-A-022	EPA 353.2	EPA 353.2
Total Dissolved Solids (TDS)	WCH-A-033	MCAWW 160.1	MCAWW 160.1

Data Qualifier Summary

None of the sample results required additional qualification.

Sample Shipping/Receiving

ALS Laboratory Group in Fort Collins, Colorado, received three water samples on November 18, 2016, accompanied by a Chain of Custody form. A copy of the air bill was included in the receiving documentation. The Chain of Custody form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The Chain of Custody form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced cooler at 1.6 °C, which is acceptable. 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.

Detection and Quantitation Limits

A method detection limit (MDL) is defined in 40 CFR 136 as the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDLs reported by the laboratory were compared to the required MDLs to assess the sensitivity of the analyses and found to be in compliance with contractual requirements.

The practical quantitation limit (PQL) for an analyte, defined as 5 times the MDL, is the lowest concentration that can be quantitatively measured, and is used when evaluating laboratory method performance in the sections below.

Laboratory Instrument Calibration

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for the analytes of interest. Initial Calibration Verification (ICV) demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. Continuing Calibration Verification (CCV) demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis. Initial and continuing calibration standards must be prepared from independent sources to ensure the validity of the calibration. All laboratory instrument calibrations and calibration verifications were performed correctly in accordance with the cited methods.

Method MCAWW 160.1
There are no initial or continuing calibration requirements associated with the total dissolved solids method.

Method EPA 353.2
Calibrations for nitrate + nitrite as N were performed using seven calibration standards on December 7, 2016. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the MDL. Initial and

continuing calibration verification checks were made at the required frequency. All calibration check results were within the acceptance criteria.

Method SW-846 6010B
Calibrations for calcium, magnesium, potassium, and sodium were performed on December 2, 2016, using three calibration standards. The correlation coefficient values were greater than 0.995. The absolute values of the intercepts were less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL and all results were within the acceptance range.

Method SW-846 6020A
Calibrations were performed for arsenic, molybdenum, selenium, and uranium on December 6, 2016, using three calibration standards. The calibration curve correlation coefficient values were greater than 0.995. The absolute values of the calibration curve intercepts were less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks associated with reported results met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 9056
Calibrations for chloride and sulfate were performed using seven calibration standards on November 18, 2016. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the PQL for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a “U” flag (not detected) when the sample result is greater than the MDL but less than 5 times the blank concentration.

Inductively Coupled Plasma Interference Check Sample Analysis

Interference check samples are analyzed to verify the instrumental interelement and background correction factors and assess any bias due to interelement interferences. Interference check samples were analyzed at the required frequency with all results meeting the acceptance criteria.

Matrix Spike Analysis

Matrix spikes are aliquots of environmental samples to which a known concentration of an analyte has been added before analysis. Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike. The spike recoveries met the acceptance criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20%. For results that are less than 5 times the PQL, the range should be no greater than the PQL. All replicate results met these criteria, demonstrating acceptable precision.

Laboratory Control Sample

Laboratory control samples (LCSs) were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All LCS results were acceptable for all analyses.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable.

Completeness

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

Chromatography Peak Integration

The integration of analyte peaks was reviewed for all ion chromatography data. All peak integrations were satisfactory.

Electronic Data Deliverable (EDD) File

The EDD file arrived on December 14, 2016. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 16118137 **Lab Code:** PAR **Validator:** Gretchen Baer **Validation Date:** 1/19/2017

Project: Ambrosia Lake Disposal Site **Analysis Type:** ☑ Metals ☑ General Chem ☐ Rad ☐ Organics

# of Samples: 3 **Matrix:** WATER **Requested Analysis Completed:** Yes

Chain of Custody

Present: OK **Signed:** OK **Dated:** OK

Sample

Integrity: OK **Preservation:** OK **Temperature:** OK

Select Quality Parameters

☑ Holding Times	All analyses were completed within the applicable holding times.
☑ Detection Limits	The reported detection limits are equal to or below contract requirements.
☐ Field/Trip Blanks	
☑ Field Duplicates	There was 1 duplicate evaluated.

Figure 1. General Validation Worksheet

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 16118137 **Lab Code:** PAR **Date Due:** 12/16/2016

Matrix: Water **Site Code:** AMB01 **Date Completed:** 12/15/2016

Analyte	Method Type	Date Analyzed	CALIBRATION				Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	CCV	CCB								
Arsenic	ICP/MS	12/06/2016	-0.0220	1.0000	OK	OK	OK	100.0	105.0	103.0	2.0	99.0		96.0
Calcium	ICP/ES	12/02/2016	0.0700	0.9983	OK	OK	OK	99.0			2.0	100.0	0.0	113.0
Magnesium	ICP/ES	12/02/2016	-0.0170	0.9998	OK	OK	OK	98.0			2.0	99.0	0.0	100.0
Molybdenum	ICP/MS	12/06/2016	-0.0120	1.0000	OK	OK	OK	94.0	92.0	96.0	1.0	104.0	5.0	107.0
Potassium	ICP/ES	12/02/2016	-0.0740	0.9998	OK	OK	OK	98.0	99.0	99.0	1.0			91.0
Selenium	ICP/MS	12/06/2016	-0.0540	0.9999	OK	OK	OK	99.0			2.0	98.0	6.0	98.0
Sodium	ICP/ES	12/02/2016	-0.0220	0.9999	OK	OK	OK	98.0			1.0		4.0	97.0
Uranium	ICP/MS	12/06/2016	-0.0010	1.0000	OK	OK	OK	96.0			0.0	99.0	6.0	80.0

Figure 2. Metals Worksheet

SAMPLE MANAGEMENT SYSTEM

Wet Chemistry Data Validation Worksheet

RIN: 16118137 **Lab Code:** PAR **Date Due:** 12/16/2016

Matrix: Water **Site Code:** AMB01 **Date Completed:** 12/15/2016

Analyte	Date Analyzed	CALIBRATION				Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	CCV	CCB						
CHLORIDE	11/18/2016	-0.042	1.0000								
CHLORIDE	11/30/2016			OK	OK	OK	96	98	97	1	
Nitrate+Nitrite as N	12/07/2016	-0.003	0.9979	OK	OK	OK	101	88	94	4	
Sulfate	11/18/2016	0.025	1.0000								
SULFATE	11/30/2016			OK	OK	OK	99	102	100	1	
TOTAL DISSOLVED SOLIDS	11/23/2016					OK	99			1	

Figure 3. Wet Chemistry Worksheet

Sampling Quality Control Assessment

The following information summarizes and assesses quality control for this sampling event.

Sampling Protocol

Sample results for all monitoring wells were qualified with an "F" flag, indicating the wells were purged and sampled using the low-flow method. At monitoring well location 0675, purging and sampling met the Category I criteria. Monitoring well 0678 was classified as Category II because this well produced water at a rate less than the minimum low-flow purging rate. The sample results for 0678 were qualified with a "Q" flag (qualitative), indicating the samples were not collected under the optimal conditions of the Category I stability criteria.

Equipment Blank Assessment

No equipment blanks were collected. All samples were collected using dedicated equipment that did not require equipment blanks.

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 duplicates, which measure only laboratory performance. Duplicate samples were collected from location 0675. The relative percent difference (RPD) for duplicate results that are greater than 5 times the PQL should be less than 20%. The RPD is not used to evaluate results that are less than 5 times the PQL. For these results (RPD is "NA" in Figure 4), the range should be no greater than the PQL. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The dissolved oxygen field measurement value at location 0678 is qualified with an "R" flag (rejected) because the field notes stated that air bubbles were present in the water, which caused the dissolved oxygen measurement to be much higher than reasonable.

SAMPLE MANAGEMENT SYSTEM

Validation Report: Field Duplicates

RIN: 16118137 **Lab Code:** PAR **Project:** Ambrosia Lake Disposal Site **Validation Date:** 1/19/2017

Duplicate: 2073 **Sample:** 0675

	Sample				Duplicate						
Analyte	**Result**	**Flag**	**Error**	**Dilution**	**Result**	**Flag**	**Error**	**Dilution**	**RPD**	**RER**	**Units**
Arsenic	0.00067	J		10	0.00092	J		10	NA		MG/L
Calcium	470			5	470			5	0		MG/L
CHLORIDE	230			100	220			100	4.44		MG/L
Magnesium	250			5	240			5	4.08		MG/L
Molybdenum	0.26			10	0.25			10	3.92		MG/L
Nitrate+Nitrite as N	25			100	27			100	7.69		MG/L
Potassium	7.6			5	7.8			5	2.60		MG/L
Selenium	0.83			10	0.8			10	3.68		MG/L
Sodium	900			5	910			5	1.10		MG/L
SULFATE	3500			100	3400			100	2.90		MG/L
TOTAL DISSOLVED SOLIDS	5200			1	5200			1	0		MG/L
Uranium	0.85			10	0.82			10	3.59		MG/L

Figure 4. Field Duplicates Worksheet

Certification

All laboratory analytical quality control criteria were met except as qualified in this report. The data qualifiers listed on the environmental database reports are defined on the last page of each report. All data in this package are considered validated and available for use.

Laboratory Coordinator: Stephen Donivan — Date 4-19-2017

Data Validation Lead: Gretchen Baer — Date 4/20/17

Attachment 1

Sampling and Analysis Work Order

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LEGEND

- WELL TO BE SAMPLED
- SITE BOUNDARY

N

SCALE N FEET

0 500 1,000

U.S. DEPARTMENT OF ENERGY
OFFICE OF LEGACY MANAGEMENT

Work Performed by
Navarro Research & Engineering, Inc.
Under DOE Contract Number DE-LM0000421

Planned Sample Locations
Ambrosia Lake, NM, Disposal Site
November 2016

DATE PREPARED: September 20, 2016

FILE NAME: S1481700-11x17

Ambrosia Lake, New Mexico, Disposal Site, Planned Sample Locations Map

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October 4, 2016

Task Assignment 103
Control Number 16-0997

U.S. Department of Energy
Office of Legacy Management
ATTN: Richard Bush
Site Manager
2597 Legacy Way
Grand Junction, CO 81503

SUBJECT: Contract No. DE-LM0000421, Navarro Research & Engineering, Inc. (Navarro) Task Assignment 103 LTS&M - UMTRCA Title I and II Sites, D&D Sites, Other Sites, and Other
November 2016 Environmental Sampling at the Ambrosia Lake, New Mexico, Disposal Site

REFERENCE: Task Assignment 103, 1-103-1-02-101, Ambrosia Lake, New Mexico, Disposal Site

Dear Mr. Bush:

The purpose of this letter is to inform you of the upcoming sampling event at the Ambrosia Lake, New Mexico, Disposal Site. Enclosed are the map and tables specifying sample locations and analytes for monitoring at the Ambrosia Lake site. Water quality data will be collected from this site as part of the routine environmental sampling currently scheduled to begin the week of November 14, 2016.

The following list shows the monitoring wells (with zone of completion) scheduled to be sampled during this event.

Monitoring Wells*

409 Al	675 Km	678 Tb

*NOTE: Al = alluvium; Km = Mancos shale; Tb = Tres Hermanos–B sandstone

All samples will be collected as directed in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*. Access agreements are being reviewed and are expected to be complete by the beginning of fieldwork.

Please contact me at (970) 248-6022 if you have any questions.

Sincerely,

Richard K. Johnson
LMS Site Lead

RKJ/lcg/csa

Enclosures

cc: (electronic)
Christina Pennal, DOE
Jeff Carman, Navarro,
Beverly Cook, Navarro
Steve Donivan, Navarro
Lauren Goodknight, Navarro
Richard Johnson, Navarro
Sam Marutzky, Navarro
Diana Osborne, Navarro
Document Determination
EDD Delivery
rc-grand.junction
File: AMB 0400.02

2597 Legacy Way - Grand Junction, CO 81503-1789 -Telephone (970) 248-6000 - Fax (970) 248-6040

Constituent Sampling Breakdown

Site	Ambrosia Lake				
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Approx. No. Samples/yr	2	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen	X				
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Arsenic	X		0.0001	SW-846 6020	LMM-02
Calcium	X		5	SW-846 6010	LMM-01
Chloride	X		0.5	SW-846 9056	WCH-A-039
Iron					
Lead					
Magnesium	X		5	SW-846 6010	LMM-01
Manganese					
Molybdenum	X		0.003	SW-846 6020	LMM-02
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X		0.05	EPA 353.1	WCH-A-022
Potassium	X		1	SW-846 6010	LMM-01
Radium-226					
Radium-228					
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica					
Sodium	X		1	SW-846 6010	LMM-01
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon					
Tritium					
Uranium	X		0.0001	SW-846 6020	LMM-02
U-234, -238					
Vanadium					
Zinc					
Total No. of Analytes	12	0			

Note: All analyte samples are considered unfiltered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Sampling Frequencies for Locations at Ambrosia Lake, New Mexico

Location ID	Quarterly	Semiannually	Annually	Triennially	Not Sampled	Notes
Monitoring Wells						
409			X			Usally dry; sample if water is present
675			X			
678			X			

Sampling conducted in November

Attachment 2

Trip Report

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memo

NAVARRO

To: Dick Johnson, Navarro

From: Jeff Price, Navarro

Date: November 28, 2016

CC: Richard Bush, DOE
Steve Donivan, Navarro
EDD Delivery

Re: Sampling Trip Report

Site: Ambrosia Lake, New Mexico, Disposal Site

Dates of Event: November 16, 2016

Team Members: Samantha Tigar and Jeff Price, Navarro

Number of Locations Sampled: Samples were collected from 2 of the 3 locations identified in the sampling notification letter.

Locations Not Sampled/Reason: Location 0409 was dry and not sampled.

Location Specific Information: None.

Quality Control Sample Cross Reference: A summary of the quality control samples collected is shown in Table 1.

Table 1. Quality Control Sample Summary

False ID	Ticket Number	True ID	Sample Type	Associated Matrix	Associated Samples
2073	OMR 058	0675	Duplicate	Groundwater	All

Requisition Index Number (RIN) Assigned: Samples were assigned to RIN 16118137. Field data sheets can be found in \\crow\SMS\16118137\FieldData.

Sample Shipment: Samples were shipped overnight via FedEx from Farmington, New Mexico, to ALS Lab in Ft. Collins, CO, on November 17, 2016.

Water Level Measurements: Water levels were measured in all sampled wells.

Data Loggers: N/A

Well Inspection Summary: No issues were identified.

Sampling Method: Samples were collected according to the *Sampling and Analysis Plan (SAP) for the U. S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, continually updated).

Field Variance: None.

Equipment: No issues.

Stakeholder/Regulatory/DOE: None.

Institutional Controls:

Fences, Gates, and Locks: No issues were observed.
Signs: No issues were observed.
Trespassing/Site Disturbances: None observed.
Disposal Cell/Drainage Structure Integrity: No issues were observed.

Safety Issues: None observed.

Access Issues: None observed.

General Information: Nothing to note.

Immediate Actions Taken: None.

Future Actions Required or Suggested: None.

The closure of CA ID 1692 (securing and measurement of sample intake tubing at well 0675) was completed. The sample intake is at 29.70 below top of PVC casing (center of screened interval, as directed by Navarro Site Lead) and is secured to PVC cap with hose clamps.

Well 0675 with Dedicated Peristaltic Tubing on top of PVC Cap

Well 0675 with Dedicated Down-Hole Tubing Hose Clamped in Place to PVC Cap

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Attachment 3

Data Presentation

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Groundwater Quality Data

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Groundwater Quality Data by Location (USEE100) FOR SITE AMB01, Ambrosia Lake Disposal Site
REPORT DATE: 1/20/2017
Location: 0675 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Arsenic	mg/L	11/16/2016	N001	22.5	-	32.5	0.00067	J	F	#	0.00012	
Arsenic	mg/L	11/16/2016	N002	22.5	-	32.5	0.00092	J	F	#	0.00012	
Calcium	mg/L	11/16/2016	N001	22.5	-	32.5	470		F	#	0.12	
Calcium	mg/L	11/16/2016	N002	22.5	-	32.5	470		F	#	0.12	
Chloride	mg/L	11/16/2016	N001	22.5	-	32.5	230		F	#	20	
Chloride	mg/L	11/16/2016	N002	22.5	-	32.5	220		F	#	20	
Dissolved Oxygen	mg/L	11/16/2016	N001	22.5	-	32.5	0.63		F	#		
Magnesium	mg/L	11/16/2016	N001	22.5	-	32.5	250		F	#	0.15	
Magnesium	mg/L	11/16/2016	N002	22.5	-	32.5	240		F	#	0.15	
Molybdenum	mg/L	11/16/2016	N001	22.5	-	32.5	0.26		F	#	0.00032	
Molybdenum	mg/L	11/16/2016	N002	22.5	-	32.5	0.25		F	#	0.00032	
Nitrate + Nitrite as Nitrogen	mg/L	11/16/2016	N001	22.5	-	32.5	25		F	#	1	
Nitrate + Nitrite as Nitrogen	mg/L	11/16/2016	N002	22.5	-	32.5	27		F	#	1	
Oxidation Reduction Potential	mV	11/16/2016	N001	22.5	-	32.5	87		F	#		
pH	s.u.	11/16/2016	N001	22.5	-	32.5	6.76		F	#		
Potassium	mg/L	11/16/2016	N001	22.5	-	32.5	7.6		F	#	0.26	
Potassium	mg/L	11/16/2016	N002	22.5	-	32.5	7.8		F	#	0.26	
Selenium	mg/L	11/16/2016	N001	22.5	-	32.5	0.83		F	#	0.00066	

Groundwater Quality Data by Location (USEE100) FOR SITE AMB01, Ambrosia Lake Disposal Site
REPORT DATE: 1/20/2017
Location: 0675 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Selenium	mg/L	11/16/2016	N002	22.5	-	32.5	0.8		F	#	0.00066	
Sodium	mg/L	11/16/2016	N001	22.5	-	32.5	900		F	#	0.23	
Sodium	mg/L	11/16/2016	N002	22.5	-	32.5	910		F	#	0.23	
Specific Conductance	umhos /cm	11/16/2016	N001	22.5	-	32.5	6178		F	#		
Sulfate	mg/L	11/16/2016	N001	22.5	-	32.5	3500		F	#	50	
Sulfate	mg/L	11/16/2016	N002	22.5	-	32.5	3400		F	#	50	
Temperature	C	11/16/2016	N001	22.5	-	32.5	12.14		F	#		
Total Dissolved Solids	mg/L	11/16/2016	N001	22.5	-	32.5	5200		F	#	200	
Total Dissolved Solids	mg/L	11/16/2016	N002	22.5	-	32.5	5200		F	#	200	
Turbidity	NTU	11/16/2016	N001	22.5	-	32.5	1.71		F	#		
Uranium	mg/L	11/16/2016	N001	22.5	-	32.5	0.85		F	#	0.000012	
Uranium	mg/L	11/16/2016	N002	22.5	-	32.5	0.82		F	#	0.000012	

Groundwater Quality Data by Location (USEE100) FOR SITE AMB01, Ambrosia Lake Disposal Site
REPORT DATE: 1/20/2017
Location: 0678 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Arsenic	mg/L	11/16/2016	N001	261.85	-	281.85	0.00085	J	FQ	#	0.00012	
Calcium	mg/L	11/16/2016	N001	261.85	-	281.85	410		FQ	#	0.24	
Chloride	mg/L	11/16/2016	N001	261.85	-	281.85	320		FQ	#	25	
Dissolved Oxygen	mg/L	11/16/2016	N001	261.85	-	281.85	27.87		RFQ	#		
Magnesium	mg/L	11/16/2016	N001	261.85	-	281.85	530		FQ	#	0.3	
Molybdenum	mg/L	11/16/2016	N001	261.85	-	281.85	0.0063		FQ	#	0.00032	
Nitrate + Nitrite as Nitrogen	mg/L	11/16/2016	N001	261.85	-	281.85	220		FQ	#	5	
Oxidation Reduction Potential	mV	11/16/2016	N001	261.85	-	281.85	87.3		FQ	#		
pH	s.u.	11/16/2016	N001	261.85	-	281.85	6.99		FQ	#		
Potassium	mg/L	11/16/2016	N001	261.85	-	281.85	33		FQ	#	0.52	
Selenium	mg/L	11/16/2016	N001	261.85	-	281.85	0.0075		FQ	#	0.00066	
Sodium	mg/L	11/16/2016	N001	261.85	-	281.85	3000		FQ	#	0.47	
Specific Conductance	umhos /cm	11/16/2016	N001	261.85	-	281.85	14300		FQ	#		
Sulfate	mg/L	11/16/2016	N001	261.85	-	281.85	8200		FQ	#	62	
Temperature	C	11/16/2016	N001	261.85	-	281.85	13.52		FQ	#		
Total Dissolved Solids	mg/L	11/16/2016	N001	261.85	-	281.85	13000		FQ	#	400	
Turbidity	NTU	11/16/2016	N001	261.85	-	281.85	2		FQ	#		
Uranium	mg/L	11/16/2016	N001	261.85	-	281.85	0.054		FQ	#	0.000012	

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).
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.		

QA QUALIFIER:

#	Validated according to quality assurance guidelines.

Static Water Level Data

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STATIC WATER LEVELS (USEE700) FOR SITE AMB01, Ambrosia Lake Disposal Site
REPORT DATE: 1/20/2017

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Measurement Time	Depth From Top of Casing (Ft)	Water Elevation (Ft)	Water Level Flag
0409		6966.98	11/16/2016	17:20:00			D
0675	D	6966.65	11/16/2016	16:55:09	20.11	6946.54	
0678	C	6987.94	11/16/2016	16:30:02	226.2	6761.74	

FLOW CODES: B BACKGROUND C CROSS GRADIENT D DOWNGRADIENT F OFFSITE
N UNKNOWN O ONSITE U UPGRADIENT

WATER LEVEL FLAGS: D Dry F Flowing B Below top of pump

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Time-Concentration Graphs

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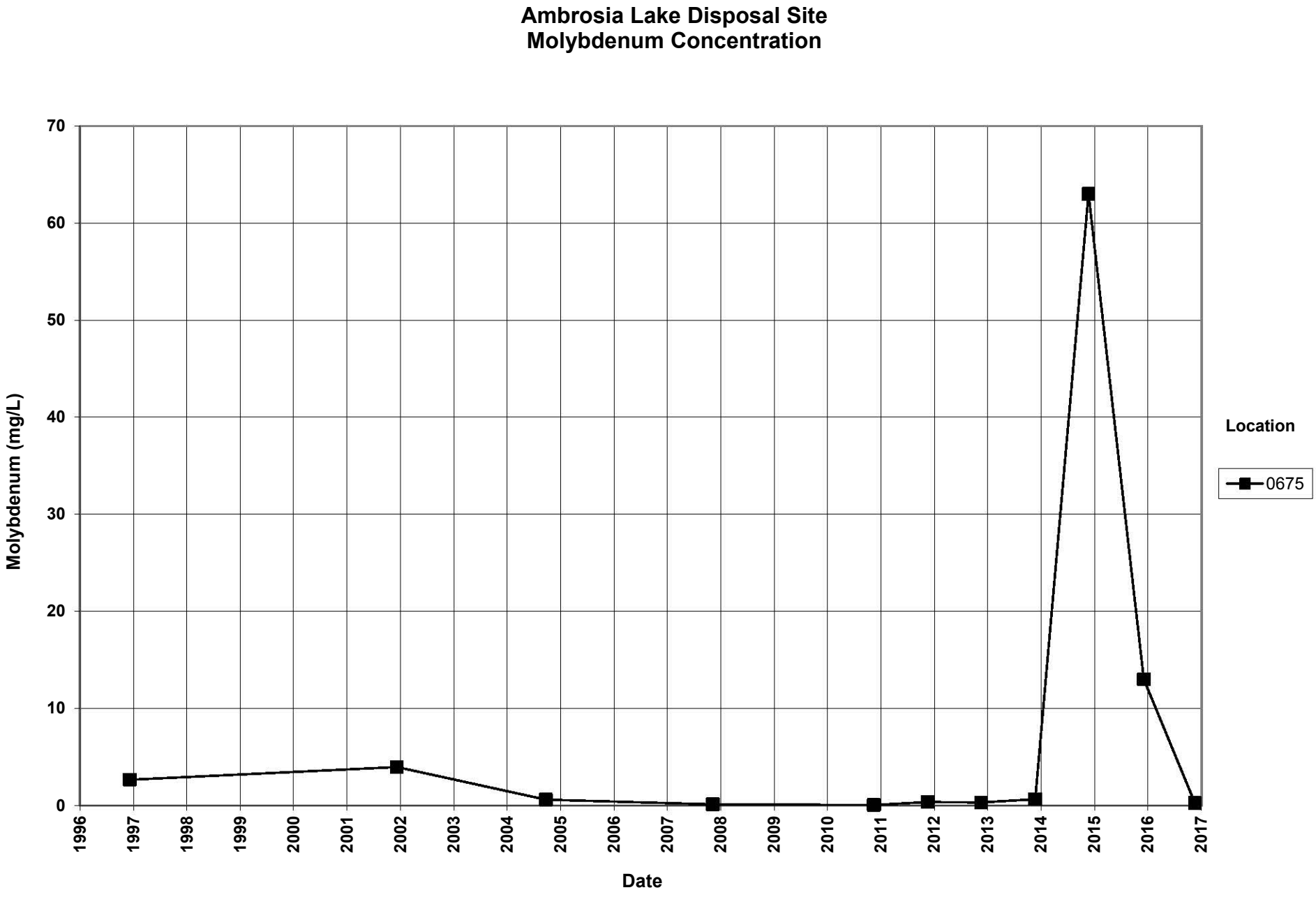
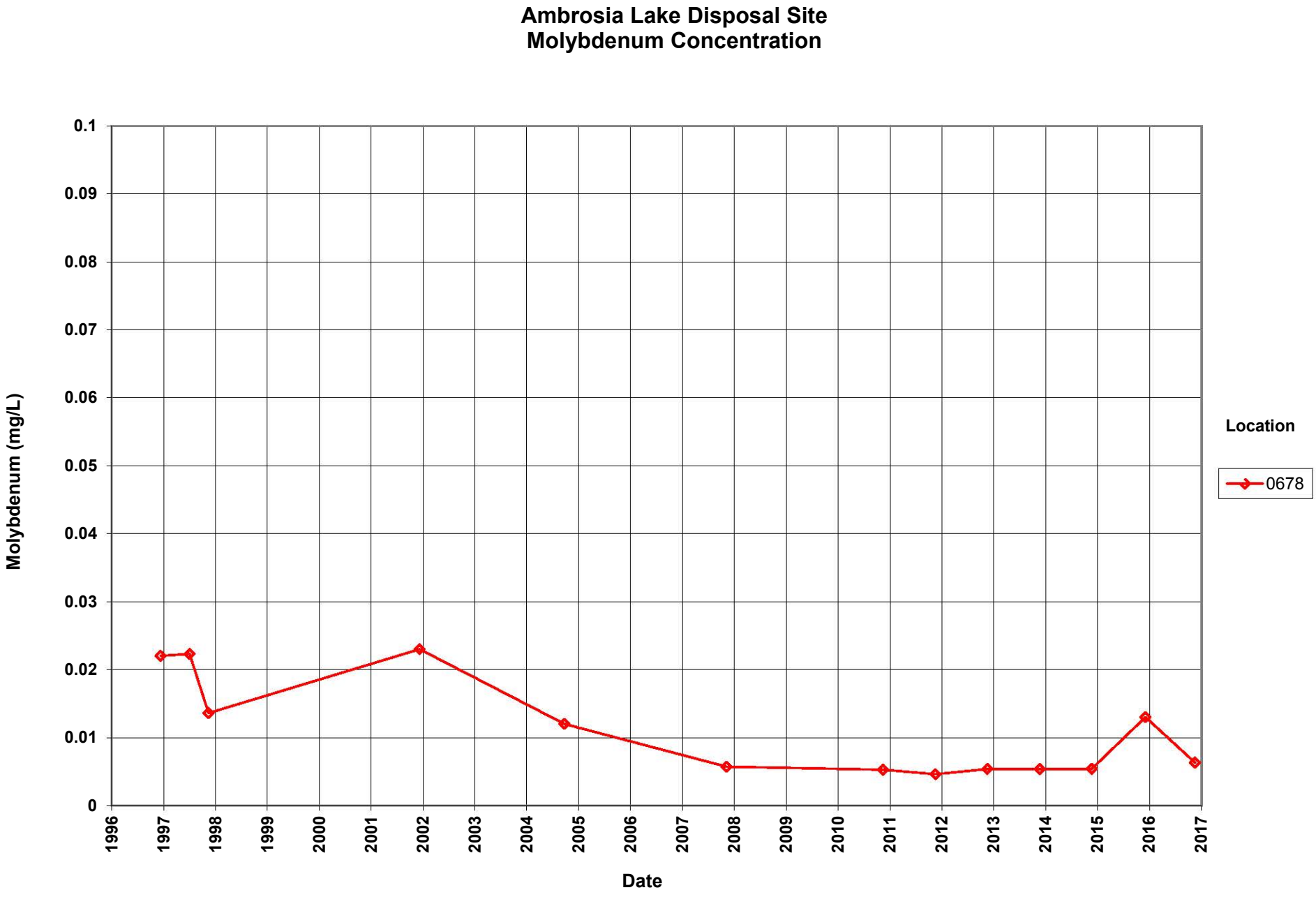
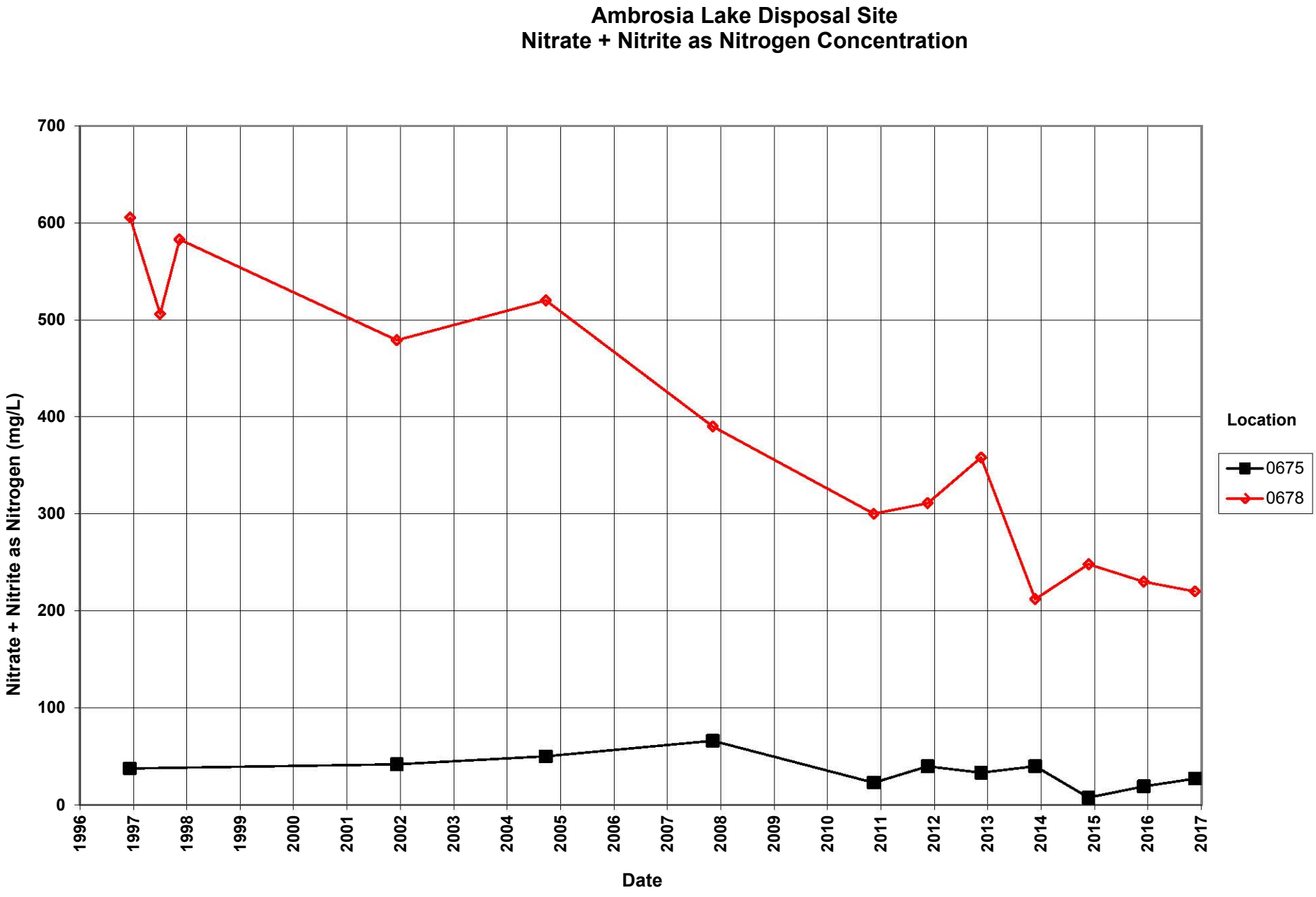

Ambrosia Lake Disposal Site
Molybdenum Concentration
Molybdenum (mg/L)
70
60
50
40
30
20
10
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Date
Location
0675


Ambrosia Lake Disposal Site
Molybdenum Concentration
Molybdenum (mg/L)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Date
Location
0678


Ambrosia Lake Disposal Site
Nitrate + Nitrite as Nitrogen Concentration
Nitrate + Nitrite as Nitrogen (mg/L)
700
600
500
400
300
200
100
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
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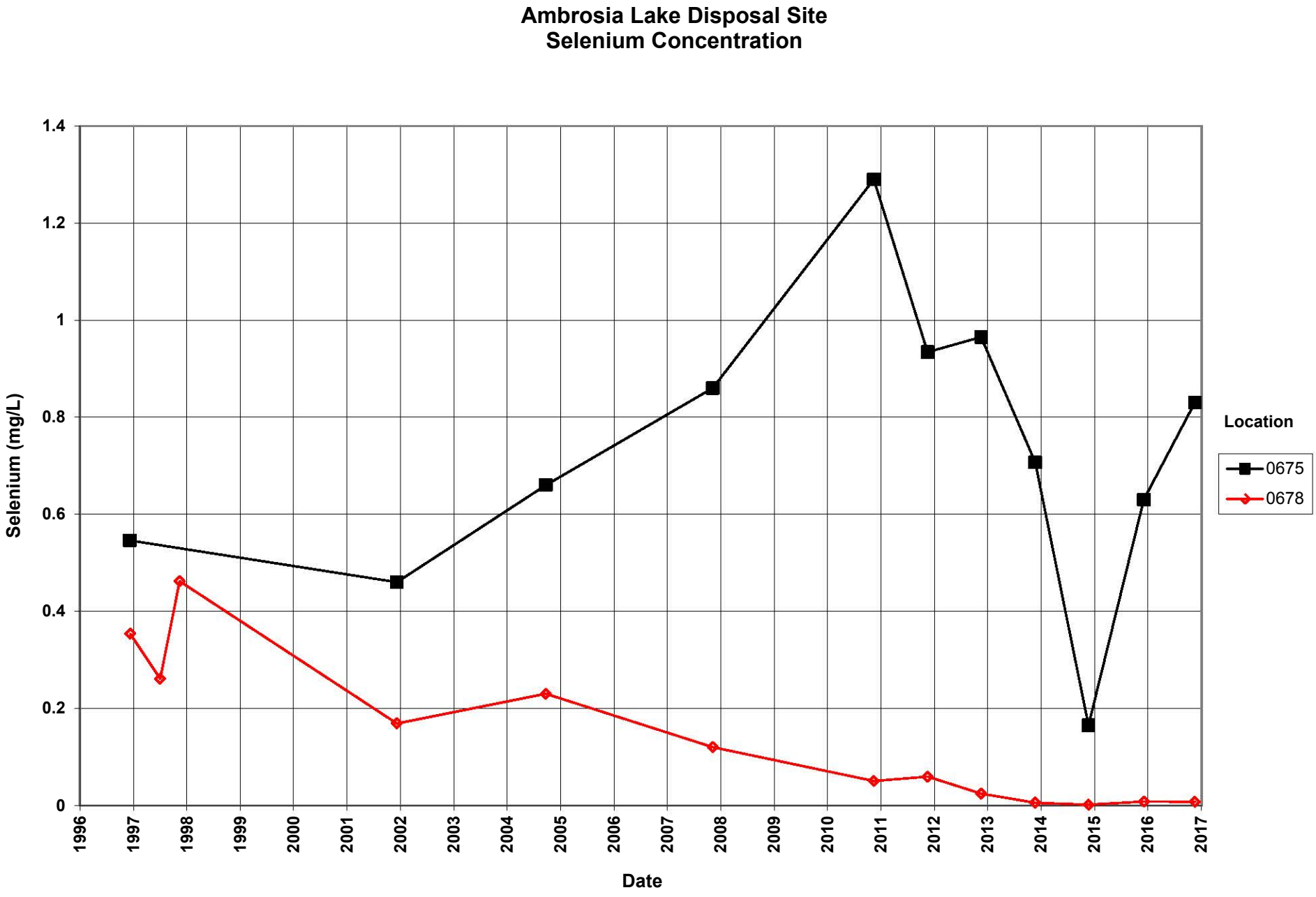
2012
2013
2014
2015
2016
2017
Date
Location
0675
0678


Ambrosia Lake Disposal Site
Selenium Concentration
Selenium (mg/L)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
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2007
2008
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2012
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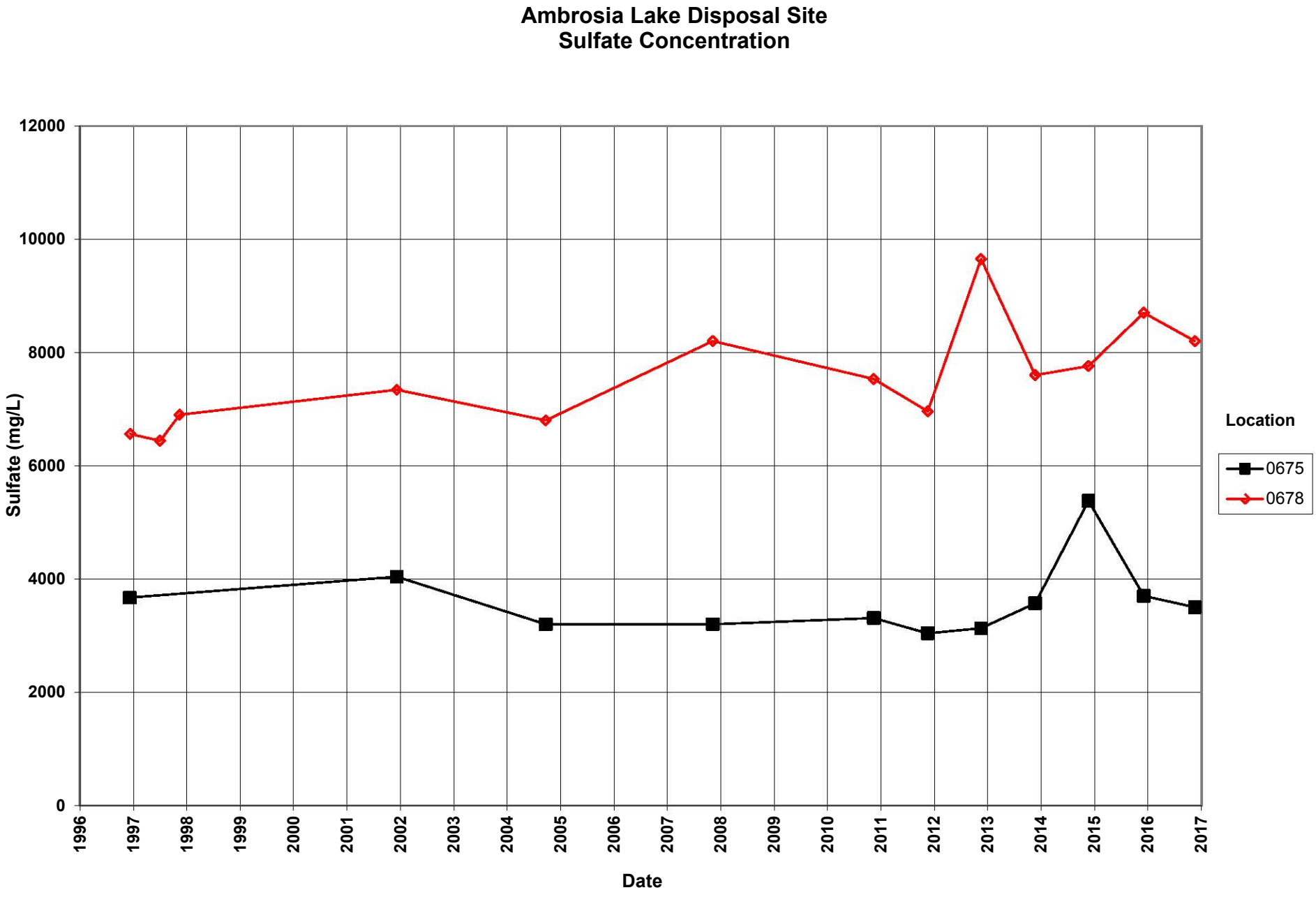
2014
2015
2016
2017
Date
Location
0675
0678


Ambrosia Lake Disposal Site
Sulfate Concentration
Sulfate (mg/L)
12000
10000
8000
6000
4000
2000
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
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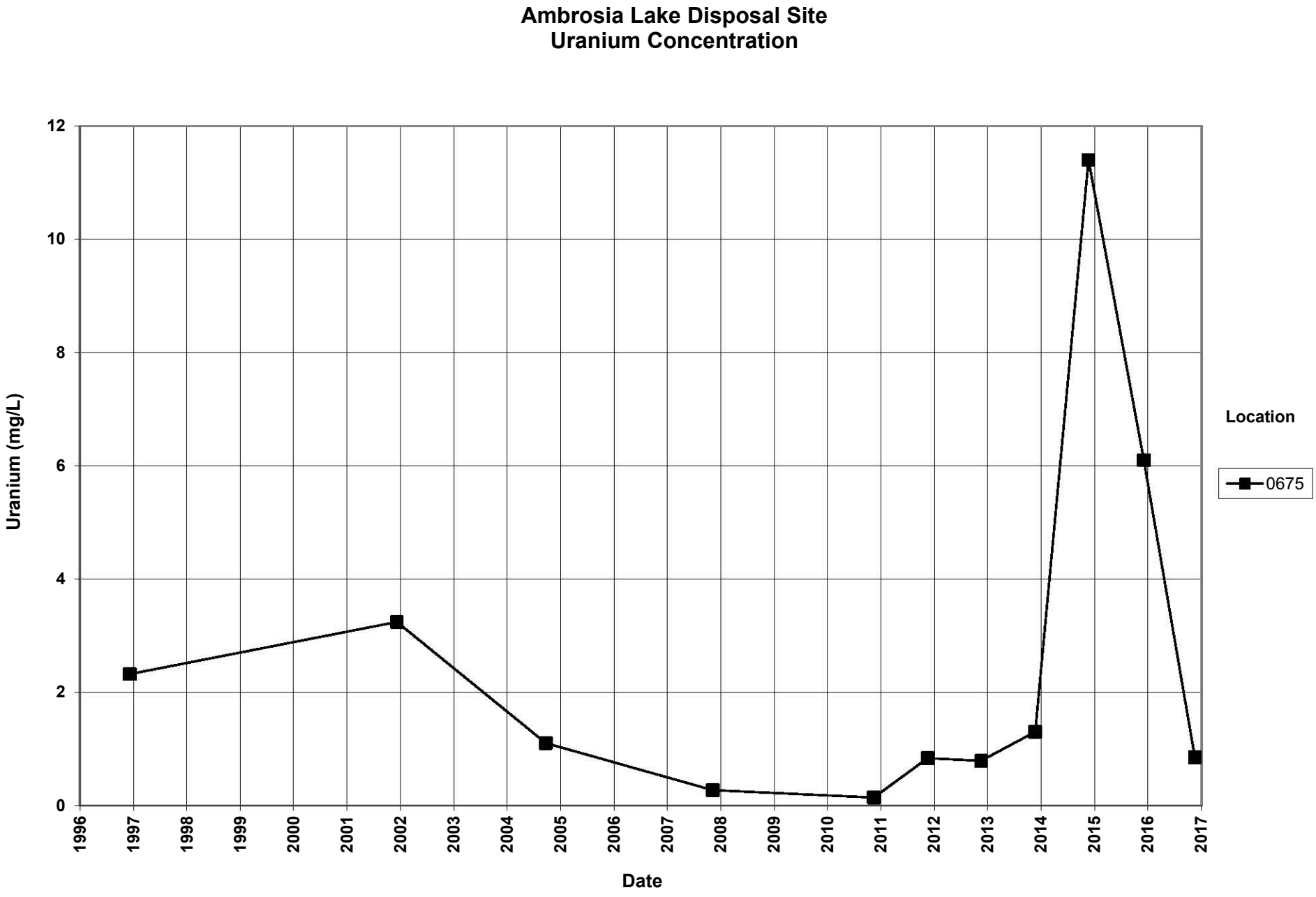
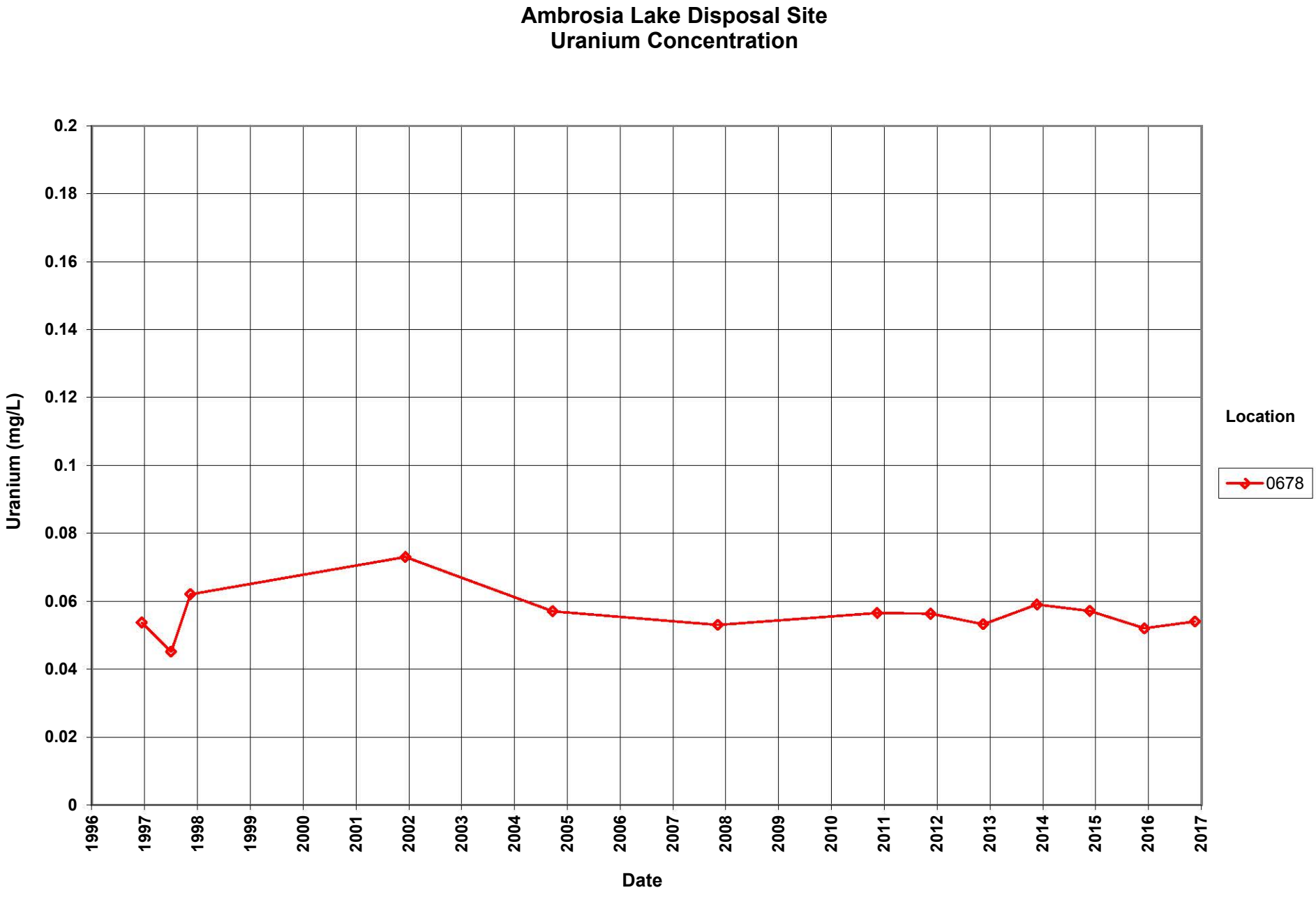
2014
2015
2016
2017
Date
Location
0675
0678


Ambrosia Lake Disposal Site
Uranium Concentration
Uranium (mg/L)
12
10
8
6
4
2
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Date
Location
0675


Ambrosia Lake Disposal Site
Uranium Concentration
Uranium (mg/L)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Date
Location
0678

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Attachment 4

Assessment of Anomalous Data

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Potential Outliers Report

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Potential Outliers Report

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers can result from transcription errors, data-coding errors, or measurement system problems. However, outliers can also represent true extreme values of a distribution and can indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not “fit” with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. **Identify extreme values that may be potential outliers.** Do this by generating the Outliers Report using the Sample Management System from data in the environmental database. The application compares the new data set (in standard environmental database units) with historical data and lists the new data that fall outside the historical data range. A determination is also made as to whether the data are normally distributed using the Shapiro-Wilk Test.
2. **Apply the appropriate statistical test.** Dixon's Test for extreme values is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. **Scientifically review statistical outliers and decide on their disposition.** The review should include an evaluation of any notable trends in the data that may indicate the outliers represent true extreme values.

Table 3 shows the outlier report that was generated using historical data. There were no potential outliers identified, and the data for this event are acceptable as qualified.

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Table 3. Data Validation Outliers Report

Data Validation Outliers Report - No Field Parameters
Comparison: All historical Data Beginning 1/1/2004
Laboratory: ALS Laboratory Group
RIN: 16118137
Report Date: 1/20/2017

					Current			**Historical Maximum**			**Historical Minimum**			**Number of Data Points**		**Statistical Outlier**
						Qualifiers			*Qualifiers*			*Qualifiers*				
Site Code	Location Code	Sample ID	Sample Date	Analyte	Result	*Lab*	*Data*	Result	*Lab*	*Data*	Result	*Lab*	*Data*	N	N Below Detect	
AMB01	0675	N001	11/16/2016	Arsenic	0.00067	J	F	0.0472	N	FJ	0.00130		F	10	1	No
AMB01	0675	N002	11/16/2016	Arsenic	0.00092	J	F	0.0472	N	FJ	0.00130		F	10	1	No
AMB01	0678	N001	11/16/2016	Arsenic	0.00085	J	FQ	0.00470	B	F	0.00091	J	FQ	8	3	No
AMB01	0678	N001	11/16/2016	Magnesium	530		FQ	515		F	475		F	8	0	No
AMB01	0678	N001	11/16/2016	Total Dissolved Solids	13000		FQ	16000		FQ	13900		F	8	0	NA

STATISTICAL TESTS:
The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test
Outliers are identified using Dixon's Test when there are 25 or fewer data points.
Outliers are identified using Rosner's Test when there are 26 or more data points.
See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

NA: Data are not normally or lognormally distributed.

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