
Sandia National Laboratories, New Mexico

Environmental Restoration Operations

A U.S. Department of Energy Environmental Cleanup Program

Consolidated Quarterly Report

October – December 2019



April 2020



United States Department of Energy
Sandia Field Office

CONSOLIDATED QUARTERLY REPORT

April 2020

SANDIA NATIONAL LABORATORIES, NEW MEXICO

ENVIRONMENTAL RESTORATION OPERATIONS

U.S. DEPARTMENT OF ENERGY:	SANDIA FIELD OFFICE
CONTRACTOR:	NATIONAL TECHNOLOGY AND ENGINEERING SOLUTIONS OF SANDIA
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NUMBER OF POTENTIAL RELEASE SITES SUBJECT TO CORRECTIVE ACTION: 6

SUSPECT WASTE: Radionuclides, metals, organic compounds, and explosives

REPORTING PERIOD: October – December 2019

OVERVIEW

This Sandia National Laboratories, New Mexico Environmental Restoration Operations (ER) Consolidated Quarterly Report (ER Quarterly Report) fulfills all quarterly reporting requirements set forth in the Compliance Order on Consent. Table I-1 lists the six sites remaining in the corrective action process. This ER Quarterly Report presents activities and data as follows:

SECTION I: Environmental Restoration Operations Consolidated Quarterly Report, October – December 2019

SECTION II: Perchlorate Screening Quarterly Groundwater Monitoring Report, October - December 2019

SECTION III: Technical Area-V In-Situ Bioremediation Treatability Study Phase I Full Scale Operation, October – December 2019

ABBREVIATIONS AND ACRONYMS

µg/L	microgram(s) per liter
AGMR	Annual Groundwater Monitoring Report
AOC	Area of Concern
BSG	Burn Site Groundwater
CME	Corrective Measures Evaluation
COC	constituent of concern
Consent Order	Compliance Order on Consent
CY	Calendar Year
CYN	Canyons (acronym used for well identification only)
Dhc	<i>Dehalococcoides</i>
DO	dissolved oxygen
DOE	U.S. Department of Energy
DP	Discharge Permit
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration Operations
ER Quarterly Report	Environmental Restoration Operations Consolidated Quarterly Report
FOP	Field Operating Procedure
GWQB	Ground Water Quality Bureau
HWB	Hazardous Waste Bureau
INJ	injection (acronym used for well identification only)
ISB	in-situ bioremediation
LTS	Long-Term Stewardship
LWDS	liquid waste disposal system (acronym used for well identification only)
MCL	maximum contaminant level
MDL	method detection limit
mg/L	milligrams per liter
MW	monitoring well (acronym used for well identification only)ND Non-detect
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NPN	nitrate plus nitrite
ORP	oxidation reduction potential
pH	potential of hydrogen (negative logarithm of the hydrogen ion concentration)
SAP	Sampling and Analysis Plan
SC	specific conductivity
SNL/NM	Sandia National Laboratories, New Mexico
SWMU	Solid Waste Management Unit
TA2-W	Technical Area-II (Well) (acronym used for well identification only)
TA2-SW	Technical Area-II (Southwest) (acronym used for well identification only)

TAG	Tijeras Arroyo Groundwater
TAV	Technical Area-V (acronym used for well identification numbers in tables only)
TA-V	Technical Area-V
TAVG	Technical Area-V Groundwater
TCE	trichloroethene
TJA	Tijeras Arroyo (acronym used for well identification numbers in tables only)
TOC	total organic carbon
TSWP	Treatability Study Work Plan
VOC	volatile organic compound

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SECTION I

ENVIRONMENTAL RESTORATION OPERATIONS CONSOLIDATED

QUARTERLY REPORT, October – December 2019

1.0 Introduction

This Environmental Restoration Operations (ER) Consolidated Quarterly Report (ER Quarterly Report) provides the status of ongoing corrective action activities being implemented at Sandia National Laboratories, New Mexico (SNL/NM) during the October - December 2019 reporting period.

Table I-1 lists the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) currently identified for corrective action at SNL/NM. This section of the ER Quarterly Report summarizes the work completed during this reporting period at sites undergoing corrective action. Corrective action activities were conducted during this reporting period at the three groundwater AOCs:

- Burn Site Groundwater [BSG] AOC,
- Technical Area-V [TA-V] Groundwater [TAVG] AOC, and
- Tijeras Arroyo Groundwater [TAG] AOC).

Corrective action activities are deferred at the Long Sled Track (SWMU 83), the Gun Facilities (SWMU 84), and the Short Sled Track (SWMU 240) because these three sites are active mission facilities. These three active mission sites are located in Technical Area-III.

There were no SWMUs or AOCs in the corrective action complete regulatory process during this reporting period. Except for the three SWMUs noted above, corrective action complete status has been approved for all SWMUs within the surface boundaries of each of the three groundwater AOCs.

2.0 Environmental Restoration Operations Work Completed

The following subsections identify the constituents of concern (COCs), summarize the corrective action milestones, and describe the ER work completed during the October - December 2019 reporting period at the three groundwater AOCs.

2.1 **Sites Undergoing Corrective Action**

In a letter dated April 14, 2016, the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) defined the scope and milestones for corrective action at three groundwater AOCs (BSG AOC, TAVG AOC, and TAG AOC) (NMED April 2016). Sections I.2.1.1 through I.2.1.3 discuss the specific milestones from this letter.

2.1.1 **Burn Site Groundwater Area of Concern**

Nitrate has been identified as a COC in groundwater at the BSG AOC based on detections above the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) in samples collected from monitoring wells. The EPA MCL and State of New Mexico drinking water standard for nitrate (as nitrogen) is 10 milligrams per liter (mg/L). The groundwater sampling and analysis program for the BSG AOC currently includes perchlorate analyses of water from five groundwater monitoring wells (CYN-MW15 through CYN-MW19).

The U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) and SNL/NM personnel met with the NMED HWB on July 20, 2015 to discuss the status of sites currently undergoing corrective action. For the BSG AOC, all parties agreed to a weight-of-evidence characterization program: (1) to conduct additional isotopic analyses/nitrate fingerprinting and age-dating of the groundwater; (2) to conduct a transducer study using existing wells to determine whether the groundwater is unconfined, semi-confined, or confined; and (3) to conduct an aquifer pumping test to help determine the origin of the elevated nitrates in the groundwater.

In January 2019, a Monitoring Well Installation Work Plan for the BSG AOC was submitted to NMED HWB (SNL/NM January 2019a) and subsequently approved by NMED HWB (NMED February 2019). The work plan proposed a minimum of four wells (CYN-MW16 through CYN-MW19) that will help define the extent of nitrate contamination in groundwater and refine the potentiometric surface in the BSG AOC. Long-term sampling from these new well locations, along with other BSG monitoring wells, will provide data to characterize the AOC and assist in evaluating potential remedial actions.

The following activities occurred at the BSG AOC during the October - December 2019 reporting period:

- Groundwater sampling was conducted in October and November 2019. Table I-3 presents the identification and the sampling frequency for these monitoring wells. The complete analytical results for Calendar Year (CY) 2019 groundwater monitoring will be presented in the SNL/NM CY 2019 Annual Groundwater Monitoring Report (AGMR), which is anticipated to be submitted to the NMED in the summer of 2020.
- Perchlorate analysis of groundwater samples from the BSG AOC is discussed in Section II of this ER Quarterly Report.
- Installed, developed, and surveyed groundwater monitoring wells CYN-MW16, CYN-MW17, CYN-MW18, and CYN-MW19. The Well Installation Report will be submitted to NMED in May 2020.
- Initial sampling event was performed at groundwater monitoring wells CYN-MW16, CYN-MW17, CYN-MW18, and CYN-MW19. A first-time exceedance of an EPA MCL occurred during this reporting period. Concentrations of nitrate plus nitrite in November in well CYN-MW16 were 10.8 mg/L and 11.1 mg/L in the environmental sample and environmental duplicate sample, respectively, exceeding the EPA MCL of 10 mg/L. These new wells will be sampled quarterly and the nitrate plus nitrite sampling results will be evaluated for any trends in subsequent ER Quarterly Reports.

2.1.2 **Technical Area-V Groundwater Area of Concern**

Trichloroethene (TCE) and nitrate have been identified as COCs in groundwater at the TAVG AOC based on detections above the EPA MCLs in samples collected from monitoring wells. The EPA MCLs and the State of New Mexico drinking water standards for TCE and nitrate (as nitrogen) are 5 micrograms per liter ($\mu\text{g/L}$) and 10 mg/L, respectively.

Personnel from the DOE/NNSA, DOE Headquarters Office of Environmental Management, SNL/NM, and NMED HWB worked together to address the groundwater contamination at the TAVG AOC. A meeting was held with the NMED HWB on July 20, 2015, and all parties agreed on a phased Treatability Study to evaluate the effectiveness of in-situ bioremediation as a potential technology to treat the groundwater contamination at the TAVG AOC.

To implement the Treatability Study, SNL/NM personnel plan to install up to three injection wells (TAV-INJ1, TAV-INJ2, and TAV-INJ3) near the highest contaminant concentrations in groundwater detected in monitoring wells TAV-MW6, TAV-MW10, and LWDS-MW1, respectively. The substrate solution containing essential food and nutrients for biostimulation is prepared in aboveground tanks. This substrate solution, along with the biodegradation bacteria, is gravity-injected to groundwater via the injection wells.

The NMED HWB approved the Revised Treatability Study Work Plan (TSWP) (SNL/NM March 2016) on May 10, 2016 (NMED May 2016). In accordance with the Revised TSWP, the Treatability Study is conducted in two phases. Phase I includes a pilot test followed by full-scale operation at the first injection well (TAV-INJ1). Phase II of the Treatability Study includes well installation and full-scale operation at the second and third injection wells (TAV-INJ2 and TAV-INJ3). The decision to install the Phase II injection wells is dependent upon the findings of the Phase I full-scale operation.

The NMED Ground Water Quality Bureau (GWQB) required groundwater Discharge Permit (DP) for operation of the injection wells. NMED GWQB issued DP-1845 to DOE/NNSA for the SNL/NM TA-V Treatability Study injection wells on May 26, 2017 (NMED May 2017a). The DP-1845 term starts on May 30, 2017 and ends on May 30, 2022. As required by DP-1845, DOE/NNSA and SNL/NM personnel submit separate quarterly reports to the NMED GWQB.

SNL/NM personnel have completed the Phase I pilot test at injection well TAV-INJ1. The operation and results of the pilot test were presented in Section III of the October 2018 ER Quarterly Report (SNL/NM October 2018). Based on the results of the pilot test, DOE/NNSA and SNL/NM personnel proposed eight modifications for the full-scale operation at well TAV-INJ1 (DOE July 2018). The NMED HWB subsequently approved the modifications on August 13, 2018 (NMED August 2018). Therefore, the implementation of the full-scale operation at well TAV-INJ1 is governed by the Revised TSWP and where applicable, the approved modifications for full-scale operation.

SNL/NM personnel started the Phase I full-scale operation at well TAV-INJ1 in October 2018 and completed the six-month injection period in April 2019. Details on the six-month injection activities were presented in Section III of the October 2019 ER Quarterly Report (SNL/NM October 2019). The injection period is followed by two years of groundwater monitoring for the performance of the in situ bioremediation. The two-year performance monitoring includes three monthly sampling events followed by quarterly sampling events for the remainder of the two-year period, as planned in the Revised TSWP (SNL/NM

March 2016). The three monthly sampling events occurred in May, June, and July 2019. The Phase I Treatability Study performance monitoring is currently on a quarterly schedule until May 2021.

The following activities occurred at TAVG AOC during the October – December 2019 reporting period:

- For the performance monitoring of the Treatability Study, groundwater sampling was conducted at the treatment zone (i.e., in the proximity of injection well TAV-INJ1) as well as outside the treatment zone during this reporting period. Section III presents the groundwater monitoring results for the Treatability Study for this quarter. Analytical results for DP-specific requirements are presented in DP quarterly reports that are submitted separately to the NMED GWQB.
- The TA-V groundwater monitoring network currently comprises of 18 active monitoring wells. Of these 18 wells, well TAV-MW6 is designated as a Treatability Study performance monitoring well and follows the sampling frequency and analytes specified for the Treatability Study (see Section III). Well TAV-MW7, because of its proximity to the injection well TAV-INJ1, continues to serve as a monitoring well for the Treatability Study, although programmatically it belongs to the TA-V groundwater monitoring network (SNL/NM January 2019b). Groundwater monitoring results at wells TAV-MW6 and TAV-MW7 will continue to be reported in Section III of the ER Quarterly Reports for the duration of the Treatability Study.
- Table I-2 presents the CY 2019 sampling frequency for the monitoring wells at TAVG AOC for the 17 wells in the TA-V groundwater monitoring network (18 wells minus well TAV-MW6). Groundwater sampling was conducted in October and November 2019. The SNL/NM CY 2019 AGMR will present the analytical results for CY 2019 groundwater monitoring, which is scheduled for submittal to the NMED HWB in the summer of 2020.
- The concentration of TCE at well TAV-MW4 exceeded the EPA MCL of 5 µg/L for the first time in May 2019 (5.44 µg/L). Data from subsequent quarterly sampling showed that TCE concentrations were 5.09 µg/L in August 2019 and 5.4 µg/L in November 2019. An evaluation of the TCE exceedance at well TAV-MW4 was provided in Appendix A of Section III of the January 2020 ER Quarterly Report (SNL/NM January 2020). Because this well is one of the eight monitoring wells

outside the Treatability Study treatment area that are sampled quarterly, its analytical results are presented in Section III of this quarterly report.

2.1.3 Tijeras Arroyo Groundwater Area of Concern

Nitrate has been identified as a COC in groundwater for the TAG AOC based on exceedances of the EPA MCL in samples collected from monitoring wells completed in the Perched Groundwater System and in the merging zone above the Regional Aquifer. TCE has been identified as a COC for the Perched Groundwater System (NMED April 2004). No TCE concentrations in Regional Aquifer samples have exceeded the EPA MCL. The EPA MCLs and State of New Mexico drinking water standards for TCE and nitrate (as nitrogen) are 5 µg/L and 10 mg/L, respectively.

In May 2017, NMED HWB completed its review of the Current Conceptual Model and Corrective Measures Evaluation Report for the TAG AOC (SNL/NM December 2016), which was submitted to the NMED HWB on November 23, 2016 (DOE November 2016). This report was submitted in accordance with NMED's "Agreements and Proposed Milestones" letter of April 14, 2016 (NMED April 2016). The subsequent disapproval letter issued by the NMED HWB (NMED May 2017b) requested the inclusion of additional information in a revised report. The Revised TAG Current Conceptual Model and Corrective Measures Evaluation Report was then submitted to the NMED HWB on February 13, 2018 (SNL/NM February 2018). The review cycle for NMED HWB is ongoing.

During October - December 2019, groundwater samples were collected from seven monitoring wells (TA2-W-19, TA2-W-26, TA2-W-28, TJA-2, TJA-3, TJA-4, and TJA-7) scheduled for quarterly sampling. Table I-2 presents the CY 2019 sampling frequency for the TAG monitoring wells. sampling purposes. The analytical results for the TAG AOC CY 2019 groundwater monitoring will be included in the SNL/NM CY 2019 AGMR, which is scheduled for submittal to the NMED HWB in the summer of 2020.

2.2 Sites in Corrective Action Complete Regulatory Process

There are currently no SWMUs or AOCs in the corrective action complete regulatory process.

3.0 References

DOE, see U.S. Department of Energy.

New Mexico Environment Department (NMED), April 2004. “Compliance Order on Consent Pursuant to the New Mexico Hazardous Waste Act § 74-4-10: Sandia National Laboratories Consent Order,” New Mexico Environment Department, Santa Fe, New Mexico. April 29, 2004.

New Mexico Environment Department (NMED), April 2016. Letter to J.P. Harrell (U.S. Department of Energy, NNSA/Sandia Field Office) and M. W. Hazen (Sandia National Laboratories, New Mexico), “Summary of Agreements and Proposed Milestones Pursuant to the Meeting of July 20, 2015, March 30, 2016, Sandia National Laboratories, EPA ID# NM5890110518, HWB-SNL-16-MISC,” NMED, Hazardous Waste Bureau, Santa Fe, New Mexico, April 14, 2016.

New Mexico Environment Department (NMED), May 2016. Letter to J. Harrell (U.S. Department of Energy NNSA/Sandia Field Office) and P. Davies (Sandia National Laboratories, New Mexico), “Approval Revised Treatability Study Work Plan for In-Situ Bioremediation at the Technical Area-V Groundwater Area of Concern, Sandia National Laboratories, EPA ID# NM5890110518, HWB-SNL-15-020,” NMED, Hazardous Waste Bureau, Santa Fe, New Mexico, May 10, 2016.

New Mexico Environment Department (NMED), May 2017a. Ground Water Discharge Permit, Sandia National Laboratories/New Mexico, Discharge Permit-1845, NMED, Ground Water Quality Bureau, Santa Fe, New Mexico, May 26, 2017.

New Mexico Environment Department (NMED), May 2017b. Letter to J.P. Harrell (U.S. Department of Energy NNSA/Sandia Field Office) and Carol Adkins (Sandia National Laboratories), “Disapproval Tijeras Arroyo Groundwater Current Conceptual Model and Corrective Measures Evaluation Report, December 2016, Sandia National Laboratories [*sic*] New Mexico, EPA ID# NM5890110518, HWB-SNL-16-020,” May 18, 2017.

New Mexico Environment Department (NMED), August 2018. Letter to J.P. Harrell (U.S. Department of Energy NNSA/Sandia Field Office) and R.O. Griffith (Sandia National Laboratories), “Approval: Technical Area-V (TA-V) Treatability Study Notification of Full-Scale Operation at Well TAV-INJ1, Sandia National Laboratory, EPA ID# NM5890110518, HWB-SNL-15-020,” August 13, 2018.

New Mexico Environment Department (NMED), February 2019. Letter to J.P. Harrell (U.S. Department of Energy NNSA/Sandia Field Office) and P. Shoemaker (Sandia National Laboratories), “Approval: Monitoring Well Installation Work Plan, Burn Site Groundwater Monitoring Wells CYN-MW16 Through CYN-MW23, Sandia National Laboratories, EPA ID# NM5890110518, HWB-SNL-19-003,” February 12, 2019.

NMED, see New Mexico Environment Department.

Sandia National Laboratories, New Mexico (SNL/NM), March 2016. *Revised Treatability Study Work Plan for In-Situ Bioremediation at the Technical Area-V Groundwater Area of Concern*, Sandia National Laboratories, Albuquerque, New Mexico, Environmental Restoration Operations, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), December 2016. *Tijeras Arroyo Groundwater Current Conceptual Model and Corrective Measures Evaluation Report*, Environmental Restoration Operations, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), February 2018. *Revised Tijeras Arroyo Groundwater Current Conceptual Model and Corrective Measures Evaluation Report*, Environmental Restoration Operations, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), October 2018. *Environmental Restoration Operations Consolidated Quarterly Report April – June 2018*, Environmental Restoration Operations, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), January 2019a. *Monitoring Well Installation Work Plan, Burn Site Groundwater Monitoring Wells CYN-MW16 through CYN-MW23*, Sandia National Laboratories, Albuquerque, New Mexico, Environmental Restoration Operations, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), January 2019b. *Environmental Restoration Operations Consolidated Quarterly Report July – September 2018*, Sandia National Laboratories, Albuquerque, New Mexico, Environmental Restoration Operations, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), October 2019. *Environmental Restoration Operations Consolidated Quarterly Report April – June 2019*, Sandia National Laboratories, Albuquerque, New Mexico, Environmental Restoration Operations, Sandia National Laboratories, Albuquerque, New Mexico.

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SNL/NM, see Sandia National Laboratories, New Mexico.

U.S. Department of Energy (DOE), November 2016. Letter to J.E. Kieling (New Mexico Environment Department), “Tijeras Arroyo Groundwater Current Conceptual Model and Corrective Measures Evaluation Report, December 2016,” November 23, 2016.

U.S. Department of Energy (DOE), July 2018. Letter to J. E. Kieling (New Mexico Environment Department), “Technical Area-V (TA-V) Treatability Study Notification of Full-Scale Operation at Well TAV-INJ1”, July 20, 2018.

Tables

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Table I-1
Solid Waste Management Units and Areas of Concern
Where Corrective Action is Not Complete

Solid Waste Management Units and Areas of Concern	
Site Number	Site Description
83	Long Sled Track
84	Gun Facilities
240	Short Sled Track
NA	Tijeras Arroyo Groundwater Investigation (TAG AOC)
NA	TA-V Groundwater Investigation (TAVG AOC)
NA	Burn Site Groundwater Investigation (BSG AOC)

Notes:

AOC = Area of Concern.
 BSG = Burn Site Groundwater.
 NA = Not applicable. A site number was not assigned.
 TAG = Tijeras Arroyo Groundwater.
 TA-V = Technical Area-V.
 TAVG = Technical Area-V Groundwater.

**Table I-2
Groundwater Sampling and Analysis**

Investigation Site	Sampling Frequency in CY 2019	Quarter of Sampling in CY 2019	Location of Analytical Results	Location of Perchlorate Analytical Results	Monitoring Wells in Network
TAVG AOC ^a	Quarterly	1,2,3,4	AGMR	NA	LWDS-MW1, TAV-MW2, TAV-MW4, TAV-MW7, TAV-MW8, TAV-MW10, TAV-MW11, TAV-MW12, TAV-MW14, TAV-MW15, TAV-MW16
	Annually	2	AGMR	NA	AVN-1, LWDS-MW2, TAV-MW3, TAV-MW5, TAV-MW9, TAV-MW13
BSG AOC	Semiannually	2,4	AGMR	Section II of ER Consolidated Quarterly Report	CYN-MW4, CYN-MW7, CYN-MW8, CYN-MW9, CYN-MW10, CYN-MW11, CYN-MW12, CYN-MW13, CYN-MW14A, CYN-MW15
	Quarterly	4	AGMR	Section II of ER Consolidated Quarterly Report	CYN-MW16, CYN-MW17, CYN-MW18, CYN-MW19
TAG AOC ^b	Quarterly	1,2,3,4	AGMR	NA	TA2-W-19, TA2-W-26, TA2-W-28, TJA-2, TJA-3, TJA-4, TJA-7
	Semiannually	1,3	AGMR	NA	TA1-W-06, TA2-W-01, TA2-W-27, TJA-6
	Annually	3	AGMR	NA	PGS-2, TA1-W-01, TA1-W-02, TA1-W-03, TA1-W-04, TA1-W-05, TA1-W-08, TA2-NW1-595, WYO-3

Notes:

^aTAVG AOC monitoring network comprises 18 active wells: 17 wells are listed here; well TAV-MW6 currently is part of the Treatability Study and follows a separate monitoring plan (see Section 2.1.2).

^bMonitoring well WYO-4 was deleted from the sampling schedule in response to the August 2017 meeting with NMED HWB personnel.

- AGMR = Annual Groundwater Monitoring Report.
- AOC = Area of Concern.
- AVN = Area-V (North) (acronym used for well identification only).
- BSG = Burn Site Groundwater (Area of Concern).
- CY = Calendar Year.
- CYN = Canyons (Burn Site Groundwater Area of Concern; acronym used for well identification only).
- ER = Environmental Restoration.
- HWB = Hazardous Waste Bureau.
- LWDS = Liquid waste disposal system (acronym used for well identification only).
- MW = Monitoring well (acronym used for well identification only).
- NA = Not applicable. No wells in the site network are currently being sampled and analyzed for perchlorate, or were not sampled during this reporting period.
- NMED = New Mexico Environment Department.
- PGS = Parade Ground South (acronym used for well identification only).
- TA1-W = Technical Area-I (Well) (acronym used for well identification only).
- TA2-NW = Technical Area-II (Northwest) (acronym used for well identification only).
- TA2-W = Technical Area-II (Well) (acronym used for well identification only).
- TAG = Tijeras Arroyo Groundwater (Area of Concern).
- TAV = Technical Area-V (acronym used for well identification only).
- TAVG = Technical Area-V Groundwater (Area of Concern).
- TJA = Tijeras Arroyo (acronym used for well identification only).
- WYO = Wyoming (acronym used for well identification only).

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SECTION II

PERCHLORATE SCREENING QUARTERLY GROUNDWATER MONITORING REPORT, October – December 2019

Introduction

1.0

Section IV.B of the Compliance Order on Consent (the Consent Order), between the New Mexico Environment Department (NMED), the U.S. Department of Energy (DOE), and Sandia National Laboratories, New Mexico (SNL/NM), effective on April 29, 2004, stipulates that a select group of groundwater monitoring wells at SNL/NM be sampled for perchlorate (NMED April 2004). This section of the Environmental Restoration Operations (ER) Consolidated Quarterly Report (ER Quarterly Report) summarizes the perchlorate screening groundwater monitoring completed during the October – December 2019 reporting period in response to the requirements of the Consent Order. The outline of this report is based on the required elements of a “Periodic Monitoring Report” described in Section X.D. of the Consent Order (NMED April 2004).

In November 2005, DOE/National Nuclear Security Administration (NNSA) and SNL/NM personnel submitted a letter report on the status of perchlorate screening in groundwater at SNL/NM monitoring wells (SNL/NM November 2005). The letter report summarized previous correspondence and sampling results and outlined proposed future work to comply with NMED Hazardous Waste Bureau (HWB) requirements for perchlorate screening of groundwater. As specified in the letter report, quarterly reports are submitted for wells active in the perchlorate screening monitoring well network.

Based on the NMED HWB response (NMED January 2006), DOE/NNSA and SNL/NM personnel submit each quarterly report within 90 days following the quarter that the data represent. In November 2008, DOE/NNSA and SNL/NM personnel received approval from the NMED HWB to proceed to semiannual reporting (NMED November 2008); however, upon further consideration, the NMED HWB once more required quarterly reporting (NMED April 2009). This did not alter the previously negotiated frequency for monitoring well CYN-MW6, an existing Burn Site Groundwater (BSG) Area of Concern (AOC) monitoring well that has been under the sampling and reporting requirements of the Consent Order since the well was installed, which remains at a semiannual frequency for sampling and reporting. Due to declining water levels, CYN-MW6 has insufficient water to routinely sample and the replacement monitoring well (CYN-MW15) was installed in December 2014; the negotiated semiannual sampling frequency transferred to the replacement well.

In September 2011, DOE/NNSA and SNL/NM personnel requested an extension of the submittal dates by one month for ER Quarterly Reports (SNL/NM September 2011). The NMED HWB approved the request (NMED September 2011), which allows DOE/NNSA and SNL/NM personnel to submit perchlorate quarterly reports within 120 days following the quarter that the data represent.

This report is the forty-ninth perchlorate screening quarterly report submitted since the November 2005 letter report (SNL/NM February 2006).

Groundwater at BSG AOC monitoring well CYN-MW15 was sampled semiannually for the eleventh time during the reporting period; and wells CYN-MW16, CYN-MW17, CYN-MW18, and CYN-MW19 were sampled for the first time during this reporting period (Table II-1). The corresponding reporting will continue for as long as a well remains active in the perchlorate screening monitoring well network, or unless otherwise negotiated with the NMED.

2.0 **Scope of Activities**

This report provides October – December 2019 perchlorate screening groundwater monitoring analytical results for wells CYN-MW15 through CYN-MW19 (Figure II-1, Table II-1). In accordance with the requirements of Table XI-1 of the Consent Order, a well with four consecutive quarters of non-detects (NDs) for perchlorate at the screening level/method detection limit (MDL) of 4 micrograms per liter ($\mu\text{g/L}$) is removed from the requirement of continued monitoring for perchlorate. Data for numerous wells identified in the Consent Order have satisfied this requirement; these wells have been removed from the perchlorate screening program. Perchlorate results for these wells are not discussed in this current report. Table II-2 lists the wells discussed in previous perchlorate screening reports.

SNL/NM personnel performed groundwater sampling for perchlorate at monitoring well CYN-MW15 in October 2019 and at wells CYN-MW16 through CYN-MW19 in November 2019 (Table II-1). Groundwater sampling activities were conducted in accordance with procedures outlined in the *Burn Site Groundwater Monitoring, Mini-SAP for First Quarter, Fiscal Year 2020* (SNL/NM September 2019) and *Burn Site Groundwater Monitoring, Mini-SAP for First Quarter, Fiscal Year 2020—ER Wells* (SNL/NM November 2019).

As described in the Mini-Sampling and Analysis Plans (SAP), groundwater sampling was performed in accordance with current SNL/NM Long-Term Stewardship Project Field Operating Procedures (FOPs). A portable BennettTM groundwater sampling system was used to collect the groundwater samples. The sampling pump and tubing bundle were

decontaminated prior to placement into each monitoring well in accordance with procedures described in FOP 05-03, “Groundwater Monitoring Equipment Decontamination” (SNL/NM January 2018a). Wells were purged a minimum of one saturated screen volume before sampling in accordance with FOP 05-01, “Groundwater Monitoring Well Sampling and Field Analytical Measurements” (SNL/NM January 2018b). Field water quality measurements for turbidity, potential of hydrogen (pH), temperature, specific conductivity (SC), oxidation-reduction potential (ORP), and dissolved oxygen (DO) were obtained from the well prior to collecting the groundwater sample. Groundwater temperature, SC, ORP, DO, and pH were measured with an In-Situ Incorporated Aqua TROLL[®] 600 Multiparameter water quality meter. Turbidity was measured with a HACH[™] Model 2100Q turbidity meter. Purging continued until four stable measurements for turbidity, pH, temperature, and SC were obtained. Groundwater stability is considered acceptable when the following parameters are achieved:

- Turbidity measurements are less than 5 nephelometric turbidity units, or within 10 percent for turbidity values greater than 5 nephelometric turbidity units.
- pH is within 0.1 units.
- Temperature is within 1.0 degree Celsius.
- SC is within 5 percent.

Field measurement logs documenting details of well purging and water quality measurements have been submitted to the SNL/NM Customer Funded Record Center.

Groundwater samples were submitted to GEL Laboratories, LLC for chemical analysis of perchlorate using U.S. Environmental Protection Agency (EPA) Method 314.0 (EPA November 1999). Table II-3 provides the sample identification, Analysis Request/Chain-of-Custody form number, and the associated groundwater investigation area. The analytical report from GEL Laboratories, LLC, including certificates of analysis (Appendix A), analytical methods, MDLs, practical quantitation limits, dates of analyses, results of quality control analyses, and data validation findings (Appendix B), have been submitted to the SNL/NM Customer Funded Record Center.

3.0 **Regulatory Criteria**

For a given monitoring well, four consecutive ND results using the screening level/MDL of 4 µg/L are considered by the NMED HWB as evidence of the absence of perchlorate, such

that additional monitoring for perchlorate in that well is not required. If perchlorate is detected using the screening level/MDL of 4 µg/L in a specific well, then monitoring will continue at that well at a frequency negotiated with the NMED. The Consent Order (NMED April 2004) also requires that detections equal to or greater than 4 µg/L be evaluated by DOE/NNSA and SNL/NM personnel to determine the nature and extent of perchlorate contamination and incorporate the results of this evaluation into a Corrective Measures Evaluation (CME), based on a screening level/MDL of 4 µg/L. The Consent Order, Section VII.C, clarifies that the CME process will be initiated where there is a documented release to the environment, and where corrective measures are necessary to protect human health and the environment.

3.1

Burn Site Groundwater Area of Concern

In March 2007, NMED HWB sent a letter of approval, which required DOE/NNSA and SNL/NM personnel to “determine the nature and extent of the contamination and complete a CME for the perchlorate-impacted groundwater in the vicinity of CYN-MW6” (NMED March 2007). As this was based solely on four quarters of monitoring results, DOE and SNL/NM personnel submitted a letter to the NMED HWB in April 2007 (SNL/NM April 2007) recommending further characterization through continued quarterly monitoring of monitoring well CYN-MW6 for an additional four quarters, ending in December 2007, to ensure appropriate characterization of this well. In January 2008, DOE/NNSA and SNL/NM personnel requested a meeting with the NMED HWB to discuss the need for continued monitoring or additional characterization work and, potentially, a CME.

In preparation for discussing the perchlorate-impacted groundwater in the vicinity of monitoring well CYN-MW6, and to show that the requirement “to determine the nature and extent of contamination” (NMED March 2007) had been met, DOE/NNSA and SNL/NM personnel provided supporting information to the NMED HWB (SNL/NM March 2008). Perchlorate in surface soil has been characterized at several Solid Waste Management Units in the study area (SNL/NM June 2006 and March 2008–Appendix C). Based on these data, DOE/NNSA and SNL/NM personnel consider the nature and extent of perchlorate in groundwater at the BSG AOC to be sufficiently characterized. Since 2004, groundwater samples from four other monitoring wells in the vicinity of the BSG AOC have been analyzed for perchlorate, including monitoring wells CYN-MW1D, CYN-MW5, CYN-MW7, and CYN-MW8. All wells were sampled for four quarters and all results were ND for perchlorate (SNL/NM March 2008–Appendix D).

In accordance with the requirements of Section VI.K.1.b of the Consent Order (NMED April 2004), a human health risk assessment has been performed to evaluate the potential for adverse health effects from the concentrations of perchlorate detected

in monitoring well CYN-MW6 groundwater samples. The maximum perchlorate concentration to date of 8.93 µg/L was used in the risk assessment. The calculated hazard quotient of 0.35 is less than the NMED HWB target level of a hazard index (the sum of all hazard quotients) of 1.0 (NMED June 2006, SNL/NM March 2008–Appendix E). For another point of comparison, NMED HWB risk assessment guidance lists a tap water standard of 13.8 µg/L for perchlorate (NMED February 2019a); therefore, the historical maximum concentration detected is 35 percent less than the NMED HWB tap water standard.

Because perchlorate concentrations in samples from monitoring well CYN-MW6 have exceeded the screening level, DOE/NNSA and SNL/NM personnel initiated a negotiation process with the NMED HWB (SNL/NM March 2007) to determine the frequency of continued monitoring. In November 2008, DOE/NNSA and SNL/NM personnel received approval from the NMED HWB to proceed with semiannual monitoring of perchlorate in monitoring well CYN-MW6 and proceed with semiannual reporting of all perchlorate results (NMED November 2008). Upon further consideration, the NMED HWB once more required that DOE/NNSA and SNL/NM personnel resume quarterly reporting of perchlorate results with the exception of monitoring well CYN-MW6 (NMED April 2009). Due to declining water levels, CYN-MW6 has insufficient water to routinely sample and was replaced; the last sample collected at CYN-MW6 was on October 15, 2012. The replacement monitoring well (CYN-MW15) was installed in December 2014 and assumed the negotiated semiannual monitoring frequency. Monitoring well CYN-MW14A was also installed in December 2014; this well was considered a new monitoring well that requires quarterly sampling due to its deep screen interval.

In April 2009, NMED HWB sent a letter that required DOE/NNSA and SNL/NM personnel to characterize the nature and extent of the perchlorate contamination in soil and groundwater in the BSG AOC (NMED April 2009). A characterization work plan was prepared and submitted to the NMED HWB (SNL/NM November 2009), approved by the NMED HWB (NMED February 2010), and implemented in July 2010.

In January 2019, a Monitoring Well Installation Work Plan for the BSG AOC was submitted to NMED HWB (SNL/NM January 2019) and subsequently approved by NMED HWB (NMED February 2019b). The work plan proposed a minimum of four wells (CYN-MW16 through CYN-MW19) that will help define the extent of nitrate contamination in groundwater and refine the potentiometric surface in the BSG AOC. These four new wells were sampled for the first time during this reporting period and will be sampled for perchlorate for a minimum of four quarters.

3.2 **Tijeras Arroyo Groundwater and Technical Area-V Groundwater Areas of Concern**

The April 2009 letter from the NMED HWB to DOE/NNSA and SNL/NM personnel was not limited to the BSG AOC (NMED April 2009). The NMED HWB had also requested that DOE/NNSA and SNL/NM personnel monitor perchlorate concentrations for a minimum of four quarters at five monitoring wells in the Tijeras Arroyo Groundwater (TAG) AOC and at four monitoring wells in the Technical Area-V Groundwater AOC. All nine wells from these two AOCs have been sampled for four consecutive monitoring events with no perchlorate detections being reported; therefore, these nine wells have been removed from the perchlorate monitoring well network. A TAG monitoring well (TA2-SW1-320) was damaged and was replaced by well, TA2-W-28 in December 2014. The replacement well was installed for monitoring the same depth interval as damaged well TA2-SW1-320. Because well TA2-SW1-320 was not one of the four TAG wells selected for perchlorate sampling, replacement well TA2-W-28 does not require perchlorate sampling.

4.0 **Monitoring Results**

Table II-3 summarizes the details of samples collected from the five monitoring wells in the October - December 2019 reporting period. Table II-4 summarizes the current and historical perchlorate results for these wells. Appendix A provides the analytical laboratory certificates of analysis for the October – December 2019 perchlorate data. For the sixth time in eleven sampling events (since December 2014), perchlorate was ND at the screening level/MDL of 4.0 µg/L in the October 2019 CYN-MW15 environmental groundwater sample (Figure II-2). The hydrograph for monitoring well CYN-MW15 (Figure II-2) shows that the water table elevation has been slightly decreasing over the past several years. Perchlorate was ND in the November 2019 environmental groundwater samples from all four new wells CYN-MW16 through CYN-MW19.

Table II-5 summarizes the stabilized water quality values measured immediately before the groundwater samples were collected. The field water quality measurements include turbidity, pH, temperature, SC, ORP, and DO.

The analytical data were reviewed and validated in accordance with Administrative Operating Procedure 00-03, “Data Validation Procedure for Chemical and Radiochemical Data,” (SNL/NM June 2017). No problems were identified with the analytical data that resulted in qualification of the data as unusable. The data are acceptable and reported quality control measures are adequate. Appendix B provides the data validation sample findings summary sheets for the perchlorate data.

No variances or nonconformances in perchlorate sampling field activities, or field conditions from requirements in the groundwater monitoring Mini-SAPs (SNL/NM September 2019, SNL/NM November 2019), were identified during the October - December 2019 sampling activities except for turbidity measurements at CYN-MW15. The turbidity of the groundwater during sampling of CYN-MW15 (Table II-5) was much higher than historical values. There was heavy construction equipment traffic near this well for several months preceding sampling, and it is postulated that excessive vibrations from this equipment caused the filter pack to settle and infiltrate the screen.

5.0 **Summary and Conclusions**

Based on analytical data presented in Table II-4 and in previous reports, the following statements can be made:

- The perchlorate concentrations for the groundwater samples from the four new monitoring wells (CYN-MW16 through CYN-MW19) were all ND.
- The perchlorate concentration for the groundwater sample from monitoring well CYN-MW15 for the October - December 2019 sampling event was ND. This is the sixth sampling event (non-consecutive) that perchlorate was ND at this well since December 2014 (Figure II-2).
- Since June 2004 (the start of sampling as required by the Consent Order), perchlorate was detected above the screening level/MDL (4 µg/L) in groundwater samples from only one well (CYN-MW6) and its replacement well (CYN-MW15) in the perchlorate monitoring well network.
- DOE/NNSA and SNL/NM personnel will continue semiannual monitoring of perchlorate at monitoring well CYN-MW15 and quarterly monitoring of perchlorate at monitoring wells CYN-MW16 through CYN-MW19.

6.0 References

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SNL/NM, see Sandia National Laboratories, New Mexico.

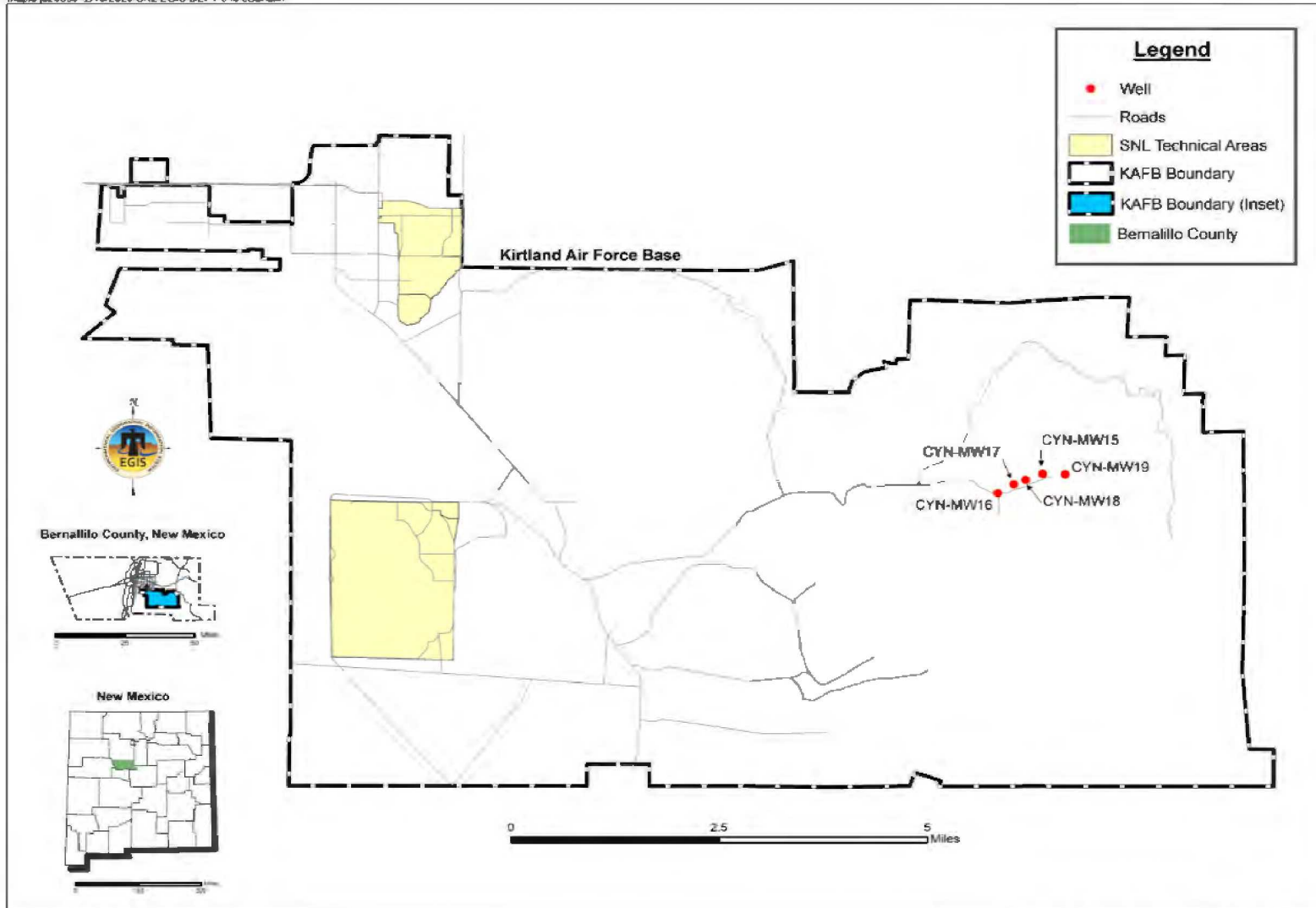
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U.S. Environmental Protection Agency (EPA), November 1999. “Perchlorate in Drinking Water Using Ion Chromatography,” EPA 815/R-00-014.

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Figures

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Sandia National Laboratories, New Mexico
Environmental Geographic Information System

New Mexico State Plane Central Zones, 1983
1988 North American Vertical Datum

Figure II-1
Sandia National Laboratories, New Mexico
Current Perchlorate Screening Monitoring Well Network, October – December 2019

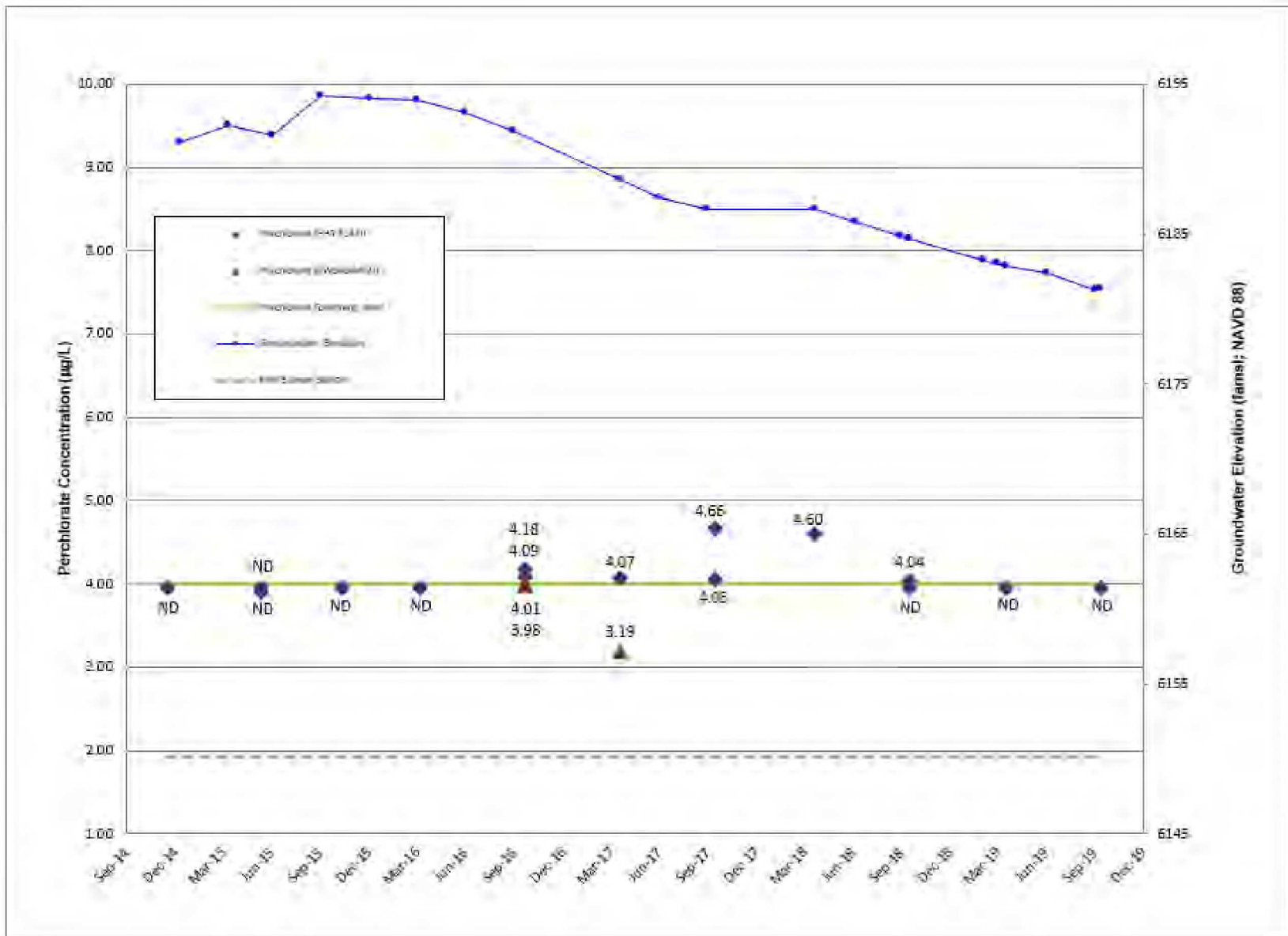


Figure II-2
Groundwater Elevations and Perchlorate Concentrations Over Time in CYN-MW15

Tables

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Table II-1
Current Perchlorate Screening Monitoring Well Network
October - December 2019

Well	Date Sampled	Number of Consecutive Sampling Events ^a	Remaining Number of Sampling Events	Sampling Equipment
CYN-MW15	11-Oct-19	11	TBD ^b	Bennett™ Pump
CYN-MW16	20-Nov-19	1	3	Bennett™ Pump
CYN-MW17	19-Nov-19	1	3	Bennett™ Pump
CYN-MW18	19-Nov-19	1	3	Bennett™ Pump
CYN-MW19	18-Nov-19	1	3	Bennett™ Pump

Notes

^aIncludes this sampling event.

^bThis well was installed as a replacement well for CYN-MW6. Because perchlorate concentrations in CYN-MW6 have exceeded the screening level/MDL, DOE/NNSA, SNL/NM, and the NMED HWB have agreed to further characterization through continued monitoring in the BSG AOC (NMED February 2010).

- AOC = Area of Concern.
- BSG = Burn Site Groundwater.
- CYN = Canyons (Burn Site Groundwater Area of Concern).
- DOE = U.S. Department of Energy.
- HWB = Hazardous Waste Bureau.
- MDL = Method detection limit.
- MW = Monitoring well.
- NMED = New Mexico Environment Department.
- NNSA = National Nuclear Security Administration.
- SNL/NM = Sandia National Laboratories, New Mexico.
- TBD = To be determined.

Table II-2
Monitoring Wells Discussed in Previous Perchlorate Screening Reports

Well	
CCBA-MW1	MWL-MW1
CCBA-MW2	MWL-MW7
CTF-MW1	MWL-MW8
CTF-MW2	MWL-MW9
CTF-MW3	NWTA3-MW2
CYN-MW1D	OBS-MW1
CYN-MW5	OBS-MW2
CYN-MW6	OBS-MW3
CYN-MW7	SWTA3-MW4
CYN-MW8	TA1-W-03
CYN-MW9	TA1-W-06
CYN-MW10	TA1-W-08
CYN-MW11	TA2-W-01
CYN-MW12	TA2-W-27
CYN-MW14A	TAV-MW11
LWDS-MW1	TAV-MW12
MRN-2	TAV-MW13
MRN-3D	TAV-MW14
MWL-BW1	TAV-MW15
MWL-BW2	TAV-MW16

Notes

- BW = Background well.
- CCBA = Coyote Canyon Blast Area.
- CTF = Coyote Test Field.
- CYN = Canyons (Burn Site Groundwater Area of Concern).
- LWDS = Liquid waste disposal system.
- MRN = Magazine Road North.
- MW = Monitoring well.
- MWL = Mixed Waste Landfill.
- NWTA3 = Northwest Technical Area (-III).
- OBS = Old Burn Site.
- SWTA3 = Southwest Technical Area (-III).
- TA1-W = Technical Area-I (Well).
- TA2-W = Technical Area-II (Well).
- TAV = Technical Area-V.

**Table II-3
Sample Details for October - December 2019 Perchlorate Sampling**

Well	Sample Identification	AR/COC Number	Associated Groundwater Investigation
CYN-MW15	110529-004	620306	BSG AOC
CYN-MW16	111922-007 111923-004	620651	BSG AOC
CYN-MW17	111926-007	620652	BSG AOC
CYN-MW18	111929-007	620653	BSG AOC
CYN-MW19	111932-007	620654	BSG AOC

Notes

AOC = Area of Concern.
 AR/COC = Analysis Request/Chain-of-Custody.
 BSG = Burn Site Groundwater.
 CYN = Canyons (Burn Site Groundwater Area of Concern).
 MW = Monitoring well.

Table II-4
Summary of Perchlorate Screening Analytical Results for the
Current Monitoring Well Network, October - December 2019

Well	Sample Date	AR/COC Number	Sample Number	Result (µg/L)	MDL (µg/L)	PQL (µg/L)	MCL (µg/L)	Laboratory Qualifier ^a	Validation Qualifier ^b	Analytical Method ^c	Comments	
Burn Site Groundwater Area of Concern												
CYN-MW15	17-Dec-14	615941	096979-020	ND	4.0	12	NE	U		EPA 314.0		
	11-Jun-15	616178	097842-020	ND	4.0	12	NE	U		EPA 314.0		
			097843-020	ND	4.0	12	NE	U		EPA 314.0	Duplicate sample	
	10-Nov-15	616396	098486-020	ND	4.0	12	NE	U		EPA 314.0		
	05-Apr-16	616862	099139-008	ND	4.0	12	NE	U		EPA 314.0		
	21-Oct-16	617385	100705-004	4.09	4.0	12	NE	J			EPA 314.0	
			100705-R04	3.98	0.25	1	NE				SW846 6850	
			100706-004	4.18	4.0	12	NE	J			EPA 314.0	Duplicate sample
	19-Apr-17	617823	102400-R04	4.01	0.25	1	NE				SW846 6850	Duplicate sample
			102400-013	4.07	4.0	12	NE	J			EPA 314.0	
			102400-R13	3.19	0.10	0.4	NE	Hh	J-		SW846 6850	
	13-Oct-17	618205	103748-004	4.05	4.0	12	NE	J			EPA 314.0	
			103749-004	4.66	4.0	12	NE	J			EPA 314.0	Duplicate sample
	19-Apr-18	618667	105068-008	4.60	4.0	12	NE	J			EPA 314.0	
	16-Oct-18	619203	106473-004	ND	4.0	12	NE	U			EPA 314.0	
106474-004			4.04	4.0	12	NE	J			EPA 314.0	Duplicate sample	
17-Apr-19	619631	108030-008	ND	4.0	12	NE	U			EPA 314.0		
11-Oct-19	620306	110529-004	ND	4.0	12	NE	NU			EPA 314.0		
CYN-MW16	20-Nov-19	620651	111922-007	ND	4.0	12	NE	U			EPA 314.0	
			111923-004	ND	4.0	12	NE	U			EPA 314.0	Duplicate sample
CYN-MW17	19-Nov-19	620652	111926-007	ND	4.0	12	NE	U			EPA 314.0	
CYN-MW18	19-Nov-19	620653	111929-007	ND	4.0	12	NE	U			EPA 314.0	
CYN-MW19	18-Nov-19	620654	111932-007	ND	4.0	12	NE	U			EPA 314.0	

Notes

^aLaboratory Qualifier

If cell is blank, then all quality control samples meet acceptance criteria with respect to submitted samples.

- H = Analytical holding time was exceeded.
- h = Prep holding time exceeded.
- J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.
- N = Results associated with a spike analysis that was outside control limits.
- U = Analyte is absent or below the MDL.

^bValidation Qualifier

If cell is blank, then all quality control samples meet acceptance criteria with respect to submitted samples.

- J- = The associated numerical value is an estimated quantity with a suspected negative bias.

Table II-4 (concluded)
Summary of Perchlorate Screening Analytical Results for the
Current Monitoring Well Network, October - December 2019

Notes (continued)

***Analytical Method**

EPA 314.0: EPA, November 1999, "Perchlorate in Drinking Water Using Ion Chromatography," EPA 815/R-00-014 .

SW846 6850: EPA, 1986 (and updates), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd ed., EPA, Washington, D.C.

% = Percent.

µg/L = Micrograms per liter.

AR/COC = Analysis Request/Chain-of-Custody.

CFR = Code of Federal Regulations.

CYN = Canyons (Burn Site Groundwater Area of Concern).

EPA = U.S. Environmental Protection Agency.

MCL = Maximum contaminant level. Established by the EPA Primary Water Regulations (40 CFR 141.11, Subpart B) and subsequent amendments or Title 20, Chapter 7, Part 1 of the New Mexico Administrative Code, incorporating 40 CFR 141.

MDL = Method detection limit. The minimum concentration that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix-specific.

MW = Monitoring well.

ND = Non-detect (at MDL).

NE = Not established.

PQL = Practical quantitation limit. The lowest concentration of analytes in a sample that can be reliably determined within specified limits of precision and accuracy by the indicated method under routine laboratory operating conditions.

SW = Solid waste.

Table II-5
Perchlorate Screening Groundwater Monitoring
Field Water Quality Measurements^a, October - December 2019

Well	Sample Date	Temperature (°C)	Specific Conductivity (µmho/cm)	Oxidation-Reduction Potential (mV)	pH	Turbidity (NTU)	Dissolved Oxygen (% Sat)	Dissolved Oxygen (mg/L)
Burn Site Groundwater Area of Concern								
CYN-MW15	11-Oct-19	16.58	1153.2	157.7	7.09	134	21.33	1.70
CYN-MW16	20-Nov-19	17.55	722.9	20.6	7.29	0.82	14.50	1.22
CYN-MW17	19-Nov-19	18.01	644.2	-41.3	7.10	1.06	15.50	1.24
CYN-MW18	19-Nov-19	17.62	785.3	90.4	6.85	20.0	11.16	0.92
CYN-MW19	18-Nov-19	16.01	686.3	92.6	7.43	0.72	77.71	6.73

Notes

^aField measurements obtained immediately before the groundwater sample was collected.

- °C = Degrees Celsius.
- % Sat = Percent saturation.
- µmho/cm = Micromho(s) per centimeter.
- CYN = Canyons (Burn Site Groundwater Area of Concern).
- mg/L = Milligrams per liter.
- mV = Millivolt(s).
- MW = Monitoring well.
- NTU = Nephelometric turbidity unit.
- pH = Potential of hydrogen (negative logarithm of the hydrogen ion concentration).

Appendix A
Analytical Laboratory Certificates of
Analysis for the Perchlorate Data

CONTRACT LABORATORY ANALYSIS REQUEST AND CHAIN OF CUSTODY

Page 6 of 9

SDG: 127857

Internal Lab

Page 1 of 1

Batch No:		SMD Use		AR/COC		620306						
Project Name: BSG AOC		Base Samples Shipped: 10/11/19		SMD Authorization: <i>[Signature]</i>		<input type="checkbox"/> Waste Characterization <input type="checkbox"/> HMA <input type="checkbox"/> Released by COC No.						
Project/Task Manager: Michael Strelby		Contract/Workorder No: 305351		SMD Contact Phone: <i>[Signature]</i>		<input checked="" type="checkbox"/> 4° Celsius SR to: Sandia National Laboratories (Accounts Payable), P.O. Box 5800, MS-0154 Albuquerque, NM 87195-0154						
Project/Task Number: 195122.12.11.01		Lab Contact: Edie Kan/843-769-7385		Wendy Patricia/505-844-3132								
Service Order: DF058-20		Lab Destination: GEL		Send Report to SMO:								
		Contract No: 1989530		Stephanie Montaña/505-284-2653								
Tech Area:		Operational Site:										
Building:		Room:										
Sample No.	Fraction	Sample Location Detail	Depth (ft)	Date/Time Collected	Sample Matrix	Container Type	Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
110529	002	CYN-MW15	182	10/11/19 10:40	GW	AG	4XT L	NONE	G	SA	TRH-DND (SMW/SMR/S)	002
110529	003	CYN-MW15	182	10/11/19 10:41	GW	P	125 ml	H2SO4	G	SA	NH (EPA 382.2)	003
110529	004	CYN-MW15	182	10/11/19 10:42	GW	P	500 ml	None	G	SA	PERCHLORATE (EPA 314.0)	004
Last Chain: <input type="checkbox"/> Yes		Sample Tracking		SMD Use		Special Instructions/QC Requirements:				Conditions on Receipt		
Validation Req'd: <input checked="" type="checkbox"/> Yes		Data Entered:				EOD <input checked="" type="checkbox"/> Yes						
Background: <input type="checkbox"/> Yes		Entered by:				Turnaround Time <input type="checkbox"/> 7-Day* <input type="checkbox"/> 15-Day* <input checked="" type="checkbox"/> 30-Day						
Confirmatory: <input type="checkbox"/> Yes		QC Inits:				Negotiated TAT <input type="checkbox"/>						
Sample Team Members	Name		Signature		Title		Company/Organization/Phone/Cell		Sample Disposal		Return to Client <input type="checkbox"/> Disposal by Lab <input checked="" type="checkbox"/>	
	William Gibson		<i>[Signature]</i>		W/2		SNL/08888/505-284-3307/505-239-7367		Return Samples By:		Comments:	
	Timothy Jackson		<i>[Signature]</i>		TJ		SNL/08888/505-284-2647/505-263-6639					
	Denisha Sanchez		<i>[Signature]</i>		DS		SNL/08888/505-545-7829/505-208-1375					
Relinquished by <i>[Signature]</i>		Org. 06035		Date 10/11/19		Time 11:30		Relinquished by		Org. Date Time		
Received by <i>[Signature]</i>		Org. 06035		Date 10/11/19		Time 11:30		Received by		Org. Date Time		
Relinquished by <i>[Signature]</i>		Org. 06035		Date 10/11/19		Time 12:10		Relinquished by		Org. Date Time		
Received by <i>[Signature]</i>		Org. 06035		Date 10/11/19		Time 9:10		Received by		Org. Date Time		

*Prior confirmation with SMO required for 7 and 15 day TAT

GEL LABORATORIES LLC

2000 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: November 11, 2010

Company: Santia National Laboratories
 Address: 1515 Eubank SE, ORG 4142
 BLDG. 1090/120, MS 1103
 Albuquerque, New Mexico 87123
 Contact: Ms. Wendy Palencia
 Project: Groundwater, Level C Package
 Client Sample ID: 110329-004
 Sample ID: 492859005
 Matrix: AQUEOUS
 Collect Date: 11-OCT-10 10:42
 Receive Date: 12-OCT-10
 Collector: Client

Project: BNL SDGW2

Client ID: SNLS005

Client Desc: CYN-MW15

Vol: Recv

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Ion Chromatography												
EPA 314.0 Perchlorate by IC: *As Received*												
Perchlorate	RL	ND	0.004	0.012	mgd		1	JLD	11/07/10	1103-100400		1

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 314.0 DOE-M	

Notes:

Column headers are defined as follows:

DF: Dilution Factor
 DL: Detection Limit
 MDA: Minimum Detectable Activity
 MDC: Minimum Detectable Concentration
 LQ/LC: Critical Level
 PF: Prep Factor
 RL: Reporting Limit
 SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savaga Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 5, 2019

Company: Smith National Laboratories
Address: 1515 Babcock SE, ORC 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 111922-007
Sample ID: 497109008
Matrix: AQUEOUS
Collect Date: 20-NOV-19 10:18
Receive Date: 21-NOV-19
Collector: Client

Project: SNLSGW6
Client ID: SNLS605

Client Desc.: ER-HSG-CYN-MW16
Vcl. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Ion Chromatography												
EPA 314.0 Perchlorate by IC "As Received"												
Perchlorate	U	ND	0.001	0.010	mg/L			LXA7	11/25/19	2:28	1000001	1

The following Analytical Methods were performed:

Method	Description
1	EPA 314.0100E-AL

Analyst Comments

Notes:

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Lo/LC: Critical Level
PF: Prep Factor
RL: Reporting Limit
SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 8, 2019

Company: Sandia National Laboratories
 Address: 1515 Fabank SE, ORG 4142
 BLDG. 1090/120, MS 1103
 Albuquerque, New Mexico 87123

Contact: Ms. Wendy Valencia
 Project: Groundwater, Level C Package

Client Sample ID: 111923-004

Project: SNLSGWtr

Sample ID: 497109018

Client ID: SNLS005

Matrix: AQUEOUS

Collect Date: 20-NOV-19 10:18

Client Desc: ER-BSG-CYN-MW16

Receive Date: 21-NOV-19

Vol. Recv:

Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Ion Chromatography												
EPA 314.0 Perchlorate by IC - As Received												
Perchlorate	U	>DL	0.004	0.012	mg/L			LXAL	11/25/19	1346	1942561	

The following Analytical Methods were performed:

Method	Description	Analyst	Comments
1	EPA 314.0 (DDE)-YL		

Notes:

Column headers are defined as follows:

- DF: Dilution Factor
- DL: Detection Limit
- MDA: Minimum Detectable Activity
- MDC: Minimum Detectable Concentration
- LU/LC: Critical Level
- PF: Prep Factor
- RL: Reporting Limit
- SQL: Sample Quantitation Limit

CONTRACT LABORATORY ANALYSIS REQUEST AND CHAIN OF CUSTODY

497022

Page 5 of 689
SMD 497022

Batch No. _____		SMD Use		AR/COC	620652
Project Name: ER BURN SITE		Date Sample Shipped: 11/19/19	SMD Authorization: _____		<input type="checkbox"/> Waste Characterization
Project/Task Manager: Michael Skeally		Carrier/Waybill No: 307048	SMD Contact Phone: _____		<input type="checkbox"/> RMA
Project/Task Number: 176092.01.06		Lab Contact: Edin Kano/845-789-7365	Wendy Valencia/505-544-3132		<input type="checkbox"/> Released by COC No. _____
Service Order: CF671-20		Lab Destination: GEL	Send Report to SMD: _____		<input checked="" type="checkbox"/> 4 th Colibus
Contract No.: 1983590		Stephanie Montano/505-264-2553		8040 Sandia National Laboratories (Accounts Payable) P.O. Box 5800, MS 0164 Albuquerque, NM 87105-0164	
Tech Area: _____		Operational Site: _____			
Building: _____	Room: _____	Operational Site: _____			

Sample No.	Fraction	Sample Location Detail	Depth (ft)	Date/Time Collected	Sample Matrix	Container		Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
						Type	Volume					
111926	001	ER-BSG-CYN-MW17	395	11/19/19 10:20	GW	G	3x40 ml	HCl	G	SA	VOC, TCL PRESERVED (SW846-8015)	011
111926	002	ER-BSG-CYN-MW17	395	11/19/19 10:27	GW	AG	4x1 L	None	G	SA	HE (SW846-8016 LCMSMS)	002
111926	003	ER-BSG-CYN-MW17	395	11/19/19 10:29	GW	AG	4x1 L	NONE	G	SA	TRH-CRD (SW846-8015)	003
111926	004	ER-BSG-CYN-MW17	395	11/19/19 10:24	GW	AG	3x40 ml	NONE	G	SA	TRH-CRD (SW846-8015)	004
111926	005	ER-BSG-CYN-MW17	395	11/19/19 10:31	GW	P	125 ml	H2SO4	G	SA	PH (EPA 853.2)	005
111926	006	ER-BSG-CYN-MW17	395	11/19/19 10:32	GW	P	125 ml	None	G	SA	PHOS-P, C, F, SO4 (SW846-8016)	006
111926	007	ER-BSG-CYN-MW17	395	11/19/19 10:33	GW	P	250 ml	None	G	SA	PERCHLORATE (EPA 814.0)	007
111926	008	ER-BSG-CYN-MW17	395	11/19/19 10:34	GW	P	500 ml	HNO3	G	SA	METALS, TAL 4-M (SW846-8017/110)	008
111926	009	ER-BSG-CYN-MW17	395	11/19/19 10:36	FGW	P	500 ml	HNO3	G	SA	METALS, TAL 4-M (SW846-8017/110)	009
111926	010	ER-BSG-CYN-MW17	395	11/19/19 10:37	GW	P	1 L	HNO3	G	SA	GRAM SPEC, SHORT LIST (EPA 801)	010

Last Chain: <input type="checkbox"/> Yes		Sample Tracking		SMD Use		Special Instructions/QC Requirements:		Comments on Receipt	
Validation Req'd: <input checked="" type="checkbox"/> Yes		Date Entered:		Date Entered:		EDD <input type="checkbox"/> Yes			
Background: <input type="checkbox"/> Yes		Entered by:		Entered by:		Turnaround Time <input type="checkbox"/> 7-Day <input type="checkbox"/> 15-Day <input checked="" type="checkbox"/> 30-Day			
Confirmatory: <input type="checkbox"/> Yes		QC Initials:		QC Initials:		Negotiated TAT <input type="checkbox"/>			
Sample Team Members	Name	Signature	ID#	Company/Organization/Phone/Cell		Sample Disposal <input type="checkbox"/> Return to Client <input checked="" type="checkbox"/> Disposal by Lab			
	Robert Lynch	<i>[Signature]</i>	100	SNL/08888/505-844-4013/505-250-7090		Return Samples By:			
	William Gibson	<i>[Signature]</i>	100	SNL/08888/505-284-3307/505-238-7367		Comments: If perchlorate detected, then request verification analysis using method SW846-8050. Trip blanks received from lab with head space.			
Relinquished by: <i>[Signature]</i>		Org: SNL	Date: 11-19-19	Time: 11:40	Relinquished by: _____		Org: _____	Date: _____	Time: _____
Received by: <i>[Signature]</i>		Org: SNL	Date: 11/19/19	Time: 11:40	Received by: _____		Org: _____	Date: _____	Time: _____
Relinquished by: _____		Org: _____	Date: _____	Time: _____	Relinquished by: _____		Org: _____	Date: _____	Time: _____
Received by: _____		Org: _____	Date: _____	Time: _____	Received by: _____		Org: _____	Date: _____	Time: _____

*Prior confirmation with SMO required for 7 and 15 day TAT
006-11
FL

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 5, 2019

Company: Sandia National Laboratories
 Address: 1515 Rubank SE, ORG-4142
 BLDG. 1090/120, MS 1103
 Albuquerque, New Mexico 87173
 Contact: Ms. Wendy Palencia
 Project: Groundwater, Level C Package

Client Sample ID: 111926-007
 Sample ID: 499022007
 Matrix: AQB1B078
 Collect Date: 19-NOV-19 10:33
 Receive Date: 26-NOV-19
 Collector: Client

Project: SNL-SGW7
 Client ID: SNL8005

Client Desc: ER-BSG-CYN-MWTT
 Vol. Rev.:

Parameter	Qualifier	Result	HL	RL	Units	PF	DF	Analyt Date	Time	Baraly	Method
Ion Chromatography											
EPA 814.0 Perchlorate by IC "As Received"											
Perchlorate	L	ND	0.004	0.01	ug/L		1	10/25/19	0225	1902561	

The following Analytical Methods were performed:

Method	Description	Analyt Comments
1	EPA 814.0 DOR (A)	

Notes:

Column headers are defined as follows:

- DF: Dilution Factor
- DL: Detection Limit
- MDA: Minimum Detectable Activity
- MDC: Minimum Detectable Concentration
- Lo/LC: Critical Level
- PF: Prep Factor
- RL: Reporting Limit
- SQL: Sample Quantitation Limit

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SMD 2012-ARCOG (4-2012)

CONTRACT LABORATORY ANALYSIS REQUEST AND CHAIN OF CUSTODY

AOP 06-10

497030

SMD: 497030 Rev 2

Normal Lab												Page 1 of 2	
Batch No. _____ SMO Use _____												AR/COC 620853	
Project Name: ER BURN SITE			SMD Authorization: _____			SMO Authorization: _____			<input type="checkbox"/> Waste Characterization				
Project/Task Manager: Michael Stelly			SMO Contact Phone: _____			SMO Contact Phone: _____			<input type="checkbox"/> RMA				
Project/Task Number: 17B092.01.00			Send Report to SMO: _____			Send Report to SMO: _____			<input type="checkbox"/> Released by COC No. _____				
Service Order: CF071-20			Contract No.: 1593550			Contract No.: 1593550			<input checked="" type="checkbox"/> 4° Celsius				
Tech Area: _____												Bill to: Serdia National Laboratories (Account Payable)	
Building: _____ Room: _____ Operational Site: _____												P.O. Box 5809, MS-0108	
												Albuquerque, NM 87115-0154	
Sample No.	Fraction	Sample Location Detail	Depth (ft)	Date/Time Collected	Sample Matrix	Container Type	Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID	
111929	001	ER-BSG-CYN-MW18	295	11/19/19 10:38	GW	G	5x40 ml	HCl	G	SA	VOC, TCL PRESERVED (SW846-8080)		
111929	002	ER-BSG-CYN-MW18	295	11/19/19 10:40	GW	AG	4x1 L	None	G	SA	PE (SW846-8080) (COMBOS)		
111929	003	ER-BSG-CYN-MW18	295	11/19/19 10:42	GW	AG	4x1 L	NONE	G	SA	TPH-ORO (SW846-8015)		
111929	004	ER-BSG-CYN-MW18	295	11/19/19 10:43	GW	AG	3x40 ml	NONE	G	SA	TPH-ORO (SW846-8015)		
111929	005	ER-BSG-CYN-MW18	295	11/19/19 10:44	GW	P	125 ml	H2SO4	G	SA	DIETHYL SULF.		
111929	006	ER-BSG-CYN-MW18	295	11/19/19 10:45	GW	P	125 ml	None	G	SA	ANIONS-B, CL, SO4 (SW846-8100)		
111929	007	ER-BSG-CYN-MW18	295	11/19/19 10:46	GW	P	250 ml	None	G	SA	PERCHLORATE (EPA 374.0)		
111929	008	ER-BSG-CYN-MW18	295	11/19/19 10:47	GW	P	500 ml	HNO3	G	SA	METALS, TAL + Mn (SW846-8020/7470)		
111929	009	ER-BSG-CYN-MW18	295	11/19/19 10:48	EGW	P	500 ml	HNO3	G	SA	METALS, TAL + Mn (SW846-8020/7470)		
111929	010	ER-BSG-CYN-MW18	295	11/19/19 10:49	GW	P	1 L	HNO3	G	SA	SWMA SPEC. SHORT LIST (EPA 801)		
Last Chain: <input type="checkbox"/> Yes			Sample Tracking			SMO Use			Special Instructions/OC Requirements:			Conditioning / Receipt	
Validation Req'd: <input checked="" type="checkbox"/> Yes			Date Entered			EDD			<input checked="" type="checkbox"/> Yes				
Background: <input type="checkbox"/> Yes			Entered by			Turnaround Time			<input type="checkbox"/> 7-Day* <input type="checkbox"/> 15-Day* <input checked="" type="checkbox"/> 30-Day				
Confirmatory: <input type="checkbox"/> Yes			OC User			Negotiated TAT			<input type="checkbox"/>				
Sample Team Members	Name		Signature		Init.		Company/Organization/Phone/Cell		Sample Disposal		<input type="checkbox"/> Return to Client <input checked="" type="checkbox"/> Disposal by Lab		
	Zachary Tenorio		<i>Zachary Tenorio</i>		ZT		SNL/08888/505-845-8835/505-250-5785		Return Samples By:				
	Timinile Jackson		<i>Timinile Jackson</i>		TJ		SNL/08888/505-284-2547/505-263-5638		Comments: If perchlorate detected, then request verification analysis using method SW846-8080. Trip blanks received from lab with head space.				
Relinquished by: <i>Timinile Jackson</i>			Org: <i>SNL</i> Date: <i>11/19/19</i> Time: <i>11:15</i>			Relinquished by: _____			Org: _____ Date: _____ Time: _____				
Received by: <i>William J. ...</i>			Org: <i>SNL</i> Date: <i>11-19-19</i> Time: <i>11:15</i>			Received by: <i>William J. ...</i>			Org: _____ Date: <i>11-20-19</i> Time: <i>11:20</i>				
Relinquished by: _____			Org: _____ Date: _____ Time: _____			Relinquished by: _____			Org: _____ Date: _____ Time: _____				
Received by: _____			Org: _____ Date: _____ Time: _____			Received by: _____			Org: _____ Date: _____ Time: _____				

*Prior confirmation with SMO required for 7 and 15 day TAT
 00641
 IT
 11/19/19

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 558-8171 - www.gel.com

Certificate of Analysis

Report Date: December 5, 2019

Company: Sandia National Laboratories
 Address: 1515 Eubank SE, ORG 4142
 BLDG 1090/120, MS 1103
 Albuquerque, New Mexico 87123

Contact: Ms. Wendy Paleocis
 Project: Groundwater, Level C, Package

Client Sample ID: 111929-007

Project: SNLSGWtr

Sample ID: #97030007

Client ID: SNLS005

Matrix: AQUEOUS

Collect Date: 19-NOV-19 10:46

Receive Date: 30-NOV-19

Client Desc: ER-BSG-CYN-MW18

Collector: Client

Val. Recv.:

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Ion Chromatography												
EPA 314.0 Perchlorate by IC "As Received"												
Perchlorate	U	ND	0.008	0.012	mg/l			LSA	11/23/19	214	1942561	I

The following Analytical Methods were performed:

Method	Description	Analyst	Comments
I	EPA 314.0 ICDL-AL		

Notes:

Column headers are defined as follows:

- | | |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor | Lc/LC: Critical Level |
| DL: Detection Limit | PF: Prep Factor |
| MDA: Minimum Detectable Activity | RL: Reporting Limit |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

CONTRACT LABORATORY ANALYSIS REQUEST AND CHAIN OF CUSTODY

496802

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SDG: 496802

Internal Lab:		Page 1 of 2										
Batch No. <i>111</i>		AR/COC 620654										
Project Name: ER BURN SITE		SMD # <i>111</i>										
Project/Task Manager: Michael Skiff		SMD Authorized: <i>[Signature]</i>										
Project/Task Number: 178092.01.05		SMD Contact Phone: Wendy Palencia/505-644-3132										
Service Order: CF571-20		Send Report to SMD: <input checked="" type="checkbox"/> Stephanie Montano/505-284-2553										
Tech Area:		<input type="checkbox"/> Waste Characterization <input type="checkbox"/> RMA <input type="checkbox"/> Released by COC No. <input checked="" type="checkbox"/> 4° Celsius										
Building:		Bill to: Santa National Laboratories (Accounts Payable) P.O. Box 800, MGR154 Albuquerque, NM 87165-0154										
Room:		Operational Site:										
Sample No.	Fraction	Sample Location Detail	Depth (ft)	Date/Time Collected	Sample Matrix	Container Type	Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample #
111932	001	ER-BSG-CYN-MW19	85	11/18/19 10:43	GW	G	3x40 ml	HCl	G	SA	VOC, TCL (RESERVED) (SW846-8060)	
111932	002	ER-BSG-CYN-MW19	85	11/18/19 10:45	GW	AG	4x1 L	None	G	SA	HE (SW846-8060) (MSMS)	
111932	003	ER-BSG-CYN-MW19	85	11/18/19 10:47	GW	AG	4x1 L	NONE	G	SA	TPH-DRO (SW846-8015)	
111932	004	ER-BSG-CYN-MW19	85	11/18/19 10:49	GW	AG	3x40 ml	NONE	G	SA	TPH-DRO (SW846-8015)	
111932	005	ER-BSG-CYN-MW19	85	11/18/19 10:50	GW	P	125 ml	H2SO4	G	SA	SW (EPA 8032)	
111932	006	ER-BSG-CYN-MW19	85	11/18/19 10:51	GW	P	125 ml	None	G	SA	AMONIS-B, CLF, SD4 (SW846-8099)	
111932	007	ER-BSG-CYN-MW19	85	11/18/19 10:52	GW	P	250 ml	None	G	SA	PERCHLORATE (EPA 214.0)	
111932	008	ER-BSG-CYN-MW19	85	11/18/19 10:53	GW	P	500 ml	HNO3	G	SA	METALS, TAL - Na (SW846-8007/470)	
111932	009	ER-BSG-CYN-MW19	85	11/18/19 10:54	GW	P	500 ml	HNO3	G	SA	METALS, TAL - Na (SW846-8007/470)	
111932	010	ER-BSG-CYN-MW19	85	11/18/19 10:55	GW	P	1 L	HNO3	G	SA	SAMBA (RED) SHORT LIST (EPA 801)	
Last Chain: <input type="checkbox"/> Yes		Sample Collected by: <i>[Signature]</i>		SMD Date: <i>11/18/19</i>		Special Instructions/QC Requirements:		Condition of Sample: EDD <input checked="" type="checkbox"/> Yes Turnaround Time: <input type="checkbox"/> 7-Day* <input type="checkbox"/> 15-Day* <input checked="" type="checkbox"/> 30-Day Negotiated TAT <input type="checkbox"/> Sample Disposal: <input type="checkbox"/> Return to Client <input checked="" type="checkbox"/> Disposal by Lab				
Validation Req'd: <input checked="" type="checkbox"/> Yes		Date Entered: <i>11/18/19</i>		Collected by: <i>[Signature]</i>								
Background: <input type="checkbox"/> Yes		QC Init:										
Confirmatory: <input type="checkbox"/> Yes												
Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cel#		Return Samples By:						
	Zachary Tenorio	<i>[Signature]</i>	<i>[Init]</i>	SNL/0888/505-845-8638/505-259-5755		Comments: If perchlorate detected, then request verification analysis using method SW846-8860. Trip blanks received from lab with head space.						
	Timmie Jackson	<i>[Signature]</i>	<i>[Init]</i>	SNL/0888/505-284-2547/505-263-8639								
	Demetria Sanchez	<i>[Signature]</i>	<i>[Init]</i>	SNL/0888/505-845-7823/505-209-1375								
Relinquished by:	<i>[Signature]</i>	Org: <i>SDG</i>	Date: <i>11/18/19</i>	Time: <i>11:40</i>	Relinquished by:	Org:	Date:	Time:				
Received by:	<i>[Signature]</i>	Org: <i>SDG</i>	Date: <i>11/18/19</i>	Time: <i>11:30</i>	Received by:	Org:	Date:	Time:				
Relinquished by:	<i>[Signature]</i>	Org: <i>SDG</i>	Date: <i>11/18/19</i>	Time: <i>1:30</i>	Relinquished by:	Org:	Date:	Time:				
Received by:	<i>[Signature]</i>	Org: <i>SDG</i>	Date: <i>11-18-19</i>	Time: <i>7:30</i>	Received by:	Org:	Date:	Time:				

*Prior confirmation with SMD required for 7 and 15 day TAT

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Certificate of Analysis

Report Date: December 5, 2019

Company: Sandia National Laboratories
Address: 1515 Eubank SE, ORG 4142
BLDG. 1090/120, MS 1103
Albuquerque, New Mexico 87123

Contact: Ms. Wendy Palencia
Project: Groundwater, Level C Package

Client Sample ID: 111932-007
Sample ID: 496802007
Matrix: AQUEOUS
Collect Date: 18-NOV-19 10:52
Receive Date: 19-NOV-19
Collector: Client

Project: SNLSQW1
Client ID: SNLS005

Client Desc.: ER-B5G-CYN-MW10
Val Rec'd:

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Ion Chromatography												
EPA 314.0 Perchlorate by IC "As Received"												
Perchlorate	IC	1.72	0.004	0.012	mg/L		1	EAAT	11/22/19	11:29	1902551	1
The following Analytical Methods were performed:												
Method	Description		Analyst Comments									
	EPA 314.0 DOR-81											

Notes:

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

MDA: Minimum Detectable Activity

MDC: Minimum Detectable Concentration

DL(C): Critical Level

PF: Prep Factor

RL: Reporting Limit

RQL: Sample Quantitation Limit

Appendix B
Data Validation Sample Findings
Summary Sheets for the Perchlorate Data



PO Box 21987
Albuquerque, NM 87154
1-888-678-5447
www.aqainc.net

Memorandum

Date: November 14, 2019
To: File
From: Mary Donovan
Subject: Inorganic Data Review and Validation – SNL
Site: BSG AOC
ARCO: 620303 and 620306
SDG: 492859
Laboratory: GEL
Project/Task: 195122.12.11.01
Analysis: General Chemistry

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM SMO Procedure AOP 00-03 Rev 5.

Summary

Two samples were prepared and analyzed with accepted procedures using method EPA 353.2 (nitrate/nitrite) and one sample was prepared and analyzed with accepted procedures using method EPA 314.0 (perchlorate). Data were reported for all required analytes. Problems were identified with the data package that resulted in the qualification of data.

Nitrate/Nitrite:

1. Samples 492859002 and -004 were analyzed at a 50X dilution; however, the PS and replicate analyses were performed on an undiluted sample and considered a dissimilar matrix. The associated results for samples -002 and -004 were detects and will be qualified J,MS1,RP1.

Data are acceptable and reported QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times and Preservation

The samples were prepared and analyzed within the prescribed holding times and were properly preserved.

Calibration

All initial and continuing calibration met QC acceptance criteria.

Blanks

No target analytes were detected in the blanks.

Laboratory Control Sample (LCS)

All LCS acceptance criteria were met.

Matrix Spike and Matrix Spike Duplicate (MS/MSD)

All MS/PS recoveries met QC acceptance criteria except as noted above in the Summary section and as follows. The PS %R was >125% for perchlorate. The associated sample result was non-detect and will not be qualified.

It should be noted that the PS analysis for nitrate/nitrite was performed on an SNL sample of similar matrix from another SDG.

Laboratory Replicate

The replicate analyses met all QC acceptance criteria except as noted above in the Summary section.

It should be noted that the replicate analysis for nitrate/nitrite was performed on an SNL sample of similar matrix from another SDG.

Detection Limits/Dilutions

All detection limits were properly reported and were correctly adjusted for dilutions. The following dilutions were performed due to high amounts of target analyte present in the sample.

Nitrate/Nitrite

Samples -002 and -004 were diluted 50X.

Other QC

No other specific issues that affect data quality were identified.

Reviewed by: Ellen McEntee

Level: 1

Date: 11/15/2019



Sample Findings Summary



AR/COC: 620303, 620306

Page 1 of 1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
EPA 353.2			
	109234-003/CYN-MW13	Nitrogen, Nitrate/Nitrite (NO3ASN)	J, MS1,RP1
	110529-003/CYN-MW15	Nitrogen, Nitrate/Nitrite (NO3ASN)	J, MS1,RP1

All other analyses met QC acceptance criteria; no further data should be qualified.



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Memorandum

Date: January 14, 2020
To: File
From: Mary Donovan
Subject: Inorganic Data Review and Validation – SNL
Site: ER Burn Site
ARCO: 620651
SDG: 497109
Laboratory: GEL
Project/Task: 176092.01.06
Analysis: General Chemistry

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM SMO Procedure AOP 00-03 Rev 5.

Summary

Two samples were prepared and analyzed with accepted procedures using methods EPA 353.2 (nitrate/nitrite) and EPA 314.0 (perchlorate) and one sample was prepared and analyzed using method EPA 9056A (anions by IC). Data were reported for all required analytes. Problems were identified with the data package that resulted in the qualification of data.

Nitrate/nitrite:

1. Samples 497109006 and -017 were analyzed at a 100X dilution for nitrate/nitrite; however, the MS and replicate analyses were performed on an SNL sample from another SDG, sample 496802005 diluted 10X and considered a dissimilar matrix. The associated result for samples -006 and -017 were detects and will be qualified J,MSI,RPI.

Data are acceptable and reported QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times and Preservation

The samples were prepared and analyzed within the prescribed holding times and were properly preserved.

Calibration

All initial and continuing calibration met QC acceptance criteria.

Blanks

No target analytes were detected in any of the blanks except as follows. Nitrate/nitrite was detected at \leq the PQL in the ICB, a bracketing CCB and EB1. EB1 was submitted on ARCOG 620650 in another SDG and associated with samples -006 and -017. The associated sample result for EB1 was qualified non-detect due to ICB/CCB contamination and was not be applied to any field sample results. The associated results for samples -006 and -017 were detects $>5X$ the ICB/CCB concentration and will not be qualified.

Chloride was detected at \leq the PQL in EB1, sample 497108006, submitted in another SDG and associated with sample -007. The associated sample result was a detect $>5X$ the EB concentration and will not be qualified.

Laboratory Control Sample (LCS)

All LCS acceptance criteria were met.

Matrix Spike and Matrix Spike Duplicate (MS/MSD)

The MS/PS met QC acceptance criteria except as noted above in the Summary section. It should be noted that the parent samples for the MS for perchlorate and nitrate/nitrite were SNL samples from other SDGs. No data will be qualified.

Laboratory Replicate

The replicate analysis met all QC acceptance criteria except as noted above in the Summary section. It should be noted that the parent samples for the duplicates for perchlorate and nitrate/nitrite were SNL samples from other SDGs. No data will be qualified.

Detection Limits/Dilutions

All detection limits were properly reported and correctly adjusted for dilutions. The following dilutions were performed due to elevated amounts of target analyte present in the samples.

Anions:

Sample -007 was diluted 10X for chloride and sulfate.

Nitrate/nitrite:

Samples -006 and -017 were diluted 100X.

Other QC

EB1 was submitted with ARCOG 620650 in another SDG and was associated with samples on ARCOG 620651. Field duplicate pairs were submitted with ARCOG 620651 for perchlorate and nitrate/nitrite. There are no "required" review criteria for field duplicate analyses comparability; no data will be qualified as a result.

No other specific issues that affect data quality were identified.

Reviewed by: Linda Thal

Level: I

Date: 01/17/2020



Sample Findings Summary



AR/COC: 620651

Page 1 of 5

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
DOE EML HASL-300, U-02-RC			
	111922-012/ER-BSG-CYN-MW16	Uranium-235/236 (15117-96-1/13982-70-)	J, FR7
EPA 353.2			
	111922-005/ER-BSG-CYN-MW16	Nitrogen, Nitrate/Nitrite (NO3ASN)	J, MS1,RP1
	111923-003/ER-BSG-CYN-MW16	Nitrogen, Nitrate/Nitrite (NO3ASN)	J, MS1,RP1
EPA 900.0/SW846 9310			
	111922-011/ER-BSG-CYN-MW16	BETA (12587-47-2)	J, FR7
EPA 901.1			
	111922-010/ER-BSG-CYN-MW16	Americium-241 (14596-10-2)	BD, FR3
	111922-010/ER-BSG-CYN-MW16	Cesium-137 (10045-97-3)	BD, FR3
	111922-010/ER-BSG-CYN-MW16	Cobalt-60 (10198-40-0)	BD, FR3
	111922-010/ER-BSG-CYN-MW16	Potassium-40 (13966-00-2)	BD, FR3
EPA 906.0 Modified			
	111922-013/ER-BSG-CYN-MW16	Tritium (10028-17-8)	BD, FR3
SW846 3005A/6020B			
	111922-008/ER-BSG-CYN-MW16	Aluminum (7429-90-5)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Antimony (7440-36-0)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Arsenic (7440-38-2)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Barium (7440-39-3)	J, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111922-008/ER-BSG-CYN-MW16	Beryllium (7440-41-7)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Cadmium (7440-43-9)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Calcium (7440-70-2)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Chromium (7440-47-3)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Cobalt (7440-48-4)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Copper (7440-50-8)	0.002UJ, B2, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Iron (7439-89-6)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Lead (7439-92-1)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Magnesium (7439-95-4)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Manganese (7439-96-5)	J-, CK3, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Molybdenum (7439-98-7)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Nickel (7440-02-0)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Potassium (9/7/7440)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Selenium (7782-49-2)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Silver (7440-22-4)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Sodium (7440-23-5)	J, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Thallium (7440-28-0)	UJ, MS1,RP1
	111922-008/ER-BSG-CYN-MW16	Vanadium (7440-62-2)	J, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111922-008/ER-BSG-CYN-MW16	Zinc (7440-66-6)	UJ, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Aluminum (7429-90-5)	UJ, IS1,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Antimony (7440-36-0)	UJ, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Arsenic (7440-38-2)	J, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Barium (7440-39-3)	J, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Beryllium (7440-41-7)	UJ, IS1,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Cadmium (7440-43-9)	UJ, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Calcium (7440-70-2)	J, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Chromium (7440-47-3)	UJ, IS1,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Cobalt (7440-48-4)	UJ, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Copper (7440-50-8)	0.002UJ, B2,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Iron (7439-89-6)	UJ, IS1,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Lead (7439-92-1)	UJ, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Magnesium (7439-95-4)	J-, IS1,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Manganese (7439-96-5)	J-, CK3,IS1,MS1,RP
	111922-009/ER-BSG-CYN-MW16	Molybdenum (7439-98-7)	J, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Nickel (7440-02-0)	J-, IS1,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Potassium (9/7/7440)	J-, IS1,MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111922-009/ER-BSG-CYN-MW16	Selenium (7782-49-2)	J, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Silver (7440-22-4)	UJ, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Sodium (7440-23-5)	J-, IS1,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Thallium (7440-28-0)	UJ, MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Vanadium (7440-62-2)	J-, IS1,MS1,RP1
	111922-009/ER-BSG-CYN-MW16	Zinc (7440-66-6)	J, MS1,RP1
SW846 3535A/8015D			
	111922-003/ER-BSG-CYN-MW16	Diesel Range Organics (68334-30-5)	UJ, MS5
	111923-001/ER-BSG-CYN-MW16	Diesel Range Organics (68334-30-5)	UJ, MS5
SW846 3535A/8330B			
	111922-002/ER-BSG-CYN-MW16	m-Nitrotoluene (99-08-1)	UJ, I4
	111922-002/ER-BSG-CYN-MW16	Nitrobenzene (98-95-3)	UJ, I4
	111922-002/ER-BSG-CYN-MW16	o-Nitrotoluene (88-72-2)	UJ, I4
	111922-002/ER-BSG-CYN-MW16	PETN (78-11-5)	UJ, C3,MS3
	111922-002/ER-BSG-CYN-MW16	p-Nitrotoluene (99-99-0)	UJ, I4
	111922-002/ER-BSG-CYN-MW16	Tetryl (479-45-8)	R, L3
SW846 8260B DOE-AL			
	111921-001/ER-BSG-FB1	Acetone (67-64-1)	UJ, MS3
	111921-001/ER-BSG-FB1	Methyl acetate (79-20-9)	UJ, I4
	111922-001/ER-BSG-CYN-MW16	Acetone (67-64-1)	UJ, MS3

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111922-001/ER-BSG-CYN-MW16	Methyl acetate (79-20-9)	UJ, I4
	111925-001/ER-BSG-TB4	Acetone (67-64-1)	J-, MS3
	111925-001/ER-BSG-TB4	Methyl acetate (79-20-9)	UJ, I4

All other analyses met QC acceptance criteria; no further data should be qualified.



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Memorandum

Date: January 14, 2020
To: File
From: Mary Donovan
Subject: Inorganic Data Review and Validation – SNL
Site: ER Burn Site
ARCOC: 620652
SDG: 497022
Laboratory: GEL
Project/Task: 176092.01.06
Analysis: General Chemistry

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM SMO Procedure AOP 00-03 Rev 5.

Summary

One sample was prepared and analyzed with accepted procedures using methods EPA 9056A (anions by IC), EPA 353.2 (nitrate/nitrite) and EPA 314.0 (perchlorate). Data were reported for all required analytes. Problems were identified with the data package that resulted in the qualification of data.

Anions:

1. The MS and duplicate analyses were performed on an SNL DI water sample from another SDG. All associated sample results were detects will be qualified J,MS1,RP1 due to lack of matrix-specific accuracy and precision data.

Data are acceptable and reported QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times and Preservation

The samples were prepared and analyzed within the prescribed holding times and were properly preserved.

Calibration

All initial and continuing calibration met QC acceptance criteria.

Blanks

No target analytes were detected in any of the blanks except as follows. Nitrate/nitrite was detected at \leq the PQL in the ICB and a bracketing CCB. The associated result for sample 497022005 was a detect $>5X$ the ICB/CCB concentration and will not be qualified.

Laboratory Control Sample (LCS)

All LCS acceptance criteria were met.

Matrix Spike and Matrix Spike Duplicate (MS/MSD)

The MS/PS met QC acceptance criteria except as noted above in the Summary section. It should be noted that the parent samples for the MS were SNL samples of similar matrix from other SDGs. No data will be qualified.

Laboratory Replicate

The replicate analysis met all QC acceptance criteria except as noted above in the Summary section. It should be noted that the parent samples for the duplicates were SNL samples of similar matrix from other SDGs. No data will be qualified.

Detection Limits/Dilutions

All detection limits were properly reported and correctly adjusted for dilutions. The following dilutions were performed due to elevated amounts of target analyte present in the samples.

Anions:

Sample -006 was diluted 10X for chloride and sulfate.

Nitrate/nitrite:

Sample -005 was diluted 10X.

Other QC

No other specific issues that affect data quality were identified.

Reviewed by: Linda Thal

Level: I

Date: 01/17/2020



Sample Findings Summary



AR/COC: 620652

Page 1 of 5

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
DOE EML HASL-300, U-02-RC			
	111926-012/ER-BSG-CYN-MW17	Uranium-235/236 (15117-96-1/13982-70-)	BD, FR3
EPA 901.1			
	111926-010/ER-BSG-CYN-MW17	Americium-241 (14596-10-2)	BD, FR3
	111926-010/ER-BSG-CYN-MW17	Cesium-137 (10045-97-3)	BD, FR3
	111926-010/ER-BSG-CYN-MW17	Cobalt-60 (10198-40-0)	BD, FR3
	111926-010/ER-BSG-CYN-MW17	Potassium-40 (13966-00-2)	R, Z2
EPA 906.0 Modified			
	111926-013/ER-BSG-CYN-MW17	Tritium (10028-17-8)	BD, FR3
SW846 3005A/6020B			
	111926-008/ER-BSG-CYN-MW17	Aluminum (7429-90-5)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Antimony (7440-36-0)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Arsenic (7440-38-2)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Barium (7440-39-3)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Beryllium (7440-41-7)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Cadmium (7440-43-9)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Calcium (7440-70-2)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Chromium (7440-47-3)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111926-008/ER-BSG-CYN-MW17	Cobalt (7440-48-4)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Copper (7440-50-8)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Iron (7439-89-6)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Lead (7439-92-1)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Magnesium (7439-95-4)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Manganese (7439-96-5)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Molybdenum (7439-98-7)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Nickel (7440-02-0)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Potassium (7440-09-7)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Selenium (7782-49-2)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Silver (7440-22-4)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Sodium (7440-23-5)	J, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Thallium (7440-28-0)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Vanadium (7440-62-2)	UJ, MS1,RP1
	111926-008/ER-BSG-CYN-MW17	Zinc (7440-66-6)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Aluminum (7429-90-5)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Antimony (7440-36-0)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Arsenic (7440-38-2)	J, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111926-009/ER-BSG-CYN-MW17	Barium (7440-39-3)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Beryllium (7440-41-7)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Cadmium (7440-43-9)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Calcium (7440-70-2)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Chromium (7440-47-3)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Cobalt (7440-48-4)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Copper (7440-50-8)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Iron (7439-89-6)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Lead (7439-92-1)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Magnesium (7439-95-4)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Manganese (7439-96-5)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Molybdenum (7439-98-7)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Nickel (7440-02-0)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Potassium (7440-09-7)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Selenium (7782-49-2)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Silver (7440-22-4)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Sodium (7440-23-5)	J, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Thallium (7440-28-0)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111926-009/ER-BSG-CYN-MW17	Vanadium (7440-62-2)	UJ, MS1,RP1
	111926-009/ER-BSG-CYN-MW17	Zinc (7440-66-6)	UJ, MS1,RP1
SW846 3535A/8015D			
	111926-003/ER-BSG-CYN-MW17	Diesel Range Organics (68334-30-5)	UJ, MS5
SW846 3535A/8330B			
	111926-002/ER-BSG-CYN-MW17	m-Nitrotoluene (99-08-1)	UJ, I4
	111926-002/ER-BSG-CYN-MW17	Nitrobenzene (98-95-3)	UJ, I4
	111926-002/ER-BSG-CYN-MW17	o-Nitrotoluene (88-72-2)	UJ, I4
	111926-002/ER-BSG-CYN-MW17	PETN (78-11-5)	UJ, C3,MS3
	111926-002/ER-BSG-CYN-MW17	p-Nitrotoluene (99-99-0)	UJ, I4
	111926-002/ER-BSG-CYN-MW17	Tetryl (479-45-8)	R, L3
SW846 8260B DOE-AL			
	111926-001/ER-BSG-CYN-MW17	Acetone (67-64-1)	UJ, MS3
	111926-001/ER-BSG-CYN-MW17	Methyl acetate (79-20-9)	UJ, I4
	111928-001/ER-BSG-TB6	Acetone (67-64-1)	UJ, MS3
	111928-001/ER-BSG-TB6	Methyl acetate (79-20-9)	UJ, I4
SW846 9056A			
	111926-006/ER-BSG-CYN-MW17	Bromide (24959-67-9)	J, MS1,RP1
	111926-006/ER-BSG-CYN-MW17	Chloride (16887-00-6)	J, MS1,RP1
	111926-006/ER-BSG-CYN-MW17	Fluoride (16984-48-8)	J, MS1,RP1
	111926-006/ER-BSG-CYN-MW17	Sulfate (14808-79-8)	J, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
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All other analyses met QC acceptance criteria; no further data should be qualified.





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Memorandum

Date: January 24, 2020
To: File
From: Mary Donovan
Subject: Inorganic Data Review and Validation – SNL
Site: ER Burn Site
ARCO: 620653
SDG: 497030
Laboratory: GEL
Project/Task: 176092.01.06
Analysis: General Chemistry

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM SMO Procedure AOP 00-03 Rev 5.

Summary

One sample was prepared and analyzed with accepted procedures using methods EPA 9056A (anions by IC), EPA 353.2 (nitrate/nitrite) and EPA 314.0 (perchlorate). Data were reported for all required analytes. Problems were identified with the data package that resulted in the qualification of data.

Anions:

1. The MS and duplicate analyses were performed on an SNL DI water sample from another SDG. All associated sample results were detects will be qualified J,MS1,RP1 due to lack of matrix-specific accuracy and precision data.

Data are acceptable and reported QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times and Preservation

The samples were prepared and analyzed within the prescribed holding times and were properly preserved.

Calibration

All initial and continuing calibration met QC acceptance criteria.

Blanks

No target analytes were detected in any of the blanks except as follows. Nitrate/nitrite was detected at \leq the PQL in the ICB and a bracketing CCB. The associated result for sample 497030005 was a detect $>5X$ the ICB/CCB concentrations and will not be qualified.

Laboratory Control Sample (LCS)

All LCS acceptance criteria were met.

Matrix Spike and Matrix Spike Duplicate (MS/MSD)

The MS/PS met QC acceptance criteria except as noted above in the Summary section. It should be noted that the parent samples for the MS for perchlorate and nitrate/nitrite were SNL samples of similar matrix from other SDGs. No data will be qualified.

Laboratory Replicate

The replicate analysis met all QC acceptance criteria except as noted above in the Summary section. It should be noted that the parent samples for the duplicates for perchlorate and nitrate/nitrite were SNL samples of similar matrix from other SDGs. No data will be qualified.

Detection Limits/Dilutions

All detection limits were properly reported and correctly adjusted for dilutions. The following dilutions were performed due to elevated amounts of target analyte present in the samples.

Anions:

Sample -006 was diluted 20X for chloride and sulfate.

Nitrate/nitrite:

Sample -005 was diluted 50X.

Other QC

No other specific issues that affect data quality were identified.



Sample Findings Summary



AR/COC: 620653

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Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
DOE EML HASL-300, U-02-RC			
	111929-012/ER-BSG-CYN-MW18	Uranium-235/236 (15117-96-1/13982-70-)	J, FR7
EPA 900.0/SW846 9310			
	111929-011/ER-BSG-CYN-MW18	ALPHA (12587-46-1)	J, FR7
EPA 901.1			
	111929-010/ER-BSG-CYN-MW18	Americium-241 (14596-10-2)	BD, FR3
	111929-010/ER-BSG-CYN-MW18	Cesium-137 (10045-97-3)	BD, FR3
	111929-010/ER-BSG-CYN-MW18	Cobalt-60 (10198-40-0)	BD, FR3
	111929-010/ER-BSG-CYN-MW18	Potassium-40 (13966-00-2)	BD, FR3
EPA 906.0 Modified			
	111929-013/ER-BSG-CYN-MW18	Tritium (10028-17-8)	BD, FR3
SW846 3005A/6020B			
	111929-008/ER-BSG-CYN-MW18	Aluminum (7429-90-5)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Antimony (7440-36-0)	UJ, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Arsenic (7440-38-2)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Barium (7440-39-3)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Beryllium (7440-41-7)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Cadmium (7440-43-9)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111929-008/ER-BSG-CYN-MW18	Calcium (7440-70-2)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Chromium (7440-47-3)	UJ, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Cobalt (7440-48-4)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Copper (7440-50-8)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Iron (7439-89-6)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Lead (7439-92-1)	UJ, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Magnesium (7439-95-4)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Manganese (7439-96-5)	J-, CK3,MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Molybdenum (7439-98-7)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Nickel (7440-02-0)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Potassium (7440-09-7)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Selenium (7782-49-2)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Silver (7440-22-4)	UJ, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Sodium (7440-23-5)	J, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Thallium (7440-28-0)	UJ, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Vanadium (7440-62-2)	UJ, MS1,RP1
	111929-008/ER-BSG-CYN-MW18	Zinc (7440-66-6)	UJ, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Aluminum (7429-90-5)	UJ, IS1,MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111929-009/ER-BSG-CYN-MW18	Antimony (7440-36-0)	UJ, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Arsenic (7440-38-2)	J, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Barium (7440-39-3)	J, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Beryllium (7440-41-7)	J-, IS1,MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Cadmium (7440-43-9)	UJ, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Calcium (7440-70-2)	J, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Chromium (7440-47-3)	UJ, IS1,MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Cobalt (7440-48-4)	J, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Copper (7440-50-8)	J, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Iron (7439-89-6)	J-, IS1,MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Lead (7439-92-1)	UJ, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Magnesium (7439-95-4)	J-, IS1,MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Manganese (7439-96-5)	J-, CK3,IS1,MS1,R P
	111929-009/ER-BSG-CYN-MW18	Molybdenum (7439-98-7)	J, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Nickel (7440-02-0)	J-, IS1,MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Potassium (7440-09-7)	J-, IS1,MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Selenium (7782-49-2)	J, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111929-009/ER-BSG-CYN-MW18	Silver (7440-22-4)	UJ, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Sodium (7440-23-5)	J-, IS1,MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Thallium (7440-28-0)	UJ, MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Vanadium (7440-62-2)	UJ, IS1,MS1,RP1
	111929-009/ER-BSG-CYN-MW18	Zinc (7440-66-6)	UJ, MS1,RP1
SW846 3535A/8015D			
	111929-003/ER-BSG-CYN-MW18	Diesel Range Organics (68334-30-5)	UJ, MS5
SW846 3535A/8330B			
	111929-002/ER-BSG-CYN-MW18	m-Nitrotoluene (99-08-1)	UJ, I4
	111929-002/ER-BSG-CYN-MW18	Nitrobenzene (98-95-3)	UJ, I4
	111929-002/ER-BSG-CYN-MW18	o-Nitrotoluene (88-72-2)	UJ, I4
	111929-002/ER-BSG-CYN-MW18	PETN (78-11-5)	UJ, C3,MS3
	111929-002/ER-BSG-CYN-MW18	p-Nitrotoluene (99-99-0)	UJ, I4
	111929-002/ER-BSG-CYN-MW18	Tetryl (479-45-8)	R, L3
SW846 8260B DOE-AL			
	111929-001/ER-BSG-CYN-MW18	1,1,1-Trichloroethane (71-55-6)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,1,2,2-Tetrachloroethane (79-34-5)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,1,2-Trichloroethane (79-00-5)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,1-Dichloroethane (75-34-3)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111929-001/ER-BSG-CYN-MW18	1,1-Dichloroethylene (75-35-4)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,2,3-Trichlorobenzene (87-61-6)	UJ, I5,MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,2,4-Trichlorobenzene (120-82-1)	UJ, I5,MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,2-Dibromo-3-chloropropane (96-12-8)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,2-Dibromoethane (106-93-4)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,2-Dichlorobenzene (95-50-1)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,2-Dichloroethane (107-06-2)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,2-Dichloropropane (78-87-5)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,3-Dichlorobenzene (541-73-1)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	1,4-Dichlorobenzene (106-46-7)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	2-Butanone (78-93-3)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	2-Hexanone (591-78-6)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	4-Methyl-2-pentanone (108-10-1)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Acetone (67-64-1)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Benzene (71-43-2)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Bromochloromethane (74-97-5)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Bromodichloromethane (75-27-4)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Bromoform (75-25-2)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111929-001/ER-BSG-CYN-MW18	Bromomethane (74-83-9)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Carbon disulfide (75-15-0)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Carbon tetrachloride (56-23-5)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Chlorobenzene (108-90-7)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Chloroethane (75-00-3)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Chloroform (67-66-3)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Chloromethane (74-87-3)	UJ, I5,MS1,RP1
	111929-001/ER-BSG-CYN-MW18	cis-1,2-Dichloroethylene (156-59-2)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	cis-1,3-Dichloropropylene (10061-01-5)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Cyclohexane (110-82-7)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Dibromochloromethane (124-48-1)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Dichlorodifluoromethane (75-71-8)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Ethylbenzene (100-41-4)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Isopropylbenzene (98-82-8)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	m,p-Xylenes (N/A)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Methyl acetate (79-20-9)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Methylcyclohexane (108-87-2)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Methylene chloride (75-09-2)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111929-001/ER-BSG-CYN-MW18	o-Xylene (95-47-6)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Styrene (100-42-5)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	tert-Butyl methyl ether (1634-04-4)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Tetrachloroethylene (127-18-4)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Toluene (108-88-3)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	trans-1,2-Dichloroethylene (156-60-5)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	trans-1,3-Dichloropropylene (10061-02-6)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Trichloroethylene (79-01-6)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Trichlorofluoromethane (75-69-4)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Trichlorotrifluoroethane (76-13-1)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Vinyl chloride (75-01-4)	UJ, MS1,RP1
	111929-001/ER-BSG-CYN-MW18	Xylenes (total) (1330-20-7)	UJ, MS1,RP1
	111931-001/ER-BSG-TB8	1,1,1-Trichloroethane (71-55-6)	R, H1
	111931-001/ER-BSG-TB8	1,1,2,2-Tetrachloroethane (79-34-5)	R, H1
	111931-001/ER-BSG-TB8	1,1,2-Trichloroethane (79-00-5)	R, H1
	111931-001/ER-BSG-TB8	1,1-Dichloroethane (75-34-3)	R, H1
	111931-001/ER-BSG-TB8	1,1-Dichloroethylene (75-35-4)	R, H1
	111931-001/ER-BSG-TB8	1,2,3-Trichlorobenzene (87-61-6)	R, H1,I5
	111931-001/ER-BSG-TB8	1,2,4-Trichlorobenzene (120-82-1)	R, H1,I5
	111931-001/ER-BSG-TB8	1,2-Dibromo-3-chloropropane (96-12-8)	R, H1
	111931-001/ER-BSG-TB8	1,2-Dibromoethane (106-93-4)	R, H1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111931-001/ER-BSG-TB8	1,2-Dichlorobenzene (95-50-1)	R, H1
	111931-001/ER-BSG-TB8	1,2-Dichloroethane (107-06-2)	R, H1
	111931-001/ER-BSG-TB8	1,2-Dichloropropane (78-87-5)	R, H1
	111931-001/ER-BSG-TB8	1,3-Dichlorobenzene (541-73-1)	R, H1
	111931-001/ER-BSG-TB8	1,4-Dichlorobenzene (106-46-7)	R, H1
	111931-001/ER-BSG-TB8	2-Butanone (78-93-3)	R, H1
	111931-001/ER-BSG-TB8	2-Hexanone (591-78-6)	R, H1
	111931-001/ER-BSG-TB8	4-Methyl-2-pentanone (108-10-1)	R, H1
	111931-001/ER-BSG-TB8	Acetone (67-64-1)	J-, H1,C3
	111931-001/ER-BSG-TB8	Benzene (71-43-2)	R, H1
	111931-001/ER-BSG-TB8	Bromochloromethane (74-97-5)	R, H1
	111931-001/ER-BSG-TB8	Bromodichloromethane (75-27-4)	R, H1
	111931-001/ER-BSG-TB8	Bromoform (75-25-2)	R, H1
	111931-001/ER-BSG-TB8	Bromomethane (74-83-9)	R, H1
	111931-001/ER-BSG-TB8	Carbon disulfide (75-15-0)	R, H1
	111931-001/ER-BSG-TB8	Carbon tetrachloride (56-23-5)	R, H1
	111931-001/ER-BSG-TB8	Chlorobenzene (108-90-7)	R, H1
	111931-001/ER-BSG-TB8	Chloroethane (75-00-3)	R, H1
	111931-001/ER-BSG-TB8	Chloroform (67-66-3)	R, H1
	111931-001/ER-BSG-TB8	Chloromethane (74-87-3)	R, H1,I5
	111931-001/ER-BSG-TB8	cis-1,2-Dichloroethylene (156-59-2)	R, H1
	111931-001/ER-BSG-TB8	cis-1,3-Dichloropropylene (10061-01-5)	R, H1
	111931-001/ER-BSG-TB8	Cyclohexane (110-82-7)	R, H1
	111931-001/ER-BSG-TB8	Dibromochloromethane (124-48-1)	R, H1
	111931-001/ER-BSG-TB8	Dichlorodifluoromethane (75-71-8)	R, H1
	111931-001/ER-BSG-TB8	Ethylbenzene (100-41-4)	R, H1
	111931-001/ER-BSG-TB8	Isopropylbenzene (98-82-8)	R, H1
	111931-001/ER-BSG-TB8	m,p-Xylenes (N/A)	R, H1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111931-001/ER-BSG-TB8	Methyl acetate (79-20-9)	R, H1
	111931-001/ER-BSG-TB8	Methylcyclohexane (108-87-2)	R, H1
	111931-001/ER-BSG-TB8	Methylene chloride (75-09-2)	R, H1
	111931-001/ER-BSG-TB8	o-Xylene (95-47-6)	R, H1
	111931-001/ER-BSG-TB8	Styrene (100-42-5)	R, H1
	111931-001/ER-BSG-TB8	tert-Butyl methyl ether (1634-04-4)	R, H1
	111931-001/ER-BSG-TB8	Tetrachloroethylene (127-18-4)	R, H1
	111931-001/ER-BSG-TB8	Toluene (108-88-3)	R, H1
	111931-001/ER-BSG-TB8	trans-1,2-Dichloroethylene (156-60-5)	R, H1
	111931-001/ER-BSG-TB8	trans-1,3-Dichloropropylene (10061-02-6)	R, H1
	111931-001/ER-BSG-TB8	Trichloroethylene (79-01-6)	R, H1
	111931-001/ER-BSG-TB8	Trichlorofluoromethane (75-69-4)	R, H1
	111931-001/ER-BSG-TB8	Trichlorotrifluoroethane (76-13-1)	R, H1
	111931-001/ER-BSG-TB8	Vinyl chloride (75-01-4)	R, H1
	111931-001/ER-BSG-TB8	Xylenes (total) (1330-20-7)	R, H1
SW846 9056A			
	111929-006/ER-BSG-CYN-MW18	Bromide (24959-67-9)	J, MS1,RP1
	111929-006/ER-BSG-CYN-MW18	Chloride (16887-00-6)	J, MS1,RP1
	111929-006/ER-BSG-CYN-MW18	Fluoride (16984-48-8)	J, MS1,RP1
	111929-006/ER-BSG-CYN-MW18	Sulfate (14808-79-8)	J, MS1,RP1

All other analyses met QC acceptance criteria; no further data should be qualified.



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Memorandum

Date: January 24, 2020
To: File
From: Mary Donovan
Subject: Inorganic Data Review and Validation – SNL
Site: ER Burn Site
ARCOC: 620654
SDG: 496802
Laboratory: GEL
Project/Task: 176092.01.06
Analysis: General Chemistry

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM SMO Procedure AOP 00-03 Rev 5.

Summary

One sample was prepared and analyzed with accepted procedures using methods EPA 9056A (anions by IC), EPA 353.2 (nitrate/nitrite) and EPA 314.0 (perchlorate). Data were reported for all required analytes. Problems were identified with the data package that resulted in the qualification of data.

Anions:

1. The MS and duplicate analyses were performed on an SNL DI water sample from another SDG. All associated sample results were detects will be qualified J,MS1,RP1 due to lack of matrix-specific accuracy and precision data.

Data are acceptable and reported QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times and Preservation

The samples were prepared and analyzed within the prescribed holding times and were properly preserved.

Calibration

All initial and continuing calibration met QC acceptance criteria.

Blanks

No target analytes were detected in any of the blanks except as follows. Nitrate/nitrite was detected at \leq the PQL in the ICB and bracketing CCBs. The associated result for sample 496802005 was a detect $>5X$ the ICB/CCB concentration and will not be qualified.

Laboratory Control Sample (LCS)

All LCS acceptance criteria were met.

Matrix Spike and Matrix Spike Duplicate (MS/MSD)

The MS/PS met QC acceptance criteria except as noted above in the Summary section

Laboratory Replicate

The replicate analysis met all QC acceptance criteria except as noted above in the Summary section

Detection Limits/Dilutions

All detection limits were properly reported and correctly adjusted for dilutions. The following dilutions were performed due to elevated amounts of target analyte present in the samples.

Anions:

Sample -006 was diluted 10X for chloride and sulfate.

Nitrate/nitrite:

Sample -005 was diluted 10X.

Other QC

No other specific issues that affect data quality were identified.

Reviewed by: Linda Thal

Level: I

Date: 01/27/2020



Sample Findings Summary



AR/COC: 620654

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Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
DOE EML HASL-300, U-02-RC			
	111932-012/ER-BSG-CYN-MW19	Uranium-235/236 (15117-96-1/13982-70-)	J, FR7
EPA 900.0/SW846 9310			
	111932-011/ER-BSG-CYN-MW19	ALPHA (12587-46-1)	J, FR7
	111932-011/ER-BSG-CYN-MW19	BETA (12587-47-2)	J, FR7
EPA 901.1			
	111932-010/ER-BSG-CYN-MW19	Americium-241 (14596-10-2)	BD, FR3
	111932-010/ER-BSG-CYN-MW19	Cesium-137 (10045-97-3)	BD, FR3
	111932-010/ER-BSG-CYN-MW19	Cobalt-60 (10198-40-0)	BD, FR3
	111932-010/ER-BSG-CYN-MW19	Potassium-40 (13966-00-2)	R, Z2
EPA 906.0 Modified			
	111932-013/ER-BSG-CYN-MW19	Tritium (10028-17-8)	BD, FR3
SW846 3005A/6020B			
	111932-008/ER-BSG-CYN-MW19	Aluminum (7429-90-5)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Antimony (7440-36-0)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Arsenic (7440-38-2)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Barium (7440-39-3)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Beryllium (7440-41-7)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111932-008/ER-BSG-CYN-MW19	Cadmium (7440-43-9)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Calcium (7440-70-2)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Chromium (7440-47-3)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Cobalt (7440-48-4)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Copper (7440-50-8)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Iron (7439-89-6)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Lead (7439-92-1)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Magnesium (7439-95-4)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Manganese (7439-96-5)	J, CK3,MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Molybdenum (7439-98-7)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Nickel (7440-02-0)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Potassium (7440-09-7)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Selenium (7782-49-2)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Silver (7440-22-4)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Sodium (7440-23-5)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Thallium (7440-28-0)	UJ, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Vanadium (7440-62-2)	J, MS1,RP1
	111932-008/ER-BSG-CYN-MW19	Zinc (7440-66-6)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111932-009/ER-BSG-CYN-MW19	Aluminum (7429-90-5)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Antimony (7440-36-0)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Arsenic (7440-38-2)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Barium (7440-39-3)	J, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Beryllium (7440-41-7)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Cadmium (7440-43-9)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Calcium (7440-70-2)	J, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Chromium (7440-47-3)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Cobalt (7440-48-4)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Copper (7440-50-8)	J, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Iron (7439-89-6)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Lead (7439-92-1)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Magnesium (7439-95-4)	J, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Manganese (7439-96-5)	J, CK3,MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Molybdenum (7439-98-7)	J, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Nickel (7440-02-0)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Potassium (7440-09-7)	J, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Selenium (7782-49-2)	J, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111932-009/ER-BSG-CYN-MW19	Silver (7440-22-4)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Sodium (7440-23-5)	J, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Thallium (7440-28-0)	UJ, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Vanadium (7440-62-2)	J, MS1,RP1
	111932-009/ER-BSG-CYN-MW19	Zinc (7440-66-6)	UJ, MS1,RP1
SW846 3535A/8015D			
	111932-003/ER-BSG-CYN-MW19	Diesel Range Organics (68334-30-5)	UJ, MS5
SW846 3535A/8330B			
	111932-002/ER-BSG-CYN-MW19	m-Nitrotoluene (99-08-1)	UJ, I4
	111932-002/ER-BSG-CYN-MW19	Nitrobenzene (98-95-3)	UJ, I4
	111932-002/ER-BSG-CYN-MW19	o-Nitrotoluene (88-72-2)	UJ, I4
	111932-002/ER-BSG-CYN-MW19	PETN (78-11-5)	UJ, C3,MS3
	111932-002/ER-BSG-CYN-MW19	p-Nitrotoluene (99-99-0)	UJ, I4
	111932-002/ER-BSG-CYN-MW19	Tetryl (479-45-8)	R, L3
SW846 8260B DOE-AL			
	111932-001/ER-BSG-CYN-MW19	1,1,1-Trichloroethane (71-55-6)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,1,2,2-Tetrachloroethane (79-34-5)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,1,2-Trichloroethane (79-00-5)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,1-Dichloroethane (75-34-3)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111932-001/ER-BSG-CYN-MW19	1,1-Dichloroethylene (75-35-4)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,2,3-Trichlorobenzene (87-61-6)	UJ, I5,MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,2,4-Trichlorobenzene (120-82-1)	UJ, I5,MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,2-Dibromo-3-chloropropane (96-12-8)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,2-Dibromoethane (106-93-4)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,2-Dichlorobenzene (95-50-1)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,2-Dichloroethane (107-06-2)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,2-Dichloropropane (78-87-5)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,3-Dichlorobenzene (541-73-1)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	1,4-Dichlorobenzene (106-46-7)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	2-Butanone (78-93-3)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	2-Hexanone (591-78-6)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	4-Methyl-2-pentanone (108-10-1)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Acetone (67-64-1)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Benzene (71-43-2)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Bromochloromethane (74-97-5)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Bromodichloromethane (75-27-4)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Bromoform (75-25-2)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111932-001/ER-BSG-CYN-MW19	Bromomethane (74-83-9)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Carbon disulfide (75-15-0)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Carbon tetrachloride (56-23-5)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Chlorobenzene (108-90-7)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Chloroethane (75-00-3)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Chloroform (67-66-3)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Chloromethane (74-87-3)	UJ, I5,MS1,RP1
	111932-001/ER-BSG-CYN-MW19	cis-1,2-Dichloroethylene (156-59-2)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	cis-1,3-Dichloropropylene (10061-01-5)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Cyclohexane (110-82-7)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Dibromochloromethane (124-48-1)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Dichlorodifluoromethane (75-71-8)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Ethylbenzene (100-41-4)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Isopropylbenzene (98-82-8)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	m,p-Xylenes (N/A)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Methyl acetate (79-20-9)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Methylcyclohexane (108-87-2)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Methylene chloride (75-09-2)	UJ, MS1,RP1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111932-001/ER-BSG-CYN-MW19	o-Xylene (95-47-6)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Styrene (100-42-5)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	tert-Butyl methyl ether (1634-04-4)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Tetrachloroethylene (127-18-4)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Toluene (108-88-3)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	trans-1,2-Dichloroethylene (156-60-5)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	trans-1,3-Dichloropropylene (10061-02-6)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Trichloroethylene (79-01-6)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Trichlorofluoromethane (75-69-4)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Trichlorotrifluoroethane (76-13-1)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Vinyl chloride (75-01-4)	UJ, MS1,RP1
	111932-001/ER-BSG-CYN-MW19	Xylenes (total) (1330-20-7)	UJ, MS1,RP1
	111934-001/ER-BSG-TB10	1,1,1-Trichloroethane (71-55-6)	R, H1
	111934-001/ER-BSG-TB10	1,1,2,2-Tetrachloroethane (79-34-5)	R, H1
	111934-001/ER-BSG-TB10	1,1,2-Trichloroethane (79-00-5)	R, H1
	111934-001/ER-BSG-TB10	1,1-Dichloroethane (75-34-3)	R, H1
	111934-001/ER-BSG-TB10	1,1-Dichloroethylene (75-35-4)	R, H1
	111934-001/ER-BSG-TB10	1,2,3-Trichlorobenzene (87-61-6)	R, H1,I5
	111934-001/ER-BSG-TB10	1,2,4-Trichlorobenzene (120-82-1)	R, H1,I5
	111934-001/ER-BSG-TB10	1,2-Dibromo-3-chloropropane (96-12-8)	R, H1
	111934-001/ER-BSG-TB10	1,2-Dibromoethane (106-93-4)	R, H1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111934-001/ER-BSG-TB10	1,2-Dichlorobenzene (95-50-1)	R, H1
	111934-001/ER-BSG-TB10	1,2-Dichloroethane (107-06-2)	R, H1
	111934-001/ER-BSG-TB10	1,2-Dichloropropane (78-87-5)	R, H1
	111934-001/ER-BSG-TB10	1,3-Dichlorobenzene (541-73-1)	R, H1
	111934-001/ER-BSG-TB10	1,4-Dichlorobenzene (106-46-7)	R, H1
	111934-001/ER-BSG-TB10	2-Butanone (78-93-3)	R, H1
	111934-001/ER-BSG-TB10	2-Hexanone (591-78-6)	R, H1
	111934-001/ER-BSG-TB10	4-Methyl-2-pentanone (108-10-1)	R, H1
	111934-001/ER-BSG-TB10	Acetone (67-64-1)	J-, H1,C3
	111934-001/ER-BSG-TB10	Benzene (71-43-2)	R, H1
	111934-001/ER-BSG-TB10	Bromochloromethane (74-97-5)	R, H1
	111934-001/ER-BSG-TB10	Bromodichloromethane (75-27-4)	R, H1
	111934-001/ER-BSG-TB10	Bromoform (75-25-2)	R, H1
	111934-001/ER-BSG-TB10	Bromomethane (74-83-9)	R, H1
	111934-001/ER-BSG-TB10	Carbon disulfide (75-15-0)	R, H1
	111934-001/ER-BSG-TB10	Carbon tetrachloride (56-23-5)	R, H1
	111934-001/ER-BSG-TB10	Chlorobenzene (108-90-7)	R, H1
	111934-001/ER-BSG-TB10	Chloroethane (75-00-3)	R, H1
	111934-001/ER-BSG-TB10	Chloroform (67-66-3)	R, H1
	111934-001/ER-BSG-TB10	Chloromethane (74-87-3)	R, H1,I5
	111934-001/ER-BSG-TB10	cis-1,2-Dichloroethylene (156-59-2)	R, H1
	111934-001/ER-BSG-TB10	cis-1,3-Dichloropropylene (10061-01-5)	R, H1
	111934-001/ER-BSG-TB10	Cyclohexane (110-82-7)	R, H1
	111934-001/ER-BSG-TB10	Dibromochloromethane (124-48-1)	R, H1
	111934-001/ER-BSG-TB10	Dichlorodifluoromethane (75-71-8)	R, H1
	111934-001/ER-BSG-TB10	Ethylbenzene (100-41-4)	R, H1
	111934-001/ER-BSG-TB10	Isopropylbenzene (98-82-8)	R, H1
	111934-001/ER-BSG-TB10	m,p-Xylenes (N/A)	R, H1

Analytical Method	Sample ID	Analyte Name (CAS#)	Qualifier, RC
	111934-001/ER-BSG-TB10	Methyl acetate (79-20-9)	R, H1
	111934-001/ER-BSG-TB10	Methylcyclohexane (108-87-2)	R, H1
	111934-001/ER-BSG-TB10	Methylene chloride (75-09-2)	R, H1
	111934-001/ER-BSG-TB10	o-Xylene (95-47-6)	R, H1
	111934-001/ER-BSG-TB10	Styrene (100-42-5)	R, H1
	111934-001/ER-BSG-TB10	tert-Butyl methyl ether (1634-04-4)	R, H1
	111934-001/ER-BSG-TB10	Tetrachloroethylene (127-18-4)	R, H1
	111934-001/ER-BSG-TB10	Toluene (108-88-3)	R, H1
	111934-001/ER-BSG-TB10	trans-1,2-Dichloroethylene (156-60-5)	R, H1
	111934-001/ER-BSG-TB10	trans-1,3-Dichloropropylene (10061-02-6)	R, H1
	111934-001/ER-BSG-TB10	Trichloroethylene (79-01-6)	R, H1
	111934-001/ER-BSG-TB10	Trichlorofluoromethane (75-69-4)	R, H1
	111934-001/ER-BSG-TB10	Trichlorotrifluoroethane (76-13-1)	R, H1
	111934-001/ER-BSG-TB10	Vinyl chloride (75-01-4)	R, H1
	111934-001/ER-BSG-TB10	Xylenes (total) (1330-20-7)	R, H1
SW846 9056A			
	111932-006/ER-BSG-CYN-MW19	Bromide (24959-67-9)	J, MS1,RP1
	111932-006/ER-BSG-CYN-MW19	Chloride (16887-00-6)	J, MS1,RP1
	111932-006/ER-BSG-CYN-MW19	Fluoride (16984-48-8)	J, MS1,RP1
	111932-006/ER-BSG-CYN-MW19	Sulfate (14808-79-8)	J, MS1,RP1

All other analyses met QC acceptance criteria; no further data should be qualified.

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APPENDICES

Appendix A NMED's Approval Letter and DOE's Submittal with the Enclosure Describing Full-Scale Operation Modifications

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SECTION III
TECHNICAL AREA-V IN-SITU BIOREMEDIATION TREATABILITY STUDY
PHASE I FULL-SCALE OPERATION, October – December 2019

Background

1.0 Sandia National Laboratories, New Mexico (SNL/NM) personnel are conducting a Treatability Study of in-situ bioremediation (ISB) to address the groundwater contamination by nitrate and trichloroethene (TCE) at Technical Area-V (TA-V) Groundwater (TAVG) Area of Concern (AOC). SNL/NM personnel plan to conduct the ISB Treatability Study in two phases. Phase I includes a pilot test followed by full-scale operation at the first injection well (TAV-INJ1); Phase II includes well installation and full-scale operations at two additional injection wells (TAV-INJ2 and TAV-INJ3), contingent on the success of Phase I full-scale operation. The locations of the three injection wells, TAV-INJ1, TAV-INJ2, and TAV-INJ3, are selected close to monitoring wells TAV-MW6, TAV-MW10, and LWDS-MW1, respectively, where the highest contaminant concentrations in TA-V groundwater have been detected.

Table III-1 presents a timeline for the Phase I ISB Treatability Study at TAVG AOC. SNL/NM personnel have begun the Phase I full-scale operation at injection well TAV-INJ1 in October 2018. The implementation of the Phase I full-scale operation at well TAV-INJ1 is governed by the Revised Treatability Study Work Plan (TSWP) (SNL/NM March 2016) and where applicable, the approved modifications for the full-scale operation at well TAV-INJ1 (U.S. Department of Energy [DOE] July 2018; New Mexico Environment Department [NMED] August 2018). Appendix A includes a copy of the NMED Hazardous Waste Bureau (HWB) approval letter and DOE's submittal of the proposed modifications.

This Section III of the Environmental Restoration Operations (ER) Consolidated Quarterly Report (ER Quarterly Report) presents the monitoring results for the October – December 2019 reporting period for the Phase I full-scale operation. No field activities other than groundwater monitoring occurred during this reporting period. In accordance with the Revised TSWP (SNL/NM March 2016), a technical memorandum for the Phase I ISB Treatability Study will be produced after the performance monitoring period has concluded in May 2021 (Table III-1), and will include a discussion of both the pilot test and the full-scale operation.

SNL/NM personnel have completed the six-month injection period for the Phase I full-scale operation at injection well TAV-INJ1, and are conducting the two-year performance monitoring in the ISB treatment zone (Table III-1).

The SNL/NM Long-Term Stewardship (LTS) personnel conduct groundwater monitoring for the entire TAVG AOC including the ISB treatment zone. Groundwater monitoring includes groundwater elevation measurements and groundwater sampling.

2.0 **Groundwater Elevation at Technical Area-V**

Figure III-1 shows the October/November 2019 groundwater elevation contour map (potentiometric surface) for the Regional Aquifer at TA-V. The general shape of the groundwater elevation contours has not changed significantly since the October 2017 pre-Treatability Study baseline (SNL/NM January 2018). Groundwater flows generally to the west and southwest at TA-V. Overall the groundwater elevation at TA-V has been declining at a rate of 0.51 to 0.88 feet per year (SNL/NM June 2019). The approximately 530,000 gallons of treatment solution injected over a six-month period (November 2018 – April 2019) did not create a noticeable impact on the contours of the potentiometric surface at TA-V.

3.0 **Groundwater Monitoring for Phase I Treatability Study**

The Phase I ISB Treatability Study treatment zone encompasses the injection well TAV-INJ1 and two nearby monitoring wells (TAV-MW6 and TAV-MW7). Performance monitoring involves groundwater monitoring of all three wells. Well TAV-MW7 is monitored in case there is any vertical impact of the injected solution because the well is screened approximately 90 feet below the water table.

The two-year performance monitoring includes three monthly sampling events followed by quarterly sampling events for the remainder of the two-year period, as described in the Revised TSWP (SNL/NM March 2016). The three monthly sampling events occurred in May, June, and July 2019. The Phase I ISB Treatability Study performance monitoring is currently on a quarterly schedule until May 2021 (Table III-1).

Groundwater monitoring is also conducted at eight wells outside the treatment zone on a quarterly schedule, as described in the Revised TSWP (SNL/NM March 2016).

3.1 **Groundwater Field Parameters inside the Treatment Zone**

During this reporting period, an In-Situ Incorporated Aqua TROLL[®] 600 Multi-parameter sonde was installed in each of the three wells undergoing performance monitoring (TAV-INJ1, TAV-MW6, and TAV-MW7). The parameters measured by the sonde include pressure, dissolved oxygen (DO), oxidation reduction potential (ORP), potential of hydrogen (pH), specific conductivity (SC), temperature, and turbidity, in accordance with the Revised TSWP (SNL/NM March 2016). Pressure readings can be converted to groundwater elevation above mean sea level.

In the October 2019 ER Quarterly Report, SNL/NM personnel proposed to remove the sonde in well TAV-MW7 because neither water levels nor water quality in this well have been affected by the injection at well TA-INJ1 (SNL/NM October 2019). The NMED HWB subsequently approved the request (NMED November 2019). The sonde was removed from well TAV-MW7 on December 17, 2019. This quarterly report still evaluates the sonde data for well TAV-MW7 up to the date the sonde was removed. Groundwater field parameters at well TAV-MW7 will be measured each time before the well is sampled, and the measurements will be presented along with the analytical results.

3.1.1 **Groundwater Quality at Injection Well TAV-INJ1**

Groundwater elevations in well TAV-INJ1 returned to the pre-injection static level after the injections were completed in April 2019, and remained at static level during this reporting period.

With the influx of substrate solution, the water has turned anaerobic with reduced conditions near the injection well since the completion of pilot test injections in November 2017 (Table III-1). Since then, DO, ORP, and pH have remained at optimal levels for the biodegradation of nitrate and TCE to occur. During this reporting period, pH was around 7.1; DO was at 0.0 milligrams per liter (mg/L); and ORP was approximately negative (-) 420 millivolts. There were no significant changes in SC and turbidity during this reporting period.

The baseline groundwater temperature in well TAV-INJ1 was approximately 21.1 degrees Celsius. The injected substrate solution, which was mainly potable water, was colder than

local groundwater. Another reason for the colder substrate solution was that most of the injections occurred in the winter season of 2018 – 2019. After injection was completed in April 2019, the water temperature in well TAV-INJ1 has been rising slowly, and was approximately 20.1 degrees Celsius in December 2019. Figure III-2 shows the groundwater temperature profile in the injection well since pre-full-scale operation in October 2018 to December 2019.

3.1.2 **Groundwater Quality at Monitoring Wells TAV-MW6 and TAV-MW7**

Well TAV-MW6 is located approximately 50 feet east-southeast of well TAV-INJ1, and is screened across the water table as is well TAV-INJ1. The groundwater elevation in well TAV-MW6 remained at static levels during this reporting period. There were no significant changes in ORP, pH, SC, temperature, and turbidity in this well during this reporting period, except for DO. The concentration of DO has decreased from the baseline of approximately 7.0 mg/L to approximately 4.0 mg/L in October 2019, and started to rise since then. Figure III-3 shows the DO concentration profile in monitoring well TAV-MW6 since pre-full-scale operation in October 2018 to December 2019.

Well TAV-MW7 is located approximately 27 feet east-southeast of well TAV-INJ1, and is screened approximately 90 feet below the water table. The groundwater elevation in well TAV-MW7 remained at static levels during this reporting period. There were no significant changes in any of the groundwater quality parameters in this well during this reporting period.

3.2 **Groundwater Sampling Inside the Treatment Zone**

Table III-2 lists the sampling dates for the October – December 2019 reporting period for all the wells pertinent to the ISB Treatability Study. Tables III-3 through III-6 presents all the analytical results. Table III-7 summarizes the stabilized water quality parameters measured immediately before sample collection at each well.

3.2.1 **Groundwater Sampling at Injection Well TAV-INJ1**

During groundwater sampling, the SNL/NM personnel discovered significant sediment accumulation in well TAV-INJ1. This is probably due to the repeated disturbance of the geological formation by the 110 injections over the six-month period. As a result, the sampling pump was placed at a higher elevation than the pre-full-scale operation sampling when the well was relatively free of sediment. Even though the purge volume (before

sample collection) at well TAV-INJ1 was 59 gallons which was determined in the baseline sampling before the ISB Treatability Study, the pump daylighted during purging after pumping approximately 11.5 gallons of groundwater (with the pump set at approximately mid-depth of the water column). The standard practice of the SNL/NM LTS program for low-yield wells is to let the well recover overnight and collect samples the next day. However, the microbial sample was required to be collected immediately after purging on the first day. For the October sampling event at well TAV-INJ1, the microbial sample was collected on October 29 and the remainder of the samples were collected on October 30, 2019 (Table III-2).

The analytical parameters for groundwater samples from well TAV-INJ1 include the following in accordance with Modification #8 (Appendix A):

- Alkalinity (total, bicarbonate, and carbonate)
- Ammonia (as nitrogen)
- Anions (bromide and sulfate)
- *Dehalococcoides* (Dhc) and, if Dhc is present, vinyl chloride reductase
- Dissolved metals (arsenic, iron, and manganese)
- Methane/ethane/ethene
- Nitrate plus nitrite (NPN)
- Total organic carbon (TOC)
- Volatile organic compounds (VOCs)

Table III-3 provides the analytical results for the October – December 2019 sampling event at well TAV-INJ1. The October 2019 results show that:

- The two constituents of concern in the groundwater at TA-V (NPN and TCE) were not detected.
- Alkalinity, ammonia, and bromide (Figure III-4) concentrations did not change significantly from the last sampling results collected in July 2019 (SNL/NM January 2020). Sulfate concentration decreased from 154 mg/L in July 2019 to 14.6 mg/L in October 2019.
- The population of Dhc decreased from 10E5 gene copies per liter in July 2019 to an estimated value (J-qualified) of 8E3 gene copies per liter in October 2019.
- Concentrations of dissolved arsenic and iron decreased from those of July 2019; while concentration of dissolved manganese increased from 0.613 mg/L in July 2019 to 0.734 mg/L in October 2019. Arsenic concentration (0.0246 mg/L) exceeded the U.S. Environmental Protection Agency maximum contaminant level of 0.01 mg/L in October 2019. This was anticipated. During the ISB, the substrate solution produces strongly anaerobic redox conditions in the aquifer that solubilize and mobilize naturally occurring metals and metalloids. The solubilization of these metals is a transient phenomenon and is limited to the treatment zone. Solubilized metals and

metalloids will precipitate into solid form once they leave the anaerobic treatment zone and enter the aerobic aquifer.

- The level of methane remained high (16,000 micrograms per liter [$\mu\text{g/L}$]) and was similar to the July 2019 concentration (14,000 $\mu\text{g/L}$). Ethene was not detected in October 2019.
- TOC concentration decreased from 54.7 mg/L in July 2019 to 13.7 mg/L in October 2019.

3.2.2 **Groundwater Sampling at Monitoring Well TAV-MW6**

The analytical parameters for groundwater samples from well TAV-MW6 are the same as those for well TAV-INJ1 in accordance with Modification #8 (Appendix A).

Table III-4 provides the analytical results for October – December 2019 sampling event at well TAV-MW6. In comparison to the pre-full-scale operation baseline levels in September 2018 (SNL/NM April 2019), the October 2019 results show that:

- Concentrations of NPN and TCE were consistent with baseline levels.
- Bromide is the inert tracer that was added to the substrate solution injected at well TAV-INJ1. Bromide concentrations are expected to increase in well TAV-MW6 as the substrate solution moves away from well TAV-INJ1. The baseline concentration of bromide was 0.815 mg/L. Figure III-4 shows the bromide concentrations in both TAV-INJ1 and TAV-MW6 since pre-full-scale operation in September 2018 to October 2019. Bromide in well TAV-MW6 reached its highest concentration in June 2019 then started to decrease.
- Methane was not detected in the baseline sample at well TAV-MW6. Methane concentration has increased to 360 $\mu\text{g/L}$ in October 2019. Ethene has not been detected at this well.
- The results for the other analytes were consistent with the baseline levels.

3.2.3 **Groundwater Sampling at Monitoring Well TAV-MW7**

The analytical parameters for groundwater samples from well TAV-MW7 include the following, in accordance with Modification #7 (Appendix A):

- Bromide
- Dissolved metals (arsenic, iron, and manganese)
- Ethene
- NPN
- VOCs

Table III-5 provides the analytical results for the October – December 2019 sampling event at well TAV-MW7, which is screened 90 feet below the water table. All the analytical results are consistent with baseline levels, including NPN, TCE, and bromide (SNL/NM April 2019).

3.3 **Groundwater Sampling Outside the Treatment Zone**

In accordance with Section 5.5 of the Revised TSWP (SNL/NM March 2016), eight wells are sampled quarterly for dissolved metals (iron, manganese, and arsenic) to evaluate potential impact of substrate solution on groundwater outside the Phase I ISB Treatability Study treatment zone. The eight wells are: LWDS-MW1, TAV-MW2, TAV-MW4, TAV-MW8, TAV-MW10, TAV-MW11, TAV-MW12, and TAV-MW14. The analytical parameters for groundwater samples from these wells include the following:

- Dissolved metals (arsenic, iron, and manganese)
- NPN
- VOCs

These parameters are the same as those for the other monitoring wells in the TA-V groundwater monitoring network (SNL/NM June 2019). Table III-6 provides the analytical results for the October – December 2019 sampling at the eight wells. Duplicate samples were collected from well TAV-MW2, per the monitoring scheme of the SNL/NM LTS program for the TA-V groundwater monitoring network. All the analytical results are consistent with the historical values at these eight wells (SNL/NM June 2019).

3.4 **Summary of Groundwater Monitoring Results for Phase I Treatability Study**

The groundwater elevations remained at static levels during this reporting period in the ISB treatment zone that encompasses the injection well TAV-INJ1 and two monitoring wells TAV-MW6 and TAV-MW7.

The groundwater quality and analytical results from injection well TAV-INJ1 show that:

- The water temperature in the well has been slowly rising, indicating the injected solution is mixing with the native groundwater (the injected solution was colder than local groundwater).
- The groundwater quality in the well remained optimal for biodegradation of nitrate and TCE as reflected by the DO, ORP, and pH levels.

- NPN and TCE were not detected. Nitrate would have been biodegraded by native bacteria as being the most favorable electron acceptor after DO was depleted (see Section 3.0 of the Revised TSWP [SNL/NM March 2016]). It is also possible that the native groundwater was displaced by the injections and has not flowed back or completely mixed with the injected solution.
- The population of Dhc declined, approaching the method detection limit (10E3) gene copies per liter in October 2019.
- The methane level remained high and TOC continued to be consumed, indicating active microbial activity along with carbon consumption.
- Ethene was not detected in October 2019. Ethene is the parameter indicating complete TCE dechlorination.
- Additional monitoring is necessary to confirm if dechlorination is occurring at the injection well.

Well TAV-MW6 serves as the monitoring well for evaluating the effectiveness of ISB inside the treatment zone. The groundwater quality and analytical results from this well show that:

- The DO levels reached the lowest point of approximately 4 mg/L in October 2019 and then started to increase over time.
- Bromide, the inert tracer, has migrated to well TAV-MW6; however, bromide reached its highest concentration (4.12 mg/L) in June 2019 and then started to decrease over time.
- The Dhc have not reached well TAV-MW6.

The groundwater quality and analytical results from well TAV-MW7 indicate that there is no impact on the deeper groundwater monitored by this well from the substrate solution injected at well TAV-INJ1.

For the eight wells located outside the treatment zone, there is no impact on the groundwater chemistry at these wells from the substrate solution injected at well TAV-INJ1.

4.0

Deviation

No deviation was encountered with regards to the Revised TWSP (SNL/NM March 2016) and where applicable, the approved modifications for the full-scale operation at well TAV-INJ1 (DOE July 2018; NMED August 2018).

5.0 Recommendation

On Page 5-20 of the Revised TSWP (SNL/NM March 2016), SNL/NM personnel proposed:

“The monitoring data collected during the full-scale injection and during the six months after injection is completed will be evaluated to determine if the Treatability Study should proceed to Phase II. These interim performance results and any associated revisions to procedures will be communicated to NMED HWB along with the decision whether to proceed to Phase II.”

Monitoring results since the end of the injection period in April 2019 to December 2019 are not yet conclusive enough for SNL/NM personnel to decide on whether to proceed to Phase II of the ISB Treatability Study. Additional monitoring is necessary before the decision can be made. Because the ISB Treatability Study performance monitoring is currently on a quarterly schedule, the decision on whether to proceed to Phase II is not anticipated until later in 2020.

6.0 References

DOE, see U.S. Department of Energy.

New Mexico Environment Department (NMED), August 2018. Letter to J.P. Harrell (U.S. Department of Energy NNSA/Sandia Field Office) and R.O. Griffith (Sandia National Laboratories), “Approval: Technical Area-V (TA-V) Treatability Study Notification of Full-Scale Operation at Well TAV-INJ1, Sandia National Laboratory, EPA ID# NM5890110518, HWB-SNL-15-020,” August 13, 2018.

New Mexico Environment Department (NMED), November 2019. Letter to J.P. Harrell (U.S. Department of Energy NNSA/Sandia Field Office) and P. Shoemaker (Sandia National Laboratories), “Approval: Environmental Restoration Operations Consolidated Quarterly Report, April – June 2019, October 2019, Sandia National Laboratory, EPA ID# NM5890110518, HWB-SNL-19-017,” November 25, 2019.

NMED, see New Mexico Environment Department.

Sandia National Laboratories, New Mexico (SNL/NM), March 2016. *Revised Treatability Study Work Plan for In-Situ Bioremediation at the Technical Area-V Groundwater Area of Concern*, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), January 2018. *Discharge Permit-1845 Quarterly Status Report, July – September 2017*, Sandia National Laboratories, Albuquerque, New Mexico.

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Sandia National Laboratories, New Mexico (SNL/NM), June 2019. *Annual Groundwater Monitoring Report, Calendar Year 2018*, Long-Term Stewardship Consolidated Groundwater Monitoring Program, Long-Term Stewardship and Environmental Restoration Operations, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), October 2019. *Environmental Restoration Operations Consolidated Quarterly Report April – June 2019*, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), January 2020. *Environmental Restoration Operations Consolidated Quarterly Report July – September 2019*, Sandia National Laboratories, Albuquerque, New Mexico.

SNL/NM, see Sandia National Laboratories, New Mexico.

U.S. Department of Energy (DOE), July 2018. Letter to J. E. Kieling (New Mexico Environment Department), “Technical Area-V (TA-V) Treatability Study Notification of Full-Scale Operation at Well TAV-INJ1”, July 20, 2018.

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Figures

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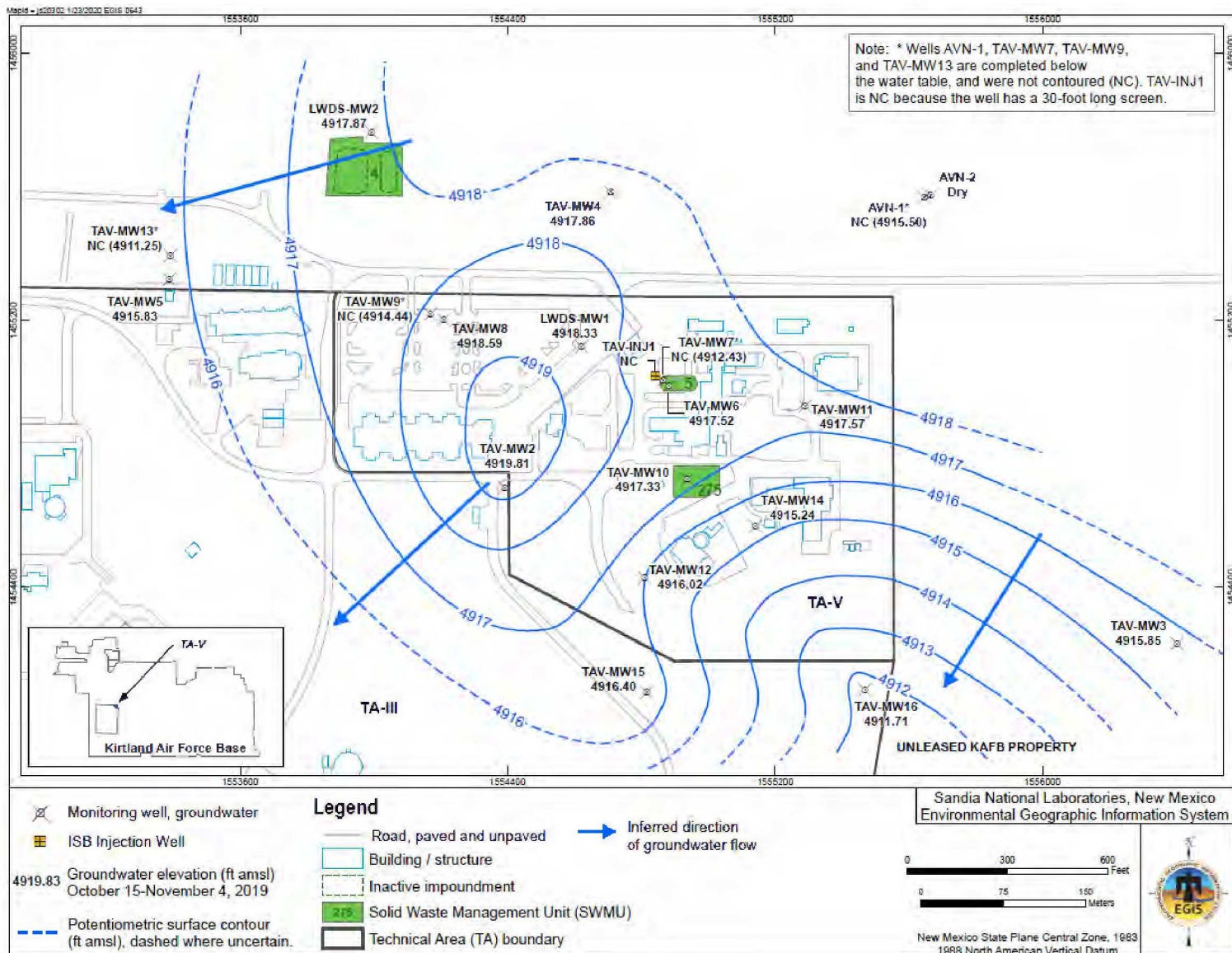


Figure III-1
Well Locations and Potentiometric Surface Contours for October/November 2019

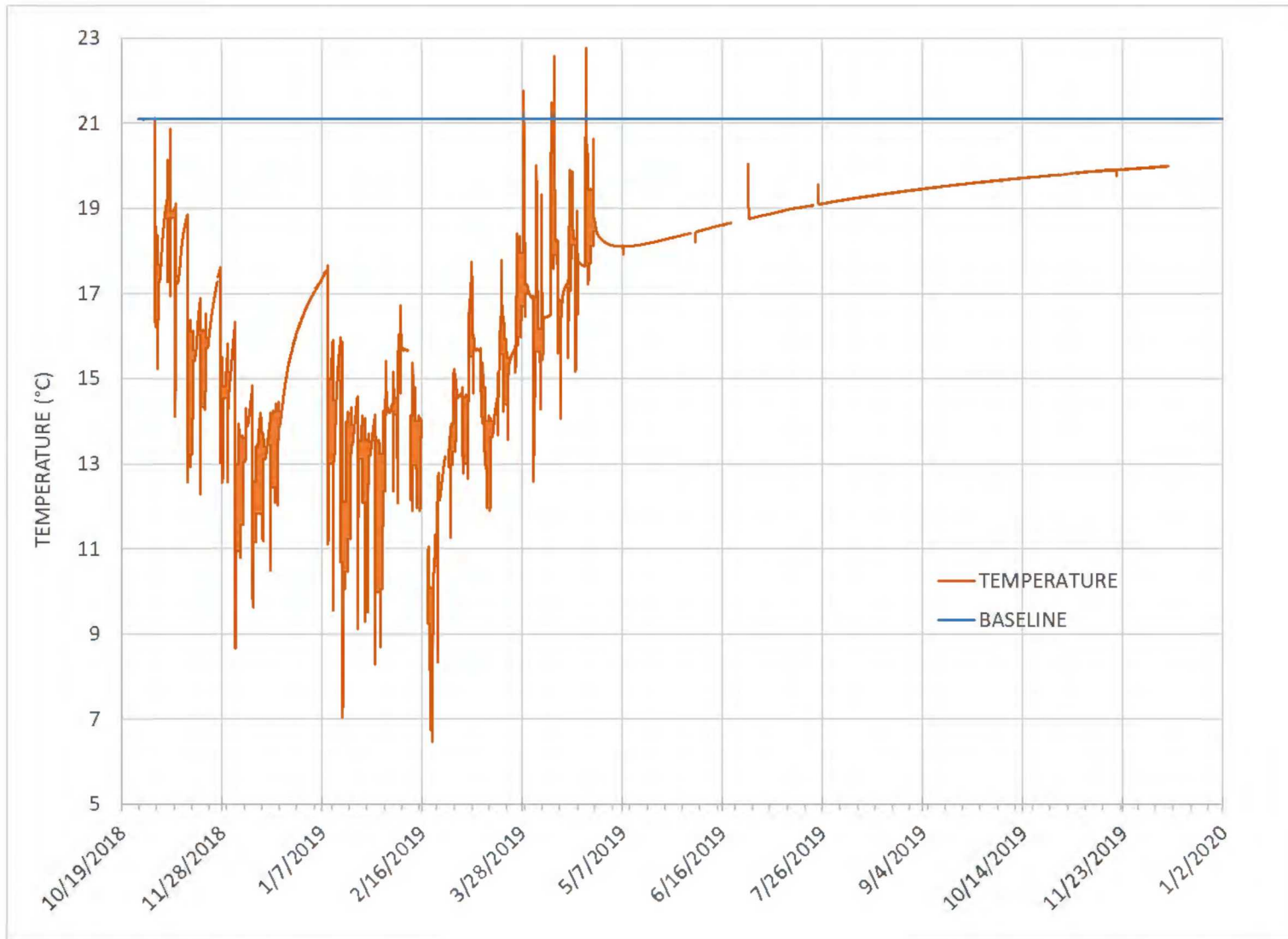


Figure III-2
Groundwater Temperature Profile in Injection Well TAV-INJ1, October 2018 – December 2019

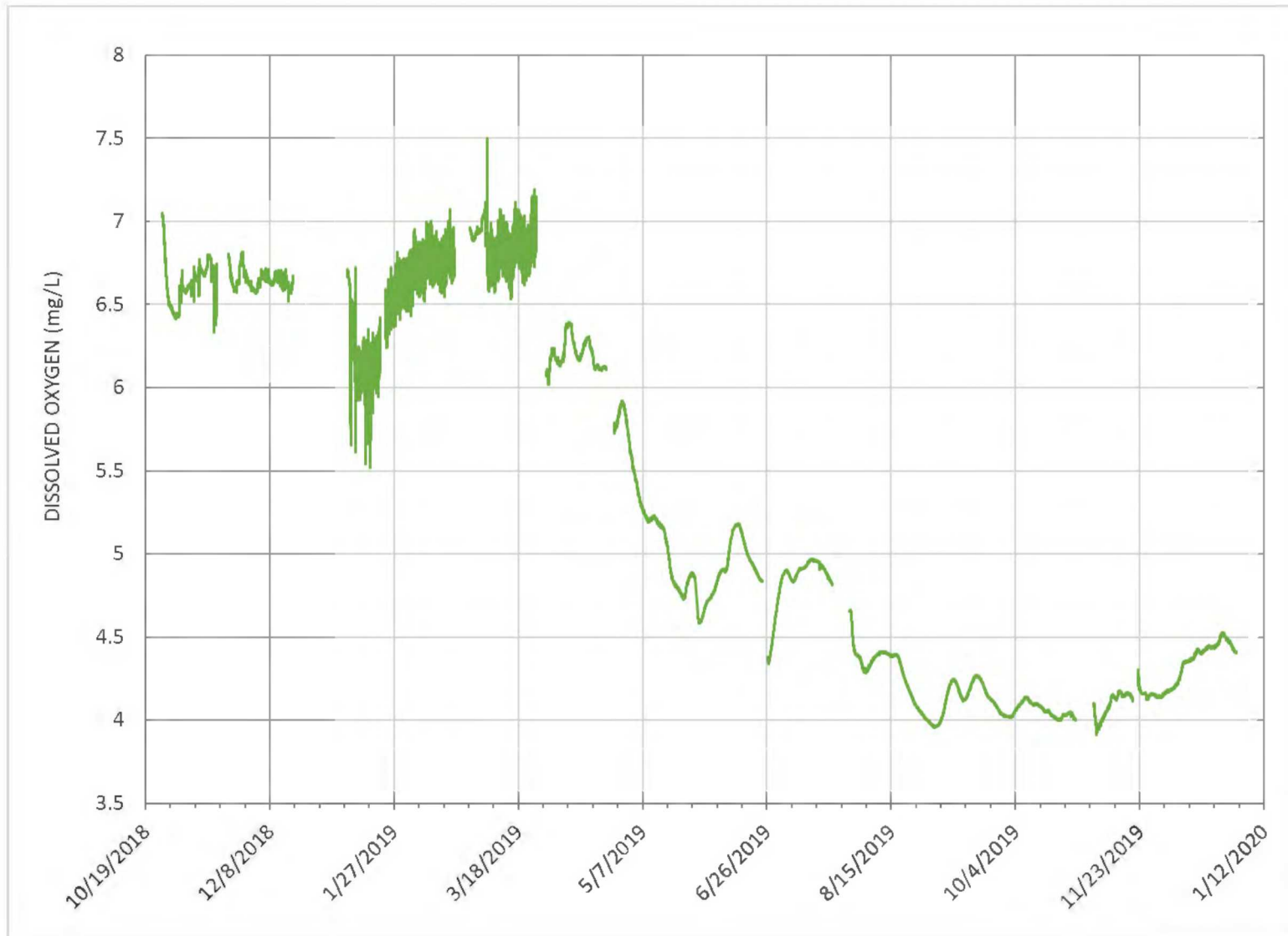


Figure III-3
Concentration of Dissolved Oxygen in Monitoring Well TAV-MW6, October 2018 – December 2019

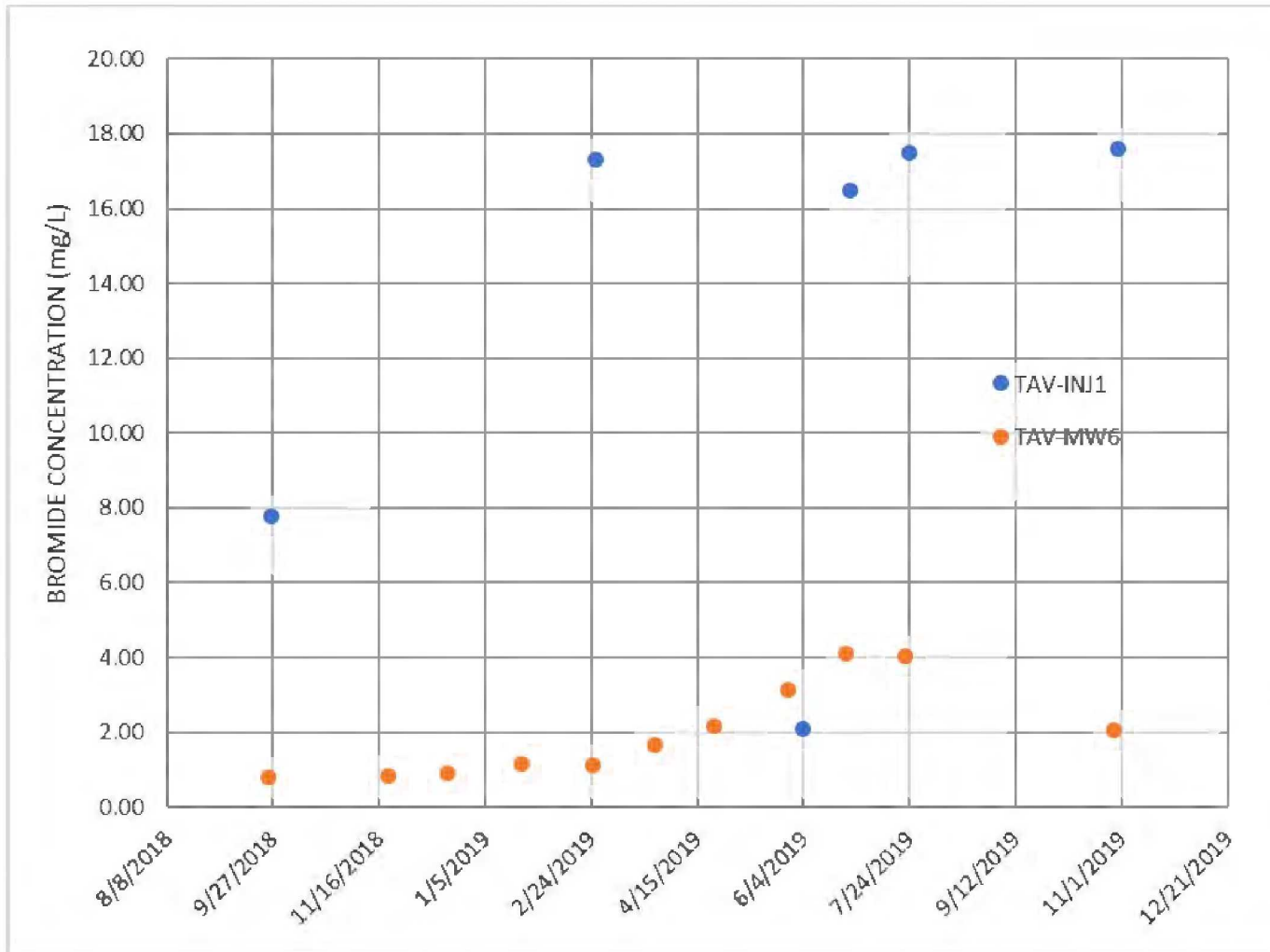


Figure III-4

Concentration of Bromide in Injection Well TAV-INJ1 and Monitoring Well TAV-MW6, September 2018 – October 2019

Note: The bromide concentration of the June 4, 2019 sample (2.09 mg/L) from well TAV-INJ1 was anomalous (SNL/NM January 2020).

Tables

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Table III-1
Timeline of Phase I In-Situ Bioremediation Treatability Study at TAVG AOC

Time	Event
July 2015	Personnel from DOE/NNSA, DOE Office of Environmental Management, SNL/NM, and NMED HWB agreed on a phased Treatability Study of In-Situ Bioremediation (ISB) to evaluate if ISB is a viable technology to treat groundwater contamination at TAVG AOC.
May 2016	NMED HWB approved the Revised Treatability Study Work Plan.
August 2016	NMOSE approved the Permit to Drill application for injection well TAV-INJ1.
May 2017	NMED GWQB issued Discharge Permit (DP)-1845 to DOE/NNSA for the TA-V Treatability Study injection wells.
November 2017	SNL/NM personnel completed installation of injection well TAV-INJ1.
November 2017	Completed Phase I pilot test injections at well TAV-INJ1.
June 2018	Completed performance monitoring of Phase I pilot test.
October 2018	SNL/NM personnel started Phase I full-scale operation of the Treatability Study.
November 1, 2018 – April 25, 2019	Completed the six-month injection period of the Phase I full-scale operation at well TAV-INJ1.
May 2019	Started the two-year performance monitoring of Phase I full-scale operation.
Fall 2020	Anticipate making a decision on whether or not to proceed to Phase II of the Treatability Study.
May 2021	Anticipate completing the performance monitoring of the Phase I full-scale operation.

Notes:

AOC = Area of Concern.

DOE = U.S. Department of Defense.

GWQB = Ground Water Quality Bureau.

HWB = Hazardous Waste Bureau.

INJ = Injection (acronym used for well identification only).

NMED = New Mexico Environment Department.

NMOSE = New Mexico Office of the State Engineer.

NNSA = Nation Nuclear Security Administration.

SNL/NM = Sandia National Laboratories, New Mexico.

TA-V = Technical Area-V.

TAV = Technical Area-V (acronym used for well identification only).

TAVG = Technical Area-V Groundwater.

Table III-2
Groundwater Sampling Conducted for Treatability Study, October – December 2019

Monitoring Well	Sampling Date
Wells Inside the Treatment Zone	
TAV-INJ1	29-30 Oct 2019 ^a
TAV-MW6	28 Oct 2019
TAV-MW7	22 Oct 2019
Wells Outside the Treatment Zone	
LWDS-MW1	18 Nov 2019
TAV-MW2	31 Oct 2019
TAV-MW4	5 Nov 2019
TAV-MW8	6 Nov 2019
TAV-MW10	13 Nov 2019
TAV-MW11	4 Nov 2019
TAV-MW12	12 Nov 2019
TAV-MW14	7 Nov 2019

Notes:

^a Microbial sample was collected on October 29, and the remainder of the samples were collected on October 30, 2019 after the water level had recovered at well TAV-INJ1.

INJ = Injection well.

LWDS = Liquid waste disposal system.

MW = Monitoring well.

TAV = Technical Area-V.

**Table III-3
Analytical Results for Groundwater Samples Collected at Injection Well TAV-INJ1, October – December 2019**

Sample Date	Analyses	Analyte	Result ^a	MDL ^b	PQL ^c	MCL ^d	Units	Lab Qual ^e	Val Qual ^f	Sample No.	Analytical Method ^g	Lab ^h
30-Oct-19	Alkalinity	Alkalinity as CaCO ₃	1,500	1.45	4.00	NE	mg/L		J	110536-005	SM 2320B	GEL
30-Oct-19	Alkalinity	Alkalinity, bicarb as CaCO ₃	1,500	1.45	4.00	NE	mg/L			110536-005	SM 2320B	GEL
30-Oct-19	Alkalinity	Alkalinity, carb as CaCO ₃	ND	1.45	4.00	NE	mg/L	U		110536-005	SM 2320B	GEL
30-Oct-19	Ammonia	Ammonia	117	4.25	12.5	NE	mg/L		J	110536-001	EPA 350.1	GEL
30-Oct-19	Anions	Bromide	17.6	1.34	4.00	NE	mg/L			110536-003	SW846 9056A	GEL
30-Oct-19	Anions	Sulfate	14.6	0.133	0.400	NE	mg/L			110536-003	SW846 9056A	GEL
29-Oct-19	Microbial	Dehalococcoides	8,000	3,000	3,000	NE	Enumeration/L	J		110544-001	Dhc	SRM
30-Oct-19	Dissolved Metals	Arsenic	0.0246	0.002	0.005	0.01	mg/L			110536-006	SW846 3005A/6020B	GEL
30-Oct-19	Dissolved Metals	Iron	0.596	0.033	0.100	NE	mg/L			110536-006	SW846 3005A/6020B	GEL
30-Oct-19	Dissolved Metals	Manganese	0.734	0.001	0.005	NE	mg/L			110536-006	SW846 3005A/6020B	GEL
30-Oct-19	MEE	Methane	16,000	0.046	0.500	NE	µg/L		J	110540-001	AM20GAX	PACE
30-Oct-19	MEE	Ethane	0.13	0.005	0.100	NE	µg/L		J	110540-001	AM20GAX	PACE
30-Oct-19	MEE	Ethene	ND	0.004	0.100	NE	µg/L	U	0.100UJ	110540-001	AM20GAX	PACE
30-Oct-19	NPN	Nitrate plus nitrite as N	ND	0.017	0.050	10	mg/L	U		110536-004	EPA 353.2	GEL
30-Oct-19	TOC	Total Organic Carbon Average	13.7	0.660	2.00	NE	mg/L			110536-002	SW846 9060A	GEL
30-Oct-19	VOC	Dichloroethene, cis-1,2-	ND	0.300	1.00	70	µg/L	U		110537-001	SW846 8260B	GEL
30-Oct-19	VOC	Trichloroethene	ND	0.3	1.00	5	µg/L	U		110537-001	SW846 8260B	GEL

Note: Header nomenclature is explained following Table III-7 in the "Footnotes for Technical Area-V Analytical Results Tables" summary.

**Table III-4
Analytical Results for Groundwater Samples Collected at Monitoring Well TAV MW6, October – December 2019**

Sample Date	Analyses	Analyte	Result ^a	MDL ^b	PQL ^c	MCL ^d	Units	Lab Qual ^e	Val Qual ^f	Sample No.	Analytical Method ^g	Lab ^h
28-Oct-19	Alkalinity	Alkalinity as CaCO ₃	208	1.45	4.00	NE	mg/L			110534-006	SM 2320B	GEL
28-Oct-19	Alkalinity	Alkalinity, bicarb as CaCO ₃	208	1.45	4.00	NE	mg/L			110534-006	SM 2320B	GEL
28-Oct-19	Alkalinity	Alkalinity, carb as CaCO ₃	ND	1.45	4.00	NE	mg/L	U		110534-006	SM 2320B	GEL
28-Oct-19	Ammonia	Ammonia	0.0403	0.017	0.050	NE	mg/L	J		110534-002	EPA 350.1	GEL
28-Oct-19	Anions	Bromide	2.05	0.067	0.200	NE	mg/L			110534-004	SW846 9056A	GEL
28-Oct-19	Anions	Sulfate	39.7	0.665	2.00	NE	mg/L			110534-004	SW846 9056A	GEL
28-Oct-19	Microbial	Dehalococcoides	ND	3,000	3,000	NE	Enumeration/L	U		110542-001	Dhc	SRM
28-Oct-19	Dissolved Metals	Arsenic	0.00252	0.002	0.005	0.01	mg/L	J		110534-007	SW846 3005A/6020B	GEL
28-Oct-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110534-007	SW846 3005A/6020B	GEL
28-Oct-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110534-007	SW846 3005A/6020B	GEL
28-Oct-19	MEE	Methane	360	0.046	0.500	NE	µg/L		J	110541-001	AM20GAX	PACE
28-Oct-19	MEE	Ethane	ND	0.005	0.100	NE	µg/L	U	0.100UJ	110541-001	AM20GAX	PACE
28-Oct-19	MEE	Ethene	ND	0.004	0.100	NE	µg/L	U	0.100UJ	110541-001	AM20GAX	PACE
28-Oct-19	NPN	Nitrate plus nitrite as N	6.45	0.170	0.500	10	mg/L			110534-005	EPA 353.2	GEL
28-Oct-19	TOC	Total Organic Carbon Average	0.457	0.330	1.00	NE	mg/L	J		110534-003	SW846 9060A	GEL
28-Oct-19	VOC	Dichloroethene, cis-1,2-	0.96	0.300	1.00	70	µg/L	J		110534-001	SW846 8260B	GEL
28-Oct-19	VOC	Trichloroethene	8.37	0.300	1.00	5	µg/L			110534-001	SW846 8260B	GEL

Note: Header nomenclature is explained following Table III-7 in the "Footnotes for Technical Area-V Analytical Results Tables" summary.

**Table III-5
Analytical Results for Groundwater Samples Collected at Monitoring Well TAV-MW7, October – December 2019**

Sample Date	Analyses	Analyte	Result ^a	MDL ^b	PQL ^c	MCL ^d	Units	Lab Qual ^e	Val Qual ^f	Sample No.	Analytical Method ^g	Lab ^h
22-Oct-19	Anions	Bromide	0.259	0.067	0.200	NE	mg/L			110549-001	SW846 9056A	GEL
22-Oct-19	Dissolved Metals	Arsenic	0.00276	0.002	0.005	0.01	mg/L	JB	0.005U	110564-003	SW846 3005A/6020B	GEL
22-Oct-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110564-003	SW846 3005A/6020B	GEL
22-Oct-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110564-003	SW846 3005A/6020B	GEL
22-Oct-19	MEE	Ethene	ND	0.008	0.100	NE	µg/L	U	0.100UJ	110546-001	AM20GAX	PACE
22-Oct-19	NPN	Nitrate plus nitrite as N	4.34	0.170	0.500	10	mg/L	N	J+	110564-002	EPA 353.2	GEL
22-Oct-19	VOC	Dichloroethene, cis-1,2-	ND	0.300	1.00	70	µg/L	U		110564-001	SW846 8260B	GEL
22-Oct-19	VOC	Trichloroethene	ND	0.300	1.00	5	µg/L	U		110564-001	SW846 8260B	GEL

Note: Header nomenclature is explained following Table III-7 in the "Footnotes for Technical Area-V Analytical Results Tables" summary.

Table III-6
Analytical Results for Groundwater Samples Collected at Monitoring Wells
LWDS-MW1, TAV-MW2, TAV-MW4, TAV-MW8, TAV-MW10, TAV-MW11, TAV-MW12, and TAV MW14, October – December 2019

Sample Date	Analyses	Analyte	Result ^a	MDL ^b	PQL ^c	MCL ^d	Units	Lab Qual ^e	Val Qual ^f	Sample No.	Analytical Method ^g	Lab ^h
LWDS-MW1												
18-Nov-19	Dissolved Metals	Arsenic	0.00368	0.002	0.005	0.01	mg/L	J		110553-003	SW846 3005A/6020B	GEL
18-Nov-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110553-003	SW846 3005A/6020B	GEL
18-Nov-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110553-003	SW846 3005A/6020B	GEL
18-Nov-19	NPN	Nitrate plus nitrite as N	12.2	0.425	1.25	10	mg/L			110553-002	EPA 353.2	GEL
18-Nov-19	VOC	Dichloroethene, cis-1,2-	4.18	0.300	1.00	70	µg/L			110553-001	SW846 8260B	GEL
18-Nov-19	VOC	Trichloroethene	20.2	0.300	1.00	5	µg/L			110553-001	SW846 8260B	GEL
TAV-MW2												
31-Oct-19	Dissolved Metals	Arsenic	0.00223	0.002	0.005	0.01	mg/L	J		110555-003	SW846 3005A/6020B	GEL
31-Oct-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110555-003	SW846 3005A/6020B	GEL
31-Oct-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110555-003	SW846 3005A/6020B	GEL
31-Oct-19	NPN	Nitrate plus nitrite as N	6.00	0.170	0.500	10	mg/L		J	110555-002	EPA 353.2	GEL
31-Oct-19	VOC	Dichloroethene, cis-1,2-	ND	0.300	1.00	70	µg/L	U		110555-001	SW846 8260B	GEL
31-Oct-19	VOC	Trichloroethene	4.08	0.300	1.00	5	µg/L			110555-001	SW846 8260B	GEL
31-Oct-19 (DUP)	Dissolved Metals	Arsenic	ND	0.002	0.005	0.01	mg/L	U		110556-003	SW846 3005A/6020B	GEL
31-Oct-19 (DUP)	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110556-003	SW846 3005A/6020B	GEL
31-Oct-19 (DUP)	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110556-003	SW846 3005A/6020B	GEL
31-Oct-19 (DUP)	NPN	Nitrate plus nitrite as N	5.69	0.170	0.500	10	mg/L		J	110556-002	EPA 353.2	GEL
31-Oct-19 (DUP)	VOC	Dichloroethene, cis-1,2-	ND	0.300	1.00	70	µg/L	U		110556-001	SW846 8260B	GEL
31-Oct-19 (DUP)	VOC	Trichloroethene	3.99	0.300	1.00	5	µg/L			110556-001	SW846 8260B	GEL
TAV-MW4												
5-Nov-19	Dissolved Metals	Arsenic	0.00232	0.002	0.005	0.01	mg/L	J		110561-003	SW846 3005A/6020B	GEL
5-Nov-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110561-003	SW846 3005A/6020B	GEL
5-Nov-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110561-003	SW846 3005A/6020B	GEL
5-Nov-19	NPN	Nitrate plus nitrite as N	4.62	0.170	0.500	10	mg/L			110561-002	EPA 353.2	GEL
5-Nov-19	VOC	Dichloroethene, cis-1,2-	0.48	0.300	1.00	70	µg/L	J		110561-001	SW846 8260B	GEL
5-Nov-19	VOC	Trichloroethene	5.40	0.300	1.00	5	µg/L			110561-001	SW846 8260B	GEL
TAV-MW8												
6-Nov-19	Dissolved Metals	Arsenic	0.00254	0.002	0.005	0.01	mg/L	J		110566-003	SW846 3005A/6020B	GEL
6-Nov-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110566-003	SW846 3005A/6020B	GEL
6-Nov-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110566-003	SW846 3005A/6020B	GEL
6-Nov-19	NPN	Nitrate plus nitrite as N	6.73	0.170	0.500	10	mg/L			110566-002	EPA 353.2	GEL
6-Nov-19	VOC	Dichloroethene, cis-1,2-	0.48	0.300	1.00	70	µg/L	J		110566-001	SW846 8260B	GEL
6-Nov-19	VOC	Trichloroethene	5.66	0.300	1.00	5	µg/L			110566-001	SW846 8260B	GEL
TAV-MW10												
13-Nov-19	Dissolved Metals	Arsenic	0.00215	0.002	0.005	0.01	mg/L	J		110568-003	SW846 3005A/6020B	GEL
13-Nov-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110568-003	SW846 3005A/6020B	GEL
13-Nov-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110568-003	SW846 3005A/6020B	GEL
13-Nov-19	NPN	Nitrate plus nitrite as N	11.2	0.425	1.25	10	mg/L			110568-002	EPA 353.2	GEL
13-Nov-19	VOC	Dichloroethene, cis-1,2-	2.38	0.300	1.00	70	µg/L			110568-001	SW846 8260B	GEL
13-Nov-19	VOC	Trichloroethene	14.9	0.300	1.00	5	µg/L			110568-001	SW846 8260B	GEL

Note: Header nomenclature is explained following Table III-7 in the "Footnotes for Technical Area-V Analytical Results Tables" summary.

Table III-6
Analytical Results for Groundwater Samples Collected at Monitoring Wells
LWDS-MW1, TAV-MW2, TAV-MW4, TAV-MW8, TAV-MW10, TAV-MW11, TAV-MW12, and TAV MW14, October – December 2019 (concluded)

Sample Date	Analyses	Analyte	Result ^a	MDL ^b	PQL ^c	MCL ^d	Units	Lab Qual ^e	Val Qual ^f	Sample No.	Analytical Method ^g	Lab ^h
TAV-MW11												
4-Nov-19	Dissolved Metals	Arsenic	0.00251	0.002	0.005	0.01	mg/L	J		110573-003	SW846 3005A/6020B	GEL
4-Nov-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110573-003	SW846 3005A/6020B	GEL
4-Nov-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110573-003	SW846 3005A/6020B	GEL
4-Nov-19	NPN	Nitrate plus nitrite as N	6.78	0.170	0.500	10	mg/L			110573-002	EPA 353.2	GEL
4-Nov-19	VOC	Dichloroethene, cis-1,2-	0.48	0.300	1.00	70	µg/L	J		110573-001	SW846 8260B	GEL
4-Nov-19	VOC	Trichloroethene	3.83	0.300	1.00	5	µg/L			110573-001	SW846 8260B	GEL
TAV-MW12												
12-Nov-19	Dissolved Metals	Arsenic	ND	0.002	0.005	0.01	mg/L	U		111912-003	SW846 3005A/6020B	GEL
12-Nov-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		111912-003	SW846 3005A/6020B	GEL
12-Nov-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		111912-003	SW846 3005A/6020B	GEL
12-Nov-19	NPN	Nitrate plus nitrite as N	4.54	0.170	0.500	10	mg/L			111912-002	EPA 353.2	GEL
12-Nov-19	VOC	Dichloroethene, cis-1,2-	ND	0.300	1.00	70	µg/L	U		111912-001	SW846 8260B	GEL
12-Nov-19	VOC	Trichloroethene	2.81	0.300	1.00	5	µg/L			111912-001	SW846 8260B	GEL
TAV-MW14												
7-Nov-19	Dissolved Metals	Arsenic	0.00224	0.002	0.005	0.01	mg/L	J		110575-003	SW846 3005A/6020B	GEL
7-Nov-19	Dissolved Metals	Iron	ND	0.033	0.100	NE	mg/L	U		110575-003	SW846 3005A/6020B	GEL
7-Nov-19	Dissolved Metals	Manganese	ND	0.001	0.005	NE	mg/L	U		110575-003	SW846 3005A/6020B	GEL
7-Nov-19	NPN	Nitrate plus nitrite as N	8.21	0.170	0.500	10	mg/L			110575-002	EPA 353.2	GEL
7-Nov-19	VOC	Dichloroethene, cis-1,2-	0.43	0.300	1.00	70	µg/L	J		110575-001	SW846 8260B	GEL
7-Nov-19	VOC	Trichloroethene	4.17	0.300	1.00	5	µg/L			110575-001	SW846 8260B	GEL

Note: Header nomenclature is explained following Table III-7 in the "Footnotes for Technical Area-V Analytical Results Tables" summary.

**Table III-7
Field Water Quality Measurementsⁱ, October – December 2019**

Well ID	Sample Date	Temperature (°C)	Specific Conductivity (µmho/cm)	Oxidation Reduction Potential (mV)	pH	Turbidity (NTU)	Dissolved Oxygen (% Sat)	Dissolved Oxygen (mg/L)
TAV-INJ1	29-Oct-19	18.70	2675.5	-267.1	6.89	20.7	0.56	0.04
TAV-INJ1	30-Oct-19	17.18	2533.7	-244.9	6.92	59.4	1.67	0.13
TAV-MW6	28-Oct-19	18.55	720.0	98.8	7.57	2.49	54.50	4.06
TAV-MW7	22-Oct-19	18.43	607.1	-67.3	7.43	1.36	3.33	0.26
LWDS-MW1	18-Nov-19	19.14	729.3	67.8	7.36	0.31	92.00	7.12
TAV-MW2	31-Oct-19	16.43	665.6	14.5	7.40	2.66	67.70	5.48
TAV-MW4	05-Nov-19	20.17	568.5	4.8	7.61	0.56	80.19	6.04
TAV-MW8	06-Nov-19	19.03	679.0	-2.9	7.56	3.16	75.99	5.82
TAV-MW10	13-Nov-19	19.48	625.7	35.7	7.51	0.51	81.90	6.24
TAV-MW11	04-Nov-19	21.51	626.1	15.2	7.54	0.28	79.55	5.69
TAV-MW12	12-Nov-19	17.94	726.5	73.3	7.44	2.49	71.35	5.64
TAV-MW14	07-Nov-19	16.95	712.7	25.2	7.36	1.30	74.55	5.98

Note: Header nomenclature is explained following Table III-7 in the "Footnotes for Technical Area-V Analytical Results Tables" summary.

Footnotes for Technical Area-V Analytical Results Tables

%	= Percent.
CaCO ₃	= Calcium carbonate.
Dhc	= <i>Dehalococcoides</i> .
DUP	= Duplicate environmental sample.
Enumeration/L	= gene copies per liter.
EPA	= U.S. Environmental Protection Agency.
ID	= Identifier.
INJ	= Injection well (acronym used for well identification only).
LWDS	= Liquid waste disposal system (acronym used for well identification only).
µg/L	= Micrograms per liter.
mg/L	= Milligrams per liter.
MEE	= Methane, ethane, ethene.
MW	= Monitoring well (acronym used for well identification only).
No.	= Number.
NPN	= Nitrate plus nitrite, as nitrogen.
TAV	= Technical Area-V (acronym used for well identification only).
TOC	= Total organic carbon.
VOC	= Volatile organic compound.

^aResult

Detected VOCs are presented in the tables.

Bold = Value exceed the established MCL.

ND = Not detected (at method detection limit).

^bMDL

MDL = Method detection limit. The minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero, analyte is matrix specific.

^cPQL

PQL = Practical quantitation limit. The lowest concentration of analytes in a sample that can be reliably determined within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions.

^dMCL

MCL = Maximum contaminant level. 2018 Edition of the Drinking Water Standards and Health Advisories Tables, EPA 822-F-18-001, Office of Water, U.S. Environmental Protection Agency, Washington, DC, March 2018.

NE = Not established.

^eLab Qualifier

If cell is blank, then all quality control samples met acceptance criteria with respect to submitted samples.

B = The analyte was found in the blank above the effective MDL.

J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.

N = Results associated with a spike analysis that was outside control limits.

U = Analyte is absent or below the method detection limit.

Footnotes for Technical Area-V Analytical Results Tables (Continued)

^fValidation Qualifier

If cell is blank, then all quality control samples met acceptance criteria with respect to submitted samples.

- J = The associated value is an estimated quantity.
- J+ = Estimated value with a suspected positive bias.
- U = The analyte was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.
- UJ = The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

^gAnalytical Method

- AM20GAX = Proprietary method of Pace Analytical Services, LLC.
- Gene-Trac Dhc = Proprietary method of SiREM.

Clesceri, Rice, Baird, and Eaton, 2012, *Standard Methods for the Examination of Water and Wastewater*, 22nd ed., Method 2320B, published jointly by American Public Health Association, American Water Works Association, and Water Environment Federation. Washington, D.C.

EPA, 1986, (and updates), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd ed., U.S. Environmental Protection Agency, Cincinnati, Ohio.

EPA, 1984, "Methods for Chemical Analysis of Water and Wastes." EPA 600-4-79-020, U.S. Environmental Protection Agency, Cincinnati, Ohio.

EPA, 1993, "Method 350.1, Determination of Ammonia Nitrogen by Semi-Automated Colorimetry." Revision 2.0.

EPA, 1993, "Method 353.2, Determination of Nitrate-Nitrite Nitrogen by Automated Colorimetry." Revision 2.0.

^hLab

- GEL = GEL Laboratories LLC, 2040 Savage Road, Charleston, South Carolina 29407.
- PACE = Pace Analytical Services, LLC, Energy Services Lab, 220 William Pitt Way, Pittsburgh, Pennsylvania 15238.
- SiREM = SiREM, 130 Stone Road. W, Guelph, Ontario, N1G 3Z2, Canada.

ⁱField Water Quality Measurements

Field measurements collected prior to sampling.

- °C = Degrees Celsius.
- % Sat = Percent saturation.
- µmho/cm = Micromhos per centimeter.
- mg/L = Milligrams per liter.
- mV = Millivolts.
- NTU = Nephelometric turbidity units.
- pH = Potential of hydrogen (negative logarithm of the hydrogen ion concentration).

Appendix A

NMED's Approval Letter and DOE's
Submittal with the Enclosure Describing
Full-Scale Operation Modifications