SAND2019-0211R

Sandia National Laboratories, New Mexico

Discharge Permit DP-1845 Quarterly Report

July – September 2018

January 2019

United States Department of Energy
Sandia Field Office

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DISCHARGE PERMIT DP-1845 QUARTERLY REPORT

SANDIA NATIONAL LABORATORIES, NEW MEXICO

January 2019

REPORTING PERIOD: July – September 2018

FACILITY INFORMATION

Facility Name:	U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA)
Discharge Permit Number:	DP-1845
Legally Responsible Party:	James W. Todd, Assistant Manager for Engineering DOE/NNSA, P. O. Box 5400, Albuquerque, NM 87185 (505) 284-6668

PERMIT INFORMATION

Discharge Permit Issued:	May 30, 2017
Discharge Permit Term Ends:	May 30, 2022
Permitted Discharge Volume:	20,000 gallons per day
Permit Contact Information:	Ground Water Quality Bureau (GWQB) New Mexico Environment Department (NMED) P. O. Box 5469, Santa Fe, New Mexico 87502 (505) 827-2900
NMED GWQB Lead Staff:	Pam Homer (505) 827-0018 pamela.homer2@state.nm.us

OVERVIEW

Discharge Permit (DP)-1845 was issued by the New Mexico Environment (NMED) Ground Water Quality Bureau (GWQB) for discharges via up to three injection wells in a phased Treatability Study of in-situ bioremediation of groundwater at the Sandia National Laboratories, New Mexico, Technical Area-V Groundwater Area of Concern. This report fulfills the quarterly reporting requirements set forth in DP-1845, Section IV.B, Monitoring and Reporting. This reporting period is July 1 through September 30, 2018. The report is due to NMED GWQB by February 1, 2019.

ABBREVIATIONS AND ACRONYMS

ABCWUA	Albuquerque Bernalillo County Water Utility Authority
AOC	Area of Concern
DOE	U.S. Department of Energy
DP	Discharge Permit
EPA	U.S. Environmental Protection Agency
GWQB	Ground Water Quality Bureau
HWB	Hazardous Waste Bureau
INJ	injection (acronym used for well identification only)
ISB	in-situ bioremediation
LWDS	liquid waste disposal system (acronym used for well identification only)
MCL	maximum contaminant level
MW	monitoring well (acronym used for well identification only)
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
SNL/NM	Sandia National Laboratories, New Mexico
TA	Technical Area
TAV	Technical Area-V (acronym used for well identification only)
TA-V	Technical Area-V
TAVG	Technical Area-V Groundwater
TCE	trichloroethene
TS/IM	Treatability Study/Interim Measure
TSWP	Treatability Study Work Plan

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1.0 Introduction

Trichloroethene (TCE) and nitrate have been identified as constituents of concern in groundwater at the Sandia National Laboratories, New Mexico (SNL/NM) Technical Area (TA)-V Groundwater (TAVG) Area of Concern (AOC) based on detections above the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) 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 and 10 milligrams per liter, respectively.

A phased Treatability Study/Interim Measure (TS/IM) of in-situ bioremediation (ISB) is being implemented to evaluate the effectiveness of ISB as a potential technology to treat the groundwater contamination at the TAVG AOC (New Mexico Environment Department [NMED] April 2016). The NMED Hazardous Waste Bureau (HWB) approved the Revised Treatability Study Work Plan (TSWP) (SNL/NM March 2016) in May 2016 (NMED May 2016). The SNL/NM Environmental Restoration Operations personnel are responsible for implementing the TS/IM of ISB at TAVG AOC in accordance with the Revised TSWP.

Per the Revised TSWP, up to three injection wells (TAV-INJ1, TAV-INJ2, and TAV-INJ3) would be installed at TA-V in the vicinity of the highest contaminant concentrations detected in groundwater at monitoring wells LWDS-MW1, TAV-MW6, and TAV-MW10. The injection wells would be used to gravity-inject substrate solution and biodegradation bacteria into the Regional Aquifer. The substrate solution consists of an inert tracer as well as essential food and nutrients for biostimulation. The substrate solution would be prepared in aboveground tanks. The TS/IM would be conducted in two phases: Phase I includes a pilot test followed by full-scale injection at the first injection well (TAV-INJ1); Phase II includes well installation and full-scale injections at the second and third injection wells (TAV-INJ2 and TAV-INJ3). The Phase I injection well (TAV-INJ1) was installed in October 2017. A decision to install the Phase II injection wells is dependent upon the findings of the Phase I operation.

The NMED Ground Water Quality Bureau (GWQB) requires a groundwater Discharge Permit (DP) for the operation of injection wells. NMED GWQB issued DP-1845 to the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) for the SNL/NM TA-V Treatability Study injection wells on May 26, 2017 (NMED May 2017). The DP-1845 term started on May 30, 2017 and ends on May 30, 2022. Attachment A provides a copy of DP-1845.

This quarterly report provides responses to DP-1845 *Operating Conditions* Terms and Conditions #3 through #8 and *Monitoring and Reporting* Terms and Conditions #10 through

#17 for the July 1 to September 30, 2018 reporting period. The other Terms and Conditions are NMED GWQB statements of fact and do not require a response.

2.0 DP-1845 Quarterly Operational Activities, July – September 2018

DP-1845 Terms and Conditions #3 through #8 are not applicable for this reporting period because no groundwater discharge (injections) occurred during this reporting period. The requirements specified in DP-1845 Terms and Conditions #3 through #8 were fulfilled in previous quarters (October – December 2017 and January – March 2018). The corresponding quarterly reports (SNL/NM April 2018 and July 2018) were submitted to the NMED GWQB.

3.0 DP-1845 Quarterly Monitoring and Reporting, July – September 2018

This section responds to the monitoring and reporting requirements in DP-1845, Section IV.B. The Terms and Conditions are repeated verbatim (in *italics*), followed by DOE/NNSA and SNL/NM personnel responses that discuss relevant activities completed during the July 1 to September 30, 2018 reporting period.

3.1 DP-1845 Terms and Conditions #10

METHODOLOGY – Unless otherwise approved in writing by NMED, the permittee shall conduct sampling and analysis in accordance with the most recent edition of the following documents.

a) Americans Public Health Association, Standard Methods for the Examination of Water and Wastewater (18th, 19th or current);

b) U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Waste;

c) U.S. Geological Survey, Techniques for Water Resource Investigations of the U.S. Geological Survey;

d) American Society for Testing and Materials, Annual Book of ASTM Standards, Part 31. Water;

e) U.S. Geological Survey, et al., National Handbook of Recommended Methods for Water Data Acquisition;

f) *Federal Register, latest methods published for monitoring pursuant to Resource Conservation and Recovery Act regulations; and*

g) *American Society of Agronomy, Chemical Methods: Methods of Soil Analysis; Part 1. Physical and Mineralogical Methods; Part 2. Microbiological and Biochemical Properties; Part 3.*

DOE/NNSA and SNL/NM Personnel Response: Groundwater sampling activities are performed in accordance with procedures that are consistent with the EPA's Technical Enforcement Guidance Document (EPA 1986). Groundwater samples were analyzed by offsite laboratories using EPA-specified protocols, except for the microbial gene analysis by a proprietary analytical method of SiREM, and the low-level biological indicator gases (methane, ethane, and ethene) analysis by a proprietary analytical method of Pace Analytical Services, LLC. Table 1 summarizes the analyses, analytical methods, and contract analytical laboratories used during the Treatability Study.

Table 1
Analyses, Analytical Methods, and Analytical Laboratories

Analyses	Analytical Method	Analytical Laboratory
Alkalinity (total, bicarbonate, and carbonate)	SM 2320B	GEL
Ammonia as nitrogen	EPA 350.1	GEL
Anions (bromide, chloride, fluoride, nitrate, nitrite, orthophosphate as phosphorus, sulfate)	SW846 9056	GEL
Dissolved Metals (arsenic, calcium, iron, magnesium, manganese, potassium, sodium)	SW846 3005/6020	GEL
Methane, ethane, and ethene	AM20GAX	PACE
Microbial (*Dehalococcoides [Dhc]*)	Gene-Trac Dhc	SiREM
Nitrate plus nitrite as nitrogen	EPA 353.2	GEL
Sulfide (reactive releasable sulfide)	SW846 Chapter 7.3.4	GEL
Total Organic Carbon	SW846 9060A	GEL
Volatile Organic Compounds	SW846 8260B	GEL

Notes
EPA = Environmental Protection Agency.
GEL = GEL Laboratories LLC, 2040 Savage Rd, Charleston, SC 29407.
PACE = Pace Analytical Services, LLC, , 220 William Pitt Way, Pittsburgh, PA 15238.
SiREM = SiREM, 130 Stone Rd. W, Guelph, Ontario, N1G 3Z2, Canada.

Additional details on the field methods and measurements, and quality control procedures used for groundwater sampling and analysis are provided in Chapter 1 (Sections 1.2 and 1.3) of the Annual Groundwater Monitoring Report Calendar Year 2017 (SNL/NM June 2018).

3.2 DP-1845 Terms and Conditions #11

The quarterly reports shall document the influent and discharge volumes from the treatment systems, quarterly groundwater and effluent sampling results, and any operations/maintenance activities performed for the prior quarter.

Quarterly monitoring shall be performed during the following periods and submitted as follows.

- *January 1st through March 31st (first quarter) – due by August 1st;*
- *April 1st through June 30th (second quarter) – due by November 1st;*
- *July 1st through September 30th (third quarter) – due by February 1st; and*
- *October 1st through December 31st (fourth quarter) – due by May 1st.*

DOE/NNSA and SNL/NM Personnel Response: Terms and Conditions #11 is divided into four sub-requirements. The requirement is shown in italics and the response is not italicized.

a) *Quarterly influent and effluent volumes*

Not applicable for this reporting period. Discharge did not occur.

b) *Quarterly groundwater and effluent sampling results*

The effluent is the treatment solution that is prepared in aboveground tanks. It is monitored (sampled) at injection well TAV-INJ1, which is the permitted discharge point, when discharges occur. No discharges occurred in the reporting period.

One groundwater sampling event was conducted in September 2018 at well TAV-INJ1 during this reporting period. Appendix A, Table A-1 provides the groundwater sampling results at well TAV-INJ1 for the September 2018 samples.

No results exceed the groundwater standards specified in 20.6.2.3103 New Mexico Administrative Code (NMAC), except for iron and manganese (Table A-1). Their concentrations exceeded respective groundwater standards, which was expected for the ISB process (SNL/NM March 2016, Section 3.0). During ISB, the injected treatment solution depletes the aquifer of dissolved oxygen and lowers the oxidation-reduction potential. This produces conditions conducive to anaerobic degradation of TCE and nitrate at the TAVG AOC. The strongly anaerobic redox conditions solubilize and mobilize naturally occurring metals and metalloids. This was observed at well TAV-INJ1 for arsenic, iron, and manganese in the fourth quarter of 2017 (SNL/NM April 2018) and in the first quarter of 2018 (SNL/NM July 2018), but the concentration

of arsenic was below the groundwater standard in June 2018 and again in September 2018. The solubilization of these metals is a transient phenomenon and is limited to the treatment area. Solubilized metals and metalloids typically precipitate into solid form once they leave the anaerobic treatment zone, and their dissolved concentrations in groundwater will fall below groundwater standards, as demonstrated by the groundwater sampling results at monitoring wells TAV-MW6 and TAV-MW7 (see Response to Terms and Conditions #17).

c) *Operation/maintenance activities performed during the quarter, if any*

After the completion of the two pilot test injections in the fourth quarter of 2017 (October – December 2017), the entire aboveground injection system assembly was drained and stored offsite. The two aboveground tanks remain at the project site. The wellhead of TAV-INJ1 is covered with a traffic-grade manhole cover. The project site is secured with fencing and traffic barriers. The project team conducted periodic inspections of the site during this reporting period.

d) *Submittal of Quarterly Report*

This quarterly report addresses the reporting period of July 1 through September 30, 2018. This is the fifth quarterly report after DP-1845 was issued in May 2017.

3.3 DP-1845 Terms and Conditions #12

Quarterly reports shall include the following general information:

a) *any periodic test of mechanical integrity conducted;*

b) *any replacement of primary or secondary vessels or associated treatment system infrastructure with an accompanying narrative explanation of the reasons for the decision to replace the vessels;*

c) *any well work-overs conducted; and*

d) *any additional operation changes with the potential to markedly affect the discharge.*

DOE/NNSA and SNL/NM Personnel Response:

a) No periodic test of mechanical integrity was necessary or required during this reporting period.

b) No replacement of primary or secondary vessels or associated treatment system infrastructure was necessary or required during this reporting period.

c) No well work-overs were necessary or required during this reporting period.

d) No additional operational changes were applicable for this reporting period. Discharge did not occur.

3.4 DP-1845 Terms and Conditions #13

Quarterly reports shall include the following system performance information:

a) monthly average, maximum, and minimum values for flow rate and volume of effluent transferred to each injection well;

b) the totalized monthly volume of effluent transferred to each injection well;

c) monthly average, maximum, and minimum values of injection water level (pressure head) above static level for each injection well; and

d) the volume pumped from each extraction well.

Each UIC well shall have a dedicated flow meter. Flow meters shall be inspected and calibrated in accordance with the associated manufacturer's recommendations.

DOE/NNSA and SNL/NM Personnel Response: No response is applicable for this reporting period. Discharge did not occur.

3.5 DP-1845 Terms and Conditions #14

The permittee shall develop a groundwater elevation contour map on a quarterly basis using the top of casing elevation data and quarterly depth-to-most-shallow groundwater measurements obtained from the groundwater monitoring wells required by this Discharge Permit.

The groundwater elevation contour map shall depict the groundwater flow direction based on the groundwater elevation contours. Groundwater elevations between monitoring well locations shall be estimated using common interpolation methods. A contour interval appropriate to the data shall be used, but in no case shall the interval be greater than two feet. Groundwater elevation contour maps shall depict the groundwater flow direction, using arrows, based on the orientation of the groundwater elevation contours, and the

location and identification of each monitoring well and contaminant source. The groundwater elevation contour map shall be submitted to NMED in the quarterly monitoring reports.

DOE/NNSA and SNL/NM Personnel Response: Figure 1 shows the TA-V groundwater elevation contour map (potentiometric surface figure) for the Regional Aquifer in the third quarter of 2018. The contours are similar to the baseline October 2017 contours (SNL January 2018).

3.6 DP-1845 Terms and Conditions #15

NMED shall have the option to perform downhole inspections of all monitoring and UIC wells identified in this Discharge Permit. NMED shall establish the inspection data and provide at least a 60-day notice to the permittee by certified mail. The permittee shall have any existing dedicated pumps removed at least 48 hours prior to NMED inspection to allow adequate settling time of sediment agitated from pump removal.

Should a facility not have existing dedicated pumps, but decide to install pumps in any of the monitoring wells, NMED shall be notified at least 90 days prior to pump installation so that a downhole well inspection(s) can be scheduled prior to pump replacement.

All confirmation analysis will be conducted by an independent environmental laboratory that is certified under the National Environmental Laboratory Accreditation Program.

DOE/NNSA and SNL/NM Personnel Response: All wells associated with DP-1845 are available for inspection by NMED GWQB. No inspections were requested or conducted by NMED GWQB during this reporting period. No confirmation sampling was requested or conducted by NMED GWQB during this reporting period.

3.7 DP-1845 Terms and Conditions #16

Groundwater samples shall be collected from each new injection well and associated monitoring well prior to discharge, and analyzed for the constituents listed below to establish baseline conditions prior to substrate injection.

- *Alkalinity (total, bicarbonate and carbonate)*
- *Ammonia (as nitrogen)*
- *Anions (bromide, chloride, fluoride, nitrite and sulfate)*
- *Dehalococcoides*
- *Dissolved metals (arsenic, calcium, iron, magnesium, manganese, potassium, sodium)*
- *Methane/ethane*

- *Nitrate as nitrogen*
- *Nitrite as nitrogen*
- *Nitrate plus nitrite (as nitrogen)*
- *Orthophosphate (as phosphorus)*
- *Total organic carbon*
- *Sulfide*
- *Volatile organic compounds*

Field parameters pH, specific conductivity, temperature, turbidity, dissolved oxygen, and oxidation-reduction potential shall be collected.

DOE/NNSA and SNL/NM Personnel Response: Results of the baseline groundwater samples and field parameter measurements are provided in the October – December 2017 Quarterly Report (SNL/NM April 2018).

3.8 DP-1845 Terms and Conditions #17

The permittee shall monitor the groundwater wells TAV-MW6, TAV-MW7, TAV-MW10, and LWDS-MW1 quarterly to determine any change to aquifer chemistry and aquifer flow direction that may be the result of injection.

This quarterly monitoring shall include analysis for the following analytes:

- *TCE*
- *Nitrate as nitrogen*
- *Nitrite as nitrogen*
- *Nitrate plus nitrite (as nitrogen)*
- *Arsenic*
- *Iron*
- *Manganese*
- *cis-1,2-DCE*
- *Vinyl chloride*
- *Ethene*

Annual sampling will include general chemistry, radiological screening parameters, and total metals as proposed by the permittee to supplement waste characterization requirements and as required under the SNL Compliance Order on Consent.

If the chemical quality of the groundwater being injected changes over time, NMED may require the permittee to conduct geochemical modeling to predict the interaction between the injection fluid and receiving groundwater. Results of all geochemical modeling shall be provided to NMED and shall include predictions on any changes to aquifer porosity and hydraulic conductivity that may result from mineral precipitation or dissolution.

DOE/NNSA and SNL/NM Personnel Response: One sampling event was conducted in September 2018 at monitoring wells TAV-MW6 and TAV-MW7 during this reporting period. Appendix A, Table A-2 provides the groundwater sampling results for the DP-1845-required analytes listed above at these two wells.

Table A-2 shows that none of the analytical results exceeded the groundwater standards specified in 20.6.2.3103 NMAC at monitoring wells TAV-MW6 and TAV-MW7. The groundwater conditions at these two wells are similar to their baseline conditions observed before the pilot test (SNL/NM April 2018, Table B-2). The pilot test injections at TAV-INJ1 did not adversely impact the groundwater quality at the two monitoring wells.

The pilot test injections at well TAV-INJ1 are not expected to have any impact on wells TAV-MW10 and LWDS-MW1 which are located geographically farther away from well TAV-INJ1 than wells TAV-MW6 and TAV-MW7. When the full-scale injections begin at TAV-INJ1, well TAV-MW6 will be considered as being located within the active ISB treatment zone and its geochemistry would most likely be affected as seen currently in well TAV-INJ1 (see Response to Terms and Conditions #11). During full-scale operations, wells TAV-MW10 and LWDS-MW1 will be considered as the closest monitoring points. Groundwater sampling results of wells TAV-MW10 and LWDS-MW1 will be reported to the NMED GWQB when full-scale operation occurs at well TAV-INJ1.

The requirement for annual sampling analyses (general chemistry, radiological screening parameters, and total metals) to supplement the waste characterization requirements became irrelevant following notification by the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) that groundwater obtained from remedial activities cannot be discharged to the sewer system (ABCWUA January 2018). Currently, the wastewater generated in the groundwater sampling process is managed by the SNL/NM Hazardous Waste Handling Unit and is shipped offsite for proper disposal in compliance with applicable regulatory requirements.

4.0 References

ABCWUA, see Albuquerque Bernalillo County Water Utility Authority.

Albuquerque Bernalillo County Water Utility Authority (ABCWUA), January 2018. Letter to J.W. Todd (U.S. Department of Energy, NNSA/Sandia Field Office), "Request for Approval to Discharge Waste Streams #1, #2, #3, and #4 to the Sanitary Sewer under Permit Number 2069K,", ABCWUA, Albuquerque, New Mexico, January 16, 2018.

EPA, see U.S. Environmental Protection Agency.

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

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.

Sandia National Laboratories, New Mexico (SNL/NM), April 2018. *Discharge Permit DP-1845 Quarterly Report, October – December 2017,* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), June 2018. *Annual Groundwater Monitoring Report, Calendar Year 2017*, 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), July 2018. *Discharge Permit DP-1845 Quarterly Report, January – March 2018,* Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories, New Mexico (SNL/NM), October 2018. *Discharge Permit DP-1845 Quarterly Report, April – June 2018,* Sandia National Laboratories, Albuquerque, New Mexico.

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

U.S. Environmental Protection Agency (EPA), 1986. RCRA Ground Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1. U.S. Environmental Protection Agency, Washington, D.C.

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Figures

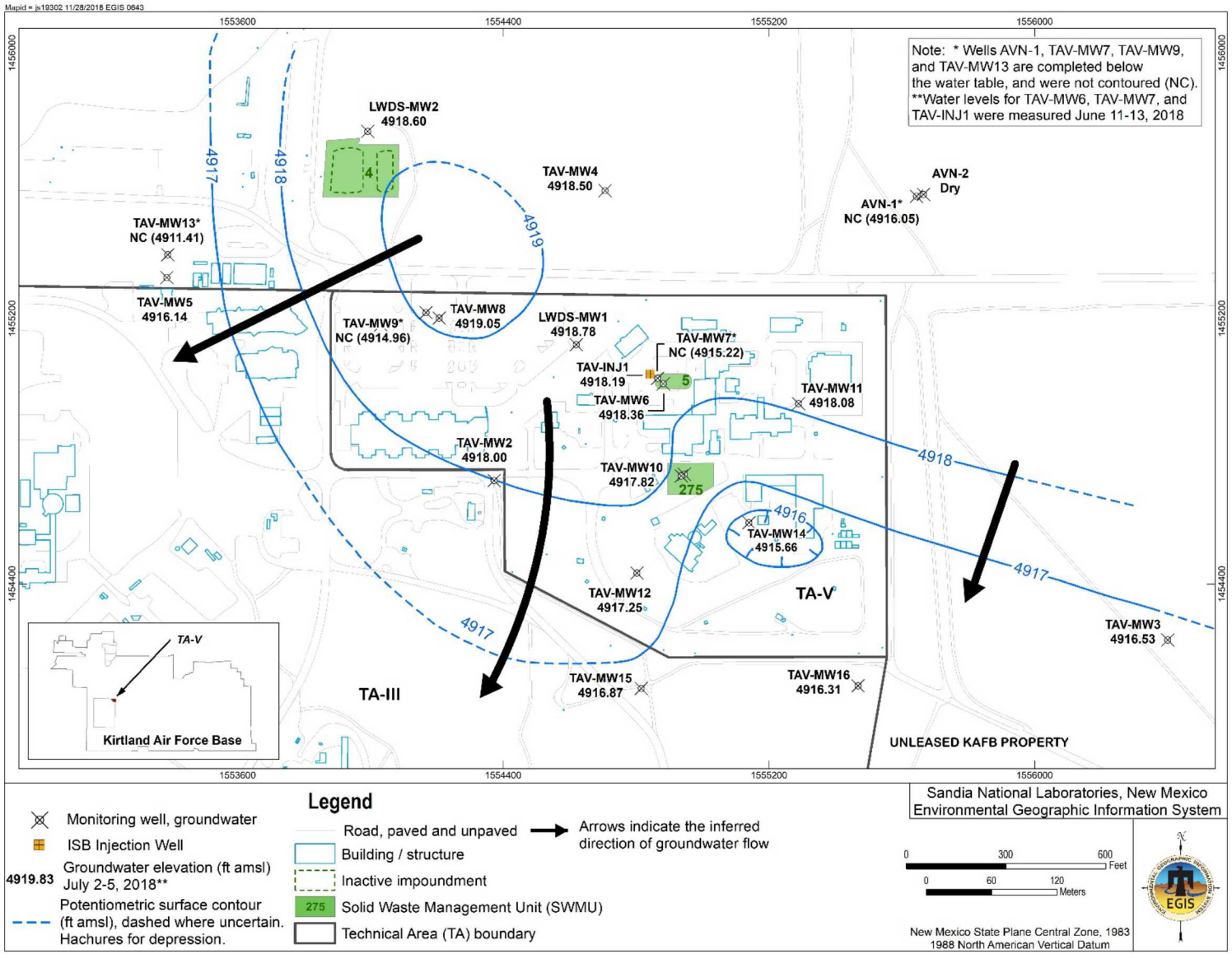

Figure 1

Groundwater Elevation Contour Map for the TAVG AOC (June/July 2018)

Appendix A
Analytical Results

Table A-1
Analytical Results for Groundwater Samples Collected at Injection Well TAV-INJ1, July – September 2018

Sample Date	Analyte[a]	Result[b]	MDL[c]	PQL[d]	Units	Groundwater Standard[e]	Lab Qualifier[f]	Validation Qualifier[g]	Sample No.	Analytical Method[h]	Lab[i]
26-Sep-2018	Trichloroethene	5.6	0.3	1	µg/L	0.1 mg/L (100 µg/L)			106331-001	SW846 8260B	GEL
26-Sep-2018	Nitrate	ND	0.165	0.5	mg/L	NE	U		106331-004	SW846 9056	GEL
26-Sep-2018	Nitrite	0.0495	0.33	1	mg/L	NE	J	J+	106331-004	SW846 9056	GEL
26-Sep-2018	Nitrate plus nitrite as N	ND	0.017	0.05	mg/L	10.0 mg/L	U		106331-005	EPA 353.2	GEL
26-Sep-2018	Arsenic	0.0446	0.002	0.005	mg/L	0.1 mg/L			106331-007	SW846 3005/6020	GEL
26-Sep-2018	Iron	**1.77**	0.033	0.1	mg/L	1.0 mg/L			106331-007	SW846 3005/6020	GEL
26-Sep-2018	Manganese	**6.86**	0.01	0.05	mg/L	0.2 mg/L		J	106331-007	SW846 3005/6020	GEL
26-Sep-2018	Dichloroethene, cis-1,2-	1.81	0.3	1	µg/L	NE			106331-001	SW846 8260B	GEL
26-Sep-2018	Vinyl chloride	ND	0.3	1	µg/L	0.001 mg/L (1 µg/L)	U		106331-001	SW846 8260B	GEL
26-Sep-2018	Ethene	0.16	0.0050	0.1	µg/L	NE		J	106340-001	AM20GAX	PACE

Refer to general footnotes at the end of this appendix.

Table A-2
Analytical Results for Groundwater Samples Collected at Monitoring Wells TAV-MW6 and TAV-MW7, July – September 2018

Sample Date	Analyte[a]	Result[b]	MDL[c]	PQL[d]	Units	Groundwater Standard[e]	Lab Qualifier[f]	Validation Qualifier[g]	Sample No.	Analytical Method[h]	Lab[i]
TAV-MW6											
25-Sep-2018	Trichloroethene	9.81	0.3	1	µg/L	0.1 mg/L (100 µg/L)			106327-001	SW846 8260B	GEL
25-Sep-2018 (DU)	Trichloroethene	9.77	0.3	1	µg/L	0.1 mg/L (100 µg/L)			106328-001	SW846 8260B	GEL
25-Sep-2018	Nitrate	7.52	0.033	0.1	mg/L	NE			106327-004	SW846 9056	GEL
25-Sep-2018 (DU)	Nitrate	7.67	0.033	0.1	mg/L	NE			106328-004	SW846 9056	GEL
25-Sep-2018	Nitrite	ND	0.033	0.1	mg/L	NE	U		106327-004	SW846 9056	GEL
25-Sep-2018 (DU)	Nitrite	ND	0.033	0.1	mg/L	NE	U		106328-004	SW846 9056	GEL
25-Sep-2018	Nitrate plus nitrite as N	8.78	0.17	0.5	mg/L	10.0 mg/L			106327-005	EPA 353.2	GEL
25-Sep-2018 (DU)	Nitrate plus nitrite as N	8.6	0.17	0.5	mg/L	10.0 mg/L			106328-005	EPA 353.2	GEL
25-Sep-2018	Arsenic	0.00204	0.002	0.005	mg/L	0.1 mg/L	J		106327-007	SW846 3005/6020	GEL
25-Sep-2018 (DU)	Arsenic	ND	0.002	0.005	mg/L	0.1 mg/L	U		106328-007	SW846 3005/6020	GEL
25-Sep-2018	Iron	ND	0.033	0.1	mg/L	1.0 mg/L	U		106327-007	SW846 3005/6020	GEL
25-Sep-2018 (DU)	Iron	ND	0.033	0.1	mg/L	1.0 mg/L	U		106328-007	SW846 3005/6020	GEL
25-Sep-2018	Manganese	ND	0.001	0.005	mg/L	0.2 mg/L	U		106327-007	SW846 3005/6020	GEL
25-Sep-2018 (DU)	Manganese	ND	0.001	0.005	mg/L	0.2 mg/L	U		106328-007	SW846 3005/6020	GEL
25-Sep-2018	Dichloroethene, cis-1,2-	1.41	0.3	1	µg/L	NE			106327-001	SW846 8260B	GEL
25-Sep-2018 (DU)	Dichloroethene, cis-1,2-	1.4	0.3	1	µg/L	NE			106328-001	SW846 8260B	GEL
25-Sep-2018	Vinyl chloride	ND	0.3	1	µg/L	0.001 mg/L (1 µg/L)	U		106327-001	SW846 8260B	GEL
25-Sep-2018 (DU)	Vinyl chloride	ND	0.3	1	µg/L	0.001 mg/L (1 µg/L)	U		106328-001	SW846 8260B	GEL
25-Sep-2018	Ethene	ND	0.0050	0.1	µg/L	NE	U	UJ	106337-001	AM20GAX	PACE
TAV-MW7											
24-Sep-2018	Trichloroethene	ND	0.3	1	µg/L	0.1 mg/L (100 µg/L)	U		106322-001	SW846 8260B	GEL
24-Sep-2018	Nitrate	3.81	0.033	0.1	mg/L	NE			106322-002	SW846 9056	GEL
24-Sep-2018	Nitrite	ND	0.033	0.1	mg/L	NE	U		106322-002	SW846 9056	GEL
24-Sep-2018	Nitrate plus nitrite as N	4.29	0.085	0.25	mg/L	10.0 mg/L			106322-003	EPA 353.2	GEL
24-Sep-2018	Arsenic	0.00211	0.002	0.005	mg/L	0.1 mg/L	J		106322-005	SW846 3005/6020	GEL
24-Sep-2018	Iron	ND	0.033	0.1	mg/L	1.0 mg/L	U		106322-006	SW846 3005/6020	GEL
24-Sep-2018	Manganese	ND	0.001	0.005	mg/L	0.2 mg/L	U		106322-005	SW846 3005/6020	GEL
24-Sep-2018	Dichloroethene, cis-1,2-	ND	0.3	1	µg/L	NE	U		106322-001	SW846 8260B	GEL
24-Sep-2018	Vinyl chloride	ND	0.3	1	µg/L	0.001 mg/L (1 µg/L)	U		106322-001	SW846 8260B	GEL
24-Sep-2018	Ethene	ND	0.0050	0.1	µg/L	NE	U	UJ	106334-001	AM20GAX	PACE

Refer to general footnotes at the end of this appendix.

Footnotes for Appendix A - Analytical Results Tables

%	= Percent.
DP	= Discharge Permit.
DU	= Duplicate.
EPA	= U.S. Environmental Protection Agency.
INJ	= Injection.
µg/L	= Micrograms per liter.
mg/L	= Milligrams per liter.
MW	= Monitoring well.
No.	= Number.
TAV	= Technical Area-V
VOC	= Volatile organic compounds.

[a]Analyte

The analyte list is specified in DP-1845 Terms and Conditions #17. Samples for metal analyses were filtered in the field.

[b]Result

Detected VOCs are presented in the tables.

Bold	= Value exceed the established Groundwater Standard.
ND	= Not detected (at method detection limit).

[c]MDL

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.

[d]PQL

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.

[e]Groundwater Standard

Groundwater Standards are from 20.6.2.3103 New Mexico Administrative Code (NMAC).

NE	= Not established in 20.6.2.3103 NMAC.

[f]Lab 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.
U	= Analyte is absent or below the method detection limit.

[g]Validation 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.
UJ	= The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

[h]Analytical Method

EPA, 1986, (and updates), “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,” SW-846, 3rd edition.

EPA, 1984, “Methods for Chemical Analysis of Water and Wastes.” EPA 600-4-79-020.

AM20GAX = Proprietary method of Pace Analytical Services, LLC.

[i]Lab

GEL	= GEL Laboratories LLC, 2040 Savage Rd, Charleston, SC 29407.
PACE	= Pace Analytical Services, LLC, 220 William Pitt Way, Pittsburgh, PA 15238.

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Attachment A
Ground Water Discharge Permit
Sandia National Laboratories/New Mexico
Discharge Permit DP-1845
(NMED May 2017)