Los Alamos NATIONAL LABORATORY EST. 1943

EM-LA

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Date: FEB 2 7 2017
Symbol: EPC-DO: 17-067
LA-UR: 17-20445
Locates Action No.: U1501760

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Subject: Discharge Permit DP-1793 Annual Monitoring Report for 2016

Dear Ms. Hunter:

This letter and enclosures from the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) are the Annual Monitoring Report for Discharge Permit DP-1793 for 2016. Discharge Permit DP-1793 was issued by the New Mexico Environment Department (NMED) on July 27, 2015, for the land application of groundwater associated with aquifer and pumping tests, well development and rehabilitation, groundwater tracer studies, and groundwater remediation activities. Before a discharge from an individual project or activity begins, DOE/LANS are required to submit a comprehensive work plan to NMED for its review and approval. In calendar year 2016, DOE/LANS submitted the following work plans.

1. **Work Plan #3**, March 22, 2016, *Multiple Activities Work Plan for the Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793 WP#3* (EPC-DO-16-063). A copy of the cover letter is provided in Enclosure 1. Work Plan #3 was approved by NMED, with conditions, on May 24, 2016. A copy of the May 24, 2016 approval letter is provided in Enclosure 1.

   Work Plan #3 was implemented by DOE/LANS for a period of 107 days between June 27, 2016 to December 15, 2016. As required by Discharge Permit DP-1793, a discharge report was submitted to NMED on February 13, 2017 (EPC-DO-17-048). A complete copy of the Work Plan #3 Discharge Report is provided in Enclosure 2.

2. **Work Plan #4,** March 22, 2016, *Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, WP#4* (EPC-DO-16-064). A copy of the cover letter is provided in Enclosure 1. Work Plan #4 was approved by NMED, with conditions, on May 27, 2016. A copy of the May 27, 2016 approval letter is provided in Enclosure 1.

   Work Plan #4 was implemented by DOE/LANS for a period of 27 days between June 22, 2016 to December 21, 2016. As required by Discharge Permit DP-1793, a discharge report was submitted to NMED on February 13, 2017 (EPC-DO-17-049). A complete copy of the Work Plan #4 Discharge Report is provided in Enclosure 3.

Condition No. 9 of Discharge Permit DP-1793, included verbatim below, requires DOE/LANS to submit an annual report.

Condition No. 9

The permittee shall submit annual monitoring report to NMED by the 1st of March each year summarizing all discharges conducted under this permit during the prior calendar year. Included will be quantity, source, and date of each individual discharge, water quality tables listing analytical results from samples collected under the water quality sampling plan, a map(s) depicting discharge locations, and copies of laboratory analytical reports.

Annual monitoring reports shall be performed during the following period:

- *January 1st through December 31st* ***report due by March 1st.***

The combined daily discharges from Work Plan #3 and Work Plan #4 during 2016 are provided in Enclosure 4. Land application under each Work Plan was completed within the daily planned volumes specified in each work plan. On one day, September 15, 2016, the combined land application volume completed under both Work Plans was 370,418 gal., which exceeds the permitted daily maximum volume of 350,000 gal. After discussions between counsel for DOE-EM, LANS and NMED it was agreed this exceedance would be summarized in this Annual Report. To address this occurrence, administrative controls will be instituted to ensure the permitted daily maximum volume is not exceeded again. The total annual discharge from both Work Plans was 16,689,493 gallons which represents approximately 30% of the maximum planned amount of 55,043,486 gal.

All other information required in the 2016 Annual Report per Condition No. 9 of Discharge Permit DP-1793, as cited above, is contained within the Work Plan #3 and Work Plan #4 Discharge Permit Reports (Enclosures 2 and 3).

Please contact William J. Foley by telephone at (505) 665-8423 or by email at bfoley@lanl.gov if you have questions regarding this information.

Sincerely,

Acting for J. Bretzke 2/15/2017

John C. Bretzke
Division Leader
Environmental Protection & Compliance
Los Alamos National Security LLC

Sincerely,

Cheryl L. Rodriguez
Program Manager, FPD-II
Environmental Management
Los Alamos Field Office

JCB/CLR/MTS/WJF:am

Enclosures:
(1) 2016 work plan submittal and NMED response letters, DP-1793
(2) Work Plan #3 Discharge Report, DP-1793
(3) Work Plan #4 Discharge Report, DP-1793
(4) 2016 Daily Land Application Volumes, DP-1793

Copy: Shelly Lemon, NMED/SWQB, Santa Fe, NM, (E-File)
John E. Kieling, NMED/HWB, Santa Fe, NM, (E-File)
Stephen M. Yanicak, NMED/DOE/OB, (E-File)
Douglas E. Hintze, EM-LA, (E-File)
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Paul B. Underwood, EM-LA, (E-File)
Annette E. Russell, EM-LA, (E-File)
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Ms. Michelle Hunter, Chief
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New Mexico Environment Department
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Santa Fe, NM 87502

GROUND WATER
FEB 27 2017
BUREAU

Subject: **Discharge Permit DP-1793 Annual Monitoring Report for 2016**

Dear Ms. Hunter:

This letter and enclosures from the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) are the Annual Monitoring Report for Discharge Permit DP-1793 for 2016. Discharge Permit DP-1793 was issued by the New Mexico Environment Department (NMED) on July 27, 2015, for the land application of groundwater associated with aquifer and pumping tests, well development and rehabilitation, groundwater tracer studies, and groundwater remediation activities. Before a discharge from an individual project or activity begins, DOE/LANS are required to submit a comprehensive work plan to NMED for its review and approval. In calendar year 2016, DOE/LANS submitted the following work plans.

1. **Work Plan #3**, March 22, 2016, *Multiple Activities Work Plan for the Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793 WP#3* (EPC-DO-16-063). A copy of the cover letter is provided in Enclosure 1. Work Plan #3 was approved by NMED, with conditions, on May 24, 2016. A copy of the May 24, 2016 approval letter is provided in Enclosure 1.

   Work Plan #3 was implemented by DOE/LANS for a period of 107 days between June 27, 2016 to December 15, 2016. As required by Discharge Permit DP-1793, a discharge report was submitted to NMED on February 13, 2017 (EPC-DO-17-048). A complete copy of the Work Plan #3 Discharge Report is provided in Enclosure 2.

ENCLOSURE 1

2016 work plan submittal and NMED response letters,
DP-1793

EPC-DO: 17-067

LA-UR-17-20445

U1501760

Date: FEB 2 7 2017

ENCLOSURE 1

COPY

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Date: MAR 22 2016
Symbol: EPC-DO-16-063
LA-UR: 16-21509
Locates Action No.: U1501760

GROUND WATER
MAR 23 2016
BUREAU

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Ms. Hunter:

Subject: **Multiple Activities Work Plan for the Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793 WP#3**

On July 27, 2015, the New Mexico Environment Department (NMED) issued a Discharge Permit (DP-1793) to the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) for the land application of treated groundwater from covered activities. Pursuant to Condition No. 3 of the above-referenced discharge permit, DOE/LANS are required to submit detailed, project-specific work plans for approval by NMED before any activities are undertaken.

Chromium (Cr) concentrations exceed the New Mexico Water Quality Control Commission (NMWQCC) Regulation 3103 groundwater standard of 50 µg/L in regional aquifer groundwater beneath Mortandad and Sandia Canyons within Los Alamos National Laboratory. The enclosed work plan is for the proposed discharge of treated groundwater from three Chromium Project activities: (1) pumping at extraction well CrEX-1 for hydraulic control of the plume, (2) development, aquifer testing, and on-going pumping to evaluate the optimum chromium mass removal pumping strategy at a new extraction well (CrEX-3, spring 2016) and injection capacity at new injection wells CrIN-1 through CrIN-5, and (3) routine monitoring well purging during sampling and five-day pumping at recently installed piezometers to confirm measured chromium concentrations.

The activities listed above will be conducted as specified in the NMED-approved Interim *Measures Work Plan for the Evaluation of Chromium Mass Removal* and *Work Plan for Chromium Plume Center Characterization.* Produced groundwater will be treated and discharged in accordance with the enclosed work plan and supporting information.

Please contact Robert S. Beers by telephone at (505) 667-7969 or by email at bbeers@lanl.gov if you have questions regarding this work plan.

Sincerely,

John P. McCann
Acting Division Leader
Environmental Protection & Compliance Division
Los Alamos National Security, LLC

Sincerely,

David S. Rhodes
Supervisor, Soil & Groundwater Remediation
Environmental Management
Los Alamos Field Office
U.S. Department of Energy

JPM:DSR:MTS:RSB/lm

Enclosures:

1) Multiple Activities Work Plan for the Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793, WP #3
2) Interim Measures Work Plan for Chromium Plume Control and Work Plan for Chromium Plume Center Characterization
3) Topographical Map of the Project Site
4) Table 3.4-1 (Chromium Investigation Monitoring Group) from the Monitoring Year 2016 Interim Facility-Wide Groundwater Monitoring Plan
5) As-Built Specifications for Well and Piezometers
6) Water-Quality Data from CrEX-1, R-42, R-45, and R-50
7) Schematic of the IX Treatment System and Technical Specifications of the IX Vessels and Resin
8) 2016 Chromium Groundwater Project Land Application Layout
9) Sample Land-Application Zone Signage

Cy: James Hogan, NMED/SWQB, Santa Fe, NM, (E-File)
John E. Kieling, NMED/HWB, Santa Fe, NM, (E-File)
Steven M. Yanicak, NMED/DOE/OB, (E-File)
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ENCLOSURE 1

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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

May 24, 2016

John P. McCann
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David S. Rhodes
Supervisor, Soil & Groundwater Remediation
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3747 West Jemez Road
Los Alamos, New Mexico 87544

RE: Approval with Modification of Workplan #3 for Treatment and Land Application of Groundwater at TA-05, Los Alamos National Laboratory, Discharge Permit 1793

Dear Messrs. McCann and Rhodes,

On March 23, 2016, the New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) received a workplan from DOE/LANS (the Permittees) for the continued land application of treated groundwater at TA-05. The workplan is required by Condition 3 of Discharge Permit 1793 (DP-1793) for activities regulated under the permit and addresses the extraction, treatment, and land application of chromium contaminated groundwater from Mortandad and Sandia Canyons during calendar year 2016. Calendar year 2015 discharges of a similar nature were authorized under Workplan #2, which was approved by NMED on October 8, 2015.

The workplan (WP#3) identifies three activities that produce potentially contaminated groundwater requiring treatment and discharge: (1) pumping at extraction well CrEX-1; (2) development, testing, and pumping at extraction well CrEX-3 and injection wells CrIN-1 through CrIN-5; and (3) purging of chromium plume monitoring wells and pumping of piezometers. These activities are conducted as specified in the *Interim Measures Work Plan for Chromium Plume Control*, May 26, 2015, and the *Work Plan for Chromium Plume Center Characterization,* July 28, 2015. NMED Hazardous Waste Bureau approved these plans for implementation in a letter dated October 15, 2015.

Specific monitoring of the extraction, treatment, and distribution systems will be completed to ensure proper procedures are maintained. Operational monitoring of the treatment system will be conducted to ensure proper process control, and regular compliance sampling will be reported in accordance with DP-1793, Conditions 8 and 9.

A copy of the proposed WP#3 was posted on LANL's Electronic Public Reading Room on March 29, 2016. In accordance with DP-1793, Condition 3, proposed WP#3 was subject to public comment for a period of 30 days. Comments received have been considered in the preparation of this response.

Groundwater discharges associated with WP#3 shall be performed in accordance with the workplan and are subject to all conditions of DP-1793. WP#3 is approved as submitted, with the following modifications:

1. The Permittees shall revise Enclosure 1, Table 7 to include sampling for perchlorate, and shall respond consistently to the contingencies outlined in Section 8 for all anthropogenic constituents. Perchlorate is identified at 20.6.2.7.WW NMAC as having a risk-based action level (Table A-1 of the *Risk Assessment Guidance for Site Investigations and Remediation*, July 2015) of 13.8 micrograms per liter (µg/l). For consistency, the treatment standard for perchlorate shall be less than 90% of that standard, 12.4 µg/l.
2. Should a storm event cause continuous flow through the Mortandad Canyon watercourse for greater than 48 hours in the proximity of the treatment areas, the Permittees shall schedule the monthly groundwater-level measurements and associated sampling as described in WP#3, Enclosure 1, Section 3, as soon as is safely and operationally possible, and no more than 15 days from the cessation of flow.
3. Six months prior to the end of the term of the discharge permit (July 27, 2020) and at the termination of discharge and final closure under the requirements of DP-1793, the Permittees shall measure total chromium in soils from a representative location in each land application zone. Analyses of these soil samples shall be performed by an off-site, independent, NELAP-accredited analytical laboratory. The Permittees shall submit an associated workplan for NMED approval at least 60 days prior to the date of the required soil sampling.

Within 60 days of cessation of the discharge authorized under this workplan, the Permittees shall submit a Discharge Report in accordance with DP-1793, Condition 8. If during the current term of DP-1793, all treatment system compliance sampling measures are below the method detection limit for chromium, *i.e.*, non-detect, the sampling and analysis requirements above shall not be effective.

Approval of WP#3 does not relieve the Permittees of the responsibility to comply with any other applicable federal, state, and/or local laws and regulations. This approval also does not relieve the Permittees of liability should operations associated with this workplan result in actual pollution of ground or surface waters.

If you have any questions, please contact Steve Pullen at (505) 827-2962. Thank you for your cooperation.

Sincerely,

Michelle Hunter, Chief
Ground Water Quality Bureau

MH:SP

cc (e-version):
James Hogan, NMED/SWQB
John Kieling, NMED/HWB
Steven Yanicak, NMED/DOEOB
Steven Huddleson, NMED/GWQB
Greg Huey, NMED/GWQB
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Date: MAR 2 2 2016
Symbol: EPC-DO-16-064
LA-UR: 16-21518
Locates Action No.: U1501760

GROUND WATER
MAR 23 2016
BUREAU

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Ms. Hunter:

Subject: **Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, WP#4**

On July 27, 2015, the New Mexico Environment Department (NMED) issued a Discharge Permit (DP-1793) to the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) for the land application of treated groundwater from covered activities. Pursuant to Condition No. 3 of the above-referenced discharge permit, DOE/LANS are required to submit a detailed, project-specific work plan for approval by NMED before any activities are undertaken.

The enclosed work plan is for the proposed discharge of treated groundwater from aquifer tests conducted to investigate the occurrence of and potential remedial alternatives for high explosives (HE) contamination in deep-perched groundwater associated with the former Outfall at Technical Area (TA)-16. The primary contaminant in groundwater within the study area is RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), a high explosives (HE) compound widely used in military and industrial applications. Low concentrations of other HE compounds and volatile organic compounds (VOCs) are also present in groundwater in the investigation area.

DOE/LANS propose to conduct three 30-day aquifer tests at monitoring wells CdV-9-1(i), CdV-16-4ip, and CdV-16-1(i). The first test is expected to begin in June 2016 with approximately 30 days of recovery time between each test. The aquifer tests were designed to evaluate the degree of hydraulic connectivity within the perched-groundwater system and to improve the general understanding of transport pathways for RDX and other contaminants to the perched groundwater zones. Additionally, water generated during well development of CdV-9-1(i) will be treated and discharged under this work plan.

Please contact Robert S. Beers by telephone at (505) 667-7969 or by email at bbeers@lanl.gov if you have questions regarding this work plan.

Sincerely,

D R Gregg acting

John P. McCann
Acting Division Leader
Environmental Protection & Compliance Division
Los Alamos National Security, LLC

Sincerely,

David S. Rhodes
Supervisor, Soil & Groundwater Remediation
Environmental Management
Los Alamos Field Office
U.S. Department of Energy

JPM:DSR:MTS:RSB/lm

Enclosures:

1) Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, WP#4
2) Figures
3) Topographic Map of Project Site
4) As-Built Specifications for TA-16 Wells
5) Analytical Data
6) GAC Well Treatment System Details

Cy: James Hogan, NMED/SWQB, Santa Fe, NM, (E-File)
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Steven M. Yanicak, NMED/DOE/OB, (E-File)
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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

May 27, 2016

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David S. Rhodes
Supervisor, Soil & Groundwater Remediation
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Los Alamos, New Mexico 87544

RE: Approval with Modification of Workplan #4 for Treatment and Land Application of Groundwater – TAs 09 and 16, Los Alamos National Laboratory, Discharge Permit DP-1793

Dear Messrs. McCann and Rhodes,

On March 23, 2016, the New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) received a workplan from DOE/LANS (the Permittees) for the land application of treated groundwater at Technical Areas (TA) 09 and 16. The workplan is required by Condition 3 of Discharge Permit 1793 (DP-1793) for activities regulated under the permit, and addresses the extraction, treatment, and land application of high explosives (HE) contaminated groundwater at the referenced TAs.

The workplan (WP #4) proposes the discharge of treated groundwater from three aquifer tests designed to investigate the occurrence and potential remedial alternative for HE contamination in the deep-perched groundwater aquifer associated with the former 260 Outfall at TA-16. In addition to the discharge of aquifer test waters, WP #4 proposes to discharge treated groundwaters generated during well development of Well CdV-9-1(i). These activities will be conducted as specified in the *Work Plan of Intermediate Groundwater System Characterization at Consolidated unit 16-021(c)-99.* NMED's Hazardous Waste Bureau approved this plan in a letter dated October 13, 2015.

The primary contaminant of concern associated with the subject groundwater, and the only contaminant expected to be above regulatory or permit standards, is hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX). Also present in the investigation area groundwater are low concentrations of multiple HE compounds and organic compounds, all measured to be significantly below associated maximum contaminant levels.

All groundwater subject to this workplan will be treated with granulated activated carbon (GAC) prior to being discharged to specific land application areas as permitted under DP-1793. Monitoring shall ensure that treated groundwater contaminate concentrations do not exceed 90% of the 20.6.2.3103 NMAC numeric standards or do not exceed 90% of the numeric standards established for tap water in Table A-1 of NMED's *Risk Assessment Guidance for Site Investigation and Remediation* for 20.6.2.7.WW NMAC toxic pollutants, *e.g.*, RDX.

The subject groundwater wells are located in the Canon de Valle watershed within T119N/R06E/S29, S30, S31, S32 and T119N/R05E/S36. The depth to the regional aquifer beneath the proposed land application sites is approximately 1200 feet below ground surface. The direction of groundwater flow beneath the site is generally to the southeast.

A copy of the proposed WP#4 was posted on LANL's Electronic Public Reading Room on March 29, 2016. In accordance with DP-1793 Condition 3, proposed WP#4 was subject to public comment for a period of 30 days. Comments received have been considered in the preparation of this response.

Groundwater discharges associated with WP #4 shall be performed in accordance with the Workplan and are subject to all conditions of DP-1793. Workplan #4 is approved as submitted with the following modifications:

1. The Permittees shall revise the land application zone map (Enclosure 3) removing all areas exceeding the 5% slope limit.
2. Six months prior to the end of the term of the discharge permit (July 27, 2020) and at the termination of discharge and final closure under the requirements of DP-1793, the Permittees shall measure the concentration of RDX and all other contaminants of concern in soils from a representative location in each land application zone. Analyses of these soil samples shall be performed by an off-site, independent, NELAP-accredited analytical laboratory. The Permittees shall submit an associated workplan for NMED approval at least 60 days prior to the date of the required soil sampling.

Within 60 days of cessation of the discharge authorized under this workplan, the Permittees shall submit a Discharge Report in accordance with DP-1793, Condition 8. If during the current term of DP-1793 all treatment system compliance sampling measures are below the method detection limit for RDX, the sampling and analysis requirements above shall not be effective.

Approval of WP#4 does not relieve the Permittees of the responsibility to comply with any other applicable federal, state, and/or local laws and regulations. This approval also does not relieve the Permittees of liability should operations associated with this workplan result in actual pollution of ground or surface waters.

If you have any questions, please contact Steve Pullen at (505) 827-2962. Thank you for your cooperation.

Sincerely,

Michelle Hunter, Chief
Ground Water Quality Bureau

MH:SP

cc (e-version):
James Hogan, NMED/SWQB
John Kieling, NMED/HWB
Steven Yanicak, NMED/DOEOB
Steven Huddleson, NMED/GWQB
Greg Huey, NMED/GWQB
Bob Beers, LANS, EM-LA
Cheryl Rodriquez, EM-LA
Stephani Swickley, ADEM-PO
Danny Katzman, ADEM-PO
Gerald Fordham, ER-ES

ENCLOSURE 2

Work Plan #3 Discharge Report,
DP-1793

EPC-DO: 17-067

LA-UR-17-20445

U1501760

Date: FEB 2 7 2017

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Date: FEB 13 2017
Symbol: EPC-DO: 17-048
LA-UR: 17-20229
Locates Action No.: U1501760

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Subject: **Work Plan #3 Discharge Report, Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793**

Dear Ms. Hunter:

The U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) are in receipt of your May 24, 2016 letter (Enclosure 1) granting approval of Work Plan #3 (Enclosure 2) under Discharge Permit DP-1793, for the continued land application of treated groundwater at Technical Area (TA)-05. These activities are regulated under the permit and address the extraction, treatment, and land application of chromium contaminated groundwater from Mortandad and Sandia Canyons. Condition No. 8 of Discharge Permit DP-1793 and the above-referenced May 24, 2016 approval letter require that DOE/LANS submit a discharge report to the New Mexico Environment Department (NMED) within 60 days of the final cessation of discharge. The following information is required in the discharge report:

1. *The total volume of groundwater discharged;*
2. *The estimated average application rate for the period of discharge;*
3. *Analytical results from samples collected under the water quality sampling plan;*
4. *Analytical reports for the samples collected under the water quality sampling plan;*
5. *Analytical data from monitoring for tracers deployed under the March 4, 2016 Notice of Intent (NOI); and*
6. *A map identifying the locations of discharge.*

Each of the above requirements are addressed in this letter and the enclosures.

Requirement No. 1: *The total volume of groundwater discharged.*

Table 1 below provides the total volume of groundwater discharge in 2016 under Work Plan #3.

Table 1. Volume of Treated groundwater discharged under Work Plan #3 in 2016

Source	Discharge Start Date	Discharge End Date	# of Days of Active Discharge	Total Volume (gal.)	Average Volume (gal.)	Maximum Daily Volume (gal.)
Legacy Water[1]	6/9/2016	6/27/2016	12	327,600	27,300	53,200
2016 Ground Water	6/28/2016	12/15/2016	95	15,954,114	167,938	339,498
Total Volume of Discharge				**16,281,714**		
Average Volume of Discharge					**152,166**	
Maximum Daily Volume of Discharge						**339,498**

Notes

[1] Legacy Water was included in Activity 1 of Work Plan #3 and consists of groundwater produced from pumping at extraction well CrEX-1 completed in CY2015 under the NMED approved DP-1793 Work Plan #2 which was in storage at the end of CY2015.

Requirement No. 2: *An estimated average application rate for the period of discharge.*

The average land application rate over the 107 days of active discharge was approximately 152,166 gallons per day (gpd). The maximum daily discharge was 339,498 gpd. In addition, there were not any storm events which resulted in continuous flow through the Mortandad Canyon watercourse for greater than 48 hours in the proximity of the treatment areas. Therefore, changes to the monthly groundwater-level measurements and sampling were not required as identified in Modification #2 of your May 24, 2016 approval letter.

Requirement No. 3: *Analytical results from samples collected under the water quality sampling plan.*

Analytical results from samples collected under Work Plan #3 are summarized in Enclosure 3. During 2016 samples were obtained from treatment systems (CTU): CTUA at CrEX-1, CTUB central location at R-28, and CTUC at CrEX-3. Perchlorate sampling was completed and is reported here in accordance with Modification #1 identified in your May 24, 2016 approval letter. No results for nitrate-nitrogen (NO_3-N), chromium (Cr), or perchlorate exceeded the land application limits of 9 mg/L, 45 µg/L, and 12.4 µg/L, respectively.

During the week of July 25 only one treated effluent sample was collected for CTUA. Based on the operational HACH® System sample results collected during the week for this system, the maximum Cr and NO_3-N concentrations for this unit were 0.00 µg/L and 2.7 mg/L, respectively. Since the HACH® System does not include perchlorate analysis, a review of the July 20, July 27, and August 1 perchlorate analytical results was conducted. The results were 0.132 µg/L, 0.113 µg/L, and 0.118 µg/L, respectively. These values are below the maximum value observed for treatment system CTUA in 2016 of 0.182 µg/L.

During the week of September 26 only one treated effluent sample was obtained for CTUC. Based on the operational HACH® System sample results collected during the week for this system, the maximum Cr and NO_3-N concentrations for this unit were 0.00 µg/L and 5.05 mg/L,

respectively. Since the HACH® System does not include perchlorate analysis, a review of the September 26 and October 3 perchlorate analytical results was conducted. The results were 0.144 µg/L and 0.131 µg/L, respectively. These values are below the maximum value observed for treatment system CTUC in 2016 of 0.232 µg/L.

Requirement No. 4: *Analytical reports for the samples collected under the water quality sampling plan.*

Enclosure 4 (CD) provides copies of the complete analytical reports from GEL Laboratories LLC.

Requirement No. 5: *Analytical data from monitoring for tracers deployed under the March 4, 2016 Notice of Intent (NOI).*

During 2016 a tracer study began to evaluate the solute transport characteristics of the aquifer and to support the future assessment of potential remedial alternatives for the Cr(VI)-contaminated regional aquifer under Mortandad Canyon. This study was completed in accordance with NMED's April 15, 2016 approval of DOE/LANS' March 4, 2016 NOI to Conduct a Tracer Study at Los Alamos National Laboratory (EPC-DO-16-047). Tracers were deployed at CrPZ-2a, CrPZ-2b, and R-28. In accordance with the NOI, tracers were monitored for their appearance in CrEX-1 and CrEX-3. Due to their location relative to the tracer deployment locations, monitoring for tracers in the quarterly sampled monitoring wells in the vicinity of the tracer deployment will begin in 2017. The only well where tracers appeared in the vicinity of the deployment locations was CrEX-3. At CrEX-3 two tracers have been detected. In CrEX-1 all tracers were below detection limits. **Enclosure 5** provides a summary table for all analytical data above detection limits at CrEX-1 and CrEX-3 in accordance with DP-1793 Work Plan #3. The analytical data for tracers at the deployment locations was unavailable at the time this discharge report was prepared.

Requirement No. 6: *A map identifying the locations of discharge.*

Enclosure 6 provides a map showing the four approved land application zones in Mortandad Canyon. All four land application zones—1, 2, 3, and 4—received discharges of treated groundwater under Work Plan #3.

Please contact William J. Foley by telephone at (505) 665-8423 or by email at bfoley@lanl.gov if you have questions regarding this information.

Sincerely,

John C. Bretzke
Division Leader
Environmental Protection & Compliance
Los Alamos National Security, LLC

Sincerely,

Cheryl L. Rodriguez
Program Manager, FPD-II
Environmental Management
Los Alamos Field Office

JCB/CLR/MTS/WJF:am

Enclosures:
(1) NMED letter dated May 24, 2016, approving Work Plan #3
(2) LANL submittal letter dated March 22, 2016 for Work Plan #3 (EPC-DO-16-063)
(3) Work Plan #3 analytical results summary table
(4) CD containing analytical reports from GEL Laboratories LLC (upon request)
(5) Tracer study results summary table
(6) Map showing land application zones receiving treated groundwater under Work Plan #3

Copy: Shelly Lemon, NMED/SWQB, Santa Fe, NM, (E-File)
John E. Kieling, NMED/HWB, Santa Fe, NM, (E-File)
Stephen M. Yanicak, NMED/DOE/OB, (E-File)
Douglas E. Hintze, EM-LA, (E-File)
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Michael T. Brandt, ADESH, (E-File)
Raeanna Sharp-Geiger, ADESH, (E-File)
Randall Mark Erickson, ADEM, (E-File)
Enrique Torres, ADEM, (E-File)
Bruce Robinson, ADEM-PO, (E-File)
Stephani F. Swickley, ADEM-PO, (E-File)
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COPY

Los Alamos NATIONAL LABORATORY EST 1943

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Date: FEB 13 2017
Symbol: EPC-DO: 17-048
LA-UR: 17-20229
Locates Action No.: U1501760

GROUND WATER
FEB 13 2017
BUREAU

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Subject: **Work Plan #3 Discharge Report, Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793**

Dear Ms. Hunter:

The U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) are in receipt of your May 24, 2016 letter (Enclosure 1) granting approval of Work Plan #3 (Enclosure 2) under Discharge Permit DP-1793, for the continued land application of treated groundwater at Technical Area (TA)-05. These activities are regulated under the permit and address the extraction, treatment, and land application of chromium contaminated groundwater from Mortandad and Sandia Canyons. Condition No. 8 of Discharge Permit DP-1793 and the above-referenced May 24, 2016 approval letter require that DOE/LANS submit a discharge report to the New Mexico Environment Department (NMED) within 60 days of the final cessation of discharge. The following information is required in the discharge report:

1. *The total volume of groundwater discharged;*
2. *The estimated average application rate for the period of discharge;*
3. *Analytical results from samples collected under the water quality sampling plan;*
4. *Analytical reports for the samples collected under the water quality sampling plan;*
5. *Analytical data from monitoring for tracers deployed under the March 4, 2016 Notice of Intent (NOI); and*
6. *A map identifying the locations of discharge.*

Each of the above requirements are addressed in this letter and the enclosures.

ENCLOSURE 1

NMED letter dated May 24, 2016, approving Work Plan #3

EPC-DO: 17-048

LA-UR-17-20229

U1501760

Date: FEB 1 3 2017

ESHID-601502

ENCLOSURE 1

NEW MEXICO
ENVIRONMENT DEPARTMENT

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SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

RYAN FLYNN
Cabinet Secretary

BUTCH TONGATE
Deputy Secretary

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

May 24, 2016

John P. McCann
Acting Division Leader
Environmental Protection & Compliance Division
Los Alamos National Security, LLC
PO Box 1663, K490
Los Alamos, New Mexico 87545

David S. Rhodes
Supervisor, Soil & Groundwater Remediation
Environmental Management
Los Alamos Field Office
U.S. Department of Energy
3747 West Jemez Road
Los Alamos, New Mexico 87544

RE: Approval with Modification of Workplan #3 for Treatment and Land Application of Groundwater at TA-05, Los Alamos National Laboratory, Discharge Permit 1793

Dear Messrs. McCann and Rhodes,

On March 23, 2016, the New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) received a workplan from DOE/LANS (the Permittees) for the continued land application of treated groundwater at TA-05. The workplan is required by Condition 3 of Discharge Permit 1793 (DP-1793) for activities regulated under the permit and addresses the extraction, treatment, and land application of chromium contaminated groundwater from Mortandad and Sandia Canyons during calendar year 2016. Calendar year 2015 discharges of a similar nature were authorized under Workplan #2, which was approved by NMED on October 8, 2015.

The workplan (WP#3) identifies three activities that produce potentially contaminated groundwater requiring treatment and discharge: (1) pumping at extraction well CrEX-1; (2) development, testing, and pumping at extraction well CrEX-3 and injection wells CrIN-1 through CrIN-5; and (3) purging of chromium plume monitoring wells and pumping of piezometers. These activities are conducted as specified in the *Interim Measures Work Plan for Chromium Plume Control*, May 26, 2015, and the *Work Plan for Chromium Plume Center Characterization,* July 28, 2015. NMED Hazardous Waste Bureau approved these plans for implementation in a letter dated October 15, 2015.

Specific monitoring of the extraction, treatment, and distribution systems will be completed to ensure proper procedures are maintained. Operational monitoring of the treatment system will be conducted to ensure proper process control, and regular compliance sampling will be reported in accordance with DP-1793, Conditions 8 and 9.

A copy of the proposed WP#3 was posted on LANL's Electronic Public Reading Room on March 29, 2016. In accordance with DP-1793, Condition 3, proposed WP#3 was subject to public comment for a period of 30 days. Comments received have been considered in the preparation of this response.

Groundwater discharges associated with WP#3 shall be performed in accordance with the workplan and are subject to all conditions of DP-1793. WP#3 is approved as submitted, with the following modifications:

1. The Permittees shall revise Enclosure 1, Table 7 to include sampling for perchlorate, and shall respond consistently to the contingencies outlined in Section 8 for all anthropogenic constituents. Perchlorate is identified at 20.6.2.7.WW NMAC as having a risk-based action level (Table A-1 of the *Risk Assessment Guidance for Site Investigations and Remediation*, July 2015) of 13.8 micrograms per liter (µg/l). For consistency, the treatment standard for perchlorate shall be less than 90% of that standard, 12.4 µg/l.
2. Should a storm event cause continuous flow through the Mortandad Canyon watercourse for greater than 48 hours in the proximity of the treatment areas, the Permittees shall schedule the monthly groundwater-level measurements and associated sampling as described in WP#3, Enclosure 1, Section 3, as soon as is safely and operationally possible, and no more than 15 days from the cessation of flow.
3. Six months prior to the end of the term of the discharge permit (July 27, 2020) and at the termination of discharge and final closure under the requirements of DP-1793, the Permittees shall measure total chromium in soils from a representative location in each land application zone. Analyses of these soil samples shall be performed by an off-site, independent, NELAP-accredited analytical laboratory. The Permittees shall submit an associated workplan for NMED approval at least 60 days prior to the date of the required soil sampling.

Within 60 days of cessation of the discharge authorized under this workplan, the Permittees shall submit a Discharge Report in accordance with DP-1793, Condition 8. If during the current term of DP-1793, all treatment system compliance sampling measures are below the method detection limit for chromium, *i.e.*, non-detect, the sampling and analysis requirements above shall not be effective.

Approval of WP#3 does not relieve the Permittees of the responsibility to comply with any other applicable federal, state, and/or local laws and regulations. This approval also does not relieve the Permittees of liability should operations associated with this workplan result in actual pollution of ground or surface waters.

If you have any questions, please contact Steve Pullen at (505) 827-2962. Thank you for your cooperation.

Sincerely,

Michelle Hunter, Chief
Ground Water Quality Bureau

MH:SP

cc (e-version):
James Hogan, NMED/SWQB
John Kieling, NMED/HWB
Steven Yanicak, NMED/DOEOB
Steven Huddleson, NMED/GWQB
Greg Huey, NMED/GWQB
Bob Beers, EPC-CP
Cheryl Rodriguez, EM-LA
Stephani Swickley, ADEM-PO
Danny Katzman, ADEM-PO
Gerald Fordham, ER-ES

ENCLOSURE 2

LANL submittal letter dated March 22, 2016
for Work Plan #3 (EPC-DO-16-063)

EPC-DO: 17-048

LA-UR-17-20229

U1501760

Date: FEB 1 3 2017

ENCLOSURE 2

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Date: MAR 2 2 2016
Symbol: EPC-DO-16-063
LA-UR: 16-21509
Locates Action No.: U1501760

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Ms. Hunter:

Subject: **Multiple Activities Work Plan for the Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793 WP#3**

On July 27, 2015, the New Mexico Environment Department (NMED) issued a Discharge Permit (DP-1793) to the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) for the land application of treated groundwater from covered activities. Pursuant to Condition No. 3 of the above-referenced discharge permit, DOE/LANS are required to submit detailed, project-specific work plans for approval by NMED before any activities are undertaken.

Chromium (Cr) concentrations exceed the New Mexico Water Quality Control Commission (NMWQCC) Regulation 3103 groundwater standard of 50 µg/L in regional aquifer groundwater beneath Mortandad and Sandia Canyons within Los Alamos National Laboratory. The enclosed work plan is for the proposed discharge of treated groundwater from three Chromium Project activities: (1) pumping at extraction well CrEX-1 for hydraulic control of the plume, (2) development, aquifer testing, and on-going pumping to evaluate the optimum chromium mass removal pumping strategy at a new extraction well (CrEX-3, spring 2016) and injection capacity at new injection wells CrIN-1 through CrIN-5, and (3) routine monitoring well purging during sampling and five-day pumping at recently installed piezometers to confirm measured chromium concentrations.

ENCLOSURE 2

The activities listed above will be conducted as specified in the NMED-approved Interim *Measures Work Plan for the Evaluation of Chromium Mass Removal* and *Work Plan for Chromium Plume Center Characterization.* Produced groundwater will be treated and discharged in accordance with the enclosed work plan and supporting information.

Please contact Robert S. Beers by telephone at (505) 667-7969 or by email at bbeers@lanl.gov if you have questions regarding this work plan.

Sincerely,

John P. McCann
Acting Division Leader
Environmental Protection & Compliance Division
Los Alamos National Security, LLC

Sincerely,

David S. Rhodes
Supervisor, Soil & Groundwater Remediation
Environmental Management
Los Alamos Field Office
U.S. Department of Energy

JPM:DSR:MTS:RSB/lm

Enclosures:

1) Multiple Activities Work Plan for the Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793, WP #3
2) Interim Measures Work Plan for Chromium Plume Control and Work Plan for Chromium Plume Center Characterization
3) Topographical Map of the Project Site
4) Table 3.4-1 (Chromium Investigation Monitoring Group) from the Monitoring Year 2016 Interim Facility-Wide Groundwater Monitoring Plan
5) As-Built Specifications for Well and Piezometers
6) Water-Quality Data from CrEX-1, R-42, R-45, and R-50
7) Schematic of the IX Treatment System and Technical Specifications of the IX Vessels and Resin
8) 2016 Chromium Groundwater Project Land Application Layout
9) Sample Land-Application Zone Signage

Cy: James Hogan, NMED/SWQB, Santa Fe, NM, (E-File)
John E. Kieling, NMED/HWB, Santa Fe, NM, (E-File)
Steven M. Yanicak, NMED/DOE/OB, (E-File)
Jody Pugh, NA-LA, (E-File)
Cheryl L. Rodriguez, EM-LA, (E-File)
Brian T. Hennessey, EM-LA, (E-File)

ENCLOSURE 2

Cy (continued):
Kirsten M. Laskey, EM-LA, (E-File)
Jordan Arnswald, NA-LA, (E-File)
Craig S. Leasure, PADOPS, (E-File)
William Mairson, PADOPS, (E-File_
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Raeanna Sharp-Geiger, ADESH, (E-File)
Randall Mark Erickson, ADEM, (E-File)
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John P. McCann, EPC-DO, (E-File)
Stephani F. Swickley, ADEM-PO, (E-File)
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ENCLOSURE 2

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(505) 606-0397/Fax (505) 284-7522

Date: MAR 2 2 2016
Symbol: EPC-DO-16-063
LA-UR: 16-21509
Locates Action No.: U1501760

GROUND WATER
MAR 23 2016
BUREAU

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Ms. Hunter:

Subject: **Multiple Activities Work Plan for the Treatment and Land Application of Groundwater from Mortandad and Sandia Canyons, DP-1793 WP#3**

On July 27, 2015, the New Mexico Environment Department (NMED) issued a Discharge Permit (DP-1793) to the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) for the land application of treated groundwater from covered activities. Pursuant to Condition No. 3 of the above-referenced discharge permit, DOE/LANS are required to submit detailed, project-specific work plans for approval by NMED before any activities are undertaken.

Chromium (Cr) concentrations exceed the New Mexico Water Quality Control Commission (NMWQCC) Regulation 3103 groundwater standard of 50 µg/L in regional aquifer groundwater beneath Mortandad and Sandia Canyons within Los Alamos National Laboratory. The enclosed work plan is for the proposed discharge of treated groundwater from three Chromium Project activities: (1) pumping at extraction well CrEX-1 for hydraulic control of the plume, (2) development, aquifer testing, and on-going pumping to evaluate the optimum chromium mass removal pumping strategy at a new extraction well (CrEX-3, spring 2016) and injection capacity at new injection wells CrIN-1 through CrIN-5, and (3) routine monitoring well purging during sampling and five-day pumping at recently installed piezometers to confirm measured chromium concentrations.

ENCLOSURE 3

Work Plan #3 analytical results summary table

EPC-DO: 17-048

LA-UR-17-20229

U1501760

Date: FEB 1 3 2017

Table E3-1
2016 Treatment Unit Effluent Data Summary For CTUA_CrEX-1

Sample	Collection Date	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	Validation Reason Code	Lab	MDL	PQL	Dilution Factor
CTU6A-16-122930	06/28/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-122930	06/28/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.84	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-122930	06/28/2016	F	SW-846:6850	Perchlorate	Y	0.107	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-122931	06/30/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-122931	06/30/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	3.3	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-122931	06/30/2016	F	SW-846:6850	Perchlorate	Y	0.15	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-122929	07/06/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-122929	07/06/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.58	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-122929	07/06/2016	F	SW-846:6850	Perchlorate	Y	0.119	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-122925	07/07/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-122925	07/07/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.69	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-122925	07/07/2016	F	SW-846:6850	Perchlorate	Y	0.117	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-122928	07/12/2016	F	SW-846:6020	Chromium	Y	3.01	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6A-16-122928	07/12/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.59	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-122928	07/12/2016	F	SW-846:6850	Perchlorate	Y	0.115	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-122926	07/14/2016	F	SW-846:6020	Chromium	Y	5.83	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6A-16-122926	07/14/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.49	mg/L		J	I4a	GELC	0.085	0.25	5
CTU6A-16-122926	07/14/2016	F	SW-846:6850	Perchlorate	Y	0.126	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-122924	07/18/2016	F	SW-846:6020	Chromium	Y	3.48	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6A-16-122924	07/18/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.81	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-122924	07/18/2016	F	SW-846:6850	Perchlorate	Y	0.129	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124223	07/20/2016	F	SW-846:6020	Chromium	Y	5.22	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6A-16-124223	07/20/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.53	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124223	07/20/2016	F	SW-846:6850	Perchlorate	Y	0.132	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124220	07/27/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-124220	07/27/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.94	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124220	07/27/2016	F	SW-846:6850	Perchlorate	Y	0.113	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-122927	08/01/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-122927	08/01/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.41	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU6A-16-122927	08/01/2016	F	SW-846:6850	Perchlorate	Y	0.118	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124226	08/03/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-124226	08/03/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.54	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU6A-16-124226	08/03/2016	F	SW-846:6850	Perchlorate	Y	0.129	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124217	08/05/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-124217	08/05/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.58	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124217	08/05/2016	F	SW-846:6850	Perchlorate	Y	0.12	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124222	08/08/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-124222	08/08/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.55	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124222	08/08/2016	F	SW-846:6850	Perchlorate	Y	0.122	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124228	08/12/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-124228	08/12/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.86	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU6A-16-124228	08/12/2016	F	SW-846:6850	Perchlorate	Y	0.121	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124227	08/15/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-124227	08/15/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.53	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124227	08/15/2016	F	SW-846:6850	Perchlorate	Y	0.127	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124219	08/18/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1

Table E3-1
2016 Treatment Unit Effluent Data Summary For CTUA_CrEX-1

Sample	Collection Date	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	Validation Reason Code	Lab	MDL	PQL	Dilution Factor
CTU6A-16-124219	08/18/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.6	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124219	08/18/2016	F	SW-846:6850	Perchlorate	Y	0.12	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124221	08/22/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-124221	08/22/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.53	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124221	08/22/2016	F	SW-846:6850	Perchlorate	Y	0.123	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124225	08/26/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6A-16-124225	08/26/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	3.11	mg/L		J	i10b	GELC	0.085	0.25	5
CTU6A-16-124225	08/26/2016	F	SW-846:6850	Perchlorate	Y	0.111	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124218	08/29/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124218	08/29/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.19	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124218	08/29/2016	F	SW-846:6850	Perchlorate	N	0.05	ug/L	U	U	U_LAB	GELC	0.05	0.2	1
CTU6A-16-124774	09/02/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124774	09/02/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	6.3	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124774	09/02/2016	F	SW-846:6850	Perchlorate	N	0.05	ug/L	U	U	U_LAB	GELC	0.05	0.2	1
CTU6A-16-124781	09/06/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124781	09/06/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.67	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124781	09/06/2016	F	SW-846:6850	Perchlorate	N	0.05	ug/L	U	U	U_LAB	GELC	0.05	0.2	1
CTU6A-16-124780	09/09/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124780	09/09/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.65	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124780	09/09/2016	F	SW-846:6850	Perchlorate	N	0.05	ug/L	U	U	U_LAB	GELC	0.05	0.2	1
CTU6A-16-124775	09/12/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124775	09/12/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.34	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6A-16-124775	09/12/2016	F	SW-846:6850	Perchlorate	N	0.05	ug/L	U	U	U_LAB	GELC	0.05	0.2	1
CTU6A-16-124777	09/16/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124777	09/16/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.37	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6A-16-124777	09/16/2016	F	SW-846:6850	Perchlorate	N	0.05	ug/L	U	U	U_LAB	GELC	0.05	0.2	1
CTU6A-16-124779	09/19/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124779	09/19/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	3.79	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU6A-16-124779	09/19/2016	F	SW-846:6850	Perchlorate	Y	0.09	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124778	09/23/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124778	09/23/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	3.25	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124778	09/23/2016	F	SW-846:6850	Perchlorate	Y	0.0882	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-124776	09/26/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-124776	09/26/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.92	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-124776	09/26/2016	F	SW-846:6850	Perchlorate	Y	0.124	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-126735	09/30/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-126735	09/30/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.67	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-126735	09/30/2016	F	SW-846:6850	Perchlorate	Y	0.147	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-126736	10/03/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-126736	10/03/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.92	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU6A-16-126736	10/03/2016	F	SW-846:6850	Perchlorate	Y	0.15	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-126737	10/07/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-126737	10/07/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.59	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU6A-16-126737	10/07/2016	F	SW-846:6850	Perchlorate	Y	0.157	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-126738	10/11/2016	F	SW-846:6020	Chromium	Y	3.19	ug/L	J	J	J_LAB	GELC	3	10	1
CTU6A-16-126738	10/11/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.66	mg/L		NQ	NQ	GELC	0.085	0.25	5

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Table E3-1
2016 Treatment Unit Effluent Data Summary For CTUA_CrEX-1

Sample	Collection Date	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	Validation Reason Code	Lab	MDL	PQL	Dilution Factor
CTU6A-16-126738	10/11/2016	F	SW-846:6850	Perchlorate	Y	0.16	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-126744	10/14/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-126744	10/14/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.24	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6A-16-126744	10/14/2016	F	SW-846:6850	Perchlorate	Y	0.158	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-126743	10/17/2016	UF	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-126743	10/17/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.5	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-126743	10/17/2016	UF	SW-846:6850	Perchlorate	Y	0.14	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-126739	10/19/2016	UF	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-126739	10/19/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.91	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-126739	10/19/2016	UF	SW-846:6850	Perchlorate	Y	0.177	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6A-16-126741	10/20/2016	UF	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU6A-16-126741	10/20/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.93	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6A-16-126741	10/20/2016	UF	SW-846:6850	Perchlorate	Y	0.182	ug/L	J	J	J_LAB	GELC	0.05	0.2	1

Notes:
F - filtered.
UF - unfiltered.
N - in the detect flag column means the analyte was undetected.
Y - in the detect flag column means the analyte was detected.
U - in the lab qualifier column means analyte is classified as not detected.
U - in the validation qualifier column means analyte is classified as not detected.
J - in the lab qualifier comment means the analyte is classified as estimated.
J - in the validation qualifier comment means the analyte is classified as estimated.
NQ - in the validation qualifier column means no qualifier.
NQ - in the validation reason column means no qualifier.
U_LAB in the validation reason column means the analyte is classified as not detected.
J_LAB in the validation reason column means the analyte is classified as estimated.
I4a in the validation reason column means the analyte result is estimated and biased high because the analyte was identified in the method blank but was >5x the concentration of related analyte in the method blank
i10b in the validation reason column means the sample and/or the duplicate sample results RPD is not within the acceptance limites. External laboratory limits are located within the associated data package.

Table E3-2
2016 Treatment Unit Effluent Data Summary For CTUB_R-28

Sample	Collection Date	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	Validation Reason Code	Lab	MDL	PQL	Dilution Factor
CTU6B-16-122939	06/14/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6B-16-122939	06/14/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	3.01	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU6B-16-122939	06/14/2016	F	SW-846:6850	Perchlorate	Y	0.183	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-122934	06/16/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6B-16-122934	06/16/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	3.08	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-122934	06/16/2016	F	SW-846:6850	Perchlorate	Y	0.171	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-122937	06/21/2016	F	SW-846:6020	Chromium	Y	2.17	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6B-16-122937	06/21/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	3.09	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-122937	06/21/2016	F	SW-846:6850	Perchlorate	Y	0.219	ug/L		NQ	NQ	GELC	0.05	0.2	1
CTU6B-16-122932	06/23/2016	F	SW-846:6020	Chromium	Y	4.73	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6B-16-122932	06/23/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.39	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-122932	06/23/2016	F	SW-846:6850	Perchlorate	Y	0.185	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-122936	06/30/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6B-16-122936	06/30/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.94	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-122936	06/30/2016	F	SW-846:6850	Perchlorate	Y	0.181	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-122935	07/05/2016	F	SW-846:6020	Chromium	Y	6.31	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6B-16-122935	07/05/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.13	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-122935	07/05/2016	F	SW-846:6850	Perchlorate	Y	0.174	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-122938	07/07/2016	F	SW-846:6020	Chromium	Y	2.79	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6B-16-122938	07/07/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.43	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-122938	07/07/2016	F	SW-846:6850	Perchlorate	Y	0.181	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-122933	07/12/2016	F	SW-846:6020	Chromium	Y	3.44	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6B-16-122933	07/12/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.54	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-122933	07/12/2016	F	SW-846:6850	Perchlorate	Y	0.216	ug/L		NQ	NQ	GELC	0.05	0.2	1
CTU6B-16-124211	07/14/2016	F	SW-846:6020	Chromium	Y	6.18	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6B-16-124211	07/14/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.08	mg/L		J	I4a	GELC	0.085	0.25	5
CTU6B-16-124211	07/14/2016	F	SW-846:6850	Perchlorate	Y	0.201	ug/L		NQ	NQ	GELC	0.05	0.2	1
CTU6B-16-124213	07/19/2016	F	SW-846:6020	Chromium	Y	6.26	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6B-16-124213	07/19/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.95	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-124213	07/19/2016	F	SW-846:6850	Perchlorate	Y	0.192	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124214	07/22/2016	F	SW-846:6020	Chromium	N	6.41	ug/L	J	U	I4	GELC	2	10	1
CTU6B-16-124214	07/22/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.49	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6B-16-124214	07/22/2016	F	SW-846:6850	Perchlorate	Y	0.156	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124215	07/26/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6B-16-124215	07/26/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.43	mg/L		J	i10b	GELC	0.085	0.25	5
CTU6B-16-124215	07/26/2016	F	SW-846:6850	Perchlorate	Y	0.152	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124216	07/28/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU6B-16-124216	07/28/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	2.02	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU6B-16-124216	07/28/2016	F	SW-846:6850	Perchlorate	Y	0.173	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124212	08/04/2016	F	SW-846:6020	Chromium	Y	8.41	ug/L	J	J	J_LAB	GELC	2	10	1
CTU6B-16-124212	08/04/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.41	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6B-16-124212	08/04/2016	F	SW-846:6850	Perchlorate	Y	0.137	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124734	08/09/2016	F	SW-846:6020	Chromium	N	10.6	ug/L		U	I4	GELC	2	10	1
CTU6B-16-124734	08/09/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.4	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6B-16-124734	08/09/2016	F	SW-846:6850	Perchlorate	Y	0.138	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124742	10/26/2016	UF	SW-846:6020	Chromium	Y	12.3	ug/L		NQ	NQ	GELC	3	10	1

Table E3-2
2016 Treatment Unit Effluent Data Summary For CTUB_R-28

Sample	Collection Date	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	Validation Reason Code	Lab	MDL	PQL	Dilution Factor
CTU6B-16-124742	10/26/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.03	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6B-16-124742	10/26/2016	UF	SW-846:6850	Perchlorate	Y	0.0834	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124741	11/01/2016	UF	SW-846:6020	Chromium	Y	10.4	ug/L		NQ	NQ	GELC	3	10	1
CTU6B-16-124741	11/01/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.08	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6B-16-124741	11/01/2016	UF	SW-846:6850	Perchlorate	Y	0.103	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124743	11/03/2016	UF	SW-846:6020	Chromium	Y	11	ug/L		NQ	NQ	GELC	3	10	1
CTU6B-16-124743	11/03/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.07	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6B-16-124743	11/03/2016	UF	SW-846:6850	Perchlorate	Y	0.0773	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124737	11/15/2016	F	SW-846:6020	Chromium	Y	10.6	ug/L		J	I10d	GELC	3	10	1
CTU6B-16-124737	11/15/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	1.06	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU6B-16-124737	11/15/2016	F	SW-846:6850	Perchlorate	Y	0.0738	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU6B-16-124736	12/15/2016	UF	SW-846:6020	Chromium	Y	10.6	ug/L		NQ	NQ	GELC	3	10	1
CTU6B-16-124736	12/15/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	0.955	mg/L		NQ	NQ	GELC	0.017	0.05	1
CTU6B-16-124736	12/15/2016	UF	SW-846:6850	Perchlorate	Y	0.0605	ug/L	J	J	J_LAB	GELC	0.05	0.2	1

Notes:
F - filtered.
UF - unfiltered.
N - in the detect flag column means the analyte was undetected.
Y - in the detect flag column means the analyte was detected.
U - in the lab qualifier column means analyte is classified as not detected.
U - in the validation qualifier column means analyte is classified as not detected.
J - in the lab qualifier comment means the analyte is classified as estimated.
J - in the validation qualifier comment means the analyte is classified as estimated.
NQ - in the validation qualifier column means no qualifier.
NQ - in the validation reason column means no qualifier.
U_LAB in the validation reason column means the analyte is classified as not detected.
J_LAB in the validation reason column means the analyte is classified as estimated.
I4 in the validation reason column means the analyte result is =<5x the concentration of related analyte in the method blank.
I4a in the validation reason column means the analyte result is estimated and biased high because the analyte was identified in the method blank but was >5x the concentration of related analyte in the method blank
i10b in the validation reason column means the sample and/or the duplicate sample results RPD is not within the acceptance limites. External laboratory limits are located within the associated data package.

Table E3-3
2016 Treatment Unit Effluent Data Summary For CTUC_CrEX-3

Sample	Collection Date	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	Validation Reason Code	Lab	MDL	PQL	Dilution Factor
CTU4C-16-122945	08/12/2016	F	SW-846:6020	Chromium	N	2	ug/L	U	U	U_LAB	GELC	2	10	1
CTU4C-16-122945	08/12/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	N	0.017	mg/L	U	U	U_LAB	GELC	0.017	0.05	1
CTU4C-16-122945	08/12/2016	F	SW-846:6850	Perchlorate	N	0.05	ug/L	U	U	U_LAB	GELC	0.05	0.2	1
CTU4C-16-122947	09/12/2016	F	SW-846:6020	Chromium	Y	6.72	ug/L	J	J	J_LAB	GELC	3	10	1
CTU4C-16-122947	09/12/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	N	0.017	mg/L	U	U	U_LAB	GELC	0.017	0.05	1
CTU4C-16-122947	09/12/2016	F	SW-846:6850	Perchlorate	N	0.05	ug/L	U	U	U_LAB	GELC	0.05	0.2	1
CTU4C-16-122946	09/16/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-122946	09/16/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	6.35	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU4C-16-122946	09/16/2016	F	SW-846:6850	Perchlorate	Y	0.0818	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-122944	09/19/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-122944	09/19/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	5.29	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU4C-16-122944	09/19/2016	F	SW-846:6850	Perchlorate	Y	0.121	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-122942	09/23/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-122942	09/23/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.9	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU4C-16-122942	09/23/2016	F	SW-846:6850	Perchlorate	Y	0.118	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-122940	09/26/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-122940	09/26/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.97	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU4C-16-122940	09/26/2016	F	SW-846:6850	Perchlorate	Y	0.144	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-122943	10/03/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-122943	10/03/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.91	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU4C-16-122943	10/03/2016	F	SW-846:6850	Perchlorate	Y	0.131	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126745	10/07/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-126745	10/07/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.9	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU4C-16-126745	10/07/2016	F	SW-846:6850	Perchlorate	Y	0.133	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126746	10/11/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-126746	10/11/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.76	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU4C-16-126746	10/11/2016	F	SW-846:6850	Perchlorate	Y	0.144	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126747	10/14/2016	F	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-126747	10/14/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.77	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU4C-16-126747	10/14/2016	F	SW-846:6850	Perchlorate	Y	0.134	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126749	10/17/2016	UF	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-126749	10/17/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.04	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU4C-16-126749	10/17/2016	UF	SW-846:6850	Perchlorate	Y	0.132	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126752	10/21/2016	UF	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-126752	10/21/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.1	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU4C-16-126752	10/21/2016	UF	SW-846:6850	Perchlorate	Y	0.118	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126754	10/24/2016	UF	SW-846:6020	Chromium	N	3	ug/L	U	U	U_LAB	GELC	3	10	1
CTU4C-16-126754	10/24/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.8	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU4C-16-126754	10/24/2016	UF	SW-846:6850	Perchlorate	Y	0.146	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126753	10/28/2016	UF	SW-846:6020	Chromium	N	5.23	ug/L	J	U	I4	GELC	3	10	1
CTU4C-16-126753	10/28/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.85	mg/L		NQ	NQ	GELC	0.17	0.5	10
CTU4C-16-126753	10/28/2016	UF	SW-846:6850	Perchlorate	Y	0.147	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126750	10/31/2016	UF	SW-846:6020	Chromium	Y	4.82	ug/L	J	J	J_LAB	GELC	3	10	1
CTU4C-16-126750	10/31/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	5.25	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU4C-16-126750	10/31/2016	UF	SW-846:6850	Perchlorate	Y	0.174	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-16-126751	11/02/2016	UF	SW-846:6020	Chromium	Y	8.9	ug/L	J	J	J_LAB	GELC	3	10	1

LA-UR-17-20445 EPC-DO: 17-067

Table E3-3
2016 Treatment Unit Effluent Data Summary For CTUC_CrEX-3

Sample	Collection Date	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	Validation Reason Code	Lab	MDL	PQL	Dilution Factor
CTU4C-16-126751	11/02/2016	UF	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.56	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU4C-16-126751	11/02/2016	UF	SW-846:6850	Perchlorate	Y	0.19	ug/L	J	J	J_LAB	GELC	0.05	0.2	1
CTU4C-17-127490	11/07/2016	F	SW-846:6020	Chromium	Y	29.8	ug/L		NQ	NQ	GELC	3	10	1
CTU4C-17-127490	11/07/2016	F	EPA:353.2	Nitrate-Nitrite as Nitrogen	Y	4.8	mg/L		NQ	NQ	GELC	0.085	0.25	5
CTU4C-17-127490	11/07/2016	F	SW-846:6850	Perchlorate	Y	0.232	ug/L		NQ	NQ	GELC	0.05	0.2	1

Notes:
F - filtered.
UF - unfiltered.
N - in the detect flag column means the analyte was undetected.
Y - in the detect flag column means the analyte was detected.
U - in the lab qualifier column means analyte is classified as not detected.
U - in the validation qualifier column means analyte is classified as not detected.
J - in the lab qualifier comment means the analyte is classified as estimated.
J - in the validation qualifier comment means the analyte is classified as estimated.
NQ - in the validation qualifier column means no qualifier.
NQ - in the validation reason column means no qualifier.
U_LAB in the validation reason column means the analyte is classified as not detected.
J_LAB in the validation reason column means the analyte is classified as estimated.

ENCLOSURE 4

CD containing analytical reports from
GEL Laboratories LLC
(upon request)

EPC-DO: 17-048

LA-UR-17-20229

U1501760

Date: FEB 1 3 2017

ABSTRACT: ENCLOSURE 4 CDs (1)

Enclosure 4 contains one CD containing the analytical results from GEL Laboratories LLC. Analytical analysis completed as part of DP-1793 Work Plan #3 in support of the land application of treated groundwater. Results provided are from the treated effluent from treatment units CTUA, CTUB, and CTUC associated with the chromium groundwater treatment system within Technical Area (TA)-05.

ENCLOSURE 5

Tracer study results summary table

EPC-DO: 17-048

LA-UR-17-20229

U1501760

Date: FEB 1 3 2017

Table E5-1
2016 Tracer Study Results Summary Table

Well Name	Sample ID	Sample Date	Tracers Detected[1,2]	
			2,7 NDS[3,5] from CrPZ-2a (mg/L)	ReO_4[4,5] from CrPZ-2a (mg/L)
CrEX-3	CrEX3-16-123277	6/24/2016	0	
	CrEX3-16-123287	6/24/2016		0.0000
	CrEX3-16-123279	9/12/2016		0.00003
	CrEX3-16-123289	9/12/2016	0.0000	
	CrEX3-16-123280	9/13/2016		0.0014
	CrEX3-16-123290	9/13/2016	0.0350	
	CrEX3-16-123281	9/14/2016		0.0024
	CrEX3-16-123291	9/14/2016	0.0591	
	CrEX3-16-123282	9/15/2016		0.0058
	CrEX3-16-123292	9/15/2016	0.2878	
	CrEX3-16-123283	9/16/2016		0.0136
	CrEX3-16-123293	9/16/2016	0.3111	
	CrEX3-16-123284	9/17/2016		0.0212
	CrEX3-16-123294	9/17/2016	0.4073	
	CrEX3-16-123285	9/18/2016		0.0312
	CrEX3-16-123295	9/18/2016	0.6541	
	CrEX3-16-123286	9/19/2016		0.0380
	CrEX3-16-123296	9/19/2016	0.7799	
	CrEX3-16-124088	9/20/2016	0.8006	
	CrEX3-16-124127	9/20/2016		0.0408
	CrEX3-16-124089	9/21/2016	2.0582	
	CrEX3-16-124128	9/21/2016		0.0614
	CrEX3-16-124090	9/22/2016	1.2807	
	CrEX3-16-124129	9/22/2016		0.0457
	CrEX3-16-124091	9/23/2016	1.1037	
	CrEX3-16-124130	9/23/2016		0.0520
	CrEX3-16-124092	9/24/2016	1.2353	
	CrEX3-16-124131	9/24/2016		0.0556
	CrEX3-16-124094	9/25/2016	1.2678	
	CrEX3-16-124133	9/25/2016		0.0594
	CrEX3-16-124095	9/26/2016	1.2110	
	CrEX3-16-124134	9/26/2016		0.0621
	CrEX3-16-124096	9/27/2016	1.3374	
	CrEX3-16-124135	9/27/2016		0.0628
	CrEX3-16-124097	9/28/2016	1.3194	
	CrEX3-16-124136	9/28/2016		0.0653
	CrEX3-16-124098	9/29/2016	1.4097	
	CrEX3-16-124137	9/29/2016		0.0692
	CrEX3-16-124100	9/30/2016	1.5099	
	CrEX3-16-124139	9/30/2016		0.0718

Table E5-1
2016 Tracer Study Results Summary Table

Well Name	Sample ID	Sample Date	Tracers Detected[1,2]	
			2,7 NDS[3,5] from CrPZ-2a (mg/L)	ReO_4[4,5] from CrPZ-2a (mg/L)
	CrEX3-16-124101	10/1/2016	1.3540	
	CrEX3-16-124140	10/1/2016		0.0680
	CrEX3-16-124102	10/2/2016	1.2667	
	CrEX3-16-124141	10/2/2016		0.0638
	CrEX3-16-124103	10/3/2016	1.3823	
	CrEX3-16-124142	10/3/2016		0.0696
	CrEX3-16-124104	10/4/2016	1.2370	
	CrEX3-16-124143	10/4/2016		0.0643
	CrEX3-16-124105	10/5/2016	1.1230	
	CrEX3-16-124144	10/5/2016		0.0657
	CrEX3-16-124106	10/6/2016	1.1050	
	CrEX3-16-124145	10/6/2016		0.0618
	CrEX3-16-124107	10/7/2016	1.1383	
	CrEX3-16-124146	10/7/2016		0.0659
	CrEX3-17-126926	10/8/2016	0.9838	
	CrEX3-17-126956	10/8/2016		0.0595
	CrEX3-17-126927	10/9/2016	0.9911	
	CrEX3-17-126957	10/9/2016		0.0593
	CrEX3-17-126928	10/10/2016	0.9664	
	CrEX3-17-126958	10/10/2016		0.0606
	CrEX3-17-126929	10/11/2016	0.8893	
	CrEX3-17-126959	10/11/2016		0.0555
	CrEX3-17-126930	10/12/2016	1.0366	
	CrEX3-17-126960	10/12/2016		0.0669
	CrEX3-17-126937	10/13/2016	1.0323	
	CrEX3-17-126967	10/13/2016		0.0560
	CrEX3-17-126938	10/13/2016	1.0310	
	CrEX3-17-126968	10/13/2016		0.0556
	CrEX3-17-126939	10/13/2016	0.9811	
	CrEX3-17-126969	10/13/2016		0.0591
	CrEX3-17-126940	10/13/2016	1.0243	
	CrEX3-17-126970	10/13/2016		0.0534
	CrEX3-17-126941	10/13/2016	1.0008	
	CrEX3-17-126971	10/13/2016		0.0567
	CrEX3-17-126942	10/13/2016	0.9996	
	CrEX3-17-126972	10/13/2016		0.0530
	CrEX3-17-126943	10/14/2016	0.9736	
	CrEX3-17-126973	10/14/2016		0.0531
	CrEX3-17-126944	10/17/2016	1.6670	
	CrEX3-17-126974	10/17/2016		0.1148

Table E5-1
2016 Tracer Study Results Summary Table

Well Name	Sample ID	Sample Date	Tracers Detected[1,2]	
			2,7 NDS[3,5] from CrPZ-2a (mg/L)	ReO_4[4,5] from CrPZ-2a (mg/L)
	CrEX3-17-126945	10/17/2016	1.2751	
	CrEX3-17-126975	10/17/2016		0.1075
	CrEX3-17-126946	10/18/2016	1.2292	
	CrEX3-17-126947	10/18/2016	0.9716	
	CrEX3-17-126977	10/18/2016		0.0571
	CrEX3-17-126948	10/18/2016	0.9448	
	CrEX3-17-126978	10/18/2016		0.0541
	CrEX3-17-126949	10/18/2016	0.9444	
	CrEX3-17-126979	10/18/2016		0.0540
	CrEX3-17-126950	10/18/2016	0.9941	
	CrEX3-17-126980	10/18/2016		0.0587
	CrEX3-17-126951	10/18/2016	0.9410	
	CrEX3-17-126981	10/18/2016		0.0565
	CrEX3-17-126952	10/18/2016	0.9334	
	CrEX3-17-126982	10/18/2016		0.0559
	CrEX3-17-126953	10/18/2016	0.9508	
	CrEX3-17-126983	10/18/2016		0.0553
	CrEX3-17-126954	10/19/2016	0.9287	
	CrEX3-17-126984	10/19/2016		0.0658
	CrEX3-17-126955	10/20/2016	0.2677	
	CrEX3-17-126985	10/20/2016		0.0587
	CrEX3-17-127050	10/21/2016	0.8555	
	CrEX3-17-127110	10/21/2016		0.0586
	CrEX3-17-127051	10/22/2016	0.0848	
	CrEX3-17-127111	10/22/2016		0.0604
	CrEX3-17-127055	10/23/2016	0.6813	
	CrEX3-17-127115	10/23/2016		0.0502
	CrEX3-17-127052	10/23/2016	0.7884	
	CrEX3-17-127112	10/23/2016		0.0408
	CrEX3-17-127053	10/24/2016	0.7660	
	CrEX3-17-127113	10/24/2016		0.0530
	CrEX3-17-127054	10/25/2016	0.7186	
	CrEX3-17-127114	10/25/2016		0.0572
	CrEX3-17-127055	10/26/2016	0.6813	
	CrEX3-17-127115	10/26/2016		0.0502
	CrEX3-17-127056	10/27/2016	0.6462	
	CrEX3-17-127116	10/27/2016		0.0468
	CrEX3-17-127057	10/28/2016	0.6313	
	CrEX3-17-127117	10/28/2016		0.0482
	CrEX3-17-127058	10/29/2016	0.6615	

Table E5-1
2016 Tracer Study Results Summary Table

Well Name	Sample ID	Sample Date	Tracers Detected[1,2]	
			2,7 NDS[3,5] from CrPZ-2a (mg/L)	ReO_4[4,5] from CrPZ-2a (mg/L)
	CrEX3-17-127118	10/29/2016		0.0442
	CrEX3-17-127059	10/30/2016	0.4898	
	CrEX3-17-127119	10/30/2016		0.0429
	CrEX3-17-127060	10/31/2016	0.5096	
	CrEX3-17-127120	10/31/2016		0.0395
	CrEX3-17-127061	11/1/2016	0.4563	
	CrEX3-17-127121	11/1/2016		0.0428
	CrEX3-17-127062	11/2/2016	0.3936	
	CrEX3-17-127122	11/2/2016		0.0345
	CrEX3-17-127063	11/3/2016	0.3258	
	CrEX3-17-127123	11/3/2016		0.0345
	CrEX3-17-127064	11/4/2016	0.2302	
	CrEX3-17-127124	11/4/2016		0.0325
	CrEX3-17-127065	11/5/2016	0.2563	
	CrEX3-17-127125	11/5/2016		0.0319
	CrEX3-17-127066	11/6/2016	0.2362	
	CrEX3-17-127126	11/6/2016		0.0306
	CrEX3-17-127067	11/7/2016	0.2038	
	CrEX3-17-127068	12/14/2016	*	
	CrEX3-17-127128	12/14/2016		0.0170

Notes:

* Analytic results not available.

[1]CrEX-3 is the only well in the vicinity of tracer deployment for which tracers deployed during 2016 were detected. In addition, additional tracers deployed in CrPZ-2b (two) and R-28 (two) have not been detected in any well.

[2]Analytical results for tracer deployment locations not available at the time of report preparation.

[3]2,7 NDS - Sodium 2,7 Naphthalene Disulfonate

[4]ReO_4 - $NaReO_4$

[5]25 kg of 2,7 NDS and 2 kg of ReO_4 deployed into CrPZ-2a on June 15-18. Tracer dissolved in 10,000 gal of potable water. An additional 10,000 gal of untraced potable "chase" water deployed June 18-20 starting immediately after tracer deployment.

ENCLOSURE 6

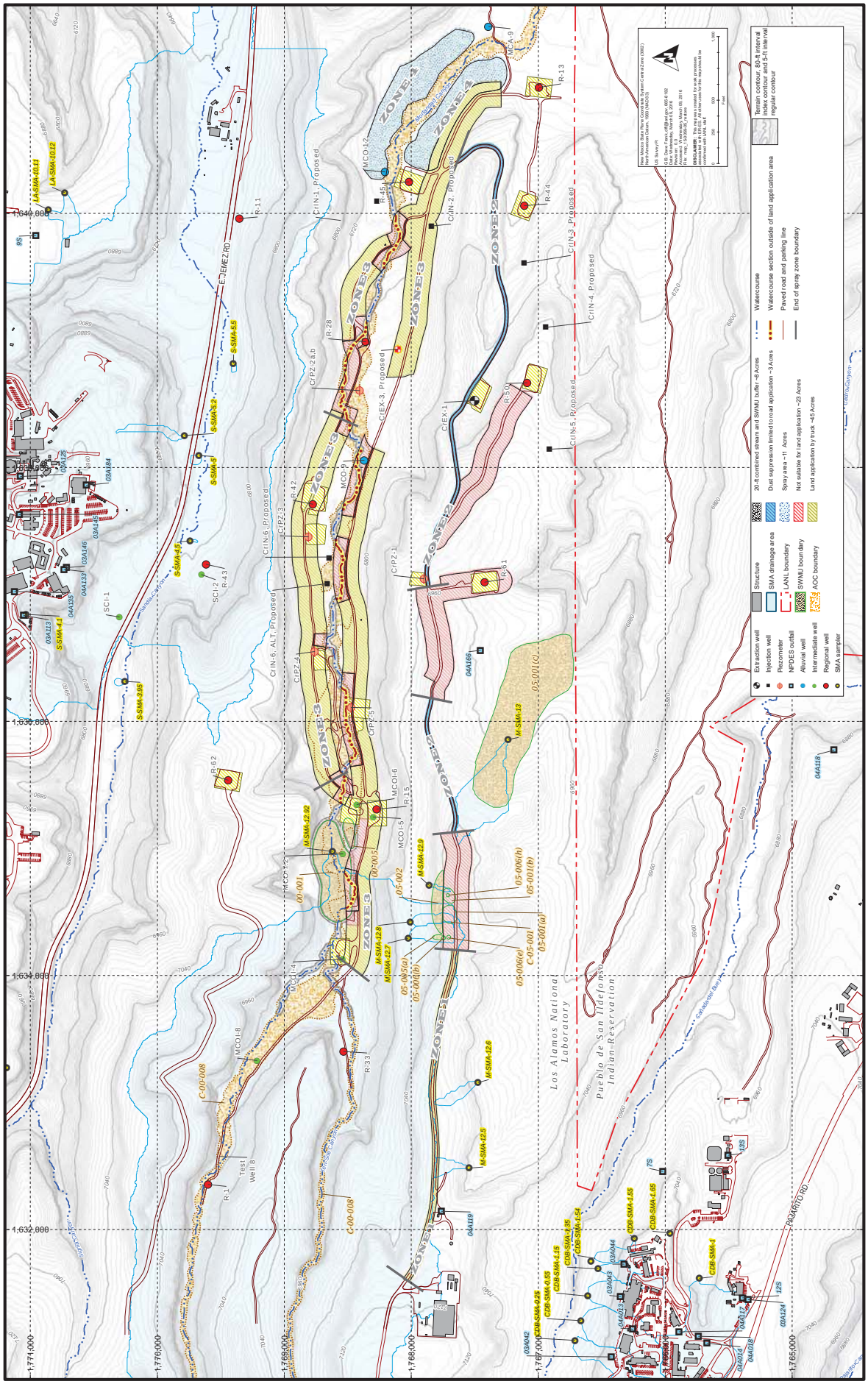
Map showing land application zones receiving treated groundwater under Work Plan #3

EPC-DO: 17-048

LA-UR-17-20229

U1501760

Date: FEB 1 3 2017


ENCLOSURE 6
LA-UR-17-20229
LA-UR-16-21509
EPC-DO: 17-048
ZONE 1
ZONE 2
ZONE 3
ZONE 4
Los Alamos National Laboratory
Pueblo de San Ildefonso Indian Reservation
Pajarito Road
East Jemez Road
Test Well 8
Structure
SMA drainage area
LANL boundary
SWMU boundary
AOC boundary
Extraction well
Injection well
Piezometer
NPDES outfall
Alluvial well
Intermediate well
Regional well
SMA sampler
Watercourse
Watercourse section outside of land application area
Paved road and parking line
End of spray zone boundary
20-ft combined stream and SWMU buffer ~9 Acres
Dust suppression limited to road application ~3 Acres
Spray area ~11 Acres
Not suitable for land application ~23 Acres
Land application by truck ~45 Acres
Terrain contour, 80-ft interval
Index contour and 5-ft interval
regular contour
Document Path: \\slip\gis\GIS\Projects\15-0058\restored_data\map_15-0099-05_restore.mxd

ENCLOSURE 3

Work Plan #4 Discharge Report,
DP-1793

EPC-DO: 17-067

LA-UR-17-20445

U1501760

Date: FEB 2 7 2017

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Date: FEB 13 2017
Symbol: EPC-DO: 17-049
LA-UR: 17-20288
Locates Action No.: U1501760

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Subject: **Work Plan #4 Discharge Report, Land Application of Treated Groundwater from Technical Areas 9 and 16, DP-1793**

Dear Ms. Hunter:

The U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) are in receipt of your May 27, 2016 letter (Enclosure 1) granting approval of Work Plan #4 (Enclosure 2) under Discharge Permit DP-1793, for the discharge of treated groundwater from aquifer tests to investigate the occurrence of and potential remedial alternatives for high explosives (HE) contamination in deep-perched groundwater associated with the former Outfall 260 at Technical Area (TA)-16. Condition No. 8 of Discharge Permit DP-1793 and the above-referenced May 27, 2016 approval letter require that DOE/LANS submit a discharge report to the New Mexico Environment Department (NMED) within 60 days of the final cessation of discharge. The following information is required in the discharge report:

1. *The total volume of groundwater discharged;*
2. *The estimated average application rate for the period of discharge;*
3. *Analytical results from samples collected under the water quality sampling plan;*
4. *Analytical reports for the samples collected under the water quality sampling plan; and*
5. *A map identifying the locations of discharge*

Each of the above requirements is addressed in this letter and the enclosures.

Requirement No. 1: *The total volume of groundwater discharged.*

Table 1 below provides the total volume of groundwater discharge in 2016 under Work Plan #4.

Table 1. Volume of Treated groundwater discharged under Work Plan #4 in 2016

Well	Discharge Start Date	Discharge End Date	# of Days of Active Discharge	Total Volume (gal.)	Average Volume (gal.)	Maximum Daily Volume (gal.)
CdV-9-1i	6/22/2016	7/28/2016	7	82,744	11,821	22,506
CdV-16-1i	8/23/2016	10/14/2016	3	16,876	5,625	10,000
CdV-16-4ip	9/15/2016	11/7/2016	12	247,159	20,597	51,209
CdV-9-1i - development water	11/21/2016	12/21/2016	5	61,000	12,200	20,000
Total Volume of Discharge				**407,779**		
Average Volume of Discharge					**15,103**	
Maximum Daily Volume of Discharge						**51,209**

Requirement No. 2: *An estimated average application rate for the period of discharge.*

The average land application rate over the 27 days of active discharge was approximately 15,103 gallons per day (gpd), as shown on Table 1. Table 1 also provides the average land application rate for each well. The maximum daily discharge was 51,209 gpd, as shown on Table 1. Table 1 also provides the maximum land application rate for each well.

Requirement No. 3: *Analytical results from samples collected under the water quality sampling plan.*

In accordance with the Work Plan #4 Sampling Plan treated water was sampled and analyzed for RDX by the on-site analytical laboratory. In addition, during the aquifer test period duplicate confirmation samples were obtained and submitted for analysis by an off-site analytical laboratory, GEL Laboratories LLC. During the period of treating and land applying water from development of well CdV-9-1i samples were analyzed for RDX by the on-site analytical laboratory without duplicate samples obtained.

The confirmation analytical results from samples collected and analyzed at the off-site analytical laboratory under Work Plan #4 are summarized in Enclosure 3. This enclosure also contains the effluent analytical results summary obtained from the on-site analytical laboratory during the period of treatment/land application of development water from well CdV-9-1(i).

No results for RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) exceeded the land application limit of 6.3 µg/L. Sampling plan terminology in future work plans will be refined/clarified to ensure weekly analysis by an off-site analytical laboratory occurs when land application occurs.

Requirement No. 4: *Analytical reports for the samples collected under the water quality sampling plan.*

Enclosure 4 (CD) provides copies of the complete analytical reports from GEL Laboratories LLC.

Requirement No. 5: *A map identifying the locations of discharge.*

Enclosure 5 provides a map showing the nine approved land application zones in TA-9 and TA-16. Five of the nine zones —1, 2, 3, 4, and 9 —received discharges of treated groundwater under Work Plan #4. The remaining #zones —5, 6, 7, and 8—were not used. This map has been revised from the original map shown in the work plan to remove all areas exceeding the 5% slope limit in accordance with Modification #1 identified in your May 27, 2016 approval letter.

Please contact William J. Foley by telephone at (505) 665-8423 or by email at bfoley@lanl.gov if you have questions regarding this information.

Sincerely,

John C. Bretzke
Division Leader
Environmental Protection & Compliance
Los Alamos National Security LLC

Sincerely,

Cheryl L. Rodriguez
Program Manager, FPD-II
Environmental Management
Los Alamos Field Office

JCB/CLR/MTS/WJF:am

Enclosures: (1) NMED letter dated May 27, 2016, approving Work Plan #4
(2) LANL submittal letter dated March 22, 2016 for Work Plan #4 (EPC-DO-16-064)
(3) 2016 Treatment Unit Effluent Data Summary for DP-1793 Work Plan #4
(4) CD containing analytical reports from GEL Laboratories LLC (upon request)
(5) Map showing land application zones receiving treated groundwater under Work Plan #4

Copy: Shelly Lemon, NMED/SWQB, Santa Fe, NM, (E-File)
John E. Kieling, NMED/HWB, Santa Fe, NM, (E-File)
Stephen M. Yanicak, NMED/DOE/OB, (E-File)
Douglas E. Hintze, EM-LA, (E-File)
David S. Rhodes, EM-LA, (E-File)
Paul B. Underwood, EM-LA, (E-File)
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Kirsten M. Laskey, EM-LA, (E-File)
Craig S. Leasure, PADOPS, (E-File)
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Michael T. Brandt, ADESH, (E-File)
Raeanna Sharp-Geiger, ADESH, (E-File)
Randall Mark Erickson, ADEM, (E-File)

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Stephani F. Swickley, ADEM-PO, (E-File)
Danny Katzman, ADEM-PO, (E-File)
Gerald F. Fordham, ER-ES, (E-File)
Michael T. Saladen, EPC-CP, (E-File)
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COPY

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Date: FEB 13 2017
Symbol: EPC-DO: 17-049
LA-UR: 17-20288
Locates Action No.: U1501760

GROUND WATER
FEB 13 2017
BUREAU

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Subject: **Work Plan #4 Discharge Report, Land Application of Treated Groundwater from Technical Areas 9 and 16, DP-1793**

Dear Ms. Hunter:

The U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) are in receipt of your May 27, 2016 letter (Enclosure 1) granting approval of Work Plan #4 (Enclosure 2) under Discharge Permit DP-1793, for the discharge of treated groundwater from aquifer tests to investigate the occurrence of and potential remedial alternatives for high explosives (HE) contamination in deep-perched groundwater associated with the former Outfall 260 at Technical Area (TA)-16. Condition No. 8 of Discharge Permit DP-1793 and the above-referenced May 27, 2016 approval letter require that DOE/LANS submit a discharge report to the New Mexico Environment Department (NMED) within 60 days of the final cessation of discharge. The following information is required in the discharge report:

1. *The total volume of groundwater discharged;*
2. *The estimated average application rate for the period of discharge;*
3. *Analytical results from samples collected under the water quality sampling plan;*
4. *Analytical reports for the samples collected under the water quality sampling plan; and*
5. *A map identifying the locations of discharge*

Each of the above requirements is addressed in this letter and the enclosures.

ENCLOSURE 1

NMED letter dated May 27, 2016, approving Work Plan #4

EPC-DO: 17-049

LA-UR-17-20288

U1501760

Date: FEB 1 3 2017

ESHID-601511

ENCLOSURE 1

NEW MEXICO
ENVIRONMENT DEPARTMENT

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SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

RYAN FLYNN
Cabinet Secretary

BUTCH TONGATE
Deputy Secretary

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

May 27, 2016

John P. McCann
Acting Division Leader
Environmental Protection & Compliance Division
Los Alamos National Security, LLC
PO Box 1663, K490
Los Alamos, New Mexico 87545

David S. Rhodes
Supervisor, Soil & Groundwater Remediation
Environmental Management
Los Alamos Field Office
U.S. Department of Energy
3747 West Jemez Road
Los Alamos, New Mexico 87544

RE: Approval with Modification of Workplan #4 for Treatment and Land Application of Groundwater – TAs 09 and 16, Los Alamos National Laboratory, Discharge Permit DP-1793

Dear Messrs. McCann and Rhodes,

On March 23, 2016, the New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) received a workplan from DOE/LANS (the Permittees) for the land application of treated groundwater at Technical Areas (TA) 09 and 16. The workplan is required by Condition 3 of Discharge Permit 1793 (DP-1793) for activities regulated under the permit, and addresses the extraction, treatment, and land application of high explosives (HE) contaminated groundwater at the referenced TAs.

The workplan (WP #4) proposes the discharge of treated groundwater from three aquifer tests designed to investigate the occurrence and potential remedial alternative for HE contamination in the deep-perched groundwater aquifer associated with the former 260 Outfall at TA-16. In addition to the discharge of aquifer test waters, WP #4 proposes to discharge treated groundwaters generated during well development of Well CdV-9-1(i). These activities will be conducted as specified in the *Work Plan of Intermediate Groundwater System Characterization at Consolidated unit 16-021(c)-99*. NMED's Hazardous Waste Bureau approved this plan in a letter dated October 13, 2015.

The primary contaminant of concern associated with the subject groundwater, and the only contaminant expected to be above regulatory or permit standards, is hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX). Also present in the investigation area groundwater are low concentrations of multiple HE compounds and organic compounds, all measured to be significantly below associated maximum contaminant levels.

All groundwater subject to this workplan will be treated with granulated activated carbon (GAC) prior to being discharged to specific land application areas as permitted under DP-1793. Monitoring shall ensure that treated groundwater contaminate concentrations do not exceed 90% of the 20.6.2.3103 NMAC numeric standards or do not exceed 90% of the numeric standards established for tap water in Table A-1 of NMED's *Risk Assessment Guidance for Site Investigation and Remediation* for 20.6.2.7.WW NMAC toxic pollutants, *e.g.*, RDX.

The subject groundwater wells are located in the Canon de Valle watershed within T119N/R06E/S29, S30, S31, S32 and T119N/R05E/S36. The depth to the regional aquifer beneath the proposed land application sites is approximately 1200 feet below ground surface. The direction of groundwater flow beneath the site is generally to the southeast.

A copy of the proposed WP#4 was posted on LANL's Electronic Public Reading Room on March 29, 2016. In accordance with DP-1793 Condition 3, proposed WP#4 was subject to public comment for a period of 30 days. Comments received have been considered in the preparation of this response.

Groundwater discharges associated with WP #4 shall be performed in accordance with the Workplan and are subject to all conditions of DP-1793. Workplan #4 is approved as submitted with the following modifications:

1. The Permittees shall revise the land application zone map (Enclosure 3) removing all areas exceeding the 5% slope limit.
2. Six months prior to the end of the term of the discharge permit (July 27, 2020) and at the termination of discharge and final closure under the requirements of DP-1793, the Permittees shall measure the concentration of RDX and all other contaminants of concern in soils from a representative location in each land application zone. Analyses of these soil samples shall be performed by an off-site, independent, NELAP-accredited analytical laboratory. The Permittees shall submit an associated workplan for NMED approval at least 60 days prior to the date of the required soil sampling.

Within 60 days of cessation of the discharge authorized under this workplan, the Permittees shall submit a Discharge Report in accordance with DP-1793, Condition 8. If during the current term of DP-1793 all treatment system compliance sampling measures are below the method detection limit for RDX, the sampling and analysis requirements above shall not be effective.

Approval of WP#4 does not relieve the Permittees of the responsibility to comply with any other applicable federal, state, and/or local laws and regulations. This approval also does not relieve the Permittees of liability should operations associated with this workplan result in actual pollution of ground or surface waters.

If you have any questions, please contact Steve Pullen at (505) 827-2962. Thank you for your cooperation.

Sincerely,

Michelle Hunter, Chief
Ground Water Quality Bureau

MH:SP

cc (e-version):
James Hogan, NMED/SWQB
John Kieling, NMED/HWB
Steven Yanicak, NMED/DOEOB
Steven Huddleson, NMED/GWQB
Greg Huey, NMED/GWQB
Bob Beers, LANS, EM-LA
Cheryl Rodriquez, EM-LA
Stephani Swickley, ADEM-PO
Danny Katzman, ADEM-PO
Gerald Fordham, ER-ES

ENCLOSURE 2

LANL submittal letter dated March 22, 2016
for Work Plan #4 (EPC-DO-16-064)

EPC-DO: 17-049

LA-UR-17-20288

U1501760

Date: FEB 1 3 2017

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Date: MAR 2 2 2016
Symbol: EPC-DO-16-064
LA-UR: 16-21518
Locates Action No.: U1501760

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
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Santa Fe, NM 87502

Dear Ms. Hunter:

Subject: **Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, WP#4**

On July 27, 2015, the New Mexico Environment Department (NMED) issued a Discharge Permit (DP-1793) to the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) for the land application of treated groundwater from covered activities. Pursuant to Condition No. 3 of the above-referenced discharge permit, DOE/LANS are required to submit a detailed, project-specific work plan for approval by NMED before any activities are undertaken.

The enclosed work plan is for the proposed discharge of treated groundwater from aquifer tests conducted to investigate the occurrence of and potential remedial alternatives for high explosives (HE) contamination in deep-perched groundwater associated with the former Outfall at Technical Area (TA)-16. The primary contaminant in groundwater within the study area is RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), a high explosives (HE) compound widely used in military and industrial applications. Low concentrations of other HE compounds and volatile organic compounds (VOCs) are also present in groundwater in the investigation area.

DOE/LANS propose to conduct three 30-day aquifer tests at monitoring wells CdV-9-1(i), CdV-16-4ip, and CdV-16-1(i). The first test is expected to begin in June 2016 with approximately 30 days of recovery time between each test. The aquifer tests were designed to evaluate the degree of hydraulic connectivity within the perched-groundwater system and to improve the general understanding of transport pathways for RDX and other contaminants to the perched groundwater zones. Additionally, water generated during well development of CdV-9-1(i) will be treated and discharged under this work plan.

Please contact Robert S. Beers by telephone at (505) 667-7969 or by email at bbeers@lanl.gov if you have questions regarding this work plan.

Sincerely,

D R Gregg acting

John P. McCann
Acting Division Leader
Environmental Protection & Compliance Division
Los Alamos National Security, LLC

Sincerely,

David S. Rhodes
Supervisor, Soil & Groundwater Remediation
Environmental Management
Los Alamos Field Office
U.S. Department of Energy

JPM:DSR:MTS:RSB/lm

Enclosures:

1) Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, WP#4
2) Figures
3) Topographic Map of Project Site
4) As-Built Specifications for TA-16 Wells
5) Analytical Data
6) GAC Well Treatment System Details

Cy: James Hogan, NMED/SWQB, Santa Fe, NM, (E-File)
John E. Kieling, NMED/HWB, Santa Fe, NM, (E-File)
Steven M. Yanicak, NMED/DOE/OB, (E-File)
Jody Pugh, NA-LA, (E-File)
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Date: MAR 2 2 2016
Symbol: EPC-DO-16-064
LA-UR: 16-21518
Locates Action No.: U1501760

GROUND WATER
MAR 23 2016
BUREAU

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Ms. Hunter:

Subject: **Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, WP#4**

On July 27, 2015, the New Mexico Environment Department (NMED) issued a Discharge Permit (DP-1793) to the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) for the land application of treated groundwater from covered activities. Pursuant to Condition No. 3 of the above-referenced discharge permit, DOE/LANS are required to submit a detailed, project-specific work plan for approval by NMED before any activities are undertaken.

The enclosed work plan is for the proposed discharge of treated groundwater from aquifer tests conducted to investigate the occurrence of and potential remedial alternatives for high explosives (HE) contamination in deep-perched groundwater associated with the former Outfall at Technical Area (TA)-16. The primary contaminant in groundwater within the study area is RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), a high explosives (HE) compound widely used in military and industrial applications. Low concentrations of other HE compounds and volatile organic compounds (VOCs) are also present in groundwater in the investigation area.

ENCLOSURE 3

2016 Treatment Unit Effluent Data Summary
for DP-1793 Work Plan #4

EPC-DO: 17-049

LA-UR-17-20288

U1501760

Date: FEB 1 3 2017

Enclosure 3

Table E3-1
2016 Treatment Unit Effluent Data Summary for DP-1793 Work Plan #4

Sample	Collection Date	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	Validation Reason Code	Lab[1]	MDL	PQL
VS-HE-4-16-121482	05/19/16	UF	SW-846:8321A_MOD	RDX	N	0.5	ug/L	U	U	U_LAB	GELC	0.16	0.5
VS-HE-4-16-121479	06/08/16	UF	SW-846:8321A_MOD	RDX	N	0.258	ug/L	U	U	U_LAB	GELC	0.0825	0.258
VS-HE-4-16-121476	06/15/16	UF	SW-846:8321A_MOD	RDX	N	0.266	ug/L	U	U	U_LAB	GELC	0.0851	0.266
VS-HE-4-16-123138	06/22/16	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE-4-16-123139	06/29/16	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE-4-16-123140	07/06/16	UF	SW-846:8321A_MOD	RDX	N	0.256	ug/L	U	U	U_LAB	GELC	0.0821	0.256
VS-HE-4-16-123145	07/12/16	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE2-03-16-124405	08/03/16	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE2-03-16-124404	08/10/16	UF	SW-846:8321A_MOD	RDX	N	0.263	ug/L	U	UJ	HE9	GELC	0.0842	0.263
VS-HE2-03-16-124798	08/17/16	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	UJ	HE9	GELC	0.0833	0.26
VS-HE2-03-16-124800	08/24/16	UF	SW-846:8321A_MOD	RDX	N	0.263	ug/L	U	U	U_LAB	GELC	0.0842	0.263
VS-HE2-03-16-124799	08/30/16	UF	SW-846:8321A_MOD	RDX	N	0.263	ug/L	U	UJ	HE9	GELC	0.0842	0.263
VS-HE2-03-16-124406	09/02/16	UF	SW-846:8321A_MOD	RDX	N	0.275	ug/L	UQ	U	U_LAB	GELC	0.0879	0.275
VS-HE-4-16-125287	09/06/16	UF	SW-846:8321A_MOD	RDX	N	0.0833	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE2-03-16-126031	09/09/16	UF	SW-846:8321A_MOD	RDX	N	0.269	ug/L	U	U	U_LAB	GELC	0.086	0.269
VS-HE-4-16-125294	09/14/16	UF	SW-846:8321A_MOD	RDX	N	0.0884	ug/L	U	U	U_LAB	GELC	0.0884	0.276
VS-HE-4-16-126272	09/21/16	UF	SW-846:8321A_MOD	RDX	N	0.087	ug/L	U	U	U_LAB	GELC	0.087	0.272
VS-HE-4-16-125290	09/28/16	UF	SW-846:8321A_MOD	RDX	N	0.0851	ug/L	U	U	U_LAB	GELC	0.0851	0.266
VS-HE-4-16-126277	10/05/16	UF	SW-846:8321A_MOD	RDX	N	0.086	ug/L	U	UJ	HE9	GELC	0.086	0.269
VS-HE-4-16-126275	10/11/16	UF	SW-846:8321A_MOD	RDX	N	0.0833	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE2-02-17-127030	10/26/16	UF	SW-846:8321A_MOD	RDX	N	0.0842	ug/L	U	U	U_LAB	GELC	0.0842	0.263
VS-HE2-03-17-127042	10/26/16	UF	SW-846:8321A_MOD	RDX	N	0.0842	ug/L	U	U	U_LAB	GELC	0.0842	0.263
VS-HE2-02-17-127027	11/02/16	UF	SW-846:8321A_MOD	RDX	N	0.0842	ug/L	U	U	U_LAB	GELC	0.0842	0.263
VS-HE2-03-17-127039	11/02/16	UF	SW-846:8321A_MOD	RDX	N	0.0909	ug/L	U	U	U_LAB	GELC	0.0909	0.284
VS-HE-4-17-128828	11/30/16	UF	SW-846:8330	RDX	N	2.0	ug/L	U	U	U_LAB	EES6	2.0	NR
VS-HE-4-17-128832	12/07/16	UF	SW-846:8330	RDX	N	2.0	ug/L	U	U	U_LAB	EES6	2.0	NR
VS-HE-4-17-128829	12/08/16	UF	SW-846:8330	RDX	N	2.0	ug/L	U	U	U_LAB	EES6	2.0	NR
VS-HE-4-17-128830	12/14/16	UF	SW-846:8330	RDX	N	2.0	ug/L	U	U	U_LAB	EES6	2.0	NR

Notes:

[1] Data from on-site analyses provided for land application of treated water originating from CdV-9-1(i) development water only. Only off-site laboratory confirmation confirmation results presented for water generated as part of aquifer test. Additional on-site analyses completed during these tests which are not presented.

UF - unfiltered.

N - in the detect flag column means the analyte was undetected.

U means the analyte is classified as not detected.

U - in the lab qualifier column means analyte is classified as not detected.

U - in the validation qualifier column means analyte is classified as not detected.

J - in the lab qualifier comment means the analyte is classified as estimated.

J - in the validation qualifier comment means the analyte is classified as estimated.

Q - in the lab qualifier coment means one or more quality control criteria was not met.

U_LAB - in the validation reason column means the analyte is classified as not detected.

HE9 - means the hold time was >1 and <=2 times the applicable holding time requirements.

NR - in the PQL column means a value was not reported.

ENCLOSURE 4

CD containing analytical reports from
GEL Laboratories LLC
(upon request)

EPC-DO: 17-049

LA-UR-17-20288

U1501760

Date: FEB 1 3 2017

ABSTRACT: ENCLOSURE 4 CDs (1)

Enclosure 4 contains one CD containing the analytical results from GEL Laboratories LLC. Analytical analysis completed as part of DP-1793 Work Plan #4 in support of the land application of treated groundwater. Results provided are from the treated effluent from two treatment units associated with the RDX aquifer test project within Technical Area (TA)-09 and TA-16.

ENCLOSURE 5

Map showing land application zones receiving treated groundwater under Work Plan #4

EPC-DO: 17-049

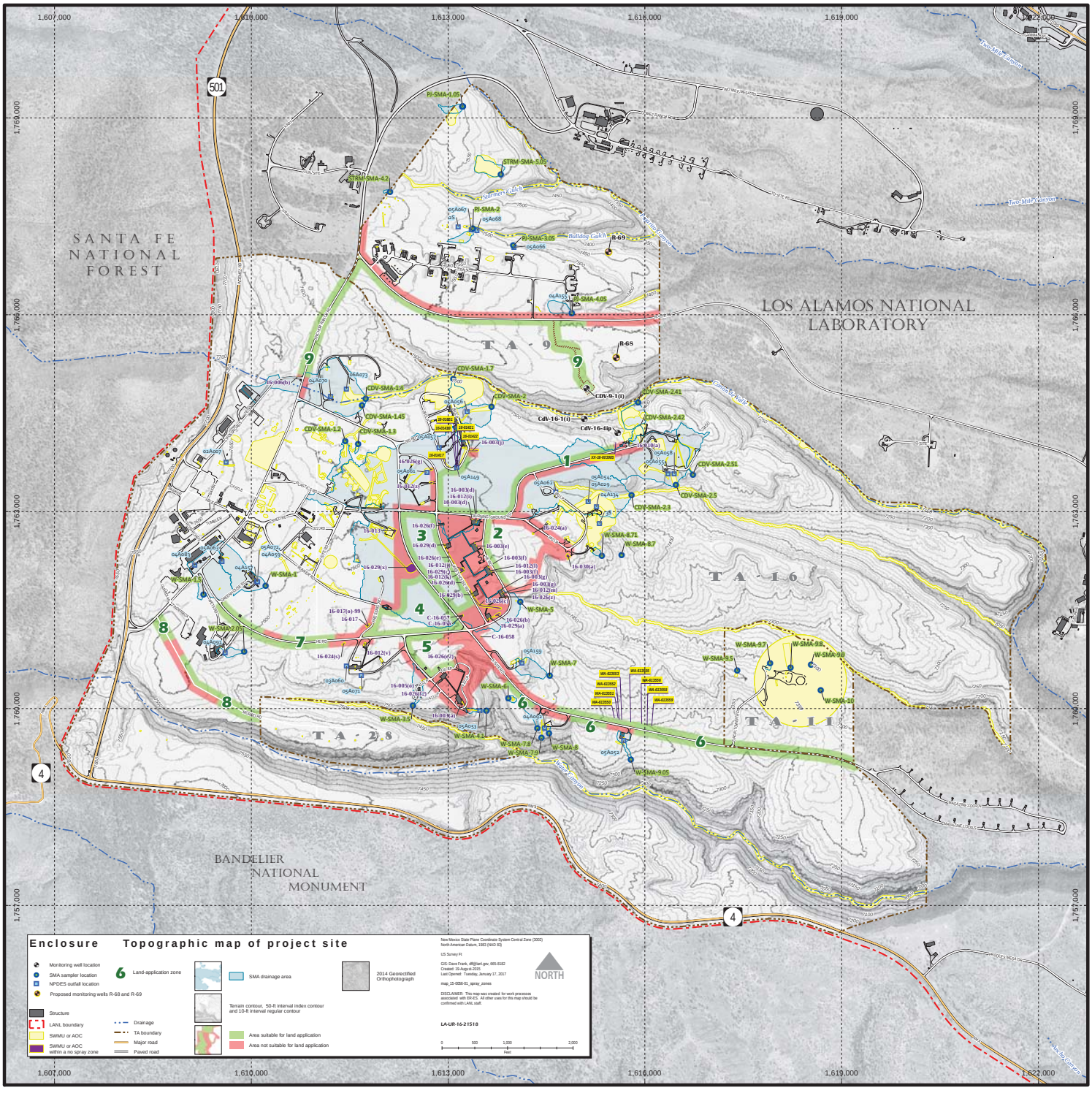
LA-UR-17-20288

U1501760

Date: FEB 1 3 2017

ENCLOSURE 3

Enclosure 5



ENCLOSURE 4

2016 Daily Land Application Volumes,
DP-1793

EPC-DO: 17-067

LA-UR-17-20445

U1501760

Date: FEB 2 7 2017

Table E4-1
DP-1793 - 2016 Annual Report
2016 Daily Land Application Volumes

	Land Application Volume (gal)		
Date	Work Plan #3 (CrEX)	Work Plan #4 (RDX)	Total
6/9/2016	21500	0	21500
6/10/2016	53200	0	53200
6/13/2016	34300	0	34300
6/14/2016	23800	0	23800
6/15/2016	25400	0	25400
6/16/2016	9900	0	9900
6/20/2016	32000	0	32000
6/21/2016	34300	0	34300
6/22/2016	17800	0	17800
6/23/2016	35200	7154	42354
6/24/2016	23300	17885	41185
6/27/2016	16900	8942	25842
6/28/2016	14100	0	14100
6/29/2016	29000	0	29000
6/30/2016	68400	0	68400
7/6/2016	167400	0	167400
7/7/2016	32200	0	32200
7/8/2016	77600	0	77600
7/11/2016	245295	0	245295
7/12/2016	188715	0	188715
7/13/2016	274029	0	274029
7/14/2016	195600	0	195600
7/15/2016	171190	0	171190
7/18/2016	143661	0	143661
7/19/2016	225274	0	225274
7/20/2016	159552	0	159552
7/21/2016	151820	0	151820
7/22/2016	150917	0	150917
7/25/2016	155741	0	155741
7/26/2016	212262	22506	234768
7/27/2016	182948	15004	197952
7/28/2016	222081	11253	233334
7/29/2016	209822	0	209822
8/1/2016	177187	0	177187
8/2/2016	160012	0	160012
8/3/2016	167760	0	167760
8/4/2016	171715	0	171715
8/5/2016	104037	0	104037
8/8/2016	244632	0	244632

Table E4-1
DP-1793 - 2016 Annual Report
2016 Daily Land Application Volumes

	Land Application Volume (gal)		
Date	Work Plan #3 (CrEX)	Work Plan #4 (RDX)	Total
8/9/2016	148405	0	148405
8/10/2016	173571	0	173571
8/11/2016	125669	0	125669
8/12/2016	186913	0	186913
8/15/2016	173760	0	173760
8/16/2016	144246	0	144246
8/17/2016	135436	0	135436
8/18/2016	109957	0	109957
8/19/2016	64084	0	64084
8/22/2016	226260	0	226260
8/23/2016	268362	10000	278362
8/24/2016	200547	0	200547
8/25/2016	146672	0	146672
8/26/2016	125748	0	125748
8/29/2016	198997	0	198997
8/30/2016	248554	0	248554
8/31/2016	167324	0	167324
9/1/2016	100982	0	100982
9/2/2016	145684	0	145684
9/6/2016	248539	0	248539
9/7/2016	208320	0	208320
9/8/2016	244805	0	244805
9/9/2016	114506	0	114506
9/12/2016	158448	0	158448
9/13/2016	169099	0	169099
9/14/2016	136774	0	136774
9/15/2016	319209	51209	370418
9/16/2016	258530	18776	277306
9/19/2016	198136	0	198136
9/20/2016	237720	0	237720
9/21/2016	231746	32400	264146
9/22/2016	138968	20700	159668
9/23/2016	247666	0	247666
9/26/2016	320643	0	320643
9/27/2016	181473	0	181473
9/28/2016	339498	7200	346698
9/29/2016	312501	22950	335451
9/30/2016	182039	19800	201839
10/3/2016	287784	0	287784

Table E4-1
DP-1793 - 2016 Annual Report
2016 Daily Land Application Volumes

	Land Application Volume (gal)		
Date	Work Plan #3 (CrEX)	Work Plan #4 (RDX)	Total
10/4/2016	209391	0	209391
10/5/2016	303832	0	303832
10/6/2016	238353	21600	259953
10/7/2016	235542	17100	252642
10/11/2016	302656	0	302656
10/12/2016	263345	0	263345
10/13/2016	254005	25200	279205
10/14/2016	203867	14400	218267
10/17/2016	266963	0	266963
10/18/2016	271731	0	271731
10/19/2016	249239	0	249239
10/20/2016	174798	0	174798
10/21/2016	112497	0	112497
10/22/2016	110776	0	110776
10/24/2016	56249	0	56249
10/25/2016	89694	0	89694
10/26/2016	63013	0	63013
10/27/2016	117445	0	117445
10/28/2016	31000	0	31000
10/31/2016	51850	0	51850
11/2/2016	161689	0	161689
11/3/2016	87976	0	87976
11/4/2016	28917	0	28917
11/7/2016	89533	2700	92233
11/8/2016	69769	0	69769
11/9/2016	20724	0	20724
11/10/2016	29168	0	29168
11/11/2016	20403	0	20403
11/21/2016	0	16000	16000
11/22/2016	0	8000	8000
12/13/2016	0	8000	8000
12/14/2016	0	9000	9000
12/15/2016	156	0	156
12/21/2016	0	20000	20000
Total	16,372,706	407,779	16,780,485
Total Planned Volume	54,468,686	574,800	55,043,486