Los Alamos
NATIONAL LABORATORY
EST. 1943

Associate Directorate for Environmental Management
P.O. Box 1663, MS M992
Los Alamos, New Mexico 87545
(505) 606-2337

Environmental Management
P.O. Box 1663, MS M984
Los Alamos, New Mexico 87545
(505) 665-5658/FAX (505) 606-2132

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NMED
Hazardous Waste Bureau

John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Drilling Work Plan for Groundwater Extraction Well CrEX-4

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of the Drilling Work Plan for Groundwater Extraction Well CrEX-4. This work plan reflects the approach agreed upon by the U.S. Department of Energy, Los Alamos National Laboratory, and the New Mexico Environment Department during a presubmittal meeting held on August 28, 2017.

If you have any questions, please contact Stephani Swickley at (505) 606-1628 (sfuller@lanl.gov) or Cheryl Rodriguez at (505) 665-5330 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Bruce Robinson, Program Director
Environmental Remediation Program
Los Alamos National Laboratory

Sincerely,

David S. Rhodes, Director
Office of Quality and Regulatory Compliance
Environmental Management
Los Alamos Field Office

38171

BR/DR/SS:sm

Enclosures: Two hard copies with electronic files – Drilling Work Plan for Groundwater Extraction Well CrEX-4 (EP2017-0116)

Cy: (w/enc.)
Cheryl Rodriguez, DOE-EM-LA
Stephani Swickley, ADEM ER Program

Cy: (w/electronic enc.)
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo
Dino Chavarria, Santa Clara Pueblo
Steve Yanicak, NMED-DOE-OB, MS M894
emla.docs@em.doe.gov
Steve White, ADEM ER Program
Danny Katzman, ADEM ER Program
Public Reading Room (EPRR)
ADESH Records
PRS Database

Cy: (w/o enc./date-stamped letter emailed)
lasomailbox@nnsa.doe.gov
Peter Maggiore, DOE-NA-LA
Kimberly Davis Lebak, DOE-NA-LA
David Rhodes, DOE-EM-LA
Bruce Robinson, ADEM ER Program
Randy Erickson, ADEM
Jocelyn Buckley, ADESH-EPC-CP
John Bretzke, ADESH-EPC-DO
Michael Brandt, ADESH
William Mairson, PADOPS
Craig Leasure, PADOPS

Drilling Work Plan for Groundwater Extraction Well CrEX-4

Primary Purpose	In accordance with the New Mexico Environment Department's (NMED's) approval with modifications for the interim measures (IM) work plan for chromium plume control, dated October 15, 2015 (LANL 2015, 600458; NMED 2015, 600959), Los Alamos National Laboratory (LANL or the Laboratory) proposes the following specific location, drilling, and preliminary design information for chromium extraction well CrEX-4. As stated in the "Interim Measures Work Plan for Chromium Plume Control," dated May 2015 (LANL 2015, 600458), the primary purpose of the IM is to achieve hydraulic control of off-site plume migration via a combination of extraction and injection. Extraction has been occurring for limited durations (up to approximately 6 continuous months) in 2016 and 2017 at extraction wells CrEX-1 and CrEX-3. Pumped water has been treated and dispositioned via land application and injection into CrIN-4 and CrIN-5 (Figure 1). Modeling indicates treated water dispositioned via injection plays a major role in controlling the downgradient edge of the plume. The amount of water currently available from CrEX-1, CrEX-2, and CrEX-3 for disposition into injection wells is approximately 200–240 gallons per minute (gpm). This amount of water distributed across six injection wells (nominally 35 gpm per well) may not take full advantage of injection capacity and optimize the performance objectives of the IM. Therefore, an additional extraction well (CrEX-4) is recommended. One purpose of CrEX-4 is to provide additional water (anticipated to be between 60–80 gpm) for distribution to injection wells. Another key purpose that drives the proposed location of CrEX-4 is to provide additional plume-center characterization data because the well will be located near the highest concentrations of chromium known in the plume and likely screened largely within the Miocene pumiceous unit where well R-42 (highest chromium in the plume) is screened. CrEX-4 is proposed for a location in the bottom of Mortandad Canyon near to and downgradient of monitoring well R-42 and CrPZ-3 (Figure 1). The borehole is expected to penetrate the top of regional saturation at a depth of approximately 918 ft, within sediments of the Puye Formation. The target borehole depth is approximately 1020 ft in what is likely within the Miocene pumiceous unit. The well is planned to be completed with a single screen set near the top of regional saturation. The initial design for CrEX-4 consists of an 8-in.-diameter casing with a 40-slot screen placed within 10–20 ft of the water table. Data from sampling conducted during sonic drilling and from piezometers installed within the coreholes indicate chromium contamination in the proposed CrEX-4 area is primarily within 50 ft of the water table (LANL 2015, 600615). Thus, the extraction well is proposed to be screened in that same zone near the water table to optimize capture of contaminated water. Figure 2 shows the predicted geology and conceptual well design. The final design will be based on data obtained during drilling, including information from lithologic logs of cuttings, water-level measurements, video logs, geophysical logs, and field team observations. Well-design recommendations will be submitted to NMED for approval before construction.
Drilling Approach	The proposed drilling approach for CrEX-4 will use fluid-assisted air-rotary with casing-advance methods. Telescoping casing sizes between 24 in. and 16 in. and dual-rotary methods will be used to advance the borehole to a depth just above the regional aquifer. The remainder of the borehole will be advanced with 14-in. casing and an underreaming bit. This approach will produce a borehole that can accommodate an approximately 3-in. annular filter pack around the 8-in. well screen.

Drilling Fluids, Composition, and Use	Fluids and additives will be used to facilitate drilling. These fluids and additives may include those previously authorized by NMED for use, including the following: • Potable water, municipal water supply, to aid in delivery of other drilling additives and to cool the drill bit; • QUIK-FOAM, a blend of alcohol ethoxy sulfates, used as a foaming agent to lift cuttings; • AQF-2, an anionic surfactant, used as a foaming agent to lift cuttings; and • EZ-MUD, a polymer emulsion to help improve the carrying capacity of air/foam injection fluids. Complete records will be maintained detailing the type and volume of fluid and additives used, and the depth where fluids or additives were added to the borehole.
Groundwater Occurrence	Water-level data from the immediate area around the proposed location of CrEX-4 indicate that regional saturation should be encountered at a depth of 918 ft within sediments of the Puye Formation. If perched-intermediate groundwater is encountered at this location, NMED will be notified and options to sample will be considered.
Core Sampling	No core collection or sampling is planned. Drill cuttings will be collected at 10-ft intervals and used for lithologic description.
Geophysical Testing	Geophysical logs may be collected when the borehole has been drilled to total depth. The suite of geophysical logs will depend on conditions in the borehole and whether logs are run in an open hole or inside the casing. Logging data will be used to refine estimates of the top of regional saturation and to characterize the hydraulic properties of saturated strata beneath the water table.
Well Completion Design	Figure 2 shows the conceptual well design of CrEX-4. Screen placement and length will be based on lithology, water level, geophysical logs, and field observations. A proposed well design will be submitted to NMED for approval before well construction.
Well Development	The well will be developed by mechanical means, and chemical means will be used only if necessary. Mechanical development includes swabbing, bailing, jetting/air-lifting, and pumping. Chemical methods may include chemicals to disperse bentonite, which is used as annular seal, or other methods. Chemicals that may be used to aid in developing and disinfecting the well screen and filter pack include • sodium hypochlorite and • AQUA-CLEAR PFD. Well development will be considered complete when sand content averages less than 5 mg/L over a 2-h pumping period and specific capacity is no longer increasing. The target water-quality parameters are turbidity <5 nephelometric turbidity units and other parameters stable. Water-quality parameters will be measured in a flow-through cell during the pumping phase of development. The parameters to be monitored are pH, specific conductance, dissolved oxygen, temperature, turbidity, and oxidation-reduction potential.
Hydraulic Testing	Step-drawdown tests will be conducted to determine the sustainable yield. Constant rate testing will also be conducted to assess near-well aquifer characteristics.
Water-Quality Sampling	The extraction well will be sampled for metals, general inorganics, and tritium after completion of the pumping phase of hydraulic testing. These sampling data will provide additional information to characterize the plume at the CrEX-4 location.

Pumping System Installation	A pumping system will be designed based on the hydraulic testing results and installed in the well.
Investigation-Derived Waste Management	Investigation-derived waste (IDW) will be managed in accordance with standard operating procedure (SOP) 10021, "Characterization and Management of Environmental Program Waste" (http://www.lanl.gov/environment/plans-procedures.php). This SOP incorporates the requirements of applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy orders, and Laboratory requirements. The primary waste streams will include drill cuttings, drilling fluids and additives, development water, purge water generated during hydraulic testing, decontamination water, and contact waste. Drill cuttings with residual additives will be managed in accordance with the NMED-approved Decision Tree for Land Application of Drill Cuttings (January 2016). Drilling fluids, purge water, and development waters will be managed in accordance with the NMED-approved Decision Tree for Land Application of Drilling, Development, Rehabilitation, and Sampling Purge Water (November 2016) or the Groundwater Discharge Permit 1793 (DP-1793) if required conditions are met. Initially, drill cuttings and drilling fluids will be stored in lined pits. The cuttings may or may not contain residue of drilling/well completion additives (e.g., drilling foam and bentonite clay). Representative samples of the drill cuttings and drilling fluids will be collected and analyzed, and waste determinations will be made from validated data. If validated analytical data show these wastes cannot be land-applied, they will be removed from the pit, containerized, and placed in accumulation areas appropriate for the type of waste. Cuttings, drilling fluids, development water, and purge water that cannot be land-applied under the cuttings and groundwater decision trees or DP-1793 will be transported to an authorized treatment, storage, or disposal facility. Decontamination water will be containerized separately at the point of generation, placed in an accumulation area appropriate to the type of waste, and directly sampled. Contact waste will be containerized at the point of generation, placed in an appropriate accumulation area, and characterized using acceptable knowledge or the media with which it came in contact.
Schedule	Well CrEX-4 will be completed by December 31, 2017.

REFERENCES

The following reference list includes documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ERID or ESHID. This information is also included in text citations. ERIDs were assigned by the Associate Directorate for Environmental Management's (ADEM's) Records Processing Facility (IDs through 599999), and ESHIDs are assigned by the Environment, Safety, and Health Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and ADEM maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

LANL (Los Alamos National Laboratory), May 2015. "Interim Measures Work Plan for Chromium Plume Control," Los Alamos National Laboratory document LA-UR-15-23126, Los Alamos, New Mexico. (LANL 2015, 600458)

LANL (Los Alamos National Laboratory), July 2015. "Work Plan for Chromium Plume Center Characterization," Los Alamos National Laboratory document LA-UR-15-24861, Los Alamos, New Mexico. (LANL 2015, 600615)

NMED (New Mexico Environment Department), October 15, 2015. "Approval with Modifications, Interim Measures Work Plan for Chromium Plume Control," New Mexico Environment Department letter to D. Hintze (DOE-NA-LA) and M. Brandt (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2015, 600959)

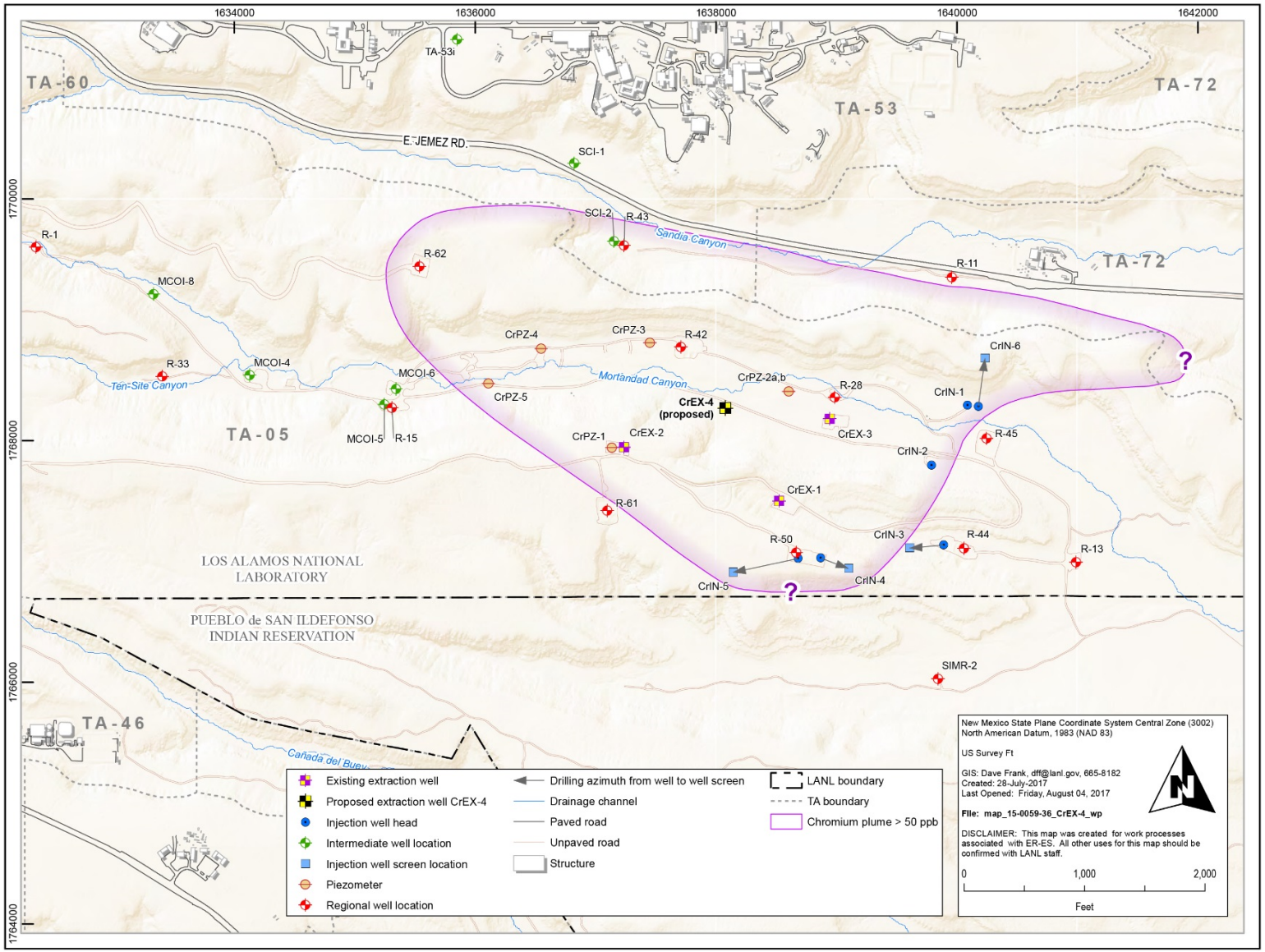

Figure 1 Proposed location for extraction well CrEX-4

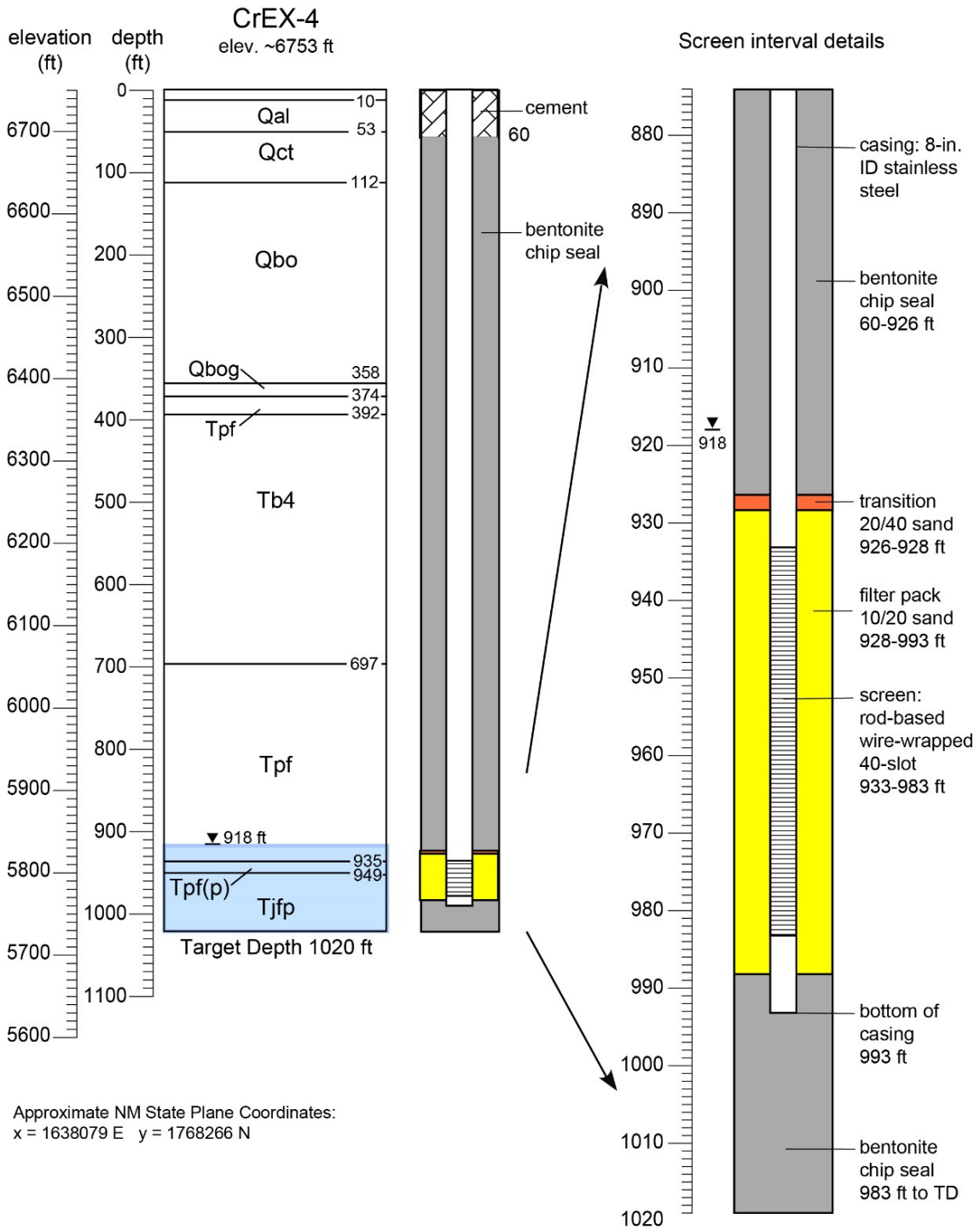

Figure 2 Predicted geology and preliminary well design for well CrEX-4