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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

October 15, 2015

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**RE: APPROVAL WITH MODIFICATIONS
INTERIM MEASURES WORK PLAN FOR CHROMIUM PLUME CONTROL
LOS ALAMOS NATIONAL LABORATORY
EPA ID#NM0890010515
HWB-LANL-15-023**

Dear Mr. Hintze and Mr. Brandt:

The New Mexico Environment Department (NMED) is in receipt of the United States Department of Energy (DOE) and the Los Alamos National Security, L.L.C.'s (collectively, the Permittees) document entitled *Interim Measures Work Plan for Chromium Plume Control* (Plan) dated May 2015, referenced by EP2015-0089, and received on May 26, 2015. NMED has reviewed the Plan, and hereby issues this approval with the following comments and modifications.

The Permittee's primary objective, as stated in the Plan, is to rapidly reduce off-site migration of hexavalent chromium (hereafter, Cr) in the regional aquifer by achieving hydraulic control of the leading edge of the Cr plume along the southern facility boundary with Pueblo de San Ildefonso (Pueblo). Specifically, the Permittee's intent is to reduce Cr concentrations at the boundary well R-50 to a level at or below the New Mexico groundwater standard of 50 µg/L. To accomplish this objective, the Permittees propose to:

1. Conduct an extended pumping event at the pilot extraction well CrEX-1 during fall of

2015, until ground is frozen, at 80-100 gallons per minute (gpm) with land application of treated groundwater, with a goal of determining the extent and shape of the CrEX-1 capture zone.

2. Commence drilling and construction of up to six injection wells (designated CrIN-1 through CrIN-6) in fall 2015, starting with two injection wells southeast (CrIN-4) and southwest (CrIN-5) of R-50, with a goal of having the reinjection infrastructure in place in 2016.
3. In 2016, contingent on the Permittees securing a discharge permit for injection wells, begin an extended pumping test at CrEX-1, with reinjection of treated groundwater at CrIN-4 and CrIN-5, with the intent of producing a west to east hydraulic barrier or mound along the property boundary with the Pueblo. Each injection well will receive approximately 40 gpm.
4. If the extended pumping at CrEX-1, combined with reinjection, does not result in hydraulic control of the southern edge of the Cr plume, the Permittees will consider installing an additional extraction well (CrEX-2), preliminarily located approximately 800 ft east of CrEX-1. The schedule for making a decision on the need for CrEX-2 is not provided in the Plan but, based on modeling, the Permittees expect to achieve hydraulic control of the plume by the second year of full operation of CrEX-1 with reinjection to CrIN-4 and CrIN-5.

Comments:

The Permittee's proposed Interim Measures (IM) actions are significantly dependent on numerical modeling results as provided in Appendix A of the Plan. NMED is in agreement with the Permittees that many uncertainties exist concerning the modeling results and associated IM actions such as selecting locations for injection wells and performance-monitoring criteria. Numerous examples of these uncertainties can be found in the Plan, such as:

- **Section 3.3 Interim Measure Performance, second paragraph, page 4:** *“Some uncertainty exists in the potential influence of injection on groundwater flow direction in that portion of the plume, but dilution of plume concentrations in that area as a result of injection would likely also result in decreases in chromium concentrations along that potential flow path.”*
- **Section 3.3 Interim Measure Performance, second paragraph, page 4:** *“There are some uncertainties specifically with respect to how quickly the plume will respond to pumping because the model and the projections shown in Figure 3.3-1 do not yet represent the role that dual porosity may play with respect to the distribution of chromium within the aquifer.”*

- **Appendix A, Section A-4.0 ANALYSIS OF CrEX-1 PUMPING TEST DATA, first paragraph, page A-3:** *“Uncertainties associated with estimates of aquifer properties based on the CrEX-1 pumping data are because of the small magnitude of the drawdowns measured in some of the observation wells.”*

In addition to the above examples concerning the significance of uncertainties in the proposed IM actions, NMED asserts that utilization of input data collected from pumping tests and contaminant monitoring at regional well R-28 in the Permittees' model is not applicable and likely increases the uncertainty of the model. The screened interval at R-28 is positioned approximately 40 to 60 ft below the regional-aquifer water table and, therefore, hydraulic properties data from aquifer tests and contaminant data collected at R-28 most likely do not reflect the upper 50 ft of regional-aquifer where the majority of Cr is present. The recently installed piezometer CrPZ-2b, screened at a depth equivalent to R-28, produced a preliminary Cr result of 19.3 $\mu\text{g/L}$, suggesting that Cr concentrations at the R-28 screened interval are much lower than those present near the water table, and that pumping R-28 is likely drawing groundwater containing higher concentrations of Cr from a zone above the R-28 screen. It should also be noted that, spatially, a large data gap exists within the interior of the plume with respect to delineating Cr distributions, potentially adding to the overall uncertainty in the Permittee's modeling results.

Modifications:

NMED is concerned that the IM actions proposed in the Plan may not be sufficient to meet the Permittee's primary objective as specified in the Plan, *“To rapidly reduce off-site chromium transport in the regional aquifer,”* Some issues of concern include:

- The recently installed regional aquifer piezometer CrPZ-1, located approximately 1,600 ft west-northwest of CrEX-1, produced a Cr concentration of 450 $\mu\text{g/L}$, significantly higher than expected, which suggests that the overall flux of Cr migrating offsite could be more extensive than previously thought;
- increasing levels of Cr at the boundary well R-50, already at approximately twice the New Mexico groundwater standard; and
- the proximity of the Cr plume to Los Alamos County production well PM-4, with the possibility of the well becoming vulnerable to contamination.

In NMED's opinion, at least one additional boundary extraction well and at least three boundary injection wells may be needed to achieve the Permittee's primary objective to control the migration of Cr offsite. NMED's opinion is based on the lack of sufficient spatial characterization of Cr concentrations, hydraulic heads and permeability in the upper portion of the regional-aquifer, as well as substantial uncertainties in the Permittees' understanding of the influence of apparent strong aquifer heterogeneity and vertical anisotropy on the capture and removal of Cr along the property boundary. Following the CrEX-1 and CrEX-3 (proposed in: LANL, EP2015-0127) pumping tests to be conducted in 2016, the Permittees must analyze all available data to determine hydraulic responses, capture zones, aquifer properties and, if possible, changes in contaminant gradients. The intent is to determine if additional extraction

and/or injection wells, as well as additional monitoring points, are needed in the vicinity of the property boundary to mitigate contaminant migration and to monitor performance of the IM. Excluding any unanticipated circumstances, the Permittees must initiate the CrEX-1 and CrEX-3 pumping test no later than **May 1, 2016** and submit a summary aquifer test report specific to the CrEX-1 and CrEX-3 pumping-test results and findings no later than **November 30, 2016**. The summary report must include recommendations as to whether additional extraction or injection wells and/or IM performance monitoring points are needed and, if so, proposed locations for the recommended wells.

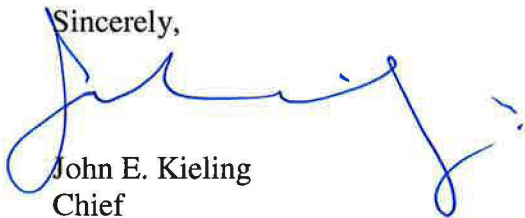
The Permittees must obtain prior approval from NMED for drill-site locations and drilling sequences for all extraction and injection wells.

If proposed boundary injection wells CrIN-3, CrIN-4, and CrIN-5 cannot be installed due to unanticipated circumstances, the Permittees must install the injection wells at alternate location(s) such as west and/or east of the chromium plume.

The Permittees must submit drilling work plan(s) for the installation of injection wells CrIN-1 through CrIN-5 and any other injection wells associated with CrEX-1 and CrEX-3 no later than **December 31, 2015**.

Please contact Michael Dale at (505) 476-3078 if you have questions.

Sincerely,



John E. Kieling
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
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File: Reading and LANL 2015, Chromium Plume