DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

EMLA-2021-BF114-02-001

June 4, 2021

Mr. Kevin Pierard
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Response to Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71 and Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-72

Dear Mr. Pierard:

The U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) is in receipt of two New Mexico Environment Department (NMED) letters, "Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71" and "Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-72," both of which are dated November 3, 2020. DOE notes that these letters and the associated technical direction were received without following the process described in Section XXIII.E of the 2016 Compliance Order on Consent that requires parties to confer to discuss comments or concerns that NMED may have on a document. In this case, NMED provided the amended approvals on these two previously approved drilling work plans without meeting with DOE to discuss NMED's proposed comments or concerns or providing DOE with any emergent information to support the amended approvals. Upon hearing from NMED during the Fiscal Year 2021 Appendix B planning process that the amended approvals were imminent, EM-LA requested to meet with NMED; however, NMED stated that a meeting was not required.

Below are EM-LA's responses to the areas of direction in NMED's amended approval letters. EM-LA also requests a meeting to discuss NMED's concerns and comments to reach alignment in advance of the initiation of drilling of R-71 and R-72. Since NMED's comments are the same for the two wells, these responses apply to both amended approval letters. The responses are presented below and are organized by topic in order of the topics in the amended approval letters.

An overarching theme to EM-LA's response to the amended approval letters hinges on several key concepts: (1) what constitutes representative data, (2) the importance of utilizing limited areas for drilling in the project area, (3) EM-LA's interest in optimizing use of the substantial time and cost to drill wells for a more aggressive schedule to remediate the chromium plume, and (4) EM-LA's position that site investigations and performance to date of the Chromium Interim Measure support the mutual benefit of engaging with NMED to utilize many of the tools and processes included in the U.S. Environmental Protection Agency's (EPA's) 2016 "Resource Conservation and Recovery Act Facilities Investigation

Remedy Selection Track – A Toolbox for Corrective Action." A joint effort to establish a common set of corrective action objectives would be helpful in addressing many of the technical issues that need to be addressed for well design and overall optimization of the Chromium Project moving forward.

With that background, the following responses are provided.

NMED Statement
(combined from amended approval for R-71 and amended approval for R-72)

The Work Plan also specifies that NMED will approve the final well design at the time of drilling. Consequently, the final design was excluded from the March 26th approval letter. NMED is amending the approval of the Work Plan to specify that the screen lengths for R-71 must not be longer than 20 feet. This is because the excessively long screens proposed by DOE, to allow for repurposing later as part of remediation infrastructure, will negate the ability of R-71 to meet its primary objective.

Proper evaluation of subsurface conditions is entirely dependent upon the ability of the monitoring well network to provide representative groundwater data that are necessary to perform the scientific studies, aquifer testing and to conduct the corrective measures evaluation required by the Compliance Order on Consent. While NMED recognizes DOE's concern of the drilling costs, NMED does not concur with DOE's repurpose design for R-71 for the following technical reasons:

- *U.S. EPA guidelines limit monitoring well screen lengths to between 2 feet and 20 feet.*
- *The highly layered nature of the regional aquifer geology mandates discrete sample intervals.*
- *The potential for sample dilution from the penetration of different geologic strata.*
- *The potential to spread contamination from one geologic stratum to other geologic strata.*
- *The potential for the sample to reflect conditions from a stratum of unknown stratigraphic position in the aquifer.*
- *The loss of the ability to compare its data to data from properly designed existing monitoring wells, specifically R-62 and R-43 (from R-71 amended approval).*
- *The loss of the ability to compare its chemical and hydraulic data to data from properly designed existing nearby monitoring wells (from R-72 amended approval).*
- *The potential to jeopardize the final remediation design by using misrepresented data.*
- *The suspect anomalous result obtained from screen 1 at R-70; the only repurpose well design with a screen exceeding 20 feet (screen 1 is 40 feet long).*
- *There is no approved remediation strategy at the northwest portion of the plume that justifies the repurpose design proposed by DOE for R-71 (from R-71 amended approval).*
- *There is no approved remediation strategy at the southwest portion of the plume that justifies the repurpose design proposed by DOE for R-72 (from R-72 amended approval).*
- *The need for a properly designed monitoring well at the R-71 location during remediation (from R-71 amended approval).*
- *The need for a properly designed monitoring well at the R-72 location during remediation (from R-72 amended approval).*

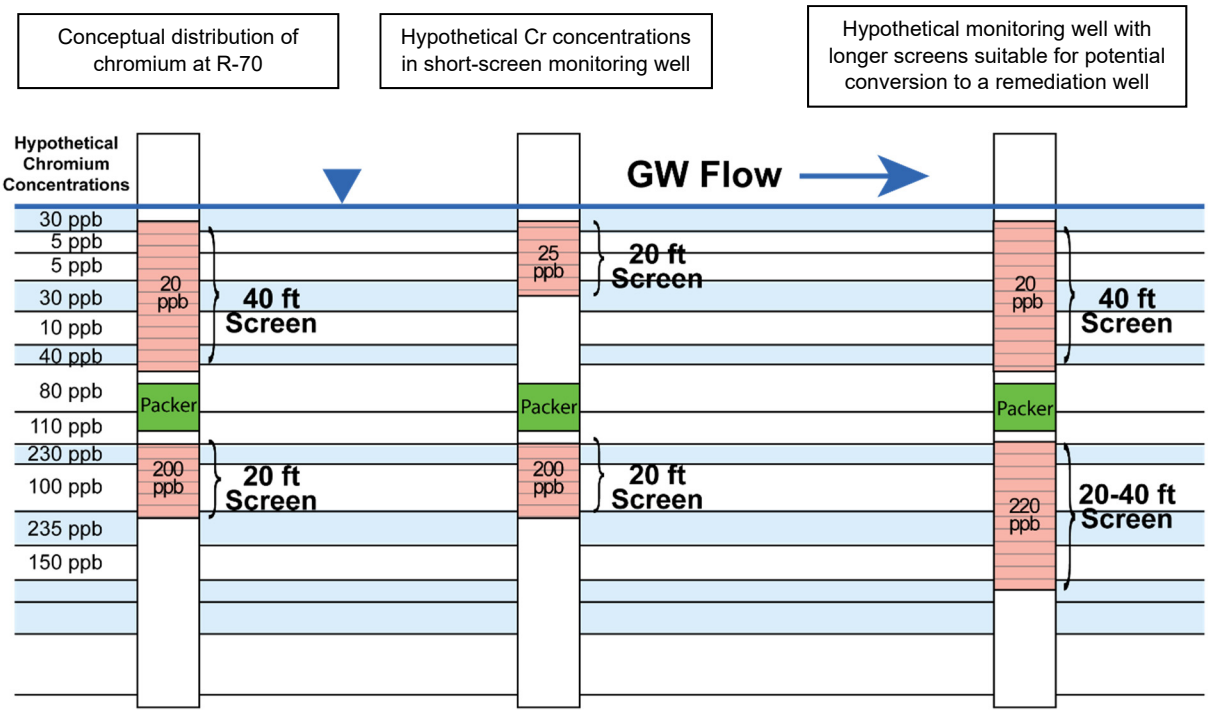
EM-LA Response

EM-LA believes that well screen lengths and other design attributes for R-71 and R-72 should be considered in the context of the project status and data quality objectives (DQOs). For the Chromium Project the key objective for wells R-71 and R-72 is to characterize and monitor specific areas of the plume. Key objectives include characterization of the vertical extent of contamination and collection of monitoring data that will inform the approach to remediation. Shorter screens may be appropriate for meeting the objective of characterizing vertical extent of contamination at both of these wells. However, longer screens may be suitable for generally characterizing integrated concentrations of chromium in areas of the plume that may be targeted for remediation since, as described below, remediation of the chromium plume is not likely to target short, relatively discrete intervals of the plume less than 20-ft thick.

During a technical team meeting held with NMED on September 10, 2020, EM-LA described that our analysis of the stratigraphy of unconsolidated units that compose the aquifer in the chromium plume area have led to an understanding that the highly stratified formations where the plume occurs function hydrologically as one hydrostratigraphic unit composed of thin (averaging approximately 1-ft thick) laterally discontinuous beds with varying hydraulic conductivity. Individual hydraulically conductive layers cannot be correlated between control points (wells), so plume-scale preferential flow is likely governed by multiple local intersects of hydraulically conductive layers that compose the dominant advective flow regime. Chromium flux at any location within the plume is therefore also expected to be occurring within a subset of beds distributed variably within the contaminated portion of the aquifer. Estimates from these high-resolution stratigraphic characterization studies indicate that preferential flow and mass chromium flux occur in approximately 50–60% of the total stratigraphic thickness of the plume.

To address the inherent local-scale uncertainty of the vertical distribution of higher hydraulic conductivity units and chromium concentrations, longer upper screens at R-71 and R-72 that integrate across thicker (30–40-ft) sections of the aquifer actually provide confidence that all potentially contaminated strata that are involved in advective flow and contaminant transport would be monitored. Although net concentrations of a constituent might be lower or higher from longer well screens at R-71 or R-72, what is most important in well-screen design from a DQO-based perspective is to characterize the vertical extent of chromium and to represent the general concentration and plume behavior of chromium at a given location since all locations with elevated chromium concentrations are likely targets for remediation. Shorter screens could easily result in a low bias in local chromium concentrations even if they are placed in units with the highest hydraulic conductivity. Figure 1 provides a hypothetical example of the potential bias in data representativeness from monitoring with short screens in the Chromium Project area, where it is not viable to monitor with a densely spaced well network with more discrete-horizon resolution. Attempts to identify and monitor the discrete strata with the maximum chromium concentration at a location (or for direct comparisons of chromium concentrations with R-62 and R-43 in the case of NMED's comment in the R-71 amended approval) are not necessary or useful for informing a remediation strategy since extraction and injection would not be limited to thin, targeted strata. Consistent with the general approach being used for the interim measure, the likely remediation approach for the chromium plume will be to address the inherent uncertainty of vertical chromium distribution at any given location by extracting and injecting across a greater thickness of aquifer that captures high hydraulic conductivity units within the chromium plume. Using that approach, extraction is likely to

access the strata with mass chromium flux as well as those with lower or negligible mass flux. Under this scenario, monitoring-well screens at R-71 and R-72 that span a similar thickness to that target for remediation are preferred over shorter screens that may not provide samples representative of the overall plume response.



Notes:

Blue shading indicates high-conductivity beds.

Beds within the stratigraphic sequence are approximately 1-ft thick on average; therefore, any screen, whether 10 ft or 40 ft in length, represents composite chromium concentrations. Beds in the figure are shown as thicker than 1 ft for conceptual purposes.

The general vertical distribution of chromium concentrations (e.g., generally lower in the upper portion of the aquifer and higher in the lower portion of the aquifer) is successfully characterized by both short and long screens.

Broad characterization is better for understanding how to design and implement remedial strategies, especially given that no single or small group of conductive beds is present that would be uniquely targeted for remediation.

Longer screens make it more likely that the well screen will include a number of conductive beds, and therefore the data will be more broadly indicative of conditions in the aquifer. Longer screens also ensure that if the well is repurposed for extraction or injection, a greater percentage of the total thickness of contaminated groundwater will be accessed for remediation.

Figure 1 Conceptualization of potential bias in data representativeness associated with different monitoring-well screen configurations

For the reasons discussed above, seeking an optimized balance between characterization objectives and remediation implementation and/or monitoring objectives for R-71 and R-72 seems prudent, especially in light of the limited areas available for drilling in the project area. Potential drill sites in the project area are constrained by numerous cultural sites, terrain challenges, and a large floodplain. Additional benefits

of longer screens for R-71 and R-72 include the ability to take advantage of these new wells to quickly pivot from a near-term monitoring objective to integration into remediation infrastructure, if necessary, and offset the high cost and time needed for installation of new wells. These objectives and opportunities would be best met with screen lengths greater than 20 ft in the shallower of two planned well screens at R-71 and R-72 (and other potential future chromium project wells). Deeper screens used to characterize vertical extent may be more appropriate at lengths of 20 ft, but not less.

EM-LA proposes to meet with NMED to discuss this response and the principles that will guide the final well-screen designs for R-71 and R-72.

NMED Statement

Lastly, NMED requires that DOE submit a detailed aquifer-performance testing plan for R-71 based on the numerous issues NMED identified in the May 7, 2020 draft comment letter and the outcome of the September 8, 2020 technical team meeting concerning the aquifer testing procedure, analyses and conclusions drawn by DOE for monitoring well R-70. Submittal and approval of a detailed aquifer-performance testing plan will provide greater assurance that conclusions can be relied upon for plume characterization and remedy development. This will also provide critical information for selection of the final remediation approach.

EM-LA Response

EM-LA is preparing a single, standalone aquifer test plan for submittal to NMED. The aquifer test plan will include the fundamental field testing methodology and data analysis approach that will be used for all future wells and will also include any specific or unique aquifer testing objectives and approaches for aquifer testing at R-71 and R-72. Similarly, EM-LA proposes that any future drilling work plans beyond R-71 and R-72 incorporate or reference the aquifer test plan and describe only site-specific aquifer testing associated with that particular well.

NMED Statement

NMED also requires that DOE provide the geophysical logs it intends to run. NMED requires at a minimum that flowmeter "spinner" logs and water quality profiling be conducted in the open borehole for characterization and optimal screen placement.

EM-LA Response

The requirement to conduct water-quality profiling and/or flowmeter logging in an open borehole in the regional aquifer at the Laboratory poses an unacceptable risk to the successful installation of any regional aquifer well. EM-LA will not conduct any downhole operations that involve a borehole being in an extended-length open (uncased) condition for any period. The unconsolidated nature of the sedimentary units that compose the regional aquifer beneath the majority of the Laboratory have a high likelihood of collapsing and potentially entombing downhole equipment, likely resulting in the loss of the borehole even under ambient conditions. The enhanced flow conditions that would be required for flowmeter

logging would present an even greater risk. Loss of a borehole would also delay completion of the well and result in significant time and expenditure to redrill. EM-LA offers to meet with NMED to further discuss the topic.

The geophysical logging in each well will also be conducted in the cased hole and include gamma and neutron logging tools. These tools have historically provided useful stratigraphic information especially when integrated with cuttings descriptions and drillers' observations.

EM-LA welcomes the opportunity to meet with NMED to discuss and seek alignment on these important matters related to advancing the Chromium Project towards remediation.

If you have any questions or wish to request a meeting, please contact Danny Katzman at (505) 309-1371 (danny.katzman@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

ARTURO DURAN

Digitally signed by ARTURO DURAN
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Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

cc (letter emailed):
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo, NM
Dino Chavarria, Santa Clara Pueblo, NM
Chris Catechis, NMED-DOE-OB
Steve Yanicak, NMED-DOE-OB
Jennifer Payne, LANL
Felicia Aguilar, N3B
William Alexander, N3B
Emily Day, N3B
Sherry Gaddy, N3B
Jeff Holland, N3B
Danny Katzman, N3B
Kim Lebak, N3B
Joseph Legare, N3B
Dana Lindsay, N3B
Pamela Maestas, N3B
Christian Maupin, N3B
Joseph Murdock, N3B

Troy Thomson, N3B
Steve Veenis, N3B
Peter Maggiore, NA-LA
M. Lee Bishop, EM-LA
Stephen Hoffman, EM-LA
Kirk D. Lachman, EM-LA
David Nickless, EM-LA
Cheryl Rodriguez, EM-LA
Hai Shen, EM-LA
emla.docs@em.doe.gov
n3brecords@em-la.doe.gov
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