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Appendix A
Public Scoping Comment Summary

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PUBLIC SCOPING COMMENT SUMMARY

A.1 INTRODUCTION

On April 28, 2023, the U.S. Department of Energy (DOE) Office of Environmental Management Los Alamos Field Office (EM-LA) gave notice of two public meetings to be held on May 8th and 9th to address scoping for the *Chromium Interim Measure and Final Remedy Environmental Assessment* (referred to as EA). Notices were published in the *Los Alamos Daily Post*, *Los Alamos Reporter*, *Santa Fe New Mexican,* and the *Rio Grande Sun*. Notices were also sent to interested stakeholders and non-governmental organizations.

This Final EA contains revisions and new information based in part on comments received on the Draft EA. Substantive revisions are indicated by side bars in the margin. Minor editorial corrections are not marked.

The 2016 Compliance Order on Consent (Consent Order) between DOE and the State of New Mexico Environment Department (NMED) is the principal regulatory document governing legacy cleanup at Los Alamos National Laboratory (LANL). The Consent Order sets forth the corrective action process, including the submission of Corrective Measures Evaluation (CME) Reports. EM-LA is preparing an EA under the National Environmental Policy Act (NEPA) to evaluate alternatives for remedial action as part of the Chromium Interim Measure (IM) and Characterization Campaign identified in the Consent Order. The EA will give DOE sufficient evidence and analysis to determine whether to issue a Finding of No Significant Impact (FONSI). To ensure that a full range of issues related to the Proposed Action are addressed, EM-LA invited Federal agencies, state, local, and Tribal governments, and the general public to comment on the scope of the EA. Specifically, EM-LA invited comments on the EA's scope, including the identification of reasonable alternatives and specific environmental issues to be addressed.

EM-LA hosted two public scoping meetings: an in-person one on May 8, 2023, and an interactive webcast on May 9, 2023. The purpose of the public scoping meetings was two-fold: (1) provide the public with information about the NEPA process and this EA scope; and (2) invite public comments on that scope.

Questions from the public were welcomed at both meetings. Participants at the in-person meeting were instructed to provide their comments that day either by providing verbal comments to the EA project's stenographer or completing a provided comment form to be given to the EM-LA representatives at the meeting. Webcast and in-person participants were invited to provide their comments after the meeting by submitting emails with "Chromium EA Scoping Comment" in the subject line to emla-nepa@em.doe.gov or by submitting comments by U.S. Mail to:

ATTN: NEPA Document Manager
U.S. DOE Environmental Management
Los Alamos Field Office
1200 Trinity Drive, Suite 400
Los Alamos, NM 87544

Participants at both meetings were instructed that comments should be postmarked by June 6, 2023, for consideration.

No comments were received at the meetings. After the meetings, DOE received seven comment documents in which 99 comments were identified. Table A-1 lists the comment documents received, commenters' affiliation (if any), and comment document number assigned by EM-LA upon receipt. Individual comments were reviewed; comments with similar input were grouped together and treated as a single comment, concern, or issue. The scoping comments and EM-LA's responses are summarized in following sections by general comment categories (i.e., NEPA Process, Purpose and Need, etc.). The numbering after each

comment summary corresponds to tracking numbers assigned to individual comments that were considered in developing the comment summaries.

This report contains a summary of the scoping comments received and EM-LA's responses to these comments.

Table A-1. List of the public scoping comment documents received, commenters' affiliation (if any), and comment document number assigned by EM-LA

Commenter(s)	Affiliation	Comment Document Number
Anna Hansen, Renee Villareal, JC Helms	Santa Fe County Commissioners	1
Anna Hamilton, Carol Romero-Wirth, Anna Hansen, Renee Villareal, JC Helms	BDD Board	2
John E. Wilks, III	Veterans For Peace, Donald and Sally-Alice Thompson Chapter #63	3
Denise Derkacs, Philo S. Shelton III, P.E.	Los Alamos County Council	4
Jay Coghlan, Scott Kovac	Nuclear Watch New Mexico	5
James C. Kenney, Cabinet Secretary	NMED	6
Rachel Conn, Beata Tsosie-Peña, Joni Arends, Marian Naranjo, Paula Garcia, Joan Brown, Marlene Perrotte	Communities for Clean Water	7

Key: # = number; BDD = Buckman Direct Diversion; NMED = New Mexico Environment Department

A.1.1 NEPA PROCESS

1. Comment Summary: Commenters requested that documents cited in this EA be publicly available. Comments: 1-6, 2-6, 5-27, 7-3

   EM-LA Response: Reference documents are a part of the administrative record for this EA. To the extent practical, reference documents will be available in the Electronic Public Reading Room (https://environment.lanl.gov/public-reading-room/), the public reading room located at 94 Cities of Gold Road, Pojoaque, New Mexico, and on the project website. DOE may not be able to include certain copyrighted materials and sensitive information.

2. Comment Summary: One commenter suggested that preparation of an EA will not address the complex technical and policy issues for the hexavalent chromium plume and that EM-LA needs to prepare an Environmental Impact Statement (EIS). Comments: 7-1, 7-2, 7-7

   EM-LA Response: In accordance with DOE's NEPA implementing regulations (10 CFR 1021.321(a)), DOE may prepare an EA at any time for a proposed action. In preparing the EA, EM-LA will consider the context (setting) and intensity (severity) of any potential environmental impacts. If no significant environmental impacts are identified, the EA is the appropriate level of analysis. If DOE determines that there may be potential significant environmental impacts resulting from a proposed action, then an EIS is appropriate. EM-LA will prepare the EA and include information to determine the potential for significant environmental impact using accepted and appropriate science, technology, and expertise.

3. Comment Summary: One commenter stated they understand the *Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EA-2005, December 2015) expires at the end

of 2023 and they were unable to identify a source of this statement. The commenter suggested that EM-LA include a citation to the document and the statement in this EA. Comment: 7-2

EM-LA Response: The *Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EA-2005, December 2015) referred to an "approximate 8-year duration" of the IM project. The EA did not state that it "expires at the end of 2023."

4. Comment Summary: One commenter objected to the use of the term "final remedy," stating that it is premature to identify the final remedy without first determining the nature and extent of the hexavalent chromium plume. Comment: 7-4

   EM-LA Response: Under both the No Action Alternative and Adaptive Site Management (ASM) alternative, EM-LA would continue to further characterize the hexavalent chromium plume. The goal of ASM is to create a framework of structured and continuous planning, implementation, and monitoring that accommodates new information and changing site conditions to develop effective and efficient cleanup strategies. Remediation under ASM addresses what is known while acknowledging what is not fully understood. It includes plans to collect the necessary information to reduce uncertainties and achieve a final, protective remedy for the site. This approach allows work to proceed in some areas while additional data collection and testing of responses is conducted to determine the appropriate level of remediation in remaining areas. ASM has been implemented at many complex remediation sites and is recommended by the U.S. Environmental Protection Agency.

   "Final remedy" is the term used in the 2016 Consent Order. The 2016 Consent Order states the final remedy will be selected by NMED after EM-LA submits a CME Report to NMED. The CME Report will identify and evaluate potential corrective measures for removal, containment, and treatment of the hexavalent chromium plume. In the CME Report, DOE will also recommend a preferred alternative for remediation. NMED will then issue a Statement of Basis, engage in a public comment period, and select a remedy.

   The environmental analysis presented in this EA will (1) identify and describe the affected environment; (2) provide sufficient evidence and analysis for determining whether to prepare an EIS or issue a FONSI; and (3) evaluate the potential environmental consequences of reasonable alternatives to remediate the hexavalent chromium plume. EM-LA will use the results and analyses from this EA to evaluate alternatives and recommend a preferred alternative for remediation in the CME Report, which EM-LA will submit to NMED.

5. Comment Summary: One commenter asked if EM-LA has created interactive, publicly available models demonstrating in real-time the pumping effects of the extraction and injection wells to the regional drinking water aquifer and the U.S. Environmental Protection Agency-designated Española Basin Sole Source Aquifer, and recommended EM-LA create such a model. Comments: 7-24, 7-25, 7-26, 7-27, 7-28

   EM-LA Response: Development of additional models is outside the scope of the environmental impacts evaluated in this EA. This EA will describe existing groundwater resources within the area of impact and analyze potential impacts on groundwater from extraction and injection wells, land application, and other actions associated with the reasonable alternatives. EM-LA will prepare the EA using groundwater models that are peer reviewed and calibrated.

6. Comment Summary: Commenter requested a definition of "downgradient migration" and "removing some." Comment: 7-33

   EM-LA Response: This EA will include a description of geology and soils, including a Conceptual Site Model to portray both known and hypothesized site information regarding contaminants, sources, and migration pathways, as well as a description of relevant terminology. Downgradient

migration is the movement of a compound or contaminant in the direction of groundwater flow. During the IM, EM-LA estimates that approximately 700 pounds of hexavalent chromium has been removed from the regional aquifer.

7. Comment Summary: Commenter objects to the use of the Finite Element Heat and Mass Transfer Code (FEHM) for the hexavalent chromium plume and recommends that EM-LA use U.S. Geological Survey's modular hydrologic model, MODFLOW, for developing this EA. Comments: 7-30, 7-31

   EM-LA Response: This EA will analyze potential impacts on groundwater from extraction and injection wells, land application, and other actions associated with the reasonable alternatives. FEHM can account for complexities associated with partially penetrating wells, aquifer heterogeneity, and complex boundary conditions and has been benchmarked against MODFLOW (https://www.usgs.gov/mission-areas/wateR-resources/science/modflow-and-related-programs). FEHM is shown to be equal in accuracy and provide improved numerical stability relative to MODFLOW.

   FEHM is a well-vetted flow and transport code that has been used at LANL and by its collaborators for 50 years, has hundreds of peer-reviewed publications (https://www.lanl.gov/orgs/ees/fehm/pdfs/FEHM_references_list.pdf), and has been benchmarked and verified against many analytical and numerical solutions, including MODFLOW (https://www.lanl.gov/orgs/ees/fehm/docs/FEHM_VERIFICATION_V3.3.0.pdf).

   LANL recalibrates the FEHM chromium model regularly as new data becomes available. The calibration compares to concentrations, drawdowns, water levels, and water-level gradient targets with excellent results.

8. Comment Summary: Several comments questioned the robustness of available monitoring data to support the analysis of impacts in this EA. Comments: 5-11, 6-4, 6-6

   EM-LA Response: LANL has a robust, laboratory-wide environmental monitoring program. This program prepares Annual Site Environmental Monitoring Reports (https://environment.lanl.gov/environmental-report/). In addition, the Chromium IM program reports monitoring results in their own reports (https://eprr.em-la.doe.gov/). Future monitoring would be performed, as appropriate and as approved by pertinent regulatory agencies (e.g., NMED), and may be verified by quality assurance comparisons with duplicate and split sampling data taken by oversight agencies (e.g., NMED).

9. Comment Summary: Several comments requested EM-LA extend the public comment period for this EA. The requests for extending the public comment period for this EA ranged from 30 to 120 days. Comments: 1-8, 2-8, 3-1

   EM-LA Response: EM-LA will evaluate extending the public comment period referred to during the public scoping meetings for this EA and will make proper notifications on the determination.

A.1.2 PURPOSE AND NEED

10. Comment Summary: One commenter stated that the purpose and need must be thoroughly addressed. Comment: 5-18

    EM-LA Response: This EA is being prepared in accordance with applicable Council on Environmental Quality and DOE NEPA regulations. The purpose of the Proposed Action is to remediate hexavalent chromium-contaminated groundwater below Sandia and Mortandad Canyons. DOE is evaluating potential reasonable alternatives for a final remedy using the threshold criteria and balancing criteria set forth in the 2016 Consent Order. The primary objective of the interim measure is to prevent migration of the hexavalent chromium plume

beyond the LANL boundary. In contrast, the final remedy will be focused on groundwater remediation to achieve compliance with groundwater quality standards.

A.1.3 ALTERNATIVES

11. Comment Summary: One commenter suggested that all requests from the NMED be analyzed as alternatives and EM-LA analyze all impacts of land applying the treated water as well as all impacts of injecting the water into the ground and/or the plume. Comment: 5-22

    EM-LA Response: Through its internal scoping, EM-LA identified potential reasonable alternatives for this EA using the threshold criteria and balancing criteria set forth in the Consent Order. For alternatives to be reasonable, they must meet the threshold criteria and be evaluated using the balancing criteria. This EA will discuss the alternatives evaluated and the alternatives considered and dismissed from detailed evaluation.

    In addition, this EA will include information to determine the potential for significant environmental impact, and it will analyze potential impacts on resources, including cumulative impacts. As stated in the scoping alternatives presented at the public scoping meetings, this EA will address treated water land application and injection.

12. Comment Summary: One commenter urged EM-LA to focus on the Enhanced Chromium IM alternative, including activities directly related to compliance with the New Mexico Water Quality Act, the 2016 Consent Order and any other applicable regulations. They also requested EM-LA focus on expanded remedial activities to address the chromium plume above and beyond what is legally required, account for DOE's past cleanup commitments and obligations, and consider expanded remedial activities and definite timelines, such as those that may be encompassed by a new compliance order on consent as the litigation on the 2016 Consent Order is resolved. Comments: 6-3, 6-5, 6-8

    EM-LA Response: The EA will address adherence of the potential reasonable alternatives to applicable Federal, state, and local laws and regulations, including the Consent Order. The remedy selected by NMED and implemented by EM-LA must comply with the Consent Order. The timeline for implementation of the remedy will depend, in significant part, on how long it takes NMED to select a remedy, as well as the remedy that NMED selects.

13. Comment Summary: One commenter suggested EM-LA include additional characterization activities in an alternative, including the installation of additional monitoring wells, that will be implemented under a work plan approved by NMED. DOE-EM should also include an assessment of converting current well infrastructure (injection wells or monitoring wells) into future extraction wells under this alternative. Comment: 6-9

    EM-LA Response: Additional wells are part of the alternatives to be analyzed in the EA. Under the Consent Order, EM-LA would submit a work plan to NMED for approval (and obtain Office of the State Engineer drilling permits) prior to construction of wells. A discussion of converting current well infrastructure will be included in the EA.

    Through its internal scoping, EM-LA identified potential reasonable alternatives for this EA. EM-LA identified two alternatives—the No Action Alternative and Adaptive Site Management. The No Action Alternative is a continuation of the preferred alternative in the *Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EA-2005) and FONSI (December 2015). Under the No Action Alternative, EM-LA would control plume migration and maintain hexavalent chromium contamination levels within the LANL boundary while long-term corrective action remedies continue to be evaluated, implemented, and continue to further characterize the plume to evaluate the effectiveness and feasibility of implementing a final remedy.

Under the Proposed Action, EM-LA would use ASM to remediate the hexavalent chromium plume. The goal of ASM is to create a framework of structured and continuous planning, implementation, and monitoring that accommodates new information and changing site conditions to develop effective and efficient cleanup strategies.

This EA will discuss the alternatives evaluated and the alternatives considered but dismissed from detailed evaluation, including additional characterization activities and any converted, new, or decommissioned wells.

14. Comment Summary: One comment noted that EM-LA needs to clearly delineate the land application locations, volumes, and times under DP-1793 and Option 2, "Land Application." Comment: 7-22

    EM-LA Response: The specifics of land application of treated water (i.e., locations, volumes, and times) was previously addressed in the 2015 EA (DOE/EA-2005). In this EA, land application is further addressed in Section 2.2., *Option 2: Mass Removal via Expanded Treatment with Land Application*, of Appendix B as part of the alternatives discussion. Treated water constituents would meet NMED Ground Water Quality Bureau permit requirements for land application.

15. Comment Summary: One commenter recommended that EM-LA provide interim measures to prevent migration of the plume beyond the laboratory boundary and that the *Interim Measures and Characterization Work Plan* (Work Plan) must be revised to include a discussion of alternative injection scenarios (i.e., shallow infiltration gallery, conversion of existing well outside the plume to an injection well, constructing a new injection well outside the plume boundary, etc.). They also noted that the Work Plan needs to be revised to include a proposal from DOE for an investigation activity that will achieve the regulatory requirement to implement an alternative injection well location for the treated water. Comment: 7-6

    EM-LA Response: This EA will discuss the alternatives evaluated and the alternatives considered but dismissed from detailed evaluation, including injection scenarios and additional well locations. Whereas a discussion of activities encompassed within the alternatives are factors considered in identifying reasonable alternatives and environmental impacts, work plan development and revision are administrative aspects of the activity that are outside the scope of the environmental impacts evaluated in this EA.

16. Comment Summary: Several commenters stated that EM-LA must clearly define, explain, and provide adequate supporting documentation of the four options under Alternative 1: ASM, including additional infrastructure for remediation and monitoring, timeframes to complete the options, coordination and consultation with regulators and opportunities for public participation. Comments: 1-4, 5-3, 2-4, 4-4, 6-10, 7-18, 7-20, 7-21

    EM-LA Response: This EA will discuss the alternatives evaluated and the alternatives considered and dismissed from detailed evaluation per NEPA regulations. The description of the alternatives will include a discussion of additional infrastructure for remediation and monitoring, timeframes to complete the options, engagement with regulators, and opportunities for public participation.

17. Comment Summary: One commenter noted EM-LA needs to specify that this EA would not include implementation of a final remedy for addressing the hexavalent chromium groundwater contamination. Rather, the results and analyses from the alternative would be used to develop recommendations for a final remedy to be presented to NMED for approval in accordance with the CME process. Comment: 6-8

    EM-LA Response: Comments noted. EM-LA intends to use the analysis of environmental impacts in this EA to develop a CME Report, which will identify and evaluate potential corrective measures alternatives for removal, containment, and treatment of the hexavalent chromium plume. In the CME Report, EM-LA will also recommend a preferred alternative for remediation. After receiving

the CME Report from EM-LA, NMED will issue a Statement of Basis, engage in a public comment period, and select a remedy.

18. Comment Summary: Several commenters noted that the evaluated alternatives should be designed to protect public drinking water. Comments: 4-6, 5-5, 7-31

    EM-LA Response: This EA will discuss the alternatives evaluated and the alternatives considered and dismissed from detailed evaluation, including measures to protect public drinking water consistent with applicable environmental laws, regulations, permits, and agreements.

19. Comment Summary: Several commenters requested clarification of the No Action Alternative. Comments: 1-5, 2-5, 6-7, 7-19

    EM-LA Response: This EA will include consideration of a No Action Alternative per NEPA regulations. The No Action Alternative is a continuation of the preferred alternative in the *Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EA-2005, December 2015) and FONSI (December 2015). Under the No Action Alternative, EM-LA would control plume migration and maintain hexavalent chromium contamination levels within the LANL boundary while long-term corrective action remedies continue to be evaluated, implemented, and continue to further characterize the plume to evaluate the effectiveness and feasibility of implementing a final remedy.

20. Comment Summary: Commenters requested information on options for hexavalent chromium source removal. One commenter suggested that EM-LA analyze an alternative that pumps or trucks treated water to the head of Sandia Canyon to the location where the chromium-contaminated water was released. Comments: 4-8, 5-4

    EM-LA Response: EM-LA has considered disposition options, other than injection of treated groundwater via injection wells, including land application at the head of Sandia Canyon into the same pathway that the chromium source initially followed. There is a potential risk associated with the outfall option if implemented in Sandia Canyon, with accelerating the release of chromium that may reside in the vadose and perched water zones between the approximate 1,000 feet between the ground surface and the regional aquifer (N3B, 2022).

21. Comment Summary: One comment noted a preference for Option 1: Expanded Pump and Treat with Expanded Injection. Comment: 4-5

    EM-LA Response: Comment noted. EM-LA intends to use the analysis of environmental impacts in this EA to develop a CME Report, which will identify and evaluate potential corrective measures alternatives for removal, containment, and treatment of the hexavalent chromium plume. In the CME Report, EM-LA will also recommend a preferred alternative for remediation. After receiving the CME Report from EM-LA, NMED will issue a Statement of Basis, engage in a public comment period, and select a remedy.

A.1.4 ENVIRONMENTAL IMPACTS

22. Comment Summary: One commenter noted that EM-LA must evaluate the environmental impacts from construction and well drilling. Comment: 5-19

    EM-LA Response: This EA will analyze potential impacts from remediation activities, including construction and well drilling.

23. Comment Summary: One commenter suggested that EM-LA include an analysis of climate change impacts. Comment: 5-23

EM-LA Response: This EA will consider greenhouse gas emissions and climate change impacts.

24. Comment Summary: Several commenters requested that EM-LA evaluate impacts to endangered species, water, air and soil, environmental justice, transportation, economics (including tourism), emergency preparedness, visual resources, future land use plans, and waste generation. Comments: 5-20, 5-24, 5-25, 5-28

    EM-LA Response: This EA will analyze potential impacts on the environment. This includes impacts on threatened and endangered species, water resources, air quality, geology and soils, environmental justice, transportation, socioeconomics, visual resources, land use, and waste management. Although emergency preparedness is not an environmental resource area, an Emergency Operations Plan (LAC, 2018) and a Local Hazard Mitigation Plan (LAC, 2016) were published by Los Alamos County to assess the potential risks associated within the region.

25. Comment Summary: Several commenters requested EM-LA evaluate impacts to water resources, including hexavalent chromium concentration increases in downgradient monitoring wells in response to injection operations, the ability to adequately control plume migration and maintain hexavalent chromium contamination within the LANL boundary, and the regulatory directive from NMED to cease injection into the plume beginning April 1, 2023. They also recommend this EA include information on impacts to the Rio Grande and the springs along the Rio Grande, including the groundwater and surface water connection and methods for offsetting or identifying consumptive uses, cumulative effects from this and other projects on the hydrologic conditions of the analysis area and vicinity, whether specific permits will be needed, and measures that would be taken to protect drinking water for communities. Comments: 1-1, 1-2, 1-3, 2-1, 2-2, 2-3, 6-7, 7-5, 7-15, 7-16, 7-17

    EM-LA Response: This EA will analyze potential impacts on surface and groundwater resources, including cumulative impacts, commensurate with the potential for impacts.

26. Comment Summary: Commenters requested that EM-LA evaluate the impacts of alternatives on water rights. Comments: 4-7, 7-12

    EM-LA Response: This EA will analyze potential impacts on surface and groundwater resources, including water rights.

27. Comment Summary: One commenter stated this EA should give some description of costs to date, estimated future costs, the anticipated time duration of the project, and the number of workers needed. Comment: 5-15

    EM-LA Response: EM-LA does not plan to present cost information in this EA. Estimates of construction and operation duration and the number of workers needed for the alternatives and options analyzed will be provided.

A.1.5 HUMAN HEALTH

28. Comment Summary: One commenter noted that Federal standards for protection of human health, such as limits on how much residual radiation will be allowed in contaminated soil, are based on "Reference Man," and recommended that the analysis address the risk to a pregnant woman farmer, her fetus, and her other children under age 18, rather than "Reference Man."

    EM-LA Response: This EA will analyze the direct, indirect, and cumulative impacts. Potential impacts on human health will be estimated using accepted scientific methods. Radiation is not a component of the hexavalent chromium plume and, therefore, is out of scope and will not be addressed in this EA.

29. Comment Summary: One comment requested that the draft environmental assessment have a good description of the negative health impacts of chromium, particularly hexavalent chromium, correlating to different amounts of parts per billion. Comment: 5-13

EM-LA Response: This EA will analyze the direct, indirect, and cumulative impacts. Potential impacts on human health will be estimated using accepted scientific methods. The applicable regulatory limits for hexavalent chromium concentrations in environmental media will be described in this EA.

A.1.6 CONSULTATION AND COORDINATION

30. Comment Summary: One commenter suggested this EA include a discussion of the relationship between EM-LA and NMED, including the roles of each. Comment: 5-14

    EM-LA Response: EM-LA regularly engages with NMED. In support of this EA, EM-LA will continue to hold discussions with NMED and other regulatory agencies consistent with past practice and the Consent Order. EM-LA intends to use the analysis of environmental impacts in this EA to support development of a CME Report, which will identify and evaluate potential corrective measures alternatives for removal, containment, and treatment of the hexavalent chromium plume. In the CME Report, EM-LA will also recommend a preferred alternative for remediation. After receiving the CME Report from EM-LA, NMED will issue a Statement of Basis, engage in a public comment period, and select a remedy.

31. Comment Summary: One comment noted that strong intergovernmental coordination is essential to ensure progress in addressing impacts to human health and the environment from ongoing and proposed activities at LANL. Comment: 6-1

    EM-LA Response: Comment noted. EM-LA is committed to strong intergovernmental coordination. This EA will evaluate potential environmental impacts on resource areas (consistent with NEPA regulations and implementing requirements and guidance) from activities associated with the hexavalent chromium plume and not ongoing and proposed activities at LANL.

    In addition, the National Nuclear Security Administration (NNSA) is preparing a Site-Wide Environmental Impact Statement (SWEIS) for LANL that will update the analysis in the 2008 LANL SWEIS (see Notice of Intent at 87 Federal Register [FR] 51083; https://www.energy.gov/sites/default/files/2022-08/noi-eis-0552-lanl-site-wide-2022-08.pdf). The SWEIS will analyze the potential environmental impacts of reasonable alternatives for continuing operations of LANL for approximately the next 15 years. The SWEIS will also analyze environmental impacts of waste remediation activities conducted by DOE-EM.

A.1.7 NATURE AND EXTENT OF THE HEXAVALENT CHROMIUM PLUME

32. Comment Summary: Several commenters noted that EM-LA needs to fill in data gaps and continue to assess the nature and extent of the hexavalent chromium plume. One commenter stated there are differences in professional opinion regarding the depth and extent of the hexavalent chromium plume. Comments: 4-1, 4-2, 5-6, 5-7, 5-8, 5-10, 5-12, 6-3, 6-8, 7-4, 7-7, 7-32

    EM-LA Response: This EA will include a description of hydrology, geology and soils, and water resources, including a Conceptual Site Model to portray both known and hypothesized site information regarding contaminants, sources, migration pathways, and impacts from extraction, injection, land application, etc. The options evaluated for the final remedy include monitoring to address data gaps and continue assessing the nature and extent of the hexavalent chromium plume. Most of the options include installation of additional wells.

33. Comment Summary: One comment noted in 2020 LANL switched from the Thin-Plate Spline (TPS) interpolation method to the Bayesian Canonical Correlation Regression and reverted to TPS in calendar year 2023 Quarter 1. The commenter requested that NMED require LANL to run the data from 2020 to 2023 in the TPS interpolation method in order to understand the difference between the

two models, to create a consistent source of data, and to alleviate public concern about the switch between models. Comment: 7-29

EM-LA Response: LANL switched from the TPS interpolation method upon request from NMED. This EA will be prepared in accordance with applicable Council on Environmental Quality and DOE NEPA regulations. The commenter's preference for deriving and displaying data are outside the scope of this EA.

A.1.8 PUBLIC PARTICIPATION

34. Comment Summary: Several comments requested EM-LA improve engagement with stakeholders, Native American groups, pueblos, local governments, and utilities and for clarification on the mechanism of cooperation with San Ildefonso Pueblo. Comments: 1-7, 2-7, 5-9, 6-2

    EM-LA Response: Maintaining an open dialog with the public is central to EM-LA's mission. This includes keeping stakeholders and the public informed about EM-LA's activities. See the webpage at https://www.energy.gov/em-la/information-center for more information about EM-LA's mission, the current status of cleanup campaigns and Consent Order milestones, recent presentations given at public meetings, and contracts related to the EM-LA mission.

    DOE maintains Tribal outreach programs with Native American groups surrounding applicable sites and routinely meets with interested Native American governments to discuss various issues.

35. Comment Summary: One comment noted support for the comments submitted by the Buckman Direct Diversion Board about the scope of this EA. Comment: 7-14

    EM-LA Response: Comment Noted. See the responses to Comments 2-1 through 2-8.

36. Comment Summary: Commenter suggested that EM-LA mail notices of the comment period to people on the NMED Facility Mailing List for LANL, post the notices to the LANL Electronic Public Reading Room, host in-person and virtual community meetings, place informative ads in local and statewide newspapers, and produce paid broadcasts on local radio stations. Comment: 7-23

    EM-LA Response: EM-LA provided notice of the public scoping meetings in four local media distributions. This provided adequate notice of the in-person and webcast meetings. Notifications were also sent directly to interested stakeholders and Non-Governmental Organizations. This notice process will be similar for this EA. EM-LA will also hold two public meetings on this EA.

37. Comment Summary: One commenter recommended improvements to scoping materials. Comments: 7-34, 7-35.

    EM-LA Response: Comments noted.

A.1.9 REGULATORY REQUIREMENTS

38. Comment Summary: Several comments requested information regarding LANL applications to the state engineer regarding the IM be included in this EA along with updated status of compliance with permits, consultations, and notifications; permit renewals; and permit compliance. Comments: 5-26, 7-8, 7-9, 7-10, 7 -11, 7-13

    EM-LA Response: This EA will describe applicable environmental laws, regulations, permits, and agreements.

A.1.10 OUT OF SCOPE

39. Comment Summary: One commenter noted that this EA must be unprejudiced by the fact that hundreds of millions of dollars are spent on nuclear weapons research and production at LANL and voiced their desire for NNSA to diversify its missions away from nuclear weapons programs and

move more toward critically needed programs, such as nonproliferation efforts, other new national security priorities (for example, port security), and pure science and energy efficiency programs. Comments: 5-1, 5-2, 5-17

EM-LA Response: Remediation activities are funded separately from NNSA nuclear weapons programs and other LANL missions. NNSA programs are outside the scope of this EA.

40. Comment Summary: One comment suggested that additional revisions to the Work Plan are required as a result of the NMED Hazardous Waste Bureau directing DOE to not restart operations at CrEX-1, CrEX-2, CrEX-3, CrIN-1, CrIN-2, and CrIN-3, and the NMED Ground Water Quality Bureau directing DOE to cease all injections authorized under DP-1835 by April 1, 2023. Comment: 7-5

    EM-LA Response: This EA will discuss the alternatives evaluated and the alternatives considered but dismissed from detailed evaluation, including groundwater withdrawal and injection scenarios (considering land application of some of the treated water) and additional well locations. This EA's alternatives and options have been formulated after consideration of these recent developments. Whereas a discussion of activities encompassed within the alternatives are factors considered in identifying reasonable alternatives and environmental impacts, work plan development and revision are administrative aspects of the activity that are outside the scope of the environmental impacts evaluated in this EA.

41. Comment Summary: One commenter noted that the Los Alamos County Department of Public Utilities (DPU) is in the process of making a substantial investment in upgrading well controls for Pajarito Well No. 3, but is concerned that this investment would go to waste should the plume advance closer to this well. DPU staff has met with EM-LA regarding these issues and DPU is receptive to DOE performing a spinner log test on the well to determine the fate of Pajarito Well No. 3. We have requested a work plan for review and approval prior to performing a spinner log test. Comment: 4-3

    EM-LA Response: Comment noted. This EA will discuss the environmental impacts, including behavior of the hexavalent chromium plume, under the alternatives evaluated. Whereas a discussion of activities encompassed within the alternatives are factors considered in identifying environmental impacts, work plan development and revision are administrative aspects of the activity that are outside the scope of the environmental impacts evaluated in this EA.

A.2 REFERENCES

LAC. (2016). *Los Alamos County Local Hazard Mitigation Plan: Comprehensive Update.* March 2016. Developed by the Los Alamos County Hazard Mitigation Planning Committee with professional planning assistance from AMEC. https://www.losalamosnm.us/files/sharedassets/public/v/1/departments/community-development/documents/la-local-hazard-mitigation-plan-2016.pdf.

LAC. (2018). *Emergency Operations Plan.* Los Alamos County, New Mexico. https://www.losalamosnm.us/files/sharedassets/public/v/1/departments/community-development/documents/n-a-lac-emergency-operations-plan-2018.pdf.

N3B. (2022). *2021 Sandia Wetland Performance Report*. Los Alamos, New Mexico: Newport News Nuclear BWXT-Los Alamos, LLC. EM2022-0012. April 2022. https://ext.em-la.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-701996-01.pdf.

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Appendix B
Description of Alternatives Supporting Information

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DESCRIPTION OF ALTERNATIVES SUPPORTING INFORMATION

B.1 INTRODUCTION

This appendix includes an in-depth discussion of alternatives that the U.S. Department of Energy (DOE) Office of Environmental Management Los Alamos Field Office (EM-LA) is considering for chromium mass removal in source areas and in the groundwater below Sandia and Mortandad Canyons. Table B-1 at the end of this appendix includes a breakdown of the supporting information for each potential alternative.

B.2 NO ACTION ALTERNATIVE

This alternative would be a continuation of the preferred alternative in the *Final Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE, 2015) (and Finding of No Significant Impact (FONSI) (December 2015)), which prioritized the Chromium Plume Interim Measure and Plume Characterization. Under the No Action Alternative, EM-LA would control plume migration and maintain chromium contamination concentrations within the LANL boundary while continuing to evaluate long-term corrective action remedies, including options for chromium mass removal. EM-LA would continue conducting field-scale studies to further characterize the plume to evaluate the effectiveness and feasibility of implementing a final remedy.

B.2.1 FACILITIES AND INFRASTRUCTURE

In addition to the continuation of the Interim Measure, the No Action Alternative also has the potential to include up to 16 new monitoring wells to the existing treatment facility. These additional monitoring wells are permitted by the *Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE, 2015), which only limits pumping volume. The location of the additional monitoring wells has not been determined, but EM-LA will continue avoidance measures for cultural and ecological resources.

B.2.2 DECOMMISSIONING AND FINAL CONTOURING

If EM-LA determines there is no future use for the installations, the disturbed areas will be restored and rehabilitated according to requirements in place at that time. EM-LA would consult with the surrounding Pueblos and others to develop the final state of the chromium final remedy operations areas.

B.3 PROPOSED ACTION

The Proposed Action for a final remedy is a combination of treatment options. Under this alternative, EM-LA would use adaptive site management (ASM) to select, implement, and manage removal of hexavalent chromium from source areas and the groundwater. Given the long timeframes associated with remedy decisions, an evolving conceptual site model and a flexible and iterative approach with multiple intermediate steps is needed to manage site uncertainty and achieve effective and efficient progress toward groundwater cleanup and protection. ASM uses science and technology to routinely re-evaluate and prioritize site remedial actions and characterization activities. The goal of the approach is to create a framework of structured and continuous planning, implementation, and monitoring processes that accommodate new information and changing site conditions to develop effective and efficient cleanup approaches that achieve required outcomes, as seen in Figure B-1.

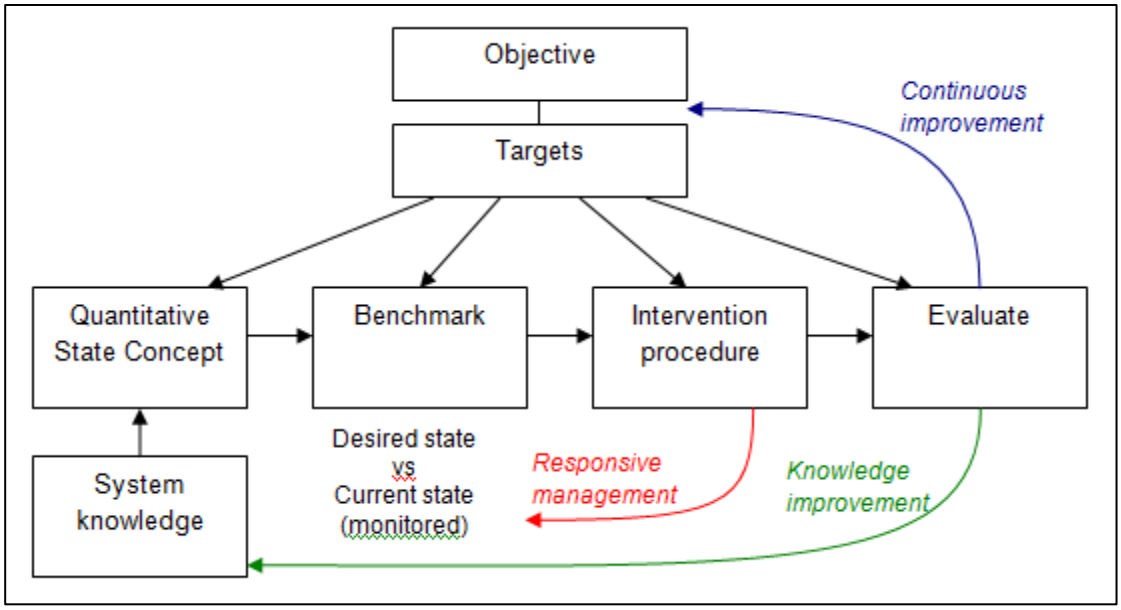

Figure B-1. Adaptive site management model

ASM promotes flexible decision making that can be adjusted as outcomes from management actions and other events become better understood. ASM includes active stakeholder involvement, management objectives, management alternatives, predictive models, monitoring plans, decision making, monitoring responses to remedial actions, and adjustment to remedial actions. Monitoring typically involves collecting groundwater samples to analyze them for the presence of contaminants and other site characteristics. An ASM approach for the mass removal of hexavalent chromium would include identifying the following:

- Site objectives that support the development of a long-term management approach.
- Interim goals that provide quantifiable, stepwise progress for achieving site objectives.
- Remedial actions that address key uncertainties and data gaps.

Under this alternative, EM-LA is considering utilization of the following options, or a combination of these options, to remediate chromium-contaminated groundwater below the Sandia and Mortandad Canyons.

B.3.1 OPTION 1: MASS REMOVAL VIA EXPANDED TREATMENT

Facilities and Infrastructure

Under this option, EM-LA would construct a 10,000-square-foot (ft^2) groundwater treatment facility situated in a previously disturbed area within Mortandad Canyon, as seen in Figure B-2. This facility would have a designed treatment capacity of 500 gallons per minute (gpm), with expansion capabilities to 1,000 gpm, and would treat water for hexavalent chromium contamination. The treatment system would consist of a 1,000-gpm dual ion exchange treatment system with prefiltration, associated piping, flow controls, and programmable logic controls and monitoring.

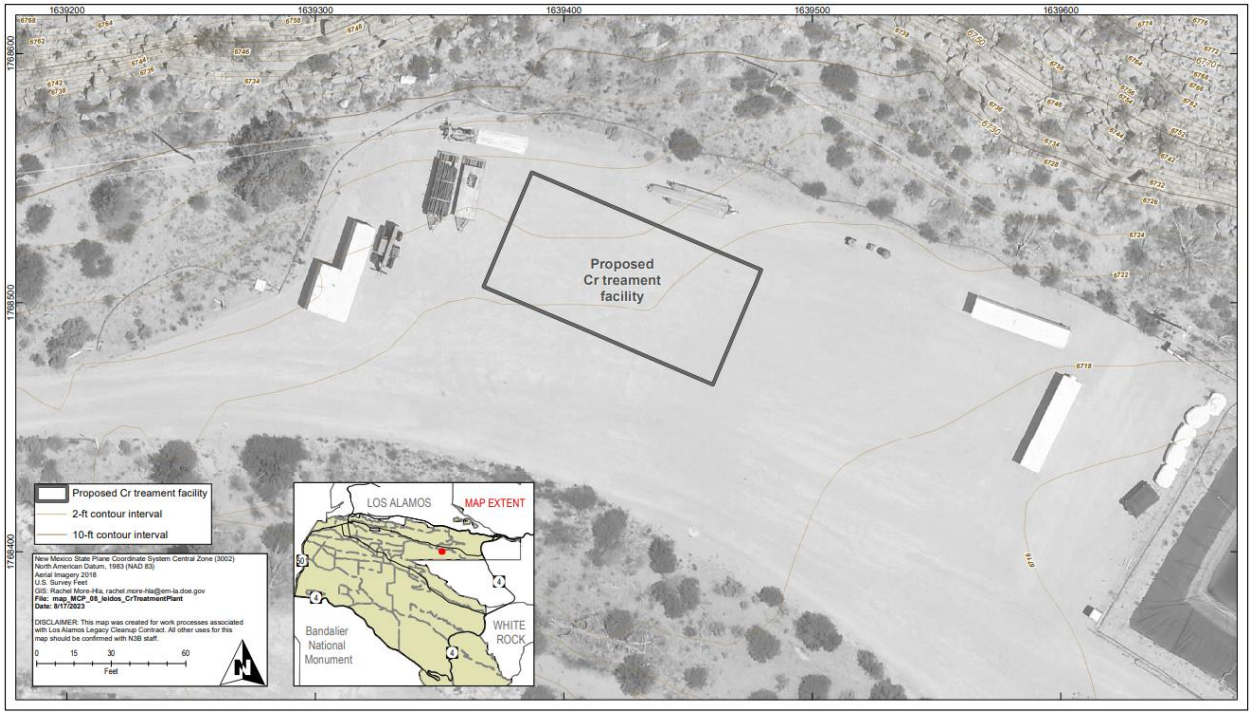

Figure B-2. Proposed hexavalent chromium treatment facility

The treatment facility would include the following:

- Contactors (e.g., disk or drum)
- Ion exchange vessels
- An electrical room
- A control room
- Feed tanks
- Injection pumps
- Electrical connection to the Los Alamos National Laboratory (LANL)
- Bathroom with septic system

In addition to the new treatment facility, this option also includes designs for 15 extraction wells; 15 injection wells; 16 monitoring wells, including one converted monitoring well; 20 shallow piezometers in the Sandia Wetlands source area; and 10 piezometers in the deep vadose zone.

These additional wells are expected to increase groundwater extraction and injection rates from 150,000,000 gallons per year (gpy) to a maximum rate of 550,000,000 gpy. The locations of the additional wells have not been determined; however, EM-LA would avoid disturbing sensitive ecological and cultural resources.

Up to 16 new monitoring wells, including one converted well, would be distributed between Sandia and Mortandad Canyons. These wells would continue to determine the nature and extent of the chromium plume. Both water-quality and pumping-volume monitoring are required under the various permits issued by the State of New Mexico for extraction, treatment, injection, land application, and evaporation. Monitoring would consist of sampling untreated and treated water and aquifer metering for both extraction and injection to ensure the system is performing as designed.

The additional 20 shallow piezometers in and around the Sandia Wetlands and 10 deep vadose zone piezometers in Mortandad Canyon would be installed for water-level monitoring and occasional water-

quality sampling. These tests would involve injection at the piezometers and monitoring at nearby monitoring wells. These studies would use tracers, chemicals, or bio-stimulants to evaluate the feasibility of in-situ remedies to convert chromium to the stable, nonmobile, non-toxic trivalent form. The additional piezometers would also be used to characterize lateral and vertical variability in water levels within the shallow alluvium in the canyon floor and the deeper vadose zone and would vary in depth with a maximum depth of approximately 1,400 feet, depending on depth to bedrock.

Directional drilling could be used to access areas under extreme slopes. Pump stations would include skid-mounted pumps enclosed within portable structures, minimizing the need for excavation. Associated electrical service would be extended from existing power lines in Mortandad Canyon.

Facility Piping

Untreated water from the additional extraction wells would be directed to the new treatment facility through existing valves in chromium extraction well 5-MH-2 and a new double-walled pipeline. It is estimated that approximately 30,000 linear feet of new double-walled pipe would be installed from the new extraction wells to the treatment system. An additional 500 feet of double-walled pipe would be necessary to tie the existing piping infrastructure into the new treatment plant.

The new treatment facility would continue to utilize existing feed tanks and injection pumps located at the R-28 well site for injection into existing wells. However, new injection wells would require new feed tanks and injection pumps to be installed in the new treatment facility. EM-LA estimates that approximately 30,000 feet of new single-walled pipe would be installed from the treatment system to the new water injection wells. An additional 500 feet of single-walled pipe would be necessary to tie the existing piping infrastructure into the new treatment plant.

Buried pipes would convey treated water from the treatment system to injection wells. The flexible piping would be buried approximately 4 feet below ground surface for freeze protection and routed along existing roads or utility corridors wherever possible. Trenching footprints would be minimized using equipment such as a Ditch Witch® or an excavator equipped with a narrow bucket.

Hexavalent Chromium Treatment

In the current operations of the Interim Measure, chromium is removed from extracted groundwater via an ion exchange system. The treatment system is modular in nature and uses portable storage tanks, skid-mounted pumps, and ion exchange vessels. The pumps and ion exchange vessels are located inside portable structures to protect them from damage; no additional contaminants are being analyzed for treatment.

Hexavalent chromium treatment at the new facility would be completed by ion exchange. The ion exchange resin is loaded into vessels. The contaminated groundwater enters the top of the vessel, runs through the resin, which removes the contaminants (in this case chromium), and the treated water exits the vessel at the bottom. Flow rate through the vessel is regulated by valves to ensure there is enough contact time for the ion exchange to take place.

The spent resin tanks may be put into a truck and taken to an offsite facility where the chromium is removed, and the resin tanks are regenerated for further use. Chromium from the spent resin would be managed or disposed of in accordance with state and Federal regulations.

Based on the increase in pumping rates and with the additional wells, EM-LA estimates to remove approximately 1,800 pounds per year of hexavalent chromium assuming concentrations of 400 parts per billion (ppb) in the untreated water. This increased treatment capacity would be gained by increased pumping volumes and continued 24-hour-per-day operation.

Facility Influent and Effluent Filtration

Both the influent and effluent filtration would use a duplex bag filter system that may be equipped with automated sequencing based on differential pressure. During preliminary design, alternative influent

filtration methods, such as sand filters, may be evaluated. The differences in filtration method are not expected to contribute to differences in environmental consequences.

B.3.2 OPTION 2: MASS REMOVAL VIA LAND APPLICATION

This option uses land application and evaporation of treated water as a disposition method. Instead of injecting all treated water into the aquifer as a method of plume control, some treated water would be stored in existing synthetically lined storage basins in Mortandad Canyon, then conveyed through an existing system of basin pumps and piping for disposition by any of the following methods: (1) irrigation-type sprinklers using an array of sprinkler heads, (2) mechanical evaporators, or (3) 3,000 to 10,000 gallon water trucks with high-pressure sprayers. Use of the irrigation system and/or mechanical evaporators would be prioritized over the use of water trucks to minimize vehicle traffic.

The land application method would only occur in permitted areas per a National Pollutant Discharge Elimination System (NPDES) land permit, only up to land application allowable/permitted limits (currently 350,000 gallons per day [gpd]), and is limited in geographic area, months of the year, and time of day, for when it can be applied (per requirements of the NMED discharge permit). The current land application areas, and areas not suitable for this disposition pathway, are shown in Figure B-3.

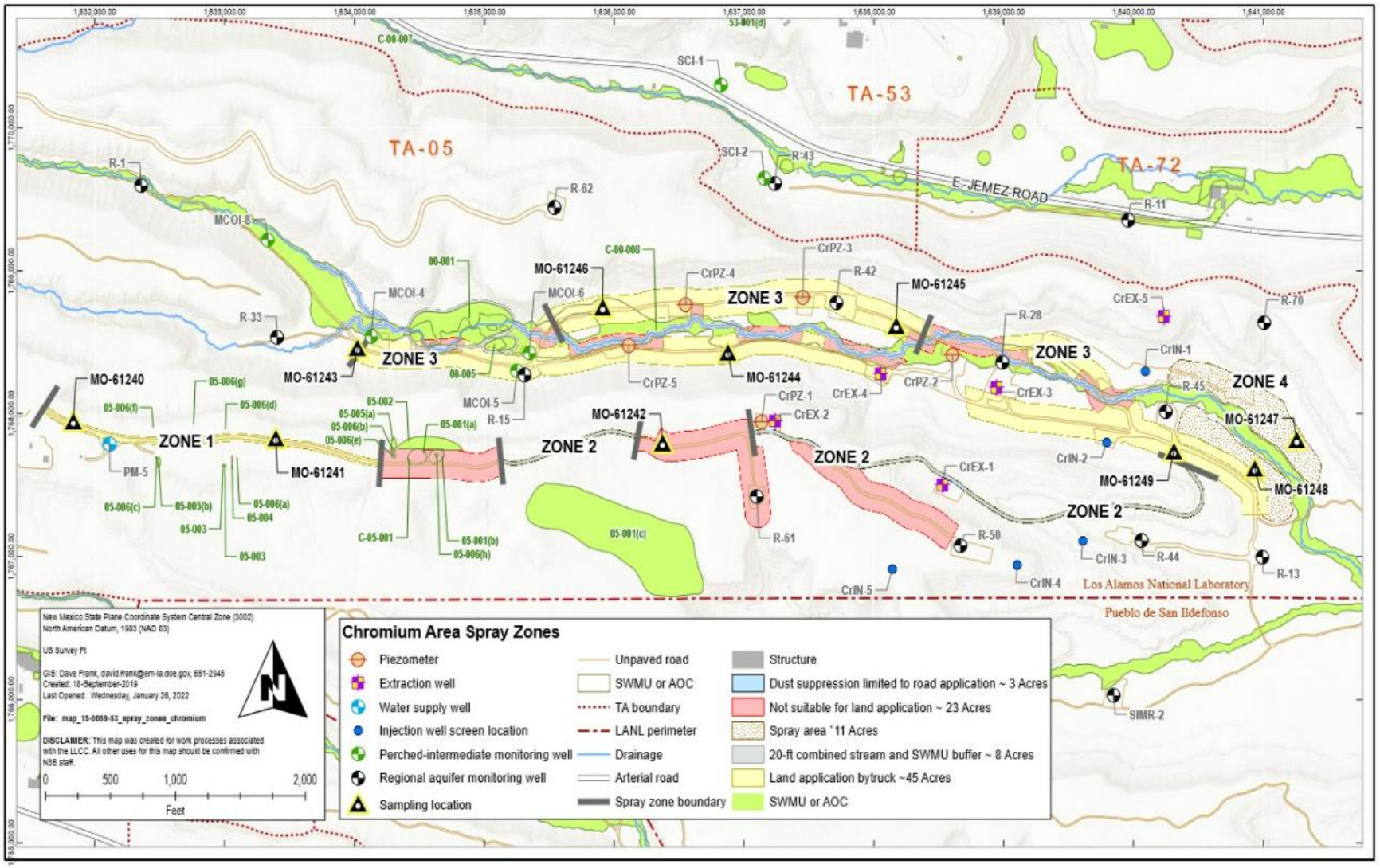

Figure B-3. Treated water land application area

B.3.3 OPTION 3: MASS REMOVAL VIA IN-SITU TREATMENT

This option uses in-situ treatments to supplement groundwater extraction and treatment of the contaminated groundwater. In-situ treatment involves introducing amendments in untreated water and relies on chemical processes to immobilize and detoxify contaminants within soil or groundwater without extracting them from the ground. Naturally occurring compounds that can act as reducing agents in a monitored natural attenuation (MNA) scenario include ferrous minerals, selected sulfur minerals, natural organic carbon, and reduced nitrogen species. Many chemicals can also be added to the aquifer to serve as reducing agents (see list). These amendments will be reviewed for use and will not contribute to additional contamination.

Potential methods for in-situ treatment include the following:

- Electrokinetic Treatment
- In-Situ Chemical Reduction Agents
  - Dithionite
  - Calcium polysulfide
  - Ferrous sulfate
  - Ferrous ammonium sulfate
  - Sodium bi/meta sulfite
  - Sulfur dioxide gas phase
  - Iron-biochar
  - Nano zero-valent iron (ZVI)
  - Activated carbon coated nanoparticles
  - Nano iron sulfide
  - Nano bimetallic ZVI, aluminum coated iron
  - Permeable Reactive Barrier with ZVI, nano ZVI, bimetallic ZVI
  - Metals Remediation Compound TM (Regenesis)
- In-Situ Biological Reduction Agents
  - Lactate
  - Emulsified vegetable oil
  - Algae/fungi
  - Bacteria cultures

Additional information on the treatment amendments that could be used is presented in (EPA, 2000) and at https://cluin.org/contaminantfocus/default.focus/sec/chromium_vi/cat/treatment_technologies/. In addition to these treatment options for chromium contamination in the regional aquifer, other measures to achieve the final remedy through source removal could be instituted in the shallow and vadose zone groundwater, alluvium, and intermediate groundwater, mostly up-canyon from the currently identified chromium groundwater plume. The discharge of treated waters could be released into Sandia Canyon or through the laboratory's NPDES outfall for treated effluent. The details related to these other measures are shown in Table B-1.

B.3.4 OPTION 4: MONITORED NATURAL ATTENUATION

This approach relies on natural physical, chemical, or biological processes to reduce concentrations, toxicity, or mobility of chromium. Regular monitoring must be conducted to ensure that MNA is working. EM-LA would consider MNA when contamination poses relatively low risks, the plume is stable or shrinking, and the natural attenuation processes are projected to achieve remedial objectives in a reasonable timeframe, compared to more active methods.

The *Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EA-1736) (NNSA, 2010) evaluated the environmental impacts of installing grade control structures in the Sandia Canyon source area to create a stable area of moist soils to minimize erosion of contaminated sediment. These grade control structures were installed in 2015, and periodic wetlands sampling indicates that chromium in wetland sediments is predominantly geochemically stable as trivalent chromium, Cr(III), and is not likely to become a future source of chromium contamination in groundwater, especially if saturated conditions are maintained within the wetland. Prior to the installation of the grade control structures, natural reducing conditions in the Sandia Canyon wetland had created a viable MNA scenario, which the grade control structures supplemented with more active water level and saturation control. Therefore, continuation of MNA is the proposed treatment option for the Sandia Canyon source area.

Adaptive Site Management Alternatives

Table B-1, Description of the Proposed Adaptive Site Management Alternatives, includes a breakdown of the supporting information and implementation needs for each potential ASM option.

This table is best read in coordination with the full analysis provided in Chapter 3 of the EA. The analysis in Chapter 3 uses a bounding approach to assess the maximum impacts based on the ASM options. This approach assumes that EM0LA would implement all of the ASM options in combination and is designed to identify the maximum range of potential impacts.

Alternatively, Table B-1 provides supporting information for each individual option. The approach in this table is used to display the separate implementation needs should EM-LA choose to select the options individually.

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
Schedule	This EA assumes well drilling occurs 24 hrs a day, 7 days a week. Approximately 4 wells can be drilled per yr, and each well takes approximately 5 months to drill. Two wells can be drilled simultaneously, with about 6 well pads[2] being constructed per yr. Expanded treatment facility would take approximately 2 yrs to construct and connect piping to existing wells. Treatment facility would operate 24 hours a day, 7 days a week.	Same as Option 1. Land application is limited in geographic area, months of the year, and time of day, for when it can be applied (per requirements of the NMED discharge permit).	Same as Option 1. There are no additional schedule limitations for in-situ treatment.	EM-LA would consider MNA when contamination poses relatively low risks, the plume is stable or shrinking, and the natural attenuation processes are projected to achieve remedial objectives in a reasonable timeframe, compared to more active methods. Routine monitoring must be conducted to ensure that MNA is working.
Wells and Piezometers	**Existing wells:** • 5 injection wells: 70 gpm (1,000 gpm max capacity) • 5 extraction wells: 70 gpm (1,000 gpm max capacity) • 13 monitoring wells • 5 Piezometers **New Wells:** • Up to 15 injection wells: 70 gpm (1,000 gpm max capacity) • Up to 15 extraction wells: 70 gpm (1,000 gpm max capacity)	**Existing wells:** Same as Option 1 **New Wells:** Same as Option 1	**Existing wells:** Same as Option 1 **New Wells:** Same as Option 1 This option introduces amendments in untreated water and rely on	**Existing Wells:** Same as Option 1 **New Wells:** Same as Option 1 DOE would only implement MNA when it can verify contamination

[1] Because the specific combination of remedial options to be implemented for effective and efficient cleanup is unknown, the analysis of impacts in this EA is based on conservative assumptions using maximum reasonably foreseeable disturbance and impact levels from a combination of all four remedial options. EM-LA could choose from the "menu" of the four Proposed Action options based on changing site conditions and could implement the options individually or in combination. The bounding approach to the analysis of environmental impacts in this EA assumes that EM-LA would implement all of the Proposed Action options in combination and is designed to identify the maximum range of potential impacts. Therefore, the impacts of the activities that could occur under the Proposed Action evaluated in this EA are considered bounding.

[2] DOE assumed individual wells would be installed. Clustering of wells would be more efficient and likely disturb less land, require fewer resources, and have smaller impacts, and therefore would be bounded by DOE's estimate generated by assuming individual wells would be installed.

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	• Up to 16 monitoring wells with 1 monitoring well converted from an existing well • Sandia Wetlands Source area: 20 wells (shallow piezometers) • Deep vadose zone: 10 wells (deep piezometers; 0–1,400 ft)		chemical processes to immobilize and detoxify contaminants within soil or groundwater without removing them from the ground. As a stand-alone option, in-situ treatment may involve infrastructure (e.g., monitoring wells) constructed as part of other ASM options.	poses relatively low risks, the plume is stable or shrinking, and the natural attenuation processes are projected to achieve remedial objectives in a reasonable timeframe. MNA may involve infrastructure (e.g., monitoring wells) constructed as part of other ASM options.
New Piping	Piping from the extraction wells to the treatment system would be double-walled pipe. Piping to injection wells would be single-walled pipe. EM-LA estimates that 30,000 ft of double-walled pipe and 30,000 ft of single-walled pipe would be needed. Pipelines supporting any new treatment facility or pumping station would be installed in previously disturbed or developed areas.	Same as Option 1, additional piping to synthetically lined storage basins, irrigation-type sprinklers, and mechanical evaporators already exists.	Same as Option 1, additional piping for in-situ treatment would not be needed.	New piping would be dependent on what ASM Options EM-LA decides to implement, and in which order.
Maximum Total Annual Extraction, Injection, and Land Application Rates	**Extraction Rate:** 550,000,000 gpy **Injection Rate:** 550,000,000 gpy	**Extraction Rate:** 550,000,000 gpy **Injection Rate:** 462,500,000 gpy **Land Application Rate:** 87,500,000 gpy (350,000 gpd * 250 days/yr)	**Extraction Rate:** Same as Options 1 and 2. Rates of extraction, injection, and land application would be dependent on what ASM Options EM-LA decides to implement, and in which order. As a stand-alone option, in-situ treatment is not dependent on rates of extraction, injection, and land application. **Injection Rate:** Same as Options 1 and 2. Rates of	**Mortandad Canyon:** The process of extraction, injection, and land application are not a necessary part of MNA. However, rates of extraction, injection, and land application would be dependent on what ASM Options EM-LA decides to implement, and in which order. **Sandia Canyon:** There would be no extraction, injection, or land application in Sandia Canyon.

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
			extraction, injection, and land application would be dependent on what ASM Options EM-LA decides to implement, and in which order. As a stand-alone option, in-situ treatment is not dependent on rates of groundwater extraction, injection, and land application.	
Other New Facilities and Infrastructure	**New Facilities:** Construct a new 10,000 ft^2 treatment facility situated in a previously disturbed area. The facility would require about 20,000 ft^2 of land for construction. The new treatment facility would continue to utilize existing feed tanks and injection pumps located at the R-28 well site for injection into existing wells CrIN-1, CrIN-2, CrIN-3, CrIN-4 and CrIN-5. New injection wells would require new feed tanks and injection pumps that could be installed in the new treatment facility. Cr treatment facility (contactors, ion exchange vessels, electrical room, control room, bathroom, septic, feed tanks, injection pumps). Electrical connection to LANL system. Requirement for power to be determined based upon final facility design. Three-phase, 480-volt power is available at the anticipated location. No new electrical lines would be	**New Facilities:** Same as Option 1 Note: The permitted land application rate is unlikely to be increased under the currently permitted areas. EM-LA currently does not approach or exceed the permitted application rate, and land application appears to be a logistically infeasible method to disposition extracted water without the addition of a new outfall for large-scale application. Permit modification applications for 1835 (injection) and 1793 (land application) are being reviewed by the state.	**New Facilities:** Same as Option 1 Option 3 involves injecting amendments into the aquifer and does not itself involve construction of new facilities or infrastructure.	**New Facilities:** Same as Option 1 DOE would only implement MNA when it can verify contamination poses relatively low risks, the plume is stable or shrinking, and the natural attenuation processes are projected to achieve remedial objectives in a reasonable timeframe. MNA may involve infrastructure (e.g., monitoring wells) constructed as part of other ASM options.

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	needed to connect to the 3-phase 480-volt power. Heating and ventilation would be required. Air conditioning is recommended for electrical and control room(s). Potable (or possibly non-potable) water would be needed if toilets are installed. Wastewater disposal via septic system or other method would be needed if toilets are installed. Design and construction require compliance with LANL and Institutional Biological Safety Committee. The existing Cr systems were exempt from IBC because the structures were unmanned, temporary and were environmental related. The new facility would not be located on or near cultural resources. Roads, pipeline, temporary pump sheds, and other support infrastructure would be located to avoid known cultural resources. Ground disturbing activities would be monitored for cultural resources according to laboratory procedures.			
Hexavalent Chromium Treatment and Removal	Untreated groundwater would be delivered to new treatment facility from extraction wells through existing valve in CrEX-5 and new double-walled pipeline.	Under this option, treated water would be disposed of using an array of sprinkler heads, mechanical evaporators, or trucks with high-pressure sprayers.	This option introduces amendments in untreated water and rely on chemical processes to immobilize and detoxify contaminants within soil or groundwater without removing them from the ground.	This option relies on natural physical, chemical, or biological processes to reduce concentrations toxicity, or mobility of chromium. Routine monitoring must be conducted to ensure that MNA is working.

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	The treatment system would consist of a 1,000-gpm dual ion exchange treatment system with prefiltration, associated piping, flow controls, and programmable logic controls and monitoring. **Amount of Chromium Removed:** Approximately 1,800 lbs/yr assuming 400 ppb Cr in extracted water and the increased pumping rate. **Ion Exchange options for Cr treatment system include:** 1. Exchangeable ion exchange vessels 2. Permanent treatment contactors with ion exchange resin would be regenerated off site and delivered via tanker truck. The use of 60 ft^3 contactors is the preferred method for treatment. Current Super 30 vessels contain a media volume of 30 ft^3; media weight is 1,685 lbs. When vessels are sent back to the vendor, a total of 3–4 are sent back at a time (90–120 ft^3 of media). The media remains in the tanks when sent back and the vendor handles the waste according to state and Federal	Land application would only occur in permitted areas per NPDES land permit (not on cultural sites or within waterways/drainages, etc.) and up to land application permitted limits (currently 350,000 gpd).	In-situ options will be evaluated as technologies emerge and will only be used if they do not contribute to additional contamination of the aquifer. For a full list of options that EM-LA is considering, see Section 1.2.	DOE would only implement MNA when it can verify contamination poses relatively low risks, the plume is stable or shrinking, and the natural attenuation processes are projected to achieve remedial objectives in a reasonable timeframe.

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	regulations. The resin is regenerated and reused multiple times. Metals are stripped from the resin and captured as metal hydroxide sludge. The sludge is shipped to a recycling facility by the vendor. EM-LA does not handle waste disposal of this material.			
Facility Effluent and Influent	Influent and effluent filtration would be completed using single or duplex bag filter systems that may be equipped with automated sequencing based on differential pressure. During preliminary design, alternative filtration methods may be evaluated.	Treated water would be land applied in accordance with the permits. Permit requirements are found NMED Ground Water Quality Bureau discharge permit DP-1793 (NMED, 2015). All areas used for land application of treated effluent would be located to avoid known historic properties.	Depending on where and when EM-LA determines in-situ is a viable option, the rates of effluent and influent filtration and application rates have the potential to be the same as Options 1 and 2. Option 3 involves injecting amendments into the aquifer and does not itself involve facility effluent and influent treatment.	A facility for treating groundwater is not a necessary component for MNA. However, MNA would be dependent on what ASM Options EM-LA decides to implement, and in which order.
Equipment for Well Drilling and Other Activities	**Combustion Equipment for Construction of One Well (~1,500 ft) and Pad**			

Equipment	Duration	Purpose
2 Air Compressors	5 months	Used with drill rig
4 Generators	12 months	Used with drill rig and pumping systems
6 Light Plants	6 months	Used during night drilling operations
1 Drill rig	6 months	Drill and install well
1 Smaller rig to set pump/Baski System	1 months	Install pump/Baski system
1 Cement/grout pump	6 months	Used to install cement into well
1 Power washer	6 months	Used to clean equipment after pumping cement
1 Smooth roller	3 months	Well pad construction
1 Sheep foot roller	3 months	Well pad construction
1 Pay loader	3 months	Well pad construction
1 Excavator	3 months	Well pad construction
1 Bulldozer	3 months	Well pad construction
1 Water truck	9 months	Supplies water during well drilling and construction

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	10 deliveries per month for drill pipe, well construction materials, well pad construction materials, frac tanks, etc.			
	Additional Notes This chart applies to all options; however, the following also apply: • **Option 2**: Includes additional trucks for land application and potentially mechanical evaporators • **Option 3:** Additional vehicles and equipment for introduction of treatment amendments and for additional well monitoring • **Option 4:** Additional vehicles and equipment for routine well monitoring			
Employment	120 **Personnel for construction of one Well and Pad:** 38-person teams working concurrently throughout the year with December off. • 8 drilling employees and 30 support/administrative personnel per well (see breakdown) • Total duration of 5 months per well **Drilling personnel:** • 2 Drillers • 4 Hands • 2 Task Managers **T2S support/admin:** • 1 Program Manager • 2 STR • 2 Project Managers • 4 FTL • 1 Engineer • 1 GIS	120 **Personnel for construction of one Well and Pad:** Same as Option 1 **Drilling personnel:** Same as Option 1 **T2S support/admin:** Same as Option 1	120 **Personnel for construction of one Well and Pad:** Same as Option 1 **Drilling personnel:** Same as Option 1 **T2S support/admin:** Same as Option 1	120 **Personnel for construction of one Well and Pad:** Same as Option 1 **Drilling personnel:** Same as Option 1 **T2S support/admin:** Same as Option 1

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	N3B support/admin: • 1 Program Manager • 2 STR • 2 Project manager • 2 FETL • 1 Craft foreman • 10 Crafts Crew • 1 SOM	**N3B support/admin:** Same as Option 1	**N3B support/admin:** Same as Option 1	**N3B support/admin:** Same as Option 1
New Land Disturbance	**Land disturbance during construction:** About 75 ac of total disturbed area for additional wells and access roads (1.33 ac each)	**Land disturbance during construction:** Same as Option 1, land application areas would not otherwise be increased.	**Land disturbance during construction:** Same as Option 1 Option 3 involves injecting amendments into the aquifer and does not itself involve new disturbance. Depending on where and when EM-LA determines in-situ is a viable option, in-situ treatment has the potential to involve the same amounts of land disturbance as Options 1 and 2.	**Land disturbance during construction:** Same as Option 1 New land disturbance is not anticipated for MNA as a stand-alone option. However, MNA would be dependent on what ASM Options EM-LA decides to implement.
Excavation and Backfill	**Cut/Fill Estimates:** Average cut is 550 yd^3; average fill is 600 yd^3. The grading design is completed to balance the cut and fill to the extent possible, and then can be field adjusted to balance even more. Any areas requiring fill are made up with base course material when completing the well pad.	**Cut/Fill Estimates:** Same as Option 1	**Cut/Fill Estimates:** Same as Option 1 Option 3 involves injecting amendments into the aquifer and does not itself involve activities requiring excavation and backfill. Depending on where and when EM-LA determines in-situ is a viable option, excavation and backfill for in-situ treatment have the potential to	**Cut/Fill Estimates:** Same as Option 1 Excavation and backfill are not anticipated for MNA as a stand-alone option. However, MNA would be dependent on what other ASM Options EM-LA decides to implement.

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
			be the same as for Option 1.	
	Base Course (crushed stone) Material: It is assumed that base course material would be applied to a depth of 4 ft over the entire well pad and access road. It is estimated that about 800 yd^3 of base course material is needed for each well and access road. Therefore for 45 additional wells, about 36,000 yd^3 of base course material would be needed. No additional fill would be needed.	**Base Course (crushed stone) Material:** Same as Option 1	**Base Course (crushed stone) Material:** Same as Option 1 Option 3 involves injecting amendments into the aquifer and does not itself involve activities requiring excavation and backfill. Depending on where and when EM-LA determines in-situ is a viable option, excavation and backfill for in-situ treatment have the potential to be the same as for Option 1.	**Base Course (crushed stone) Material:** Same as Option 1 Excavation and backfill are not anticipated for MNA as a stand-alone option. However, MNA would be dependent on what other ASM Options EM-LA decides to implement.
Utility Usage	**Electricity:** Well construction would use portable generators. Operations: Wells/treatment facility will be connected to the existing electrical line system in place for the IM – 3-phase 480-volt power Total electricity use for construction and operation under this option would be 473,040 kilowatt-hours per year.	**Electricity:** Same as Option 1. Land application would require minor additional electricity requirements	**Electricity:** Same as Option 1. In-situ does not require additional electricity	**Electricity:** Same as Option 1
	Water: Well construction would use offsite water and portable toilets. Operations: Water is pumped into production lines, and booster pump stations lift this water to reservoir tanks	**Water:** Same as Option 1	**Water:** Same as Option 1	**Water:** Same as Option 1

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	for distribution. DOE purchases water from Los Alamos County for LANL use.			
Site Access	No Change	No Change	No Change	No Change
Truck Transportation	**Estimated number of truckloads of fill:** Approximately 3,960 truckloads of fill for 45 wells and 10 deep vadose zone piezometers (2,173 loads of fill + 1,788 crushed stone)	**Estimated number of truckloads of fill:** Same as Option 1	**Estimated number of truckloads of fill:** Same as Option 1 Option 3 does not itself involve activities requiring transportation of fill material. Depending on where and when EM-LA determines in-situ is a viable option, excavation and backfill for in-situ treatment have the potential to be the same as for Option 1.	**Estimated number of truckloads of fill:** Same as Option 1 Excavation and backfill are not anticipated for MNA as a stand-alone option. However, MNA would be dependent on what other ASM Options EM-LA decides to implement.
	Estimated number of truckloads of crushed stone: 1,788 crushed stone	**Estimated number of truckloads of crushed stone:** Same as Option 1	**Estimated number of truckloads of crushed stone**: Same as Option 1	**Estimated number of truckloads of crushed stone:** Same as Option 1
	Estimated number of truckloads of concrete: Extraction and injection well pads would require a total of 110 truckloads of concrete into the site. Shallow piezometers in Sandia Canyon would require approximately 5 truckloads of concrete.	**Estimated number of truckloads of concrete:** Same as Option 1	**Estimated number of truckloads of concrete:** Same as Option 1	**Estimated number of truckloads of concrete:** Same as Option 1
	Estimated number of truckloads of well casing: 4,950 total truckloads for 45 wells and 10 deep vadose zone	**Estimated number of truckloads of well casing:** Same as Option 1	**Estimated number of truckloads of well casing:** Same as Option 1	**Estimated number of truckloads of well casing:** Same Option 1

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	piezometers – 10 deliveries per month per well for drill pipe, well construction materials, well pad construction materials, frac tanks, etc.			
	Estimated number of truckloads of piping: 16 truckloads of piping would be needed to transport the 61,000 ft of new piping.	**Estimated number of truckloads of piping:** Same as Option 1	**Estimated number of truckloads of piping:** Same as Option 1	**Estimated number of truckloads of piping:** Same as Option 1
	Estimated number of truckloads of Ion Exchange Resin: 75–100 (or an average of 88) truck shipments annually	**Estimated number of truckloads of Ion Exchange Resin:** Same as Option 1	**Estimated number of truckloads of Ion Exchange Resin:** Same as Option 1	**Estimated number of truckloads of Ion Exchange Resin:** Same as Option 1
	Estimated number of truckloads of other materials and equipment: Construction and operation of the new wells and piezometers would need about a total of about 3, 960 truckloads of course base fill, about 130 truckloads of concrete and piping, 4,950 truck deliveries for the drilling operations, 2,011 truckloads of road fills, and 88 truckloads ion exchange resin for the annual road maintenance and treatment facilities operation.	**Estimated number of truckloads of other materials and equipment:** Same as Option 1	**Estimated number of truckloads of other materials and equipment:** Same as Option 1	**Estimated number of truckloads of other materials and equipment:** Same as Option 1
Waste Management	No sources of hazardous materials or waste are known that would substantively contribute to potential project efforts. Small quantities of construction debris, approximately 30 gpy of hazardous waste; industrial waste (i.e., construction debris) generated from the project would be	Same as Option 1	Same as Option 1	Same as Option 1

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	approximately 50 yd^3 per yr. This waste would be shipped to various facilities outside Los Alamos for disposal. Ion exchange resin would be tracked and a vessel would be removed from service once the resin capacity is exhausted. Resin vessel would be sampled and analyzed to determine if it is a hazardous waste before the resin is returned to the vendor for regeneration and/or shipped as hazardous waste but still returned to vendor for regeneration. Injection well maintenance would occur once per year, per well. Approximately 50,000 gal of treated water with chemical additives would be produced from each well annually. If 4 wells are drilled in one year a total of 200,000 gal of treated water with chemical additives would be produced each year.			
Hazardous Materials and Waste Generation	**Annual Volumes of Nonhazardous Waste Generated:** 50 yd^3 per yr **Annual Volumes of Hazardous Waste Generated:** 30 gpy **Annual Volume of Wastewater Generated:** 50,000 gpy of treated	**Annual Volumes of Nonhazardous Waste Generated:** Same as Option 1 **Annual Volumes of Hazardous Waste Generated:** Same as Option 1 **Annual Volume of Wastewater Generated:** Same as Option 1	**Annual Volumes of Nonhazardous Waste Generated:** Same as Option 1 **Annual Volumes of Hazardous Waste Generated:** Same as Option 1 **Annual Volume of Wastewater Generated:** Same as Option 1	**Annual Volumes of Nonhazardous Waste Generated:** Same as Option 1 **Annual Volumes of Hazardous Waste Generated:** Same as Option 1 **Annual Volume of Wastewater Generated:** Same as Option 1

Table B-1. Description of the proposed adaptive site management alternatives[1]

Issue	ASM Option 1: Mass Removal with Expanded Pump and Treat and Expanded Injection	ASM Option 2: Mass Removal with Land Application	ASM Option 3: Mass Removal with In-situ Treatment	ASM Option 4: Monitored Natural Attenuation (MNA)
	water from maintenance and monitoring at each injection well. **Waste Treatment and Disposal Pathways:** All wastes are handled, treated, and disposed of in accordance with state regulations; applicable to specific waste classifications.	**Waste Treatment and Disposal Pathways:** Same as Option 1	**Waste Treatment and Disposal Pathways:** Same as Option 1	**Waste Treatment and Disposal Pathways:** Same as Option 1
Noise	**Schedule for construction of wells (i.e., days per well, hours of operation, etc.):** See schedule information. **Schedule of operation for water trucks for dust control (i.e., hours and days of operation):** fugitive dust suppression activities would be necessary during construction of wells, access roads, and other ground disturbing activities.	**Schedule for construction of wells (i.e., days per well, hours of operation, etc.):** Same as Option 1 **Schedule of operation for water trucks for dust control (i.e., hours and days of operation):** Same as Option 1 **Schedule of operation for water trucks for land application (i.e., hours and days of operation):** See schedule information above.	**Schedule for construction of wells (i.e., days per well, hours of operation, etc.):** Same as Option 1 **Schedule of operation for water trucks for dust control (i.e., hours and days of operation):** Same as Option 1	**Schedule for construction of wells (i.e., days per well, hours of operation, etc.):** Same as Option 1 **Schedule of operation for water trucks for dust control (i.e., hours and days of operation):** Same as Option 1

Key: < = less than; % = percent; ac = acre; AOCs = areas of concern; ASM = adaptive site management; Cr = chromium; CrIN = chromium injection; CrEX = chromium extraction; DOE = U.S. Department of Energy; DP = discharge permit; EA = Environmental Assessment; EM-LA = Environmental Management Los Alamos; FETL = Field Execution Team Leader; ft = feet; ft^2 = square feet; ft^3 = cubic feet; FTL = Field Team Leader; gal = gallon; GIS = geographic information systems; gpd = gallons per day; gpm = gallons per minute; gpy = gallon per year; hr = hour; IBC = International Building Codes; IM = interim measure; IM EA = Interim Measure Environmental Assessment; ISBR = in-situ biological reduction ; ISCR = in-situ chemical reduction; LANL = Los Alamos National Laboratory; lbs = pounds; MNA = monitored natural attenuation; N3B = Newport News Nuclear BWXT-Los Alamos, LLC; N/A = not applicable; NMED = New Mexico Environmental Department; NPDES = National Pollutant Discharge Elimination System; ppb = parts per billion; SME = subject matter expert; SOM = ; Shift Operations Manager; STR = Subcontractor Technical Representative; SWMU = Solid Waste Management Unit; yd^3 = cubic yard; yr = year

B.4 ALTERNATIVES CONSIDERED BUT NOT EVALUATED

EM-LA considered other alternatives in the development of potential actions to remediate the hexavalent chromium plume. Many technologies were considered for mass removal and control of chromium migration in regional groundwater and treatment of the chromium sources in Sandia Canyon sediment, shallow or vadose zone groundwater, and intermediate groundwater. Those evaluated, but removed from consideration, are listed in Table B-2.

B.5 REFERENCES

DOE. (2015). *Environmental Assessment for Chromium Plume Control Interim Measure and Plume Center Characterization.* U.S. Department of Energy. https://www.energy.gov/sites/default/files/2015/12/f27/EA-2005-FEA-2015.pdf.

EPA. (2000). *In Situ Treatment of Soil And Groundwater Contaminated With Chromium - Technical Resource Guide*. Cincinnati, OH: U.S. Environmental Protection Agency. https://nepis.epa.gov/Exe/ZyPDF.cgi/30004GUQ.PDF?Dockey=30004GUQ.PDF.

LANL. (2009). *Investigation Report for Sandia Canyon.* Los Alamos National Laboratory document LA-UR-09-6450. Los Alamos, New Mexico: October. https://permalink.lanl.gov/object/tr?what=info:lanl-repo/lareport/LA-UR-09-06450.

NMED. (2015). *Ground Water Quality Bureau discharge permit DP-1793.* New Mexico Environmental Department. https://www.env.nm.gov/wp-content/uploads/sites/12/2016/05/DP1793-Permit-07-27-2015.pdf.

NNSA. (2010). *Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Envrionmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory Los Alamos, New Mexico*. DOE/EA-1736. Los Alamos, New Mexico: U.S. Department of Energy National Nuclear Security Administration. August 24. https://www.energy.gov/nepa/articles/doeea-1736-final-environmental-assessment.

Table B-2. Alternatives considered but not evaluated

Location	Technology	Effectiveness	Maturity	Relative Cost	Implementability	Reason Eliminated from Further Analysis
Sandia Canyon	Sediment/soil excavation	+	+	-	-	Excavation is technically feasible but cost prohibitive. Further, the status as a protected wetland prevents excavation of the area.
	DPT injection with ISCR/ISBR agents	-	-	-	-	Not needed. Data from geochemical studies presented in the Phase I IR (LANL, 2009) and Sandia wetland performance reports indicate that chromium in wetland sediments is predominantly geochemically stable as Cr(III) and is not likely to become a future source of chromium contamination in groundwater, especially if saturated conditions are maintained within the wetland.
	Sediment/soil mixing with ISCR/ISBR agents	+	+	-	-	
	Infiltration with ISCR/ISBR agents	-	-	-	-	
	Phytoremediation	-	-	+	-	Insoluble Cr(III) is not conducive to plant uptake, and some species can increase dissolved oxygen near their roots, which may not be favorable for maintenance of Cr(III).
	Containment	+	+	-	-	Containment barriers such as capping, grout walls are not needed to limit human or ecological exposure. Also not needed because chromium in wetland sediments is predominantly geochemically stable as Cr(III) and is not likely to become a future source of chromium contamination in groundwater, especially if saturated conditions are maintained within the wetland.
	Electrokinetic treatment	-	-	-	-	Innovative but has only been tested at pilot scale. Requires soluble Cr(VI), not insoluble Cr(VI). Expensive to install and operate.
Sandia Canyon Shallow/Vadose Zone Groundwater	Extraction with wells	+	+	-	-	Alluvium is too thin with low transmissivity for extraction wells.
	Extraction using a recovery trench	+	+	+	+	If extraction is used, a recovery trench spanning the width of the alluvium would be needed.

Table B-2. Alternatives considered but not evaluated

Location	Technology	Effectiveness	Maturity	Relative Cost	Implementability	Reason Eliminated from Further Analysis
	Extraction + ex situ groundwater treatment	+	+	+	+	Groundwater extraction would be feasible, if the occasional exceedances of Sandia Canyon alluvial groundwater (50–75 g/L range) indicate the need. Two of the proven industry-standard, full-scale treatment technologies are coagulation (or flocculation) and ion exchange. Others are not widely used for Cr in groundwater.
	Ion exchange for Cr(VI)	+	+	-	+	
	Reduction, precipitation and coagulation for Cr(VI)	+	+	-	+	
	Electrochemical precipitation for Cr(VI)	-	-	-	+	
	Reverse Osmosis/nanofiltration for Cr(VI)	-	-	-	+	
	Biochemical reactor/fluidized bed for Cr(VI)	-	-	-	+	
	Adsorption (activated carbon, Fe/Mn greensand) for Cr(VI)	-	-	-	+	
	Treated groundwater for municipal supply	+	-	-	-	Unlikely to attain public support, though currently used at several Cr contaminated drinking water aquifers in the U.S.
	Treated groundwater to POTW NPDES	+	+	-	-	The POTW for Los Alamos does not discharge to Sandia Canyon, and piping the discharge from a Sandia Canyon system would be impractical. The permitted Sandia Canyon outfall serves as the discharge for LANL treated sewage, and inclusion in the NPDES outfall permit may be possible for low flow rates.
	PRB	+	+	-	+	A PRB was included to potentially treat the occasional exceedance of the Cr standard in Sandia Canyon groundwater, but these exceedances are likely due to mobilized Cr(III) precipitates, which could be filtered but are non-reactive.

Table B-2. Alternatives considered but not evaluated

Location	Technology	Effectiveness	Maturity	Relative Cost	Implementability	Reason Eliminated from Further Analysis
	ZVI for Cr(VI)	+	+	-	+	Often used in a PRB setting (see PRB explanation).
	Adsorptive amendment for Cr(III)	-	-	-	+	As currently conceptualized, mobile Cr(III) colloids or nano precipitates are not adsorbed.
	Containment: slurry wall/sheet pile/grout curtain + extraction + treatment	+	+	-	-	If groundwater extraction in the alluvium were implemented, a groundwater extraction trench rather than these types of barriers would be used.
Intermediate and Regional Groundwater	Extraction + ex situ groundwater treatment	+	+	-	+	Two of the proven industry-standard, full-scale treatment technologies are coagulation (or flocculation) and ion exchange. Others are not widely used for Cr in groundwater.
	Electrochemical precipitation for Cr(VI)	-	-	-	+	
	Reverse Osmosis/nanofiltration for Cr(VI)	+	-	-	+	
	Biochemical reactor/fluidized bed for Cr(VI)	+	-	-	+	
	Adsorption (activated carbon, Fe/Mn greensand) for Cr(VI)	+	-	-	+	
	Constructed wetland (passive treatment) for Cr(VI)	+	-	+	-	
	Treated groundwater for municipal supply	+	-	-	-	Unlikely to attain public support, though currently used at several Cr contaminated drinking water aquifers in the U.S.
	Containment - fracture grouting	-	-	-	-	Involves sealing the fractured infiltration in intermediate groundwater, but fracture sealing the tuff would be difficult and sealing the brecciated Cerro del Rio all but impossible.

Key: Cr = chromium; DPT = direct push technology; Fe/Mn = iron/manganese; g/L = grams per liter; IR =Investigation Report; ISBR = in-situ biological reduction; ISCR = in-situ chemical reduction; LANL = Los Alamos National Laboratory; NPDES = National Pollutant Discharge Elimination System; PRB = Permeable Reactive Barrier; POTW = Publicly Owned Treatment Works; U.S. = United States

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Appendix C
Environmental Resources Supporting Information

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ENVIRONMENTAL RESOURCES SUPPORTING INFORMATION

C.1 WATER RESOURCES

This section presents figures illustrating groundwater components, contours of CR(VI), water table maps, and deep screen hydraulic head maps.

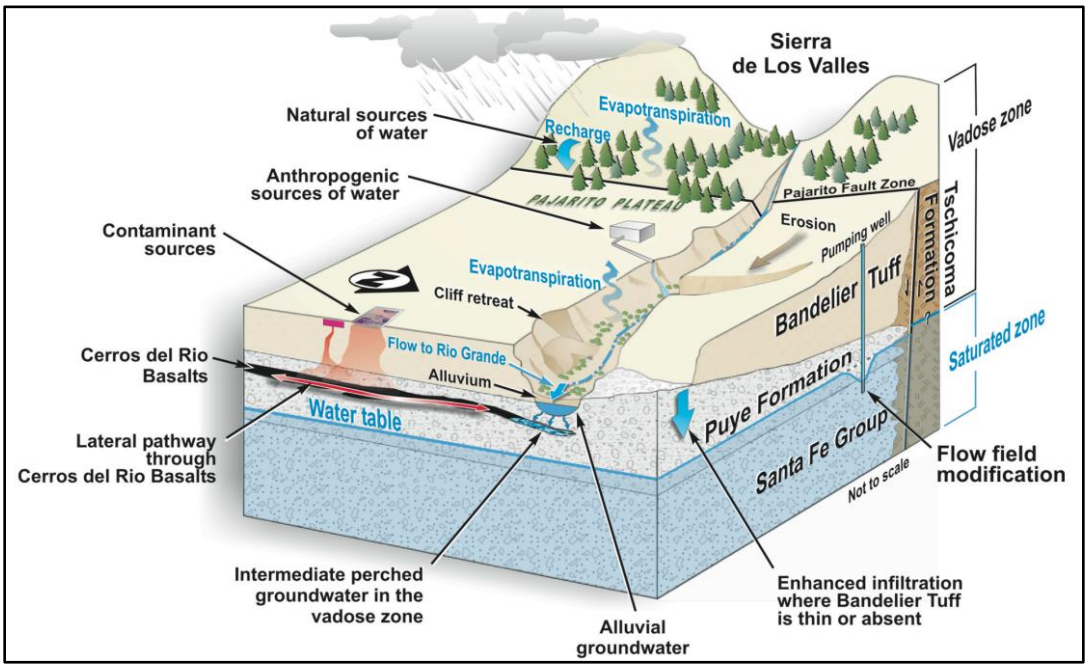


Figure C-1. Groundwater components at Los Alamos National Laboratory (Figure 1-2 from LANL, 2005)

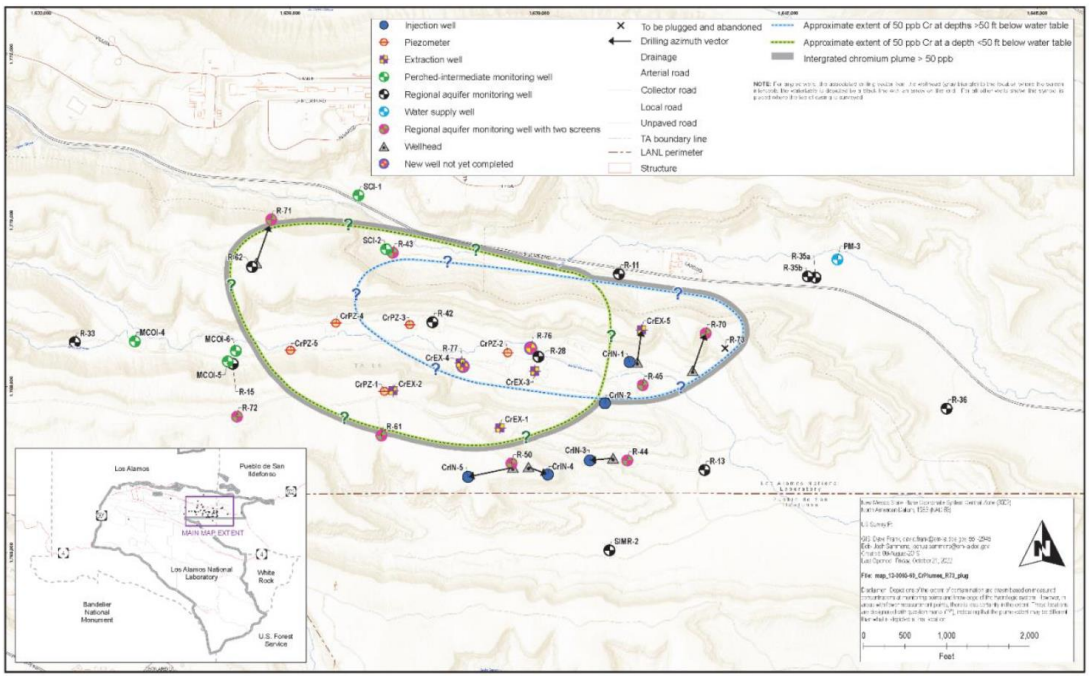


Figure C-2. Approximate iso-concentration contours of Cr(VI) in the regional aquifer with the locations of monitoring, injection, extraction, and water supply wells, and piezometers

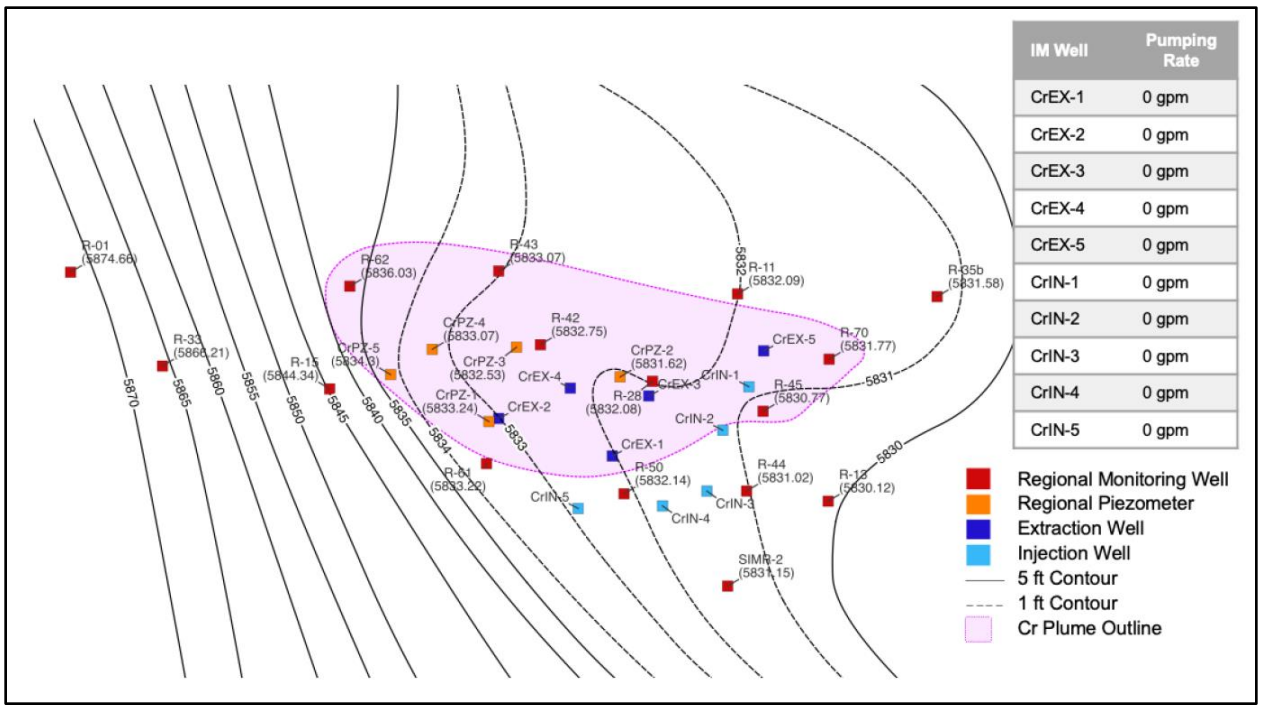


Figure C-3. Water table map for May 1, 2020, 1:00 a.m., which represents ambient ("baseline") conditions (Figure 8 from Neptune, 2023)

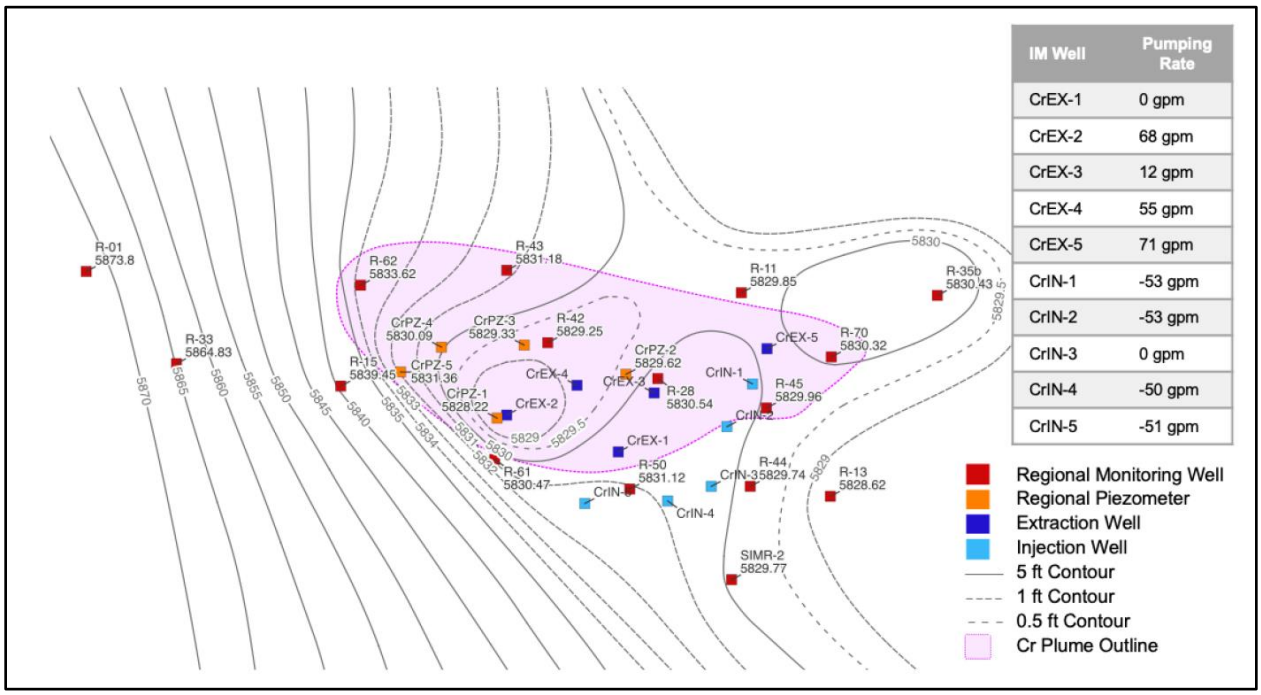
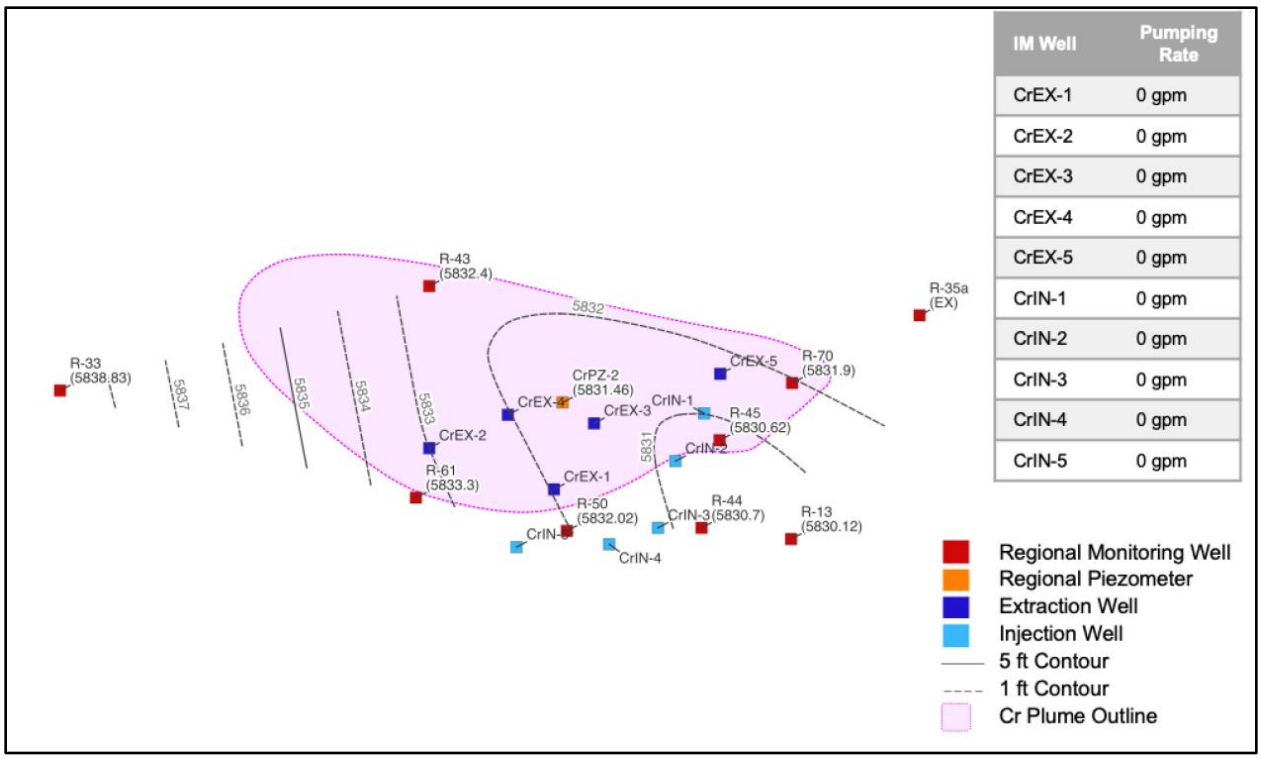
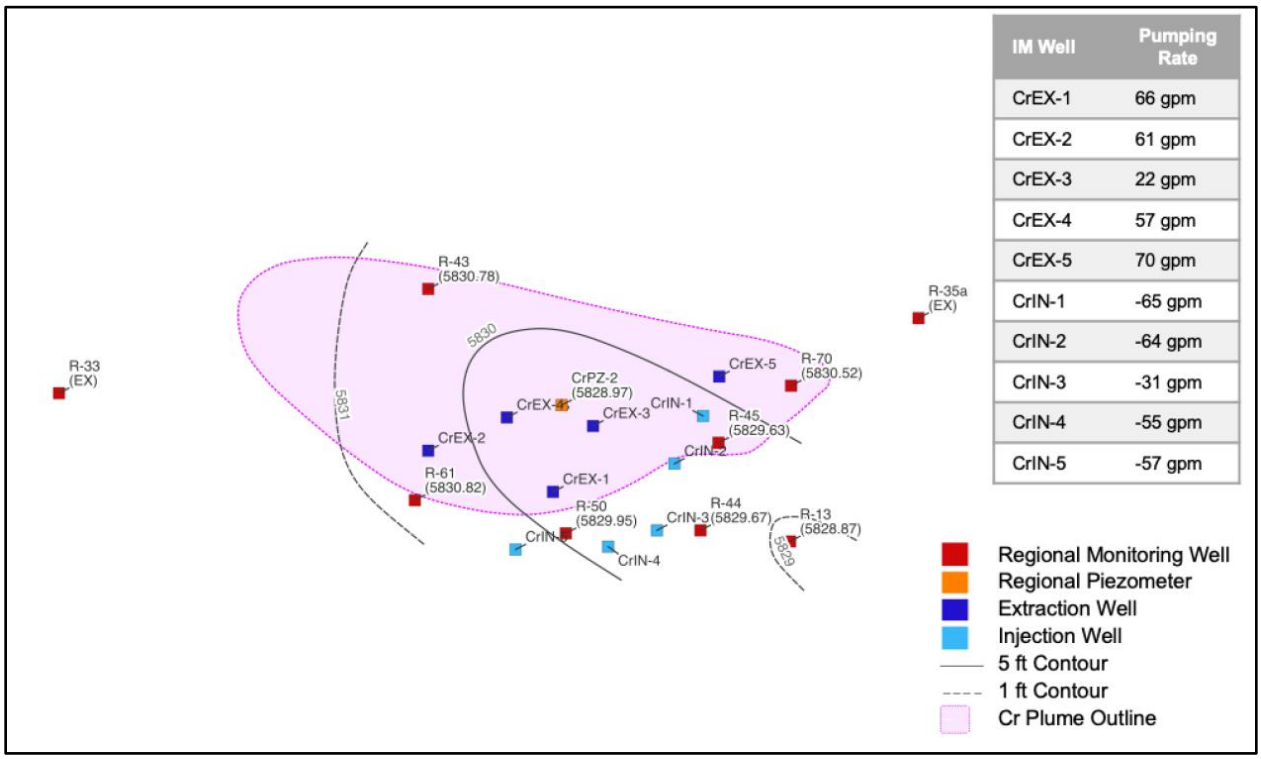


Figure C-4. Water table map for November 1, 2021, 1:00 a.m., which includes nearly full interim measure operation (with the exception of CrEX-1 and CrIN-3) (Figure 6 from Neptune, 2023)



IM Well	Pumping Rate
CrEX-1	0 gpm
CrEX-2	0 gpm
CrEX-3	0 gpm
CrEX-4	0 gpm
CrEX-5	0 gpm
CrIN-1	0 gpm
CrIN-2	0 gpm
CrIN-3	0 gpm
CrIN-4	0 gpm
CrIN-5	0 gpm

Figure C-5. Deep screen hydraulic head map for May 1, 2020, 1:00 a.m., which represents ambient ("baseline") conditions (Figure 9 from Neptune, 2023)



IM Well	Pumping Rate
CrEX-1	66 gpm
CrEX-2	61 gpm
CrEX-3	22 gpm
CrEX-4	57 gpm
CrEX-5	70 gpm
CrIN-1	-65 gpm
CrIN-2	-64 gpm
CrIN-3	-31 gpm
CrIN-4	-55 gpm
CrIN-5	-57 gpm

Figure C-6. Deep screen hydraulic head map for June 15, 2021, 1:00 a.m., which includes full interim measure operation (pumping and injection at all CrIN/CrEX wells) (Figure 10 from Neptune, 2023)

Water Resources Supporting Information References

LANL. (2005). *Los Alamos National Laboratory's Hydrogeologic Studies of the Pajarito Plateau: A Synthesis of Hydrogeologic Workplan Activities (1998-2004)*. LA-14263-MS. https://www.osti.gov/servlets/purl/883647.

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C.2 AIR QUALITY

This section presents a figure illustrating the wind rose for Technical Area (TA)-5 Mortandad Canyon (MDCN).

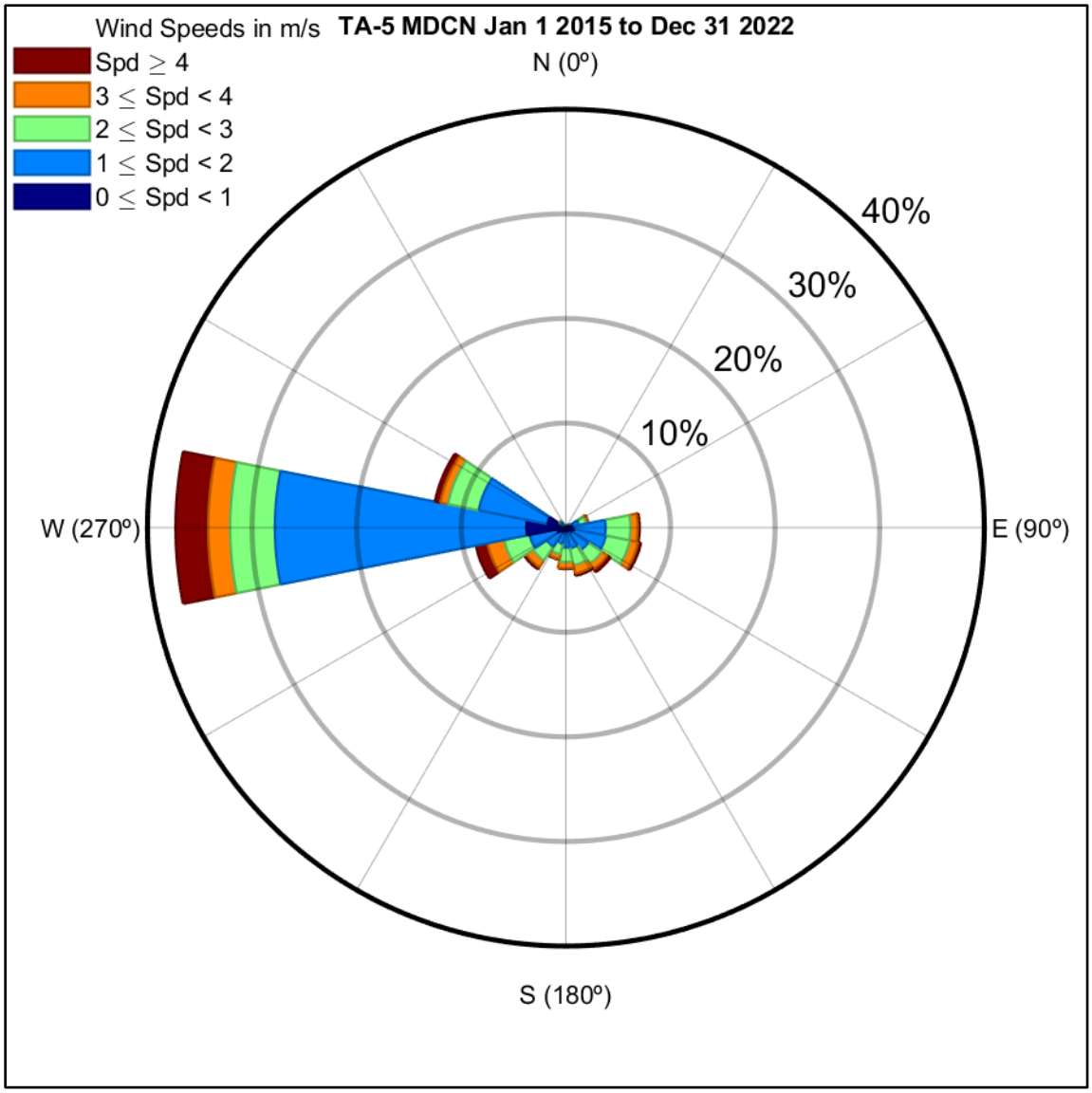

Figure C-7. Wind rose with speeds in meters per second (TA-5 MDCN)

The U.S. Department of Energy (DOE) Office of Environment Management (EM) would implement the following best management practices to minimize fugitive dust emissions during the proposed installation activities:

- During conditions of dry soil, use water spray/mists to minimize dust emissions generated from the operation of equipment on bare soils and the movement of vehicles on unpaved surfaces. When necessary due to dry conditions, apply water at the end of the workday to areas of soils disturbed during the day.
- Limit haul truck speeds to 15 miles per hour on any unpaved surface and 20 miles per hour on any paved surface. Post signs throughout the site to remind equipment operators and truck drivers of the speed limits.
- Consider covering unpaved roads with a low-silt-content material such as recycled road base or gravel to a minimum of 4 inches.
- Load and unload materials carefully to minimize the potential for spills or dust creation. Minimize drop height from loader bucket.
- To prevent soil haul trucks from tracking soil onto paved roads, use at least one of the following measures at each vehicle egress from on-site unpaved surfaces to on-site paved roads or public roads:
    - Install a pad consisting of washed gravel (minimum size of 1 inch) that is maintained in a clean condition to a depth of at least 6 inches and extending at least 30 feet wide and at least 50 feet long.
    - Pave the surface at least 100 feet long and at least 20 feet wide.
    - Use a wheel shaker/wheel spreading device, also known as a rumble grate, consisting of raised dividers (rails, pipe, or grates) at least 24 feet long and at a sufficient width to allow all wheels of vehicle traffic to travel over grate to remove bulk material from tires and vehicle undercarriages before vehicles exit unpaved surfaces.
    - Install and use a wheel-washing system to remove bulk material from tires and vehicle undercarriages before vehicles exit unpaved surfaces.
    - Use any other control measure or device that prevents track-out onto paved roads.
- Use properly secured tarps that cover the entire surface area of truck loads. Maintain a minimum of 6 inches of freeboard or water, or otherwise treat the bulk material to minimize loss of material to wind or spillage.
- Soil Storage Piles: Implement at least one of the following measures:
    - Apply water at a sufficient quantity and frequency to prevent wind-driven dust.
    - Apply a non-toxic dust suppressant that complies with air and water quality agency standards at a sufficient quantity and frequency to prevent wind-driven dust.
    - Install and anchor tarps or plastic over the material.
    - Use surface crusting agents on inactive storage piles.
- Use a street sweeper at least twice per day to remove silt from on-site, paved roads traveled by haul trucks. Remove all track-out at the conclusion of each workday.
- To avoid fugitive dust during high wind conditions, cease soil disturbance activities if on-site wind speeds exceed 25 miles per hour for at least 5 minutes in an hour.

- Designate personnel to monitor the dust control program and increase control measures, as necessary, to minimize the generation of dust. This responsibility would extend to after-work hours.

C.3 ECOLOGICAL RESOURCES

This section presents figures and tables depicting vegetation types and special status species in the project area.

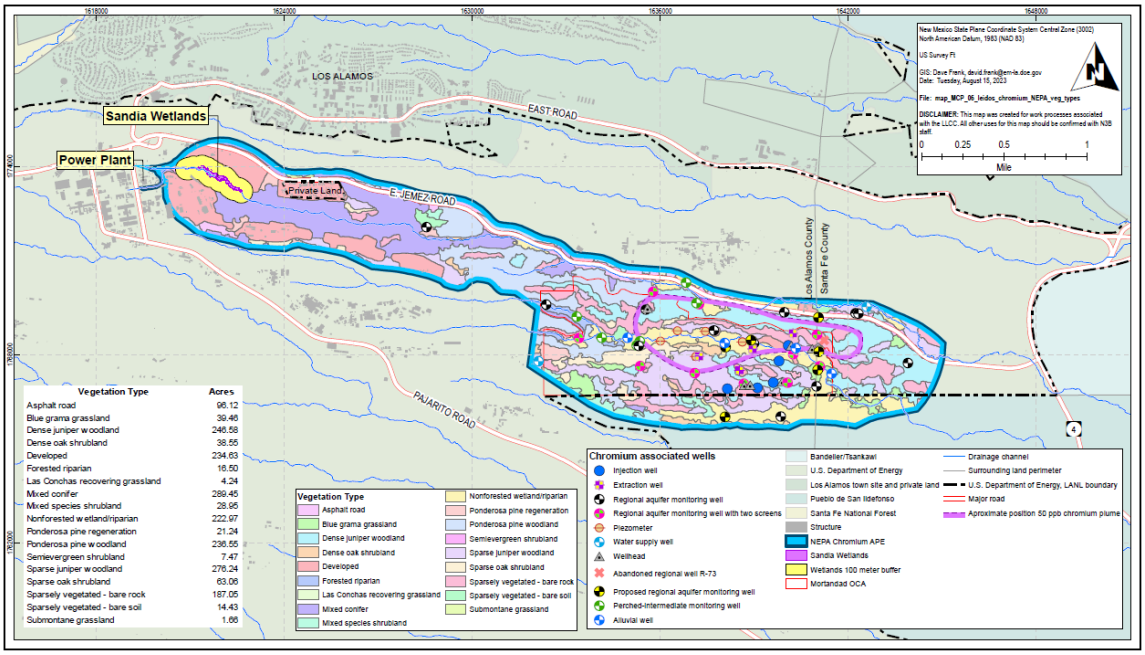

Figure C-8. Vegetation types in the project area

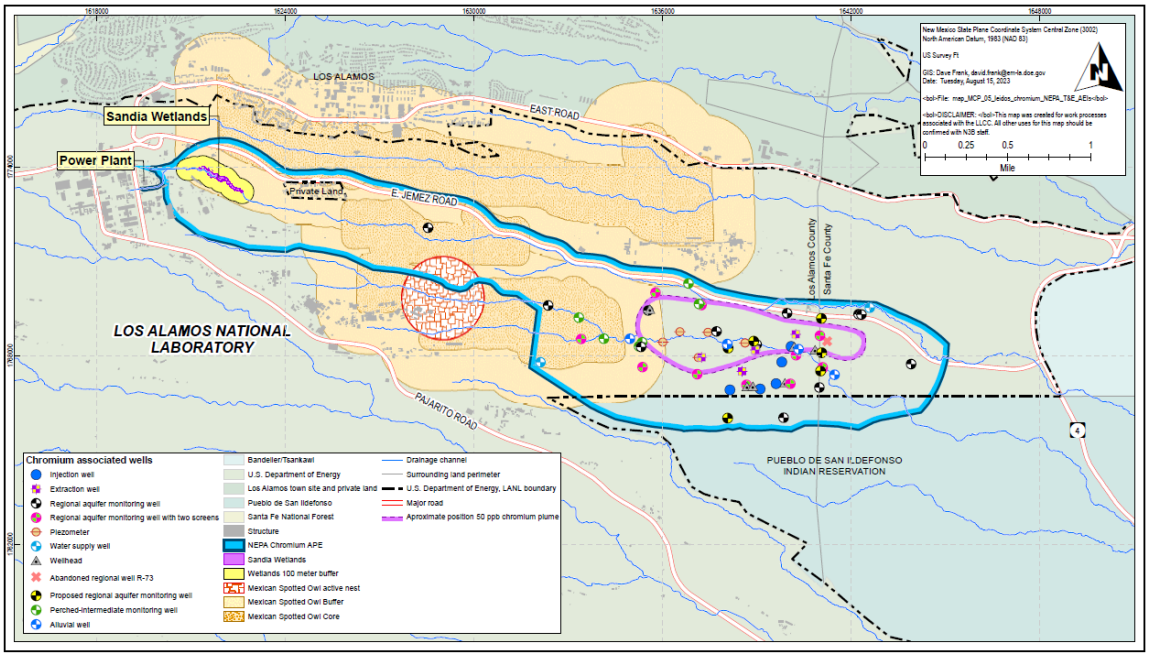

Figure C-9. Threatened, endangered, and sensitive species in the project area

Table C-1. Sensitive species at Los Alamos National Laboratory

Common name	Scientific name	New Mexico State Status	SWAP Category	NHNM [a]	Other [b]
Mammals					
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*		Susceptible	S3	
Spotted Bat	*Euderma maculatum*	Threatened	Susceptible	S3	
Gunnison's prairie dog	*Cynomys gunnisoni*		Immediate priority	S2	
Birds					
Bald Eagle	*Haliaeetus leucocephalus*	Threatened		S1	
Peregrine Falcon	*Falco peregrinus*	Threatened		S3	
Northern Goshawk	*Accipiter gentilis*			S2, S3	
Flammulated Owl	*Psiloscops flammeolus*		Immediate priority	S3	PIFWL
Lewis's Woodpecker	*Melanerpes lewis*		Immediate priority	S3	PIFWL
Gray Vireo	*Vireo vicinior*	Threatened	Immediate priority	S3	PIFWL
Pinyon Jay	*Gymnorhinus cyanocephalus*		Immediate priority	S2, S3	PIFWL
Juniper Titmouse	*Baeolophus ridgwayi*		Immediate priority		
Evening Grosbeak	*Coccothraustes vespertinus*		Susceptible		PIFWL
Cassin's Finch	*Haemorhous cassinii*		Susceptible	S3	PIFWL
Black-chinned Sparrow	*Spizella atrogularis*		Immediate priority	S3	PIFWL
Virginia's Warbler	*Leiothlypis virginiae*		Immediate priority	S3	PIFWL
Grace's Warbler	*Setophaga graciae*		Immediate priority	S3	PIFWL
Black-throated Gray Warbler	*Setophaga nigrescens*		Immediate priority	S3	
Amphibians and Reptiles					
Smooth Green Snake	*Opheodrys vernalis*			S3	
Plants					
Mountain wood lily	*Lilium philidelphicum*	Endangered		S3	
Springer's Blazingstar	*Mentzelia springeri*			S2	
Yellow Lady's Slipper	*Cypripedium parviflorum*	Endangered		S2	
Giant Helleborine Orchid	*Epipcactis gigantea*			S2	
Sapello canyon larkspur	*Delphinium sapellonis*			S3	
Invertebrates					
Monarch Butterfly	*Danaus plexippus*				Proposed

Sources: (LANL, 2020a)
Key: NHNM = Natural Heritage New Mexico; PIFWL = Partners in Flight watch list; Proposed; SWAP = New Mexico State Wildlife Action Plan
Notes:
[a] NHNM : Natural Heritage New Mexico state rankings of critically imperiled (S1), imperiled (S2), vulnerable (S3).New Mexico
[b] PIFWL: Partners in Flight watch list; Proposed: Proposed for Federal listing under the Endangered Species Act.

Table C-2. Summary of best management practices for threatened, endangered, sensitive species, pollinators, migratory birds and non-native invasive plants on Los Alamos National Laboratory

Common name Scientific name	Best Management Practices
Mammals	
Pale Townsend's Big-eared Bat *Corynorhinus townsendii pallescens*	Do not disturb active bat roosts, including on buildings. Avoid removing standing dead trees in the summer months. Buildings and outside structures slated for demolition should be inspected by biologists before work is conducted.
Spotted Bat *Euderma maculatum*	Do not disturb active bat roosts, including on buildings. Avoid removing standing dead trees in the summer months. Buildings and outside structures slated for demolition should be inspected by biologists before work is conducted. Because this species is so rare and not well understood, any sightings should be reported to biologists.
Gunnison's prairie dog *Cynomys gunnisoni*	Survey known locations before development.
Birds	
Bald Eagle *Haliaeetus leucocephalus*	In Bald Eagle habitat on LANL's eastern boundary along the Rio Grande, new power lines should comply with the suggested practices adopted by the electrical industry.
Peregrine Falcon *Falco peregrinus*	Avoid disturbing cliff structure in the canyons between March 1 and May 15 without having a Biological Resources SME survey the cliffs for peregrine nests. Limit human activity within 400 m of a nest site.
Northern Goshawk *Accipiter gentilis*	Avoid large tree removal in mixed conifer habitat from April through June. If tree removals are necessary during this time, contact a Biological Resources SME to survey trees before removal. No logging within 800 m of active nests or within established post-fledging areas (Reynolds et al. 1992).
Flammulated Owl *Psiloscops flammeolus*	Avoid tree and snag removal in mixed conifer habitat from April through June. If tree or snag removals are necessary during this time, contact a Biological Resources SME to survey the trees before removal.
Lewis's Woodpecker *Melanerpes lewis*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Gray Vireo *Vireo vicinior*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Pinyon Jay *Gymnorhinus cyanocephalus*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Juniper Titmouse *Baeolophus ridgwayi*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be

Table C-2. Summary of best management practices for threatened, endangered, sensitive species, pollinators, migratory birds and non-native invasive plants on Los Alamos National Laboratory

Common name Scientific name	Best Management Practices
	paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Evening Grosbeak *Coccothraustes vespertinus*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Cassin's Finch *Haemorhous cassinii*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Black-chinned Sparrow *Spizella atrogularis*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Virginia's Warbler *Leiothlypis virginiae*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Grace's Warbler *Setophaga graciae*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Black-throated Gray Warbler *Setophaga nigrescens*	During vegetation-removal operations, active nests with eggs or nestlings could get destroyed. The BMP to protect these nests is to schedule tree and shrub removal outside of the peak bird-nesting season, May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.
Mexican Spotted Owl *Strix occidentalis lucida*	Restriction of activities in undeveloped occupied Mexican spotted owl AEI. In Core habitat, people, vehicles, other light production and noise production is restricted from March 1–August 31. In AEIs Timing of projects must take into account that projects in core areas or projects that violate restrictions for occupied buffer areas must stop on February 28 of each year until occupancy status of the AEI is determined. Make every reasonable effort to reduce the noise from explosives testing within 800 m (2,624 ft) of occupied habitat. Methods to reduce noise could include contained shots, noise shields in the direction of AEI cores, etc. For night shots, every reasonable effort should be made to limit the amount of light directed into AEI core areas. Install signs on dirt roads and trails that lead into AEIs, posting them as restricted access areas and providing a contact number for access restrictions. Keep disturbance and noise to a minimum. Avoid unnecessary disturbance to vegetation (e.g., excessive parking areas or equipment storage areas, off-road travel, materials storage areas, crossing of streams or washes). Avoid removal of vegetation along drainage systems and stream channels.

Table C-2. Summary of best management practices for threatened, endangered, sensitive species, pollinators, migratory birds and non-native invasive plants on Los Alamos National Laboratory

Common name Scientific name	Best Management Practices
	Avoid all vegetation removals not absolutely necessary. Employ appropriate erosion and runoff controls to reduce soil loss. The controls must be put in place and periodically checked throughout the life of projects. Revegetate all exposed soils as soon as feasible after construction to minimize erosion. Focus development away from undeveloped areas on the western end of the Los Alamos Canyon AEI. Any development in buffer of Sandia-Mortandad AEI would require consultation.
Southwestern Willow Flycatcher *Empidonax traillii extimus*	Restriction of activities in undeveloped occupied Southwestern Willow Flycatcher AEI. In Core habitat, people, vehicles, other light production and noise production is restricted from May 15–September 15. No wetland vegetation will be removed outside of developed areas. Employ appropriate erosion and runoff controls to reduce soil loss. Avoid unnecessary disturbance to vegetation (e.g., excessive parking areas or equipment storage areas, off-road travel, materials storage areas, crossing of streams or washes). Avoid removal of vegetation along drainage systems and stream channels. Avoid all vegetation removals not absolutely necessary. Appropriate erosion controls must be put in place and periodically checked throughout the life of any projects. Revegetate all exposed soils as soon as feasible after disturbance to minimize erosion.
Amphibians and Reptiles	
Smooth Green Snake *Opheodrys vernalis*	Survey sites with suitable habitat before development.
Jemez Mountain Salamander *Plethodon neomexicanus*	Habitat alterations other than the fuels management practices and utility corridor maintenance are not allowed in undeveloped core areas. If a project or activity is planned that would alter habitat in an undeveloped core area, it must be individually evaluated for Endangered Species Act compliance. Habitat alterations in buffer areas must be reviewed by LANL biologists to ensure that there are no impacts to core habitat.
Plants	
Mountain wood lily *Lilium philidelphicum*	Survey sites with suitable habitat before development.
Springer's Blazingstar *Mentzelia springeri*	Survey sites with suitable habitat before development.
Yellow Lady's Slipper *Cypripedium parviflorum*	Survey sites with suitable habitat before development.
Giant Helleborine Orchid *Epipcactis gigantea*	Survey sites with suitable habitat before development.
Sapello canyon larkspur *Delphinium sapellonis*	Survey sites with suitable habitat before development.
Invertebrates	
Monarch Butterfly *Danaus plexippus*	Prioritize mowing before July 1. Do not mow from July 1–October 15. If mowing is necessary during that period, biologists should check the milkweed patches for eggs, caterpillars, and pupae before mowing. During the early breeding season (May–June), perform light mowing at minimum height of 30–40 cm and/or mow milkweed in patches. Preserve some milkweed patches during the breeding season.

Table C-2. Summary of best management practices for threatened, endangered, sensitive species, pollinators, migratory birds and non-native invasive plants on Los Alamos National Laboratory

Common name Scientific name	Best Management Practices
	Plant native milkweed and wildflower seeds where possible for mitigation, restoration, and/or to enhance existing habitat. No mowing recommended July1–October 15, Light Mowing May 1–June 30, Priority mowing October 16–April 30.
Pollinators	If a high-quality site is identified in a project area, recommended site-specific prescriptions can be used to lessen the effects of the project and ensure that this valuable resource is protected. Site-specific prescriptions could include administrative controls, such as roadside vegetation management timing considerations, and physical controls, such as flushing bars on mowers to allow pollinators to escape mowing.
Native Bees	• Use seed from native forbs, grasses, and other plant species beneficial to local pollinators, and prioritize plant species that will provide continuous blooms from early spring to late fall for use in restoration and mitigation projects. • Avoid disturbing high-quality habitat areas that contain a variety of native flowering plants. • Remove invasive species opportunistically. Invasive non-flower species—particularly invasive Eurasian grasses—do not provide food for pollinators and restrict native bee-nesting areas. When possible, integrate roadside vegetation management, including mow during non-blooming seasons (late October through April). • When summer mowing is necessary, stagger mowing and/or mow in patches to ensure that some nectar flowers are always available and/or cut vegetation high (minimum 12–16 in). Allow pollinators and other wildlife to escape mower blades by using a flushing bar on the mower. Use herbicides efficiently and effectively. Avoid damage to non-target plants by using selective herbicides when feasible.
Migratory Birds	
	• Schedule tree and shrub removal outside of the peak bird-nesting season: May 15–July 15. During this time, EPC-ES biologists can survey trees and shrubs immediately before removal. If active nests are discovered outside of the breeding season, then work will be paused, and EPC-ES biologists must be notified. • Do not remove standing dead trees unless there is a hazard to workers. • Any active bird nests encountered regardless of the time of year are protected, including nests built within structures or equipment. Contact a LANL biological resources subject matter expert if an active nest is encountered during work activities. Do not disturb active nests. An active nest is a nest with eggs and/or nestling birds. • For new or remodeled buildings, designers can use features such as overhangs, shutters, louvers, mesh, and awnings to reduce glass reflections or reduce visibility into transparent areas. Another option is to install windows at an angle so that the pane reflects the ground instead of the surrounding sky and habitat. Reduce the exterior reflectivity of windows by applying the window film CollidEscape (http://www.collidescape.org/) or installing a permanent sunscreen over the window. For buildings higher than two stories tall, turn off or dim lights near windows at night. Program building lighting systems to achieve a measurable reduction in nightlighting from 9 p.m. to 6 a.m., or, ideally, ensure that all lights are switched off during that period. • Extinguish all exterior vanity lighting (roof-top floods, perimeter spots, etc.) during migration periods (February 15–May 15 and August 15–November 30). When lights must be left on at night, examine and adopt alternatives to bright, all-night, floor-wide lighting. Options include installing motion-sensitive lighting, using desk lamps and task lighting, re-programming timers, adopting

Table C-2. Summary of best management practices for threatened, endangered, sensitive species, pollinators, migratory birds and non-native invasive plants on Los Alamos National Laboratory

Common name Scientific name	Best Management Practices
	lower-intensity lighting, reducing perimeter lighting, re-scheduling work and night cleaning, establishing interior working areas, and using blinds and curtains. • Report all observed bird mortalities and injuries to a LANL biological resources subject matter expert. If the event is a collision with a building or window, identify the location so that problem areas can be identified and rectified.
Non-Native Invasive Plants	
	• Use native species in landscaping, restoration, and forest management; consult with Forest Health and Biological Resources SMEs in the Environmental Stewardship Group to assess for existing invasive species and for planning restoration. • Projects that are subject to a CGP, must adhere to all measures for stabilization, sediment and erosion control, and storm water management. Projects not covered by a CGP must follow project-specific comments provided by EPC-CP personnel in the IRT. • Remove mud from boots, gear, and vehicles before entering and leaving the work site. This action is especially important when changing fieldwork locations. Mud can harbor high densities of seeds, including those of invasive species. • Field personnel should take care not to get seeds on clothing. Burs, cockleburs, burdock found attached to personal articles of clothing or other items should be removed close to the source or disposed of in an appropriate municipal waste receptacle if in an open area. • Contact Environmental Stewardship personnel to participate in documenting new populations of invasives with the Survey 123 invasive species mobile application. Promote the use of locally native species in landscaping, restoration, and forest management.
Floodplain and Wetlands	
	The following best management practices will be used to mitigate impacts: • Disturbed areas will be revegetated using an appropriate native seed mix. • Erosion and sediment control measures will be installed during construction. • Heavy equipment will not be used within the wetland. • Permanent equipment staging areas will not be located within the floodplains or wetland. • All equipment that can be efficiently moved will be refueled at least 100 ft from the floodplains or wetland. Equipment requiring refueling within the floodplain will be refueled only while within secondary containment to eliminate the risk of accidental discharge of fuel to the ground surface. • Hazardous materials, chemicals, fuels, and oils will not be stored within the floodplains or wetland. • If any spillage occurs, all contaminated soil will immediately be containerized and relocated. • Portable generators, compressors, and other fuel-driven equipment will be staged on bermed plastic sheeting as a form of secondary containment. Construction equipment (e.g., graders, dozers, excavators, etc.) and light vehicles will not be subject to this restriction. • Support structures, such as the treatment facility, personnel trailers, storage tanks, or permanent laydown yards will not be installed within the floodplains or wetland. • Project will remove all trash and debris (e.g., construction material) from the floodplains and wetland after completion. • Well pads and roads will be reinforced to minimize erosion and/or flooding following project completion.

Table C-2. Summary of best management practices for threatened, endangered, sensitive species, pollinators, migratory birds and non-native invasive plants on Los Alamos National Laboratory

Common name Scientific name	Best Management Practices
	• Any excavation within the source area (i.e., Sandia Wetland) will require an additional Wetland Assessment to determine the potential impacts of that proposed action on the Sandia Wetland. • The land application of treated water within portions of the 100-year floodplain within Mortandad Canyon is anticipated to have a long-term positive impact by enhancing native plant growth and stabilizing soils.

Sources: (LANL, 2020a; 2020b; 2021a; 2022; 2024)
Key: AEI = Area of Environmental Interest; BMP = best management practice; CGP = Construction General Permit; cm = centimeter; EPC-CP = Environmental Protection and Compliance Division – Compliance Program; EPC-ES = Environmental Protection and Compliance Division – Environmental Science; ft = feet; in = inches; IRT = Integrated Review Tool; LANL = Los Alamos National Laboratory; m = mile; SME = subject matter expert

Biological Resources Supporting Information References

DOE (2024). Final Floodplain and Wetland Assessment for Chromium Remediation in Sandia and Mortandad Canyons, Los Alamos National Laboratory. Prepared by N3B. See Appendix E.

LANL. (2020a). *Sensitive Species Best Management Practices Source Document, Revision 5.* Jesse T. Berryhill, Jenna E. Stanek, Elisa J. Abeyta, and Charles D. Hathcock Environmental Protection and Compliance Division Environmental Stewardship Group. https://cdn.lanl.gov/files/document-32_aaab3.pdf.

LANL. (2020b). *Migratory Bird Best Management Practices Source Document for Los Alamos National Laboratory, Revised June 2020.* Biological Resources Program Environmental Protection and Compliance Division, Environmental Regulatory Document. https://cdn.lanl.gov/files/document-33_7cfac.pdf.

LANL. (2021). *Pollinator Protection Plan for Los Alamos National Laboratory*. Prepared by Environmental Protection and Compliance Division Environmental Stewardship Group, Resources Management Team Los Alamos National Laboratory. https://cdn.lanl.gov/files/document-34_5d142.pdf.

LANL. (2022). *Threatened and Endangered Species Habitat Management Plan for Los Alamos National Laboratory*. Prepared for Environmental Protection and Compliance Division Resources Management Team Los Alamos National Laboratory. https://ext.em-la.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-703240_LANL%202022_T_and_E_Species_Habitat_Management_Plan_041422.pdf.

C.4 CULTURAL RESOURCES

C.4.1 RESOURCE DEFINITION

Cultural resources are physical manifestations of culture, specifically archaeological sites, architectural properties, ethnographic resources, and other historical resources relating to human activities, society, and cultural institutions that define communities and link them to their surroundings. They include expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, buildings, structures, objects, and districts, which are considered important to a culture, subculture, or community. Cultural resources can also include locations of important historic events and aspects of the natural environment, such as natural features of the land or biota, which are part of traditional lifeways and practices.

The National Register of Historic Places (NRHP) is a listing maintained by the Federal government of prehistoric, historic, and ethnographic buildings, structures, sites, districts, and objects that are considered significant at a national, state, or local level. Listed resources can have significance in the areas of history, archaeology, architecture, engineering, or culture.

Cultural resources listed on the NRHP, or determined eligible for listing, have been documented and evaluated according to uniform standards and have been found to meet criteria of significance and integrity. Cultural resources that meet the criteria for listing on the NRHP, regardless of age, are called historic properties. Resources that have undetermined eligibility are treated as historic properties until a determination otherwise is made.

C.4.2 REGULATORY FRAMEWORK

A number of Federal laws and Executive Orders (EOs) address cultural resources and Federal responsibilities regarding them. Foremost among these statutory provisions, and most relevant to the current analysis, is the

National Historic Preservation Act (NHPA) (54 U.S.C. 300101 et seq.). Section 106 of the NHPA requires Federal agencies to take into account the effect of their undertakings on historic properties. The Advisory Council on Historic Preservation regulations that implement Section 106 (36 Code of Federal Regulations [CFR] 800) describe the process for identifying and evaluating resources; assessing effects of Federal actions on historic properties; and consulting to avoid, minimize, or mitigate those adverse effects. The NHPA does not mandate preservation of historic properties, but it does ensure that Federal agency decisions concerning the treatment of these properties result from meaningful consideration of cultural and historical values and identification of options available to protect the properties.

DOE has multiple policies, orders, plans, agreements, and protocols that stipulate how it manages the cultural resources on lands under its jurisdiction and provides guidance on implementing actions in accordance with Federal laws and regulations. Specific to DOE's responsibilities at the Los Alamos National Laboratory (LANL), DOE has executed a Programmatic Agreement (DOE, 2006) with the Advisory Council on Historic Preservation and the New Mexico State Historic Preservation Officer that outlines how DOE will administer its activities that have the potential to affect historic properties to satisfy the agency's responsibilities under Section 106 of the NHPA. The LANL Cultural Resources Management Plan (CRMP) is a comprehensive plan that defines the responsibilities, requirements, and methods for managing cultural resources located on DOE-administered lands at LANL, focusing on effective management of those cultural resources that warrant long-term protection (LANL, 2017).

As a Federal agency, DOE has a trust responsibility to American Indian Tribes (Tribes) to protect Tribal cultural resources and to consult with Tribes on a government-to-government basis regarding those resources. Section 101(d)(6) of the NHPA mandates that Federal agencies consult with Tribes and other Native American groups who either historically occupied the project area or may attach religious or cultural significance to historic properties in the region.

The National Environmental Policy Act (NEPA) implementing regulations link to the NHPA, as well as to the American Indian Religious Freedom Act (AIRFA) (42 U.S.C. 1996), EO 13007 Indian Sacred Sites (61 Federal Register [FR] 26771), EO 13175 Consultation and Coordination with Indian Tribal Governments (65 FR 67249), and the Executive Memorandum on Government-to-Government Relations with Native American Tribal Governments (59 FR 22951). These requirements call on agencies to consult with American Indian Tribal leaders and others knowledgeable about cultural resources important to them. DOE Order 144.1, American Indian and Alaska Natives Tribal Government Policy, outlines the principles to be followed by the department in its interactions with Tribes.

Both the Programmatic Agreement and LANL CRMP address consultation to be undertaken by DOE with Tribes in furtherance of compliance with environmental and cultural resource laws.

C.4.3 CULTURAL RESOURCE INVESTIGATIONS

Cultural resource investigations have been undertaken to develop the information needed to assess the potential impacts of the proposed project on cultural resources and to meet compliance requirements under Section 106 of the NHPA. These investigations included archaeological survey, testing, and Tribal consultation and were conducted in accordance with the CRMP, state, and Federal requirements.

Archaeological Survey and Testing

Previous archaeological investigations have been conducted in Mortandad Canyon and surrounding areas. These investigations, dating to as early as 1967, included site recording, surveying, and periodic monitoring. Most recently, an intensive investigation was conducted following the Cerro Grande fire in 2000 (LANL, 2002). The report of this work provides information regarding fire effects on archaeological sites located within and adjacent to Mortandad Canyon. The report recommends annual monitoring, and archaeological sites are periodically revisited by archaeologists and updated as part of ongoing cultural resources site monitoring. For the 2015 Interim Measure Environmental Assessment (EA), all previously identified

cultural resources were revisited for the purpose of updating the site recording forms and obtaining additional data for NRHP eligibility determinations.

Intensive pedestrian surveys of the portions of the 2015 Interim Measures EA (DOE, 2015) area of potential effect (APE) that were not previously surveyed were conducted to identify archaeological sites that meet the criteria for eligibility for listing on the NRHP (DOE, 2015). The areas surveyed in 2015 included the upper portion of Mortandad Canyon and the north-facing cliff face and slope. The pedestrian survey was conducted using evenly spaced 33-foot (10-meter) transects and transects that followed slope topography. Newly identified resources were recorded in the field; this effort included in-field analyses of artifacts and features, creation of sketch maps, collection of geographic information system data, and photographs of the site, features, and artifacts. Boundaries at some revisited sites were expanded to include additional associated features that had not been previously identified.

DOE evaluated all identified archaeological sites for NRHP eligibility, determined the potential for effects to eligible properties from the proposed project, and will submit a report of its findings and determinations to the New Mexico State Historic Preservation Officer for review and concurrence.

Tribal Consultation

The purposes of consultation are to elicit from Tribal representatives concerns for potential impacts from the proposed project on the Tribe or resources that are important to the Tribe and to identify possible measures to avoid, minimize, or mitigate potential impacts.

Tribes that have shown an interest in, or claimed affiliation to, cultural resources located on LANL property include Pueblo de San Ildefonso, Santa Clara Pueblo, Pueblo de Cochiti, Jemez Pueblo, Acoma Pueblo, Mescalero Apache Tribe, Hopi Tribe, and Jicarilla Apache Tribe (LANL, 2017). Acoma Pueblo, Mescalero Apache Tribe, and the Hopi Tribe have all indicated to DOE that they do not need to be active participants in cultural resource consultations for activities at LANL. Jicarilla Apache Tribe, Jemez Pueblo, Pueblo de Cochiti, and Santa Clara Pueblo all claim cultural affiliation to resources that are located in portions of LANL property, outside of the project area. Representatives from the Pueblo de San Ildefonso view the entire project area to be within their ancestral land use areas and claim cultural affiliation to the Ancestral Pueblo cultural remains within it (LANL, 2017). DOE recognizes the affiliation for all of these Pueblos; however, in this area of LANL property the Pueblo de San Ildefonso is the recognized affiliated Pueblo. For this reason, DOE has focused its Tribal consultation for this project on Pueblo de San Ildefonso.

Consultation with federally recognized Tribes for the Proposed Action commenced during the Public Scoping period, beginning with a courtesy phone call to the environment department of each of the Accord Pueblos (Pueblo de Cochiti, Pueblo de San Ildefonso, Pueblo of Jemez, Santa Clara Pueblo) ahead of the Public Scoping meeting, followed by letters regarding the scoping with an offer for in-person consultation.

Consultation for this proposal is ongoing, and cultural resources in the APE within Pueblo de San Ildefonso Reservation, as well as the Tribal cultural resources concerns for the chromium plume area have yet to be identified.

C.4.4 EVALUATION OF ARCHAEOLOGICAL SITE SIGNIFICANCE

DOE evaluated the sites identified during archaeological surveys and testing efforts to determine their eligibility for listing on the NRHP. Evaluation was conducted to determine those resources that have status as historic properties, which is needed to determine the effect of the project on historic properties under Section 106 of the NHPA and 36 CFR 800. Properties eligible for the NRHP must have significance in American history, archaeology, architecture, engineering, or culture. The guidelines for evaluation of significance can be found in 36 CFR 60.4. For a cultural resource to be considered significant, the resource must meet at least one of four significance criteria:

A. Association with events that have made a significant contribution to the broad patterns of our history.

B. Association with the lives of persons significant in our past.

C. Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.

D. Have yielded, or may be likely to yield, information important in prehistory or history.

The property must also possess integrity or the ability to convey its significance. The NRHP recognizes seven aspects or qualities that, in varying combinations, define integrity. These are as follows: location, design, setting, materials, workmanship, feeling, and association. In the case of properties that possess traditional cultural significance, it is also important to consider the integrity of relationship and condition.

C.4.5 CULTURAL RESOURCES IN THE APE

As a result of the archaeological survey, testing, and Tribal consultation, DOE identified archaeological sites and Tribal cultural resources that were considered when assessing the potential impact of the project. These resources are described in this section.

Archaeological Sites

Based on previous archaeological surveys and testing investigations, 114 archaeological sites are located within the APE. The majority of the sites consist of two site types: cavate sites and pueblo or roomblock sites. The 32 cavate sites identified in the APE are predominantly located along the south-facing wall of Mortandad Canyon, although some cavates are located along the north-facing canyon wall. Cavate sites include plastered walls, sooted ceilings, vent holes, niches, rock art, viga holes, evidence of talus rooms (located out front of the cavate entrances), and stairways of hand and foot holds in the bedrock near the cavate entrances. Few artifacts are usually present, and none of the cavate sites have identified middens (trash mounds).

The 27 Pueblos or roomblock sites, which are all located on the mesa tops north and south of Mortandad Canyon, generally range in size from 1 to 10 rooms, to 10 to 20 rooms. One site has 20 to 40 rooms surrounding a plaza, and another has 100-plus rooms surrounding a plaza with an identifiable kiva (subterranean ceremonial room). These sites have surface artifact scatters containing many artifacts and sometimes large, distinct middens. Shaped tuff blocks are present at most of the sites, and one site contains adobe blocks; sometimes these are seen in their original wall alignments.

The remaining 54 sites in the APE include 10 fieldhouses, 14 prehistoric artifact scatters with no evidence of architecture, 2 game traps carved into bedrock, 10 prehistoric trails and stairways of hand and foot holds carved into bedrock, 2 rock art sites, 3 rock features, 3 rock rings, 1 rockshelter, 1 thermal feature, 2 water control features, 4 Homestead period structures, 2 Homestead period wagon roads, and a Homestead period trash scatter.

Artifacts found at the sites include ceramic sherds of multiple types; flaked stone tools and manufacturing debris comprised of obsidian, chert, chalcedony, basalt, quartzite, and petrified wood; and ground stone tools of sandstone, quartzite, basalt, and granite that include manos (hand-held grinding tools), metates (surface on which grinding occurred), and bedrock grinding slicks. Other than the 7 Homestead period sites and 6 of the artifact scatters deposited during the Archaic (5500 B.C. to A.D. 600) and Late Archaic (800 B.C. to A.D. 600), these sites represent occupations occurring during the Coalition (A.D. 1150 to 1325) and Classic (A.D. 1325 to 1600) cultural periods, which is consistent with the ages of cultural resources found throughout LANL.

The condition of the sites is generally quite good, in part because of the restricted access at LANL. Almost all the sites have experienced some level of impact from water runoff, although this has occurred mainly as sheet wash and not in the development of drainage cuts. Other impacts to the sites include damage from construction of dirt roads on the mesa tops that were developed historically, vandalism or limited pot hunting at two of the sites, and modern graffiti at one site.

Shovel testing and geomorphological analysis previously conducted in areas where proposed interim project infrastructure would occur close to known sites revealed that no intact sediments or cultural deposits exist within those areas (DOE, 2015), which may be an indication of the potential for subsurface deposits at other sites in the expanded APE.

Of the 114 sites in the APE, DOE determined 80 sites eligible, 18 sites not eligible, and 16 sites either potentially eligible for listing in the NRHP or unevaluated. The sites determined eligible have significance for their potential to yield important information about settlement and subsistence patterns on the Pajarito Plateau during the Coalition and Classic periods and the sites retain their integrity. The sites determined not eligible are either (a) in poor condition because of erosion and existing road impacts and do not retain enough integrity to demonstrate their historical significance or (b) are located directly on bedrock and thus lack the presence of subsurface cultural deposits that would give the sites significance for their information potential. Shovel testing and geomorphological analysis were conducted in areas where proposed project infrastructure would occur close to known sites because of a concern for possible impacts to buried cultural deposits. The testing and analysis revealed that no intact sediments or cultural deposits exist within those areas. Although some artifacts were observed during testing, the limited number and fragmentary nature of the artifacts indicate they are present in secondary colluvial deposits derived from sediment and artifacts eroding downslope from nearby roomblocks. Results of the previous testing may be an indication of the potential for subsurface deposits at other sites in the expanded APE.

Historic Buildings

There are 12 historical buildings within the APE, all of which were built during the Cold War between 1959 and 1986 (Table C-3). Five of them have been determined eligible for listing in the NRHP (two under Criterion A, and three under Criterion A and C). The other seven buildings are not evaluated or are currently undergoing assessment for significance and NRHP eligibility, and are managed as NRHP-eligible until a final determination is made.

There are no buildings or sites within the legislative boundary of the Manhattan Project National Historical Park within the APE.

Table C-3. Los Alamos National Laboratory historic buildings in the area of potential effects

Building Number	Building Name	Construction Date	Historic Use	NRHP Status
03-0066	Sigma Building	1959	Central laboratory and administration building for the Sigma Complex. Constructed to fabricate a variety of structural materials, including steel, brass, lead, and uranium, in support of the weapons program.	Eligible - Criterion A
03-0141	Beryllium Technology Facility	1959	Fabrication of graphite-enriched uranium dioxide fuel components in support of the Rover rocket program. Other activities include power metallurgy, filament welding, ceramics research, and fabrication using beryllium and uranium.	Eligible - Criterion A
03-0223	Utilities Control	1966	Utilities control center for TA-3 and	Under Assessment

	Center		surrounding technical areas.	
03-0317	Graphite Flour Storage	1967	Storage of graphite used in the processing, characterizing, and fabrication of metallic, ceramic, and depleted-uranium items.	Under Assessment
53-0056	Storage Building	1970	Support facility housing industrial equipment for the abrasive cleaning of ion pumps.	Not Evaluated
60-0001	Mobile Equipment Repair Shop	1977	Vehicle and heavy equipment repair shop.	Under Assessment
60-0002	JCI Warehouse	1978	Maintenance warehouse for Johnson Controls, Inc.	Under Assessment
60-0017	Test Fabrication Facility (Assembly Building)	1986	Assembly of experimental racks used in underground nuclear testing activities at the Nevada Test Site.	Eligible - Criteria A, C
60-0019	Test Fabrication Facility (Rack Tower)	1986	Testing of experimental racks used in underground nuclear testing activities at the Nevada Test Site.	Eligible - Criteria A, C
60-0045	High Frequency Radio Facility	1966	Emergency and civil defense radio communications center.	Under Assessment
72-0008	Office Building (Former Guard Station TA-20-47 / TA-00-271)	1952	Public security checkpoint/guard station for East Jemez Road.	Eligible - Criteria A, C
72-0013	Storage Building	1966	General storage building.	Under Assessment

Key: NRHP = National Register of Historic Places; TA = Technical Area

Tribal Cultural Resources

Consultation for this proposal is ongoing, and cultural resources in the APE within the Pueblo de San Ildefonso Reservation, as well as the Tribal cultural resources concerns for the chromium plume area have yet to be identified.

During their meeting with DOE for the 2015 Interim Measure EA, Pueblo de San Ildefonso representatives described the cultural resources and activities within and surrounding the project area in the following way (DOE, 2015): The Pueblo representatives consider the entire area on which LANL is located to be part of a larger Sacred Area that has been used and inhabited by their ancestors for over a thousand years. This Sacred Area is of great importance to the Pueblo and thus continues to be used by Pueblo members today. The resources located within the Sacred Area that contribute to its importance include naturally occurring water, animals, plants, springs, rocks, and soil as well as cultural-defined places such as archaeological sites and deposits; religious or ceremonial features and places; traditional areas used for gathering plants, clay, or other materials; hunting areas; and viewsheds. Important traditional activities conducted in the Sacred Area include hunting, gathering, collecting, and ceremonial practices. It should be noted that this list is likely not exhaustive.

According to the Pueblo representatives, the Sacred Area plays a very important role in the history, culture, and religious practices of the Pueblo, and this forms the basis for its importance. Because of this intrinsic significance, the Sacred Area is used only for traditional cultural and religious activities by Pueblo members. By conducting these activities in the Sacred Area, or by using resources collected from the Sacred Area, the importance of the Sacred Area is transferred to those activities and materials, instilling in them cultural "power" and ensuring their efficacy. In turn, the conduct of these activities within the Sacred Area and the use of these materials imbue the Sacred Area with even greater importance. This illustrates the circular relationship between the Sacred Area, the resources and activities located within it, and explains the Pueblo's consideration of the Sacred Area and its resources as important.

Pueblo representatives explained that, though varied in character, the resources in the Sacred Area are not distinguished into types such as natural, cultural, economic, secular, or sacred. Rather, the resources of the Sacred Area are regarded as comprising an integrated "whole," connected with one another through physical, functional, and spiritual relationships. This "whole" is regarded as essential to the continued survival of the Pueblo, and thus all the resources contained within it are considered cultural. The resources located within the project area and in the areas adjacent to it, both on and off LANL property, are considered to be a part of and connected to this whole (DOE, 2015).

C.4.6 ENVIRONMENTAL CONSEQUENCES ANALYSIS METHODOLOGY

The following analysis details the anticipated direct and indirect effects of the Proposed Action alternative and the No Action Alternative on cultural resources. Potential effects were identified through application of the NHPA Section 106 Criteria of Adverse Effects (36 CFR 800.5) to historic properties and through consultation with the Pueblo de San Ildefonso to learn about potential impacts to Tribal cultural resources and practices. Potential effects to historic properties were determined based on the proximity of the property to proposed project facilities or infrastructure; proximity to project infrastructure development, operations, or reclamation activities; and the presence of workers in the area. Because historic properties are a finite resource and cannot be regenerated, all physical impacts to historic properties are considered to be permanent in duration.

Criteria of Adverse Effects

Section 106 of the NHPA requires Federal agencies to take into account the effects of their actions on any district, site, object, building, or structure included in, or eligible for inclusion in, the NRHP. An adverse effect occurs when an undertaking diminishes the integrity of those characteristics of an historic property that qualify it for inclusion in the NRHP. Implementing regulations for Section 106 (36 CFR 800) provide specific criteria for identifying effects on historic properties. The types of possible adverse effects include:

- Physical destruction of or damage to all or part of a property
- Physical alteration of a property
- Removal of a property from its historic location
- Change in the character of a property's use or of physical features within a property's setting that contribute to its historic significance
- Introduction of visual, atmospheric, or auditory elements that diminish the integrity of a property's significant historic features
- Neglect of a property, which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance
- Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of a property's historic significance (36 CFR 800.5[a][2])

DOE applied the criteria of adverse effects to the activities planned under the Proposed Action alternative and the No Action Alternative to identify potential effects to historic properties identified within the APE.

Tribal Consultation

Consultation with federally recognized Tribes for the Proposed Action commenced during the Public Scoping period. Each of the Accord Pueblos (Pueblo de Cochiti, Pueblo de San Ildefonso, Pueblo of Jemez, Santa Clara Pueblo) received a courtesy phone call to the pueblo environment department ahead of the Public Scoping meeting, followed by letters regarding the scoping with an offer for in-person consultation. DOE Office of Environmental Management Los Alamos Field Office (EM-LA) also had an in-person meeting on

the scoping with the Pueblo de San Ildefonso environment department. Additionally, EM-LA Corrective Measures Evaluations presented at the Accord Technical Exchange Meeting (ATEM) on July 11, 2023, regarding the NEPA for the Proposed Action. Representatives from each of the Accord Pueblos were in attendance for that occurrence of the ATEM. EM-LA will send another round of letters to each of the Accord Pueblos when the Draft EA is available, which will include an offer to consult, after which there will be another presentation to the ATEM on the Draft EA. Pueblo de San Ildefonso has responded that they plan to request consultation at that time.

Cultural Resources Supporting Information References

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C.5 SOCIOECONOMICS

In order to tailor the affected environment discussion to a level commensurate with the potential for impact, which is expected to be small given the small in-migrating workforce and population associated with the Proposed Action, the characterization of socioeconomic data in this EA focuses primarily on population, employment/unemployment, income, and housing data, where the potential for adverse impact from an in-migrating population (workers and their families) would be greatest.

With respect to impacts on community services, it is assumed that the potential impacts from any in-migrating population on existing population levels in the region of influence (ROI) would serve as a surrogate for analyzing potential impacts on each of the community services that support that population currently. As such, this analysis does not include a discussion of community services within the ROI where the potential increase in population would be very small (e.g., generally less than 0.1 percent of the existing population). At such small levels, it is assumed that the level of community services currently available to the population would be sufficient to accommodate the small population influx resulting from the Proposed Action.

Summary data are provided for the ROI, which is defined for purposes of this analysis as a four-county region encompassing the Los Alamos County (host county for LANL) and immediately adjacent counties (Rio Arriba, Sandoval, Santa Fe Counties) in New Mexico, where the majority of workers for proposed chromium plume remediations would be expected to reside and spend most of their salary, and in which a significant portion of site purchase and non-payroll expenditures from the construction and operation of the Proposed Action and alternatives are expected to take place. Note that this is slightly smaller than the ROI identified in the most recent Supplemental Analysis to the 2008 LANL (DOE August 2020 SA-06) but considered appropriate given the limited geographic scope of the Proposed Action.

Table C-4 summarizes socioeconomic conditions for the ROI with respect to population, income, housing, and employment. Data are for 2021 unless otherwise indicated.

Table C-4. Region of influence summary data for select socioeconomic conditions

Parameter	Los Alamos	Rio Arriba	Sandoval	Santa Fe	Region of Influence	New Mexico
Population						
2022	19,187	40,048	153,501	155,644	368,400	2,113,344
2021	19,169	40,347	153,632	147,327	360,475	2,109,366
2020	19,419	40,363	148,834	154,823	363,439	2,117,522
2010	17,950	40,246	131,561	144,170	333,027	2,059,179
Housing						
Total units	8,593	19,585	57,857	75,798	161,833	937,397
Occupied	8,029 Owner: 5,963 Rental: 2,066	13,293 Owner: 10,342 Rental: 2,951	53,567 Owner: 42,549 Rental: 11,018	65,856 Owner: 46,974 Rental: 18,882	140,745 Owner: 105,828 Rental: 34,917	797,596 Owner: 543,834 Rental: 253,762
Vacant	564	6,292	4,290	9,942	21,088	139,801
Vacancy rate (# vacant units/ total units)	6.6%	32%	7.4%	13.5%	13%	14.9%
Vacancy rate for owner-occupied units/Rental vacancy rate	0.9 / 1.7	1.8 / 4.5	1.2 / 7.4	0.8 / 5.0	1.1% / 5.5%	1.5% / 7.3%
Median value	$343,100	$179,800	$222,200	$315,100		$184,800
Income						
Median Household income	$123,677	$46,994	$68,947	$64,423		$54,020
Per capita income	$64,521	$25,342	$32,246	$40,952		$29,624
Employment						
Civilian labor force	10,599	16,627	69,670	74,838	171,734	952,564
Employed	10,269	15,591	64,827	70,904	161,591	889,428
Unemployed	330	1,036	4,843	3,934	10,143	63,136
Unemployment rate	3.1%	6.2%	7.0%	5.0%	5.9%	6.6%
LANL employees (laboratory, contractor, guard force)*: 15,707 (as of 9/30/2022)	5,225 (37%) [5,187 (Triad + N3B CY 2021 from SWEIS 2021 Yearbook)]	2,175 (15.5%) 2,191 (2021)	580 (4.1%) Not broken out	3,460 (24.6%) 3,239 (2021)	Rio Arriba: 2,175 (15.5%)	Other NM: 1,558 Outside NM: 1,056

Sources: (LANL, 2023a; 2023b), (USCB, 2023a; 2023b; 2023c; 2023d)
Key: # = number; % = percent; CY = calendar year; LANL = Los Alamos National Laboratory; N3B = Newport News Nuclear BWXT-Los Alamos; NM = New Mexico; ROI = region of influence; SWEIS = Site-wide Environmental Impact Statement

Population levels fluctuated slightly in Los Alamos County, the ROI, and New Mexico between 2020 and 2022 (slight decreases between 2020 and 2021), but showed a small increase in 2022. The Pueblo of San Ildefonso is a minority-dominated community nearest LANL and the existing plume; it had a population of 2,261 in 2021.

In 2021, there were a total of 161,833 housing units in the four-county area, with 87 percent occupied and 13 percent vacant. The median value of owner-occupied homes in Los Alamos County ($343,100) is the

greatest of the four counties and nearly twice the median value of owner-occupied homes in Rio Arriba County ($179,800). According to the most recent Supplemental Analysis to the LANL Site-Wide Environmental Impact Statement (SWEIS) (DOE, 2020), Los Alamos County is experiencing a housing shortage that affects the quality of life for individuals who work in Los Alamos, including LANL, and reside elsewhere in the ROI. A 2019 housing study indicates that approximately 576 new units would be needed to accommodate new hires to the county, including LANL (LAC, 2019, pp. 44).

There are major differences in the income levels among the four counties, especially between Rio Arriba County, at the low end with a median household income in 2021 of $46,994 and a per capita income of $25,342, and Los Alamos County, at the upper end with a median household income of $123,677 and a per capita income of $64,521. The median household income in Los Alamos County is over twice that of the New Mexico State average ($54,020 in 2021).

The total population of the ROI is 368,400 with a total workforce population of 171,734 people. As of 2022, LANL full-time employees represented represent 87 percent of the total workforce within the ROI and 1.5 percent of the total workforce in New Mexico. The annual unemployment rate in the ROI is 5.9 percent, compared to New Mexico's annual unemployment rate of 6.6 percent.

LANL is a major economic force in the region; it has a positive economic impact on Northern New Mexico by creating jobs, generating income, and purchasing goods and services from local businesses. Local DOE activities directly and indirectly account for more than a third of employment, wage and salary income, and business activity in the region. Based on a 3-year study, LANL expended an average of $752.6 million on procurement of goods, services, and construction within the ROI, New Mexico, and out of state. Just over one-half of those purchases were from New Mexico-based businesses (UNM, 2019). Expenditures by LANL and its full-time employees generated $1.65 billion in sales for businesses within the ROI.

As of 2018, LANL had a total direct labor income of $1.34 billion. Indirectly, LANL supported 19,122 jobs and those jobs equal $1.57 billion in labor income to the State of New Mexico (UNM, 2019). An update to the 2019 Economic Report identified the annual salary at LANL at 1.53 billion ($689,636,978 in Los Alamos County) and the Laboratory spent $915,988,873 on procurement in New Mexico (LANL, 2023a).

Assumptions Regarding Workforce Requirements and Worker In-Migration to the Study Area

- No Action Alternative: The total peak workforce that could be on-site at one time for a short duration of the year is estimated at 75 workers; based on up to two wells being drilled at same time (four new wells would be drilled over the course of a year under the No Action Alternative), including 38 relating to construction (8 drillers and 30 admin/support staff) and 42 relating to operation (12 drillers and 30 admin/support staff).
- ASM Proposed Action options: Same breakout per well as No Action Alternative but more wells within a given year and peak workforce up to 120 on-site at one time.
- Regarding the well and pad construction and operation, a large number of the workers include T2S and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) personnel (e.g., contractor management/admin staff, see Appendix B, *Description of Alternatives Supporting Information,* Table B-1), which would be pulled from existing contractor staff (e.g., transition from current positions associated with the ongoing measures to contain the plume boundary or transition over from other LANL activities) or would be local hires if new positions were created.
- Drilling crews would be subcontractors and hired per job. They would be unlikely to live in the Los Alamos area, as most contractors currently come on site from Albuquerque area, and would relocate to the site on a temporary, per job basis. The drilling crews would comprise the in-migrating workforce for purposes of this analysis.

- Regarding construction and operation of the new treatment facility, it is assumed that the same employees, counted in the well pad builds, also would construct the facility; and that operation of the facility would be conducted by existing contractor staff.
- A breakout of an in-migrating workforce associated with the drilling crew would include:
  - ASM options: 24 construction (8 x 3) and 36 (12 x 3) operations workers (assuming up to 3 wells drilled concurrently during a five-month period over course of year.
  - No Action Alternative: 16 construction (8 x 2 wells) and 24 (12 x 2 wells) operations workers, assuming two wells would be drilled concurrently during a 5-month period over the course of a year.
- It is unlikely that the drilling crews, based on the short-term nature of the work, would bring their families with them. However, the analysis assumes they would bring their families in order to provide a more conservative bounding scenario. In some cases, the same worker may stay on to drill subsequent wells on-site during the course of the project.
- In-migrating families would consist of 2.59 family members, including the worker, based on average household size in New Mexico in 2021.

The assumptions listed above would result in an in-migrating workforce and total population as follows:

- ASM options: 62 in-migrating population with construction and 93 with operations, including the workers.
- It is estimated that 50 to 75 (ASM options), or 81.1 percent, of these employees (and their families) would live within the ROI based on existing residence rates.
- No Action Alternative: 41 in-migrating population with construction and 62 with operation, including the workers.
- The existence of these direct jobs would be expected to result in the creation of up to another indirect 100 jobs (under ASM option operations), based on the LANL multiplier used in the 2008 SWEIS (1.06).

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C.6 ENVIRONMENTAL JUSTICE

C.6.1 REGULATORY BACKGROUND

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued on February 16, 1994, focused attention on the environmental and human health effects of Federal actions on those populations with the goal of achieving environmental protection for all communities. The EO directs Federal agencies to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations to the greatest extent practicable and permitted by law. The following discussion is consistent with the guidelines and procedures for compliance with the EO (12898) promulgated by the CEQ (CEQ, 1997).

The definitions of environmental justice, minority, low-income, and minority and low-income populations are presented below.

- **Environmental Justice** – The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA, 2023).
- **Minority** – Individual(s) who have identified themselves as members of one or more of the following population groups as designated in the U.S. Census Bureau (USCB) data: Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Some Other Race, as well as Hispanic or Latino of any race (USCB now refers to these individuals as people of color).
- **Low income** – The USCB uses a set of money income thresholds that vary by family size and composition to determine who is in poverty (i.e., classified as "low income"). A family and each individual in the family is considered in poverty if the total family income is less than the family's threshold or the dollar amount calculated by the USCB to determine poverty status (USCB, 2023a).

- **Minority or low-income population** – A minority population is a population where either: (a) the minority population of the selected geographic units of analysis (block group) exceeds 50 percent, or (b) the minority population percentage of the block group is meaningfully greater (e.g., 10 or 20 percent greater) than the minority population percentage in a reference community (i.e., state). For low-income populations, the presence of the population is determined if the percentage of low-income individuals residing within the selected geographic units of analysis (block groups) is equal to or greater than the percentage of low-income individuals residing within the reference community (in this case the State of New Mexico). In identifying minority or low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected minority population.

On January 27, 2021, President Biden issued EO 14008, *Tackling the Climate Crisis at Home and Abroad*, which further directs Federal agencies to take steps to address disproportionately high and adverse impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts. EO 14008 established the Justice40 Initiative. This initiative mandates 40 percent of the benefits of Federal climate and clean energy investments to be provided to disadvantaged communities.

EM-LA Justice40 Initiative

As a part of the Justice40 Initiative, DOE has conducted an analysis to identify disadvantaged communities in the United States, which DOE defines as underserved, overburdened, and front-line communities (DOE, 2022). The Justice40 Initiative focuses on Federal investments to disadvantaged communities in the following areas: clean energy and energy efficiency, clean transit, affordable and sustainable housing, training and workforce development, the remediation of legacy pollution, and the development of critical clean water infrastructure.

In July 2021 EM-LA in New Mexico was selected as one of five DOE Justice40 Initiative Pilot Programs and it is the only Justice40 Pilot Program in EM. EM-LA's mission falls under the covered program of "remediation and reduction of legacy pollution." The focus of EM's environmental cleanup work under Justice40 is soil and groundwater remediation.

EM-LA and its cleanup contractor N3B engage with numerous "disadvantaged communities" in the areas surrounding Los Alamos County. By way of example, these disadvantaged communities include Tribal jurisdictions and Northern New Mexico counties, as well as predominantly Hispanic communities in which there are low incomes and high levels of poverty.

Tribal jurisdictions include the following Pueblos:

- Pueblo de San Ildefonso
- Pueblo of Jemez
- Santa Clara Pueblo
- Pueblo de Cochiti
- Pueblo of Pojoaque
- Taos Pueblo

The (proximate) Accord Tribes, which comprises four New Mexico Pueblo Governments (Santa Clara Pueblo, Pueblo de Cochiti, Pueblo of Jemez and Pueblo de San Ildefonso), have individual cooperative agreements to develop and maintain environmental monitoring programs through the Los Alamos Pueblos Project. These agreements and grants funded by EM-LA (e.g., EM funds the Santa Fe Indian School) enable the Los Alamos Pueblos Project Tribal program personnel to obtain the training to monitor and sample soil,

air, groundwater, and other media, and facilitate development of Pueblo environmental programs to analyze and monitor the impact, if any, of DOE operations to Pueblo lands. EM-LA also provides numerous educational and training briefings to Pueblo members to enhance awareness of ongoing efforts regarding remediation and reduction of legacy waste. EM-LA continues to pursue additional opportunities to inform, train, and educate these disadvantaged communities regarding ongoing cleanup projects in and around LANL. These opportunities would consist of both presentations and site visits.

Each year, as part of its Community Commitment Program, N3B donates 5 percent of its anticipated annual fee to workforce development programs and nonprofit organizations that benefit Northern New Mexico communities. Since August 2019, N3B's workforce development programs have served 34 students—19 of which are from the neighboring Rio Arriba County, a predominantly Hispanic community in which 20 percent of the population lived below the poverty line in 2020. N3B covers tuition costs for participating students, who receive on-the-job training from N3B mentors while being compensated with competitive salaries and benefits.

N3B offers three workforce development programs: (1) the 2-year Nuclear Operator Apprenticeship Program in partnership with Northern New Mexico College; (2) the 12-week Waste Processing Operator Boot Camp; and (3) the Radiological Control Technician Boot Camp. Students in the Apprenticeship Program earn an associate degree, while students in the Boot Camps earn 10 college credits and a program certificate. All three programs put students in the educational pipeline to pursue advanced degrees in STEM-related fields.

In the past 2 years, N3B has also provided $48,000 in scholarships to six Northern New Mexico students in need of financial aid to pursue STEM-related degrees at regional colleges. Four of the six scholarship recipients are from economically disadvantaged communities.

Since N3B's start of contract in April 2018, N3B has donated $973,444 to workforce development programs and Northern New Mexico nonprofits.

Recent Tribal outreach efforts specific to the Proposed Action include the following (see Chapter 5):

- Each of the Accord Pueblos (Pueblo de Cochiti, Pueblo de San Ildefonso, Pueblo of Jemez, Santa Clara Pueblo) received a courtesy phone call to the pueblo environment department ahead of the Public Scoping meeting, followed by letters regarding the scoping and an offer for in-person consultation.
- An in-person meeting on the scoping with Pueblo de San Ildefonso environment department was conducted on July 11, 2023.
- EM-LA CMEs presented at the ATEM on July 11, 2023, regarding the NEPA analysis for chromium. Representatives from each of the Accord Pueblos were in attendance for that occurrence of the ATEM.

EM-LA anticipates sending out another round of letters related to publication of the Draft EA, with an accompanying offer to consult followed by a presentation to the ATEM on the draft. Pueblo de San Ildefonso has indicated that they plan to request consultation at that time.

C.6.2 AFFECTED ENVIRONMENT AND SUPPORTING DATA

The potentially affected area includes all of Los Alamos County, and parts of Sandoval, Santa Fe and Rio Arriba Counties in New Mexico.

The potentially affected area is located primarily in Los Alamos County, New Mexico. The demographics for Los Alamos County are as follows (2021 data): Non-Hispanic/Latino comprise 81.8 percent of residents. People of Hispanic or Latino ethnicity represent 18.2 percent of the residents; this percentage is much lower (2.8 times) than New Mexico, which is at 50.2 percent. Native Americans represent approximately 1.5 percent of residents, while Blacks and African Americans make up 1.4 percent of residents (USCB, 2023b). The total minority population in New Mexico in 2021 was 64.3 percent.

In addition to ongoing engagement efforts with the Pueblos in Northern New Mexico, EM-LA and N3B have programs for disadvantaged communities in neighboring counties, including Rio Arriba County (EM-LA, n.d.). In 2021, the demographics of the five largest ethnic groups in Rio Arriba County were 75.7 percent White (Hispanic), 71.0 percent Other (Hispanic), 20.2 percent American Indian and Alaska Native (Non-Hispanic), 12.9 percent White (Non-Hispanic), and 1.0 percent African American (USCB, 2023b).

The population and income levels of four additional nearby pueblos for 2021 were as follows (USCB, 2023c):

Pueblo	Population	Median Household income	% families living below poverty
San Ildefonso	2,261	$52,424	19.2%
Santa Clara	11,893	$45,313	16.5%
Cochiti	1,465	$44,732	13%
Jemez	2,042	$49,700	13.4%
Pojoaque	3,608	$57,277	11.4%

Region of Analysis

For purposes of the EM-LA Justice40 Pilot Program, EM-LA determined eight counties are included or partially included in the potentially affected legacy pollution area (Bernalillo, Los Alamos, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe and Taos), based on potential radiological risk from current missions performed at LANL, and as measured within a 50-mile radius from the emissions stack at the Los Alamos Neutron Science Center in Technical Area (TA)-534. These areas include the City of Santa Fe and Indian Reservations in North Central New Mexico; they also are consistent with the ROI defined in past LANL SWEISs and the currently in progress SWEIS. The majority of properties within a 50-mile radius of LANL consist of Federal property without full-time residents.

The proposed region of analysis for environmental justice in this EA is significantly smaller than 50-miles since no radiological air emissions would be expected from the proposed project. Rather, the project boundary is based on the existing area of (and potential movement of) the contaminated chromium groundwater plume that is better defined and more limited in size. Specifically, it is identified as a 5-mile radius of the plume boundary. This is consistent with the for the ROI for water resources (i.e., groundwater) and potential health effects analyzed in this EA; these resource areas are considered to be the primary drivers for determining potential adverse effects of most concern to any environmental justice populations identified. The ROI lies within a part of Los Alamos County (primarily within LANL site boundary), and very small portions of Rio Arriba, Santa Fe, and Sandoval Counties, New Mexico.

Methodology for Determining Minority and Low-Income Populations

The methodology used for the environmental justice analysis, is described in EPA's *Promising Practices for EJ Methodologies in NEPA Reviews* (EPA, 2016) and typically includes both the 50 percent and greater meaningful analysis as defined previously. This EA is using only the 50 percent analysis in identifying minority populations, consistent with the methodology used in the 2008 SWEIS. The analysis of minority and low-income populations focuses on USCB data for geographic units (i.e., block groups) that represent, as closely as possible, the potentially affected areas.

Minority Population in 2021

Minority populations were evaluated using the 50 percent for potentially affected block groups within 5 miles of the chromium groundwater plume. If a block group's percentage of minority individuals was greater than 50 percent, then the block group was identified as having a minority population. The total population of New Mexico is 2,109,366, of which 64.0 percent would be considered members of a minority population.

According to 2021 census data, approximately 8,030 minority individuals resided within the 5-mile radius of LANL. This represented 34 percent of the total population within the 5-mile radius. The largest minority

group in the study area was the Hispanic population (51.9 percent), followed by American Indians (4.5 percent). Minorities are about 29.2 percent of Los Alamos County's population, with Hispanics being the largest minority group (18.3 percent). Hispanics reside throughout the 50-mile (80-kilometer) radius area, but most are located in the Española Valley and in the Santa Fe metropolitan area.

Based on 2021 census data, Table C-5 shows minority population for all block groups within the study area, including those where more than 50 percent of the block group population is minority.

Table C-5. Communities within 5 miles of the chromium plume – Los Alamos National Laboratory, New Mexico (block group by tract)

Block Group by Tract		Total Population	Minority	% Minority	Population for Whom Poverty is Calculated	Low-Income Population	% Low Income
Census Tract 1	Block Group 1	1,161	263	22.6	1,161	38	3.3
	Block Group 2	857	218	25.4	857	0	0
	Block Group 3	1,886	574	30.4	1,886	157	8.3
Census Tract 2	Block Group 1	1,271	390	30.7	1,271	83	6.5
	Block Group 2	1,016	254	25	1,016	52	5.1
	Block Group 3	1,640	421	25.7	1,640	0	0
	Block Group 4	1,644	603	36.7	1,644	0	0
Census Tract 4	Block Group 1	768	262	34.1	724	0	0
	Block Group 2	1,083	601	55.5	1,083	86	7.9
	Block Group 3	781	251	32.1	781	40	5.1
	Block Group 4	1,321	515	39%	1,288	197	15.3
Census Tract 5	Block Group 1	494	95	19.2	494	0	0
	Block Group 2	876	69	7.9	876	39	4.4
	Block Group 3	1,491	376	25.2	1,491	61	4.1
	Block Group 4	602	38	6.3	602	4	0.7
	Block Group 5	1,116	409	36.6	1,116	0	0
	Block Group 6	1,162	269	23.1	1,162	45	3.9
Census Tract 102.4	Block Group 2	903	151	16.7	903	159	17.6
Census Tract 109	Block Group 2	962	128	13.3	962	165	17.1
Census Tract 9403*	Block Group 1	822	743	90.4	812	165	20.3
Census Tract 9408	Block Group 3	1,427	1,400	98.1	1,422	219+92 311	21.9
ROI (5-mile radius): [%]		23,283	8,030	34	23,283	1,602	6.9

Sources: (USCB, 2023c; 2023d)
Key: % = percent
Note: *Found in Santa Fe County; note that no population is found in the portion of Sandoval County that contains part of Census Tract 9403.

Three block groups (of the 21 block groups within the ROI) have a percentage that would meet the 50 percent threshold for minority populations: one block group each in Los Alamos, Santa Fe, and Rio Arriba Counties. None of these block groups include any portion of the groundwater plume itself. While the plume does extend into a small corner of Sandoval County and the Pueblo San de Ildefonso Reservation, there is no population in the block group found within this portion of the reservation according to Census Bureau records.

Low-Income Population in 2021

According to 2021 census data, approximately 1,602 individuals residing within the 5-mile radius of LANL were identified as living below the Federal poverty threshold, which represents approximately 6.9 percent of the study area population. The median household income for New Mexico in 2022 was $54,020, while 18.3 percent of the population was determined to be living below the Federal poverty threshold.

Los Alamos County had the highest median income ($123,677) within the state, and the lowest percentage (4.2 percent) of individuals living below the poverty level when compared to other counties in the area.

Census block groups were considered low-income block groups if the percentage of the populations living below the Federal poverty threshold exceeded 18.3 percent. Table C-5 shows all low-income block groups within the study area, including where more than 18.3 percent of the block group population is living below the Federal poverty threshold. Based on Census data, 2 of the 21 block groups within the ROI have percentages that would meet the threshold for low-income populations and include population living below the Federal poverty threshold. However, it should be noted that two additional blocks (Census Tract 102.4, Block Group 2, and Census Tract 109, Block Group 2), have percentages that are just under the threshold, at 17.6 and 17.1 percent, respectively.

Environmental Justice Supporting Information References

CEQ. (1997). *Environmental Justice Guidance Under the National Environmental Policy Act.* Council on Environmental Quality, Executive Office of the President. Washington, D.C. December 10. https://apps.dtic.mil/sti/tr/pdf/ADA434918.pdf.

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EPA. (2016). *Promising Practices for EJ Methodologies in NEPA Reviews.* Report of the Federal Interagency Working Group on Environmental Justice & NEPA Compliance. https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf.

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USCB. (2023a). *How the Census Bureau Measures Poverty*. Retrieved from U.S. Census Bureau: https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html.

USCB. (2023b). *Quick Facts (queries for New Mexico and associated counties).* Retrieved from U.S. Census Bureau: https://www.census.gov/quickfacts/fact/table/NM,US/PST045222.

USCB. (2023c). *My Tribal Area.* Individual Tribe information retrieved July 12, 2023, from U.S. Census Bureau: https://www.census.gov/tribal/.

USCB. (2023d). *American Community Survey, Table C17002 Ratio of Income to Poverty Level in the past 12 months (for 2021): ACS 5-Year Estimates Detailed Tables.* Queries for select census tracts and census blocks. Retrieved July 24, 2023, from U.S. Census Bureau: https://data.census.gov/table.

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Appendix D
Responses to Public Comments on the Draft EA

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RESPONSES TO PUBLIC COMMENTS ON THE DRAFT EA

D.1 INTRODUCTION

On December 14, 2023, the U.S. Department of Energy (DOE) Office of Environmental Management – Los Alamos Field Office (EM-LA) gave notice of the 60-day comment period on the *Draft Chromium Interim Measure and Final Remedy Environmental Assessment* (referred to as Draft EA), commencing with this notice on December 14, 2023, and ending on February 12, 2024. EM-LA also announced two public meetings to be held on January 22, 2024, and January 24, 2024, to share information and gather verbal and written comments on the Draft EA. Notices were published in the *Los Alamos Daily Post*, *Albuquerque Journal*, *Santa Fe New Mexican*, and the *Rio Grande Sun.* Notices were also posted on the Los Alamos National Laboratory (LANL) Legacy Electronic Public Reading Room and distributed via email to stakeholders on the Reading Room's notification list.

The 2016 Compliance Order on Consent (Consent Order) between DOE and the State of New Mexico Environment Department (NMED) is the principal regulatory document governing legacy cleanup at Los Alamos National Laboratory (LANL). The Consent Order sets forth the corrective action process, including the submission of Corrective Measures Evaluation (CME) Reports. EM-LA is preparing an EA under the National Environmental Policy Act (NEPA) to evaluate alternatives for remedial action as part of the Chromium Interim Measure (Chromium IM) and Characterization Campaign identified in the Consent Order. The EA will give DOE sufficient evidence and analysis to determine whether to issue a Finding of No Significant Impact (FONSI) or prepare an Environmental Impact Statement (EIS). To ensure that public comments and concerns were addressed, EM-LA invited Federal agencies, state, local, and Tribal governments, and the general public to comment on the Draft EA.

EM-LA hosted two public meetings: an in-person meeting on January 22, 2024 at Cities of Gold Hotel and Casino, and an interactive webcast on January 24, 2024. The purpose of the public meetings were two-fold: (1) provide the public with information about the NEPA process and this EA; and (2) invite public comments on the Draft EA.

The public meetings included a presentation and poster session to share information on the process used to analyze the Proposed Action and Alternatives in the Draft EA. Questions from the public were welcomed at both meetings. Participants at the in-person meeting were instructed to provide their comments that day either verbally to the EA project's stenographer or in writing by completing a comment form, which was then to be given to the EM-LA representatives at the meeting. Participants attending the webcast meeting were instructed to submit comments using Zoom's chat function, which was saved for submission into the formal record. Webcast and in-person participants were invited to provide their comments after the meeting by submitting emails with "Chromium Draft EA Comment" in the subject line to emla-nepa@em.doe.gov or by submitting comments by U.S. Mail to following address.

ATTN: EM-LA NEPA Document Manager
U.S. DOE Environmental Management
Los Alamos Field Office
1200 Trinity Drive, Suite 400
Los Alamos, NM 87544

The initial public comment period was expected to close on February 12, 2024, but EM-LA gave notice of a 30-day extension until March 13, 2024. This notice of extension was published in the aforementioned newspapers, posted on the LANL Legacy Electronic Public Reading Room, and distributed via email to stakeholders on the Reading Room's notification list.

One comment was received at the meetings, and DOE received 40 comment documents throughout the comment period. From these 40 comment documents, 209 individual comments were identified.

Table D-1 lists the commenter, the commenter's affiliation (if any), and comment document number assigned by EM-LA. Individual comments were reviewed; comments with similar input were grouped together and treated as a single comment, concern, or issue. The comments and EM-LA's responses are grouped in the following sections by general comment categories (i.e., NEPA Process, Purpose and Need, etc.). This report contains a summary of the comments received and EM-LA's responses to these comments.

Table D-1. List of the public comment documents received, commenter's affiliation (if any), and comment document number assigned by EM-LA

Comment Document Number	Commenter	Affiliation
1	Joni Arends	Concerned Citizens for Nuclear Energy
2	Anthony	
3	Hank Hughes	Santa Fe County
4	Carol Romero-Wirth	Santa Fe City
5	Haylea Nisbet	LANL
6	Joni Arends	Concerned Citizens for Nuclear Energy
7	Janet Greenwald	Citizens for Alternatives to Nuclear Dumping
8	John Wilks, III	Veterans for Peace
9	Jean Stevens	
10	Cynthia McNamara	
11	Sydney Lienemann	NMED
12	Robert Josephs	
13	Janet Gabriel	
14	Betty Kuhn	
15	Robert Anderson	
16	Elaine Cimino	
17	Frances Hatfield	
18	Dr. Corrine Sanchez	Tewa Women United
19	Kely Pasholk	
20	Gail Seydel	
21	Jan Boudart	
22	Nathana Bird	Okhay Owingeh
23	Isabel Trujillo	
24	Doris Finney	
25	Jim Wohlegemuth	Veterans for Peace
26	Janet Berry	
27	Rachel Conn	Communities for Clean Water
28	Deborah Reade	Citizens for Alternatives to Radioactive Dumping (CARD)
29	Barb O'Connor	
30	Allison Lemons	
31	Jeanne Green	
32	Cynthia McNamara	
33	Bill Tiawald	
34	John Buscher	Sierra Club, Rio Grande Chapter
35	Janet Greenwald	Citizens for Alternatives to Radioactive Dumping's (CARD)
36	Beata Tsosie	Birth of My Heart Birthplace
37	John Buchser	Rio Grande Chapter Sierra Club
38	L. Watchempino	Pueblo of Acoma
39	Philo S. Shelton III	Los Alamos County
40	Joni Arends	Concerned Citizens for Nuclear Safety

D.1.1 AIR QUALITY

Comment Summary: A final remedy for the hexavalent chromium groundwater plume needs to simultaneously manage fugitive dust and diesel equipment emissions produced during remediation. In

Table B-1 LANL proposes Adaptive Site Management Alternative Options 1 through 4, singularly or in combination, that would cause an increase in fugitive dust emissions during cleanup. Due to LANL's proximity to Class I Area-Bandelier National Monument, LANL also proposes the use of U.S. DOE-Environmental Management best management practices (BMP) to control fugitive dust emissions associated with the implementation of these remediation options. AQB supports the implementation and use of all the proposed BMP measures to control fugitive dust as described in Section C.2 Air Quality of Draft Chromium Interim Measure and Final Remedy Environmental Assessment, Volume II. **Comment**: 11-15.

Response: NMED's support for DOE's use of the best management practices (BMPs) listed in Section C.2 of the EA to control fugitive dust emissions is noted.

Comment Summary: Since the project includes the use of generators, light towers, and other diesel-powered equipment, it may require registration or an air quality permit if the emissions of any criteria pollutant will exceed 10 pounds per hour or 10 tons per year. Please contact Rhonda Romero of the NMED AQB Permitting Section at (505) 629-3934 to determine if a permit is required. **Comment**: 11-16.

Response: Activities would be conducted in compliance with applicable regulations and permits.

Comment Summary: NMED recommends using Tier 4-rated generators, gensets, and compressors to reduce particulate matter and nitrogen oxide emissions from this type of diesel-powered equipment. Tier 4-compliant engines use oxidation catalysts, particulate filters, and selective catalytic reduction systems to significantly reduce nitrogen oxide, hydrocarbon, carbon monoxide, particulate matter, and non-methane hydrocarbon emissions. In combination with Tier 4 engines, the AQB also strongly recommends using low sulfur fuel in all diesel-powered equipment at the project site. Using low sulfur diesel fuel reduces exhaust smoke, particulate matter, and sulfur dioxide engine emissions by 60% to 90%. **Comment**: 11-17

Response: As described in Section 3.5.2.1 of the EA, the Proposed Action would implement the following mitigation measures: (1) where feasible, electrify fossil fuel-powered well development generators and stationary engines; (2) use only ultra-low sulfur diesel fuel in equipment and vehicles; (3) provide economic incentives to drilling contractors to use equipment with engines that meet the U.S. Department of Energy (EPA) nonroad Tier 4 emission standards; and (4) designate personnel to monitor the dust control program and to increase control measures, as necessary, to prevent the transport of project dust emissions beyond the LANL boundary.

Comment Summary: Analysis of Climate Change Impacts Is Required. When conducting climate change analyses in NEPA reviews, agencies should consider: (1) the potential effects of a proposed action on climate change, including by assessing both greenhouse gas (GHG) emissions and reductions from the proposed action; and (2) the effects of climate change on a proposed action and its environmental impacts. Analyzing reasonably foreseeable climate effects in NEPA reviews helps ensure that decisions are based on the best available science and account for the urgency of the climate crisis. **Comment** 40-31B.

Response: Section 3.5 of the EA includes an analysis of climate change impacts.

D.1.2 ALTERNATIVES

Comment Summary: Based on the analytical data in the DP-1835 quarterly reports from the IX treatment system, we support Option 2. This Option proposes continued operation of the IX treatment system with land application of treated water to create the needed cone of depression. **Comment**: 3-4

Response: Your support for Option 2 is noted. As you have stated, pumping from extraction wells removes water in a region around the well and may result in a cone of depression in the unconfined aquifer. Conversely, injection wells may produce a groundwater mound in the unconfined aquifer. Please note that Option 1 and Option 2 would likely result in similar "cones of depression" around the extraction wells because the amount of water extracted is the same, and injection wells are purposely located at a distance from the extraction wells so as not to interfere with the extraction of contaminated groundwater.

Comment Summary: We also strongly urge LANL not to use spray trucks as they do not guarantee an even distribution of the land applied treated water. **Comment**: 3-7, 4-6

Response: Land application of treated groundwater would be performed in compliance with NMED DP-1793 (NMED, 2015). As described in Chapter 3, because of controls implemented as part of the permit conditions (e.g., land application must be conducted in a manner that maximizes infiltration and evaporation, no ponding of water, no runoff, and no application on slopes greater than [>] 5 percent), land application would have minimal impacts. As described in Section B.3.2, note that use of the irrigation system and/or mechanical evaporators would be prioritized over the use of water trucks to minimize vehicle traffic.

Comment Summary: The EM-LA absolutely needs to take action and remediate the chromium plume that is contaminating the groundwater. Doing nothing would be irresponsible and harmful to the public and to the environment. I strongly support DOE's proposed action to carry out various treatment methods. **Comment**: 5-1

Response: Comment noted.

Comment Summary: Section 1.1.2 describes the use of adaptive site management (ASM) to remediate CrVI contamination in the regional drinking water aquifer. It is premature for DOE/NNSA/LANL/Triad/N3B to suggest the use of ASM as the NMED has not selected a recommended remediation remedy. Frankly, DOE/NNSA/LANL/Triad/N3B have not taken good care of the Española Basin Sole Source Drinking Water Aquifer. The federal entities and their contractors have contaminated the drinking water aquifer for decades. They have struggled for at least the last two decades to "clean up" the hexavalent chromium. ASM must be removed from the list of alternatives. **Comment**: 6-7

Response: As described in Section 1.2 of the EA, EM-LA prepared the EA under NEPA, as amended (Title 42 United States Code [U.S.C.] Section 4321 et seq.), to evaluate alternatives for remedial action as part of the Hexavalent Chromium Interim Measures and Characterization Campaign identified in Appendix A of the Consent Order. In accordance with the Consent Order, EM-LA will identify and evaluate potential corrective measure alternatives for removal, containment, and/or treatment of the hexavalent chromium plume in the CME report and recommend a preferred alternative for remediation. NMED will then review the CME, issue a Statement of Basis, engage in a public comment period, provide an opportunity for a public hearing on the remedy, and aid in the selection of a final remedy. As described in Section 2.3 of the EA, the use of ASM helps develop effective cleanup strategies by ensuring continuous planning, implementation, and monitoring that accommodates new information and changing site conditions. Remediation under ASM addresses what is known while acknowledging what is not fully understood; it includes plans to collect the necessary information to reduce uncertainties and achieve a final, protective remedy for the site. This approach allows work to proceed in some areas while additional data collection and testing of responses is conducted to determine the appropriate level of remediation in remaining areas. ASM has been implemented at many complex remediation sites and is recommended by the EPA. Plume movement is a dynamic process as groundwater moves and conditions change. ASM accounts for this process and allows changes to be made in remediation techniques in response to changing conditions. Any changes would need to be reviewed and approved by NMED.

Comment Summary: Section 2.1.3. Mass Removal via In-Situ Treatment has failed – molasses clogged the well and well screens requiring expensive well replacement. It should not be considered as an alternative. **Comment**: 6-9, 8-5, 17-9, 19-10, 24-9, 27-9, 28-7, 32-8, 40-15B

Response: In response to this comment, molasses was removed from the list of potential amendments. As described in Section 2.3 of the EA, the Proposed Action includes four options that can be utilized individually or as a combination to remediate chromium contaminated groundwater below Sandia and Mortandad Canyons. It is unlikely that Option 3 would be the only option used. It is more likely that if used, it would be used in limited areas to deal with a particular circumstance or situation. In-situ treatment could be used to target both source area contamination in Sandia Canyon as well as groundwater

contamination beneath Mortandad Canyon. As described in Appendix B (Section B.3.3 of the EA, Option 3: Mass Removal via In-Situ Treatment), there are many potential amendments that could be used. Proposals for the use of in-situ treatment amendments would need to be reviewed and approved by NMED.

Comment Summary: Section 2.1.4. Monitored Natural Attenuation (MNA) is preposterous considering the proximity of three of the most productive drinking water wells in Los Alamos County to the hexavalent chromium and perchlorate plumes in the regional drinking water aquifer. LANL must withdraw MNA as an alternative. **Comment**: 6-10, 8-6, 17-10, 18-5, 19-11, 24-10, 27-10, 28-8, 32-9, 40-16B

Response: As described in Section 2.3 of the EA, the Proposed Action includes four options that can be utilized individually or as a combination to remediate chromium contaminated groundwater below Sandia and Mortandad Canyons. It is unlikely that Option 4 would be the only option used. It is more likely that if used, it would be used in limited areas to deal with a particular circumstance or situation. EM-LA would consider MNA when contamination poses relatively low risks, the plume is stable or shrinking, and the natural attenuation processes are projected to achieve remedial objectives in a reasonable timeframe, compared to more active methods. Proposals for the use of MNA would need to be reviewed and approved by NMED.

Comment Summary: Taking into consideration the unfavorable responses to injection within the plume boundary and the need to fill data gaps prior to selection of a final remedy, NMED urges DOE to focus on an Enhanced Chromium Interim Measures alternative, including activities directly related to compliance with the New Mexico Water Quality Act, the 2016 Consent Order, and any other applicable regulations. **Comment**: 11-3

Response: DOE notes NMED's preference for continuation of the interim measures (i.e., the No Action Alternative). In EM-LA and N3B's February 28, 2023, letter to NMED, it states: "Results of the data-driven and numerical modeling analyses support the conclusion that groundwater located at R-45 screen 2 is captured by the extraction wells. The cause for an increase in chromium concentrations at this location is the migration of a zone of chromium concentrations that existed between the two well screens at R-45 before the commencement of IM operations. Hence, planned monitoring well R-80 is needed on a priority basis to either confirm or refute this conclusion and provide additional performance monitoring data downgradient of R-45. Deep extraction does not appear to be necessary at this time to continue to achieve IM objectives but may emerge as a priority, pending analyses that will become available when deeper monitoring wells (R-76 and R-77) are installed." Also note that as described in Section 2.3 of the EA, the Proposed Action could install up to 45 new extraction, injection, and monitoring wells and up to 30 new deep vadose zone piezometers. These wells and piezometers would greatly enhance the ability to monitor groundwater flow, contaminant transport, and the effectiveness of remediation activities. Regardless of the NEPA alternative selected, EM-LA will ensure compliance with the New Mexico Water Quality Act, the 2016 Consent Order, and any other applicable regulation. The final remedy will be selected by NMED through the Resource Conservation and Recovery Act (RCRA) CME approval process.

Comment Summary: The scope of the evaluation in the EA for the four options within the Proposed Action does not provide sufficient detail for potential environmental impacts. All four options included the expansion of the pump-and-treat treatment system, with the installation of new infrastructure, including up to 15 injection wells, up to 15 extraction wells, up to 15 monitoring wells, piezometers and an expanded groundwater treatment facility. Option 1 is intended to evaluate the environmental impacts of the implementation of mass removal via expanded treatment. Applying that expansion to Options 2, 3 and 4 prevents the inclusion of sufficient details on the environmental impacts of mass removal with land application, mass removal via in-situ treatment, and monitored natural attenuation. NMED urges a reevaluation of the four options included in the Proposed Action to focus on the potential environmental impacts of land application, all potential in-situ treatments listed in Appendix B, and the impacts of monitored natural attenuation. NMED also urges the inclusion of an option to evaluate the environmental impacts of potential vadose zone remediation alternatives. **Comment**: 11-7

Response: As stated by the EPA, "Adaptive site management combines iterations of remediation and monitoring to determine progress towards remedial action objectives (RAOs) and remediation goals, inform uncertainties, and make decisions about whether and when additional remediation is necessary to achieve RAOs." The numbers of wells and piezometers and treatment facility actions in the options are reasonable limits for environmental analysis at this point in the ASM process. The when, where, and how of additional remediation strategy will be discerned in an on-going process as new data are collected. For now, impacts for these activities can be extrapolated from these same activities that have been carried out for many years at LANL and addressed in previous reports. The list of in-situ treatments in Appendix B are inclusive of what is possibly feasible based upon literature search as are the potential impacts. The ASM process will permit additional assessment of the body of knowledge that exists where these methods have been used before and determine their viability for use here. ASM by virtue of the process institutes flexibility to address variance in approaches and could include, for example, vadose zone remediation if that is found to be a viable approach. Any of these approaches that DOE might proposed would need to be approved by NMED prior to use just as they were during the interim measure operation.

Comment Summary: The evaluation of Option 3, mass removal via in-situ treatment, under the environmental consequences to water resources as presented in Section 3.4.2.1 does not sufficiently fulfill the requirement to address any adverse environmental effects which cannot be avoided should the proposal be implemented. Appendix B, Description of Alternatives Supporting Information, includes a list of thirteen (13) in-situ chemical reduction agents and five (5) in-situ biological reduction agents and states that these amendments will be reviewed for applicability, effectiveness, and toxicity and would not be used if they would contribute to additional contamination. However, each of these potential in-situ treatments should be evaluated in the EA to determine if any of the potential amendments included in the Proposed Action would have adverse environmental effects which cannot be avoided during implementation. **Comment**: 11-8

Response: See the response to Comment 11-7 in Section D.1.2, Alternatives. It is likely that in-situ treatment would be used to address a specific problem at a specific location on a case by case basis. This could vary with the amendment used, the depth and volume of groundwater to be treated, the characteristics of the geologic media, and the groundwater chemistry. This could impact the amount of amendment used and the application rate. The various combinations and permutations of how treatment technologies could potentially be used are unknowable at this time. For more information on in-situ treatment technologies, see EPA (2000) and "Chromium VI Treatment Technologies" at https://clu-in.org/contaminantfocus/default.focus/sec/chromium_vi/cat/treatment_technologies/. Future changes to the remediation approach would be subject to additional NEPA review as appropriate.

Comment Summary: NMED recommends that EM-LA's effort in collecting groundwater information (i.e., groundwater characterization), proceeds at a pace equal to, or greater than, other options of the ASM. **Comment**: 9-10

Response: Comment noted. The collection of groundwater information is an important part of any remediation alternative. As described in Section 2.3 of the EA, the Proposed Action could install up to 45 new extraction, injection, and monitoring wells and up to 30 new deep vadose zone piezometers. These wells and piezometers would greatly enhance the ability to monitor groundwater flow, contaminant transport, and the effectiveness of remediation activities.

Comment Summary: The Chromium-6 contamination needs to be treated at the source. DOE's preferred method of pump and treat does not remove the contaminants at the source. Therefore, DOE may need to pump and treat for a century or more, which is unlikely given budget uncertainties and human frailness. To truly protect the environment and precious groundwater resources, and in the long run to save American taxpayer money, trucking or pumping treated water uphill to flush out the Cr-6 contamination at the source should be analyzed and considered. **Comment**: 17-11, 19-12, 24-11, 28-9, 32-10, 40-23B

Response: ASM is flexible and allows for new or emerging solutions to be implemented in the future. Section 2.3 of the EA states that Option 1: Mass Removal via Expanded Treatment would target both source

area contamination in Sandia Canyon and groundwater contamination in Mortandad Canyon. This section also states that In-situ treatment would be used to target both source area contamination in Sandia Canyon as well as groundwater contamination beneath Mortandad Canyon and that in addition to these options, other measures to achieve the final remedy through source removal could be instituted in the shallow and vadose zone groundwater. In addition, Appendix B, Section B.3.3, states that other measures to achieve the final remedy through source removal could be instituted in the shallow and vadose zone groundwater, alluvium, and intermediate groundwater, mostly up-canyon from the currently identified chromium groundwater plume. The discharge of treated waters could be released into Sandia Canyon or through the laboratory's NPDES outfall for treated effluent. The details related to these other measures are shown in Table B-1. Note: Using water to flush contaminants into the aquifer (i.e., adding contamination to the aquifer) is not likely to be warmly received by the regulators.

Comment Summary: We also oppose the option of mass removal with land application, echoing concerns from local communities regarding the location and process of 'applying' the removed plume water above ground. **Comment**: 18-6

Response: Comment noted. As described in Section 1.2 of the EA, the ion exchange treatment technology is extremely effective in removing the chromium from the groundwater. Water returned to the aquifer or discharged via land application would meet all standards for water quality in NMED DP-1793 (NMED, 2015) including chromium and perchlorate limits. The amount of water applied to the land (87,500,000 gpy) would be about 16 percent of the amount of water withdrawn from the aquifer. As described in Section 3.4.2.1 of the EA, land application of this much water over an area of 50 acres would have minor impacts. Proposals for the use of land application would need to be reviewed and approved by NMED.

Comment Summary: Los Alamos County Department of Public Utilities (LAC) (DPU) has reviewed the Chromium Draft EA and requests that Option 2 - Mass Removal with Land Application of Treated Groundwater be removed from consideration. First, Los Alamos County water rights are not sufficient in quantity to support this land application option when including the community of Los Alamos and LANL. The regional aquifer is currently declining at an average rate of six inches per year. What would be the impact to the regional aquifer water table with this land application alternative? LAC has been developing an extensive reclaim water system to irrigate parks and school grounds to help preserve the regional aquifer water table and place treated wastewater effluent to beneficial use. This Option 2 would degrade the water table elevation, require additional pumping costs to the LAC water system as the water table falls, and would not be placing this treated groundwater to any beneficial use to the community since Option 2 is designed as a spray irrigation/evaporation system. Furthermore, on page 10 "The discharge of treated waters could be released into Sandia Canyon or through LANL's NPDES outfall for treated effluent." is another unbounded use of water resources. **Comment**: 39-1

Response: NEPA requires that a range of reasonable alternatives be evaluated. As described in Section 2.3 of the EA, the combined extraction rate for the existing and new extraction wells would be approximately 550,000,000 gpy. However, current extraction rates for the interim measure are limited by water rights authorized by the New Mexico Office of the State Engineer (NMOSE) and is currently limited to a groundwater extraction rate of up to 648,000 gpd, or up to a maximum diversion of groundwater of 679 acre-feet per year. This translates into maximum extraction and injection rates of approximately 450 gpm for the interim measure. Any additional extraction for the Proposed Action above the current rates authorized for the interim measure would require authorization from NMOSE. As described in response to Comment 3-1, under Option 1: Mass Removal via Expanded Treatment, most groundwater would be treated and returned to the aquifer resulting in little consumptive use of groundwater and little impact on baseflow to the Rio Grande. Also, Option 3: Mass Removal via In-situ Treatment and Option 4: Monitored Natural Attenuation would result in little removal of water from the aquifer and therefore, little change in groundwater levels and baseflow to the Rio Grande. Only Option 2: Mass Removal with Land Application would not return the water directly to the aquifer. The amount of water injected under Option 2 would be about 16 percent less than under Option 1. Consumptive water use under Option 2 would be only 87,500,000 gpy, less than the

221,253,000 gpy (679 acre-feet per year) allowed in the permit. As described in Section 3.4.2.1, Option 3 would have little impact on groundwater levels.

Comment Summary: Whatever remedy is adopted, it needs to be designed to protect the County's only source of drinking water from contamination. It must also contain the plume safely away from Pajarito Well No. 3 and assure no breakthrough of chromium into the municipal drinking water system at any concentration above background concentrations. If this assurance cannot be provided, then DOE will need to construct a replacement drinking well with production capabilities similar to Pajarito Well No. 3. **Comment**: 39-6

Response: As described in Section 1.3 of the EA, the EA evaluates alternatives for groundwater remediation with the primary goal of chromium mass removal or remediation to achieve compliance with groundwater quality standards. Protection of any drinking water supplies is a priority concern. The hexavalent chromium plume is not currently endangering any drinking water supply wells and DOE, NMED, and the drinking water suppliers are closely monitoring the situation.

Comment Summary: DPU's preferred alternative is Option 1: Mass Removal via Expanded Treatment where under this option, additional extraction, injection, and monitoring wells would be added to raise the rate of groundwater extraction and increase the rate of mass removal, treatment, and injection. This option calls for extraction of the contaminated water, removal of the chromium contaminant by treatment with ion exchange, and injection of clean water back into the groundwater supply. Removal of the chromium from the drinking water supply is clearly the best way to maintain water quality for downstream drinking water use. The results of the Interim Measure in terms of both removing chromium and mitigating plume growth have been very promising. This option also allows for the most economical usage of the County's water rights while preserving the County's ability to meet its residential development growth goals. **Comment**: 39-7

Response: Los Alamos County DPU's preference for Option 1 is noted.

Comment Summary: Meanwhile, and to the detriment of protecting groundwater from further contamination, the NMED's Corrective Action Plan has been ignored by EM-LA, particularly the "acceptable corrective action" measure of locating an alternative re-injection site outside of the plume. What work has been done to locate alternative injection sites in the years since the re-injection concern was raised? DOE appears to have no interest in acceding to its regulator's concerns. According to NMED's letter dated Feb 6, 2024: "EM-LA does not agree with the conditions required as part of the acceptable corrective actions and has requested to restart the use of injection wells CrlN-2, CrlN-3, CrlN-4, and CrlN-5 without implementing the protective measures proposed by NMED." It appears, then, that DOE wishes to do whatever they want without taking seriously the grave potential consequences raised by NMED and the public regarding re-injecting clean water directly into and on top of the plume. Why has DOE done nothing in terms of finding an alternative re-injection or land application locations so that the extraction method can continue? We note that DP-1793, issued on July 27, 2015, allows for land application of treated waters across the Pajarito Plateau. Surely there are one or more places where land application of the treated waters could be done. We quote from Sec. I. Introduction of Ground Water Discharge Permit - LANL Groundwater Projects, DP-1793. "Projects conducted by the Los Alamos National Laboratory are located within the 55 sections referenced in this permit (Table and Figure provided as Attachment), approximately 1.5 miles to 7 miles south of Los Alamos, New Mexico. Discharge of treated effluent is through surface application to one of the 55 sections identified by the permittee (Table and Figure provided as Attachment) in Sections 25 and 36 of Township 19N, Range 05E, Sections 1, 2, 3, 4, 10, 11, 12, 13, 14, 24 and 25 Township 18N, Range 06E, Sections 13 through 36, Township 19N, Range 06E, Sections 5, 6, 7, 8, 16, 17, 18, 19, 20, 21, 29, and 30 Township 18N, Range 07E, and Sections 17, 18, 19, 20, 31 and 32 Township 19N, Range 07E, Los Alamos County. Ground waste most likely to be affected ranges in depth between 45 and 900 feet below ground surface and has a total dissolved solids concentration of between 270 and 300 milligrams per liter." (NMED, 2015, pp. 1-2).

Section 4.1, Objective 1, Interim Measures to Prevent Migration of the Plume Beyond the Laboratory Boundary, of the Work Plan must be revised to include a discussion of alternative injection scenarios (i.e., shallow infiltration gallery, conversion of existing well outside the plume to an injection well, constructing a new injection well outside the plume boundary, etc.). The Work Plan must also be revised to include a proposal from DOE for an investigation activity that will achieve the regulatory requirement to implement an alternative injection well location for the treated water. **Comment**: 40-19B

Response: There are substantial difficulties in land application. As described in Section 3.4.2.1 of the EA, permit restrictions associated with land application—for example, the limited land area where land application can occur; time-of-day restrictions; and the inability to land-apply water when temperatures are below freezing, during precipitation events, and under ponding conditions— are likely to reduce the amount of water that can be land applied to an amount well below the 87,500,000 gpy (16 percent of the 550,000,000 gpy of water proposed to be extracted for treatment). These same limitations apply to continuation of the interim measure without reinjection as proposed by NMED. There are also substantial difficulties with injection at a location outside Mortandad Canyon. Running a pipeline to a distant location is not feasible and trucking such a large volume of water would not be practical. Changes in the extraction, reinjection, or land application permits would require approval from the State of New Mexico.

As described in Section 2.3 of the EA, the Proposed Action could install up to 45 new extraction, injection, and monitoring wells. The locations, design, and function of any new wells would need to be reviewed and approved by NMED. Because the depth to the water table is between approximately 1,230 feet and 920 feet, a shallow infiltration gallery is not feasible.

Comment Summary: On the behalf of our 2,000 members and over 4,000 supporters in Northern New Mexico, I would like to express our support for the concerns as expressed by the Concerned Citizens for Nuclear Safety in their letter of February 9. **Comment**: 34-1

Response: Your support of the comments submitted by Concerned Citizens for Nuclear Safety (CCNS) in their February 9th letter is noted. The CCNS comment document is document #6. Therefore, if you would like to see DOE EM-LA's response to the comments submitted by CCNS, see the response to Comments 6-1 through 6-12.

D.1.3 ANALYTICAL APPROACH

Comment Summary: For both DP-1835 and DP-1793 DOE agreed to a 45 ppb limit for chromium, or 90% of the standard. Yet the maps shown use the 50 ppb limit. Concerned Citizens for Nuclear Safety (CCNS) urges DOE to use the 45 ppb permit limit for its surface maps. **Comment**: 1-1, 40-10B

Response: The New Mexico Water Quality Control Commission (NWQCC) groundwater standard for human health is 50 micrograms per liter (µg/L) of total chromium. Therefore, this number must be the value used for comparison. As described in Section 1.2 of the EA, the ion exchange treatment technology is extremely effective in removing the chromium. Therefore, treated water that is returned to the aquifer via injection wells or is land applied meets NMED permit requirements (NMED, 2015) and has almost no chromium. In response to this comment, DOE has added text to Section 1.2 of the EA to recognize the commitment that states: "Prior to discharge, all groundwater will be treated to achieve standards equal to less than (<) 90% of the numeric standards of 20.6.2.3103 NMAC and < 90% of the numeric standards established for tap water in Table A-1 for constituents not listed in 20.6.2.3103 NMAC."

Comment Summary: Hexavalent Chromium (Cr6) is the contaminant of concern due to its severe adverse human health effects. In its January 24, 2019, letter to Ramona Martinez, District Manager of Water Rights District VI for the New Mexico Office of State Engineer (OSE), Los Alamos National Laboratory (LANL) specifically referenced control and further characterization of the Hexavalent Chromium plume.

The Draft EA should specifically reference Cr6 in addition to Total Chromium. The analytical results recorded in quarterly reports from New Mexico Environment Department (NMED) Discharge Permit

(DP)-1835 show that the groundwater that is re-injected almost always has Chromium concentrations below or at the report detection limit (RDL) of 10 micrograms per liter (pre-2018) and 3 micrograms per liter (post 2018). The sample results of the injected water are below the U.S. Environmental Protection Agency drinking water standard of 100 micrograms per liter and the NMED groundwater standard of 50 micrograms per liter for Total Chromium. The Draft EA should specifically provide analytical results for Cr6 in addition to Total Chromium. **Comment**: 3-2, 4-2

Response: The New Mexico Water Quality Control Commission (NWQCC) groundwater standard for human health is 50 micrograms per liter (µg/L) of total chromium. Therefore, this number must be the value used for comparison. As described in Section 1.2 of the EA, the EA uses the term chromium by itself, to mean total chromium (hexavalent and trivalent); however, the groundwater plume is almost entirely hexavalent chromium. As described in Section 1.2 of the EA, the ion exchange treatment technology is extremely effective in removing both forms of chromium. Therefore, treated water that is returned to the aquifer via injection wells or is land applied meets NMED permit requirements and has almost no chromium of either form.

D.1.4 CULTURAL RESOURCES

Comment Summary: Further, the integrity of the cultural lands, the countless sacred and cultural sites within the entire region must be identified through a process of tribally led ethnographic studies and tribal consultation. The Peoples who trace lineage to these lands must be given fair and just opportunities for free, informed, and prior consent for any activities that could impact or continue to limit access to cultural sites and landscapes. **Comment**: 36-5

Response: Section 3.7 (Cultural Resources) and its supporting appendix (Appendix C.4) of the EA describe important Tribal cultural resources specific to the Pueblo de Sa Ildefonso, within and surrounding the project area. As stated in Section 3.7.2.1 of the EA, consultation with representatives of Pueblo de San Ildefonso concerning the Proposed Action is ongoing.

D.1.5 CUMULATIVE EFFECTS

Comment Summary: The analysis of the Proposed Action does not provide sufficient detail to address the cumulative impacts of the environmental consequences to water resources from the four proposed ASM options. **Comment**: 11-9

Response: As described in Section 3.4.2.2 of the EA, environmental consequences to water resources from the four proposed ASM Options would be either beneficial (i.e., from removing Cr(VI) mass) or minor. Because environmental consequences would be beneficial or minor and limited in areal extent, they would not substantially contribute to cumulative impacts on water resources from other actions. Any potential environmental consequences to water resources would be mitigated by adherence to Federal and state regulations, continuation of mitigation efforts (LANL, 2020a; LANL, 2020b), and compliance with the NMED Consent Order.

Comment Summary: Table B-1, Description of the proposed adaptive site management alternatives, pg. B-9. i. Under the schedule issue for Option 1, the EA assumes that approximately four wells can be drilled per year. Evaluations in the EA have the potential to underestimate the cumulative impacts to the environment by utilizing an assumption that does not represent current conditions. For instance, the impacts of expanding the timeline to accommodate the drilling operations moving slower than the EA assumes could cause additional environmental impacts to ecological resources and traffic and transportation. **Comment**: 11-14

Response: DOE believes the assumption made in the EA is a reasonable assumption that would generally bound the impacts of this activity. Drilling four wells per year would have more annual impacts (higher intensity) than drilling three wells per year. For example, drilling four wells would disturb more land, produce more air emissions, and generate more traffic on an annual basis. In addition, most permits and

regulatory limits are based on durations that are annual or shorter in duration, so it makes sense to bound impacts on an annual basis. Where applicable, total impacts are also evaluated (e.g., total land disturbed, total GHGs emitted, total truck shipments).

Comment Summary: The cumulative and long-term impacts of the RDx and Perchlorate plume adjacent and within the same aquifer to the Hexavalent Chromium plume must be considered and analyzed. **Comment**: 36-10

Response: Impacts were evaluated in Chapter 3 of this EA. In general, impacts from the Proposed Action would be small and limited to the project area. Because impacts would be small, they would not substantially contribute to cumulative impacts. That treated groundwater that is returned to the aquifer via injection wells or is land applied, meets NMED permit requirements including those for chromium and perchlorate. Therefore, there are no substantial cumulative impacts from these constituents. The RDx plume is a couple miles from the hexavalent chromium plume. Therefore, the plumes do not interact and there are no substantial cumulative impacts.

Comment Summary: Cumulative Impacts from Past, Present and Reasonably Foreseeable Actions NEPA requires DOE to address the cumulative impacts on the 50-mile radii surrounding DOE facilities and missions. DOE must be specific about potential impacts to water, air and soil, environmental justice, transportation, economics (including tourism), emergency preparedness, and waste generation. **Comment**: 40-30B

Response: See the response to Comment 40-27B in Section D.1.8, Environmental Justice. In addition, it should be noted that, as described in Section 3.14 of this EA, with respect to the socioeconomic analysis, this EA uses a larger ROI fully encompassing four counties: Los Alamos County (host county for LANL) and immediately adjacent counties (Rio Arriba, Sandoval, Santa Fe Counties) in New Mexico. This was based on where the majority of workers for proposed chromium plume remediations would be expected to reside and spend most of their salary, and in which a significant portion of site purchase and non-payroll expenditures from the construction and operation of the Proposed Action and alternatives would occur (see Appendix C, Section C.5).

D.1.6 EDITORIAL

Comment Summary: Typographical Errors: i) Pg. 1 line 22: (NWQCC) and ii) Pg. 9 line 35: New Mexico Office of State Engineer (NMOSE). **Comment**: 11-19

Response: These typographical errors have been corrected.

D.1.7 ENVIRONMENTAL IMPACTS

Comment Summary: I'm concerned about the hexavalent chromium (Cr-6) plume and how it will negatively impact the land, water, and communities who rely on the Española Basin Drinking Water Aquifer, including the Rio Grande environment and Santa Fe. **Comment**: 12-1, 13-1, 14-1, 15-1, 17-1, 19-1, 22-1, 23-1, 24-1, 25-1, 26-5, 27-1, 29-1, 31-1, 32-1, 33-1, 34-2, 36-1, 37-1, 38-1

Response: As described in Section 3.4.1.1 of the EA, the hexavalent chromium plume lies in the upper part of the regional aquifer approximately 1,230 to 920 feet beneath the LANL site and is not currently impacting any water supply wells. Therefore, there is currently no human health or ecological exposure from the hexavalent chromium groundwater plume. DOE has been working toward characterization and containment of the hexavalent chromium plume since its discovery in 2004. As described in Section 1.2 of the EA, although there is still uncertainty with respect to the vertical and lateral distribution of the hexavalent chromium plume in the plume centroid and the northeastern regions of the plume, the hydraulic and geochemical data and information indicate that interim measure operations have generally contained the plume within the LANL site boundary. As described in Section 1.3 of the EA, the purpose of the Proposed

Action is to remediate hexavalent chromium contaminated groundwater below Sandia and Mortandad Canyons.

Comment Summary: We remain seriously concerned about the chromium (both CrIII and CrVI) and toxic pollutant perchlorate (ClO4) plumes from surface waters to deep groundwater below Los Alamos National Laboratory (LANL) and how they negatively impact the land, water, and communities who rely on the Española Basin Sole Source Drinking Water Aquifer. See: https://www.epa.gov/dwssa/map-sole-source-aquifer-locations. It's been twenty years since toxic and dangerous CrVI and ClO4 were discovered in the groundwater, and still DOE still fails to produce workable plans for protecting the region's drinking water. **Comment**: 40-2B

Response: See the response to Comment 12-1 in Section D.1.7, Environmental Impacts, and Comment 40-11B in Section D.1.18, Regulatory Concern.

D.1.8 ENVIRONMENTAL JUSTICE

Comment Summary: For too long, Native families in New Mexico have been dealing with discriminatory policies that have historically been felt by generations as acts of violence on our shared lands, and ultimately enabled and perpetrated a culture of violence on our bodies. In order to continue to lay claim to our ancestral places, the suppression of our cultural societal structures and matrilineal ways of knowing are being replaced with a contaminated existence. This ongoing contamination is of great concern for the future wellbeing of our children and birthing people in our communities and is rooted in an ideology that is not Indigenous to these lands and does not love or care for us. **Comment**: 36-3

Response: DOE EM-LA is committed to transparency and public input on legacy cleanup. Chapter 5 describes consultation and coordination activities related to this EA. Appendix C.6 (Environmental Justice) of the EA describes ongoing cooperative agreements and engagement activities between DOE EM-LA and its cleanup contractor (N3B), and Tribal jurisdictions in northern New Mexico, including Pueblo de San Ildefonso, Pueblo of Jemez, Santa Clara Pueblo, Pueblo de Cochiti, Pueblo of Pojoaque, and Taos Pueblo. Appendix C.6 also describes recent Tribal outreach efforts specific to the Proposed Action. Potential impacts on Tribal populations, including those related to human health and water resources, are described in Sections 3.15 (Environmental Justice). Also see the response to Comment 36-4 (Section D.1.10, Human Health) regarding potential human health effects on indigenous birthing people.

Regarding cultural resources, note that Section 3.7 (Cultural Resources) and its supporting appendix (Appendix C.4) of the EA describe important Tribal cultural resources specific to the Pueblo de Sa Ildefonso, within and surrounding the project area. As described in Section 3.7.1.2, because identifying a bounding geographic area for Tribal cultural resources is challenging due to the complexity of the relationships and interactions between these resources and important Tribal practices and beliefs, potential for impacts to such resources is being assessed through consultation with representatives of the Pueblo de San Ildefonso.

Comment Summary: Environmental Justice Issues and Concerns Must Be Addressed for a Wider Area. This EA only has a radius of influence of 5-miles for environmental impacts. This must be wider. Importantly, DOE's environmental justice analyses must extend beyond Los Alamos County itself and into the surrounding counties and communities which are continuously impacted by LANL's ongoing legacy of environmental contamination. Restricting analyses to Los Alamos County inaccurately skews environmental justice screenings and analyses. Largely owing to LANL's hiring practices, Los Alamos County is predominantly white and affluent, and, to this extent, is not representative of the economic and ethnic makeup of the region. However, LANL's contamination runs in water and drifts in air to regions of northern New Mexico far beyond the white and affluent enclave on the mesa. From an environmental justice standpoint, it is incumbent upon DOE to consider the realistic environmental and public health impacts of the Lab's activities as they extend into the surrounding areas. **Comment**: 40-27B

Response: DOE believes that a 5-mile radius for environmental impacts is appropriate for this type of Proposed Action. The 5-mile radius includes all of Los Alamos County, and parts of Sandoval, Santa Fe, and Rio Arriba Counties in New Mexico. With respect to the environmental justice analysis, the population and income levels of nearby pueblos also were included (San Ildefonso, Santa Clara, Cochiti, Jemez and Pojoaque). As described in the EA, there are no disproportionate and adverse impacts at 5 miles (nor would disproportionate and adverse impacts be expected within 50 miles). The 2008 LANL Site-Wide EIS (SWEIS) (LANL, 2008) evaluated a larger radius, as was appropriate for the scope of that document; and the ongoing LANL SWEIS (Notice of Intent [NOI] published August 19, 2022, 87 Federal Register [FR] 51083) is evaluating environmental impacts, including environmental justice impacts, within a 50-mile radius, as is appropriate for the scope of that document.

D.1.9 FLOODPLAIN AND WETLAND ASSESSMENT

Comment Summary: The outdated 2001 LANL Floodplain Extent Model must be updated to reflect conditions on the Pajarito Plateau. With regard to the Federal Flood Risk Management Standard (FFRMS) (reinstated May 20, 2021), the draft states that the 2001 LANL floodplain extent model "complies with the 'climate informed science approach (CISA)' described in the FFRMS in the following ways." P. 1. The draft does not state that the 2001 LANL floodplain extent model meets all of the FFRMS requirements.

The 2001 LANL floodplain extent model does not provide full analyses of the floodplain risks across the Pajarito Plateau. The draft states: Future projections of extreme precipitation events in the region do not indicate a clear and actionable trend and/or are not of a temporal and spatial resolution that could inform a watershed-scale, event-based hydrologic model. P. 1.

To the contrary, Dave McInroy, LANL's program director for environmental corrective action, stated in a September 23, 2013 Phys.org online article following extreme precipitation: Last week we experienced an epic event. We received more than 7-and-a-half inches of rain in a four-day period and more than an inch-and-a-half in one hour on Sept. 13th. None of our recorded history has shown anything like this. file:///Users/ccns/Downloads/2013-09-los-alamos-national-laboratory-storm.pdf

Please see the photo of the extreme flow through Mortandad Canyon. Los Alamos County was declared a disaster. Millions of dollars of damage was done in the County and at LANL that needed repair. Did the 2001 floodplain extent model anticipate the extreme precipitation events that occurred across the Pajarito Plateau in September 2013? The draft does not say.

The September 2013 extreme precipitation events provide evidence that all the canyons that flow across the Pajarito Plateau require additional FFRMS analyses "to forecast flood hazard areas under future climate changes and other factors." P.1. Again, the draft should be withdrawn in order for additional FFRMS analyses may be done "to forecast flood hazard areas under future climate changes and other factors."

As a precautionary measure, the draft should be analyzing for 500-year storms impacting floodplains and wetlands across the Pajarito Plateau, and specifically within Mortandad and Sandia Canyons, given the impacts of the September 2013 storm events. Please review the Phys.org photo referenced above of high-water levels in Mortandad Canyon after the storms. **Comment**: 6-4

Response: Section 1.0 (Introduction of the Floodplain and Wetland Assessment) describes how the model meets the Federal Flood Risk Management Standard (FFRMS) requirements (81 FR 64403). The FFRMS does not require 1,000-year precipitation events (such as the September 2013 precipitation event) to be used in modeling the extent of floodplains. While the FFRMS does provide an option to use the 500-year floodplain, it notes that the CISA, as is used in this EA, is "preferred."

Data products that provide precipitation frequency estimates under future climate scenarios with spatial and temporal resolution capable of forcing a watershed-scale, event-based hydrologic model are not yet available for New Mexico (Dr. Andrew Fullhart, personal communication, December 18, 2023).

Current precipitation frequency estimates obtained from the NOAA Atlas 14 for Los Alamos, New Mexico, estimate 2.85 inches of cumulative rainfall for the 100-year, 6 hour duration storm (2.43–3.28 inches - 90% CI). This is consistent with McLin et al. (2001; Table B-1) who also accounted for elevation across the watershed.

The 2001 LANL base floodplain extent map was modeled using watershed hydrologic parameters representative of post-fire conditions immediately following the Cerro Grande Fire (2000). This resulted in very broad floodplain extents that would only be expected under the most extreme and hydrologically responsive conditions.

Comment Summary: The draft does not state how the Los Alamos County Pajarito Mesa (PM) drinking water wells will be protected during extreme precipitation events such as the extreme event which occurred September 2013 when seven and one-half (7 1/2) inches of rain fell in a four day period. **Comment**: 6-5, 8-3

Response: The Los Alamos County Pajarito Mesa drinking water wells are not owned or operated by DOE EM-LA. For wells that are owned and operated by DOE EM-LA, surface well design requirements can be found in the New Mexico Administrative Code (NMAC) 19.27.4.29 Well Drilling – General Requirements. This is outlined in the well permitting application process under the Artesian Well Plan of Operations (overseen and approved by the NMOSE). An approved application is required by NMOSE and details the depths, materials, and methods of surface completion. The design requirements include controls for preventing "unintended flood waters from entering the well and contaminating the aquifer."

Comment Summary: Section 1.1.1 references the National Pollutant Discharge Elimination System (NPDES) Permit No. NM002835, but it does not mention the New Mexico Environment Department (NMED) groundwater discharge permits (DP)-1793 (issued July 27, 2015) and DP-1835 (issued August 31, 2016) for remediation of the regional drinking water aquifer of hexavalent chromium and other contaminants. DP-1793 allows land application of treated waters extracted from the regional drinking water aquifer. DP-1835 allows the construction and operations of extraction and injection wells into the regional drinking water aquifer.

At LANL's insistence, both groundwater discharge permits state: The groundwater to be treated and discharged may contain water contaminants which may be elevated above the standards of Section 20.6.2.3103 NMAC and/or toxic pollutants as defined in Subsection WW of 20.6.2.7 NMAC. Prior to discharge, all groundwater will be treated to achieve standards [DP-1973 'equal to'] less than (<) 90% of the numeric standards of 20.6.2.3103 and < 90% of the numeric standards established for tap water in Table A-1 for constituents not listed in 20.6.2.3103 NMAC. p.1, DP-1793; p. 2, DP-1835 GWQP

The New Mexico human health standard for chromium is 50 parts per billion (ppb) 20.6.2.3103.A(1)(f) NMAC. As required by the discharge permits, the limit of less than 90% of the numeric standards applies. Ninety percent of 50 ppb is 45 ppb. The draft must include the more protective permit standards for land application and extraction and possible injection. **Comment**: 6-6, 8-4

Response: Sections 2.1.2 and 3.3 of the Floodplain and Wetland Assessment were amended to include references to DP-1793 and DP-1835 permit conditions.

Comment Summary: Section 2.1.2. Mass Removal with Land Application. DP-1793 and DP-1835 contain restrictions for when and where land application may be used. For example, no land application is allowed in the winter season. The draft does not address these restrictions. One correction: The NPDES land permit does not allow for land application; the correct permit is NMED DP-1793. **Comment**: 6-8

Response: Sections 2.1.2 and 3.3 of the Floodplain and Wetland Assessment were amended to include references to DP-1793 and DP-1835 permit conditions.

Comment Summary: Section 3.0, Floodplain and Wetland Impacts and Section 3.1, Short-Term Impacts. Please review the DP-1793 and DP-1835 permit conditions for remediation of the short-term negative direct

and indirect effects to the floodplains and wetlands within the project area and incorporate those conditions into new analyses and the draft SWEIS. For example, see DP-1793:

- Section IV.A.3 (workplans requiring public review and comment);
- Section IV.A.4 (criteria for land application, including prohibitions when precipitation if occurring or when the temperature is below freezing);
- Section IV.B "Monitoring, Reporting, and Other Requirements;"
- Section IV.B.11 (sampling of surficial soils at areas of land application of treated water);
- Section IV.B.12 (mandatory and voluntary posting of documents to LANL's electronic public reading room); See also DP-1835 posting at Section IV.B.17;
- Section IV.C. (contingency plan); See also DP-1835 contingency plan at Section IV.C, 18 - 23; and
- Section IV.D (closure plan – which goes to the long-term impacts); See also DP-1835 closure plan at Section IV.D, 24. **Comment**: 6-11

Response: Sections 2.1.2 and 3.3 of the Floodplain and Wetland Assessment were amended to include references to DP-1793 and DP-1835 permit conditions. Anticipated impacts to the floodplain from land application were detailed in Section 3.0 of the draft Floodplain and Wetland Assessment. The SWEIS is outside the scope of this Floodplain and Wetland Assessment.

Comment Summary: Section 3.2. Long-Term Impacts. The draft does not state or show where "infrastructure," including a proposed 10,000 square foot treatment facility, would be constructed and operated. This omission prevents meaningful public comment on this aspect of the proposed project. DP-1793 requires the submission of plans and specifications to NMED for changes to the quantity or quality of the discharge. See Section IV.E.24. See also DP-1835, Section IV.E.29. **Comment**: 6-12, 8-7

Response: More detailed information on the Proposed Action is provided in Appendix B, Section B.3, of the EA. Section B.3.1 describes the infrastructure that would be constructed and operated under Option 1, including the treatment facility. The treatment facility would be built on previously disturbed land outside the floodplain and any wetlands. Sections 2.1.2 and 3.3 of the Floodplain and Wetland Assessment were amended to include references to DP-1793 and DP-1835 permit conditions.

Comment Summary: Citizens for Alternatives to Radioactive Dumping supports the comments of Concerned Citizens for Nuclear Safety concerning the proposed floodplain and wetland action for chromium remediation in Sandia and Mortandad Canyons at Los Alamos National Laboratory. **Comment**: 7-1A

Response: Comment noted. See the responses to the comments from Concerned Citizens for Nuclear Safety (CCNS) at Comment 6-1 through 6-12.

Comment Summary: We make this timely public comment in the hope you will find the current Floodplain and Wetland Action for Hexavalent Chromium Remediation in Sandia and Mortandad Canyons at the Los Alamos Nuclear Weapons Plant, dated January 2024, EM2024-0044), premature.

The current draft plan should be withdrawn to await the pending regulatory decision by the New Mexico Environmental Department (NMED) for the remediation of the hexavalent chromium (CrVI) plume. Additionally, the two DOE EM-LA documents for the proposed floodplain and wetland action and the interim measure and final remedy, should be incorporated into the draft LANL Site-Wide Environmental Impact Statement (SWEIS) which is expected to be released for public review and comment in fall 2024. Finally, with the announcement on February 8, 2024, of the extension of the public comment period on the *Draft Environmental Assessment for the Hexavalent Chromium Interim Measures and Final Remedy*, we believe that DOE EM-LA ought to merge the related two documents, republish a consolidated document, extend the comment period, and co-ordinate all related proposals, which consider the provisions of the imminent regulatory decision from the state. **Comment**: 8-1

Response: Per 10 CFR 1022.1(b), Floodplain and Wetland Environmental Review requirements shall be implemented through existing procedures such as those established to implement the NEPA. The Draft EA was developed simultaneously with the CME submittal to NMED, so as to avoid precluding public comment during the process of selecting remediation strategies. This is the appropriate time to release the Draft Floodplain and Wetland Assessment for public review and comment. Should the NMED statement of basis suggest alternate remediation strategies than those in the EA (and reflected in the CME), then a revised Floodplain and Wetland Assessment will be released for public comment and review at that time. Also see the Response to Comment 6-1 in Section D.1.13, NEPA.

Comment Summary: We find that the 2001 LANL floodplain extent model is outdated and must be updated to reflect current conditions on the Pajarito Plateau. The 2001 LANL floodplain extent model does not provide full analyses of the floodplain risks across the Pajarito Plateau. **Comment**: 8-2

Response: Comment noted. Section 1.0 (Introduction of the Floodplain and Wetland Assessment) details how the 2001 LANL Floodplain Extent Model conforms to the Federal Flood Risk Management Standard.

D.1.10 HUMAN HEALTH

Comment Summary: Indigenous birthing people must be centered in protections and standards of clean up at the hexavalent chromium (CrVI) plume site. We ask that the current allowable levels of harm of 45 ppb be rescinded and be made more stringent, accompanied by further research studies, and changed to a standard that is protective of the birth waters for unborn children and the bodies of those most vulnerable. There are currently methods of bio and mycoremediation that can clean up the levels of CrVI to 0 ppb. It is long overdue for these standards and methodologies to be implemented. One such recommendation was given by expert mycologist Peter McCoy, on behalf of Communities for Clean Water, during the public hearing that took place a few years back on remediation of the plume. Please revisit his recommendation and extended comments. **Comment**: 36-4

Response: DOE is not responsible for setting standards for the acceptable amount of chromium in groundwater. The New Mexico Water Quality Control Commission (NWQCC) groundwater standard for human health is 50 micrograms per liter (µg/L) of total chromium. Therefore, this number must be the value used for comparison. As described in Section 1.2 of the EA, the ion exchange treatment technology is extremely effective in removing the chromium. Therefore, treated water that is returned to the aquifer via injection wells or is land applied meets NMED permit requirements and has almost no chromium. Because of the proven effectiveness of the ion exchange treatment technology, alternative technologies are not being evaluated.

As described in "Children and Drinking Water Standards" (EPA, 1999), EPA's drinking water standards are designed to protect children and adults. The standards take into account the potential effects of contaminants on segments of the population that are most at risk. When EPA sets each standard, the agency conducts a risk assessment in which scientist evaluate whether fetuses, infants, or children, or other groups are more vulnerable to a contaminant than the general population. The standard is set to protect the most vulnerable group. The EPA drinking water standard for total chromium is 100 µg/L (equivalent to ppb) while the NWQCC groundwater standard for human health is 50 µg/L.

Comment Summary: The analyses must protect those most at risk. Many federal standards for protection of human health, such as limits on how much residual radiation will be allowed in contaminated soil, are based on "Reference Man." He is defined as a hypothetical adult Caucasian male who is 20 to 30 years old, 154 pounds in weight, five feet seven inches tall, and is "Western European or North American in habitat and custom." He does not represent other humans, including women, children, and embryos/fetuses, that are more sensitive to the harmful effects of radioactive, toxic, and hazardous materials. All analyses must address the risk to a pregnant woman farmer, her fetus, and her other children under age 18, rather than "Reference Man." As a matter of reproductive and environmental justice, the most potentially vulnerable human beings must be protected. **Comment**: 40-29B

Response: As described in "Children and Drinking Water Standards" (EPA, 1999), EPA's drinking water standards are designed to protect children and adults. The standards take into account the potential effects of contaminants on segments of the population that are most at risk. When EPA sets each standard, the agency conducts a risk assessment in which scientist evaluate whether fetuses, infants, or children, or other groups are more vulnerable to a contaminant than the general population. The standard is set to protect the most vulnerable group. The EPA drinking water standard for total chromium is 100 µg/L while the NWQCC groundwater standard for human health is 50 µg/L. Radiation is not a component of the hexavalent chromium plume and, therefore, is not within the scope of this EA. As described in Section 3.4.1.1 of the EA, the depth to the top of the regional aquifer (and therefore the chromium plume) from the mesa tops is between approximately 1,230 to 920 feet. Therefore, soil contamination is not an issue for the chromium plume and is not discussed in the EA.

D.1.11 LEGACY CONTAMINATION

Comment Summary: We can no longer rely on findings from DOE/LANL or its associates, which expose communities, people, and wildlife in northern New Mexico to nuclear waste and its contaminants for over 75 years. Citizens' right to know has been delayed for far too long. **Comment**: 16-2 (cont.), 26-5

Response: As described in Section 1.2 of the EA, the hexavalent chromium plume originated from LANL's non-nuclear power plant at the head of Sandia Canyon. From 1956 to 1972, water containing potassium dichromate (with chromium in its hexavalent form [Cr+6 or Cr(VI)]) was utilized as a corrosion inhibitor for the plant cooling towers, as was a common practice at the time. This water was discharged into the headwaters of Sandia Canyon and infiltrated into the ground. As described in Section 1.3 of the EA, in accordance with applicable Federal and state regulations, and the Consent Order, DOE-EM needs to assess, identify, clean up, and otherwise address environmental contamination at LANL. DOE EM-LA is preparing this EA to evaluate the environmental impacts of corrective measures to remediate contaminated groundwater below Sandia and Mortandad Canyons and to determine whether to issue a FONSI or to prepare an EIS. Concerns about remediation of other environmental contamination is outside the scope of this EA.

D.1.12 MONITORING

Comment Summary: A map should be provided showing the locations of proposed vadose zone and ground water monitoring locations for each proposed land application area. **Comment**: 3-6, 4-5

Response: In Appendix B, Figure B-3 shows areas where land application of treated water could occur. Soil sampling locations and monitoring wells (including perched groundwater and regional aquifer monitoring wells) are shown on this map. Monitoring of land application areas would be performed in compliance with NMED DP-1793 (NMED, 2015).

Comment Summary: As LANL and NMED continue to examine remediation options, frequent and adequate plume monitoring as a method of ensuring community safety must be a priority. While the new plan would establish additional monitoring stations in the Sandia and Mortandad Canyons, we request that additional, independent third-party groundwater monitoring for the purpose of identifying hexavalent chromium contamination be conducted in surrounding communities, including the Pueblos of Santa Clara and San Ildefonso, and the cities of White Rock, Española, and Pojoaque. **Comment**: 18-7

Response: DOE is proposing to install monitoring wells on San Ildefonso Pueblo lands just across the LANL site boundary to monitor for the potential for the hexavalent chromium plume to cross under the site boundary. The hexavalent chromium plume is not currently endangering any drinking water supply wells and DOE, NMED, and the drinking water suppliers are closely monitoring the situation. Therefore, there is currently no reason related to the hexavalent chromium plume, to monitor the groundwater or surface water in offsite communities.

D.1.13 NEPA

Comment Summary: This EA is short on timelines, details, plans, and goals. **Comment**: 2-1

Response: The Proposed Action is described in Section 2.3 of the EA, with additional detail provided in Appendix B, Section B.3. DOE prepared this EA in accordance with the Council on Environmental Quality (CEQ) NEPA regulations (Title 40 Code of Federal Regulations [CFR] Parts 1500–1508) and DOE's NEPA-implementing procedures (10 CFR 1021).

Comment Summary: This draft floodplain and wetland assessment is premature. It should be withdrawn to await the recommended regulatory decision by the New Mexico Environment Department (NMED) for the remediation of the hexavalent chromium (CrVI) plume. In fact, the proposed floodplain and wetland action should be incorporated into the draft LANL Site-Wide Environmental Impact Statement (SWEIS) which is expected to be released for public review and comment in the fall of 2024. We note the draft SWEIS is already six years behind schedule. **Comment**: 6-1

Response: See the response to Comment 9-3B in Section D.1.13, NEPA. A Floodplain and Wetland Assessment is required to be performed when an EA is being developed and before a finding is issued. Therefore, it would not be appropriate to wait until the SWEIS is issued. The preparation of the SWEIS is outside the scope of the Chromium EA and associated Floodplain and Wetland Assessment.

Comment Summary: We note that yesterday, February 8, 2024, we received an electronic notice that the comment period for the related Draft Environmental Assessment for the [Hexavalent] Chromium Interim Measures and Final Remedy was extended to Wednesday, March 13, 2024. CCNS expected to receive a similar notice for the floodplain and wetland assessment comment period. We asked for a seven-day extension of time to Friday, February 16, 2024, but did not receive a response from DOE EM-LA. **Comment**: 6-2

Response: Although the comment period on the Floodplain and Wetland Assessment was not extended, all comments received within the EA comment period, which ended on March 13, 2024, were considered in developing the Final Floodplain and Wetland Assessment.

Comment Summary: Now, DOE proposes to put the cart before the horse, skipping necessary steps and rushing into a draft Environmental Assessment (EA) and "final remedy." The draft EA presented is incomplete and technically deficient. Nor does the draft include plans for consultation with public stakeholders. Accordingly, DOE must withdraw the EA and prepare a more detailed Environmental Impact Statement (EIS). **Comment**: 9-3, 10-3, 17-4, 19-4, 24-3, 26-1, 27-3, 28-1, 29-4, 31-4, 32-3, 37-3, 40-1B

Response: As described in Section 1.3 of the EA, DOE EM-LA prepared the EA under the CEQ NEPA regulations (Title 40 CFR Parts 1500–1508) and DOE's NEPA-implementing procedures (10 CFR 1021). At the conclusion of the EA process, DOE will assess whether to issue a FONSI or to prepare an EIS. As described in Section 1.5 of the EA, stakeholders were given the opportunity to comment during the scoping period and during review of the Draft EA. As described in Section 1.2 of the EA, public input will also be solicited during NMED selection of a final remedy.

Comment Summary: The draft Environmental Assessment is premature and must be withdrawn. Why would DOE and its Environmental Management Los Alamos office (DOE EM-LA) release this "Draft Hexavalent Chromium Interim Measure and Final Remedy Environmental Assessment" now? Doing so preempts important steps for public disclosure and prohibits the preparation of a more detailed EIS for public review and comment. Prior to the EA stage, the process requires the Environment Department to reveal all of the following: a preferred alternative for remediation, a Statement of Basis for how to proceed, opportunities for public review and comments, and requests for a public hearing. All of these steps are necessary to engage the public and determine the most protective and respectful processes for cleaning up the plume. Neglecting these steps shrouds the process in secrecy. **Comment**: 9-3B, 10-3, 20-5, 25-3, 28-2, 33-3, 36-6, 37-4, 38-5

Response: Due to the degree of public interest in the remediation of the chromium plume, DOE issued the Draft EA so that members of the public and interested stakeholders would have an opportunity to provide input on the range of potential remedial actions. Both public scoping (before publication of the Draft EA) and public comment hearings were held to engage the public and interested stakeholders in providing comments and questions. The EA provided a range of remediations options and a viable approach to cleanup using ASM to allow for flexibility to address new information or conditions as they arise during the further site characterization. The final remedy to be selected is not within DOE's ability to state since under RCRA it is the State of New Mexico that will select that remedy. DOE is tasked with providing the potential remedy strategies and the potential environmental impacts of those strategies to the extent that they can be estimated at this point.

Comment Summary: DOE's plan for an environmental assessment leads to segmentation. The National Environmental Policy Act (NEPA) warns against 'segmentation,' or dividing environmental analyses into smaller parts, which can then be approved without looking at the big picture. I don't know the big picture because NMED has not yet decided on its preferred alternative for remediation, a Statement of Basis, more opportunities for public comments, a public hearing, and/or a final remedy determination. DOE EM-LA has not explained why it is not waiting for the Environment Department to make its required regulatory decisions. **Comment**: 9-6, 10-6, 17-7, 19-8, 20-8, 24-7, 25-6, 26-4, 27-7, 28-5, 30-2, 31-7, 32-6, 33-6, 36-9, 37-7, 38-7, 40-7B

Response: The EA covers all actions related to hexavalent chromium plume remediation and therefore does not result in segmentation. In accordance with the Consent Order, DOE EM-LA will identify and evaluate potential corrective measures alternatives for removal, containment, and/or treatment of the hexavalent chromium plume in the CME report and recommend a preferred alternative for remediation. NMED will then review the CME, issue a Statement of Basis, engage in a public comment period, provide an opportunity for a public hearing on the remedy, and aid in the selection of a final remedy.

Comment Summary: The EA follows a standard NEPA EA format where the full suite of elements regarding potential environmental and cultural impacts are addressed. **Comment**: 11-5

Response: Comment Noted.

Comment Summary: Citizens for Alternatives to Radioactive Dumping's (CARD) position on the EA of the Department of Energy on the chromium plume in the Española Aquifer is that the EA is incomplete and that the public has not been fully informed or meaningfully involved:

- DOE held its hearing on the EA during pueblo feast days.
- At the hearing, the public was not allowed to hear the testimony of the NMED or others before coming to their own conclusions.
- No history of the remediation efforts is included
- No history of NMED's positions on the many issues involved is included.

Though we understand that proceeding at a good pace is highly important, denying the public adequate information and input is not acceptable. **Comment**: 035-1B

Response: As stated in Section 1.5 (Public Involvement), the EA describes two scoping meetings that were held in person and virtually via webcast. Notices were published in the local papers and notices were sent to interested stakeholders including CARD. Questions were welcomed from all attending at both meetings. Public Hearings were similarly held. All formal comments received were considered in preparing the final EA.

A brief history of the hexavalent chromium contamination was provided in Sections 1.1 and 1.2 of the EA. The history of the chromium project and LANL's and NMEDs comments and responses can be found on

their LANL Chromium Groundwater Contamination website: https://www.env.nm.gov/hazardous-waste/chromium-groundwater-contamination/.

Comment Summary: Now, DOE proposes to put the cart before the horse, overlooking critical issues that bear upon the selection of a final remedy to effectively control the trajectory and extent of the plume, rather than deflecting the plume toward an indigenous tribal community that predated LANL by 643 years. The draft EA is not comprehensive and technically deficient. No plans for engaging in consultation with tribal and public stakeholders were provided. Therefore, DOE should withdraw its premature EA and prepare a more comprehensive Environmental Impact Statement (EIS) instead. **Comment**: 38-4

Response: See the response to Comment 9-3 in Section D.1.13, NEPA. Section 1.5 of the EA describes public involvement opportunities for this EA. Chapter 5 describes consultation and coordination activities. As stated in Section 1.5, the EA describes two scoping meetings that were held in person and virtually via webcast. Notices were published in the local papers and notices were sent to interested stakeholders including CARD. Questions were welcomed from all attending at both meetings. Public Hearings were similarly held. All formal comments and questions received were considered in preparing the Final EA.

Comment Summary: The Draft Environmental Assessment is premature and must be withdrawn and replaced by a draft Environmental Impact Statement DOE has put the cart before the horse, skipping the necessary administrative steps. DOE has rushed into a draft EA and an absolutely premature "final remedy." The draft EA presented for public review and comment is incomplete, vague, and technically deficient. Accordingly, DOE must withdraw the EA and prepare a more detailed draft Environmental Impact Statement (EIS), starting with new scoping, as requested by many of the non-governmental organizations in June 2023 scoping comments.

Furthermore, it is premature for DOE to declare a "final remedy" now because the nature and extent of the CrVI plume has yet to be determined. We object to the assumption that the EA/EIS will include the Final Remedy. As detailed in the May 31, 2023 NMED correspondence to Mr. Arturo Duran, of the Los Alamos Field Office, DOE has not identified the nature and extent of the CrVI plume.[1] It is premature to identify a final remedy without first determining the nature and extent of the CrVI plume. Please delete "final remedy" language from the materials supporting the preparation of this EA/EIS. The draft EA/EIS must include multiple plans for consultation with public stakeholders Prior to the EA stage, the administrative procedure process requires NMED and DOE to disclose all of the following:

- A preferred alternative for remediation,
- A Statement of Basis for how to proceed from NMED,
- Opportunities for public review and comments, and
- Requests for a public hearing.

All of these steps are necessary to engage the public and determine the most protective and respectful processes for cleaning up the plumes. Neglecting these steps shrouds the process in a lack of transparency. Given the number of uncertainties that remain, we question why DOE has presented a "final remedy" in the draft EA. It is clear that DOE does not have clear evidence of the plume's depth and extent, or at least does not publicly disclose it. Increasing concentrations detected among the sporadically placed wells indicate the unpredictable movement of the groundwater and the toxic contaminants within it. Re-injecting needs to be more fully modeled and understood before this draft EA comes to fruition. In fact, this is another example of why new scoping must be done for a draft EIS. **Comment**: 27-4, 40-4B

Response: See the response to Comments 38-4 and 9-3B in Section D.1.13, NEPA.

Comment Summary: We also note how outdated and inadequate the last LANL Site-Wide Environmental Impact Statement, completed in 2008, is for the purpose of "tiering" this CR-VI Environmental Assessment (which again we assert should be a more comprehensive environmental impact statement). DOE should release the new draft SWEIS, which is reportedly already nearly complete, without further delay. Indeed,

this urgent issue of CR-VI groundwater contamination should be analyzed and discussed in the new LANL SWEIS. Better yet, this CR-VI Environmental Assessment should be withdrawn, to be followed by a CR-VI environmental impact statement that is tiered off of a new final LANL SWEIS. **Comment**: 40-32B

Response: See the response to Comment 9-3 in Section D.1.13, NEPA. Also note that the new LANL SWEIS is currently being prepared and a draft is expected to be released to the public in the Summer of 2024. The NOI for the LANL SWEIS (87 FR 51083) states that the SWEIS will include the environmental impacts of legacy waste remediation conducted by DOE's Office of Environmental Management (DOE–EM).

D.1.14 NUCLEAR WEAPONS

Comment Summary: Why not ask the DOE who will be present, presenting, praising, supporting and funding all our industries together in one place, and leading further development and use of highly toxic materials as we lead this nuclear arms race, while in Washington, D.C., January 31st – Feb. 2nd's "Annual Nuclear Deterrence Summit" to have all the "expertise" in the full rooms brainstorm a solution to their collective industries irresponsible pollution of the planet? You have the scientists and financiers present, and the gov. reps of all in the industry. And further, why not have those ask/demand the DOE to support on that day of Jan. 22nd, the TPNW, which has in its Treaty the charge to gather experts from around the world to deal directly with Remediation for all contamination from this "Enterprise." They want solutions? First step would be to STOP the further contamination, and the second step would be to come together urgently to save this planet. **Comment**: 2-2

Response: Concerns about nuclear weapons and remediation of other environmental contamination are outside the scope of this EA. As described in Section 1.2 of the EA, the hexavalent chromium plume originated from LANL's non-nuclear power plant at the head of Sandia Canyon. From 1956 to 1972, water containing potassium dichromate (with chromium in its hexavalent form [Cr+6 or Cr(VI)]) was utilized as a corrosion inhibitor for the plant cooling towers, as was a common practice at the time. This water was discharged into the headwaters of Sandia Canyon and infiltrated into the ground. As described in Section 1.3 of the EA, in accordance with applicable Federal and state regulations, and the Consent Order, DOE-EM needs to assess, identify, clean up, and otherwise address environmental contamination at LANL. DOE EM-LA is preparing this EA to evaluate the environmental impacts of corrective measures to remediate contaminated groundwater below Sandia and Mortandad Canyons and to determine whether to issue a FONSI or to prepare an EIS.

Comment Summary: I would say that until the Los Alamos Labs and the Nuclear Industry can figure out what to do with all the WASTE from all of the past years of their work, they should STOP building the plutonium PITS that they are soon to start work on! We don't need more nuclear weapons! It is unbelievable that the people who run these programs are still continuing this abominable program. $$$ Just to remind people: A WAR CANNOT BE FOUGHT WITH NUCLEAR WEAPONS! **Comment**: 29-5

Response: Concerns about nuclear weapons and waste from nuclear weapons activities are outside the scope of this EA.

D.1.15 PROPOSED ACTION

Comment Summary: Twenty years after CrVI was discovered in the aquifer, DOE still has not protected the regional drinking water aquifer. The problem is getting worse, not better, as evidenced by the work stoppages and failed wells. **Comment**: 9-2, 10-2, 11-2, 13-2, 14-2, 15-2, 16-2, 17-2, 19-2, 20-2, 20-6, 22-1, 23-1, 24-1, 27-1, 29-3, 30-1, 31-3, 32-1, 33-4, 36-7, 38-3,

Response: DOE has been working toward characterization and containment of the hexavalent chromium plume since its discovery in 2004. Section 1.1 and 1.2 of the EA describe the chronology of the hexavalent chromium contamination and measures to date to characterize and contain the contamination. As described in Section 1.2 of the EA, although there is still uncertainty with respect to the vertical and lateral distribution of the hexavalent chromium plume in the plume centroid and the northeastern regions of the plume, the hydraulic and geochemical data and information indicate that interim measure operations have generally

contained the plume within the LANL site boundary. The hexavalent chromium plume is not currently endangering any drinking water supply wells and DOE, NMED, and the drinking water suppliers are closely monitoring the situation. As described in Section 1.3 of the EA, the purpose of the Proposed Action is to remediate hexavalent chromium contaminated groundwater below Sandia and Mortandad Canyons. While the groundwater underlying Sandia and Mortandad Canyons was treated as an interim measure, DOE is evaluating corrective measures for a final remedy that achieves permanence, cost effectiveness, and cleanup requirements. Whereas the primary objective of the interim measure was to prevent migration of the hexavalent chromium plume past the LANL boundary (hydraulic control), with the incidental benefit of removing chromium mass from the regional aquifer, DOE now needs to evaluate alternatives for groundwater remediation with the primary goal of chromium mass removal or remediation to achieve compliance with groundwater quality standards. This EA has been prepared to address potential environmental impacts from a range of remediation options that will be proposed in the Chromium Plume CME report that will be submitted to NMED for their consideration, and remedy selection.

Comment Summary: In regard to the proposed remedies outlined in the newest draft Environmental Assessment, Tewa Women United advocates for the adoption of a comprehensive treatment plan rooted in harm prevention, protection of environmental quality, efficacy, and transparency. LANL has an opportunity to correct a tremendous wrong and prevent an ecological disaster. As mothers, daughters, sisters, and members of Española Basin communities, we advocate for the prioritization of effective remediation and consideration of Pueblo and land-based waters and communities on the path to a 'final remedy.' **Comment**: 18-4

Response: DOE's activities will be conducted in compliance with all applicable regulations and permits. These regulations and permits specify the steps that must be taken, the documents that must be prepared, and the activities that must be performed. As described in Section 1.2 of the EA, in accordance with the Consent Order, DOE EM-LA will identify and evaluate potential corrective measures alternatives for removal, containment, and/or treatment of the Cr(VI) plume in the CME report and recommend a preferred alternative for remediation. NMED will then review the CME, issue a Statement of Basis, engage in a public comment period, provide an opportunity for a public hearing on the remedy, and aid in the selection of a final remedy. DOE believes that the steps taken and the steps to be taken, are rooted in harm prevention, protection of environmental quality, efficacy, and transparency. Note that as described in Section 3.4.1.1 of the EA, the depth to the top of the regional aquifer from the mesa tops is between approximately 1,230 to 920 feet. Therefore, there is currently no human health or ecological exposure from the hexavalent chromium groundwater plume.

D.1.16 PUBLIC INVOLVEMENT

Comment Summary: We note the draft floodplain and wetland assessment does not provide a full address or phone number in order for the public to submit comments or ask a question. There is an assumption that commenters have access to the internet even though the 2020 U.S. Census data shows that over 20 percent of New Mexicans do not have access to the internet. Please ensure that all public notices provide not only an email address, but a full address and phone number so that the public may contact DOE EM-LA with any questions or comments. **Comment**: 06-3

Response: DOE EM-LA did not include a mailing address in the public notice for the *Proposed Floodplain and Wetland Action for Chromium Remediation in Sandia and Mortandad Canyons*. DOE EM-LA took this comment into consideration and included a mailing address when the notice to extend the public comment period for the *Draft Chromium Interim Measure and Final Remedy Environmental Assessment* was issued. EM-LA will continue to include the option of postal mail submissions in notices for public comment. Most recently, a mailing address was included in the *Notice of Proposed Floodplain Action for Regional Groundwater Monitoring Well SIMR-3 and Access Road Improvements*.

Comment Summary: Does Adaptive Site Management exclude the public? DOE claims that using Adaptive Site Management, or ASM, allows it to change tactics, techniques, and remedial measures as more knowledge is gained about the plume and as new problems arise. But this is the method DOE has used for the past 20 years with limited success. Another proposal for ASM underscores the extent to which the CrVI problem and the proper strategies for cleaning it up remain unknown.

As required by the Environmental Protection Agency (EPA), the public is an active participant in the decision-making process. The DOE's ASM proposal does not allow the public to actively participate in the decision-making processes, let alone have a seat at the decision-making table. DOE does not explain in the draft EA whether ASM will allow DOE EM-LA to make decisions about the cleanup without prior and informed public disclosure, including approval from state regulators and crucial input from the public. **Comment**: 9-4, 10-4, 17-5, 19-5, 19-6, 24-4, 24-5, 25-4, 25-5, 26-2, 26-3, 27-5, 28-3, 31-5, 32-4, 37-5, 38-6, 40-5B,

Response: As described in Section 1.2 of the EA, in accordance with the Consent Order, DOE EM-LA will identify and evaluate potential corrective measures alternatives for removal, containment, and/or treatment of the Cr(VI) plume in the CME report and recommend a preferred alternative for remediation. NMED will then review the CME, issue a Statement of Basis, engage in a public comment period, provide an opportunity for a public hearing on the remedy, and aid in the selection of a final remedy. Plume movement is a dynamic process as groundwater moves and conditions change. ASM accounts for this process and allows changes to be made in remediation techniques in response to changing conditions. Any changes would need to be reviewed and approved by NMED. See the response to Comment 9-3b (Section D.1.13, NEPA) for a discussion of public involvement associated with the EA.

Comment Summary: On February 6, 2024, the Environment Department authorized DOE EM-LA to begin re-injecting treated water into the plume at two injection wells—CrIN-3 and CrIN-4. [These acronyms stand for the chromium injection wells 3 and 4.] This authorization was granted absent public notice or an opportunity for public comment. The fact that this has already happened underscores my concern with ASM: Without substantive language in the draft EA or draft EIS that clearly articulates how the public would be involved in "adaptive site management" measures, or an alternative to ASM, there is a real danger that the public will continue to be excluded from important decisions that impact land, water, and communities. **Comment**: 9-5, 10-5, 17-6, 19-7, 20-7, 24-6, 27-6, 28-4, 31-6, 32-5, 33-5, 36-8, 37-6, 38-7, 40-6B,

Response: NMED's public involvement process for its activities, including the decision to halt and restart re-injection, is outside the scope of this EA. Injection of treated groundwater at these wells is part of the interim measure that was evaluated in the 2015 *Environmental Assessment for Chromium Plume Control Interim Measure and Plume Center Characterization, Los Alamos National Laboratory* (DOE, 2015). The public was provided the opportunity to comment on the interim measure evaluated in the 2015 EA. Restarting injection at these wells is part of the interim measure and therefore, does not require additional review. Also, see the response to Comment 9-4 in Section D.1.16, Public Involvement.

Comment Summary: Strong intergovernmental coordination, as required by the National Environmental Policy Act (NEPA), is essential to ensure progress in addressing impacts to human health and the environment from ongoing and proposed activities at LANL. Public engagement is also imperative in addressing LANL's legacy contamination in New Mexico and on tribal lands. NMED encourages DOE EM-LA to maintain a good technical working relationship with all parties involved: the facility (LANL), NMED, San Ildefonso Pueblo, the public, and pertinent Non- Governmental Organizations. **Comment**: 11-1

Response: DOE is committed to open communication and maintaining good working relationships with all involved parties. Although NEPA regulations do not require public comment on an EA, DOE EM-LA has been proactive in engaging the public through public scoping meetings, and public meetings on the Draft EA, in order to ensure that we address stakeholder concerns. Section 1.5 of the EA describes public involvement opportunities for this EA. Chapter 5 describes consultation and coordination activities.

Comment Summary: Make all reference documents available to the public on the DOE website. All reference documents must be available online, including all letters, at the time the draft EIS is released for public review and comment. **Comment**: 17-12, 19-13, 24-12, 27-11, 28-10, 32-11, 40-21B

Response: References cited in the Final EA are linked to their locations on publicly accessible websites.

D.1.17 PURPOSE AND NEED

Comment Summary: As an organization concerned with the prevention of violence in all forms and the protection of land, earth, water, air, and beloved local communities, we believe it is imperative that Los Alamos National Labs (LANL) uphold their obligation to see through comprehensive, timely, and effective cleanup of the hexavalent chromium plume in the Española Basin Sole Source Drinking Water Aquifer.

As members of local tribal and land-based communities, we recognize that water is life. The contamination of our sole-source drinking water aquifer with hexavalent chromium, a well-documented carcinogen, poses an existential threat to the people and ecosystems of the Española Valley. We believe it is the responsibility of Los Alamos National Labs, the Department of Energy, and the New Mexico Environment Department (NMED) to address this contamination effectively, without delay, and in transparency with local communities, regardless of cost. Comment: 18-1, 20-1, 21-1, 26-2,

Response: DOE has been working toward characterization and containment of the hexavalent chromium plume since its discovery in 2004. As described in Section 1.3 of the EA, the purpose of the Proposed Action is to remediate hexavalent chromium contaminated groundwater below Sandia and Mortandad Canyons. While the groundwater underlying Sandia and Mortandad Canyons was treated as an interim measure, DOE is evaluating corrective measures for a final remedy that achieves permanence, cost effectiveness, and cleanup requirements. Whereas the primary objective of the interim measure was to prevent migration of the hexavalent chromium plume past the LANL boundary (hydraulic control), with the incidental benefit of removing chromium mass from the regional aquifer, the EA evaluates alternatives for groundwater remediation with the primary goal of chromium mass removal or remediation to achieve compliance with groundwater quality standards. As described in Chapter 3 of the EA, the impacts of DOEs Proposed Action (Adaptive Site Management) would not be significant and would result in the reduction in hexavalent chromium contamination in the groundwater.

D.1.18 REGULATORY CONCERN

Comment Summary: For Options 1 and 2, LANL proposes to divert 550,000,000 gallons per year (1,688 ac-ft/yr) of water. This volume significantly exceeds pending and protested application before the Office of State Engineer (OSE) for a diversion of 679 ac-ft/yr. Both Options 1 and 2 require a new application to the OSE that must be publicly noticed for a diversion of 1,688 ac-ft/yr. **Comment**: 3-3, 3-5, 4-3,

Response: As described in Section 2.3 of the EA, the combined extraction rate for the existing and new extraction wells would be approximately 550,000,000 gpy. However, current extraction rates for the interim measure are limited by water rights authorized by the NMOSE and is currently limited to a groundwater extraction rate of up to 648,000 gpd, or up to a maximum diversion of groundwater of 679 acre-feet per year. Any additional extraction for the Proposed Action above the current rates authorized for the interim measure would require authorization from NMOSE. As described in response to Comment 3-1, under Option 1: Mass Removal via Expanded Treatment, most groundwater would be treated and returned to the aquifer resulting in little consumptive use of groundwater and little impact on baseflow to the Rio Grande. Also, Option 3: Mass Removal via In-situ Treatment, and Option 4: Monitored Natural Attenuation, would result in little removal of water from the aquifer and therefore, little change in groundwater levels and baseflow to the Rio Grande. Only Option 2: Mass Removal with Land Application, would not return the water directly to the aquifer. The amount of water injected under Option 2 would be about 16 percent less than under Option 1. Consumptive water use under Option 2 would be only 87,500,000 gpy, less than the 221,253,000 gpy (679

acre-feet per year) allowed in the permit. As described in Section 3.4.2.1, Option 3 would have little impact on groundwater levels.

Comment Summary: Based on the analytical data in the DP-1835 quarterly reports from the IX treatment system the Board supports Option 2. This Option proposes continued operation of the IX treatment system with land application of treated water to create the needed cone of depression. The Buckman Direct Diversion Board (BDDB) reiterates its caveat that Rio Grande depletions must be fully offset as requested in the BDDB's protest to the OSE of Application RG-00485-S-6 and S-7; RG-00486, RG-00486-S, RG-00486-S-2 -S-3 and S-4; RG-00487, RG-00487-S-S, S-3, and S-4; RG-00488, SP-01503, AND SP-1802, 01802 AMENDED, 01802-B and-C for permit to divert 679 acre-ft for uses at Los Alamos National Laboratory, as well as groundwater remediation, municipal and industrial uses. **Comment**: 4-4

Response: The Santa Fe City Council's support for Option 2 is noted. Also see the response to Comment 3-3 in Section D.1.18, Regulatory Concern.

Comment Summary: Further, given the extensive history of the CrVI plume, the draft EIS must provide a history of the successes and failures in addressing the CrVI contamination, as well as the ins and outs of other regulatory processes involved, including the Environment Department's groundwater discharge permits DP-1793 (land application of treated waters) and DP-1835 (extraction and reinjection of treated waters); a description of applications to the Office of the State Engineer; and an accounting of concerns raised by other government entities, including the Pueblos and the Buckman Direct Diversion Project. **Comment**: 9-7, 10-7, 17-8, 19-9, 24-8, 27-8, 28-6, 32-7, 37-8, 40-8B

Response: A brief history of the hexavalent chromium contamination was provided in Sections 1.1 and 1.2 of the EA. Section 4.2 of the EA describes permits DP-1793 and DP-1835. Scoping comments and the responses to these comments are provided in Appendix A. Comments on the Draft EA and the responses to these comments are provided in Appendix D.

Comment Summary: In NMED's view, the 2016 Consent Order has failed, prompting NMED's February 2021 complaint against DOE in district court to terminate the order and initiate court-supervised negotiations to establish enforceable terms that accelerate clean-up of legacy contamination. **Comment**: 11-4

Response: Comment noted. The Consent Order process is outside of the scope of this EA.

Comment Summary: Implementation of remediation activities in the hexavalent chromium contamination plume in Mortandad and Sandia Canyons are regulated as corrective action under the 2016 Compliance Order on Consent (Consent Order). Under the Consent Order, NMED will notify DOE that a Corrective Measures Evaluation (CME) is required, then DOE shall perform a CME to identify and evaluate potential final remedy alternatives. NMED contends that there has not been a notification requiring the submittal and evaluation of potential corrective measures alternatives for the chromium plume in a CME. NMED does not support the evaluation of final remediation alternatives while necessary characterization activities are being performed. NMED maintains that it is premature to adequately evaluate the environmental Impacts of potential proposed final remedy alternatives, which include the precipitous exclusion of the vadose zone remediation alternatives within the EA. NMED reiterates the need to initiate remediation efforts under the interim measures until the characterization data is available to support a determination of remedial action objectives and the evaluation of potential final remedy technologies. **Comment**: 11-6

Response: In order for DOE to take a Federal action that has potential environmental impacts, DOE is required to first conduct a NEPA review of the potential actions which is herein an EA. Making a final decision on a proposed action once the NEPA has been completed still requires compliance with other applicable Federal, state, and local regulations. The ASM remediation approach alternative will collect new information and may at some time in the future require the NEPA to be supplemented to address what is not currently known but doesn't preclude the alternative from being considered. ASM by virtue of the process institutes flexibility to address variance in approaches and could include, for example, vadose zone remediation if that is found to be a viable approach.

Comment Summary: Section 1.2, Background, pg. 4. The purposes of the Consent Order are (1) to fully determine the nature and extent of releases of contaminants at or from the LANL site; (2) to identify and evaluate, where needed, alternatives for corrective measures, to clean up contaminants in the environment, and to prevent or mitigate the migration of contaminants at or from the LANL site; and (3) to implement such corrective measures." The 2016 Compliance Order on Consent Section II, Purpose and Scope of Consent Order, states that the general purposes are to (1) provide a framework for current and future actions to implement regulatory requirements; (2) establish an effective structure for accomplishing work on a priority basis through cleanup campaigns with achievable milestones and targets; (3) drive toward cost-effective work resulting in tangible, measurable environmental clean-up; (4) minimize the duplication of investigative and analytical work and documentation to ensure the quality of data management; (5) set a structure for the establishment of additional cleanup campaigns and milestones as new information becomes available and campaigns are completed; (6) facilitate cooperation, exchange of information, and participation of the Parties; (7) provide for effective public participation; and (8) define and clarify its relationship to other regulatory requirements. To fulfill such requirements, the Consent Order sets forth a process for characterizing the nature and extent of contaminant releases, characterizing the risks to human health and the environment resulting from these releases, and mitigating unacceptable risks. The process to identify and evaluate alternatives for corrective measures and the implementation of such measures is included within the scope of the Consent Order but does not adequately represent the totality of the purposes. Comment: 11-11

Response: In response to this comment, DOE has revised the description of the Purpose and Scope of the Consent Order in Section 1.2 of the Final EA.

Comment Summary: In Section 4.2 State Laws and Regulations, the Draft EA lists all the state agencies involved with this Chromium Project except for the NM State Engineer. The State Engineer will not only issue well drilling permits for the groundwater extraction and injection wells, the State Engineer review and approve the use of the County's water rights. **Comment**: 39-2

Response: The authority of the NMOSE was recognized in Sections 2.3, 3.4.1.1, and 3.4.2.1 of the Draft EA. Reference to the NMOSE was added to Section 4.2 of the Final EA.

Comment Summary: At a treatment rate of 550 million gallons per year, that is treating and using 1,703 acre feet of the County's water rights per year, this will exceed the available water rights to support the community of Los Alamos County including LANL who is a wholesale customer of LAC. Should Option 2 be advanced in this EA and source removal in the shallow and vadose zone groundwater be instituted where the treatment of discharge of these treated waters could be released into Sandia Canyon or through LANL's NPDES outfall for treated effluent, the result is an unbounded use of water. Is LANL purchasing additional water rights to support this Option 2 and source removal? Currently the Office of the State Engineer only approved 679 acre feet of consumptive use to this groundwater remediation project. **Comment**: 39-3

Response: See the response to Comment 3-3, in Section D.1.18, Regulatory Concern. As described in this response, any additional extraction for the Proposed Action above the rates currently authorized by the NMOSE would require approval from NMOSE.

Comment Summary: As part of the Human health and worker safety section of the EA for Adaptive Site Management, LAC requests monthly meetings with the remediation team to assure PM-3 well and staff are not impacted by these remedial measures. Currently, PM-3 well access is limited by the shooting range activities, and DPU staff needs to be protected as well as the community's drinking water from chromium. **Comment**: 39-5

Response: DOE and its contractors are committed to conducting activities in a safe manner and in compliance with all applicable regulations and agreements. DOE and its contractors are in frequent communication with Los Alamos County officials and will diligently work towards our shared goals of

protecting the community's drinking water and any personnel that may be on site at PM-3. That said, activities at the shooting range are outside the scope of the EA.

Comment Summary: NMED Groundwater Discharge Permits DP-1793 and DP-1835 are only briefly addressed. NMED groundwater discharge permits DP-1793 (land application of treated waters) and DP-1835 (extraction and reinjection of treated waters) are only briefly mentioned in the draft EA. The two groundwater discharge permits are integral to addressing the CrVI and ClO4 contamination. **Comment**: 40-9B

Response: Section 4.2 of the EA describes permits DP-1793 and DP-1835.

Comment Summary: The draft EA notes perchlorate as a co-contaminant in the CrVI plume. Perchlorate, according to the draft, resulted from discharges from the Radioactive Liquid Waste Treatment Facility. Perchlorate discharges date to 1963 and continued until as recently as 2002—a span of nearly 40 years. The draft states perchlorate concentrations in the regional aquifer beneath Sandia and Mortandad Canyons "rarely" exceed the NMED Toxic Pollutant Standard. The draft EA further acknowledges perchlorate exceedances have occurred at three locations near extraction well CrEX-2. This means DOE EM-LA has violated the state Toxic Pollutant Standard for perchlorate at least three times. Despite these repeat violations, the Draft goes on to state, "perchlorate contamination is not being specifically addressed in this Environmental Assessment (EA)." The NMED Toxic Pollutant Standards do not allow for "rare" exceedances. The standards are violated in the event of any exceedance, and any exceedance of toxic pollutant standards have not been taken seriously in the draft EA. This is yet another example of why an EIS is required given the seriousness of DOE's lackadaisical attitude towards contamination in the regional drinking water aquifer.

We note that since approximately 2014 the perchlorate plume (to the west and south of the chromium plume) has disappeared from maps showing the chromium plume. This June 2014 map shows both plumes. http://nuclearactive.org/wp-content/uploads/2014/06/LANL-HEXAVALENT-CHROMIUM-PLUME-AND-PERCHLORATE-PLUME.pdf. The ClO standard at that time was 2 ppb.

Option 2: Mass Removal with Land Application. Prior to considering mass removal with land application, DOE must ensure that the treatment process removes perchlorate so that waters being discharged on the land and in the watershed are not impaired. In both Proposed Action Options 1 and 2, DOE proposes extracting the waters poisoned by perchlorate and CrIV from the contaminated groundwater plume. Option 1 calls for increasing the rate of mass removal, treatment, and injection; however, the same draft states "the ion exchange largely removes chromium, and perchlorate is largely untreated by this process." If perchlorate is "largely untreated," then there is a real risk that option 1 would result in the injection of perchlorate-poisoned water back into the regional aquifer. Furthermore, option 2, which calls for "land application of treated groundwater", poses a real danger of discharging untreated perchlorate-poisoned waters onto the surfaces of land, water, and thus into the communities of northern New Mexico. It is clear from these concerns that DOE must not gloss over perchlorate as merely a "rare" exceedance but must include treatment modifications to remove perchlorate from any waters extracted from the plume. **Comment**: 40-11B

Response: As described in Section 1.2 of the EA, perchlorate is a co-contaminant in the Cr(VI) plume. The primary source of perchlorate is historic discharges released from the Radioactive Liquid Waste Treatment Facility from 1963 until March 2002. Starting in 2002, improvements in perchlorate removal technology were made at the Radioactive Liquid Waste Treatment Facility, resulting in substantial decreases in perchlorate concentrations in effluent. The NMED Toxic Pollutant Standard for perchlorate is 13.8 µg/L, and concentrations in the regional aquifer beneath Sandia and Mortandad Canyons rarely exceed this concentration except at three locations next to extraction well CrEX-2. Note that treated water that is returned to the aquifer via injection wells or is land applied, meets NMED permit requirements including those for perchlorate.

Comment Summary: Status of renewal of DP-1793 and DP-1835 permits. We request that the draft EIS include information about the administrative permit renewal processes before these two NMED permits begin. **Comment**: 40-12B

Response: Section 4.2 of the EA describes permits DP-1793 and DP-1835, including their renewal status. Additional detail is outside the scope of the EA.

Comment Summary: Where are the DP-1793 and DP-1835 Administrative Records Located? In our review of the draft EA, we were unable to locate the Administrative Records (ARs) for the New Mexico Environment Department (NMED) groundwater discharge permits DP-1793 (land application) and DP-1835 (extraction and injection wells). Please include cites to the ARs administered by the DOE Permittees and the New Mexico Environment Department (NMED) in this matter. **Comment**: 40-13B

Response: A large number of documents related to the LANL Chromium Groundwater Contamination are located on the NMED website: https://www.env.nm.gov/hazardous-waste/chromium-groundwater-contamination/. Records maintained by NMED and other state agencies are outside the scope of this EA and are not DOE's responsibility. Permits and correspondence directly related to DOE EM-LA/N3B remediation activities can be found on the DOE EM-LA electronic public reading room: https://eprr.em-la.doe.gov/.

Comment Summary: Where is the Administrative Record for the chromium and perchlorate plumes? In our review of the draft EA, we were unable to locate the ARs for the chromium and perchlorate plumes. We were unable to locate the AR for the interim measures. Please include cites to the ARs administered by the DOE Permittees and the New Mexico Environment Department (NMED) in this matter. Where are ARs or electronic documents for other matters/concerns about the CrVI and ClO4 plumes?

There are a number of other agencies with authority/concerns about the plumes. We were unable to locate these as references in the DOE's electronic documents for other matters/concerns about the CrVI and ClO4 plumes? Please make these documents readily available before the draft EIS is released for public comment:

- Applications to the Office of the State Engineer to move waters under its authority;
- Written concerns raised by other government entities, including the Pueblos and the Buckman Direct Diversion Project; and
- Please include cites to the ARs administered by the DOE Permittees and the New Mexico Environment Department (NMED), or electronic documents in other platforms in these matters. **Comment**: 40-14B

Response: An Administrative Record (AR) is being developed for the chromium EA. The AR for the chromium EA includes all the scoping comments and public comments from review of the Draft EA, and all the references cited in the EA. The AR for the chromium EA is in progress and will not be complete until the EA is finalized and if it is determined that there are no significant impacts, a FONSI is issued. A large number of documents related to the LANL Chromium Groundwater Contamination are located on the NMED website: https://www.env.nm.gov/hazardous-waste/chromium-groundwater-contamination/. Records maintained by NMED are outside the scope of this EA and are not DOE's responsibility. References cited in the Final EA are linked to their locations on publicly accessible websites.

Comment Summary: Most recently, at the behest of state legislators, NMED has agreed to seek further "expert" advice from DOE's counterparts and contractors at the contaminated Savannah River Site. N3B, which is the central party to the technical CRVI-plume dispute at LANL, is the same contractor on the management and operating contract at Savannah River. How "objective" could these so-called "outside experts" be when they are employed not just by the same government agency, but by the same contracting firm? NMED has raised this issue as well: "To ensure the technical review represents the best interests of New Mexicans, NMED has proposed the inclusion of subject matter experts that are not affiliated with the DOE." The public has heard no response on this matter from DOE. We demand that outside independent experts who are not affiliated with DOE must be brought into the evaluation process. **Comment**: 40-20B

Response: As discussed during the April 18, 2024, Environmental Management Cleanup Forum - Expert Technical Review of Chromium Project, Dr. Inés Triay of Florida International University is leading a team of independent experts that will review numerous aspects of the chromium plume contamination characterization, groundwater modelling, and interim measure efficacy. This team is independent of DOE and NMED and their activities are endorsed by both parties.

D.1.19 SOCIOECONOMICS

Comment Summary: DOE must address the following questions for all alternatives:

- How many jobs will be created for local residents? How long will these jobs last?
- Will people be brought in from outside of the area to work at these facilities?
- If so, what positions will they fill?
- How many construction workers will be needed, by year?
- Where do the economic benefits end up?
- Please analyze the socioeconomic effects for all surrounding New Mexico counties, including limited housing and an induced rising cost of living.
- How much of every dollar spent for construction would actually stay in New Mexico?
- What is the impact of housing construction workers in local communities?
- What are the risks of increased transport of materials to and from the site?
- What are the risks to minority communities inside and around Los Alamos County of the legacy wastes generated? **Comment**: 40-28B

Response: Section 3.14 of the EA evaluates socioeconomic impacts at a level appropriate for an EA and this Proposed Action. Additional detail is also found in Appendices B and C. Specifically, Appendix B, Table B-1, includes a breakout of employment requirements/assumptions by position and alternative; and Appendix C.5 provides further detail regarding workforce assumptions and socioeconomic conditions within the region of influence (ROI) with respect to population, employment, income and housing (Table C-4). Section 3.9 evaluates the impacts of traffic and transportation and Section 3.15 evaluates environmental justice impacts. The impacts of legacy waste management are outside the scope of this EA.

D.1.20 UTILITIES AND INFRASTRUCTURE

Comment Summary: The Draft EA identifies "Impacts to electrical and water infrastructure would be minor." Please quantify these impacts. **Comment**: 39-4

Response: Impacts to utilities and infrastructure are described in detail in Section 3.8 of the EA.

D.1.21 WATER RESOURCES

Comment Summary: Our primary concerns with the Proposed Actions are related to the effectiveness of the chromium treatment system and depletions on Rio Grande flows resulting from pumping extraction wells in an effort to control and remediate the chromium plume. **Comment**: 3-1, 4-1, 13-3

Response: As described in Section 1.2 of the EA, the ion exchange treatment technology is extremely effective in removing the chromium. Water returned to the aquifer or discharged via land application would meet all NMED permit standards for water quality. Under Option 1: Mass Removal via Expanded Treatment, most groundwater would be treated and returned to the aquifer resulting in little depletion of groundwater and little impact on baseflow to the Rio Grande. Also, Option 3: Mass Removal via In-situ Treatment, and Option 4: Monitored Natural Attenuation, would result in little removal of water from the aquifer and therefore, little change in groundwater levels and baseflow to the Rio Grande. Only Option 2:

Mass Removal with Land Application, would not return water directly to the aquifer. The amount of water injected under Option 2 would be about 16 percent less than under Option 1. As described in Section 3.4.2.1, Option 3 would have minor impacts on groundwater levels and availability. The volume of water extracted for the Hexavalent Chromium Plume remediation and not returned to the aquifer is a very small percentage of the baseflow of the Rio Grande. The river reach considered the Upper Rio Grande in New Mexico runs from the Colorado-New Mexico state line to the Otowi gage located near State Highway 4 and San Ildefonso Pueblo. Upper Rio Grande tributaries include the Red River, Rio Hondo, Pueblo de Taos, Embudo Creek and the largest tributary, the Rio Chama. While the annual flow of the Rio Grande is quite variable, of the approximate 1.1 million acre-feet (long-term average) of native Rio Grande surface water that leaves the Upper Rio Grande and is measured at the Otowi stream flow gage, about one-third comes from Colorado, one-third comes from the Sangre de Cristo Mountains, and another third comes from the Rio Chama watershed. Also see https://www.ose.nm.gov/Maps/images/URG_letter.jpg.

Comment Summary: I'm concerned about the hexavalent chromium (CrVI) plume and how it will negatively impact the land, water, and communities who rely on the Española Basin Drinking Water Aquifer. The extent and depth of the plume remain unknown, and serious concerns have been raised about re-injecting treated water into the contaminated plume. So serious were these concerns that the New Mexico Environment Department ordered the Department of Energy (DOE) to halt reinjections in April 2023. The public deserves an informed response as to whether reinjection "smears" the plume, pushing dangerous contaminants toward Pueblo de San Ildefonso and deeper into the sole source drinking water aquifer upon which thousands of people depend. DOE must describe specifically how it plans to address this issue.
Comment: 9-1, 10-1, 13-3, 14-3, 15-3, 16-3, 17-3, 19-3, 18-2, 22-2, 23-2, 24-2, 25-2, 27-2, 29-2, 31-2, 32-2, 37-2, 38-2, 40-3B. 40-6B (cont.)

Response: Additional text was added to Section 1.2 of the EA to describe NMEDs concern with reinjection and DOE EM-LAs response. In DOE EM-LA and N3B's February 28, 2023, letter to NMED, it states: "Results of the data-driven and numerical modeling analyses support the conclusion that groundwater located at R-45 screen 2 is captured by the extraction wells. The cause for an increase in chromium concentrations at this location is the migration of a zone of chromium concentrations that existed between the two well screens at R-45 before the commencement of interim measure operations. Hence, planned monitoring well R-80 is needed on a priority basis to either confirm or refute this conclusion and provide additional performance monitoring data downgradient of R-45. Deep extraction does not appear to be necessary at this time to continue to achieve interim measure objectives but may emerge as a priority, pending analyses that will become available when deeper monitoring wells (R-76 and R-77) are installed." An Interim Facility-Wide Groundwater Monitoring Plan (IFGMP) for Monitoring Year 2024 was submitted to NMED to address additional characterization (EMID-702783) (EM-LA, 2023).

Also submitted was a "Work Plan for Hydrogeologic Testing of Regional Aquifer Groundwater Monitoring Well R-42 at the Los Alamos National Laboratory" (N3B, 2024). This work plan has been prepared in response to an NMED letter dated April 17, 2023, that requested a work plan for hydrogeologic testing at well R-42 (EMID-703084) (https://ext.em-la.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-703084_EMLA-24-BF115-2-1R-42%20Hydro_Test_WP_020124.pdf). DOE EM-LA is addressing the issues that NMED has raised.

Also note that as described in Section 2.3 of the EA, the Proposed Action could install up to 45 new extraction, injection, and monitoring wells and up to 30 new deep vadose zone piezometers. These wells and piezometers would greatly enhance the ability to monitor groundwater flow, contaminant transport, and the effectiveness of remediation activities. Proposed well installation locations and functions would be reviewed and approved by NMED.

Comment Summary: NMED has directed DOE to characterize the contamination, including determining the extent of the plume with additional monitoring wells, and utilize adaptive site management to expand the interim measures treatment system to continue remediation in a manner that ensures protection for New

Mexicans. DOE concurs with additional characterization but has rejected the direction to expand the interim measures and delayed clean-up. The lack of adequate monitoring wells prevents DOE from producing scientific data that would confirm the effectiveness of this interim measure and sufficient characterization data is required to evaluate the environmental impacts of the potential final remedy alternatives. **Comment**: 11-3 (cont.)

Response: DOE EM-LA can only install injection, extraction, or monitoring wells with the States' approval and through their permitting process. Because of the depth, complexity of drilling in canyons near canyon walls, and restrictions due to endangered species nesting, limited new wells can be constructed each year. An Interim Facility-Wide Groundwater Monitoring Plan (IFGMP) for Monitoring Year 2024 was submitted to NMED to address additional characterization (EMID-702783) (EM-LA, 2023). Also submitted was a "Work Plan for Hydrogeologic Testing of Regional Aquifer Groundwater Monitoring Well R-42 at the Los Alamos National Laboratory." This work plan has been prepared in response to a NMED letter dated April 17, 2023, that requested a work plan for hydrogeologic testing at well R-42 (EMID-703084) (https://ext.em-la.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-703084_EMLA-24-BF115-2-1_R-42%20Hydro_Test_WP_020124.pdf). DOE EM-LA is addressing the issues that NMED has raised. As described in Section 2.3 of the EA, the Proposed Action could install up to 45 new extraction, injection, and monitoring wells and up to 30 new deep vadose zone piezometers. These wells and piezometers would greatly enhance the ability to monitor groundwater flow, contaminant transport, and the effectiveness of remediation activities.

Comment Summary: The nearest public water supply source to the known plume boundary is Los Alamos Municipal Water System (NM3500115) Pajarito Mesa Well #3, located approximately 1,500 feet to the NE. Expanded treatment would reduce the risk of eventual contamination of this source. The runoff from any ground disturbance caused by this project would likely flow in a stream that discharges below the nearest surface water source, Buckman Regional Water (NM3502826) Surface Water Intake. There are not any regulated public surface water system intakes within 10 miles downgradient of the project boundary, therefore, this project is unlikely to have a significant near-term negative impact on any regulated public water system and will reduce the long-term risk to public drinking water. **Comment**: 11-18

Response: DOE agrees with NMEDs assessment of the low risk to public water supplies.

Comment Summary: I'm worried about the impact of the hexavalent chromium (Cr-6) plume on the Española Basin Drinking Water Aquifer. Under CERCLA, the Espanola Sole Source Aquifer federal status emphasizes citizens' concerns for safeguarding groundwater as drinking water. Funding should be allocated to tribes, municipalities, and community water systems for drinking water treatment. **Comment**: 16-1

Response: DOE has been working toward characterization and containment of the hexavalent chromium plume since its discovery in 2004. Sections 1.1 and 1.2 of the EA describe the chronology of the hexavalent chromium contamination and measures to date to characterize and contain the contamination. As described in Section 1.2 of the EA, although there is still uncertainty with respect to the vertical and lateral distribution of the hexavalent chromium plume in the plume centroid and the northeastern regions of the plume, the hydraulic and geochemical data and information indicate that interim measure operations have generally contained the plume within the LANL site boundary. The hexavalent chromium plume is not currently endangering any drinking water supply wells and DOE, NMED, and the drinking water suppliers are closely monitoring the situation. As described in Section 1.3 of the EA, the purpose of the Proposed Action is to remediate hexavalent chromium contaminated groundwater below Sandia and Mortandad Canyons. While the groundwater underlying Sandia and Mortandad Canyons was treated as an interim measure, DOE is evaluating corrective measures for a final remedy that achieves permanence, cost effectiveness, and cleanup requirements. Whereas the primary objective of the interim measure was to prevent migration of the hexavalent chromium plume past the LANL boundary (hydraulic control), with the incidental benefit of removing chromium mass from the regional aquifer, the EA evaluates alternatives for groundwater remediation with the primary goal of chromium mass removal or remediation to achieve compliance with

groundwater quality standards. As described in Chapter 3 of the EA, the impacts of DOEs Proposed Action (Adaptive Site Management) would not be significant.

The hexavalent chromium plume is not currently endangering any drinking water supply wells and DOE, NMED, and the drinking water suppliers are closely monitoring the situation. Therefore, there is currently no reason to supply an alternative drinking source or provide funding for drinking water treatment.

Comment Summary: I suggest that the citizens' request a demonstration project utilizing LIDAR and ground penetrating radar, with third-party reports publicly available on open-source platforms, that can reveal contamination in the leaky basalt geology. **Comment**: 16-4

Response: DOE is sampling numerous monitoring wells and has a good understanding of the extent of most of the hexavalent chromium plume. As described in Section 3.4.1.1 of the EA, the depth to the top of the regional aquifer from the mesa tops decreases eastward from approximately 1,230 feet in the western part of the plateau to approximately 920 feet in the eastern parts of the plateau near the eastern boundary of LANL. LIDAR (light detection and ranging) and ground-penetrating radar would not be effective at detecting chromium contamination at this depth.

Comment Summary: We object to the continued use of the LANL's Finite Element Heat and Mass Transfer Code (FEHM) for the CrVI plume. While FEHM is used throughout the DOE complex, it does not efficiently facilitate communities' work with technical experts. Use of FEHM requires these experts to learn FEHM, whereas technical experts around the world are familiar with USGS's modular hydrologic model, MODFLOW. MODFLOW is the international standard for simulating and predicting groundwater conditions and groundwater/surface water interactions. Detections of CrVI exceedances have been ongoing since 2004 – 20 years. It is time for DOE to adopt MODFLOW for use across the LANL site generally, and for the chromium plume specifically. We cannot waste any more time to stop migration of the CrVI plume towards drinking water supplies and the Rio Grande. In order to protect groundwater, DOE must use MODFLOW exclusively going forward. **Comment**: 18-3, 40-26B

Response: The FEHM is a well-vetted flow and transport code that has been used at LANL and by its collaborators for 50 years, has hundreds of peer-reviewed publications (https://www.lanl.gov/orgs/ees/fehm/pdfs/FEHM_references_list.pdf), and has been benchmarked and verified against many analytical and numerical solutions, including MODFLOW (https://www.lanl.gov/orgs/ees/fehm/docs/FEHM_VERIFICATION_V3.3.0.pdf). FEHM can account for complexities associated with partially penetrating wells, aquifer heterogeneity, and complex boundary conditions and has been benchmarked against MODFLOW (https://www.usgs.gov/mission-areas/wateR-resources/science/modflow-and-related-programs). FEHM has been shown to be equal in accuracy and provide improved numerical stability relative to MODFLOW. LANL recalibrates the FEHM chromium model regularly as new data becomes available. The calibration compares to concentrations, drawdowns, water levels, and water-level gradient targets with excellent results.

Comment Summary: Specifically, I am concerned about how the hexavalent chromium (CrVI) plume negatively impacts the land, water, and communities who rely on the Española Basin Drinking Water Aquifer. The extent and depth of the plume remain unknown, and serious concerns have been raised about reinjecting treated chromium water and untreated perchlorate contaminated waters into the plume. The re-injecting of treated chromium and perchlorate waters into our aquifer by the LANL and its contractors is totally unacceptable. **Comment**: 20-3, 20-4, 33-2, 36-2

Response: As described in Section 1.2 of the EA, the ion exchange treatment technology is extremely effective in removing the chromium. Therefore, treated water that is returned to the aquifer via injection wells or is land applied, meets NMED permit requirements and has almost no chromium. As described in Section 1.2 of the EA, perchlorate is a co-contaminant in the Cr(VI) plume. The primary source of perchlorate is historic discharges released from the Radioactive Liquid Waste Treatment Facility from 1963 until March 2002. Starting in 2002, improvements in perchlorate removal technology were made at the

Radioactive Liquid Waste Treatment Facility, resulting in substantial decreases in perchlorate concentrations in effluent. The NMED Toxic Pollutant Standard for perchlorate is 13.8 µg/L (ppb), and concentrations in the regional aquifer beneath Sandia and Mortandad Canyons rarely exceed this concentration except at three locations next to extraction well CrEX-2. During interim measure operations, the ion exchange largely removes chromium, and perchlorate is largely untreated by this process. The ion exchange system could be modified to remove perchlorate. However, chromium is the contaminant of highest concern because it exceeds 50 µg/L in the regional aquifer beneath Mortandad Canyon and Sandia Canyon. Therefore, perchlorate contamination is not being specifically addressed in this EA. Note that treated water that is returned to the aquifer via injection wells or is land applied, meets NMED permit requirements including those for perchlorate. Text was added to Section 1.2 of the EA that states: "As described in Attachment E of Submittal of DP-1835 Renewal Application (EM-LA, 2021), perchlorate levels coming into the treatment system are expected to range from 0.727 to 4.07 µg/L, with perchlorate in the treatment effluent at 0.05 to 0.56 µg/L well below the NMED Toxic Pollutant Standard for perchlorate of 13.8 µg/L." Also see the response to Comment 16-1 in Section D.1.21, Water Resources.

Comment Summary: DOE has a history of converting injection wells, which were supposed to be located at the purported "edge" of the plume, into extraction wells, which instead are made to draw dangerously contaminated groundwater from the interior of the plume. These conversions from injection to extraction occur precisely because incorrect assumptions are chronically made about the extent and depth of the plume. In 2018, for example, 'CrIN-6' was converted from an injection well into 'CrEx-5', an extraction well. This change was made when higher-than-expected CrIV concentrations were found in that well, thus indicating the likelihood that the well had been drilled not at the edge of the plume, as was expected, but in the plume's interior. To inject in the center of the plume would not create a hydraulic barrier at the plume's edge, as DOE claims, but would rather force water directly into the contaminated zone, potentially spreading the CrVI and inevitably the ClO4. **Comment**: 40-17B

Response: DOE is sampling numerous monitoring wells and has a good understanding of the extent of most of the hexavalent chromium plume. That said, plume movement is a dynamic process as groundwater moves and conditions change in response to natural processes, and pumping and injection. Well CrIN-6 was drilled and installed in 2017 as a single-screen injection well as part of the Chromium Interim Measure. Measured chromium concentrations of approximately 260 ug/L in CrIN-6 obtained from initial pumping from the well led to a model-based evaluation of the optimal operational configuration to meet the interim measure objectives. The results presented in the "Evaluation of Chromium Plume Control Interim Measure Operational Alternatives for Injection Well CrIN-6" (LANL 2018) indicated that extraction, rather than injection, from the CrIN-6 location would provide the most optimal approach for meeting the interim measure objective and avoid the possibility that injection would push the chromium plume towards nearby water-supply well PM-3. Based on the evaluation, NMED approved proceeding with the recommendation to convert CrIN-6 from an injection well to an extraction well (CrEX-5) and DOE EM-LA completed that activity (N3B, 2019).

While previous investigation indicates what might be below at this great depth it isn't confirmed until the well is drilled. CrIN-6 is a good example of needing to make a change based upon what was previously unknown. NMED approved the conversion once they were able to see the sampling results. ASM accounts for this process and allows changes to be made in remediation techniques in response to changing conditions. This includes changing the function of wells between monitoring, extraction, and injection. Any changes would need to be reviewed and approved by NMED.

Comment Summary: Furthermore, claims made about the plume's depth are continuously and repeatedly coming up wrong. For example, R70 S2, drilled in 2019, detected chromium located at about 90 feet, deeper than what the public was previously told. According to NMED, contamination has been found more than 100-feet below the top of the water table. But the public was told the contamination was only at 50 feet. These adjustments in depth and extent are getting deeper and wider, not shallower and smaller. Again, this

raises the specter that the plume is deeper, more complex, and more extensive than the DOE claims to the public. **Comment**: 40-18B

Response: As more wells are drilled, more information is collected. New wells almost always result in some changes in the known lateral extent and depth of the plume. In addition, the natural processes of advection, dispersion, and diffusion tend to disperse the plume. The interim measure has been containing the plume by pumping contaminated groundwater and injecting treated groundwater to form a hydraulic barrier. R70 well was drilled at a 25 degree angle from vertical because of its location. As mentioned by NMED (2019) the installation of R-70 was recommended by the DOE to monitor plume response to the interim measure and help define the lateral and vertical extent of chromium in the northeastern plume area. Earlier wells were drilled in the area of the LANL boundary to address more immediate concerns about the plume going offsite. This well was drilled to investigate the northeastern area, and it served its purpose.

An Interim Facility-Wide Groundwater Monitoring Plan (IFGMP) for Monitoring Year 2024 (EM-LA, 2023) was submitted to NMED to address additional characterization (EMID-702783). Also submitted was a "Work Plan for Hydrogeologic Testing of Regional Aquifer Groundwater Monitoring Well R-42 at the Los Alamos National Laboratory" (N3B, 2024). This work plan has been prepared in response to a NMED letter dated April 17, 2023, that requested a work plan for hydrogeologic testing at well R-42 (EMID-703084) (https://ext.em-la.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-703084_EMLA-24-BF115-2-1_R-42%20Hydro_Test_WP_020124.pdf). DOE EM-LA is addressing the issues that NMED has raised.

Comment Summary: R45 is a case in point. During a period before injections, the deeper screen did not detect CrVI in concentrations exceeding state standards. After re-injections started at nearby wells CrIN 1 and CrIN 2—at the supposed 50-foot contamination level—the deeper screen at R45 began reporting detections exceeding the state CrVI standard. Similar concerns have been brought forward at well R61, which is one of the closest wells to the southern boundary with Pueblo de San Ildefonso. Alarmed by these results, NMED ordered DOE to halt re-injections. After the submission of the Interim Measures and Characterization Work Plan (Work Plan) on September 29, 2022, the NMED Hazardous Waste Bureau (HWB) directed DOE to not restart operations at CrEX-1, CrEX-2, CrEX-3, CrIN-1, CrIN-2, and CrIN-3, that had been offline due to electrical issues, until further notice via an email sent and received on November 21, 2022. Following this, NMED Ground Water Quality Bureau (GWQB) directed DOE in a letter, to cease all injections authorized under Discharge Permit 1835 (DP-1835) by April 1, 2023. Due to this change in regulatory directive after the submission of the Work Plan, additional revisions to the Work Plan are required.

DOE responded by electing to shut down not just re-injections but extractions as well. As a consequence, CrVI concentrations have increased. Stopping re-injections and extractions at the same time introduced two new variables into the Interim Measures. Two variables are more difficult to model than one, meaning this decision to stop both only added to the uncertainty. At this juncture, it is difficult to know whether the CrVI concentrations are increasing because of the lack of re-injections alone, or whether the concentrations are increasing because extractions stopped as well. **Comment**: 40-3B (cont.)

Response: A newer work plan was submitted to NMED. An Interim Facility-Wide Groundwater Monitoring Plan (IFGMP) for Monitoring Year 2024 (EM-LA, 2023) was submitted to NMED to address additional characterization (EMID-702783) (https://ext.em-la.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-702783_EMLA-23-BF206-2-1_MY2024_IFGMP_061323.pdf). Also submitted was a "Work Plan for Hydrogeologic Testing of Regional Aquifer Groundwater Monitoring Well R-42 at the Los Alamos National Laboratory." This work plan has been prepared in response to a NMED letter dated April 17, 2023, that requested a work plan for hydrogeologic testing at well R-42 (EMID-703084) (https://ext.em-la.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-703084_EMLA-24-BF115-2-1_R-42%20Hydro_TestWP_020124.pdf). DOE EM-LA is addressing the issues that NMED has raised.

When the stop order for injection was received and injection halted prior to the Aprill 2023 date, it was also necessary to stop extraction because the volumes extracted could not be alternately land applied because the quantity of treated water was well beyond what was allowed in the land application discharge permit.

As of February 6, 2024, NMED (2024) has sent DOE EM-LA a "Response to New Mexico Environment Department September 6, 2023, Letter, 'Corrective Action under DP-1835 associated with the chromium plume.'" In this letter, NMED is proposing another compromise for partial operation with the implementation of acceptable corrective actions. The proposal is to allow a two-year temporary authorization to inject into CrIn-3 and CrIn-4 while an alternative injection location is constructed. This is consistent with the ASM approach evaluated in this EA.

Comment Summary: We support the June 2023 Buckman Direct Diversion Board comments, with our modifications, including:

- The need for the EA/EIS to analyze the connection between surface and groundwater with a focus on whether and how Interim Measures pumping of the extraction wells could deplete Rio Grande surface flows, which are a present and future use of the resource for drinking water. All analyses must include the potential cumulative impacts and how those impacts may affect off-site resources, such as the Rio Grande and the springs along the Rio Grande. Analyses of the method of offset or identifying consumptive use. Upstream depletions of the BDD Project intake that are not offset may directly affect the BDD's ability to provide water to its customers.
- Analyses of whether the Interim Measure under the 2016 NMED Order on Consent for LANL is an adequate mechanism to assure that the CrVI plume is sufficiently characterized in a timely manner. The analyses must include remediation and protection for present and future use of potentially affected resources, including the Rio Grande and the springs along the Rio Grande. For these reasons, the draft EA does not address the issues raised by the Buckman Direct Diversion Board. These issues must be addressed to safeguard the drinking water of residents of Santa Fe. **Comment**: 40-24B

Response: The volume of water extracted for the hexavalent chromium plume remediation and not returned to the aquifer is a very small percentage of the baseflow of the Rio Grande. The river reach considered the Upper Rio Grande in New Mexico runs from the Colorado-New Mexico state line to the Otowi gage located near State Highway 4 and San Ildefonso Pueblo. Upper Rio Grande tributaries include the Red River, Rio Hondo, Pueblo de Taos, Embudo Creek and the largest tributary, the Rio Chama. While the annual flow of the Rio Grande is quite variable, of the approximate 1.1 million acre-feet (long-term average) of native Rio Grande surface water that leaves the Upper Rio Grande and is measured at the Otowi stream flow gage, about one-third comes from Colorado, one-third comes from the Sangre de Cristo Mountains, and another third comes from the Rio Chama watershed.

An IFGMP for Monitoring Year 2024 (EM-LA, 2023) was submitted to NMED to address additional characterization (EMID-702783) (https://ext.em-la.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-702783_EMLA-23-BF206-2-1_MY2024_IFGMP_061323.pdf). Also submitted was a "Work Plan for Hydrogeologic Testing of Regional Aquifer Groundwater Monitoring Well R-42 at the Los Alamos National Laboratory." This work plan has been prepared in response to a New Mexico Environment Department (NMED) letter dated April 17, 2023, that requested a work plan for hydrogeologic testing at well R-42 (EMID-703084) (https://ext.emla.doe.gov/GovFTPFiles/api/GetFiles/GetFile?fileName=EMID-703084EMLA-24-BF115-2-1R-42%20Hydro_Test_WP_020124.pdf). DOE EM-LA is addressing the issues that NMED has raised.

Comment Summary: In 2020, during the start of the pandemic, LANL switched from the Thin-Plate Spline (TPS) interpolation method [Id., p. 26] to the Bayesian Canonical Correlation Regression (BCCR) (Carson 2020) method. In calendar year 2023 Quarter 1, LANL reverted back to TPS. These types of changes, without explanation or cites to key documents, require the public to ask questions. LANL states: "This change was made because of the greater representation of TPS in the scientific literature. The primary

difference between the two methods is the incorporation of prior information as an initial estimate of water levels." To understand the difference between the two models, to create a consistent source of data, and to alleviate public concern about the switch back and forth between models, DOE must run the data from 2020 to 2023 in the TPS interpolation method. **Comment**: 40-25B

Response: Thin Plate Spline, or TPS for short, is an interpolation method that finds a "minimally bended" smooth surface that passes through all given points. This is one of a number of methods (including the Bayesian Canonical Correlation Regression method) used to estimate the configuration of a surface (such as an aquifer surface or contaminant plume isoconcentration surface) from data points. LANL switched from the TPS interpolation method upon request from NMED. The commenter's preference for deriving and displaying data are outside the scope of this EA.

D.1.22 WELL DESIGN

Comment Summary: Section 3.9.3.1, Proposed Action Alternative (Adaptive Site Management - ASM), pg. 57. The EA states that each well would have a concrete pad approximately 10 feet by 15 feet. Clarity is needed on whether the dimensions reflect a single well or a cluster well design. Additionally, NMED encourages the evaluation conducted throughout the EA include the potential environmental impacts for concrete well pads with dimensions that allow for cluster wells. **Comment**: 11-12

Response: DOE provided a conservative assumption for the size of an individual well pad. DOE multiplied this by the number of new wells needed to get conservative totals for resources used and to develop impacts estimates. Clustering of wells would be more efficient and likely would disturb less land, require fewer resources, and have smaller impacts and therefore would be bounded by DOEs estimate generated by assuming individual wells would be installed. DOE believes its bounding estimate is sufficient for this EA. This information was added to Section 3.9.3.1 and Table B-1 of the Final EA.

Comment Summary: Well design and completion during the ASM must maintain consistency with respect to existing regional aquifer groundwater monitoring wells (R-Wells) that show acceptable chemical concentration results for representative formation water. Altering or changing well design, well completion, and more importantly, experimenting with In-situ amendments has been shown to impact water chemistry thus rendering some costly wells and their associated decision-making sample results unreliable for evaluating chemical trends over time. **Comment**: 11-13

Response: DOE agrees that well integrity and the ability to accurately monitor groundwater quality are paramount considerations in a groundwater monitoring network. NMED would review and approve any proposed in-situ treatment method.

Comment Summary: All future groundwater monitoring wells must be single screen monitoring wells. LANL has resisted installing single-screen monitoring wells. It has struggled to install multi-screen monitoring wells that have resulted in cross-contamination, unreliable data and an inaccurate picture of the contamination in the regional drinking water aquifer. Multi-screen wells are expensive and do not provide the necessary data to address the movement of the chromium and perchlorate contamination in the regional drinking water supply. It is way past time for NMED to order LANL to install only single screen monitoring wells so that clean, reliable, and accurate data is provided to address the migration of the chromium and perchlorate plumes. **Comment**: 40-22B

Response: DOE currently utilizes wells with single and multiple screens. DOE will utilize various well construction techniques and configurations depending on what is best for the situation at hand. Wells will be constructed in compliance with applicable regulations and standards.

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Appendix E
Floodplain and Wetland Assessment

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EM2024-0385

Final Floodplain and Wetland Assessment for Chromium Remediation in Sandia and Mortandad Canyons, Los Alamos National Laboratory

N3B Los Alamos

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1.0 INTRODUCTION

This floodplain and wetland assessment was prepared in accordance with Title 10, Code of Federal Regulations (CFR) Part 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements." According to 10 CFR Part 1022.4, a floodplain is defined as "the lowlands adjoining inland and coastal waters and relatively flat areas and flood prone areas of offshore islands"; a "base floodplain" is further defined as a "100-year floodplain, that is, a floodplain with a 1.0 percent chance of flooding in any given year." A wetland is defined as "an area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, and similar areas."

Per Executive Order 14030, "Climate-Related Financial Risk," the Federal Flood Risk Management Standard (FFRMS) was reinstated. The FFRMS provides three approaches or options for federal agencies to establish flood hazard areas. The Climate-Informed Science Approach (CISA) requires federal agencies to "use the best available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science" (FEMA 2015). Furthermore, for areas vulnerable to riverine flood hazards, federal agencies must "account for changes in riverine conditions due to current and future changes in climate and other factors (e.g., land use) by applying state-of-the art science in a manner appropriate to policies, practices, criticality, and consequences (risk)."

The currently implemented base floodplain-extent model at Los Alamos National Laboratory (LANL) (LANL 2001) uses the best available and actionable data and methods to forecast flood hazard areas under future climate changes and other factors to comply with the CISA, as described in the FFRMS, in the following ways:

- The digital elevation model (i.e., topography) used in the base floodplain extent model is of a resolution equal to or superior to other publicly available data sources.
- The empirically measured rainfall-intensity data used are still the best available and actionable data for use in determining flood hazard areas.
- The watershed hydrologic parameterization methods used are the best available and are typical of current watershed modeling efforts.
- The model results were validated using observed data from stream gages located throughout LANL.
- The model was developed using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) and River Analysis System (HEC-RAS), which the Federal Emergency Management Agency (FEMA) has approved for use in flood hazard mapping.
- Future projections of extreme precipitation events in the region do not indicate a clear and actionable trend and/or are not of a temporal and spatial resolution that could inform a watershed-scale, event-based hydrologic model.
- Flooding-related impacts from changes in land use are limited within the Pajarito Plateau watershed.
- The base floodplain extent map was modeled using watershed hydrologic parameters representative of post-fire conditions.

The U.S. Department of Energy Environmental Management Los Alamos Field Office (EM-LA) has prepared this floodplain and wetland assessment to evaluate the potential impacts of the proposed actions on the floodplains and wetland within the project area, identify alternatives to the proposed actions, and allow for meaningful public comment.

1.1 Background

1.1.1 Floodplains and Wetland Descriptions

The Sandia Wetland is located at the head of Sandia Canyon. The wetland is primarily sustained via effluent discharged from the Sanitary Effluent Reclamation Facility (National Pollutant Discharge Elimination System Permit No. NM002835; permitted outfalls 001 and 03A199) at LANL. At the terminus of the wetland, a grade-control structure maintains high groundwater levels and prevents further migration of a headcut into the wetland from the Sandia Canyon floodplain (Figure 1). Vegetation within the wetland primarily consists of broadleaf cattail, narrow-leaf cottonwood, Siberian elm, sedges, and rushes. The wetland area is approximately 3.65 acres (N3B 2019).

The Sandia Wetland drains into Sandia Canyon, creating a perennial segment of the waterway until the confluence with Sigma Canyon (LANL 2021). The infiltrated water below Sandia Canyon percolates through a heterogeneous and complex vadose zone before reaching the regional aquifer underlying both lower Sandia and Mortandad Canyons. The upper Sandia and Mortandad Canyon floodplains are largely undeveloped, with a single dirt road providing access to the Sandia Wetland, monitoring wells, and stormwater-monitoring infrastructure. Vegetation within the upper Sandia and Mortandad Canyon floodplains includes Douglas fir, ponderosa pine, box elder, and narrow-leaf cottonwood.

Lower Sandia and Mortandad Canyons are considerably more developed. Lower Sandia Canyon converges on East Jemez Road, a major commuter artery to LANL. Both lower Sandia and Mortandad Canyons have numerous well pads interspersed throughout the canyon bottoms. In Mortandad Canyon, a network of dirt roads provide access to this infrastructure. Vegetation within the lower sections of these canyons is more xeric, with sparse ponderosa pine, piñon, and juniper canopy interspersed with bunchgrasses and shrubs.

1.1.2 Chromium Contamination

From 1956 to 1972, water used in power plant cooling towers at LANL was treated with potassium dichromate, a corrosion inhibitor. The resulting effluent was discharged into Sandia Canyon (Vesselinov et al. 2013), which resulted in hexavalent chromium [Cr(VI)] contamination in the groundwater underlying Sandia and Mortandad Canyons. Since 2005, an ongoing investigation of the Cr(VI) plume has indicated Cr(VI) concentrations within the regional aquifer in excess of the New Mexico groundwater standard of 50 ppb. Beginning in 2015, an interim measure was implemented to impede potential plume migration into adjacent Pueblo de San Ildefonso property and further characterize the nature and extent of contamination in preparation for a final remedy.

EM-LA is proposing to use adaptive site management (ASM) to select and implement options to further remediate Cr(VI) contamination in Sandia and Mortandad Canyons. The goal of ASM is to create a framework of structured and continuous planning, implementation, and monitoring, to develop effective and efficient cleanup strategies that accommodate new information and changing site conditions. Remediation under ASM addresses what is known while acknowledging uncertainty. It includes plans to collect the necessary information to improve understanding of plume dynamics and achieve a final remedy for the site. This approach allows work to proceed in some areas while additional data collection

and testing of responses is conducted to determine the appropriate remediation strategies in remaining areas.

2.0 PROJECT DESCRIPTION

2.1 Adaptive Site Management

ASM is a dynamic and flexible management approach intended to efficiently characterize contamination, optimize remediation strategies, and limit risk. Central to ASM is the conceptual site model (CSM), which provides an evolving representation of the site. The CSM is constantly being refined as data are gathered and uncertainties are informed. The CSM illustrates data gaps and allows EM-LA to prioritize resources to improve understanding of the plume and efficaciously remedy the contamination.

Because ASM relies on monitoring of evolving conditions to inform optimal remediation strategies, a suite of options is being proposed. ASM will provide the framework for determining which options are implemented. The following four remediation options are being analyzed. Any combination of these options may ultimately be implemented.

- mass removal via expanded treatment
- mass removal with land application
- mass removal via in-situ treatment
- monitored natural attenuation

2.1.1 Mass Removal via Expanded Treatment

Under the mass removal via expanded treatment option, EM-LA would extract contaminated water from the regional aquifer, pump the water to a treatment facility, remove Cr(VI) from the water, pump the treated water to injection wells, and inject the treated water back into the regional aquifer. The efficacy of remediation efforts would be monitored via an array of wells and piezometers installed throughout the project area.

As part of this option, EM-LA would construct a 10,000-ft^2 Cr(VI) treatment facility. The treatment system will consist of an ion-exchange treatment system with prefiltration, associated piping, flow controls, and programmable logic controls and monitoring. The treatment facility will include contactors, ion-exchange vessels, an electrical room, a control room, feed tanks, injection pumps, an electrical supply connection, and a bathroom with a septic system.

In addition to the new treatment facility, this option also includes designs for the following:

- 15 extraction wells with piping network to treatment facility
- 15 injection wells with piping network from treatment facility
- 15 monitoring wells
- 20 shallow piezometers in the source area (i.e., Sandia Wetland and Sandia Canyon)
- 10 piezometers in the deep vadose zone in Mortandad Canyon
- roads and wells pads as needed

2.1.2 Mass Removal with Land Application

The mass removal with land application option uses the same treatment facility processes and treatment options as the mass removal via expanded treatment option, except treated water would not be injected back into the regional aquifer. Instead, treated water would be stored in existing synthetically lined storage basins in Mortandad Canyon, then conveyed through an existing system of basin pumps and piping for disposition by any of the following methods: (1) irrigation-type sprinklers using an array of sprinkler heads, (2) mechanical evaporators, or (3) 3000- to 10,000-gal. water trucks with high-pressure sprayers. Use of an irrigation system and/or mechanical evaporators would be prioritized over the use of water trucks to minimize vehicle traffic.

The land-application method will only occur in permitted areas per Discharge Permit (DP) 1793 (Figure 2) and only up to land application–allowable/permitted limits (currently 350,000 gpd).

2.1.3 Mass Removal via In-Situ Treatment

The mass removal via in-situ treatment option would use in-situ treatment to address Cr(VI)-contaminated groundwater. In-situ treatment involves injecting reducing agents in untreated water and relying on chemical processes (e.g., sodium dithionite amendments) to immobilize and detoxify contaminants within soil or groundwater without removing them from the ground. In situ treatment would be used to target source-area contamination in Sandia Canyon as well as groundwater contamination beneath Mortandad Canyon.

2.1.4 Monitored Natural Attenuation

The monitored natural attenuation (MNA) option relies on natural physical, chemical, or biological processes to reduce concentrations, toxicity, or mobility of chromium, and incorporates regular monitoring to verify that MNA is working. In the case of chromium, attenuation occurs via the reduction of mobile Cr(VI) to insoluble trivalent chromium [Cr(III)]. EM-LA would consider MNA when contamination poses relatively low risks, the plume is stable or shrinking, and the natural attenuation processes are projected to achieve remedial objectives in a reasonable timeframe, compared with more active methods.

The new treatment facility will not be installed within the 100-yr floodplain or Sandia Wetland. As practicable, all other infrastructure (e.g., wells, well pads, piping, roads) will not be installed within the 100-yr floodplain or Sandia Wetland. Where infrastructure is installed in the 100-yr floodplain and/or Sandia Wetland, the nature and extent of the floodplain hazard are not expected to change.

3.0 FLOODPLAIN AND WETLAND IMPACTS

3.1 Short-Term Impacts

Ground disturbance from the proposed action may result in short-term negative direct and indirect effects to the floodplains and wetland within the project area. The following best management practices will be used to mitigate these impacts:

- Disturbed areas will be revegetated using an appropriate native seed mix.
- Erosion and sediment control measures will be installed during construction.
- Heavy equipment will not be used within the wetland.

Additionally, controls will be put in place to ensure hazardous materials, chemicals, fuels, and/or oils do not directly or indirectly negatively impact the floodplains and wetland within the project area. These controls include the following:

- Permanent equipment staging areas will not be located within the floodplains or wetland.
- All equipment that can be efficiently moved will be refueled at least 100 ft from the floodplains or wetland. Equipment requiring refueling within the floodplain will be refueled only while within secondary containment to eliminate the risk of accidental discharge of fuel to the ground surface.
- Hazardous materials, chemicals, fuels, and oils will not be stored within the floodplains or wetland.
- In the event of a spill or release, any contaminated media will be remediated in compliance with all applicable EM-LA procedures and state and federal regulations.
- Portable generators, compressors, and other fuel-driven equipment will be staged on bermed plastic sheeting as a form of secondary containment. Construction equipment (e.g., graders, dozers, excavators, etc.) and light vehicles will not be subject to this restriction.

3.2 Long-Term Impacts

Although infrastructure will not be installed within the floodplains and/or wetland where a practicable alternative exists, some infrastructure may be permanently installed within the floodplains and/or wetland (e.g., well pad, road, piping, piezometers, etc.). These developments have the potential to have a long-term adverse impact on floodplains and the wetland within the project area. To mitigate these direct and/or indirect effects, the following best management practices will be used:

- Support structures, such as the treatment facility, personnel trailers, storage tanks, or permanent laydown yards, will not be installed within the floodplains or wetland.
- Project staff will remove all trash and debris (e.g., construction material) from the floodplains and wetland after project completion. All material will be disposed of at an EM-LA-authorized facility appropriate for the waste regulatory classification and disposal facility waste acceptance criteria.
- Well pads and roads will be reinforced to minimize erosion following project completion.
- Any proposed excavation within the Sandia Wetland will require an additional wetland assessment to determine the potential impacts of that proposed action on the Sandia Wetland.

The land application of treated water within portions of the 100-yr floodplain within Mortandad Canyon is anticipated to have a long-term positive impact by enhancing native plant growth and stabilizing soils.

No effects to life and property associated with floodplain disturbance are anticipated. No effects to the survival, quality, and function of the Sandia Wetland are anticipated.

3.3 Regulatory Compliance

EM-LA requires all project work to be reviewed by subject matter experts (SMEs) via their Project Planning and Regulatory Review system. This system allows for the early identification of all institutional, state, and/or federal requirements relevant to the project. In coordination with SMEs, the project management

team ensures compliance with all applicable regulations. Identified regulatory requirements include the following:

The project area includes habitat for federally listed threatened and endangered species. The proposed action will comply with the Threatened and Endangered Species Habitat Management Plan for Los Alamos National Laboratory (LANL 2022), or EM-LA will further consult with the U.S. Fish and Wildlife Service to ensure compliance with the Endangered Species Act.

- To comply with the Migratory Bird Treaty Act, vegetation will not be removed during the peak bird-nesting season (May 15 through July 31) unless a biological resources SME conducts a nest check to ensure no active nests will be disturbed. Bollards and empty pipes will be capped so birds are not caught inside.
- Work that may result in any discharge into Waters of the United States will require a permit under Sections 401 and/or 404 of the Clean Water Act.
- The land application of extracted groundwater will comply with DP-1793.
- The discharge of all treated groundwater to the regional aquifer will comply with DP-1835.
- As required, stormwater pollution prevention plans will be developed to ensure coverage under the U.S. Environmental Protection Agency's Construction General Permit for stormwater discharges.

4.0 ALTERNATIVES

Alternatives to the proposed action that were considered but not evaluated included (1) alternative project locations and (2) alternative actions.

Because chromium contamination is located within Sandia Wetland and underlies Sandia and Mortandad Canyon floodplains, remediation of the contamination will necessarily require project activities to be centered on these areas. Where practicable, disturbance to the floodplains and/or wetland in the project area will be avoided under the proposed action.

EM-LA solicited public feedback on alternative actions during the National Environmental Policy Act scoping period that occurred during the summer of 2023. No alternative actions that meet the project objectives and do not impact the floodplains and wetland in the project area were identified.

A no-action alternative was previously evaluated during the planning of the chromium plume control interim measure (LANL 2015). "No action" does not necessarily mean doing nothing; instead, it involves maintaining or continuing the existing status or condition. Under the no-action alternative, EM-LA would control plume migration and maintain chromium contamination concentrations within the LANL boundary while continuing to evaluate long-term corrective action remedies, including options for chromium mass removal. The no-action alternative was not selected because it would not meet the objective of both chromium mass removal and contaminant source control.

5.0 CONCLUSIONS

Implementation of the proposed action will provide the flexibility required to actively manage Cr(VI) contamination in the source area and regional aquifer and will respond to evolving conditions. The proposed action will allow EM-LA to impede plume migration off LANL property, while remediating Cr(VI) contamination within Sandia and Mortandad Canyons. The project will minimize long-term adverse

impacts to the floodplains and wetland in the project area through the implementation of best management practices, including erosion and sediment controls. Most impacts will conclude upon completion of construction activities. The proposed project will not significantly modify the existing structure and function of floodplains and wetland within the project area. EM-LA anticipates the project will not adversely impact natural and beneficial floodplain and wetland values.

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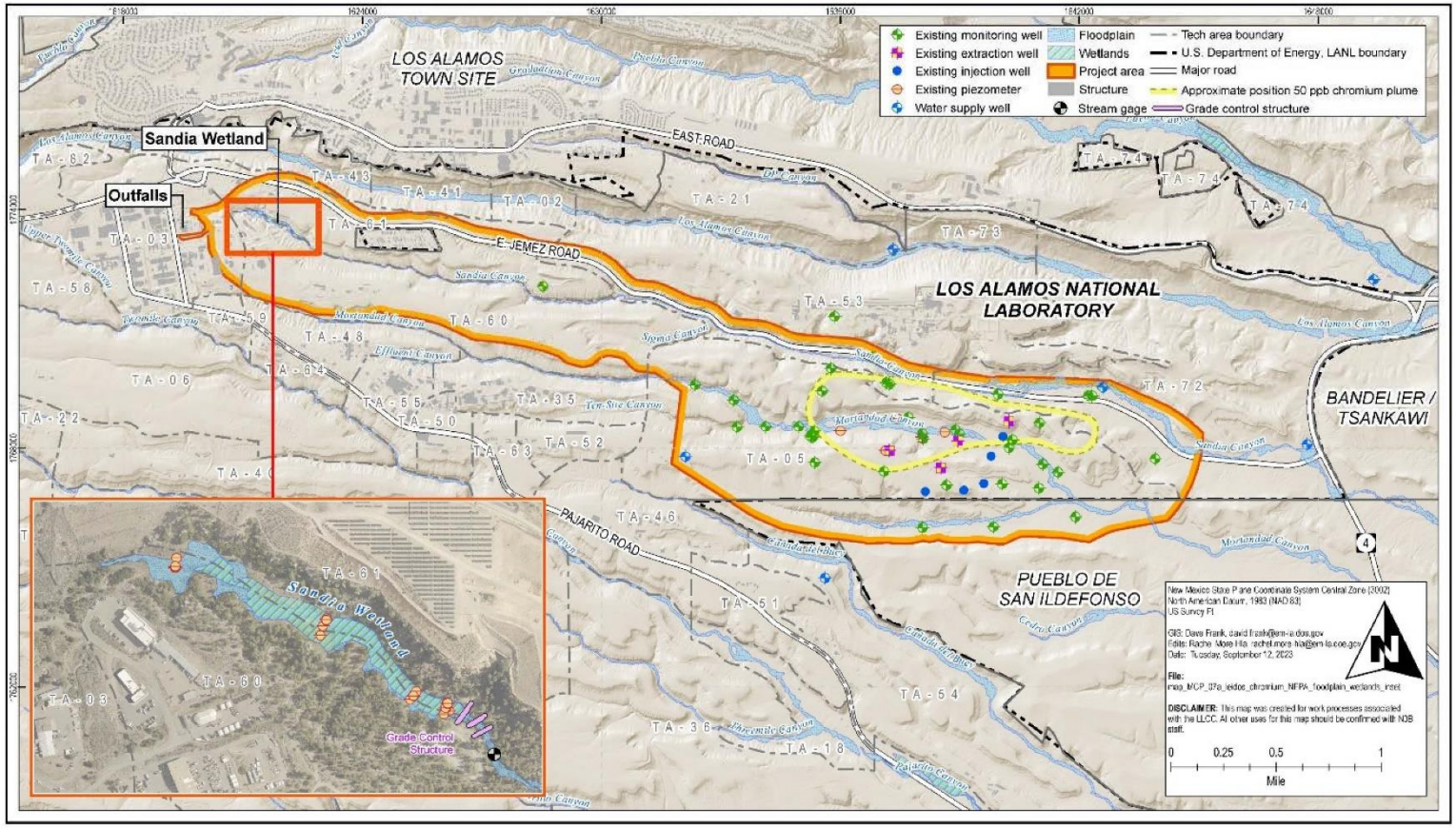

Figure 1 **Proposed project area, including Sandia Wetland (inset), Sandia Canyon, and Mortandad Canyon**

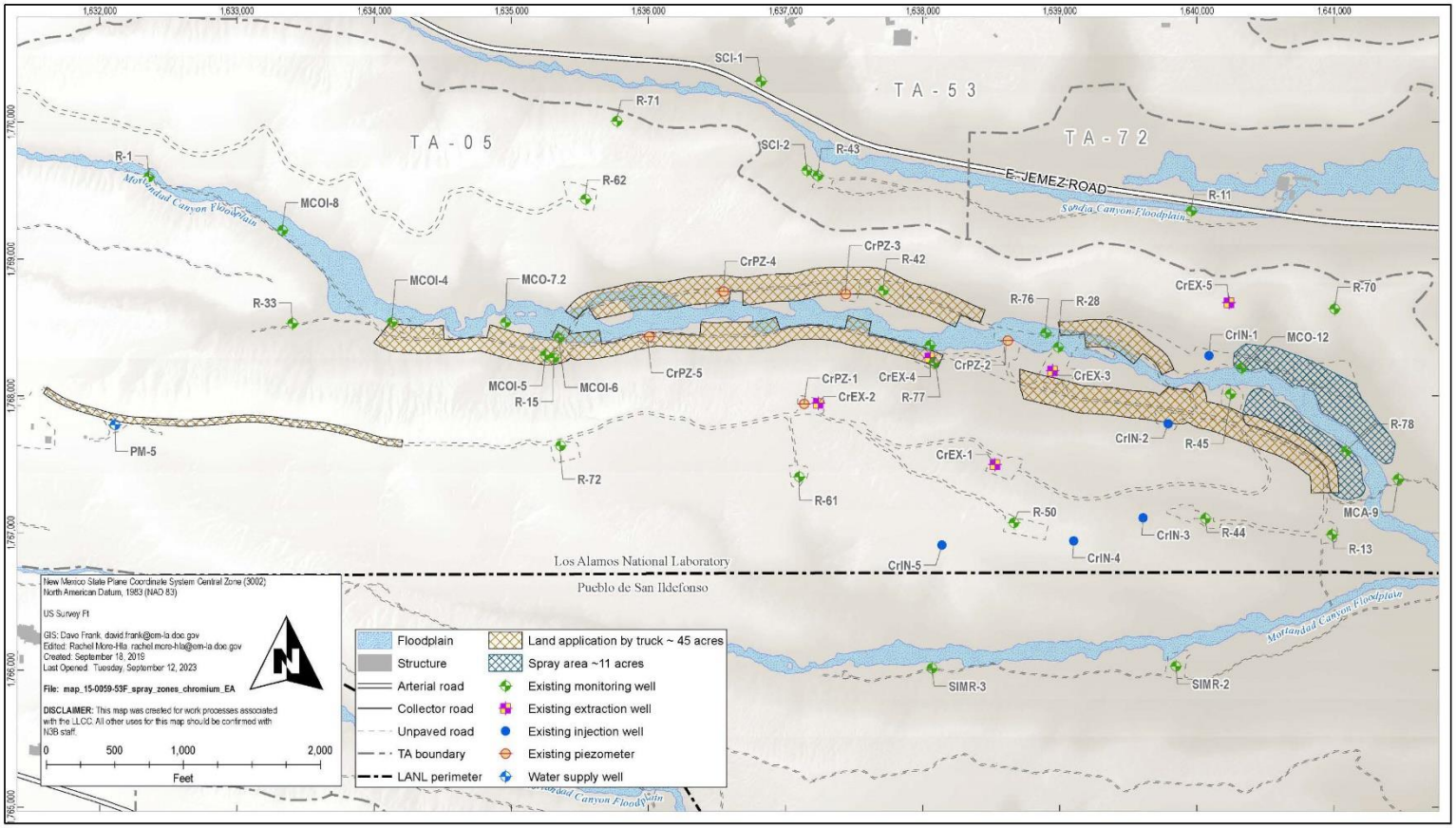

Figure 2 **Permitted land-application zones for treated groundwater**

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