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Draft

**Chromium Interim Measure and Final
Remedy Environmental Assessment**

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1 The National Environmental Policy Act of 1969 (NEPA), as amended (42 United States Code 4321
2 et seq.), requires Federal agencies to consider the environmental consequences of proposed actions
3 before making decisions. In complying with NEPA, the U.S. Department of Energy’s (DOE’s)
4 Office of Environmental Management follows the Council on Environmental Quality (CEQ)
5 regulations (40 Code of Federal Regulations 1500–1508) and DOE’s NEPA-implementing
6 procedures (10 Code of Federal Regulations 1021). In accordance with NEPA requirements and
7 implementing procedures, this Environmental Assessment of the proposed DOE action and
8 alternatives provides DOE with sufficient evidence and analysis to determine whether to issue a
9 Finding of No Significant Impact or to prepare an environmental impact statement.

10 In July 2020, the CEQ comprehensively updated its NEPA regulations, which went into effect on
11 September 14, 2020. On April 20, 2022, CEQ issued the Phase 1 Final Rule, which finalized a
12 narrow set of changes to generally restore regulatory provisions that were in effect before the 2020
13 rule. On July 28, 2023, CEQ announced a Phase 2 Notice of Proposed Rulemaking—the
14 “Bipartisan Permitting Reform Implementation Rule”—to revise its regulations for implementing
15 the procedural provisions of NEPA, including to implement the amendments to NEPA by the Fiscal
16 Responsibility Act of 2023. However, this Chromium Interim Measure and Final Remedy
17 Environmental Assessment was started prior to the effective date of the revised CEQ regulations,
18 and the Office of Environmental Management Los Alamos Field Office has elected to complete this
19 Environmental Assessment pursuant to the April 20, 2022, Phase 1 Final Rule.

SUMMARY

Groundwater sampling data from monitoring wells at Los Alamos National Laboratory (LANL) indicate the presence of chromium contamination in the regional aquifer resulting from historical use of potassium dichromate, a corrosion inhibitor, in cooling tower water that was discharged to an outfall as part of operational maintenance activities. Concentrations of chromium within the groundwater plume beneath Mortandad Canyon exceed the New Mexico groundwater standard of 50 parts per billion (ppb) near the property boundary between LANL and the Pueblo de San Ildefonso and are as high as 1,000 ppb in the plume center. In 2015, the U.S. Department of Energy (DOE) prepared the *Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory* (DOE/EA-2005) (referred to as the 2015 Interim Measures EA) (DOE, 2015). The purpose of the 2015 Interim Measures EA was to analyze the environmental impacts associated with implementing the chromium interim measure for plume control and plume characterization.

The DOE Office of Environmental Management Los Alamos Field Office (EM-LA) initiated sustained operations of the southern portion of the interim measure in 2018 and the remaining portions of the interim measure were brought online at a later date, mostly toward the end of 2019. While the groundwater underlying Sandia and Mortandad Canyons is currently being treated as an interim measure, DOE is evaluating alternatives for groundwater remediation with the primary goal of chromium mass removal or remediation to achieve compliance with groundwater quality standards.

DOE's Proposed Action for a final remedy is a combination of treatment options whereby EM-LA would use adaptive site management (ASM) to select, implement, and manage removal of hexavalent chromium from source areas and the groundwater. The use of ASM helps develop effective cleanup strategies by ensuring continuous planning, implementation, and monitoring that accommodates new information and changing site conditions. The Proposed Action includes four options noted below, that can be utilized individually or as a combination to remediate chromium contaminated groundwater below Sandia and Mortandad Canyons. This approach will provide DOE the flexibility to make timely environmental cleanup decisions related to cost, impacts, and effectiveness as work progresses. The Proposed Action options are:

- Option 1: Mass Removal via Expanded Treatment—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.
- Option 2: Mass Removal with Land Application—This option would use land application of treated groundwater as a disposition method.
- Option 3: Mass Removal via In-situ Treatment—This option would use in-situ treatments to supplement treatment of the contaminated groundwater.
- Option 4: Monitored Natural Attenuation—Monitored natural attenuation (MNA) 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.

The Proposed Action would use infrastructure already in place as a result of ongoing investigations of the chromium plume and install new infrastructure. Existing infrastructure includes injection,

1 extraction, and monitoring wells; piezometers; a water treatment system with portable storage tanks,
2 storage basins, and associated connecting pipelines; unpaved access roads; power lines; and an
3 irrigation system for land application of treated water. The Proposed Action would include
4 installation of the following new infrastructure:

- 5 • Up to 15 injection wells in the regional aquifer: 70 gallons per minute (gpm) (1,000 gpm
6 max total capacity).
- 7 • Up to 15 extraction wells in the regional aquifer: 70 gpm (1,000 gpm max total capacity).
- 8 • Up to 15 new monitoring wells in the regional aquifer. One existing well would be
9 converted into a monitoring well in the regional aquifer, for a total of 16 monitoring
10 wells.
- 11 • Up to 20 piezometers in the shallow zone (i.e., the alluvial aquifer) in Sandia Canyon
12 Wetlands source area.
- 13 • Up to 10 piezometers in the deep vadose zone (i.e., the intermediate-perched aquifer) in
14 Mortandad Canyon.
- 15 • A new 10,000 square foot groundwater treatment facility.
- 16 • Well pads and infrastructure to support installation and operation of the wells, including
17 well heads, shipping containers (or similar shelters), portable storage tanks, and piping.
- 18 • Spray irrigation/evaporation system.
- 19 • Buried piping.
- 20 • Unpaved access roads.

21 The Proposed Action would increase groundwater extraction and injection rates from 150,000,000
22 gallons per year (gpy) to a maximum rate of 550,000,000 gpy. EM-LA would avoid disturbing
23 sensitive ecological and cultural resources. Water would be treated to verify all constituents meet
24 New Mexico Environmental Department (NMED) Ground Water Quality Bureau permit
25 requirements before injection into the aquifer through the injection wells or land application.

26 In addition to the Proposed Action, DOE evaluated a No Action Alternative. The No Action
27 Alternative is the continuation of the preferred alternative in the 2015 Interim Measures EA
28 (DOE/EA-2005) (DOE, 2015) and Finding of No Significant Impact (December 2015), whereby
29 EM-LA would control plume migration and maintain chromium contamination concentrations
30 within the LANL boundary while continuing to evaluate long-term corrective action remedies,
31 including options for chromium mass removal. EM-LA would continue conducting field-scale
32 studies to further characterize the plume to evaluate the effectiveness and feasibility of
33 implementing a final remedy.

34 The environmental effects of the Proposed Action would be as follows:

- 35 • **Land use**—Activities would take place within the LANL boundary in an area of active
36 groundwater investigation; activities would be compatible with existing land uses.
- 37 • **Geology and soils**—Installation and operation of wells would have little to no impacts on
38 geology. Some soil erosion by wind and stormwater would likely occur in disturbed

1 areas. Soil erosion would be controlled by adherence to best management practices
2 (BMPs) and would be minor.

- 3 • **Groundwater**— Environmental consequences to groundwater and groundwater quality
4 relate to the well construction and the operation of the extraction/injection operations.
5 Well construction would have minor impacts on water quality and minor temporary
6 impacts on water levels. Operating extraction wells would alter the groundwater quality
7 by reducing the chromium concentration in the well’s vicinity. Similarly, injection wells
8 would alter the groundwater quality by injecting treated water. The intent overall is to
9 return the majority of extracted water back into the regional aquifer. Water injected into
10 the aquifer through injection wells, land-applied, or evaporated would meet NMED
11 Ground Water Quality Bureau permit standards. The Proposed Action would have
12 positive environmental consequences from chromium mass reduction.
- 13 • **Surface water**— Soil disturbance resulting from infrastructure development, operation,
14 and maintenance activities associated with the Proposed Action could result in
15 sedimentation to surface waters. With anticipated soil disturbance totaling 75 acres and
16 implementation of BMPs, potential environmental consequences to surface waters are
17 expected to be minor.
- 18 • **Air quality**— Implementing the Proposed Action would result in air emissions of criteria
19 pollutants, hazardous air pollutants, and greenhouse gas emissions from road
20 construction, installation of well pads, well development, pipeline installation, and
21 construction of the treatment facility. The intermittent nature of operational emissions
22 and emissions from installation activities, in combination with air quality mitigation
23 measures, would not contribute to an exceedance of an ambient air quality standard at
24 locations outside the LANL site. Impacts to air quality would be minimal.
- 25 • **Ecological resources**—Impacts to ecological resources from the Proposed Action could
26 include temporary and permanent disturbances; degradation or loss of habitat from land
27 clearing activities; disturbance or displacement of wildlife due to an increase in noise and
28 human activity; habitat fragmentation; and an increase in human-wildlife interactions.
29 The Proposed Action would follow all BMPs, monitoring plans and measures related to
30 ecological resources established for LANL. Implementing the Proposed Action with
31 identified controls would not result in significant impacts to these species or resources.
- 32 • **Cultural resources**—Historic properties would be avoided to the maximum extent
33 possible during Proposed Action activities. Erosion control measures would be
34 incorporated to limit direct and indirect impacts to archaeological sites from stormwater
35 runoff or erosion. Regular consultation with Pueblos de San Ildefonso would be
36 implemented to discuss how to best limit impact. No significant impacts to
37 archaeological or historic properties would be anticipated.
- 38 • **Utilities and infrastructure**— The proposed chromium treatment facility would require
39 a connection to the existing LANL electrical system. No new electrical lines would be
40 required for connection. The potable water supply and existing water-supply
41 infrastructure would accommodate project use. Impacts to electrical and water
42 infrastructure would be minor. The project area is largely in a less frequently travelled
43 area of LANL. Other than construction of new access roads, activities under the

1 Proposed Action would not affect road infrastructure, and overall effects on the road
2 infrastructure at LANL would be minimal.

- 3 • **Traffic and transportation**—The Proposed Action would increase the number of
4 personal commuter vehicles and number of truck deliveries for the construction of the
5 groundwater treatment facility, well pads, wells, and piezometers. Routine daily traffic
6 volumes would be expected to decrease after construction of the proposed groundwater
7 treatment facility is completed. Proposed traffic improvements (a new Pajarito Road
8 roundabout and widening of Diamond Drive) would help alleviate congestion and traffic
9 safety issues on Pajarito Road. As such, adverse traffic impacts are expected to be minor.
- 10 • **Hazardous materials and waste generation**—Small quantities of industrial (i.e.,
11 construction debris) and hazardous wastes would be generated from the Proposed Action.
12 Waste would be handled in accordance with LANL’s waste management procedures.
13 The waste quantities generated under the Proposed Action would be minimal, thus
14 impacts to on-site waste operations or off-site disposal facilities are anticipated to be
15 small.
- 16 • **Noise**—The Proposed Action would generate noise from construction activities and from
17 the use of equipment, machinery, and vehicles, which could affect noise-sensitive
18 receptors. Elevated noise levels would generally be limited to the immediate area of the
19 noise source and are expected to dissipate before reaching publicly accessible areas. Any
20 adverse noise impacts would generally be minor.
- 21 • **Visual resources**—There would be little to no substantial dominant visual change in
22 Mortandad Canyon or Sandia Canyon as observed from outside vantage points, no
23 substantial change in visibility caused by predicted air pollutant emissions, no conflict
24 with Federal land management agency visual standards, and no long-term dominant
25 visual interruption of existing or unique viewsheds.
- 26 • **Human health and worker safety**—The Proposed Action would not involve direct
27 hazards to the public. Chromium in public water supply wells is monitored by LANL
28 and the Los Alamos County Department of Public Utilities (LADPU), and there is no
29 indication that the chromium plume has affected water supply wells. Access to the
30 project area is restricted and noise-generating activities and air emissions would be
31 unlikely to affect members of the public at the nearest publicly accessible points. Effects
32 on human health would be negligible. Applicable safety and health training and
33 monitoring, personal protective equipment, and work-site hazard controls would be
34 required for workers; activities would not be expected to have any adverse health effects
35 on workers.
- 36 • **Socioeconomics**—The direct workforce requirements for the Proposed Action would be
37 very small and comprise less than (<) 0.1 percent of the existing workforce in the region
38 (0.02 percent). Similarly, the total population influx from implementing any of the ASM
39 options would comprise <0.1 percent of the total population in the region (0.02 percent).
40 Potential adverse impacts from the Proposed Action options would be expected to be
41 small on the housing market and community services within the region of influence
42 because the expected worker and population influx is expected to be very small. The
43 small increase in employment (direct and indirect jobs) from both construction and

1 operation would be expected to result in small and beneficial impacts on the local
2 economy and ROI from the increase in jobs, income and salaries, as well as expenditures
3 and revenue from state and local taxes.

- 4 • **Environmental justice**—Implementation of the Proposed Action would not result in
5 disproportionate and adverse impacts in the resource areas of concern for minority and
6 low-income populations, especially health and safety. In addition, the Proposed Action
7 would not have lasting or irreversible adverse effects. However, representatives of
8 Pueblo de San Ildefonso previously anticipated a direct, adverse impact from the
9 proposed Chromium Plume Control Interim Measure and Plume-Center Characterization
10 Project to Tribally important resources and practices associated with the Sacred Area.
11 However, these representatives also understood that the currently proposed ASM
12 implementing options would offset those concerns by reducing the chromium plume
13 contamination.

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1

ACRONYMS AND ABBREVIATIONS

2	<	less than	50	IM	Interim Measure
3	>	greater than	51	kV	kilovolt
4	AADT	annual average daily traffic	52	LANL	Los Alamos National Laboratory
5	AOC	Area of Concern	53	LADPU	Los Alamos County Department of Public Utilities
6	APE	area of potential effects	54		
7	AQB	Air Quality Bureau	55	lbs	pounds
8	ASM	adaptive site management	56	µg/L	micrograms per liter
9	ATEM	Accord Technical Exchange Meeting	57	MNA	monitored natural attenuation
10	BMP	best management practice	58	N3B	Newport News Nuclear BWXT-Los Alamos, LLC
11	CAA	Clean Air Act	59		
12	CEQ	Council on Environmental Quality	60	NAAQS	National Ambient Air Quality Standards
13	CFR	Code of Federal Regulations	61	NEPA	National Environmental Policy Act of 1969
14	CME	corrective measures evaluation	62	NHPA	National Historic Preservation Act
15	CMIP	Corrective Measures Implementation Plan	63	NM	New Mexico State Road
16			64	NMAC	New Mexico Administrative Code
17	Cr(III)	trivalent chromium	65	NMDOT	New Mexico Department of Transportation
18	Cr(VI)	hexavalent chromium, or chromium 6+	66	NMED	New Mexico Environment Department
19	CrEX	chromium extraction	67	NMOSE	New Mexico Office of State Engineer
20	CrIN	chromium injection	68	NMSA	New Mexico Statutes Annotated
21	CRMP	Cultural Resources Management Plan	69	NNLEMS	Network of National Laboratories for Environmental Management and Stewardship
22	CWA	Clean Water Act	70		
23	DART	days away, restricted, or transferred	71		
24	dBA	A-weighted decibel	72	NNSA	National Nuclear Security Administration
25	DOE	U.S. Department of Energy	73	NPDES	National Pollutant Discharge Elimination System
26	DOE-EM	U.S. Department of Energy Office of Environmental Management	74		
27			75	NRHP	National Register of Historic Places
28	DP	Discharge Permit	76	NWQCC	New Mexico Water Quality Control Commission
29	DPU	Los Alamos County Department of Public Utilities	77		
30			78	OSHA	Occupational Safety and Health Administration
31	EA	Environmental Assessment	79		
32	EIS	Environmental Impact Statement	80	PA	Programmatic Agreement
33	EM-LA	U.S. Department of Energy Office of Environmental Management, Los Alamos	81	PGA	peak ground acceleration
34			82	ppb	parts per billion
35			83	RCRA	Resource Conservation and Recovery Act
36	EO	Executive Order	84	ROI	region of influence
37	EPA	U.S. Environmental Protection Agency	85	SDWA	Safe Drinking Water Act
38	FEHM	Finite Element Heat and Mass Transfer Code	86	SR	State Road
39			87	SWEIS	Site-Wide Environmental Impact Statement
40	FONSI	Finding of No Significant Impact	88	SWPPP	Stormwater Pollution Prevention Plan
41	FR	Federal Register	89	TA	Technical Area
42	ft ²	square feet	90	TPS	Thin-Plate Spline
43	ft ³	cubic feet	91	TRC	total recordable case
44	<i>g</i>	standard unit of gravity	92	USACE	U.S. Army Corps of Engineers
45	gpd	gallons per day	93	U.S.C.	United States Code
46	gpm	gallons per minute	94	USCB	U.S. Census Bureau
47	gpy	gallons per year	95	USFWS	U.S. Fish and Wildlife Service
48	GHG	greenhouse gas	96	yd ³	cubic yards
49	HAP	hazardous air pollutant	97	ZVI	zero-valent iron

1.0 PURPOSE AND NEED FOR AGENCY ACTION

1.1 INTRODUCTION

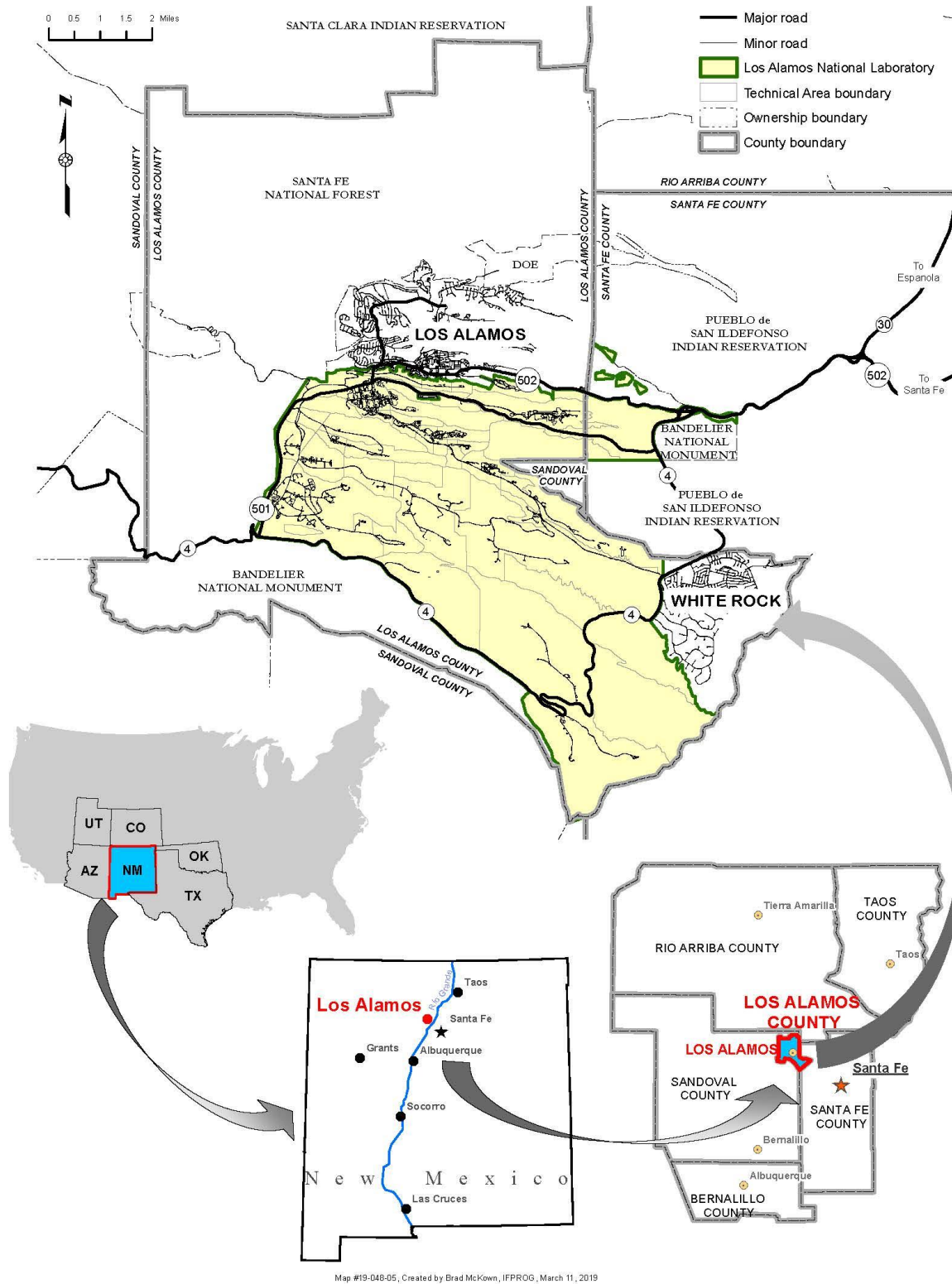
The Los Alamos National Laboratory (LANL) site is located in Los Alamos County in north-central New Mexico, approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe (see Figure 1-1). The U.S. Department of Energy (DOE) is the Federal agency responsible for managing the LANL site. The DOE Los Alamos Field Offices include the National Nuclear Security Administration (NNSA), a semiautonomous agency within DOE, and the DOE Office of Environmental Management (DOE-EM). The NNSA Los Alamos Field Office oversees the management and operating contract for LANL, and the DOE-EM Los Alamos (EM-LA) Field Office is responsible for legacy waste cleanup at the LANL site.

The LANL site is about 40 square miles and sits on the Pajarito Plateau, a series of mesas separated by east-west trending canyons, at the eastern edge of the Jemez Mountains. Large tracts of land north, west, and south of the site are managed by the Santa Fe National Forest, the U.S. Bureau of Land Management, Bandelier National Monument, and Los Alamos County. The town of Los Alamos borders LANL to the north. The Pueblo de San Ildefonso and the town of White Rock border LANL to the east. Santa Clara Pueblo is north of LANL, but does not share a border. The two primary residential areas within Los Alamos County are the Los Alamos townsite and the White Rock residential area. Approximately 345,000 people live within a 50-mile radius of LANL (EPA, 2023a). At the end of calendar year 2021, the LANL site employed 14,380 employees (including DOE contractor employees) (LANL, 2023a).

In 2004, samples from a newly constructed monitoring well exceeded the New Mexico Water Quality Control Commission (NWQCC) groundwater standard for human health of 50 micrograms per liter ($\mu\text{g/L}$) of chromium. As a result, under LANL's 2005 Order on Consent with the New Mexico Environment Department (NMED) Hazardous Waste Bureau, LANL was required to submit an interim measures report for hexavalent chromium (i.e., Cr(VI)). An interim measure is a formal process under the Resource Conservation and Recovery Act (RCRA) that allows actions and activities to be used to control or abate ongoing risks to human health or the environment in advance of the final remedy.

In 2015, EM-LA completed the *Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization* (DOE/EA-2005) (DOE, 2015) (referred to as the 2015 Interim Measures EA) to analyze the environmental impacts of conducting an interim measure to control migration of a plume of chromium contaminated groundwater and conducting field-scale studies to further characterize the plume center. The 2015 Interim Measures EA for the interim measure and plume-center characterization did not include an analysis of a final remedy to address chromium contaminated groundwater in Sandia and Mortandad Canyons. Based on analyses in the 2015 Interim Measures EA, DOE EM-LA determined that its proposed action would not result in any significant adverse impacts and issued a Finding of No Significant Impact (FONSI).

EM-LA initiated interim measure operations in 2018 to prevent migration of the plume beyond the LANL site boundary and to perform scientific studies to obtain data necessary to evaluate and recommend a final remedy. DOE now seeks to address the Cr(VI) contamination by evaluating appropriate final remedial actions that (1) can be implemented quickly, safely, and efficiently; (2) are cost-efficient; and (3) protect human health and the environment.



1
2

Figure 1-1. Regional location of Los Alamos National Laboratory

1.2 BACKGROUND

In 2004, groundwater samples collected from groundwater monitoring well R-28 screened in the upper portion of the regional aquifer beneath Mortandad Canyon at LANL indicated the presence of Cr(VI) contamination. Subsequent investigations determined that the Cr(VI) 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. This water was discharged into the headwaters of Sandia Canyon, releasing as much as 160,000 pounds (lbs) of potassium dichromate (LANL, 2018a). This discharge was part of operational maintenance activities through a National Pollutant Discharge Elimination System (NPDES) Permit NM0028355 that empties into upper Sandia Canyon on the south rim.

Much of the discharged chromium was converted to a lower toxicity form of chromium (Cr^{+3} or trivalent chromium [Cr(III)]) in a several-acre effluent-supported wetland immediately downstream of the NPDES outfall in Sandia Canyon. The remaining chromium, in predominantly hexavalent form, was transported via surface water down Sandia Canyon. Approximately 2 miles east of the wetland, a porous unit of the Bandelier Tuff bedrock at the surface enabled part of this discharge to infiltrate vertically through a 1,000- to 1,230-foot-thick geologically complex zone that is mostly unsaturated by water and referred to as the vadose zone (N3B, 2023a). The infiltration of these Cr(VI) waters ultimately created the chromium plume in the portion of the regional aquifer that lies beneath Mortandad Canyon. The concentrations of Cr(VI) are at levels above the NMED groundwater standard of 50 $\mu\text{g/L}$ in an area estimated to be approximately 1 mile in length and about a half-mile wide.¹ Hexavalent chromium contamination generally occurs within the upper 100 feet of the regional aquifer. A few locations (e.g., well R-70 area) are known to have chromium deeper than 100 feet (Figure 1-2). Additional investigations are underway to complete the delineation of the lateral and vertical extent of that contamination. While natural background concentrations (4 to 10 $\mu\text{g/L}$) of Cr(VI) are detected in many of the wells screened in the regional aquifer, regular sampling of nearby potable water supply wells indicates this plume has not affected any of them.

In 2015, DOE prepared the 2015 Interim Measures EA and FONSI (DOE, 2015). The proposal included drilling additional extraction wells and installing associated infrastructure to improve the effectiveness of the system to control chromium plume migration.

The interim measure infrastructure currently consists of five extraction wells (referred to as CrEX wells, for chromium extraction), an ion exchange treatment system, and five injection wells (referred to as CrIN wells, for chromium injection), with the latter component located along the downgradient portion of the plume to hydraulically control plume migration (see Figure 1-2) (N3B, 2023a). The approach is to extract chromium contaminated groundwater, treat it at the surface using ion exchange, and reinject treated water into the aquifer downgradient from where it was extracted in an effort to reverse the water table gradient to mitigate the movement of chromium in the southerly direction. The treated water is tested to verify that constituents meet NMED Ground Water Quality Bureau permit requirements before it is injected into the aquifer through the injection wells or sent for land application. Discharge Permit (DP)-1793 authorizes the EM-LA cleanup contractor to land-apply the treated groundwater using spray irrigation, an evaporation system, or

¹ This EA uses the term *chromium* by itself, to mean total chromium (hexavalent and trivalent); however, the groundwater plume is almost entirely hexavalent chromium.

1 water trucks along unpaved access roads, though those practices have been implemented only on a
2 very limited basis to date. Land application as specified in the permit is limited in geographic area,
3 months of the year, and time of day for when it can be applied, and at best could only dispose of ten
4 percent of the treated water produced by the interim measure system when in full operational mode.

5 EM-LA initiated operations of the southern portion of the interim measure in the spring of 2018,
6 due to the proximity of the plume leading edge to the property boundary with Pueblo de San
7 Ildefonso. The remaining portions of the interim measure were brought online at a later date,
8 mostly toward the end of 2019. Although there is still uncertainty with respect to the vertical and
9 lateral distribution of the chromium plume in the plume centroid and the northeastern regions of the
10 plume, the hydraulic and geochemical data and information indicate that interim measure operations
11 have generally contained the plume within the LANL site boundary (N3B, 2023a).

12 Perchlorate is a co-contaminant in the Cr(VI) plume. The primary source of perchlorate is historic
13 discharges released from the Radioactive Liquid Waste Treatment Facility from 1963 until March
14 2002. Starting in 2002, improvements in perchlorate removal technology were made at the
15 Radioactive Liquid Waste Treatment Facility, resulting in substantial decreases in perchlorate
16 concentrations in effluent. The NMED Toxic Pollutant Standard for perchlorate is 13.8 µg/L, and
17 concentrations in the regional aquifer beneath Sandia and Mortandad Canyons rarely exceed this
18 concentration except at three locations next to extraction well CrEX-2. During interim measure
19 operations, the ion exchange largely removes chromium, and perchlorate is largely untreated by this
20 process. Perchlorate is partly removed by the Cr(VI) ion exchange treatment process in
21 concentrations generally ranging from 0.05 µg/L to 0.232 µg/L. The ion exchange system could be
22 modified to remove perchlorate. However, chromium is the contaminant of highest concern
23 because it exceeds 50 µg/L in the regional aquifer beneath Mortandad Canyon and Sandia Canyon.
24 Therefore, perchlorate contamination is not being specifically addressed in this Environmental
25 Assessment (EA). The 2016 Compliance Order on Consent (Consent Order) between DOE and
26 NMED is the principal regulatory document governing nonradioactive legacy cleanup at the LANL
27 site. Legacy low-level mixed-waste cleanup is also regulated by NMED due to the hazardous waste
28 component. The Consent Order sets forth the corrective action process, including the development
29 of Corrective Measures Evaluation (CME) Reports. The purposes of the Consent Order are (1) to
30 fully determine the nature and extent of releases of contaminants at or from the LANL site; (2) to
31 identify and evaluate, where needed, alternatives for corrective measures, to clean up contaminants
32 in the environment, and to prevent or mitigate the migration of contaminants at or from the LANL
33 site; and (3) to implement such corrective measures.

34 EM-LA is preparing this EA under the National Environmental Policy Act (NEPA), as amended,
35 (Title 42 United States Code [U.S.C.] Section 4321 et seq.) to evaluate alternatives for remedial
36 action as part of the Chromium Interim Measures and Characterization Campaign identified in
37 Appendix A of the Consent Order. In accordance with the Consent Order, EM-LA will identify and
38 evaluate potential corrective measures alternatives for removal, containment, and/or treatment of the
39 Cr(VI) plume in the CME report and recommend a preferred alternative for remediation. NMED
40 will then review the CME, issue a Statement of Basis, engage in a public comment period, provide
41 an opportunity for a public hearing on the remedy, and aid in the selection of a final remedy.

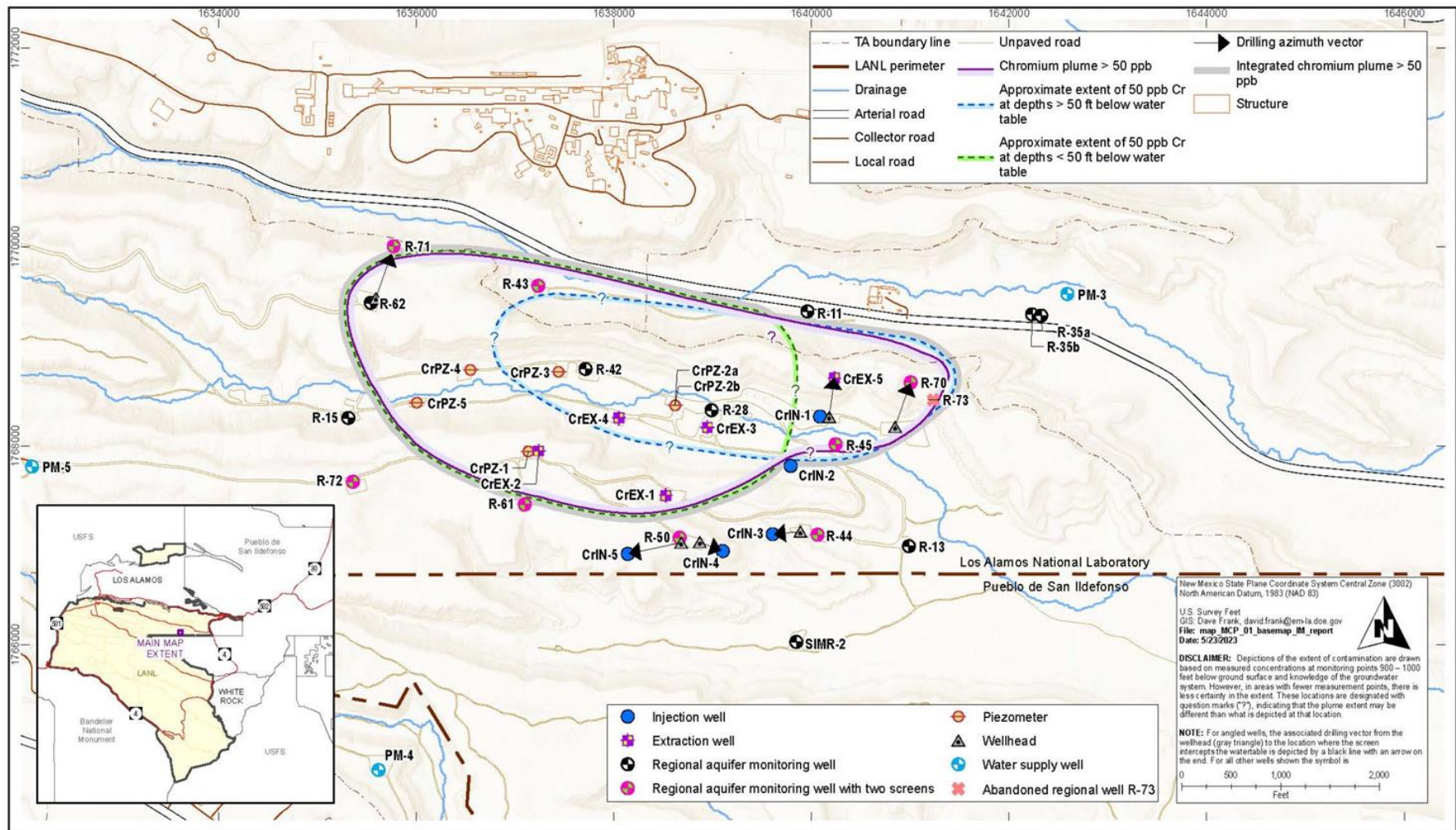


Figure 1-2. Present-day plume depiction, along with symbols depicting the level of chromium concentration (>50 or <50 µg/L) at sampling locations

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2
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1 **1.3 PURPOSE AND NEED**

2 NEPA requires Federal agencies to consider the environmental consequences of proposed actions
3 before making decisions. In complying with NEPA, EM-LA follows the Council on Environmental
4 Quality (CEQ) regulations (Title 40 Code of Federal Regulations [CFR] Parts 1500–1508) and
5 DOE’s NEPA-implementing procedures (10 CFR 1021). In accordance with NEPA requirements
6 and implementing procedures, EM-LA is preparing this EA to evaluate the environmental impacts
7 of corrective measures to remediate contaminated groundwater below Sandia and Mortandad
8 Canyons and to determine whether to issue a FONSI or to prepare an Environmental Impact
9 Statement (EIS).

10 In accordance with applicable Federal and state regulations, and the Consent Order, DOE-EM needs
11 to assess, identify, clean up, and otherwise address environmental contamination at LANL.

12 The purpose of the Proposed Action is to remediate chromium contaminated groundwater below
13 Sandia and Mortandad Canyons. While the groundwater underlying Sandia and Mortandad
14 Canyons was treated as an interim measure, DOE is evaluating corrective measures for a final
15 remedy that achieves permanence, cost effectiveness, and cleanup requirements. Whereas the
16 primary objective of the interim measure was to prevent migration of the chromium plume past the
17 LANL boundary (hydraulic control), with the incidental benefit of removing chromium mass from
18 the regional aquifer, DOE now needs to evaluate alternatives for groundwater remediation with the
19 primary goal of chromium mass removal or remediation to achieve compliance with groundwater
20 quality standards.

21 **1.4 RELEVANT NEPA DOCUMENTS AND SCOPE OF THIS ENVIRONMENTAL**
22 **ASSESSMENT**

23 In 2010, the NNSA Los Alamos Field Office prepared the *Final Environmental Assessment for the*
24 *Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach*
25 *S-2 of Sandia Canyon at Los Alamos National Laboratory, Los Alamos, New Mexico*
26 (DOE/EA-1736) (NNSA, 2010) (referred to as the SERF Expansion EA) to assess the potential
27 environmental consequences of implementing two expansion action alternatives at the SERF. The
28 SERF Expansion EA addressed the expanded treatment capacity that the SERF would need to treat
29 discharges from the Sanitary Wastewater System Plant, the Strategic Computing Complex and
30 Laboratory Data Communications Center cooling tower blowdown, and Power Plant boiler
31 blowdown discharged to Outfall 001. It also addressed contamination in upper Sandia Canyon
32 sediments from chromium and polychlorinated biphenyls. This EA incorporates information (tiers)
33 from the 2010 SERF Expansion EA.

34 In 2008, DOE prepared the *Final Site-Wide Environmental Impact Statement for Continued*
35 *Operation of the Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EIS-0380)
36 (DOE, 2008) (referred to as the SWEIS). The SWEIS and subsequent supplement analyses to the
37 SWEIS document a comprehensive analysis of all LANL activities foreseen at the time of
38 preparation, including actions required under the Consent Order. DOE anticipated that future
39 actions could include installing wells, and pumping, sampling, and treating groundwater (described
40 in Appendix I of the SWEIS). This EA has been prepared to present a detailed evaluation of
41 proposed Consent Order activities related to, and potential environmental impacts associated with,
42 the Mortandad Canyon Cr(VI) plume. This EA incorporates information (tiers) from the SWEIS.

1 In 2015, EM-LA prepared the 2015 Interim Measures EA (DOE, 2015) to analyze the
2 environmental impacts associated with implementing the interim measure for Cr(VI) plume control
3 and plume-center characterization. This EA incorporates information (tiers) from the 2015 Interim
4 Measures EA; where relevant, information is either summarized in this EA or incorporated by
5 reference.

6 **1.5 PUBLIC INVOLVEMENT**

7 On April 28, 2023, EM-LA gave notice of two public scoping meetings, which they hosted in
8 person on May 8, 2023, and via interactive webcast on May 9, 2023. Notices were published in the
9 *Los Alamos Daily Post*, *Los Alamos Reporter*, *Santa Fe New Mexican*, and the *Rio Grande Sun*.
10 Notices were also sent to interested stakeholders and non-governmental organizations.

11 The public scoping meetings and notices provided the public with information about the NEPA
12 process and the *Chromium Interim Measure and Final Remedy Environmental Assessment* and
13 invited public comments on the scope of this EA.

14 Questions from the public were welcomed at both meetings. Participants at the in-person meeting
15 were instructed to provide their comments as either verbal comments to the EA project's
16 stenographer or in writing by submitting a comment form to the EM-LA representatives at the
17 meeting. Webcast and in-person participants were also invited to provide their comments after the
18 meeting via email or mail.

19 This public scoping period closed on June 6, 2023. No comments were received at the meetings,
20 but afterwards, DOE received seven comment documents in which 99 comments were identified.
21 The scoping comments and EM-LA's responses are summarized in Appendix A, *Scoping*
22 *Comments Summary*.

2.0 DESCRIPTION OF ALTERNATIVES

2.1 INTRODUCTION

The CEQ regulations in 40 CFR 1508.9(b) require that an EA include a brief discussion of reasonable alternatives to a proposed action. EM-LA considered alternatives for chromium mass removal in source areas and regional groundwater below Sandia and Mortandad Canyons. For alternatives to be reasonable, they must meet the following criteria:

- Control migration of chromium in groundwater
- Reduce the mass of chromium in groundwater
- Control, reduce, or eliminate the sources of chromium in groundwater
- Achieve cleanup objectives
- Protect human and ecological receptors
- Manage remediation waste in accordance with state and Federal regulations.

This section describes the Proposed Action, the No Action Alternative, and alternatives considered but eliminated from further analysis. A more detailed description of the Proposed Action can be found in Appendix B, *Description of Alternatives Supporting Information*.

2.2 NO ACTION ALTERNATIVE

The No Action Alternative establishes a baseline against which this EA compares the Proposed Action. “No action” does not necessarily mean doing nothing but involves maintaining or continuing the existing status or condition. In this document, the No Action Alternative is the continuation of the preferred alternative in the 2015 Interim Measures EA (DOE, 2015) and 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. Evaluations and analyses performed during implementation of the No Action Alternative would continue to contribute to recommendations of a final remedy. When EM-LA has identified a final remedy, they would perform a NEPA evaluation.

2.3 PROPOSED ACTION

In 2022, the Network of National Laboratories for Environmental Management and Stewardship (NNLEMS) completed *the Independent Review of Groundwater Remediation Strategy for Hexavalent Chromium and RDX Groundwater Plumes at Los Alamos National Laboratory* (NNLEMS, 2022). The report documents an independent technical review by scientists from the DOE NNLEMS to provide recommendations for potential near-term actions to address and optimize remediation for the Cr(VI) plume. The overarching recommendation of the NNLEMS

1 review team is that the Cr(VI) plume should be addressed in context of the emerging “management
2 of complex sites” paradigm. A primary goal of the complex site paradigm is to recognize that it is
3 difficult to generate advanced knowledge sufficient to provide a technically defensible basis for the
4 final remediation decision, design, and implementation. Instead, an adaptive management strategy
5 encourages a focus on what can be done now with the information that is known, what can be done
6 to stabilize the plume and mitigate risk, and what achievable interim objectives can be added as part
7 of the adaptive management process that will allow success.

8 Under the Proposed Action, EM-LA would use adaptive site management (ASM) to select and
9 implement options to remediate Cr(VI) contamination in Mortandad and Sandia Canyons. The use
10 of ASM helps develop effective cleanup strategies by ensuring continuous planning,
11 implementation, and monitoring that accommodates new information and changing site conditions.
12 Remediation under ASM addresses what is known while acknowledging what is not fully
13 understood; it includes plans to collect the necessary information to reduce uncertainties and
14 achieve a final, protective remedy for the site. This approach allows work to proceed in some areas
15 while additional data collection and testing of responses is conducted to determine the appropriate
16 level of remediation in remaining areas. ASM has been implemented at many complex remediation
17 sites and is recommended by the U.S. Environmental Protection Agency (EPA) (EPA, 2022).

18 The Proposed Action provides four options for implementing the ASM approach to remediate
19 chromium contaminated groundwater below Sandia and Mortandad Canyons. EM-LA would
20 utilize these options individually or in combination, to improve the effectiveness of remediation, the
21 cost of remediation, or minimize potential effects resulting from the Proposed Action. More
22 detailed descriptions of these options are included in Appendix B, *Description of Alternatives*
23 *Supporting Information*, including numeric estimates of key information used to bound and assess
24 the environmental impacts (Table B-1).

- 25 • Option 1: Mass Removal via Expanded Treatment—Under this option, EM-LA would
26 construct a semi-permanent treatment facility within Mortandad Canyon and add up to 45
27 new extraction, injection, and monitoring wells with associated piping infrastructure and
28 up to 30 new deep vadose zone piezometers. This option would target both source area
29 contamination in Sandia Canyon and groundwater contamination in Mortandad Canyon.
30 The additional wells and the larger groundwater treatment capability would raise the rate
31 of groundwater extraction and increase the rate of mass removal, groundwater treatment,
32 and injection in the affected areas. The combined extraction rate for the existing and new
33 extraction wells would be approximately 550,000,000 gallons per year (gpy). However,
34 current extraction rates for the interim measure are limited by water rights authorized by
35 the New Mexico Office of State Engineer (NMOSE) and is currently limited to a
36 groundwater extraction rate of up to 648,000 gallons per day (gpd), or up to a maximum
37 diversion of groundwater of 679 acre-feet per year. This translates into maximum
38 extraction and injection rates of approximately 450 gallons per minute (gpm) for the
39 interim measure (N3B, 2023a). Any additional extraction for the Proposed Action above
40 the current rates authorized for the interim measure would require authorization from
41 NMOSE.
- 42 • Option 2: Mass Removal with Land Application—This option would use land
43 application of treated groundwater as a disposition method. Land application would only
44 occur in permitted areas per a NPDES DP that regulates land application rates. Land
45 application would be limited in geographic area, months of the year, and time of day, for

1 when it can be applied. Land application of treated water in permitted areas would
2 encompass about 50 acres of land. The areas for land application under the Proposed
3 Action are the same as those currently available for this activity under the interim
4 measure.

- 5 • Option 3: Mass Removal via In-situ Treatment—This option would use in-situ treatment
6 to address Cr(VI) contaminated groundwater. In-situ treatment involves injecting
7 reducing agents in untreated water and relying on chemical processes (e.g., sodium
8 dithionite amendments) to immobilize and detoxify contaminants within soil or
9 groundwater without removing them from the ground. In-situ treatment would be used to
10 target both source area contamination in Sandia Canyon as well as groundwater
11 contamination beneath Mortandad Canyon.
- 12 • Option 4: Monitored Natural Attenuation—Monitored natural attenuation (MNA) relies
13 on natural physical, chemical, or biological processes to reduce concentrations, toxicity,
14 or mobility of chromium and incorporates regular monitoring to verify that MNA is
15 working. In the case of chromium, attenuation occurs via the reduction of mobile Cr(VI)
16 to insoluble Cr(III). EM-LA would consider MNA when contamination poses relatively
17 low risks, the plume is stable or shrinking, and the natural attenuation processes are
18 projected to achieve remedial objectives in a reasonable timeframe, compared to more
19 active methods.

20 In addition to these options, other measures to achieve the final remedy through source removal
21 could be instituted in the shallow and vadose zone groundwater. The discharge of treated waters
22 could be released into Sandia Canyon or through LANL's NPDES outfall for treated effluent. The
23 details related to these other measures are shown in Appendix B, *Description of Alternatives*
24 *Supporting Information*, Table B-1.

25 The SERF Expansion EA (NNSA, 2010) evaluated the environmental impacts of installing
26 grade-control structures in the Sandia Canyon source area to create a stable area of moist soils to
27 minimize erosion of contaminated sediment. DOE installed these structures in 2015, and periodic
28 wetlands sampling indicates that chromium in the wetland sediments is predominantly present in the
29 geochemically stable Cr(III). The presence of Cr(III) is not likely to become a future source of
30 chromium contamination in groundwater, especially if saturated conditions are maintained within
31 the wetland. Prior to the installation of the grade-control structures, natural reducing conditions in
32 the Sandia Canyon wetland had created a viable MNA scenario, which the grade-control structures
33 supplemented with more active water level and saturation control. Therefore, continuation of MNA
34 is the proposed treatment option for the Sandia Canyon source area.

35 ***The Proposed Adaptive Site Management Approach***

36 A National Environmental Policy Task Force prepared a report for the CEQ in 2003 concerning
37 modernizing NEPA implementation². One part of that report (i.e., Chapter 4) focuses on ASM
38 and monitoring in the preparation of NEPA documents. Their guidance or recommendation is
39 that a NEPA document should describe the proposed ASM approach, how the approach is
40 reflected in the alternatives being considered, the monitoring protocols, desired outcomes, and

² <https://ceq.doe.gov/docs/ceq-publications/report/finalreport.pdf>

1 performance measures and factors. These aspects of the proposed ASM approach are addressed
2 hereafter.

3
4 In addition, the NNLEMS published an *Independent Review of Groundwater Remediation for*
5 *Hexavalent Chromium and RDX Groundwater Plumes at Los Alamos National Laboratory* for
6 DOE³. The Executive Summary provided DOE short- and long-term ASM recommendations for
7 complex sites, which have been used to guide this project's site-specific approach.

8 The specifics of the ASM approach would be resolved through the RCRA decision-making process⁴
9 enforced by NMED through the Consent Order where EM-LA will develop recommendations for a
10 final remedy to be presented to NMED for agreement in accordance with the CME process, as
11 described in the Consent Order. EM-LA will then prepare a Corrective Measures Implementation
12 Plan (CMIP) explaining the design, construction, operation, maintenance, and monitoring of the
13 corrective measure or measures. EM-LA will define the adaptive management approach (i.e., the
14 monitoring protocols, desired outcomes, performance measures, interim objectives, and other
15 factors) in the CMIP.

16 ***Reflection of the Adaptive Management Approach in the Alternatives***

17 EM-LA has determined from prescreening that the four Proposed Action options represent a range
18 of the most viable methods and technologies to address Cr(VI) mass removal and reductions in
19 groundwater concentrations. EM-LA eliminated some methods and technologies from
20 consideration during prescreening, and these are cited in Appendix B, *Description of Alternatives*
21 *Supporting Information*. Some of these options have been successfully implemented at the project
22 site (e.g., pump, treat, and inject). Together, the four options are the available approaches that EM-
23 LA can use through ASM to provide flexibility to remedial actions to optimize the pace,
24 thoroughness, and cost-effectiveness of remediation. For instance, in the pump, treat, and inject
25 scenario, a well which is initially utilized for extraction may reduce the chromium concentration
26 well below the New Mexico groundwater standard of 50 ug/L. At that point, it may be
27 advantageous to repurpose the well for monitoring or injection purposes.

28 ***Monitoring Protocols***

29 Monitoring supports continuous learning about remediation effectiveness, provides information to
30 guide the planning of future actions, and facilitates decision-making. In general, there are three
31 monitoring types: (1) compliance monitoring, which is required by permits and other regulatory
32 documents with the goal of determining whether remediation actions have been completed as planned;
33 (2) effectiveness monitoring, which measures achievement of targets; and (3) explorative research or
34 explorative monitoring, which tests a conceptual model by evaluating hypotheses with targeted
35 research. Monitoring under the ASM approach may include these three types of monitoring as well as
36 the following elements, which, as noted above, would be defined in the CMIP:

- 37 • Groundwater – Perform routine in-situ/ex-situ (as appropriate) chemical sampling of
38 groundwater for Cr(VI) concentrations in injection, extraction, monitoring, and water

³ See https://www.energy.gov/sites/default/files/2023-07/Network-of-National-Laboratories-for-Environmental-Management-and-Stewardship-NNLEMS-2022-00003_R.1%20final-20233-07-10.pdf

⁴ See <https://www.epa.gov/hw/learn-about-corrective-action#theprocess> for more information.

1 supply wells within the project area to evaluate increasing/decreasing trends above the
2 50-parts-per-billion (ppb) water quality standard.

- 3 • Surface Water – Perform chemical sampling of perennial and ephemeral surface waters
4 for Cr(VI) concentrations in the project area to evaluate increasing/decreasing trends in
5 Cr(VI) above the 50-ppb water quality standard.
- 6 • Potentiometric Mapping – Map the potentiometric surface of the regional aquifer’s water
7 table, with measurements gathered from monitoring wells and piezometers, to evaluate
8 the effectiveness of the hydraulic barrier near the southern boundary with the Pueblo de
9 San Ildefonso as well as the effectiveness of the extraction wells in creating a cone of
10 depression.
- 11 • Flow and Solute Modeling – Run the groundwater models to assess through particle-
12 tracking/well capture, and solute transport analysis the effects of adding or removing
13 injection, extraction wells, or new water supply wells.

14 Appendix F of the Consent Order gives guidance on the methods used to conduct investigation,
15 corrective action, and monitoring activities. Site-specific work plans are developed and include
16 data quality objectives to fulfill the requirements of the Consent Order and provide accurate data for
17 the evaluation of site conditions, the nature and extent of contamination and contaminant migration,
18 and for corrective measures selection and implementation. Future monitoring would be performed,
19 as appropriate and as approved by pertinent regulatory agencies (e.g., NMED), and may be verified
20 by quality assurance comparisons with duplicate and split sampling data taken by oversight
21 agencies (e.g., NMED).

22 ***Desired Outcome***

23 In adaptive management, the outcomes of decisions, assessed through monitoring, are compared
24 against explicit predictions of those outcomes, with the comparative results fed back into decision-
25 making to produce more effective decision-making. The ASM approach would involve
26 implementing the remedial options, individually or in combination, to achieve the following
27 Desired Outcomes:

- 28 • Control migration of Cr(VI) in groundwater
- 29 • Remove the mass of Cr(VI) in groundwater
- 30 • Control, reduce, or eliminate the sources of Cr(VI) in groundwater
- 31 • Protect human and ecological receptors
- 32 • Manage remediation waste in accordance with Federal and state regulations

33 ***Performance Measures***

34 The remedial options would allow EM-LA to use multiple technologies in combination or
35 sequentially, guided by technology performance. Performance measures guide evaluations of how
36 remediation is progressing toward the Desired Outcomes. The Proposed Action incorporates the
37 following performance measures:

- 1 • Conduct an annual assessment to determine compliance with the following performance
2 measures and evaluate whether the methods and technologies employed are effective.
- 3 • Annually observe reductions in Cr(VI) concentrations in groundwater along the plume's
4 50 ppb water quality standard perimeter.
- 5 • Annually observe a reduction in the area encompassed by the 50 ppb Cr(VI) iso-
6 concentration contour lowering progressively.
- 7 • Annually achieve a reduction (or conversion to Cr(III) from in-situ treatment) of the
8 estimated mass of Cr(VI) in groundwater from implementation of the remedy.
- 9 • Dispose of Cr(VI) when removed from groundwater, in accordance with Federal and
10 state regulations.
- 11 • Ensure extracted and treated groundwater to be used for injection, land application, or
12 mechanical evaporation meets Federal and state requirements for the intended purpose.
- 13 • Ensure no human or ecological receptors are affected by the Proposed Action.
- 14 • Continue mitigation measures associated with the 2015 Interim Measures EA previously
15 agreed to (FY 2020 Mitigation Action Plan for LANL Operations, December 2, 2020;
16 [https://www.energy.gov/nepa/articles/mitigation-action-plan-lanl-operations-september-](https://www.energy.gov/nepa/articles/mitigation-action-plan-lanl-operations-september-2020)
17 [2020](https://www.energy.gov/nepa/articles/mitigation-action-plan-lanl-operations-september-2020)) in Sandia Canyon.

18 The Proposed Action would use infrastructure already in place as a result of ongoing investigations
19 of the chromium plume and install new infrastructure. Existing infrastructure includes injection,
20 extraction, and monitoring wells; piezometers; a water treatment system with portable storage tanks,
21 storage basins, and associated connecting pipelines; unpaved access roads; power lines; and an
22 irrigation system for land application of treated water. The Proposed Action would include
23 installation of the following new infrastructure:

- 24 • Up to 15 injection wells in the regional aquifer: 70 gpm (1,000 gpm max total capacity).
- 25 • Up to 15 extraction wells in the regional aquifer: 70 gpm (1,000 gpm max total capacity).
- 26 • Up to 15 new monitoring wells in the regional aquifer. One existing well would be
27 converted into a monitoring well in the regional aquifer, for a total of 16 monitoring
28 wells.
- 29 • Up to 20 piezometers in the shallow zone (i.e., the alluvial aquifer) in Sandia Canyon
30 Wetlands source area.
- 31 • Up to 10 piezometers in the deep vadose zone (i.e., the intermediate-perched aquifer) in
32 Mortandad Canyon.
- 33 • A new 10,000 square foot (ft²) groundwater treatment facility.
- 34 • Well pads and infrastructure to support installation and operation of the wells, including
35 well heads, shipping containers (or similar shelters), portable storage tanks, and piping.
- 36 • Spray irrigation/evaporation system.
- 37 • Buried piping.
- 38 • Unpaved access roads.

1 Associated infrastructure improvements also include temporary, remote pumping stations. Remote
 2 pumping stations would be temporarily installed on previously constructed well pads or other
 3 previously disturbed areas. Pipelines to and from the groundwater treatment facility and pumping
 4 stations would also be installed in previously disturbed or developed areas (e.g., in existing road
 5 rights-of-way).

6 Table 2-1 summarizes the potential surface disturbance from implementing the Proposed Action.

7 **Table 2-1. Summary of potential surface disturbance from implementing the Proposed**
 8 **Action**

Proposed New Infrastructure	Potential New Disturbance	Total New Land Disturbance
Up to 15 injection wells in the regional aquifer ^(a)	0.70 acres per well	10.5 acres
Up to 15 extraction wells in the regional aquifer ^(a)	0.70 acres per well	10.5 acres
Up to 15 new monitoring wells in the regional aquifer ^(a,b)	0.70 acres per well	10.5 acres
Up to 20 piezometers in the shallow zone in Sandia Canyon Wetlands source area	100 ft ² per piezometer	0.05 acres
Up to 10 piezometers in the deep vadose zone in Mortandad Canyon ^(a,c)	0.70 acres per piezometer	10.5 acres
New 10,000 ft ² treatment facility	Located in previously disturbed area.	0 acres
Spray irrigation/evaporation system	No new disturbance. The areas for land application under the Proposed Action are the same as those currently available for this activity under the interim measure.	
Buried Piping	No new or additional disturbance. Would be located along access roads and in previously disturbed areas.	0 Acres
Unpaved Access Roads	0.60 acres per well and deep vadose zone piezometer	33 acres
Total New Disturbance		75 acres

Key: ft² = square feet

Notes:

^(a) The area of disturbance for new wells and deep vadose zone piezometers includes well pads and infrastructure to support installation and operation of the wells, including well heads, shipping containers (or similar shelters), portable storage tanks, and piping.

^(b) The Proposed Action includes operation and maintenance activities for up to 16 monitoring wells in the regional aquifer, but one of these monitoring wells would be an existing well that would be converted to a monitoring well. Additional surface disturbance is not anticipated for the activities necessary to convert the well.

^(c) The deep vadose zone piezometers are likely to require less surface disturbance, time for construction, casing materials, and other associated infrastructure than extraction, injection, and monitoring wells. For the purposes of this analysis, the area of disturbance for these piezometers is considered to be bounding.

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

13 Appendix B, *Description of Alternatives Supporting Information*, gives a detailed description of
 14 treatment technologies, construction, and other activities comprising the Proposed Action.

15 2.4 ALTERNATIVES CONSIDERED BUT NOT EVALUATED

16 EM-LA considered other alternatives in the development of potential actions to remediate the
 17 hexavalent chromium plume. Many technologies were considered for mass removal and control of

1 chromium migration in regional groundwater below Mortandad Canyon and treatment of the
2 chromium sources in Sandia Canyon sediment, shallow/vadose zone groundwater, and intermediate
3 groundwater. For example, EM-LA determined that MNA alone would be insufficient to control
4 plume advancement and maintain chromium contamination within the Laboratory's boundary,
5 based on current concentrations and plume migration; therefore, MNA does not meet the purpose
6 and need or the screening criteria and was eliminated from further analysis as a stand-alone
7 alternative. However, as part of the ASM approach, MNA was kept as an option that EM-LA could
8 consider at any time during or after the implementation of other remedial options when controlling
9 migration of chromium in groundwater is most likely to be sustained, does not pose a risk for off-
10 site migration or to water supply wells, or meets the other evaluation criteria. Other alternatives
11 that EM-LA evaluated, but removed from consideration, are listed in Appendix B, *Description of*
12 *Alternatives Supporting Information*, Table B-2.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 INTRODUCTION AND REGIONAL SETTING

Introduction

This section provides a brief description of the existing conditions of resource areas that may be affected by the Proposed Action. Discussion of the present day setting in this document is limited to environmental information that relates to the scope of the Proposed Action. The level of detail varies depending on the potential for impacts for each resource area. This section summarizes several site-specific and recent project-specific documents that describe the affected environment and incorporates these documents by reference.

As described in Section 2.2, *No Action Alternative*, Cr(VI) plume remediation activities at LANL would continue under interim measure operations, and the Proposed Action would not be implemented. EM-LA completed the 2015 Interim Measures EA to evaluate the environmental impacts of implementing the interim measure. Based on analyses in the EA, EM-LA determined that conducting the interim measure to control migration of the Cr(VI) plume and field-scale studies to further characterize the plume center would not result in any significant adverse impacts. A detailed description of the interim action and plume characterization studies, together with a discussion of the associated environmental consequences, are in the 2015 Interim Measures EA, which is incorporated by reference. The No Action Alternative would not result in impacts to resources at LANL beyond those captured in the discussion of the affected environment and as previously analyzed in the relevant NEPA documents listed in Section 1.4, *Relevant NEPA Documents and Scope of this Environmental Assessment*. These impacts are summarized in Section 3.16.

The ASM approach enables EM-LA to monitor and evaluate changing conditions, acquire information during the implementation of the Proposed Action, and report the findings to NMED. Based on this evaluation, EM-LA can propose future changes that could affect the remediation strategy and construction of associated infrastructure, including the number and location of extraction and injection wells. This approach is guided by the development of interim objectives and performance metrics in parallel with remedial options to protect human health and the environment. Application of the performance measures, monitoring protocols, project design features, and other engineering and administrative controls are described in Chapter 2, *Description of Alternatives*, and Appendix B, *Description of Alternatives Supporting Information*. These descriptions demonstrate that the proposed remediation options are capable of meeting the criteria listed in Section 2.1, *Introduction*, and can be implemented to improve the effectiveness of remediation, the cost of remediation, and minimize adverse environmental impacts resulting from the Proposed Action. The performance of these methods and technologies would be routinely evaluated and reported to EM-LA and NMED to aid in the decision-making process.

Because the specific combination of remedial options to be implemented is unknown, the analysis of impacts in this EA is based on conservative assumptions using maximum reasonably foreseeable disturbance and impact levels. 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

1 that EM-LA would implement all options in a combination⁵, and is designed to identify the
2 maximum range of potential impacts. Therefore, the impacts of the activities that could occur under
3 the Proposed Action evaluated in this EA are considered bounding.

4 Important ASM considerations are discussed in resource areas, as applicable, in accordance with
5 CEQ's direction to discuss impacts in proportion to their significance (40 CFR 1502.2(b)). The
6 regulatory framework of the Consent Order includes the process for establishing the specifics of the
7 ASM. This ensures that the ASM specifics are by design protective of the public and environment.

8 In addition, cumulative impacts can result from individually minor, but collectively significant,
9 on-site or off-site actions occurring over time (40 CFR 1508.7). Those actions within the spatial
10 and temporal boundaries (i.e., project impact zone) of the Proposed Action are considered in this
11 EA. DOE reviewed the resources at risk; geographic boundaries; past, present, and reasonably
12 foreseeable future actions; and baseline information in determining the significance of cumulative
13 impacts. Actions that have little or no impact generally do not result in cumulative impacts.

14 Conclusions regarding cumulative impacts are included in the following sections.

15 ***Regional Setting***

16 LANL is located in Los Alamos and Santa Fe counties, in north-central New Mexico,
17 approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe (see
18 Figure 1-1). The Laboratory sits on the Pajarito Plateau at the eastern edge of the Jemez Mountains.
19 The Sierra de los Valles range of the Jemez Mountains is directly west of the Laboratory, and White
20 Rock Canyon, containing the Rio Grande, is east. The Pajarito Plateau is a series of mesas separated
21 by east-west trending canyons. Mesa tops range in elevation from about 7,800 feet on the western
22 side to about 6,200 feet on the eastern side.

23 Los Alamos County has a semiarid climate, meaning that more water is lost from the soil and plants
24 through evaporation and transpiration than is received as annual precipitation. The average annual
25 precipitation (which includes both rain and the water equivalent of snow, hail, and other frozen
26 precipitation) is about 17 inches. The average annual snowfall is about 43 inches. Annual
27 temperatures and amounts of precipitation vary across the county because of the 5,000-foot change
28 in elevation and the complex topography.

29 Four distinct seasons occur in Los Alamos County. Winters are generally mild with occasional
30 snowstorms. Spring is the windiest season. Summer is the rainy season with frequent afternoon
31 thunderstorms. Fall is typically dry, cool, and calm.

32 On average, winter temperatures range from 30°F to 50°F during the day and from 15°F to 25°F
33 during the night. The Sangre de Cristo Mountains to the east of the Rio Grande act as a barrier to
34 wintertime arctic air masses, making the occurrence of subzero temperatures rare. On average,
35 summer temperatures range from 70°F to 88°F during the day and from 50°F to 59°F during the night.

36 The rainy season begins in early July and ends in early September. Afternoon thunderstorms form
37 in the summer as moist air from the Pacific Ocean and the Gulf of Mexico lifts over the Jemez
38 Mountains and then often moves eastward across the Laboratory. These thunderstorms produce
39 short, heavy downpours and an abundance of lightning. Local lightning density is estimated at
40 15 strikes per square mile per year.

⁵ 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.

1 The complex topography of the Pajarito Plateau influences local wind patterns. Daytime winds in
2 the Los Alamos area are predominantly from the south, as heated daytime air moves up the Rio
3 Grande valley. Nighttime winds on the Pajarito Plateau are lighter and more variable than daytime
4 winds and are typically from the west, a result of prevailing upper-level winds from the west and
5 the downslope flow of cooled mountain air.

6 The Proposed Action includes construction and operation of the groundwater treatment facility;
7 wells, well pads, and access road stubs; pipelines; and other infrastructure in Sandia and Mortandad
8 Canyons, as described in Chapter 2, *Description of Alternatives*, and detailed in Appendix B,
9 *Description of Alternatives Supporting Information*. Figure 3-1 depicts the project area for the
10 chromium interim measures and final remedy.

11 **3.2 LAND USE**

12 Land use is the term used to describe the human development and use of land. It represents the
13 economic and cultural activities (e.g., agriculture, residence, and industry) that are practiced at a
14 given place.

15 **3.2.1 LAND USE – AFFECTED ENVIRONMENT**

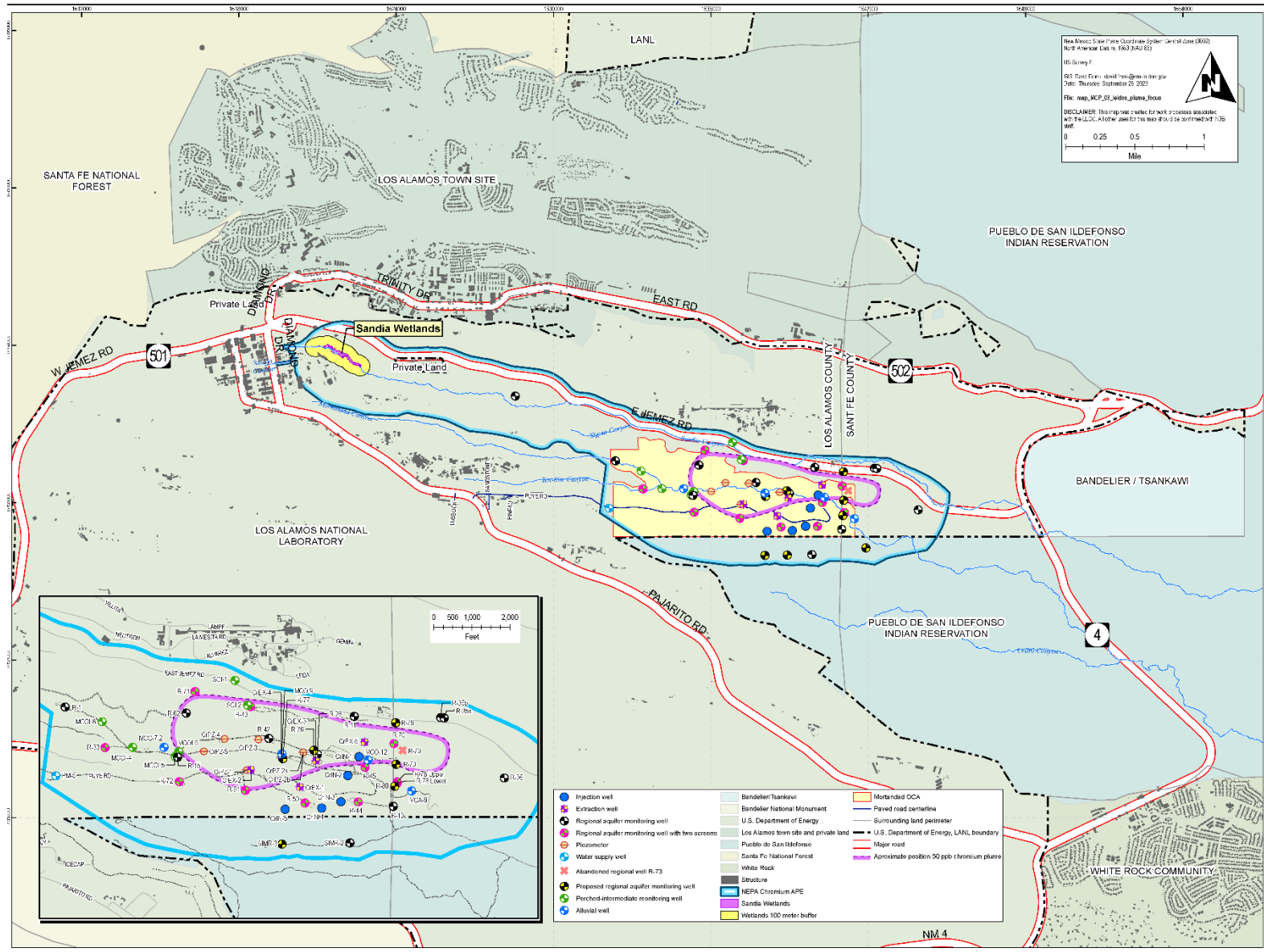
16 LANL is located on approximately 40 square miles of land in north-central New Mexico (see Figure
17 1-1). Commercial and residential development in Los Alamos County is confined to several mesa
18 tops that are north (the Los Alamos townsite), or southeast (the community of White Rock) of the
19 core LANL developed area (DOE, 2015).

20 LANL is divided into 46 contiguous technical areas (see Table 3-1). In total, approximately
21 20 percent of LANL is developed. The highest concentration of facilities and workers is found in
22 Technical Area (TA)-03, TA-53, and along the Pajarito Corridor in TA-35, TA-46, TA-48, TA-50,
23 TA-55, and TA-66. Future development will likely take place in and near these areas because they
24 have the appropriate accessibility and infrastructure for expansion (DOE, 2015).

25 Buildings and facilities at LANL total approximately 8.2 million ft² (gross), including
26 approximately 850 permanent and 500 temporary and miscellaneous structures. There are no
27 agricultural activities on the LANL site (including prime farmlands), nor are there residential areas.
28 However, the Elk Ridge Mobile Home Park, surrounded by TA-61 along East Jemez Road, is a
29 privately owned mobile home community containing 180 residential rental sites, ten recreational
30 vehicle pads, and associated amenities (DOE, 2022a).

31 In December 2014, the Manhattan Project National Historical Park was established. DOE and the
32 Department of Interior developed a Memorandum of Understanding to complete a Park
33 Management Plan. Three park sites were established at LANL and, although no public access exists
34 to these facilities, tours offered by the National Park Service are available to the public three times a
35 year to historic buildings associated with the Manhattan Project (DOE, 2015).

36 In the 1970s, DOE established National Environmental Research Parks within their land holdings to
37 serve as field laboratories for ecological research and the study of environmental impacts of energy
38 developments. In 1976, the National Environmental Research Parks was established at LANL and
39 includes the entire 40 square miles of the Laboratory.



1
2

Figure 3-1. Chromium Interim Measure and Final Remedy project area

Table 3-1. Land use categories at Los Alamos National Laboratory

Category	Description/Use
Administration, Service, and Support	Administrative functions, services, and support for LANL management and employees
Experimental Science	Applied research and development activities tied to major programs
High-Explosives Research and Development	Research and development of new explosive materials (land in this category is isolated for security and safety)
High-Explosives Testing	Large, isolated, exclusive-use areas required to maintain safety and environmental compliance during testing of newly developed explosive materials and new uses for existing materials (land in this category includes exclusion and buffer areas)
Nuclear Materials Research and Development	Isolated, secured areas for conducting research and development involving nuclear materials (land in this category includes security and radiation hazard buffer zones, but not waste disposal sites)
Physical and Technical Support	Includes roads, parking lots, and associated maintenance facilities; infrastructure such as communications and utilities; facility maintenance shops; and maintenance equipment storage (land in this category is generally free from chemical, radiological, or explosives hazards)
Public and Corporate Interface	Provides links with the public and other outside entities conducting business at LANL, including technology transfer activities
Reserve	Areas not otherwise included in one of the other categories (it may include environmental core and buffer areas, vacant land, and proposed land transfer areas)
Theoretical and Computational Science	Interdisciplinary activities involving mathematical and computational research and related support activities
Waste Management	Activities related to the handling, treatment, and disposal of all generated waste products, including solid, liquid, and hazardous materials (chemical, radiological, and explosive)

Source: (DOE, 2015)

Under the LANL Trails Management Program, there are certain open spaces throughout the site (e.g., TA-70 and TA-71) with trails used for hiking and other recreational purposes (LANL, 2022a). While there are multiple hiking trails and recreational uses of land surrounding LANL (e.g., Los Alamos County, Bandelier National Monument, and Santa Fe National Forest), there are no hiking trails or recreational uses of LANL land available to the public.

Access to the area of LANL near the project site is restricted. The project area encompasses approximately 2,025 acres, of which about 235 acres (about 12 percent) is currently developed (see Appendix C, *Environmental Resources Supporting Information*, Figure C-8). Infrastructure associated with previous work within the canyon, including a network of monitoring, extraction, and injection wells, have been installed within and around the Cr(VI) plume perimeter area (see Appendix C, Figure C-2). These wells and associated infrastructure support the interim measure efforts to characterize the plume and to halt the plume's movement. The remainder of the project area is generally undeveloped.

1 **3.2.2 LAND USE – ENVIRONMENTAL CONSEQUENCES**

2 **3.2.2.1 Proposed Action (Adaptive Site Management)**

3 *Option 1 – Mass Removal via Expanded Treatment*

4 Option 1 would result in the construction of a 10,000-ft² (0.23 acres) groundwater treatment facility
5 situated in a previously disturbed area within Mortandad Canyon. The construction, operation, and
6 maintenance of the groundwater treatment facility would be compatible with the current use of the
7 area. There would be an additional ground disturbance of approximately 75 acres for the
8 installation of new infrastructure and access roads. Option 1 would not result in any change of land
9 ownership or modification of existing land uses. LANL would remain restricted for public
10 recreational activities such as those available in surrounding areas.

11 Actions under Option 1 would not have any irreversible impacts and would not hinder current or
12 future public or private land uses in the areas surrounding LANL. Up to four of the proposed
13 monitoring wells would be installed on San Ildefonso Pueblo land. Section 3.7, *Cultural Resources*,
14 addresses potential impacts to San Ildefonso Pueblo lands and cultural resources identified within
15 the area of potential effects (APE) of the project.

16 *Option 2 – Mass Removal with Land Application*

17 Option 2 would involve the same activities as discussed under Option 1, but also includes land
18 application of treated water in permitted areas on about 50 acres of land. The areas for land
19 application under the Proposed Action are the same as those currently available for this activity
20 under the interim measure. Potential impacts to land use would be essentially the same as discussed
21 under Option 1. Option 2 would not result in any change of land ownership, modification of
22 existing land uses, or irreversible impact to land use in the areas surrounding LANL.

23 *Option 3 – Mass Removal via In-Situ Treatment*

24 Option 3 has the potential to involve the same amount of ground disturbance as Options 1 and 2,
25 depending on the number of wells and other infrastructure EM-LA decides to construct and where
26 and when in-situ treatments are implemented. Option 3 would not result in any change of land
27 ownership, modification of existing land uses, or irreversible impact to land use in the areas
28 surrounding LANL.

29 *Option 4 – Monitored Natural Attenuation*

30 Option 4 has the potential to involve the same amount of ground disturbance as Options 1 and 2,
31 depending on when EM-LA determines MNA would be a viable treatment option. Option 4 would
32 not result in any change of land ownership, modification of existing land uses, or irreversible impact
33 to land use in the areas surrounding LANL.

34 **3.2.2.2 Cumulative Impacts**

35 As previously described, impacts from the Proposed Action on land use would be small and limited
36 to the project area. Because impacts would be small, they would not substantially contribute to
37 cumulative impacts on land use.

1 **3.3 GEOLOGY AND SOILS**

2 Geologic resources are consolidated or unconsolidated earth materials, including ore and aggregate
3 materials, fossil fuels, and significant landforms. Soil resources are the loose surface materials of
4 the earth in which plants grow, usually consisting of disintegrated rock, organic matter, and soluble
5 salts.

6 **3.3.1 GEOLOGY AND SOILS – AFFECTED ENVIRONMENT**

7 **Geology**

8 LANL lies along a continental rift called the Rio Grande Rift, which trends north to south through
9 central New Mexico. The Jemez Mountains and associated Pajarito fault system form the western
10 margin of the rift (DOE, 2022a). Continental rifts occur where tectonic plates in the earth’s crust
11 move apart; a rift allows magma (molten rock) to rise near the earth’s surface, and volcanoes are
12 common features of rifts. The Jemez Mountains are the remnants of a cluster of volcanoes. Many
13 of the rock formations that make up the Pajarito Plateau come from materials expelled during
14 volcanic eruptions (LANL, 2022b).

15 The mesas of the Pajarito Plateau are mostly composed of Bandelier Tuff, which is a type of soft
16 rock that forms from hardened volcanic ash. The Bandelier Tuff is more than 1,000 feet thick in the
17 western part of the plateau and thins to about 260 feet thick on the eastern edge of the plateau near
18 the Rio Grande. On the western side of the Pajarito Plateau, the Bandelier Tuff overlaps the
19 Tschicoma Formation of the Jemez Mountains. The Tschicoma Formation is an older rock layer of
20 volcanic dacite. Eastward near the Rio Grande, the Puye Formation, a layer of sand and gravel that
21 underlies the Bandelier Tuff, becomes visible in places. Basalt rocks originating from the Cerros
22 del Rio volcanoes east of the Rio Grande mix with the Puye Formation along the river and extend
23 beneath the Bandelier Tuff in places. The Santa Fe Group sedimentary rocks lie below the Puye
24 Formation and Bandelier Tuff, extends between the Jemez and Sangre de Cristo Mountains, and is
25 more than 3,300 feet thick in places (LANL, 2022b). Figure 3-2 shows the stratigraphic sequence
26 of geologic units under the project area.

27 See the *Interim Facility-Wide Groundwater Monitoring Plan for the 2024 Monitoring Year* (EM-
28 LA, 2023a) for a more detailed description of the rock units beneath the site. The occurrence of
29 groundwater is discussed in Section 3.4, *Water Resources*.

30 Mortandad and Sandia Canyons are narrow canyons on the central part of the Pajarito Plateau. The
31 canyons were cut by stream channel erosion through the Bandelier Tuff. Mortandad, Sandia, and other
32 similar canyons in the area separate multiple linear mesas that parallel the canyons (DOE, 2015).

33 The Pajarito fault system is part of the Rio Grande Rift structure and consists of the Pajarito,
34 Rendija Canyon, and Guaje Mountain Faults. Although large historical earthquakes have not
35 occurred in the Pajarito fault system, geologic evidence indicates that it is seismically active. The
36 latest (horizontal) probabilistic peak ground acceleration (PGA) map from the United States
37 Geologic Survey, used to indicate seismic hazard, shows a maximum PGA between 0.2 and 0.3 *g*
38 for the central LANL area. The PGA values cited corresponding to an annual occurrence
39 probability of about 1 in 2,500. The potential for seismically induced land subsidence at LANL is
40 considered to be low, and for soil liquefaction, negligible (DOE, 2022a).

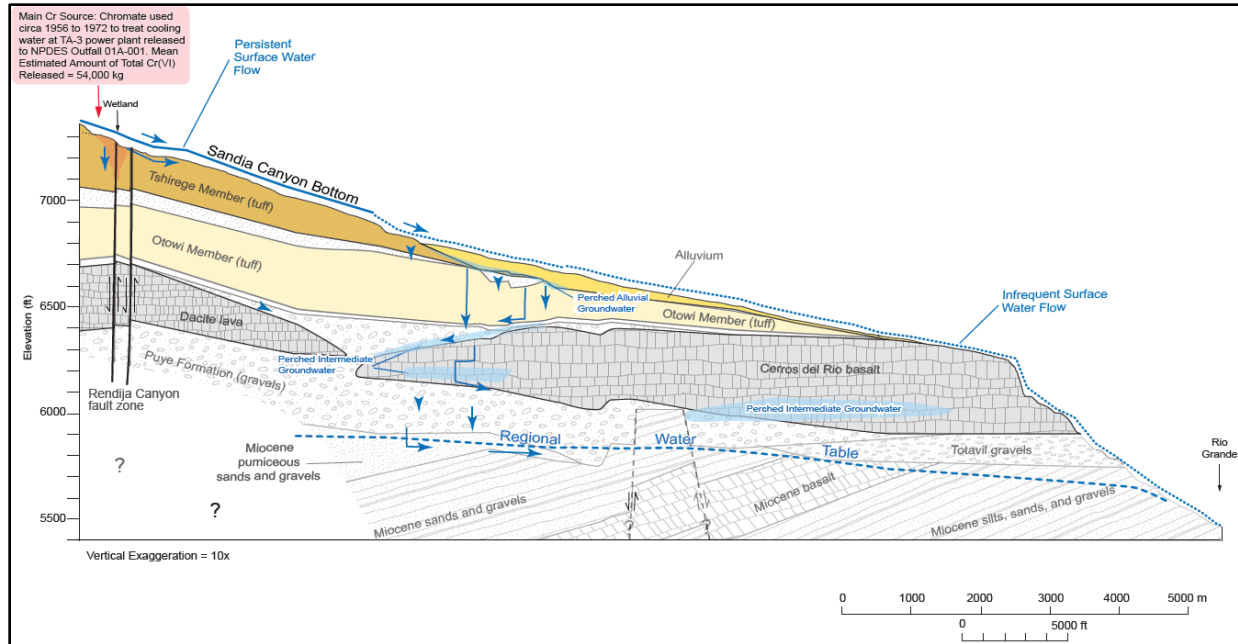


Figure 3-2. Geologic units and conceptual flow model

Volcanism in the vicinity of the LANL site is very unlikely over the next 50 to 100 years. The recurrence rate for an eruption that could produce major impacts at LANL was estimated to be 1×10^{-5} per year. Because of the low recurrence rate, the risk from volcanic events is low (DOE, 2022a).

Potential mineral resources at LANL consist of rock and soil for use as backfill or borrow material. Sand and gravel are primarily used at LANL for road building, and pumice is used for landscaping. The only borrow pit currently in use at LANL is the East Jemez Road Borrow Pit in TA-61, which is cut into the upper Bandelier Tuff. No sizable, economically valuable geologic deposits are known to occur in the vicinity. Numerous commercial offsite borrow pits and quarries in the vicinity of LANL produce sand, gravel, and volcanic pumice. Eleven pits or quarries are located within 30 miles of LANL, which is the distance considered the upper economically viable limit for hauling borrow material to LANL (DOE, 2022a).

Soils

Soils in the project area have developed from the decomposition of volcanic and sedimentary rocks within a semiarid climate, and they range in texture from clay and clay loam to gravel. Soils that formed on the mesa tops of the Pajarito Plateau are well drained and range from very shallow (0 to 10 inches) to moderately deep (20 to 40 inches); the greatest depth to the underlying Bandelier Tuff is about 60 inches. Soils that develop in canyon settings can be locally much thicker than those on the mesa tops (DOE, 2022a). Alluvium thickness within Mortandad Canyon is 1 to 2 feet near its headwaters and more than 100 feet near the LANL boundary, east of the project area (DOE, 2015).

1 Approximately half of the area is identified as rock outcrop (NRCS, 2023). Within the project area,
2 soils were mapped differently in Los Alamos and Sandoval Counties versus Santa Fe County. The
3 major soil types identified in the project area in Los Alamos and Sandoval Counties are as follows:

- 4 • **Hackroy-Nyjack association.** These soils are composed of nearly equal percentages of
5 Hackroy and Nyjack soils. A typical profile for a Hackroy soil is shallow with sandy loam
6 from 0 to 3 inches above clay extending from 3 to 13 inches in depth overlying bedrock.
7 These soils are formed from sediment weathered from tuff and found on mesas and plateaus.
8 The low saturated hydraulic conductivity gives Hackroy soils a high potential for runoff. A
9 typical profile for Nyjack soil is composed of loam from 0 to 3 inches, clay loam from 3 to
10 24 inches, and gravelly sandy loam from 24 to 39 inches in depth. These soils are formed
11 from eolian deposits over slope alluvium derived from tuff and are found on mesas and
12 plateaus. Nyjack soils have a medium runoff potential (DOE, 2015).
- 13 • **Totavi loamy sand.** These soils are formed from stream alluvium derived from tuff and
14 found on stream terraces, valley floors, and closed depressions. A typical profile can
15 extend as deep as 5 feet and has a very low runoff potential because of its high saturated
16 hydraulic conductivity (DOE, 2015).
- 17 • **Carjo loam.** A typical profile for Carjo loam soil is moderately deep with loam from
18 0 to 4 inches, above clay loam extending from 4 to 12 inches in depth, overlying clay
19 from 12 to 20 inches, overlying very fine sandy loam from 20 to 25 inches, overlying
20 bedrock. These soils are residuum weathered from tuff and found on mesa shoulders and
21 sides on 1 to 9 percent slopes. The slow permeability makes these soils well drained
22 (NRCS, 2008).

23 The major soil types identified in the project area in Santa Fe County are as follows:

- 24 • **Navajita complex.** A typical profile for a Navajita complex soil is very deep with loam
25 from 0 to 13 inches, above sandy clay loam extending from 13 to 32 inches in depth,
26 overlying coarse sandy loam from 32 to 63 inches, and overlying paragravelly loamy
27 coarse sand from 63 to 110 inches. These soils are eolian deposits and slope alluvium
28 derived from rhyolitic tuff and found on north-facing valley sides on 2 to 15 percent
29 slopes. The moderate permeability makes these soils well drained (NRCS, 2009).
- 30 • **Totavi ashy loamy coarse sand.** A typical profile for a Totavi soil is very deep with
31 ashy loamy coarse sand from 0 to 3 inches above ashy coarse sand extending from 3 to
32 31 inches in depth, overlying gravelly ashy loamy sand and coarse sand from 31 to
33 80 inches. These soils are alluvium derived from latite, dacite, and rhyolitic tuff, and
34 found on stream terraces on valley floors on 1 to 3 percent slopes. The very rapid
35 permeability makes these soils somewhat excessively drained (NRCS, 2009).

36 No soils at the LANL site are classified as prime farmland. Soils at LANL are acceptable for
37 standard construction techniques (DOE, 2022a).

1 **3.3.2 GEOLOGY AND SOILS – ENVIRONMENTAL CONSEQUENCES**

2 **3.3.2.1 Proposed Action (Adaptive Site Management)**

3 **Geology**

4 ***Option 1: Mass Removal via Expanded Treatment***

5 Under Option 1, the installation, operation, maintenance, and monitoring of wells (which are similar
6 to existing nearby County wells) and piezometers (which are similar to existing monitoring wells)
7 would have small impacts on geology. This EA assumes that each well pad, deep vadose zone
8 piezometer, and access road would require 800 cubic yards (yd³) of crushed stone. This would be
9 44,000 yd³ of crushed stone for the installation of 55 wells. No additional fill material would be
10 needed. The 44,000 yd³ of crushed stone would be a relatively small quantity of a regionally
11 plentiful resource and would not be a significant impact.

12 The wells, including the deep vadose zone piezometers, would be installed to a depth of up to
13 1,400 to 2,000 feet below grade. The operation of injection wells would contribute to hydraulic
14 control of the chromium plume and to return treated water to the aquifer in the same area and at
15 similar depths from which the water was extracted. Water injection into the aquifer would be
16 gravity fed. Injection well operation would have negligible impacts on geology. The operation of
17 the groundwater treatment plant, monitoring and maintenance of wells, and other related site
18 infrastructure would have little to no impacts on geology.

19 ***Options 2, 3, and 4***

20 Under Option 2, *Mass Removal with Land Application*, wells and their associated infrastructure
21 would be constructed and operated as described in Option 1, although less water would be
22 reinjected into the aquifer under Options 2 and 3. Instead, treated water would be applied to land
23 surfaces in approved locations in accordance with permits. Land application would have no impacts
24 on geology. Impacts to geology would be bounded by the groundwater extraction and injection
25 option previously discussed (Option 1). Option 3, *Mass Removal via In-Situ Treatment*, would add
26 in-situ treatment. Although it is not known exactly which treatment methods might be used, and
27 some treatment methods might physically or chemically change the rock that the groundwater flows
28 through, in-situ treatment would likely be used to target specific areas or levels of chromium, and
29 therefore would not impact large areas of rock. Therefore, in-situ treatment is not expected to have
30 significant impacts on geology. Option 4, *Monitored Natural Attenuation*, would not remove or add
31 water to the aquifer and would not add treatment compounds. Therefore, Option 4 would have no
32 impacts on geology.

33 **Soils**

34 ***Option 1: Mass Removal via Expanded Treatment***

35 Under Option 1, infrastructure development, operation, and maintenance activities associated with
36 the Proposed Action would cause effects to soil profiles from soil disturbance. Soil disturbance
37 would be necessary for well pad installation for the new extraction wells, injection wells, and
38 piezometers, for short access roads, and for installation of a larger groundwater treatment plant.

1 This EA conservatively assumes 0.73 acres would be disturbed for each well pad and deep vadose
2 zone piezometer and 0.60 acres for the associated access road stub. As described in Appendix B,
3 *Description of Alternatives Supporting Information*, a total of about 75 acres of land could be
4 disturbed under the Proposed Action. Some soil erosion by wind and stormwater would likely
5 occur in these disturbed areas. Soil erosion would be mitigated by adherence to best management
6 practices (BMPs) and would not be expected to be significant. BMPs could include installation of
7 ground cover, straw wattles, or silt fencing, and dust suppression by soil watering.

8 Lined pits would be required for well drilling to contain drill cuttings, drilling mud, and water.
9 After well completion, the drill cuttings in the lined pit would be sampled, and if cuttings meet the
10 residential soil screening levels, the liner would be removed and the pit backfilled. If the cuttings
11 do not meet the criteria for land application, they would be disposed of off-site in a permitted,
12 approved landfill. After the pits are backfilled, the overall well pad footprint would be reduced
13 (DOE, 2015).

14 Excavations would be required to direct-bury piping to the new extraction wells, injection wells,
15 and treatment plant. Stabilization controls and BMPs would limit soil erosion.

16 *Options 2, 3, and 4*

17 Under Option 2, *Mass Removal with Land Application*, wells, piezometers, and other associated
18 infrastructure would be constructed and operated as described in Option 1, although less water
19 would be reinjected into the aquifer under Option 2. Impacts to soils from well installation,
20 operation, maintenance, and monitoring would be the same as under Option 1. Treated water that is
21 not reinjected would be applied to the surface in approved locations in accordance with permits (see
22 Appendix B, *Description of Alternatives Supporting Information*, Figure B-3). Because of controls
23 implemented as part of the permit conditions (e.g., land application must be conducted in a manner
24 that maximizes infiltration and evaporation, no ponding of water, no runoff, and no application on
25 slopes greater than [$>$] 5 percent), land application would have minimal impacts on soils. Option 3,
26 *Mass Removal via In-Situ Treatment*, would add in-situ treatment. Although it is not known exactly
27 which treatment methods might be used, in-situ treatment would not have impacts on soils.
28 Likewise, Option 4, *Monitored Natural Attenuation*, would not remove or add water to the aquifer
29 and would not add treatment compounds. Therefore, Option 4 would have no impacts on soils.

30 **3.3.2.2 Cumulative Impacts**

31 As previously described, impacts from the Proposed Action on geology would be small. Because
32 impacts would be small, they would not substantially contribute to cumulative impacts on geology.

33 The LANL site is located on approximately 26,058 acres of land with approximately 20 percent
34 (5,200 acres) of the site developed (DOE, 2022a). As previously described, impacts to soils would
35 be mitigated by permit conditions and adherence to BMPs and would not be expected to be
36 significant. The approximate 75 acres of soils disturbed under the Proposed Action would be
37 approximately 0.3 percent of the total LANL land area and 1.4 percent of the developed land at
38 LANL. The relatively small amounts of soils disturbed under the Proposed Action would not
39 substantially contribute to cumulative impacts on soils.

3.4 WATER RESOURCES

3.4.1 WATER RESOURCES – AFFECTED ENVIRONMENT

3.4.1.1 Groundwater and Groundwater Quality

Groundwater in the Sandia and Mortandad Canyon area occurs in three types of settings: as shallow alluvial groundwater in canyon-floor sediments; as intermediate-depth perched groundwater in bedrock units of the vadose zone; and as deep groundwater in the regional aquifer (Figure 3-3).

Alluvial water is found in the upper reaches of Sandia Canyon predominantly sustained by effluent from a NPDES outfall (Permit No. NM002835) (N3B, 2022). Alluvial water ultimately infiltrates through the vadose zone to accumulate and pass through perched zones above the regional aquifer (Figure 3-3).

The regional aquifer below Mortandad and Sandia Canyons is part of a system of aquifers within the Espanola Basin that underlies the Chromium Measures and Final Remedy project area (Figure 3-1 in Section 3.1, *Introduction and Regional Setting*). 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. Existing Los Alamos County water supply wells in the area penetrate approximately 1,400 to 1,800 feet into the regional aquifer. Water produced for public consumption from the regional aquifer water supply wells meets Federal and state drinking water standards (LADPU, 2023).

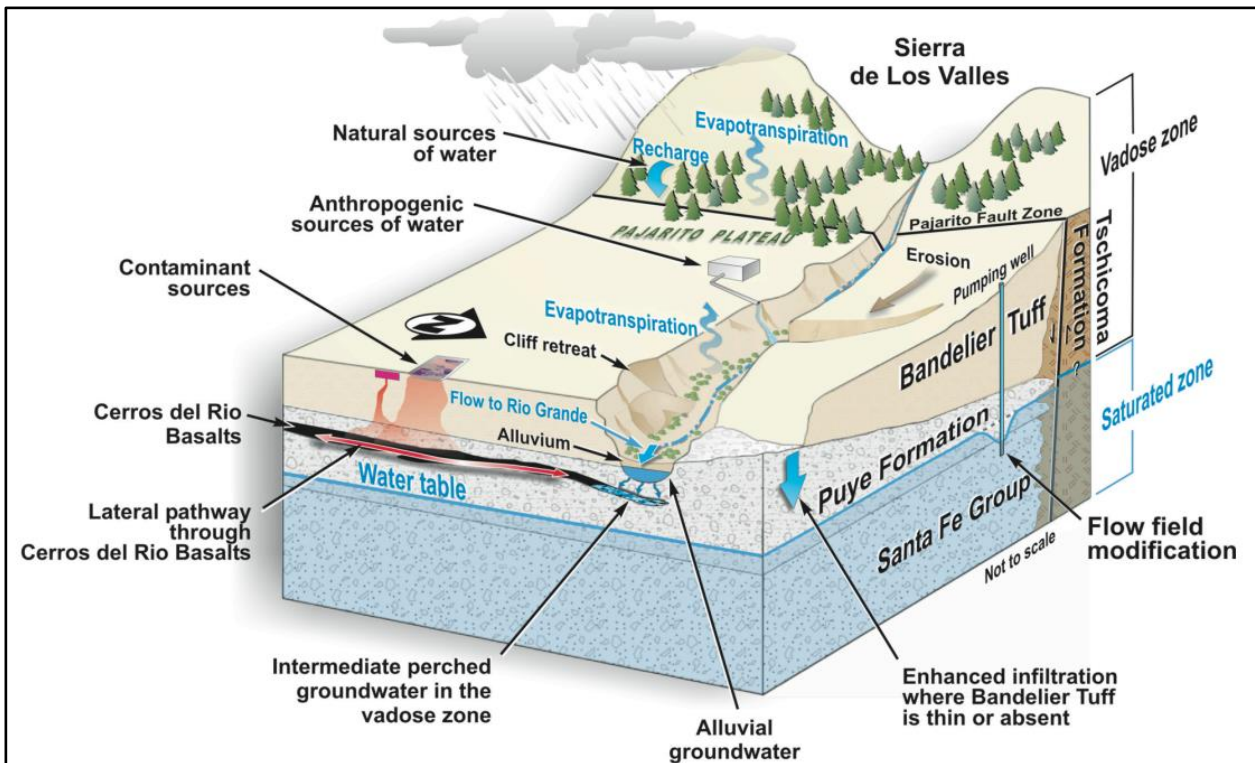


Figure 3-3. Groundwater components at Los Alamos National Laboratory (Figure 1-2 from LANL, 2005)

After the initial discovery of Cr(VI) in the regional aquifer, a discrete plume of Cr(VI) was identified that was above the NWQCC groundwater standard of 50 ppb (or $\mu\text{g/L}$) (Heikoop et al.,

1 2014; LANL, 2008; DOE, 2015; LANL, 2018a; LANL, 2018b; LANL, 2018c; N3B, 2023a;
2 Vesselinov et al., 2013). The lateral extent of the Cr(VI) plume in upper and lower zones of the
3 regional aquifer is displayed in Appendix C, *Environmental Resources Supporting Information*,
4 Figure C-2 (Neptune and Company, 2023a). Cr(VI) was also found to exist in two perched-
5 intermediate zone wells (MCOI-6 and SCI-2) (see Figure C-2) at levels well above the 50-ppb
6 standard (Figure 5-15 in LANL, (2022b)).

7 Subsequent to finding Cr(VI) in the regional aquifer, DOE installed monitoring wells to further
8 identify the extent of contamination. Increasing Cr(VI) concentrations in some monitoring wells
9 along the plume’s southeastern edge in 2015 indicated possible plume expansion (LANL, 2015),
10 and as a result, DOE proposed to NMED to conduct an interim measure under the 2016 Consent
11 Order (NMED, 2016) to control and reduce plume migration while a final remedy was being
12 evaluated, as described in Section 1.0, *Purpose and Need for Agency Action*.

13 The >50 ppb plume is approximately 1 mile long, 0.5 miles wide, and 50 to 75 feet thick. Projected
14 estimates of the plume growth rate prior to implementing the interim measure are around 30 to 60
15 feet per year. After contamination was first observed and starting in 2007, both DOE and the Los
16 Alamos County Department of Public Utilities (LADPU) have monitored County water supply
17 wells for chromium (LADPU, 2015). In 2013, total chromium was detected at concentrations from
18 4.06 to 9.9 ppb in Los Alamos County water supply wells, substantially below the New Mexico
19 groundwater standard of 50 ppb (LADPU, 2015). As reported in the 2022 Annual Drinking Water
20 Quality Report for Los Alamos County, chromium was detected at a concentration of approximately
21 4 ppb (LADPU, 2023). Those concentrations are consistent with background concentrations of
22 chromium within the regional aquifer (DOE, 2015).

23 Appendix C, *Environmental Resources Supporting Information*, Figure C-3 shows a water table or
24 potentiometric map for May 1, 2020, 1:00 a.m., which represents ambient (“baseline”) conditions
25 without interim measures functioning. Figure C-4 shows a water table map for November 1, 2021,
26 1:00 a.m., which includes nearly full interim measure operation (with the exception of CrEX-1 and
27 CrIN-3). These are representative only of the upper regional aquifer.

28 Figure C-5 and Figure C-6 are maps of the hydraulic heads representing “baseline” and full interim
29 measure operating conditions of the deeper zone. The deeper zone represented in Figure C-3 as a
30 blue dashed line is at depths >50 feet. There are fewer deeper zone data points to prepare these
31 maps. Effects of the interim measure operations are indicated by lowering heads on the order of 2
32 to 3 feet across the plume area.

33 The injection wells were designed to both dispose of the treated water and create a hydraulic barrier,
34 or mound of water, along the southern boundary to slow or reverse flow in the regional aquifer
35 away from the boundary. An analysis was conducted to evaluate the effectiveness and performance
36 of the Cr(VI) plume interim measure at LANL. Conclusions of this report (Neptune and Company,
37 2023a) are summarized as follows:

- 38 • During periods when interim measure operations are off, groundwater flows toward the
39 east to southeast.
- 40 • Small, but quantifiable, impacts on hydraulic gradients from county supply well PM-4
41 pumping are observed in the chromium plume.

- 1 • The operation of extraction and injection wells as part of the interim measure is observed
2 to result in large, systematic changes on hydraulic gradients within the vicinity of the
3 chromium plume (i.e., the interim measure changes the direction of flow). Hydraulic
4 gradients appear stronger in magnitude upgradient of the interim measure as a result of
5 operations, with a shift in direction generally toward the extraction wells.
- 6 • Changes in hydraulic gradients as the result of interim measure operations are at least 50
7 percent greater compared to that from PM-4 in all areas of the chromium plume;
8 hydraulic gradients close to the extraction and injection wells indicate impacts from the
9 interim measure are at least 10 times greater.
- 10 • Vertical gradient changes due to the onset of interim measure operations were apparent at
11 all dual-screened well pairs in the chromium plume (R-43, R-44, R-45, R-50, and R-61).
12 Small ambient downward vertical gradients were observed at most wells during periods
13 when interim measure operations were off. Most well pairs show a small but systematic
14 increase, on the order of 0.01 to 0.001 foot per foot, in the downward gradient as a result
15 of interim measure operations.

16 These impacts are likely to have a greater effect in the upper portion of the regional aquifer.
17 Injection and extraction wells operated under the interim measure seem to indicate that injected
18 water migrates within the upper approximate 50 feet of the aquifer (Neptune and Company,
19 2023b). When the interim measure is not operating, sustained pumping at PM-4 has the largest
20 impact on water levels and hydraulic gradients with respect to the Cr(VI) plume (Neptune and
21 Company, 2023a). However, local to the interim measure capture zone (i.e., where extraction
22 wells pull in contaminated water), interim measure pumping has more effect on the direction of
23 flow of groundwater than PM-4 during interim measure operations (except at monitoring well
24 R-33) (Neptune and Company, 2023a).

25 Operation of the interim measure for Cr(VI) remediation appears to have reduced Cr(VI)
26 concentrations within the plume; Cr(VI) concentrations have decreased at all five extraction
27 wells since initiating the interim measure (N3B, 2023a).

28 In Los Alamos County, there is a total of 5,547.1-acre-feet per year water rights for municipal,
29 industrial, and related purposes (N3B, 2023a). These rights are jointly owned by DOE and Los
30 Alamos County, with a 30/70 split, respectively. Los Alamos County leased the 30 percent
31 DOE-owned water rights from 2001 to 2011 and once again in 2020. To support the chromium
32 interim measure, DOE and Los Alamos County submitted a joint application to the NMOSE in
33 May 2016 to change the water right. A request for emergency authorization also accompanied
34 the application, which was granted in September 2016. The emergency authorization allowed
35 for the extraction of water of up to 648,000 gpd, or up to a maximum diversion of groundwater
36 of 679 acre-feet per year. This translates into maximum extraction and injection rates of
37 approximately 450 gpm for the interim measure. As of 2019, the permit had not been issued,
38 prompting DOE to submit an updated joint application and request for emergency authorization
39 in September 2019, and the request for emergency authorization was approved that same month.
40 To date, the interim measure, when operational, operates under the 2019 emergency
41 authorization.

3.4.1.2 Surface Water

Surface water in the LANL area flows primarily as ephemeral streams in response to local precipitation or snowmelt. Streams that drain the LANL area are dry for most of the year; only about 2 miles of the over 85 miles of watercourses within LANL boundaries are naturally occurring perennial streams. Additionally, approximately 3 miles of watercourses are perennial waters created by supplemental flows from wastewater discharges (DOE, 2008).

Two ephemeral streams pass through the project area: one within Mortandad Canyon and one within Sandia Canyon. These ephemeral streams have been designated as “impaired,” meaning they are not supporting one or more “designated uses,” such as livestock watering and aquatic life (NMED, 2022). Streams are considered to be impaired, or not supporting the designated use, if data from stream sample analyses exceed one or more parameters when compared with the standards for the stream’s designated use(s), in accordance with Section 303(d) of the Clean Water Act (CWA). Table 3-2 summarizes the impairment status of each of these ephemeral waterways, as well as the cause.

Table 3-2. Impairment status of surface waters within the study area

Designated Use	Attainment Status	Cause
Mortandad Canyon		
Limited Aquatic Life	Not Supporting	Copper, dissolved
Livestock Watering	Not Supporting	Gross alpha, adjusted
Secondary Contact	Not Assessed	---
Wildlife Habitat	Not Supporting	Polychlorinated biphenyls
Sandia Canyon		
Limited Aquatic Life	Not Supporting	Polychlorinated biphenyls Copper, dissolved Aluminum, total recovered
Livestock Watering	Not Supporting	Gross alpha, adjusted
Secondary Contact	Not Assessed	---
Wildlife Habitat	Not Supporting	Mercury, total Polychlorinated biphenyls

Source: (NMED, 2022)
Key: --- = not available

Several additional drainage channels exist within the project area. While these channels are among the drainageways that are typically dry, they may convey water eastward toward the perennial Rio Grande following precipitation events or during snowmelt.

A wetland area, located at the head of Sandia Canyon, is within the project area. Occupying a small footprint in the 1950s, the wetland has grown as a result of receiving effluent from LANL and now encompasses approximately 3.65 acres. Two NPDES-permitted outfalls (001 and 03A199) discharge to the wetland; a third outfall discharged effluent from 2012 to 2016. As a result of these discharges, contaminants such as chromium, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons have been detected in the wetland sediments. A grade-control structure was installed in 2013 in an effort to contain contaminants of concern and prevent further downgradient migration. Annual performance reports detail the state of the Sandia wetland since 2014 following a 2012 to 2014 baseline assessment. Per the 2021 performance report, the wetland continues to be stable following installation of the grade-control structure, even as effluent volumes entering the wetland

1 have decreased. Chromium concentrations remain below the New Mexico water quality standard
2 (N3B, 2022).

3 **3.4.2 WATER RESOURCES – ENVIRONMENTAL CONSEQUENCES**

4 **3.4.2.1 Proposed Action (Adaptive Site Management)**

5 In this EA, the ASM options are designed to address the environmental consequences of
6 implementing remedial measures to achieve the Desired Outcomes listed in Section 2.3, *Proposed*
7 *Action*. The ASM Monitoring Protocols in Section 2.3, *Proposed Action*, are also selected to
8 evaluate success in achieving the Desired Outcomes. Other monitoring protocols could be
9 identified in the future that would help in assessing the Desired Outcomes. As described in
10 Section 2.3, *Proposed Action*, EM-LA would use results from monitoring to evaluate success in
11 meeting the Performance Measures and Desired Outcomes.

12 **Groundwater and Groundwater Quality**

13 ***Option 1 – Mass Removal via Expanded Treatment***

14 Option 1 includes expanded chromium mass removal through new extraction wells, expanded water
15 treatment operations, and expanded treated water injection beyond the interim measure levels.
16 Along with these changes, additional regional aquifer monitoring wells and piezometers would be
17 constructed. Environmental consequences to groundwater and groundwater quality relate to well
18 construction and the operation of the extraction and injection operations.

19 When EM-LA decides it is necessary to drill any type of well, the locations, drilling, and well
20 construction design would be determined through the Consent Order process with NMED.
21 Directional drilling for regional aquifer wells could be required for installation near canyon walls.

22 Under this option, existing extraction, injection, or monitoring wells, and piezometers, would still
23 be used and operated.

24 The combined extraction rate for the existing and new extraction wells would be approximately
25 550,000,000 gpy. The combined injection rate for the existing and new injection wells also would
26 be approximately 550,000,000 gpy. However, current extraction rates for the interim measure are
27 limited by water rights authorized by NMOSE, and as previously noted, is currently limited to a
28 groundwater extraction rate of up to 648,000 gpd, or up to a maximum diversion of groundwater of
29 679 acre-feet per year. This translates into maximum extraction and injection rates of
30 approximately 450 gpm for the interim measure (N3B, 2023a). Any additional extraction for the
31 Proposed Action above the current rates authorized for the interim measure would require
32 authorization from NMOSE.

33 By intent, extraction wells alter the groundwater quality by reducing the intended contaminant
34 concentration, such as Cr(VI) in the well’s vicinity. Similarly, injection wells alter the groundwater
35 quality by injecting treated water absent of the contaminant—in this case, Cr(VI).

36 Extraction wells lower the water table and draw water surrounding them to the intake zones or well
37 screens. The water table surface surrounding the extraction well exhibits an inverted drawdown
38 funnel-shape indicating the pressure is lowest at the well and higher away from the well. The

1 injection well is essentially the opposite creating a mounding of the water table in the vicinity of the
2 well. The degree of drawdown or mounding are dependent upon a number of factors relating to the
3 hydrologic characteristics of the aquifer and the well construction and operation.

4 Extraction wells remove Cr(VI) mass and are used currently near the plume perimeter to pull back
5 the Cr(VI) plume defined by a 50 ppb Cr(VI) concentration. Injection wells are currently
6 constructed downgradient or down slope from extraction wells and the Cr(VI) plume. The effect of
7 the injection well is to raise the pressure head of water so that the slope of the water table is
8 reversed (i.e., aiming toward, not from), slowing the flow rate of water away from the plume or, if
9 possible, reversing it entirely, stopping the migration altogether.

10 Newly constructed extraction wells may also be used for removing mass of Cr(VI) in the center and
11 high Cr(VI) concentration areas of the plume. This would increase the rate of mass removal.

12 Newly constructed injection wells would be used as before to create a hydraulic barrier to
13 migration, but they may also be located in areas outside the plume for excess water disposal so as to
14 not affect the plume. The intent overall is to return the majority of water extracted back into the
15 regional aquifer after it has been treated.

16 Since it is not known where new extraction or injection wells would be located, it is not reasonable
17 to try and project through water particle tracking, capture zone, or solute transport modeling the
18 effects on the plume geometry, as the number of permutations is excessive. It would also not
19 change the result that the plume would still be reduced, and Cr(VI) mass would be removed at an
20 increased rate. As noted in the affected environment section, the interim measures have been shown
21 to be effective at pulling back the 50 ppb Cr(VI) plume contour away from the Laboratory's
22 southern boundary and removing Cr(VI) mass. Therefore, it is known that the approach of pump
23 and treat is effective.

24 The adverse environmental consequences on groundwater quality and availability for this option
25 would be localized near the extraction and injections wells and would be minor. Through the years,
26 EM-LA has developed procedures to utilize well construction techniques that minimize introduction
27 of contaminants from drilling fluids into water bearing zones (e.g., drilling with air, and using
28 casing-advance or sonic drilling). Similarly, EM-LA utilizes well development procedures that
29 clean and optimize the hydraulic properties of the aquifer zones open to each well. Together these
30 procedures ensure minimal and very local impact on groundwater quality, and minor temporary
31 impacts to water levels during well construction. This option would also result in positive
32 environmental consequences on groundwater quality, as instituting Option 1 results in Cr(VI) mass
33 reduction and working towards achieving the ASM Desired Outcomes.

34 ***Option 2 – Mass Removal with Land Application***

35 The environmental consequences for this option to groundwater and groundwater quality are
36 essentially the same as Option 1: minor. The difference is that less water would be injected into the
37 regional aquifer. Under this option, the extraction rate for existing and new extraction wells would
38 be the same at 550,000,000 gpy; the injection rate for existing and new injection wells would be
39 reduced to 462,500,000 gpy and the land applications rate would be 87,500,000 gpy (350,000 gpd
40 for 250 days per year). Land application would only occur in permitted areas per an NPDES DP.
41 Permit restrictions associated with land application—for example, the limited land area where land

1 application can occur; time-of-day restrictions; and the inability to land-apply water when
2 temperatures are below freezing, during precipitation events, and under ponding conditions— are
3 likely to reduce the amount of water that can be land applied to an amount well below the
4 87,500,000 gpy. Water that could not be land applied would be reinjected into the regional aquifer.

5 The adverse environmental consequences for this option would be the same as Option 1 and would
6 be minor for groundwater levels and availability. Because of controls implemented as part of the
7 permit conditions (e.g., land application must be conducted in a manner that maximizes infiltration
8 and evaporation, no ponding of water, no runoff, and no application on slopes >5 percent), land
9 application would have minimal impacts on groundwater. Additionally, treated water would need
10 to meet NMED Ground Water Quality Bureau permit standards before being land applied or
11 evaporated. This option would result in positive environmental consequences on groundwater
12 quality as instituting Option 2 results in Cr(VI) mass reduction.

13 ***Option 3 – Mass Removal via In-Situ Treatment***

14 Depending on where and when EM-LA determines in-situ treatment is a viable option, the rates of
15 extraction and injection into the regional aquifer and land application for Option 3 has the potential
16 to be the same as for Options 1 and 2, and the environmental consequences for these activities are
17 bounded by the impacts for Options 1 and 2, which are minor.

18 Many chemicals can be added to the aquifer to serve as reducing agents (see Appendix B,
19 *Description of Alternatives Supporting Information*, Section B.2.3). These amendments would be
20 reviewed for applicability, effectiveness, toxicity, etc. and not be used if they would contribute to
21 additional contamination. Introduction of any compounds into the aquifer as part of in-situ
22 treatment would be implemented under approved permits from NMED.

23 The adverse environmental consequences on groundwater quality for this option would be
24 controlled through permit conditions and would be minor for groundwater levels and availability.
25 This option would result in positive environmental consequences on groundwater quality, as
26 instituting Option 3 results in Cr(VI) mass reduction.

27 ***Option 4 – Monitored Natural Attenuation***

28 This approach relies on natural physical, chemical, or biological processes to reduce concentrations,
29 toxicity, or mobility of chromium. Regular monitoring must be conducted to ensure that MNA is an
30 effective treatment. EM-LA has determined that MNA alone would be insufficient to control plume
31 advancement and maintain the 50-ppb-and-greater chromium contamination concentrations within
32 the Laboratory’s boundary, based on current concentrations and plume migration. EM-LA would
33 consider proposing MNA at any time during or after the implementation of other remedial options
34 when controlling migration of chromium in groundwater is most likely to be sustained and does not
35 pose a risk for offsite migration or to water supply wells.

36 Option 4 has little, if any, adverse environmental consequence to groundwater and groundwater
37 quality if closely monitored and applied under the circumstances previously described.

1 **Surface Water**

2 ***Option 1 – Mass Removal via Expanded Treatment***

3 Under Option 1, soil disturbance resulting from infrastructure development, operation, and
4 maintenance activities associated with the Proposed Action could result in sedimentation to surface
5 waters. The primary location where this could be an issue would be for the installation of
6 piezometers in the Sandia Canyon Wetlands. Section 3.3, *Geology and Soils*, provides further
7 details regarding potential impacts to soils and associated BMPs. With anticipated soil disturbance
8 to be about 75 acres throughout the project area and limited to about 0.05 acres in the Sandia
9 Wetlands, potential environmental consequences to surface waters are expected to be minor. The
10 potential impacts to surface waters, including floodplains and wetlands, would be further reduced
11 through implementation of the following BMPs identified by Newport News Nuclear BWXT-Los
12 Alamos, LLC (N3B) (N3B, 2023c), which would mitigate impacts from ground disturbance and or
13 hazardous materials, chemicals, fuels, and/or oils:

- 14 • Disturbed areas would be revegetated using an appropriate native seed mix.
- 15 • Erosion and sediment control measures would be installed during construction.
- 16 • Heavy equipment would not be used within the wetland.
- 17 • Permanent equipment staging areas would not be located within the floodplains or
18 wetland.
- 19 • All equipment would be refueled at least 100 feet from the floodplains and wetland.
- 20 • Hazardous materials, chemicals, fuels, and oils would not be stored within the floodplains
21 or wetland.
- 22 • If any spillage occurs, all contaminated soil would immediately be containerized and
23 relocated.
- 24 • Portable generators, compressors, and other fuel-driven equipment would be staged on
25 bermed plastic sheeting as a form of secondary containment. Construction equipment
26 (e.g., graders, dozers, excavators, etc.) and light vehicles would not be subject to this
27 restriction.
- 28 • Support structures, such as the treatment facility, personnel trailers, storage tanks, or
29 permanent laydown yards would not be installed within the floodplains or wetland.
- 30 • Project would remove all trash and debris (e.g., construction material) from the
31 floodplains and wetland after completion.
- 32 • Well pads and roads would be reinforced to minimize erosion and/or flooding following
33 project completion.
- 34 • Any excavation within the source area (i.e., Sandia Wetland) would require an additional
35 Wetland Assessment to determine the potential impacts of that proposed action on the
36 Sandia Wetland.

1 **Option 2 – Mass Removal with Land Application**

2 Option 2 would involve the same activities discussed under Option 1; therefore, impacts to surface
3 water resources as discussed under Option 1 would also be applicable under Option 2. Option 2
4 includes the added use of land application and evaporation as additional means of treated water
5 disposition. Under this option, the bounding land applications rate would be 87,500,000 gpy
6 (350,000 gpd for 250 days per year). Land application of this much water over an area of 50 acres
7 would have minor impacts as controlled by the NMED permit conditions summarized in Appendix
8 B, *Description of Alternatives Supporting Information*. The proposed land application is not
9 anticipated to result in ponding or runoff. Therefore, anticipated environmental consequences to
10 surface water resources would be minor.

11 **Option 3 – Mass Removal via In-Situ Treatment**

12 Depending on where and when EM-LA determines in-situ treatment is a viable option, Option 3 has
13 the potential to include all activities discussed under Options 1 and 2; therefore, impacts to surface
14 water resources as discussed under Options 1 and 2 would also be applicable under Option 3.
15 Option 3 includes the use of in-situ treatment for the contaminated groundwater. This option
16 involves injecting reducing agents into the groundwater and does not involve surface water. No
17 surface water environmental consequences are expected to occur beyond those discussed for
18 Options 1 and 2, which are minor.

19 **Option 4 – Monitored Natural Attenuation**

20 Option 4 involves MNA which occurs only in groundwater. There are no environmental
21 consequences to surface water.

22 **3.4.2.2 Cumulative Impacts**

23 As previously described, environmental consequences to water resources from the four proposed
24 ASM Options would be either positive (i.e., from removing Cr(VI) mass) or minor. Because
25 environmental consequences would be minor and limited in areal extent, they would not
26 substantially contribute to cumulative impacts on water resources from other actions. Any potential
27 environmental consequences to water resources would be mitigated by adherence to Federal and
28 state regulations, continuation of mitigation efforts (LANL, 2022b), and compliance with the
29 NMED Consent Order.

30 **3.5 AIR QUALITY**

31 **3.5.1 AIR QUALITY – AFFECTED ENVIRONMENT**

32 The EPA established the National Ambient Air Quality Standards (NAAQS) to regulate the
33 following criteria pollutants: ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur
34 dioxide (SO₂), particulate matter less than or equal to 10 microns in diameter (PM₁₀), particulate
35 matter less than or equal to 2.5 microns in diameter (PM_{2.5}), and lead. The Clean Air Act (CAA)
36 and its subsequent amendments establish air quality regulations and the NAAQS and delegate the

1 enforcement of these standards to the states. Under the CAA, state and local agencies may establish
2 ambient air quality standards and regulations of their own, provided these are at least as stringent as
3 the Federal requirements. The NMED Air Quality Bureau (AQB) is responsible for enforcing air
4 pollution regulations in New Mexico. The AQB enforces the NAAQS and state ambient air quality
5 standards by monitoring air quality, developing rules to regulate and to permit stationary sources of
6 air emissions, and contributing to air quality attainment planning processes statewide.

7 In addition to criteria pollutants, the EPA also regulates hazardous air pollutants (HAPs). HAPs are
8 emitted from a range of industrial facilities and vehicles. EPA sets Federal regulations to reduce
9 HAP emissions from stationary sources in the National Emission Standards for Hazardous Air
10 Pollutants (EPA, 2023b).

11 Currently, the area encompassing LANL and Los Alamos County is classified as an attainment area
12 for all NAAQS (EPA, 2023c). Therefore, no conformity determination is required.

13 LANL borders the Tsankawi unit of the Bandelier National Monument CAA Class I area to the east
14 (about 0.5 miles from the project area) and the main portion of the Monument (about 3.5 miles
15 southwest of the project area). The CAA provides special protection for air quality and air
16 quality-related values in Class I areas, where any appreciable deterioration of air quality is
17 considered significant. Air monitoring shows a trend of gradually improving visibility within the
18 Bandelier National Monument during the period of available data (1992 through 2021) (National
19 Park Service, 2023).

20 LANL is considered a major source of air pollutants under the CAA, based on its potential to emit
21 nitrogen oxides (NO_x), carbon monoxide, and volatile organic compounds (LANL, 2022b). In
22 accordance with Title V of the CAA and AQB regulations, emission sources at LANL operate
23 under a site-wide Title V Operating Permit. Prior to construction, the AQB requires air permits for
24 new stationary emission sources, depending on their design and operations. Operations at LANL
25 emit criteria pollutants primarily from combustion sources, such as boilers, generators, and motor
26 vehicles. Estimated actual emissions of air pollutants for LANL in 2021 were substantially below
27 the facility annual Title V Operating Permit facility-wide levels.

28 The project site generates minor amounts of air emissions when the interim measure is operating.
29 Sources mainly include gasoline- and diesel-powered vehicles and nonroad equipment and fugitive
30 dust due to the operation of vehicles on unpaved surfaces.

31 Recent scientific evidence indicates a correlation between increasing global temperatures over the
32 past century and the worldwide proliferation of greenhouse gases (GHGs) emitted by mankind.
33 Climate change associated with this global warming is predicted to produce negative environmental,
34 economic, and social consequences across the globe (IPCC, 2021; USGCRP, 2018). Detailed
35 predictions of future climate change and environmental impacts for the Southwest region that
36 encompasses LANL are available in the *Fourth National Climate Assessment – Volume II –*
37 *Impacts, Risks, and Adaptation in the United States* (USGCRP, 2018).

38 On January 9, 2023, the CEQ released interim guidance that describes how Federal agencies should
39 consider the effects of GHGs and climate change in their NEPA reviews (CEQ, 2023)The air
40 quality analysis for this EA considers aspects of the CEQ 2023 interim guidance.

41 Atmospheric levels of GHGs and their resulting effects on climate change are due to innumerable
42 sources of GHGs across the globe. The direct environmental effect of GHG emissions is an

1 increase in global temperatures, which indirectly causes numerous environmental and social effects.
2 Therefore, the region of influence (ROI) and potential effects of GHG emissions from the project
3 are by nature global and cumulative.

4 **3.5.2 AIR QUALITY – ENVIRONMENTAL CONSEQUENCES**

5 **3.5.2.1 Proposed Action (Adaptive Site Management)**

6 Implementation of the Proposed Action would result in air emissions of criteria pollutants, HAPs,
7 and GHGs. The following evaluates projected emissions relative to air quality conditions within the
8 project region.

9 ***Option 1 – Mass Removal via Expanded Treatment***

10 Air quality impacts from the Proposed Action under Option 1 would occur from (1) combustive
11 emissions from fossil-fuel-powered equipment, trucks, and worker commuter vehicles; and (2)
12 fugitive dust emissions from operating equipment and vehicles on exposed soils and the handling of
13 soils and aggregates. The main sources of emissions from installation activities would occur from
14 road construction, installation of well pads, well development, pipeline installation, and
15 construction of the treatment facility.

16 The Proposed Action would implement best management practices to minimize fugitive dust
17 emissions during installation activities (listed in Appendix C, *Environmental Resources Supporting*
18 *Information*, Section C.2). In addition, stationary sources of emissions, such as diesel-powered
19 generators for well development, could require a construction permit from the AQB, which would
20 limit their emissions and resulting impacts. As a result of these measures and regulations, the
21 transport of project emissions at least 0.5 miles to the LANL boundary would result in dispersed
22 concentrations of air pollutants at locations outside the LANL site. Therefore, emissions from
23 project construction activities would not contribute to an exceedance of an ambient air quality
24 standard.

25 Wells, pumps, and the treatment facility would be electrified and would not generate substantial
26 emissions. The intermittent nature of operational emissions, in combination with emissions from
27 installation activities, would not contribute to an exceedance of an ambient air quality standard at
28 locations outside the LANL site.

29 Air emissions from the Proposed Action would have the potential to affect the Bandelier National
30 Monument Class I area. Meteorological data collected within Mortandad Canyon show that winds
31 blow on average almost 60 percent of the time from the sector (west-southwest to west-northwest)
32 that would transport project emissions to the Monument (see Appendix C, *Environmental Resources*
33 *Supporting Information*, Figure C-7). The transport of project emissions at least 0.5 miles to the
34 border of the Monument would substantially dilute their concentrations. However, they could affect
35 visibility within the Monument, especially fugitive dust emissions. Therefore, to minimize project
36 air quality impacts within the Monument, the Proposed Action would implement the following
37 mitigation measures:

- 38 • Where feasible, electrify fossil fuel-powered well development generators and stationary
39 engines.
- 40 • Use only ultra-low sulfur diesel fuel in equipment and vehicles.

- 1 • Provide economic incentives to drilling contractors to use equipment with engines that
2 meet EPA nonroad Tier 4 emission standards.
- 3 • Designate personnel to monitor the dust control program and to increase control
4 measures, as necessary, to prevent the transport of project dust emissions beyond the
5 LANL boundary.

6 Implementing these mitigation measures would ensure that the Proposed Action would negligibly
7 affect air quality-related values within the Bandelier National Monument pristine Class I area.

8 The atmospheric evaporation of groundwater with chromium compounds would be a source of
9 HAPs from project activities, particularly Cr(VI). Given that Option 1 of the Proposed Action
10 would operate water systems that are closed to the atmosphere, emissions of chromium compounds
11 and resulting ambient impacts would be minimal.

12 ***Option 2 – Mass Removal with Land Application***

13 Air quality impacts under Option 2 would be nearly identical to those estimated for Option 1.
14 However, implementation of land application of treated water would result in slightly higher
15 releases of chromium compounds into the atmosphere. Since it is expected that the concentration of
16 chromium compounds in treated water would be very low, the release of these HAPs into the
17 atmosphere would result in minimal ambient impacts. Implementation of the air quality mitigation
18 measures proposed for Option 1 would ensure that the Proposed Action under Option 2 would result
19 in less than significant air quality impacts.

20 ***Option 3 – Mass Removal via In-Situ Treatment***

21 Option 3 has the potential to involve the same activities as Options 1 and 2 depending on the
22 number of wells and other infrastructure EM-LA decides to construct and where and when in-situ
23 treatments are implemented. Air quality impacts from construction and operation of the Proposed
24 Action under Option 3 would be nearly identical to those estimated for the Proposed Action under
25 Options 1 and 2.

26 In-situ treatment generally involves introducing amendments to groundwater (see Appendix B,
27 *Description of Alternatives Supporting Information*, Section B.2.3). These amendments would be
28 reviewed for applicability, effectiveness, toxicity, etc. and not be used if they would contribute to
29 impacts on air quality. Implementation of the air quality mitigation measures proposed for Option 1
30 would ensure that the Proposed Action under Option 3 would result in less than significant air
31 quality impacts.

32 ***Option 4 – Monitored Natural Attenuation***

33 Subsequent to the completion of the approved chromium mass removal option, monitoring activities
34 under Option 4 would produce lower amounts of air emissions due to equipment and vehicle usages
35 and fugitive dust compared to construction and operation activities. Implementation of the air
36 quality mitigation measures proposed for Option 1 would ensure that the Proposed Action under
37 Option 4 would result in less than significant air quality impacts.

1 **3.5.2.2 Cumulative Impacts**

2 The nearest locations of cumulative project emissions would occur from facilities within TA-53 and
3 vehicles along Jemez Road. These emissions are far enough away and of such low magnitude that
4 when transported to the project site, they would produce low ambient pollutant concentrations.
5 When combined with mitigated project emissions, the transport of these cumulative emissions at
6 least 0.5 miles to the LANL boundary would result in dispersed concentrations of air pollutants at
7 locations outside the LANL site that would not contribute to an exceedance of an ambient air
8 quality standard or negligibly affect air quality-related values within the Bandelier National
9 Monument Class I area. Therefore, the Proposed Action would not substantially contribute to
10 cumulative impacts on air quality.

11 Options 1 through 4 of the Proposed Action would emit GHGs due to the operation of fossil
12 fuel-powered equipment, trucks, and worker commuter vehicles. The total GHGs emitted from the
13 transport of materials by truck for each option are estimated to be 1,053 metric tons. These emissions,
14 in combination with GHG emissions from the operation of fossil fuel-powered equipment and worker
15 commuter vehicles, would be substantially less than the annual GHGs emitted from all stationary
16 sources at the LANL facility (77,243 metric tons in 2022) (LANL, 2023b). The GHG emissions from
17 Options 1 through 4 of the Proposed Action would result in a negligible contribution to cumulative
18 impacts on climate change. To minimize GHG emissions from each Option, emission sources would
19 comply with applicable regulations and GHG policies, and for mobile sources, Federal vehicle clean
20 fuels, mileage efficiencies, and emissions regulations.

21 The social cost of GHGs is the monetary value (in U.S. dollars) of the net harm to society
22 associated with adding GHG emissions to the atmosphere (IWG, 2021). In principle, it includes the
23 value of all climate change impacts, including (but not limited to) changes in net agricultural
24 productivity, human health effects, property damage from increased natural disasters, disruption of
25 energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The
26 social cost of GHG values estimated for GHGs emitted from the transport of materials by truck
27 would range from \$14,400 to \$160,000, based on different discount rates presented in the
28 Interagency Working Group methodology (IWG, 2021). Inclusion of all GHG emissions from
29 Options 1 through 4 of the Proposed Action would result in somewhat higher social cost of GHG
30 values.

31 Environmental justice communities located near LANL could experience disproportionate impacts
32 from climate change. In areas surrounding LANL, drought would negatively impact subsistence
33 farming, which occurs in the neighboring Pueblos. Communities located within canyons also could
34 be subject to increased flooding and potential displacement. In accordance with the 2021 Climate
35 Adaptation and Resilience Plan, DOE facilities address climate change within neighboring
36 communities by coordinating with Tribal, state, and local governments, as well as Federal agencies
37 to provide communities near DOE sites with climate and extreme weather information and
38 resources necessary to implement climate adaptation and mitigation measures (DOE, 2021). Also,
39 DOE is identifying and providing opportunities to engage energy and environmental justice
40 communities for meaningful involvement in agency decision-making, as well as providing
41 resilience and reductions in pollution and emissions (DOE, 2022b). Implementation of these
42 measures would mitigate climate change impacts to environmental justice communities near LANL
43 from activities associated with the Proposed Action.

1 Climate change could impact implementation of the Proposed Action at LANL and the adaptation
2 strategies needed to respond to future conditions. For the region surrounding the LANL project site,
3 the main effect of climate change is increased temperature and aridity (USGCRP, 2018). These
4 analyses predict that in the future, the region will experience (1) increases in temperatures,
5 droughts, and wildfires, and (2) scarcities of water supplies. Current operations at LANL have
6 adapted to droughts, high temperatures, wildfires, and scarce water supplies. However,
7 exacerbation of these conditions in the future could impede site activities during extreme events.
8 Due to Federal and agency mandates, LANL develops adaptation measures to compensate for future
9 climatic events. For example, in the 2021 Climate Adaptation and Resilience Plan, DOE described
10 the priority actions planned to promote climate change adaptation and resilience at DOE sites
11 (DOE, 2021), which includes reducing energy and water needs for site operations. At LANL,
12 planning is underway for a 10 megawatt photovoltaic electric generating station (LANL, 2022b).
13 Lastly, as part of their adaptive process, DOE routinely monitors climate change analyses and,
14 where appropriate, would implement measures to make facilities more resilient to future climate
15 impacts. Implementation of these measures would mitigate the effects of climate change at the
16 project site.

17 **3.6 ECOLOGICAL RESOURCES**

18 **3.6.1 ECOLOGICAL RESOURCES – AFFECTED ENVIRONMENT**

19 Ecological resources include the plant and animal species, habitats, and relationships of the land and
20 water areas within the ROI, which is the area directly or indirectly affected by the Proposed Action.
21 Particular consideration is given in the ROI to sensitive species, which are those species protected
22 under Federal or state law, including threatened and endangered species, migratory birds, and bald
23 and golden eagles. Ecological resources at LANL are monitored by the Environmental Protection
24 and Compliance Division, Los Alamos National Laboratory. The program implements management
25 plans (e.g., LANL Threatened and Endangered Species Habitat Management Plan (LANL, 2022c),
26 Wildland Fire Mitigation and Forest Health Plan (LANL, 2019a), Sensitive Species Best
27 Management Practices Source Document (LANL, 2020a), Invasive Plant Species Management Plan
28 (LANL, 2022d), and Migratory Bird Best Management Practices Source Document (LANL, 2020b)
29 and Pollinator Protection Plan (LANL, 2021a)). The program also implements comprehensive
30 species monitoring via routine plant and animal surveys. Historical reports and further information
31 on ecological resources are available on the LANL website (LANL, 2023c).

32 **3.6.1.1 Vegetation**

33 LANL provides habitat for a diverse assemblage of vegetation. The landscape is primarily
34 undeveloped with land cover types from forests, woodlands, shrublands, and grasslands to wetlands
35 and waterways. Between 2001 and 2014, the Los Alamos region experienced drought, bark beetle
36 outbreaks, widespread tree mortality, and severe wildfires (the Cerro Grande fire in 2000 and the
37 Las Conchas fire in 2011) (LANL, 2018d). These disturbances caused substantial changes in
38 vegetative communities over a relatively short period of time and with ongoing abnormal climate
39 patterns, additional changes to the land cover types are expected.

40 In 2018, 28 land cover classes were reported in the Los Alamos Region (LANL, 2018d). Within the
41 Sandia and Mortandad Canyon project area, 18 vegetation types occur (see Appendix C,

1 *Environmental Resources Supporting Information*, Figure C-8). Mixed conifer, juniper woodland,
 2 ponderosa pine woodlands, nonforested wetland/riparian, and developed or sparsely vegetated rock
 3 areas have the highest proportion of cover, with grasslands and shrublands also present (Table 3-3).
 4 Tree and shrub species such as juniper (*Juniperus monosperma*), ponderosa pine (*Pinus ponderosa*),
 5 Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), limber pine (*Pinus flexilis*),
 6 oneseed juniper (*Juniperus monosperma*), and piñon (*Pinus edulis*) are characteristic species. The
 7 nonforested wetland/riparian areas contain wetland shrubs or herbaceous species such as coyote
 8 willow (*Salix exigua*), skunkbush sumac (*Rhus trilobata*), cattails (*Typha* sp.) and a variety of
 9 sedges, rushes, and grasses (N3B, 2023b).

10 **Table 3-3. Vegetation and land cover types within the project area**

Vegetation Type	Acres	Proportion of Project Area Percent (%)
Asphalt road	96.12	4.75
Blue grama grassland	39.46	1.95
Dense juniper woodland	246.58	12.18
Dense oak shrubland	38.55	1.9
Developed	234.63	11.59
Forested riparian	16.5	0.81
Las Conchas recovering grassland	4.24	0.21
Mixed conifer	289.45	14.29
Mixed species shrubland	28.95	1.43
Nonforested wetland/riparian	222.97	11.01
Ponderosa pine regeneration	21.24	1.05
Ponderosa pine woodland	236.55	11.68
Semievergreen shrubland	7.47	0.37
Sparse juniper woodland	276.24	13.64
Sparse oak shrubland	63.06	3.11
Sparsely vegetated – bare rock	187.05	9.24
Sparsely vegetated – bare soil	14.43	0.71
Submontane grassland	1.66	0.08

Sources: (N3B GIS)

Note: Details and description of each vegetation type is provided in (LANL, 2018d).

11 The Sandia Wetland is located at the head of Sandia Canyon and since the early 1950s has
 12 expanded from a relatively small footprint to 3.65 acres in response to liquid effluent released by
 13 LANL (N3B, 2023b). The project area also lies within the 100-year floodplains of Mortandad and
 14 Sandia Canyons. A floodplain and wetland assessment would be prepared to support this project in
 15 accordance with 10 CFR Part 1022, “Compliance with Floodplain and Wetland Environmental
 16 Review Requirements.” The upper Sandia and Mortandad Canyons floodplains are largely
 17 undeveloped with a single dirt road providing access to the Sandia Wetland, monitoring wells, and
 18 stormwater monitoring infrastructure. The Sandia Wetland drains into a perennial waterway that
 19 reaches Sigma Canyon (N3B, 2023c). Lower Sandia and Mortandad Canyons are more developed
 20 with a commuter access. Additional information on the floodplains is included in Appendix C,
 21 *Environmental Resources Supporting Information*.

22 3.6.1.2 Wildlife

23 The LANL region functions as a refuge for wildlife because of restricted access to certain areas, the
 24 lack of permitted hunting, and management of contiguous Bandelier National Monument and U.S.
 25 Forest Service lands. Sandia and Mortandad Canyons provide habitat for a variety of terrestrial
 26 wildlife species. Mammals observed include elk (*Cervus elaphus*), deer (*Odocoileus hemionus*),

1 bear (*Ursus americanus*), mountain lions (*Puma concolor*), coyotes (*Canis latrans*), and rodents.
2 There are also numerous species of bats, reptiles, amphibians, invertebrates, and a myriad of
3 resident, seasonal, and migratory birds.

4 The Sandia Wetlands provides year-round water access and dense vegetative habitat and serves as
5 an important food resource and nesting habitat. More than 100 species of birds have been detected
6 throughout the year including species of special concern (e.g., western bluebird [*Sialia mexicana*]
7 and pine siskin [*Spinus pinus*]) (N3B, 2023b). Further information of wildlife species documented
8 on LANL is available on the LANL website (LANL, 2023c).

9 **3.6.1.3 Threatened and Endangered Species**

10 Threatened and endangered species include those listed by U.S. Fish and Wildlife Service (USFWS)
11 as threatened or endangered under the Endangered Species Act of 1973 (16 U.S.C. 1531), species
12 that are candidates for listing, and designated critical habitat (USFWS, 2023). Other sensitive
13 species include those listed at the state level under the New Mexico Wildlife Conservation Act,
14 species included in the New Mexico State Wildlife Action Plan (NMDGF, 2016), Natural Heritage
15 New Mexico database, and Partners in Flight watch list (Partners in Flight, 2021). LANL maintains
16 a list of threatened, endangered, and sensitive species (see Appendix C, *Environmental Resources*
17 *Supporting Information*, Section C.3). Further details on sensitive species at LANL can be found in
18 the Status of Federally Listed Threatened and Endangered Species at Los Alamos National
19 Laboratory (LANL, 2021b) and in *Sensitive Species Best Management Practices Source Document*,
20 Revision 5 (LANL, 2020a).

21 Federally listed threatened or endangered species are managed under the Threatened and
22 Endangered Species Habitat Management Plan for LANL (LANL, 2022c). Five federally listed
23 species have been reported in the vicinity of LANL: the Mexican spotted owl (*Strix occidentalis*
24 *lucida*), Jemez mountains salamander (*Plethodon neomexicanus*), southwestern willow flycatcher
25 (*Empidonax traillii extimus*), yellow-billed Cuckoo (*Coccyzus americanus*), and the New Mexico
26 meadow jumping mouse (*Zapus hudsonius luteus*). At LANL, suitable habitats for three of these
27 species (Mexican spotted owl, southwestern willow flycatcher, and Jemez mountains salamander),
28 along with a protective buffer area surrounding the habitats, have been designated as Areas of
29 Environmental Interest. Of these species, only the Mexican spotted owl has been reported within
30 the project area. The current Mexican spotted owl Area of Environmental Interest inventory
31 consists of five areas spanning seven canyons at LANL. Designated critical habitat occurs on
32 Bandelier National Monument property west-southwest of LANL.

33 Mexican spotted owls prefer mixed conifer, pine-oak woodlands and Gambel oak (*Quercus*
34 *gambelli*) forests throughout the mountains and canyons. Although seasonal movements vary
35 among owls, adults commonly remain within their summer home ranges throughout the year.
36 Mexican spotted owl surveys have been conducted on LANL property since 1994. Each spring,
37 focused surveys are conducted in six canyons. In 2004, 2005, and 2006, a territory in Mortandad
38 Canyon was occupied by at least one Mexican spotted owl. This area was re-occupied in 2013 and
39 continues to be occupied to date with a pair of owls (LANL, 2021b; LANL, 2023d). Mexican
40 spotted owls occupy a large portion of Mortandad Canyon, and the project area contains core and
41 buffer habitat for this species (see Appendix C, *Environmental Resources Supporting Information*,
42 Figure C-9).

1 **3.6.1.4 Migratory Birds and Sensitive Species**

2 Migratory birds are protected under the Federal Migratory Bird Treaty Act of 1918 (16 U.S.C. 703).
3 Bird species can be yearlong residents or migrants and can also be special-status species including
4 bald and golden eagles (with special status under the Federal Bald and Golden Eagle Protection
5 Act), and species listed by USFWS as Birds of Conservation Concern (USFWS, 2021). Migratory
6 birds at LANL are managed under the *Migratory Bird Best Management Practices Source*
7 *Document* (LANL, 2020b). No nesting habitat for bald or golden eagles has been reported near the
8 project area, but eagles are known to travel through and could forage at the site.

9 **3.6.2 ECOLOGICAL RESOURCES – ENVIRONMENTAL CONSEQUENCES**

10 **3.6.2.1 Proposed Action (Adaptive Site Management)**

11 The Proposed Action is subject to existing management practices and would follow all BMPs,
12 monitoring plans and measures related to ecological resources established for LANL (see Appendix
13 C, *Environmental Resources Supporting Information*, Section C.3).

14 ***Option 1 – Mass Removal via Expanded Treatment***

15 Detailed locations are not yet known for the proposed 10,000-ft² treatment facility; injection,
16 extraction, and monitoring wells; or any associated infrastructure, such as access roads, electrical
17 lines, and pipelines to and from any new well pads. It is assumed that under Option 1, about 75
18 acres of the 2,025 acre project area, including access roads, would be disturbed during infrastructure
19 development.

20 Impacts to ecological resources from implementation of Option 1 could include temporary and
21 permanent disturbances, degradation or loss of habitat from land clearing activities, disturbance or
22 displacement of wildlife due to increased noise, vibration, lights, and human. Impacts could also
23 include fragmentation of remaining habitats and an increase in human-wildlife interactions (such as
24 encounters and collisions between wildlife and motor vehicles).

25 Groundwater wells and access routes already exist in the project area, and vegetation and wildlife
26 habitat in the vicinity have been disturbed by installation of this infrastructure and associated
27 activities. Personnel and equipment accessing the project area for the Proposed Action would
28 temporarily disturb wildlife in the local area and have minor and minimal adverse impacts on
29 vegetation and wildlife habitat. These impacts would be minimized by pre-installation surveys,
30 avoidance of sensitive habitats and nesting birds, using pollinator friendly practices, and
31 monitoring. These localized impacts would generally be short term and would not be anticipated to
32 result in long-term or permanent impacts to surrounding vegetation communities.

33 Vegetation would be restored and the introduction of invasive plant species and impacts to
34 pollinators would be minimized by following the Invasive Plant Species Management Plan (LANL,
35 2022d) and Pollinator Protection Plan (LANL, 2021a). Initially, it would be very difficult to
36 rehabilitate native vegetation similar in species composition, structure, and ecological function to
37 that originally present, but over time the area is expected to recover and serve similar ecological
38 functions.

1 Impacts to the Sandia Wetlands would be localized and riparian habitat would be avoided. The
2 project would minimize long-term, adverse impacts to the floodplains and wetland in the project
3 area through the implementation of BMPs, including erosion and sediment controls. Most impacts
4 would conclude upon completion of construction activities. The Proposed Action would not
5 significantly modify the existing floodplains and wetland within the project area and not adversely
6 impact natural and beneficial floodplain and wetland values.

7 Construction of the treatment facility and well drilling for 24 hours per day, 7 days per week could
8 cause disturbances (e.g., noise and vibration) to wildlife. Species in the vicinity of the construction
9 area would likely move to suitable habitat nearby. Delaney et al. (1999) noted that Mexican spotted
10 owl flush responses increased in response to closer and louder noise sources. Noise (i.e.,
11 chainsaws) below 46 A-weighted decibels (dBA) did not generate a flush response; however, the
12 alert distance was considerably longer (Delaney et al., 1999). Noise studies on LANL found that
13 current noise levels have increased in developed areas around Sigma Mesa but have not increased in
14 undeveloped areas that are lower in elevation (LANL, 2019b). Noise levels at 50 feet from the
15 project could reach 91 dBA and would attenuate to 71 dBA (at 500 feet), 61 dBA (at 1,500 feet), 57
16 dBA (at 0.5 miles), and 51 dBA (at 1 mile). The local topography would substantially lower noise
17 levels to below the noise level estimates beyond a half a mile, and elevated noise levels would
18 likely be faint or not detected. Heavy trucks would typically have noise levels between 74 dBA and
19 85 dBA at 50 feet and could generate noise levels ranging from 54 dBA to 65 dBA at 500 feet
20 (FHWA, 2006). The recovery plan for the Mexican spotted owl species recommends that activities
21 that generate noise levels exceeding 69 dBA be restricted within 165 feet of an owl site during the
22 breeding season. Foraging individuals present within 500 feet of construction activity would be
23 subjected to construction-specific increases in noise, general disturbance, and human presence, and
24 would likely avoid the area for the duration of the disturbance. Noise levels would be subject to the
25 guidelines on disturbance or habitat alterations for threatened and endangered and other special-
26 status species. Further impacts to noise to species is discussed in the *Noise Study for the Mexican*
27 *Spotted Owl Sandia-Mortandad Area of Environmental Interest* (LANL, 2019b).

28 Impacts to threatened and endangered species, including removal of Mexican spotted owl core and
29 buffer habitat, would be minimized and mitigated in compliance with the Threatened and
30 Endangered Species Habitat Management Plan (LANL, 2022c). Surface and vegetation disturbing
31 activities would avoid nesting seasons for the various groups of birds protected under the Migratory
32 Bird Treaty Act or considered sensitive or be preceded by surveys to confirm the absence of nesting
33 birds. Any potential for sensitive plant species habitat in the project area would be surveyed prior
34 to disturbance and appropriate mitigation would be implemented.

35 Multiple hazards (e.g., accidental spill from treated water, storage basins) pose a risk for potential
36 deleterious effects on vegetation and wildlife such as decline in species diversity, mortality, growth
37 rate, vigor, and genetic mutations.

38 ***Option 2 – Mass Removal with Land Application***

39 Option 2 would involve all activities as discussed under Option 1, except for the land application of
40 treated water in permitted areas, which would encompass about 50 acres of land. The areas for land
41 application under the Proposed Action are the same as those currently available for this activity
42 under the interim measure. Therefore, impacts to ecological resources discussed under Option 1
43 would also be applicable. The actual amount of treated water injected into the aquifer would be

1 less; and the treated water volume applied to the land and the duration of land application would
2 increase. Land application would only occur in permitted areas per NPDES land permit and not
3 within wetlands, water courses, waterways or drainages, slopes >2 percent if the site is poorly
4 vegetated (less than [$<$] 50 percent ground cover), or slopes >5 percent if the site is well vegetated
5 (>50 percent ground cover), thus reducing impacts to ecological resources.

6 ***Option 3 – Mass Removal via In-Situ Treatment***

7 Option 3 would be similar to Option 1 and 2 and no further impacts to ecological resources are
8 expected to occur beyond those discussed for Options 1 and 2.

9 ***Option 4 – Monitored Natural Attenuation***

10 Option 4 has the potential to involve the same amount of ground disturbance as Options 1 and 2,
11 depending on when EM-LA determines MNA would be a viable treatment option, thus impacts
12 to ecological resources would be the same as Options 1 and 2.

13 **3.6.2.2 Cumulative Impacts**

14 Reasonably foreseeable cumulative projects in the region that require ground disturbance,
15 vegetation clearing, grading, and excavations could result in localized effects to ecological
16 resources that may be individually comparable to those associated with Option 1.

17 Potential cumulative impacts associated with the loss and disturbance of ecological resources from
18 the Proposed Action could result in long-term impacts due to the intense effort needed to restore the
19 habitat. However, impacts would be reduced with implementation of BMPs, monitoring plans, and
20 measures related to ecological resources established for LANL described in the affected
21 environment section and as summarized in Appendix C, *Environmental Resources Supporting*
22 *Information*, Section C.3. Ongoing coordination and consultation with appropriate agencies would
23 occur prior to any new action that would impact ecological resources.

24 The spatial and temporal extent of potential impacts on ecological resources from other cumulative
25 projects are expected to be limited due to implementation of BMPs and permit conditions that
26 would maximize conservation of threatened and endangered and sensitive species. As a result, the
27 Proposed Action is not expected to substantially contribute to cumulative impacts on ecological
28 resources.

29 **3.7 CULTURAL RESOURCES**

30 **3.7.1 CULTURAL RESOURCES – AFFECTED ENVIRONMENT**

31 **3.7.1.1 Definition and Regulatory Framework**

32 The definition of cultural resources, as well as the regulatory setting and methodology of analysis,
33 are found in Appendix C, *Environmental Resources Supporting Information*.

1 **3.7.1.2 Area of Potential Effects**

2 The APE, as defined in 36 CFR 800.16[d], is the area within which an undertaking may directly or
3 indirectly cause alterations in the character or use of historic properties, if any such properties exist.
4 The APE for this project includes the areas within which direct land disturbance from infrastructure
5 installation, access road development, operations, and reclamation activities are planned to occur, as
6 well as the area that could be subject to vibrations from project operations. This APE also includes
7 those areas in which there is the potential for indirect impacts, including changes to erosion patterns
8 and inadvertent damage. Accordingly, for the proposed project, the APE for archaeological sites
9 includes the area surrounding the proposed project facilities and infrastructure in the Mortandad
10 Canyon bottom as well as along the northern and southern mesa tops and cliff faces adjacent to the
11 canyon.

12 While the APE for historic properties has been defined, identifying a similar bounding geographic
13 area for Tribal cultural resources is challenging due to the complexity of the relationships and
14 interactions between these resources and important Tribal practices and beliefs. Thus, an APE for
15 Native American resources is not defined and potential for impacts to such resources has been
16 assessed through consultation with representatives of the Pueblo de San Ildefonso.

17 **3.7.1.3 Cultural Resource Investigations**

18 Cultural resource investigations helped develop the information needed to assess the potential
19 impacts of the proposed project on cultural resources and to meet compliance requirements under
20 Section 106 of the National Historic Preservation Act of 1966 (NHPA). These investigations
21 included archaeological survey, testing, and Tribal consultation; they were conducted in accordance
22 with the Cultural Resources Management Plan (CRMP), state, and Federal requirements.
23 Investigations to identify cultural resources in the APE are described more fully in Appendix C,
24 *Environmental Resources Supporting Information*.

25 **3.7.1.4 Cultural Resources in the Area of Potential Effects**

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

29 ***Archaeological Sites***

30 Based on the archaeological survey and testing investigations described in Appendix C,
31 *Environmental Resources Supporting Information*, 114 archaeological sites are located within the
32 APE. The condition of the sites is generally quite good, in part because of the restricted access at
33 LANL. Almost all the sites have experienced some level of impact from water runoff, although this
34 has occurred mainly as sheet wash and not in the development of drainage cuts. Other impacts to
35 the sites include damage from construction of dirt roads on the mesa tops that were developed
36 historically, vandalism or limited pot hunting at two of the sites, and modern graffiti at one site.

37 Of the 114 sites in the APE, DOE determined 80 sites eligible for listing in the National Register of
38 Historic Places (NRHP), 18 sites not eligible for the NRHP, and 16 sites either potentially eligible
39 for the NRHP or unevaluated. Shovel testing and geomorphological analysis previously conducted
40 in areas where proposed interim measure project infrastructure would occur close to known sites

1 revealed that no intact sediments or cultural deposits exist within those areas (DOE, 2015), which
2 may be an indication of the potential for subsurface deposits at other sites in the expanded APE.

3 *Historic Buildings*

4 There are 12 historical buildings within the APE, all of which were built during the Cold War
5 between 1959 and 1986 (see Appendix C, *Environmental Resources Supporting Information*,
6 Table C-3, Los Alamos National Laboratory Historic Buildings in the Area of Potential Effects).
7 Five of them have been determined eligible for listing in the NRHP (two under Criterion A, and
8 three under Criteria A and C). The other seven buildings are not evaluated or currently
9 undergoing assessment for significance or NRHP eligibility and are managed as NRHP-eligible
10 until a final determination is made. The APE does not encompass any building or site within the
11 legislative boundary of the Manhattan Project National Historical Park.

12 *Native American Cultural Resources*

13 DOE recognizes the affiliation for all Tribes that have shown an interest in, or claimed affiliation to,
14 cultural resources located on LANL property (as listed in Appendix C, *Environmental Resources*
15 *Supporting Information*). However, in this area of LANL property, the Pueblo de San Ildefonso is
16 the recognized affiliated Pueblo. For this reason, DOE will focus its Tribal consultation for this
17 project on Pueblo de San Ildefonso.

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

30 According to the Pueblo representatives, the Sacred Area plays a very important role in the history,
31 culture, and religious practices of the Pueblo, and this forms the basis for its importance. Because
32 of this intrinsic significance, the Sacred Area is used only for traditional cultural and religious
33 activities by Pueblo members. By conducting these activities in the Sacred Area, or by using
34 resources collected from the Sacred Area, the importance of the Sacred Area is transferred to those
35 activities and materials, instilling in them cultural “power” and ensuring their efficacy. In turn, the
36 conduct of these activities within the Sacred Area and the use of these materials imbues the Sacred
37 Area with even greater importance. This illustrates the circular relationship between the Sacred
38 Area, the resources and activities located within it, and explains the Pueblo’s consideration of the
39 Sacred Area and its resources as important. (DOE, 2015)

40 Pueblo representatives explained that, though varied in character, the resources in the Sacred Area are
41 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).

3.7.1.5 Section 106 Compliance Status

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 (e.g., 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 the Pueblo de San Ildefonso Reservation, and the Pueblo cultural resources concerns for the chromium plume area have yet to be identified. However, Pueblo concerns of cultural resources for the chromium plume area from previous consultation is available and summarized here. EM-LA also held an in-person meeting on the scoping with Pueblo de San Ildefonso environment department.

Compliance with Section 106 of the NHPA and 36 CFR 800 at LANL follows the Programmatic Agreement (PA) executed in 2006 (amended and updated in 2015, 2017, and 2022) between DOE, NNSA, Los Alamos Field Office, the New Mexico State Historic Preservation Office and the Advisory Council on Historic Preservation (LANL, 2022e).

3.7.2 CULTURAL RESOURCES – ENVIRONMENTAL CONSEQUENCES

The definition of cultural resources, regulatory setting, and methodology of analysis are found in Appendix C, *Environmental Resources Supporting Information*.

3.7.2.1 Proposed Action (Adaptive Site Management)

Option 1 – Mass Removal via Expanded Treatment

Historic Properties

Archaeological Resources

Detailed locations are not yet known for the proposed 10,000-ft² treatment facility; injection, extraction, and monitoring wells; and any associated infrastructure required, such as access roads, electrical lines, and pipelines to or from any new well pads. However, DOE would situate the 10,000-ft² treatment facility in a previously disturbed area and is committed to avoiding direct impacts to all known historic properties, to the maximum extent possible, for the siting, construction, and operation of proposed project facilities and infrastructure.

Seven archaeological sites are located along and bisected by historically established Puye Road, which accesses the project area in Mortandad Canyon from the mesa top to the south. Six of these sites have been determined eligible for the NRHP and one, a historic wagon road, has been determined not eligible. Increased use and maintenance of the road associated with the Proposed Action could potentially create additional impacts to these seven sites. Preemptive BMPs have

1 already been implemented along Puye Road to address the risk for potential impacts from existing
2 use and maintenance, and continuation of these measures would prevent additional potential
3 impacts from the Proposed Action (DOE, 2015)

4 Installation and development of project infrastructure and increased activity during operations could
5 result in changes to, or increases in, erosional processes and patterns in the vicinity of
6 archaeological sites, resulting in potential impacts to those sites. Incorporated into the activities
7 planned under the Proposed Action are BMPs to control stormwater runoff and erosion, including
8 the use of retention basins, berming around facility perimeters, placement of sediment control
9 structures, and placement of base-course gravel. These measures would be implemented in
10 accordance with the project Stormwater Pollution Prevention Plan (SWPPP), as needed (see Section
11 3.4, *Water Resources*). To provide additional protection, erosion controls, such as straw wattles,
12 would be installed in and around the archaeological sites in close proximity to stormwater runoff
13 paths. These erosion control measures would limit indirect impacts to archaeological sites from
14 stormwater runoff or erosion associated with the Proposed Action.

15 N3B cultural resource staff would implement monitoring throughout the duration of the Proposed
16 Action. Ground-disturbing activities occurring in the vicinity of archaeological sites would be
17 monitored to ensure inadvertent trespass does not occur and to address any subsurface
18 archaeological discoveries. The effectiveness of erosion and stormwater runoff controls also would
19 be monitored periodically and evaluated to determine if additional or modified controls are
20 necessary. Discoveries of previously unrecorded archaeological deposits or impacts to
21 archaeological materials would be identified, recorded, and evaluated in accordance with the
22 procedures in the LANL CRMP (LANL, 2017) and the PA (LANL, 2022e). Discoveries of human
23 remains, funerary objects, sacred objects, and objects of cultural patrimony would be treated in
24 accordance with the Native American Graves Protection and Repatriation Act and its LANL
25 standard operating procedure (LANL, 2020c).

26 With the protective measures already in place for Puye Road, along with implementation of the
27 stormwater runoff and erosion control measures and archaeological monitoring that would be
28 conducted for the project, no significant impacts to archaeological historic properties would be
29 anticipated to occur from Option 1. As previously stated, DOE is committed to locate proposed
30 project facilities and infrastructure to avoid impact to any known archaeological sites, to the
31 maximum extent possible. However, as project facilities planning advances, and given the
32 constraints of topography in the APE, a new well pad, access road, pipeline, or electrical line could
33 cross the site buffer area of one or more sites. If this were the case, DOE would propose
34 appropriate measures to mitigate any determined effect and would consult with the New Mexico
35 State Historic Preservation Officer and concerned Tribes to negotiate a memorandum of agreement
36 that details those measures, in accordance with stipulations in the PA.

37 In accordance with the LANL PA, DOE would follow the NHPA Section 106 review, determination
38 of effects, and consultation process for archaeological historic properties as described above in
39 Section 3.7.1.5, *Section 106 Compliance Status*.

40 ***Architectural Resources***

41 All new facilities and infrastructure would be located within the chromium plume area previously
42 analyzed in the 2015 Interim Measures EA (DOE, 2015). Under the Proposed Action, there would
43 be no substantial dominant visual change as observed from any of the 12 Cold War Era historic
44 buildings in the APE and no long-term dominant visual interruption of unique historic viewsheds.

1 No impacts to historic architectural historic properties would be anticipated to occur due to Option 1
2 of the Proposed Action.

3 ***Tribal Cultural Resources***

4 Consultation for this proposal is ongoing, and cultural resources in the APE within the Pueblo de
5 San Ildefonso Reservation, and the Pueblo cultural resources concerns for the chromium plume
6 area have yet to be identified. However, Pueblo cultural resources concerns for the chromium
7 plume remediation from previous consultation is available and summarized here.

8 Representatives of Pueblo de San Ildefonso previously anticipated a direct, adverse impact from the
9 interim measure to Tribally important resources and practices located within the entire Sacred Area,
10 which would concurrently impact the traditional culture and people of the Pueblo (DOE, 2015).
11 The Pueblo representatives explained that because all resources within the Sacred Area are
12 culturally meaningful and connected to one another, a change or impact to one resource in one
13 location would simultaneously impact all of the resources, resulting in a holistic impact to the
14 resources and associated practices. This detrimental impact would extend to the people depending
15 on those resources and practices as well as to their traditional culture. The associated mental and
16 emotional effects to the people would, in turn, affect their ceremonies and rituals.

17 The Pueblo representatives understood that the proposed chromium plume control interim measures
18 were intended to reduce the impacts, and they viewed this as a necessary offset. The representatives
19 reported that knowledge of the chromium plume had already curbed use of the Sacred Area in the
20 vicinity of LANL property by their people because of concerns about contamination. However, the
21 Pueblo representatives perceived that there would be impacts from the proposed interim measures,
22 even though these would be a trade-off for the impacts of the chromium plume. Addressing those
23 impacts through regular consultation with Pueblo de San Ildefonso throughout implementation of
24 Option 1 of the Proposed Action, and avoiding to the maximum extent possible any potentially
25 impacted resources, would limit the impacts.

26 ***Option 2 – Mass Removal with Land Application***

27 Under Option 2, the proposed new facilities and infrastructure would be the same as Option 1; the
28 actual amount of treated water injected into the aquifer would be less; and the treated water volume
29 applied to the land and the duration of land application would increase. Land application of treated
30 water in permitted areas would encompass about 50 acres of land. The areas for land application
31 under the Proposed Action are the same as those currently available for this activity under the
32 interim measure. Impacts to cultural resources, both historic properties and Tribal cultural
33 resources, would be bounded by the evaluation of impacts discussed for Option 1. As with
34 Option 1, EM-LA would perform NHPA Section 106 review for each new proposed activity in
35 accordance with the LANL PA as project design advances and would assess and determine the
36 effects per the process specified in Stipulation 10 of the PA. Impacts to cultural resources, both
37 historic properties and Tribal cultural resources, would be bounded by the evaluation of impacts
38 discussed for Option 1.

1 **Option 3 – Mass Removal via In-Situ Treatment**

2 Option 3 has the potential to involve the same activities as Options 1 and 2, depending on the
3 number of wells and other infrastructure EM-LA decides to construct and where and when in-situ
4 treatments are implemented. EM-LA would follow the same process as described under Options 1
5 and 2 for NHPA Section 106 review in accordance with the LANL PA. Therefore, the impacts to
6 cultural resources, both historic properties and Tribal cultural resources, from implementing
7 Option 3 would be similar to those for Options 1 and 2.

8 **Option 4 – Monitored Natural Attenuation**

9 Under the MNA option, the proposed new facilities and infrastructure, the amounts of treated water
10 injected into the aquifer and applied to the land and the duration of land application have the
11 potential to be the same as under Options 1 and 2. Impacts to cultural resources, both historic
12 properties and Tribal cultural resources, would be bounded by the evaluation of Option 1.

13 **3.7.2.2 Cumulative Impacts**

14 Because the Proposed Action is not anticipated to result in significant impacts to cultural resources,
15 there would be no substantive contribution to cumulative impacts on cultural resources under the
16 Proposed Action.

17 **3.8 UTILITIES AND INFRASTRUCTURE**

18 Infrastructure consists of the basic physical structures, facilities, and services needed to support
19 planned and continued operations at LANL. LANL manages all utility systems that serve
20 programmatic mission needs. Systems analyzed in this EA include electric power, water, and roads.
21 While roads are often considered part of the infrastructure, they are only briefly described in this
22 section. The roadway network outside and within LANL, including volume and condition, is
23 discussed in greater detail in Section 3.9, *Traffic and Transportation*.

24 **3.8.1 UTILITIES AND INFRASTRUCTURE – AFFECTED ENVIRONMENT**

25 **3.8.1.1 Electricity**

26 LANL participates in an electric coordination agreement for its electric power supply, known as the
27 Los Alamos Power Pool, with Los Alamos County. The Public Service Company of New Mexico
28 is the transmission operator serving LANL. Electric power is supplied to the site via two 115
29 kilovolt (kV) import transmission lines: the Norton Line that terminates at the Eastern TA
30 substation in TA-05 and the Reeves Line that terminates at the Southern TA substation in TA-71. A
31 third, planned import transmission line would connect the Norton substation to the Southern TA
32 substation, providing added system capacity, redundancy, and reliability. LANL operates and
33 maintains the transmission and distribution resources serving all on-site facilities (LANL, 2022a).

34 LANL also operates a combustion gas turbine generator on the 13.8 kV distribution system to
35 generate power on-site from natural gas and maintains several emergency combustion engine

1 generators that utilize diesel fuel (LANL, 2022a). In FY 2021, LANL consumed 605,969 megawatt
2 hour from the Los Alamos Power Pool and 77 megawatt of the peak load demand (DOE, 2022a).

3 In the project area, power drops are located at wells CrEX-1, R-42, R-28, and R-62. An existing
4 power line extends to well R-45, from which there are local power drops to the storage basins to
5 support land-application pumps and associated controls (DOE, 2015).

6 **3.8.1.2 Water**

7 Los Alamos County operates the water-production system that supplies potable water to LANL.
8 LANL operates and maintains its water-distribution system. County deep water supply wells are
9 located in three municipal well fields (Guaje, Otowi, and Pajarito). The county supplies water from
10 wells to primary storage tanks for distribution throughout LANL. In general, the LANL distribution
11 system lines begin at primary storage tanks maintained by the county (DOE, 2015; LANL, 2022a).
12 LANL's sitewide, gravity fed water distribution system supplies both domestic and fire-protection
13 requirements, and the system uses approximately 270 million gallons of water per year. Water is
14 pumped into production lines and booster pump stations lift this water to 1 of 16 distribution water
15 tanks that provide water storage at high and intermediate storage points within the system (DOE,
16 2015; LANL, 2022a).

17 **3.8.1.3 Roads**

18 LANL is served by a limited number of public roadways. LANL and the town of Los Alamos can
19 be accessed from public thoroughfares branching from New Mexico State Road (NM) 4, from the
20 east by NM 502 and by East Jemez Road, and from the southwest by NM 501. A fourth paved
21 road, Pajarito Road, leads to LANL from the southeast, but through traffic is limited to authorized
22 personnel. Approximately 83 miles of paved roads and parking surfaces are currently present on
23 the site. A portion of Pajarito Road restricted to the public provides the only vehicle access to and
24 from the project area by means of Puye Road, which leads from Pajarito Road into Mortandad
25 Canyon. Puye Road near Pajarito Road is paved, while the portion within Mortandad Canyon is
26 unpaved (DOE, 2015).

27 **3.8.2 UTILITIES AND INFRASTRUCTURE – ENVIRONMENTAL CONSEQUENCES**

28 **3.8.2.1 Proposed Action (Adaptive Site Management)**

29 **Electricity**

30 ***Option 1 – Mass Removal via Expanded Treatment***

31 Under Option 1, the proposed chromium treatment facility would require a connection to the LANL
32 electrical system with the total power requirement to be determined by the final facility design.
33 Three-phase 480-volt power is already available at the proposed facility location, and no new
34 electrical lines would be required. Once treatment wells are constructed and operational, they
35 would be connected to the existing electrical system. During construction of wells and piezometers,
36 portable generators would be used. Total electricity used for construction and operation under
37 Option 1 would be 473,040 kilowatt-hours per year, which would be <1 percent of total yearly
38 usage for LANL. The overall increase in demand and effect of the capacity of the electrical system
39 at LANL would be minor under Option 1.

1 ***Option 2, 3, and 4***

2 Option 2 would involve all activities as discussed under Option 1; therefore, impacts to the
3 electrical system at LANL would be the same as discussed under Option 1. Option 2 includes the
4 use of land application and evaporation of treated water as a disposition method; overall impacts to
5 the electrical system at LANL would remain minor under Option 2. The use of in-situ treatments
6 under Option 3 would not require the use of additional electricity. Under Option 4, groundwater
7 monitoring and well maintenance would require electricity, but less than that required under
8 Options 1 and 2. Overall impacts to the electrical system at LANL are anticipated to be minor.

9 **Water**

10 ***Option 1 – Mass Removal via Expanded Treatment***

11 Under Option 1, water would be required during construction (e.g., to suppress fugitive dust). Well
12 construction would use off-site water and portable toilets. Some water would be required for
13 potable use and for toilets (potable or non-potable) at the treatment facility. Water used would be
14 derived from the same system operated by Los Alamos County and maintained by LANL. Total
15 water usage for construction is estimated up to 5,000,000 gpy and usage for operation of the
16 treatment facility and wells is estimated to be up to 500,000 gpy, which is estimated to be <1
17 percent of the total yearly water use at LANL. Therefore, the overall increase in demand and effect
18 of the capacity of the water delivery and distribution system at LANL would be minor under
19 Option 1.

20 ***Option 2, 3, and 4***

21 Options 2, 3, and 4 would use approximately the same yearly volume of water as Option 1;
22 therefore, the overall increase in demand and effect of the capacity of the water delivery and
23 distribution system at LANL also would be minor.

24 **Roads**

25 ***Option 1 – Mass Removal via Expanded Treatment***

26 Access to the project area would be made via paved and unpaved roads as described in Section
27 3.8.1.3, *Roads*. The Proposed Action would generate increased traffic volumes from commuting
28 workers and from trucks transporting equipment, supplies, and materials to and from the project
29 sites. Trucks would be required during construction and operation of the treatment facility and
30 wells for fill, crushed stone, concrete, well casing, piping, ion exchange resin, and other materials
31 and equipment. Access to the proposed treatment facility would be achieved through existing paved
32 and unpaved roads. Construction of new road surfaces and some improvements to existing roads in
33 the project area would be required. Any new road construction would be undertaken using BMPs
34 including use of wattles, ditches, and culverts to minimize sediment transport and erosion.
35 Considering that the project area under Option 1 is largely in a less frequently travelled area of
36 LANL, other than construction of additional access roads, activities under Option 1 would not affect
37 road infrastructure, and overall effects on the road infrastructure at LANL would be minimal.

1 Section 3.9.2, *Traffic – Environmental Consequences*, describes the potential effects of the
2 Proposed Action on the volume and capacities of the existing roadway network and traffic within
3 LANL and the surrounding area.

4 ***Option 2, 3, and 4***

5 Options 2, 3, and 4 would result in the same increased traffic and truck transportation trips to the
6 project area as Option 1. This option would also result in the same level of road construction and
7 upgrade of existing roads; therefore, potential impacts to road infrastructure at LANL would be the
8 same as under Option 1.

9 **3.8.2.2 Cumulative Impacts**

10 As described in the previous sections, overall impacts to utilities and infrastructure would be small
11 considering the total capacities described in Section 3.8.1, *Utilities and Infrastructure – Affected*
12 *Environment*. Because impacts from the Proposed Action would be small when compared to total
13 usage at LANL, they would not substantially contribute to cumulative impacts on utilities and
14 infrastructure.

15 **3.9 TRAFFIC AND TRANSPORTATION**

16 **3.9.1 TRAFFIC AND TRANSPORTATION – AFFECTED ENVIRONMENT**

17 Regional access to LANL is provided by State Road (SR)-502 from the east and north; SR-4 from
18 the east and south; and SR-501 from the west. Smaller public roadways that directly serve LANL
19 include Jemez Road and Diamond Drive. The town of Los Alamos can be accessed from three
20 public roadways that branch off from SR-4: from the east by SR-502 and Jemez Road, and from the
21 southwest by SR-501. The community of White Rock is served by SR-4, east of LANL. The
22 roadway system surrounding LANL is shown in Figure 1-1.

23 Main entry into LANL is via a controlled entry gate located on SR-501/West Jemez Road near its
24 intersection with Diamond Drive, in the northwest portion of LANL. Near this entry, Diamond
25 Drive directly connects to the town of Los Alamos. A controlled entry gate is also located further
26 south on SR-501/West Jemez Road, near its intersection with West Road.

27 Pajarito Road is a restricted access road (limited to authorized personnel) with a controlled entry
28 gate located at its intersection with SR-4. This road traverses from the southeast (at SR-4) to the
29 northwest, leading to the LANL administration area and connecting to SR-501/West Jemez Road.
30 The restricted portion of Pajarito Road provides the only vehicle access to and from the project area
31 by means of Puye Road, which extends from Pajarito Road into Mortandad Canyon and the project
32 site. The community of White Rock is located immediately east of the intersection of Pajarito Road
33 and SR-4; traffic movement at this intersection is signalized. Local roadways surrounding LANL
34 are presented in Figure 3-1.

35 Annual average daily traffic (AADT) data for key roadway segments at or near LANL was obtained
36 from New Mexico’s Department of Transportation (NMDOT) database and is presented in

Table 3-4. AADT is a measure of the average daily number of vehicles that pass through a given segment of roadway and is indicative of traffic conditions (i.e., higher AADT volumes lead to increases in traffic congestion and delays). The key roadway segments listed in Table 3-4 have exhibited declines or slight increases in traffic volumes since 2018. Based on recent AADT data, SR-4 (between Pajarito Road and SR-502) and Pajarito Road continue to be relatively busy roads.

Table 3-4. Annual average daily traffic on key roadway segments near project site

Street (Location)	Roadway Functional Class	Number of Lanes	2018 AADT (vehicles per day)	2022 AADT (vehicles per day) [percent change]
SR-4 (north of East Jemez Road intersection)	Minor arterial	2	11,883	11,995 [+1%]
SR-4 (between East Jemez Road and Pajarito Road)	Minor arterial	2	10,663	10,713 [+0.5%]
SR-501/West Jemez Road (west of LANL main gate, between Pajarito Road and Diamond Drive)	Minor arterial	4	8,232	2,294 [-72%]
Pajarito Road (northwest of SR-4)	Minor arterial	2	11,579	12,438 [+7%]
Pajarito Road (southeast of SR-501)	Minor arterial	2	11,041	10,771 [-2%]

Source: (NMDOT, 2023a)

Key: % = percent; AADT = Annual Average Daily Traffic; LANL = Los Alamos National Laboratory; SR = State Route

Prior to work restrictions in March 2020 due to the Coronavirus Disease of 2019 pandemic, traffic congestion at LANL was evident and travel delays and parking inconveniences were common issues with commuting workers (LANL, 2022f). Key traffic areas of concern included the northwestern portion of LANL (administration area) and the SR-4 corridor along the eastern boundary of LANL (between White Rock and SR-502). More specifically, traffic congestion occurred in the afternoon exit commute along Diamond Drive and the approaches to the intersection of SR-4 and East Jemez Road. Traffic movement at the intersection of SR-4 and East Jemez Road is controlled by a traffic signal. As work restrictions lifted, traffic congestion and delays have remained at or below levels exhibited prior to March 2020 due to telecommuting, hybrid work schedules, and staggered shifts (LANL, 2022f).

3.9.2 TRAFFIC – ENVIRONMENTAL CONSEQUENCES

3.9.2.1 Proposed Action (Adaptive Site Management)

The Proposed Action would generate increased traffic volumes from personal vehicles of commuting workers and from trucks transporting equipment, supplies, and materials to or from the project sites. For all Proposed Action options, access to the project site would remain the same as current operations. The majority of project-related vehicles would enter LANL from the main entrance at Jemez Road to Diamond Drive, then onto Pajarito Road. Pajarito Road connects to Puye Road, the direct access road leading into the project area. A limited number of vehicles could enter from the controlled entry gate at the eastern terminus of Pajarito Road, at its intersection with SR-4.

1 The project-related traffic volumes could lead to an increase in traffic congestion and delays at the
2 LANL entrances and on the roadways during peak commuting hours, a degradation in the operating
3 capacity of a roadway and intersection, or an increase in traffic safety hazards. Generally, the
4 surrounding public roadways would have the excess capacity to handle any additional traffic
5 volumes associated with the project and adverse traffic impacts would be considered short term and
6 minor for all options under the Proposed Action. Potential traffic impacts for each Proposed Action
7 option are described in greater detail in the following subsections.

8 ***Option 1 – Mass Removal via Expanded Treatment***

9 Option 1 would involve an increase in the number of personal vehicles from commuting personnel
10 and number of truck deliveries for the construction of the groundwater treatment facility, well pads,
11 wells, and piezometers. For the construction of the groundwater treatment facility and associated
12 infrastructure, routine daily vehicles from personnel and trucks would be up to approximately 50
13 roundtrips per day. For the construction of wells (a maximum of 2 wells could be constructed
14 simultaneously), routine daily vehicles from personnel and trucks would be up to 100 roundtrips per
15 day. Simultaneous construction of the new treatment facility and two well pads would generate up
16 to 150 roundtrips per day (or 300 single vehicle trips per day). This value represents the maximum
17 daily traffic volume that could occur during a peak construction period. Routine daily traffic
18 volumes would be expected to decrease after construction of the proposed groundwater treatment
19 facility is completed.

20 It is assumed that limited project-related traffic would access the project sites from SR-4, hence it
21 would contribute to negligible traffic impacts on this roadway. As shown in Table 3-4,
22 SR-501/West Jemez Road (between Pajarito Road and Diamond Drive) has experienced a great
23 decline in traffic volumes since 2018; therefore, it is expected that this roadway would have the
24 excess capacity to handle the additional project-related traffic. Project-related peak traffic would
25 increase daily traffic volumes on Pajarito Road by approximately 5 percent and would cause an
26 increase in congestion and delays on this roadway and at the main entrance, especially during peak
27 commuting hours. However, the increase in project traffic volumes would be reduced after
28 construction of the proposed groundwater treatment facility is completed (LANL, 2022f). As such,
29 adverse traffic impacts are expected to be minor under Option 1.

30 ***Option 2 – Mass Removal with Land Application***

31 Option 2 would involve all activities discussed under Option 1; therefore, traffic impacts as
32 discussed under Option 1 would also be applicable under Option 2. Additionally, Option 2 includes
33 the use of land application and evaporation of treated water as a disposition method. One of the
34 land application methods proposed is the use of water trucks. However, the water trucks would
35 remain within LANL property and would not travel on public roadways. Therefore, there would be
36 a negligible incremental increase in traffic impacts and overall traffic impacts would remain minor
37 under Option 2.

38 ***Option 3 – Mass Removal via In-Situ Treatment***

39 Option 3 would potentially involve all activities as discussed under Options 1 and 2; therefore,
40 traffic impacts as discussed under Options 1 and 2 would also be applicable under Option 3.

1 Additionally, Option 3 includes the use of in-situ treatment for the contaminated groundwater. A
2 limited increase in daily traffic volumes is expected from routine personnel and trucks associated
3 with the in-situ treatment, and, therefore, they would result in a negligible incremental increase in
4 traffic impacts. As such, overall traffic impacts would remain minor under Option 3.

5 ***Option 4 – Monitored Natural Attenuation***

6 Option 4 would involve MNA potentially following the completion of other remedial actions within
7 the ASM; therefore, traffic impacts as discussed under Options 1, 2, and 3 would also be applicable
8 under Option 4. A limited increase in daily traffic volumes is expected from routine personnel and
9 trucks associated with monitoring wells; therefore, they would result in a negligible incremental
10 increase in traffic impacts. As such, overall traffic impacts would remain minor under Option 4.

11 **3.9.2.2 Cumulative Impacts**

12 Increases in traffic volumes are predicted on the roadways within and surrounding LANL as an
13 increase in workforce at LANL is projected over the next several years. Because Pajarito Road and
14 SR-4 are relatively busy, cumulative traffic impacts are expected to range from minor to moderate,
15 although the contribution from the Proposed Action would be expected to be small and would not
16 substantially contribute to cumulative impacts on traffic. Traffic continues to be a top priority at
17 LANL and several traffic projects are planned to help alleviate congestion. Strategies, such as
18 conducting a transit options study and implementing a pilot bus service, are also being developed to
19 reduce employee-owned single-occupancy vehicles on-site (LANL, 2022f). Additionally, NMDOT
20 is conducting an alignment study for SR-4 (from SR-502 to Rover Boulevard in White Rock),
21 which will identify existing deficiencies and identify any improvements needed to bring the
22 roadway to current standards (NMDOT, 2023b).

23 **3.9.3 TRANSPORTATION – ENVIRONMENTAL CONSEQUENCES**

24 This section presents human health considerations associated with transport elements of the
25 Proposed Action. In this EA, the transportation activities do not involve radioactive wastes and
26 material transports and would be limited to nonradiological health impacts from construction and
27 support equipment supplies.

28 **3.9.3.1 Proposed Action Alternative (Adaptive Site Management)**

29 The major transportation activities in this EA include the transport of materials and infrastructure
30 supports for implementing the Proposed Action. Major project infrastructure to be installed and
31 operated under the Proposed Action alternative is described in Section 2.3, *Proposed Action*, and in
32 more detail in Appendix B, *Description of Alternatives Supporting Information*.

33 Prior to installing an injection or extraction well or deep vadose zone piezometer, it would be
34 necessary to grade an area approximately 200 feet by 200 feet and cover it with gravel-base coarse
35 material. Each well would have the completed well head and associated valves and instrumentation
36 and would be fitted with a concrete pad approximately 10 feet by 15 feet. Each piezometer is
37 expected to have a concrete pad size of <6 feet by 6 feet (DOE, 2014). Based on these
38 considerations, it is estimated that the installation of each extraction, injection, deep vadose zone

1 piezometer, or monitoring well pad and related road would require approximately 72 loads of base
2 course from dump trucks, resulting in approximately 4,030 total loads that would be brought into
3 the site (EM-LA, 2023b; DOE, 2015). In addition, for the duration of the project, an estimated 4
4 inches of base course would need to be brought in for annual road maintenance, resulting in
5 approximately 1,807 loads of base course per year for the new roads, and 225 loads for the existing
6 roads (DOE, 2015).

7 Concrete would also be required to install the pads at the injection, extraction, and monitoring
8 wells, as well as the deep vadose zone and shallow piezometers. Extraction and injection well pads
9 would require a total of approximately 110 truckloads of concrete into the site. Shallow
10 piezometers in Sandia Canyon would require a total of approximately five truckloads of concrete
11 (DOE, 2015).

12 The ion exchange in the treatment facilities would need replacement and regeneration periodically.
13 Based on the past experience with five extraction wells operating, there were five ion exchange
14 module exchanges per month on average in the 2022 calendar year (EM-LA, 2023c). Under the
15 Proposed Action, the water treatment capacity would be about five times larger than that of the
16 existing operation; therefore, it is estimated that there would be 25 ion exchange module exchanges
17 per month. If each module contains 30 cubic feet (ft³) of resin and between three to four modules
18 are shipped to be regenerated and brought back (EM-LA, 2023b), then the ion exchange operation
19 would need between 75 to 100 truck shipments (or an average of 88 shipments) annually. If the
20 decision is made to use larger, 60 ft³ contactors, along with the permanent treatment contactors with
21 ion exchange resin regenerated off-site and delivered via tanker truck (EM-LA, 2023b), considering
22 a truck capacity of 600 ft³ (Evoqua, 2023), then 30 tanker truck deliveries would be needed
23 annually.

24 Piping from the extraction wells to the treatment system would be double-walled pipe. Piping to
25 injection wells would be single-walled pipe. It is estimated that the additional 15 injection and
26 15 extraction wells would each need about 30,000 feet of double- and single-walled pipe,
27 respectively (or a total of 60,000 feet)⁶. Also, the connections between the existing and the new
28 treatment facilities would need about 500 feet of double- and single-walled pipe, each. Based on
29 the assumption of a 6-inch pipe diameter dimension and about 4,000 linear feet of piping per
30 truck load (note the truck load would be cargo-sized limited), it is estimated that about 16
31 shipments of the piping would be needed.

32 It is also estimated that drilling activity for each injection, extraction, and monitoring well and deep
33 vadose zone piezometer would require 10 deliveries of the required materials (including the well
34 casing piping) per month for the duration of its construction, which is assumed to be 9 months (EM-
35 LA, 2023b). Hence, for drilling 45 wells and 10 deep vadose zone piezometers⁷, a total of 4,950
36 truck deliveries would be needed.

⁶ This estimate is based on the locations of existing injection wells and their average distance to the groundwater treatment facility (about 1,500 linear feet). It also includes consideration of an additional 30 percent increase on the estimated pipe lengths to cover the uncertainties on the locations of the 15 new extraction and 15 new injections wells, with respect to the groundwater treatment facility.

⁷ These include 15 extraction wells, 15 injection wells, 10 deep vadose zone piezometers, and 15 monitoring wells. Note: it was assumed that the monitoring wells would have similar depths and needs as those of extraction/injection wells, for conservatism.

1 Based on the previous discussion, the construction and operation of the new wells and piezometers
 2 would need about a total of about 3, 960 truckloads of course base fill, about 130 truckloads of
 3 concrete and piping, 4,950 truck deliveries for the drilling operations, 2,011 truckloads of road fills,
 4 and 88 truckloads ion exchange resin for the annual road maintenance and treatment facilities
 5 operation. Assuming one-way distances of about 20 miles for the course base fill; about 40 miles
 6 for the concrete, piping, and drilling support; about 100 miles for the delivery and regeneration of
 7 ion exchange resins; and using the New Mexico State truck accident and fatality rates of 1.77×10^{-7}
 8 and 1.69×10^{-8} per kilometer (Saricks & Tompkins, 1999; UMTRI, 2003), the likelihood of a truck
 9 shipment being involved in an accident of any type during the initial construction and the annual
 10 operations, thereafter would be approximately 16 percent and 3 percent, respectively. These
 11 operations are unlikely, however, to lead to a single traffic accident fatality during the initial
 12 construction (0.02 per year) and the follow-up operations (0.003 per year). If the U.S. average truck
 13 accident and fatality rates of 5.77×10^{-7} and 2.34×10^{-8} per kilometer were to be used, then the
 14 likelihood of a truck shipment being involved in an accident of any type during the initial
 15 construction, and the annual operations, thereafter, would be approximately 52 percent and 9
 16 percent, respectively. Again, these operations are unlikely to lead to a single traffic accident fatality
 17 during the initial construction (0.02 per year) and the follow-up operations (0.004 per year). Table
 18 3-5 summarizes the transportation impacts for each option under the Proposed Action. Hence, the
 19 consequences of any accidents from transportation of aforementioned construction materials would
 20 be small.

Table 3-5. Summary of transportation impacts – all potential options under the Proposed Action

Materials	Shipment Numbers	Travel Distance one way (mi)	Total Distance round trip (km)	U.S. Average Truck		New Mexico Truck	
				Accidents	Fatalities	Accidents	Fatalities
Construction							
Course base fill	3,960	20	254,870	0.15	0.006	0.05	0.004
Concrete	115	40	14,800	0.009	0.0003	0.003	0.0003
DW/SW piping	16	40	2,060	0.001	0.00005	0.0004	0.00003
Drilling supplies	4,950	40	637,160	0.4	0.015	0.1	0.01
Subtotal	9,041	-	908,890	52%	2%	16%	2%
Operation							
Road maintenance	2,011	20	129,460	0.07	0.003	0.02	0.002
Ion exchange resin replacement	88	100	28,320	0.02	0.0007	0.005	0.0005
Subtotal	2,099	-	157,780	9%	0.4%	3%	0.3%

Key: % = percent; - = not applicable; DW = double-walled; km = kilometer; mi = mile; SW = single walled; US = United States

Notes: Operation impacts are occurring annually.

Because the individual impacts are rounded to single digits, their sums may differ from the subtotal impacts.

1 **3.10 HAZARDOUS MATERIALS AND WASTE GENERATION**

2 **3.10.1 HAZARDOUS MATERIALS AND WASTE GENERATION – AFFECTED ENVIRONMENT**

3 Radioactive and chemical wastes are generated by production, maintenance, and remediation
4 activities at LANL. Radioactive wastes categories include (1) low-level radioactive waste, (2)
5 mixed low-level radioactive waste, and (3) transuranic waste including mixed transuranic waste.
6 Chemical wastes categories include (1) hazardous (i.e., designated under RCRA regulations), (2)
7 toxic, (3) hazardous construction and demolition debris, and (4) mining and milling special waste as
8 defined under Subtitle C of the RCRA. Waste quantities vary with different operations,
9 construction activities, and implementation of waste minimization activities. Site-wide capabilities
10 to manage all waste categories generated at LANL are analyzed in the 2008 SWEIS under the solid
11 radioactive and chemical waste facilities and the radioactive liquid waste treatment facility.
12 Activities and capabilities for waste management include waste characterization, packaging, and
13 labeling; waste transport, receipt, and acceptance; waste treatment; waste staging; waste disposal;
14 and radioactive liquid waste treatment. All wastes are handled, treated, transported, and disposed in
15 accordance with Federal and state regulations applicable to specific waste classifications.

16 **3.10.2 HAZARDOUS MATERIALS AND WASTE GENERATION – ENVIRONMENTAL CONSEQUENCES**

17 **3.10.2.1 Proposed Action (Adaptive Site Management)**

18 Under the ASM implementing options, small quantities of industrial (i.e., construction debris) and
19 hazardous wastes would be generated. The annual quantities of these waste categories generated at
20 LANL, as reported in the Annual Site Environmental Reports, are approximately 1,600 tons and
21 40,000 kilograms, respectively. No other category of wastes discussed in Section 3.10.1,
22 *Hazardous Materials and Waste Generation – Affected Environment*, would be generated under any
23 of the implementing options under the Proposed Action.

24 Hazardous waste generation would be associated with the use of ion exchange resins to remove
25 chromium under the non-in-situ mass reduction implementing options, chemicals in field kits used
26 for sample analyses, and well maintenance. Treatment of water for chromium removal would
27 involve the use of ion exchange resins; that resin would then be sampled and analyzed to determine
28 if it is a hazardous material before being returned to the vendor for regeneration. If the sampling
29 and analysis determined the resin to be hazardous, it would be manifested and shipped as a
30 hazardous material and returned to the vendor for regeneration. Under previous mass removal
31 activities involving the use of ion exchange resins, no samples have tested as hazardous.

32 Well maintenance activities would also occur periodically. Wastewater with chemical additives
33 would be produced. The wastewater from this activity would be collected and sampled and then a
34 determination would be made for disposal. It is anticipated that most of the wastewater could be
35 disposed of with other treated waters.

36 All waste would be handled in accordance with LANL’s waste management procedures. The waste
37 quantities generated by all implementing options under the Proposed Action would be minimal, thus
38 impacts to on-site waste operations or off-site disposal facilities are anticipated to be small.

1 **3.10.2.2 Cumulative Impacts**

2 Small quantities of construction debris and hazardous materials and wastes would be generated
3 throughout the duration of all implementing options under the Proposed Action. All waste would
4 be handled in accordance with LANL's waste management procedures. As previously described,
5 impacts on waste management from the Proposed Action would be small. Because impacts would
6 be small, they would not substantially contribute to cumulative impacts on waste management.

7 **3.11 NOISE**

8 **3.11.1 NOISE – AFFECTED ENVIRONMENT**

9 The area surrounding the project site is characterized as being predominantly natural, surrounded by
10 canyonlands with vegetation dotting the landscape. Regionally, elevated noise levels mainly result
11 from vehicular traffic on the highways. The closest manmade structures within the project
12 boundary are numerous access roads and LANL facilities. Primary noise contributors in the project
13 area include natural sounds (e.g., the wind and occasionally wildlife) and manmade sounds,
14 including vehicular traffic and activities associated with DOE and LANL.

15 Within LANL property, the vegetation cover and regional topography quickly attenuate noise and
16 vibrations with distance from the noise source. Because much of LANL is forested and the
17 topography consists of widely varied elevations and rock formations, these factors greatly reduce
18 how far noise and vibration travel from DOE operations. As such, existing noise levels within and
19 surrounding the project area are relatively low.

20 The residential areas closest to the project boundary are in the communities of White Rock and Los
21 Alamos, located 3 miles to the southeast and 2 miles northwest, respectively. Noise-sensitive
22 receptors also include wildlife (see Section 3.6, *Ecological Resources*), the Pueblo de San Ildefonso
23 Indian Reservation (adjacent to the project's southern border) and the Tsankawi section of Bandelier
24 National Monument, about 0.5 miles to the east and across the LANL boundary and SR-4.

25 Within Mortandad Canyon, manmade noise is primarily limited to that associated with periodic
26 Consent Order activities, including vehicular traffic and equipment and machinery operation (DOE,
27 2015). Noise from most of these activities is inaudible in the communities of Los Alamos or White
28 Rock and the Bandelier National Monument (Tsankawi) and are barely audible or are inaudible at
29 the LANL boundary with the Pueblo de San Ildefonso, to the south. Some activities at the east end
30 of the project area are audible at the Pueblo de San Ildefonso boundary, approximately 250 feet
31 from the existing monitoring well R-13. Within Sandia Canyon, manmade noise is primarily from
32 vehicle traffic along East Jemez Road (DOE, 2015).

33 **3.11.2 NOISE – ENVIRONMENTAL CONSEQUENCES**

34 **3.11.2.1 Proposed Action (Adaptive Site Management)**

35 The Proposed Action would generate noise from construction activities and from the use of
36 equipment, machinery, and vehicles, which could affect noise-sensitive receptors. Elevated noise
37 levels would generally be limited to the immediate area of the noise source, with noise levels
38 quickly attenuating from the source due to the topography of the project region (e.g., steep canyon
39 walls would limit the propagation of sound).

Elevated noise levels can affect the health and safety of personnel, result in annoyance/disturbance to receptors nearby, and disturb wildlife. It can degrade the quality of outdoor space, including public recreational areas. Noise-sensitive receptors evaluated for this project include on-site workers, residential areas, the Pueblo de San Ildefonso, the Bandelier National Monument (Tsankawi), public recreational areas, and wildlife.

Project-related noise could adversely impact areas of the Pueblo de San Ildefonso and is discussed in Section 3.7, *Cultural Resources*. Additionally, elevated noise levels could adversely impact wildlife, which is discussed in Section 3.6, *Ecological Resources*.

In general, noise impacts are expected to be greatest during construction of the proposed groundwater treatment facility and new wells. Any adverse noise impacts would generally be minor due to the topography of the project area. Potential noise impacts for each of the Proposed Action options are described in greater detail in the following subsections.

Option 1 – Mass Removal via Expanded Treatment

Option 1 involves the construction of a groundwater treatment facility, well pads, wells, and piezometers. Although the locations of the additional wells and piezometers have not yet been determined, it would be within the boundary of the project area as shown in Figure 3-1.

Site preparation and construction of the proposed facilities, including the groundwater treatment facility and wells, would involve heavy equipment that generate high levels of noise. Drilling of a single well would occur over 5 months. Two wells can be drilled simultaneously, with approximately 6 well pads being constructed in a given year. During construction of a well, drill rigs would be active 24 hours per day, 7 days per week until well installation is completed.

Except for the drilling of wells, all construction activities would occur during the daytime. The transport of equipment, materials, supplies, and personnel would also be limited to daylight hours. Table 3-6 presents typical noise levels of standard heavy construction equipment that could be used during construction.

Table 3-6. Typical noise levels of construction equipment

Construction Equipment	Noise Level (dBA) at 50 Feet
Air Compressor	80
Generator	82
Drill Rig	84
Cement Pump	82
Roller	85
Loader	80
Excavator	81
Dozer	85
Grader	85
Scraper	85
Trucks	84

Sources: (FTA, 2018); (FHWA, 2006)
 Key: dBA = A-weighted decibel

Conservatively assuming simultaneous use of some of the loudest noise-generating construction equipment listed in Table 3-6, intermittent elevated noise levels would be at approximately 91 dBA) (at 50 feet). It is assumed that this noise level would occur for the construction of a treatment facility and associated infrastructure (e.g., pipelines), a well pad, or a well.

1 At 91 dBA (at 50 feet), construction noise levels would attenuate to 71 dBA (at 500 feet), 61 dBA
2 (at 1,500 feet), 57 dBA (at 0.5 miles), and 51 dBA (at 1 mile). Beyond half a mile, any elevated
3 noise levels would likely be faint or not detected as the local topography would substantially lower
4 noise levels to below the noise level estimates. Heavy trucks would typically have noise levels
5 between 74 dBA and 85 dBA at 50 feet (FHWA, 2006). Therefore, heavy trucks could generate
6 noise levels ranging from 54 dBA to 65 dBA at 500 feet.

7 Project-related sound levels would be expected to dissipate to background levels before reaching
8 most publicly accessible areas. The closest residential communities are located over a mile from
9 the closest project boundary and therefore would not detect project-related noise except for small
10 increases in vehicular traffic on SR-4, SR-502, and other major highways serving the LANL region.
11 As the Bandelier National Monument (Tsankawi unit) is located approximately 0.5 miles from the
12 eastern most boundary of the project area and abutting SR-4, it is expected that project-related noise
13 would not be detected or would not be discernable over existing traffic noise on SR-4 at this
14 location.

15 Adverse noise impacts would be minimized to the extent possible by using standard noise controls
16 on equipment (e.g., mufflers) and implementing additional noise control measures, such as project
17 scheduling (e.g., scheduling construction activities outside of the breeding season of the Mexican
18 spotted owl, as outlined in the Threatened and Endangered Species Habitat Management Plan; see
19 Section 3.6, *Ecological Resources*). Personal protective equipment would be used per Occupational
20 Safety and Health Administration (OSHA) regulations to protect on-site personnel. As such,
21 adverse noise impacts would be minor under Option 1.

22 ***Option 2 – Mass Removal with Land Application***

23 Option 2 would involve all activities as discussed under Option 1; therefore, noise impacts as
24 discussed under Option 1 would also be applicable under Option 2. Option 2 includes the additional
25 use of land application and evaporation of treated water as a disposition method. One of the land
26 application methods proposed is the use of 3,000- to 10,000-gallon water trucks with high-pressure
27 sprayers. Trucks would only operate during daylight hours and could be active up to 10 hours per
28 day, for approximately 8 months during the year, as restricted by the NMED DP.

29 Elevated noise levels would be limited to the immediate area surrounding the truck and potential
30 adverse impacts would be limited to personnel and wildlife. Personnel would be required to
31 adhere to OSHA regulations regarding the use of personal protective equipment for the safety of
32 workers. For the protection of wildlife, observance of activity restrictions as outlined in the
33 Threatened and Endangered Species Habitat Management Plan would be observed as discussed in
34 Section 3.6, *Ecological Resources*. As such, adverse noise impacts would remain minor under
35 Option 2.

36 ***Option 3 – Mass Removal via In-Situ Treatment***

37 Option 3 would potentially involve all activities as discussed under Options 1 and 2; therefore,
38 noise impacts as discussed under Options 1 and 2 would also be applicable under Option 3.
39 Additionally, Option 3 includes the use of in-situ treatment for the contaminated groundwater. The
40 in-situ treatment is not expected to generate any additional noise levels except for a limited amount

1 of increase in vehicular traffic from personnel and the transport of equipment or supplies. As such,
2 adverse noise impacts would remain minor under Option 3.

3 ***Option 4 – Monitored Natural Attenuation***

4 Under the MNA option, the proposed new facilities and infrastructure, the amounts of treated water
5 injected into the aquifer and applied to the land, and the duration of land application have the
6 potential to be the same as other options; therefore, noise impacts as discussed under Options 1, 2,
7 and 3 would also be applicable under Option 4. Increases in traffic related to routine well-
8 monitoring activities would be very small. As such, overall noise impacts would remain minor
9 under Option 4.

10 **3.11.2.2 Cumulative Impacts**

11 As previously described, due to the topography of the region, and the general decrease in noise with
12 distance from the source, increases in noise levels would remain near the source and impacts to off-
13 site receptors would be small. Because noise impacts would be small, they would not substantially
14 contribute to cumulative impacts on off-site receptors.

15 **3.12 VISUAL RESOURCES**

16 Visual resources are natural and manmade features that provide character and aesthetic quality to a
17 landscape, which can contribute to public perception and enjoyment of a given environment.
18 Visual resources can describe the collective effect on a viewer of natural landforms, vegetation,
19 water features, and human modifications (structures, infrastructure, and cultural landscape
20 features).

21 **3.12.1 VISUAL RESOURCES – AFFECTED ENVIRONMENT**

22 Much of the development within LANL has occurred out of public view and on mesa tops (DOE,
23 2015; LANL, 2023a). Much of LANL remains undeveloped as grasslands, shrublands,
24 woodlands, and forests. The most visible developments at LANL include a limited number of tall
25 structures; facilities at relatively high, exposed locations; or facilities beside publicly accessible
26 and well-travelled roads. The eight-story National Security Sciences Building is visible from most
27 locations in Los Alamos (DOE, 2015; DOE, 2011).

28 Areas with line of sight to LANL land and facilities include the towns of Los Alamos and White
29 Rock, the Pueblo of San Ildefonso, Bandelier National Monument (including the Tsankawi
30 section), the Santa Fe National Forest, and the Valles Caldera National Preserve. At night, the
31 lights of LANL, Los Alamos, and White Rock can be directly visible from various locations
32 across the viewshed and as far away as the towns of Española and Santa Fe (DOE, 2022a).

33 Over the last several years, light pollution from LANL has become more noticeable in a region
34 where dark skies are noted as a draw for tourism. In 2021, Valles Caldera National Preserve
35 received an International Dark Sky Park Certification and Bandelier National Monument has
36 applied for this certification. An International Dark Sky Park is a land area possessing an
37 exceptional or distinguished quality of starry nights and a nocturnal environment specifically

1 protected for its scientific, natural, educational, cultural heritage, and/or public enjoyment.
2 However, this certification does not carry any legal or regulatory authority (International Dark
3 Sky, 2023; PEEC, 2023).

4 The Cerro Grande fire of 2000 burned approximately 9,000 acres and 100 buildings on LANL but
5 virtually all portions of the Laboratory were affected (LANL, 2002). Prior to the Cerro Grande
6 Fire, the view of most LANL property from many stretches of area roadways and other viewsheds
7 was woodlands and low brushy areas. Although the visual environment remains diverse and
8 panoramic, portions of the visual landscape affected by the fire are stark, with burn scars still
9 noticeable in many places and rock layers underlying burned forest areas visible. Grasses and
10 shrubs are slowly replacing forest stands, thus contributing to the visual contrast between the
11 burned and unburned areas for many years to come (DOE, 2011).

12 The project area includes TA-05, located in the north-central area of LANL. The footprint of
13 TA-05 encompasses both mesa tops and a large, open area in the bottom of Mortandad Canyon.
14 TA-05 was established in the 1940s as a research-scale test-firing site but has remained largely
15 undeveloped to the present day. The overall visual character of the project area is mixed, with
16 large portions of the Mortandad Canyon rim and slopes undeveloped, with vegetation consisting
17 of juniper savannas, piñon juniper woodlands, and grasslands (see Section 3.6, *Ecological*
18 *Resources*, for a more detailed description of vegetation and flora at LANL and in the project area)
19 (DOE, 2015). The only substantial physical assets within TA-05 are the Eastern TA Substation
20 Complex and a variety of other utility infrastructure, including those associated with the interim
21 measure, including groundwater wells, overhead electrical lines, water lines, water treatment and
22 equipment storage buildings, and roads that generally run west to east with the topography
23 (LANL, 2022a). Within Sandia Canyon, the most prominent feature in the viewshed is East
24 Jemez Road to the north (DOE, 2015).

25 **3.12.2 VISUAL RESOURCES – ENVIRONMENTAL CONSEQUENCES**

26 **3.12.2.1 Proposed Action (Adaptive Site Management)**

27 *Option 1 – Mass Removal via Expanded Treatment*

28 Under Option 1, there would be little to no substantial dominant visual change in Mortandad
29 Canyon or Sandia Canyon as observed from outside vantage points, no substantial change in
30 visibility caused by predicted air pollutant emissions (impacts to air quality are discussed in
31 Section 3.5.2.1, *Proposed Action (Adaptive Site Management)*), no conflict with Federal land
32 management agency visual standards, and no long-term dominant visual interruption of existing or
33 unique viewsheds. Direct visual observation in the project area is locally limited to portions of
34 Los Alamos to the north and the Pueblo of San Ildefonso to the east, where a small portion of the
35 Mortandad Canyon is visible.

36 Construction activities associated with Option 1 could potentially affect scenic views and visibility
37 from the visual intrusion of vehicles, equipment, workers, vegetation clearing, and new
38 infrastructure. However, these impacts would be temporary and limited to the two-year window
39 estimated for the construction of the treatment facility and monitoring, extraction, and injection
40 wells.

1 As discussed in Section 3.5.2.1, *Proposed Action (Adaptive Site Management)*, air emissions
2 associated with Option 1 have the potential to affect the Tsankawi section of Bandelier National
3 Monument. However, implementation of BMPs and mitigation measures identified in that section
4 would ensure that air quality-related values would be negligibly affected within the Monument.

5 Although construction activities would be conducted 24 hours a day, few impacts are expected
6 from light pollution, as light sources would be small, localized, and downward pointing. The
7 treatment facility would operate during nighttime, but exterior lighting of the facility would be
8 expected to comply with LANL Master Specifications, STD-342-200, Section 26 5600, *Exterior*
9 *Lighting*, which indicates that each exterior lighting unit exceeding 6,400 lumens⁸ would comply
10 with the New Mexico Night Sky Protection Act and no light would be emitted above a horizontal
11 plane through the lowest light-emitting part of the unit.

12 **Option 2, 3, and 4**

13 Impacts to visual resources during construction and operation would be nearly identical to those
14 described under Option 1. Land application of treated water would occur in permitted areas
15 encompassing about 50 acres of land. The areas for land application under Option 2 are the same
16 as those currently available for this activity under the interim measure. As with Option 1, the
17 implementation of BMPs and mitigation measures under Options 2 and 3, and would ensure that
18 less than significant impacts to visual resources would result from the Proposed Action.

19 **3.12.2.2 Cumulative Impacts**

20 As previously described, impacts on visual resources from the Proposed Action would be small.
21 Because impacts would be small, they would not substantially contribute to cumulative impacts on
22 visual resources.

23 **3.13 HUMAN HEALTH AND WORKER SAFETY**

24 **3.13.1 HUMAN HEALTH AND WORKER SAFETY – AFFECTED ENVIRONMENT**

25 **3.13.1.1 Human Health**

26 For this EA, the topic of human health encompasses the baseline health condition of area residents,
27 workers, and uninjured workers who could be negatively or positively affected by implementation
28 of a project.

29 The nature of some LANL activities present potential human health risks that are avoided or
30 mitigated through operational controls and verified through monitoring. Health risks can be caused
31 through exposure to chemicals or radionuclides (through ingestion, respiration, or skin contact) or
32 from direct physical harm. The LANL 2021 *Annual Site Environmental Report* (LANL, 2022b) and
33 2021 SWEIS Yearbook (LANL, 2023a) gives descriptions of the public health baseline,
34 radionuclides, and chemicals in the environment surrounding LANL. Annual air, water, soil, and

⁸ For comparison, a standard 60-watt incandescent light bulb produces about 800 lumens of light.

1 biota monitoring data indicate public exposures to LANL emissions are maintained at or below
2 permitted or recommended levels and protect public health and welfare.

3 The project area is located in an access-controlled portion of LANL. The nearest residential areas
4 are two neighborhoods of the Los Alamos townsite, each about 2 miles to the northwest of the
5 project area, and within White Rock, about 3 miles to the southeast. The nearest publicly accessible
6 locations to the project area are along East Jemez Road, approximately 0.2 miles to the north, and
7 along the boundary between the Pueblo de San Ildefonso and LANL, about 250 feet south of
8 monitoring well R-13 (Figure 3-1). DOE recognizes that the area immediately south of the
9 boundary between the Pueblo de San Ildefonso and LANL near the project area is actively used by
10 members of the Pueblo year-round.

11 The regional aquifer is the primary source of drinking water for Los Alamos County residents.
12 Water supplied by the LADPU meets all Federal and state drinking water standards. Chromium in
13 public water supply wells is monitored by LANL and LADPU (see Section 3.4.1, *Water Resources*
14 – *Affected Environment*).

15 **3.13.1.2 Worker Safety**

16 Operations at LANL are required to comply with the DOE requirements for worker health and
17 safety. DOE environmental, safety, and health programs regulate the work environment and seek to
18 minimize the likelihood of work-related exposures, illnesses, and injuries. These programs are
19 controlled by the safety and health regulations for DOE contractor workers governed by 10 CFR
20 851, which establishes requirements for worker safety and health programs to ensure that DOE
21 contractor workers have a safe work environment. Provisions are included to protect against
22 occupational injuries and illnesses, accidents, and hazardous chemicals.

23 For the 12-month period ending January 2022, LANL recorded a total recordable case (TRC) rate of
24 1.65, and days away, restricted, or transferred (DART) rate of 0.51 per 200,000 hours worked
25 (DOE, 2023). These rates compare favorably with 2022 Federal rates (TRC 1.05, DART 0.77)
26 (DOE, 2023) and New Mexico rates (TRC 2.8, DART 1.4) (U.S. Bureau of Labor Statistics, 2023).

27 **3.13.2 HUMAN HEALTH AND WORKER SAFETY – ENVIRONMENTAL CONSEQUENCES**

28 **3.13.2.1 Proposed Action (Adaptive Site Management)**

29 **Human Health**

30 Under the ASM implementing options, project activities would not involve direct hazards to the
31 public. The regional aquifer is the primary source of drinking water for Los Alamos County
32 residents. Water supplied by the LADPU meets all Federal and state drinking water standards.
33 Chromium in public water supply wells is monitored by LANL and LADPU (see Section 3.4.1,
34 *Water Resources – Affected Environment*). While low concentrations (4 to 10 µg/L) of Cr(VI)
35 due to natural conditions are detected in many of the wells screened in the regional aquifer, there
36 is no indication that this plume has affected water supply wells. Access to the Mortandad
37 Canyon portion of the project area is restricted and not readily accessible to the public. Sandia
38 Canyon, while not fenced from East Jemez Road, is posted as “no trespassing.” Noise-
39 generating activities and fugitive dust would be unlikely to affect members of the public at the
40 nearest publicly accessible points. Land application of treated water would be in accordance
41 with an NMED DP and would not pose inhalation risks to members of the public. The

1 hexavalent chrome, when removed from groundwater, would be disposed of in accordance with
2 state and Federal regulations. Extracted and treated groundwater to be used for injection, land
3 spreading, or mechanical evaporation would meet all state and Federal regulatory permits.
4 Introduction of any compounds into the aquifer as part of in-situ treatment would be
5 implemented under approved permits from NMED.

6 The level of exposure to hazards, the regulatory requirements for managing those hazards, and
7 existing exposures are not anticipated to change. Therefore, the direct, indirect, and cumulative
8 impacts from exposure to normal industrial hazards would be small. Effects on human health
9 would be negligible.

10 **Worker Safety**

11 Activities planned under the Proposed Action would not be expected to have any adverse health
12 effects on workers. Under the ASM implementing options, various heavy equipment would be used
13 for well installation: front end loader, bulldozer, grader, dump truck, drill rig, and forklift. Pipeline
14 installation would require an excavator or trencher, loader, and dump trucks. Electrical installation
15 would require an auger and a line truck. Road maintenance would require a grader. Water trucks
16 would be used to land-apply water. A forklift would also be used occasionally for moving supplies.

17 Primarily support and maintenance contractors would be involved in site clearing, earth moving,
18 heavy-equipment operations, access road maintenance, well drilling, electrical installation, and
19 land-application activities. LANL employees would serve mostly in oversight roles.

20 Approximately 120 workers would be involved during periods of peak activity. Applicable safety
21 and health training and monitoring, personal protective equipment (e.g., steel-toed boots, hardhats,
22 hearing protection), and work-site hazard controls would be required for workers.

23 Potentially serious exposures to various hazards or injuries are possible during the infrastructure
24 development activities. Hazards include direct injury; noise; heat stress; slips, trips and falls; and
25 rattlesnake bites. Effects could range from relatively minor events (such as cuts or sprains) to major
26 injuries (such as broken bones or fatalities). To minimize the potential of serious injuries, workers
27 would be required to adhere to a health and safety plan while performing project activities.

28 Adherence to an approved plan, use of personal protective equipment and engineered controls, and
29 completion of appropriate hazards training would be expected to help prevent adverse acute or
30 chronic health effects to workers.

31 Adverse health effects associated with Cr(VI) exposure include occupational asthma, eye irritation
32 and damage, perforated eardrums, respiratory irritation, kidney damage, liver damage, pulmonary
33 congestion and edema, upper abdominal pain, nose irritation and damage, respiratory cancer, skin
34 irritation, and erosion and discoloration of the teeth. Some workers can also develop an allergic
35 skin reaction, called allergic contact dermatitis. This reaction occurs from handling liquids or solids
36 containing Cr(VI). However, workers are unlikely to contact or be exposed to chromium
37 contaminated groundwater because extracted groundwater in pumped through pipes to the treatment
38 facility through pipes where it treated by ion exchange. There is a potential for exposure to Cr(VI)
39 chromium contaminated groundwater during well drilling, operational maintenance, and during
40 changeout of ion exchange vessels.

1 Per 10 CFR 851 (2012), employee exposures to hazardous agents are maintained below the
 2 American Conference of Governmental Industrial Hygienists threshold limit values, the OSHA
 3 permissible exposure limits, and other applicable standards as defined by DOE.

4 Standard industrial hazards are hazards that are routinely encountered in general industry and
 5 construction; for these hazards national consensus codes and standards, such as OSHA standards
 6 and DOE-prescribed occupational safety and health standards, guide project activities.

7 The level of exposure to industrial hazards, the regulatory requirements for managing those hazards,
 8 and existing exposures are not anticipated to change. Therefore, the direct and indirect impacts
 9 from exposure to normal industrial hazards would be small.

10 **3.13.2.2 Cumulative Impacts**

11 As previously described, impacts on human health and worker safety from the Proposed Action
 12 would be small. Because impacts would be small, they would not substantially contribute to
 13 cumulative impacts on human health and worker safety.

14 **3.14 SOCIOECONOMICS**

15 Industrial projects have the potential to affect the socioeconomic dynamics of the communities in or
 16 around which they are situated. Capital expenditures and the migration of workers and their families
 17 into a community may influence factors such as regional income; employment levels; local tax
 18 revenue; housing availability; and area community services such as healthcare, schools, and law
 19 enforcement (police and fire). The Proposed Action includes the implementation of optional
 20 measures to remediate the Cr(VI) contaminated groundwater below Sandia and Mortandad Canyons.

21 **3.14.1 SOCIOECONOMICS – AFFECTED ENVIRONMENT**

22 This EA focuses primarily on population, employment and unemployment, as well as income and
 23 housing data, where the potential for adverse impact from an in-migrating population (workers and
 24 their families) would be greatest. Specifically, summary data are evaluated for the socioeconomic
 25 ROI, which is defined for this analysis as a four-county region encompassing the Los Alamos
 26 County (host county for LANL) and immediately adjacent counties (Rio Arriba, Sandoval, Santa Fe
 27 Counties) in New Mexico, where the majority of workers for proposed chromium plume
 28 remediations would be expected to reside and spend most of their salary. This is also where the
 29 majority of the current LANL workforce resides. Detailed county and subject-specific data tables
 30 are provided in Appendix C, *Environmental Resources Supporting Information*. Summary data for
 31 2021 (LANL, 2023a; USCB, 2023a; USCB, 2023b; USCB, 2023c; USCB, 2023d) for the ROI are
 32 included in Table 3-7:

33 **Table 3-7. Region of influence summary data for select socioeconomic conditions**

Parameter	Los Alamos	ROI	New Mexico
Population			
2022	19,187	368,400	2,113,344
2021	19,169	360,475	2,109,366
2020	19,419	363,439	2,117,522
2010	17,950	333,027	2,059,179
Housing			

Parameter	Los Alamos	ROI	New Mexico
Total units	8,593	161,833	937,397
Occupied	8,029	140,745	297,596
Vacant	564	21,088	139,801
Vacancy rate	6.6%	13%	14.9%
	0.9% vacancy rate for owner occupied units 1.7% rental vacancy rate	1.1% vacancy rate for owner occupied units 5.5% rental vacancy rate	1.5% vacancy rate for owner occupied units 7.3% rental vacancy rate
Median value	\$343,100	\$179,800 (lowest value in Rio Arriba County)	\$184,800
Income			
Median Household income	\$123,677	\$46,994 (lowest value in Rio Arriba County)	\$54,020
Per capita income	\$64,521	\$25,342 (lowest value in Rio Arriba County)	\$29,624
Employment			
Civilian labor force	10,599	171,734	952,564
Employed	10,269	161,591	889,428
Unemployed	330	10,143	63,136
Unemployment rate	3.1%	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)]	Rio Arriba: 2,175 (15.5%) [2,191 CY 2021] Sandoval: 580 (4.1%) Santa Fe: 3,460 (24.6%) [3,239 CY 2021]	Other NM: 1,558 Outside NM: 1,056

Sources: (LANL, 2023f; LANL, 2023e; USCB, 2023a; USCB, 2023b; USCB, 2023c; USCB, 2023d)

Key: % = 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

1 LANL benefits New Mexico by creating jobs, generating income, and purchasing goods and
2 services from local businesses. Local DOE activities directly and indirectly account for more than a
3 third of employment, wage and salary income, and business activity in the region. Based on a 3-
4 year study, LANL expended an average of \$752.6 million on procurement of goods, services, and
5 construction within the ROI, New Mexico, and out of state. Just over one-half of those purchases
6 were from New Mexico-based businesses (UNM, 2019). Expenditures by LANL and its full-time
7 equivalents generated \$1.65 billion in sales for businesses within the ROI.

8 As of 2018, LANL had a total direct labor income of \$1.34 billion. Indirectly, LANL supported
9 19,122 jobs and those jobs equal \$1.57 billion in labor income to the State of New Mexico (UNM,
10 2019). An update to the 2019 Economic Report identified the annual salary at LANL at 1.53 billion
11 (\$689,636,978 in Los Alamos County) and the Laboratory spent \$915,988,873 on procurement in
12 New Mexico (LANL, 2023e).

13 3.14.2 SOCIOECONOMICS – ENVIRONMENTAL CONSEQUENCES

14 The trigger for adverse socioeconomic impacts is the need to relocate construction and operations
15 workers, and their families, into local communities. The severity of socioeconomic impacts is
16 proportional to the level of stress placed on housing and community services (i.e., educational
17 services, police, fire, and health services) by the relocated workers and their families. In addition,
18 the increases in jobs and income from construction and operation of the proposed facilities would
19 have both direct and indirect impacts on the local and regional economy. To the extent these

1 increases would help reduce existing unemployment levels and boost the economy through
2 increased income and revenue, they are considered to be beneficial.

3 The estimated workforce for each of the ASM options and the No Action Alternative are detailed in
4 Appendix B, *Description of Alternatives Supporting Information*, Table B-1. The total peak
5 workforce is anticipated to be 75 workers for the No Action Alternative and 120 workers for ASM
6 options. The number of total workers who would migrate into the area (associated with drilling
7 crews) would include 24 and 36 for construction and operations, respectively, for each ASM option
8 and 16 and 24 construction and operation personnel, respectively, under the No Action Alternative.
9 Indirect jobs created as a result of the Proposed Action would be small (a maximum of 100, based
10 on a multiplier of 1.06 used in the 2008 SWEIS) and are assumed to be local hires within the ROI,
11 resulting in no population influx.

12 For construction and operation of the new treatment facility, it is assumed that the same
13 employees counted in the drilling crews also would construct the facility, and that operation of
14 the facility would be conducted by existing contractor staff. Based on the short-term nature of
15 the work, it is unlikely that the drilling crews would bring their families with them. However,
16 the analysis assumes they would bring their families in order to provide a more conservative
17 bounding scenario. In some cases, the same worker may stay on to drill subsequent wells on-site
18 during the course of the project. It is estimated that 50 to 75 (all ASM options) of these
19 employees (and their families), or 81.1 percent, would live within the ROI based on existing
20 residence rates.

21 **3.14.2.1 Proposed Action (Adaptive Site Management)**

22 The direct workforce requirements for the ASM options would be very small and comprise <0.1
23 percent of the existing workforce in the region (0.02 percent). Similarly, the total population influx
24 from implementing any of the ASM options would comprise <0.1 percent of the total population in
25 the region (0.02 percent). Each would represent approximately 0.3 percent and 0.5 percent of the
26 existing workforce and total population, respectively, in Los Alamos County (host county), if all
27 were to relocate there. For comparison, only 25 percent of the LANL employees currently reside in
28 Los Alamos County. Furthermore, due to the temporary nature of the well drilling work, the
29 majority (if not all) of the in-migrating workforce would be expected to find temporary (i.e., rental)
30 housing and not purchase a new home.

31 Potential adverse impacts from the Proposed Action options would be expected to be small on the
32 housing market and community services within the ROI because the expected worker and
33 population influx is expected to be very small. With respect to housing, a 2019 study on the Los
34 Alamos County housing market needs identified a housing shortage for both rental homes and
35 available homes for sale. However, it also identified housing projects in the development pipeline,
36 including development on properties that the county has released to developers for affordable rental
37 housing and market rate single family and rental housing (LAC, 2019). In addition, not all in-
38 migrating workers would necessarily settle in Los Alamos County, but rather would be expected to
39 distribute throughout the ROI (as only 25 percent of the existing LANL workforce currently reside
40 in Los Alamos County), and there are a large number of vacant units within the ROI. Finally,
41 temporary accommodation (e.g., hotels, motels, and mobile home parks) also could help supplement
42 the available housing vacancies if needed.

The small increase in employment (direct and indirect jobs) from both construction and operation would be expected to result in small and beneficial impacts on the local economy and ROI from the increase in jobs, income and salaries, as well as expenditures and revenue from state and local taxes. The extent of beneficial impacts would depend on the number of jobs created and where the new workers choose to reside within the ROI (e.g., distributed evenly or targeting one county).

3.14.2.2 Cumulative Impacts

As previously described, the expected population influx associated with the ASM options would be small and no adverse effects have been identified. Because impacts would be small, they would not substantially contribute to cumulative impacts on socioeconomics. Potential beneficial economic impacts from the creation of new jobs would be small but would further support LANL’s already significant role in supporting the local and regional economies.

3.15 ENVIRONMENTAL JUSTICE

Environmental justice is 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. The background and affected environment information in this section summarizes information and supporting data tables found in Appendix C, *Environmental Resources Supporting Information*, Section C.6.

3.15.1 ENVIRONMENTAL JUSTICE – AFFECTED ENVIRONMENT

The proposed ROI for environmental justice in this EA is a 5-mile radius surrounding the project area; this is a conservative approach that includes an area slightly larger than the defined project area (e.g., used analysis of groundwater and health and safety impacts) to ensure full capture of nearby populated areas and Tribal lands areas (see Appendix C, *Environmental Resources Supporting Information*, Section C.6, for additional information regarding the ROI). 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. The small portion of Sandoval County has no population found there. The analysis of minority and low-income populations focuses on U.S. Census Bureau (USCB) data for geographic units (i.e., block groups) that represent, as closely as possible, the potentially affected areas. Table 3-8 shows the minority and low-income composition of the potentially affected area surrounding the chromium plume.

Table 3-8. Communities within 5 miles of groundwater plume, Los Alamos National Laboratory, New Mexico

Area Name	Total Population 7/1/22	Minority	% Minority	Population for Whom Poverty is Determined 2021 [past 12 months]	Low-Income Population	% Low Income
New Mexico	2,109,366	1,349,449	64.3%	2,067,620	378,896	18.3%
Los Alamos County, New Mexico [includes Census tracts 1-4]	19,169	5,608	29.2%	19,092	802	4.2%

Area Name	Total Population 7/1/22	Minority	% Minority	Population for Whom Poverty is Determined 2021 [past 12 months]	Low-Income Population	% Low Income
Sandoval County [Census tract 9403]	147,327	85,519	58%	148,075	15,023	10.3%
Santa Fe County, New Mexico [census tracts 102.04, 109, 9403]	153,632	88,666	57.7%	151,070	18,515	12.3%
Rio Arriba County, New Mexico [census tract 9408]	40,347	35,580	88.2%	40,137	8,951	22.3%
Block Group by Tract	Total Population	Minority	% Minority	Population for Whom Poverty is Determined	Low-Income Population	% Low Income
Census Tract 4 Block Group 2	1083	601	55.5%	1,083	86	7.9%
Census Tract 9403* Block Group 1	822	743	90%	812	165	20.3%
Census Tract 9408 Block Group 3	1,427	1400	98%	1,422	311	21.9%

Source: (USCB, 2023)

Key: % = percent; NM = New Mexico; ROI = region of influence

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.

1 Minority populations were evaluated using the Fifty Percent analyses for potentially affected block
2 groups within the ROI, which offers a more conservative approach (i.e., results in larger numbers)
3 in identifying minority populations given the already high percentage of minorities in the reference
4 community (i.e., state of New Mexico), at 64.3 percent. If a block group's percentage of minority
5 individuals was >50 percent of the total population, then the block group was identified as having a
6 minority population. This is consistent with the method used in the SWEIS (DOE, 2008). According
7 to 2021 census data, approximately 8,030 individuals out of 23,283, residing within the 5-mile
8 radius of the plume were identified as minority population, which represents approximately 34
9 percent of the study area population. Based on Census data, three of the 21 block groups within the
10 ROI have a percentage that exceeds the 50 percent threshold for minority populations (Table 3-8).

11 The total population of New Mexico for whom poverty is determined is 2,067,620, of which 18.3
12 percent would be considered members of a low-income population. Census block groups were
13 considered low-income block groups if the percentage of the populations living below the Federal
14 poverty threshold exceeded 18.3 percent. Based on Census data, two of the 21 block groups within
15 the ROI have percentages that would meet the threshold for low-income populations (Table 3-8).
16 However, it should be noted that two additional blocks (Census Tract 102.4, Block Group 2, and
17 Census Tract 109, Block Group 2), have percentages that are just under the threshold, at 17.6 and
18 17.1 percent, respectively. According to 2021 Census data, approximately 1,602 individuals
19 residing within the 5-mile radius of LANL were identified as living below the Federal poverty
20 threshold, which represent approximately 6.9 percent of the study area population.

21 Detailed minority and low-income population results for each block group within the 5-mile radius
22 is found in Appendix C, *Environmental Resources Supporting Information*, Table C-5. Another
23 useful tool of note to explore the locations of disadvantaged populations (including federally

1 recognized Tribes) within the U.S. is the Climate and Economic Justice screening
2 (<https://screeningtool.geoplatform.gov/en/#6.84/36.223/-96.082>). To respect Tribal sovereignty
3 and self-government, and to fulfill Federal trust and treaty responsibilities to Tribal Nations, land
4 within the boundaries of federally recognized Tribes are designated as disadvantaged on the map.

5 The four Accord Tribes (Santa Clara Pueblo, Pueblo de Cochiti, Pueblo of Jemez and Pueblo de San
6 Ildefonso) have individual cooperative agreements that enable the Los Alamos Pueblos Project
7 Tribal program personnel to obtain the training to monitor and sample soil, air, groundwater, and
8 other media, and facilitate development of Pueblo environmental programs to analyze and monitor
9 the impact, if any, of DOE operations to Pueblo lands (EM-LA, 2021).

10 **3.15.2 ENVIRONMENTAL JUSTICE – ENVIRONMENTAL CONSEQUENCES**

11 **3.15.2.1 Proposed Action (Adaptive Site Management)**

12 Although there are minority and low-income populations located within the ROI, impacts would not
13 be disproportionate and adverse. No affected block groups are located directly within the
14 contaminated plume boundary, although Census Tract 9403 is located directly east and south of the
15 plume, both on Pueblo de San Ildefonso Tribal lands. With the implementation of best management
16 practices, potential impacts from all proposed ASM options are expected to be minor (to no
17 impacts). In particular, there would be no direct health and safety impacts on the surrounding
18 public, as described in Section 3.13.2, *Human Health and Worker Safety – Environmental*
19 *Consequences*. Therefore, no adverse impacts would be anticipated to nearby minority and low-
20 income populations, including the Pueblo.

21 It should be noted that consultation with the Tribes for this proposal is ongoing, and cultural
22 resources in the APE within the Pueblo de San Ildefonso, as well as the Tribal cultural resources
23 concerns for the chromium plume area have yet to be identified. While some cultural impacts
24 would be expected to disproportionately affect members of the Pueblo de San Ildefonso (e.g.,
25 generation of noise and artificial lighting during infrastructure development, presence of nearby
26 work on traditional hunting activities, visual impacts to viewshed over the Sacred Area from Tribal
27 lands), addressing such impacts through regular consultation with the Pueblo people to address and
28 mitigate these impacts, including avoiding to the maximum extent possibly any potentially impacted
29 resources, would help limit the impacts, as discussed in Section 3.7, *Cultural Resources*.

30 Furthermore, as previously described and in Appendix C, *Environmental Resources Supporting*
31 *Information*, Section C.6, DOE maintains cooperative agreements with four Pueblos to develop and
32 maintain groundwater monitoring programs, among other media, including the development of
33 Pueblo environmental programs to analyze and monitor the potential impact of DOE operations to
34 Pueblo lands. EM-LA also provides numerous educational and training briefings to Pueblo members
35 to enhance awareness of ongoing efforts regarding remediation and reduction of legacy waste and
36 continues to pursue additional opportunities to inform, train, and educate these disadvantaged
37 communities regarding ongoing cleanup projects in and around LANL (EM-LA, 2021).

38 EM-LA has reached out to the four Accord Pueblos as part of the NEPA process for this EA,
39 including an offer for in-person consultation and an in-person meeting with Pueblo de San Ildefonso,
40 as the project ROI extends onto their lands (Chandler, 2023). In addition, Pueblo site-specific

1 training has been held with EM-LA and contractor staff to enhance cultural awareness and
 2 strengthen the DOE consultation capacity (see Appendix C.6 for recent Tribal outreach efforts).

3 **3.15.2.2 Cumulative Impacts**

4 Implementation of the ASM options would not result in adverse impacts in the resource areas of
 5 concern for minority and low-income population, especially health and safety. In addition, the
 6 Proposed Action would not have lasting or irreversible adverse effects. Therefore, the Proposed
 7 Action would not contribute to potential cumulative impacts on minority and low-income
 8 populations when combined with past, present, and reasonably foreseeable actions occurring at
 9 LANL.

10 Potential long-term impacts relating to changing climate conditions could disproportionately
 11 affect environmental justice communities located near LANL, as described in Section 3.5, *Air*
 12 *Quality*. These include potential negative impacts on subsistence farming, which occurs in the
 13 neighboring Pueblos, and potential displacement from increased flooding to communities located
 14 within canyons. Implementation of DOE’s 2021 Climate Adaptation and Resilience Plan, which
 15 requires coordination, information sharing, engagement opportunities and necessary resource
 16 provisions (where identified), would mitigate climate change impacts to environmental justice
 17 communities near LANL from activities associated with the Proposed Action.

18 **3.16 CONCLUSION**

19 Table 3-9 lists a summary of the anticipated environmental impacts from the No Action Alternative
 20 and the Proposed Action. Implementing the Proposed Action would not result in any significant
 21 adverse impacts. In addition, these impacts, in conjunction with other past, present, and reasonably
 22 foreseeable future actions, would not result in discernible cumulative impacts.

23 **Table 3-9. Summary of environmental impacts for the No Action Alternative and the**
 24 **Proposed Action**

Resource Area	No Action Alternative ^(a)	Proposed Action
Land Use	Activities would take place within the LANL boundary in an area of active groundwater investigation; activities would be compatible with existing land uses.	Activities would take place within the LANL boundary in an area of active groundwater investigation; activities would be compatible with existing land uses.
Geology and soils	Installation and operation of extraction and injection wells would have minimal to negligible effects to geology. Small effects to soil profiles would occur from soil disturbance associated with grading.	Installation and operation of wells would have little to no impacts on geology. Some soil erosion by wind and stormwater would likely occur in disturbed areas. Soil erosion would be controlled by adherence to BMPs and would be minor.
Groundwater	Nearby Los Alamos County water-supply wells draw water from the regional aquifer. Pumping from proposed extraction wells would result in temporary increases in drawdown of up to 6.4 feet at county wells in the Pajarito Mesa wellfield. This drawdown would likely not affect	Well construction would have minor impacts on water quality and minor temporary impacts on water levels. Operating extraction wells would alter the groundwater quality by reducing the chromium concentration in the well’s vicinity. Similarly, injection wells would alter the groundwater quality by

Resource Area	No Action Alternative ^(a)	Proposed Action
	<p>the economic or physical characteristics of the wells. Water injected into the aquifer through injection wells, land-applied, or evaporated would meet NMED Ground Water Quality Bureau permit standards; activities would not increase the flow of contaminants into groundwater.</p>	<p>injecting treated water. The intent overall is to return the majority of extracted water back into the regional aquifer. Water injected into the aquifer through injection wells, land-applied, or evaporated would meet NMED Ground Water Quality Bureau permit standards. The Proposed Action would have positive environmental consequences from chromium mass reduction.</p>
Surface water	<p>Stormwater runoff from activities would be controlled through best management practices; effects on surface-water quality or quantity would be minimal.</p>	<p>Soil disturbance resulting from infrastructure development, operation, and maintenance activities could result in sedimentation to surface waters. With anticipated soil disturbance totaling 75 acres and implementation of BMPs, potential environmental consequences to surface waters are expected to be minor.</p>
Air quality	<p>Activities would produce criteria-pollutant, hazardous air-pollutant, and/or greenhouse-gas emissions from earth-moving activities (dust), use of equipment (exhaust), and operation of mechanical evaporators (particulate matter). Effects on air quality would be small to negligible.</p>	<p>The Proposed Action would result in air emissions of criteria pollutants, hazardous air pollutants, and greenhouse gas emissions from road construction, installation of well pads, well development, pipeline installation, and construction of the treatment facility. The intermittent nature of operational emissions and emissions from installation activities, in combination with air quality mitigation measures, would not contribute to an exceedance of an ambient air quality standard at locations outside the LANL site. Impacts to air quality would be minimal.</p>
Ecological resources	<p>A portion of the activity area lies within buffer habitat for the Mexican spotted owl. Potential effects to the Mexican spotted owl from direct disturbance, noise, or treated-water disposition would be avoided through annual biological surveys to ensure the project area is not occupied or nest locations are farther than 1,300 feet from project activities and restricting activities, such as land application within the buffer area, from March 1 to August 31. Activities are not likely to affect the Mexican spotted owl, migratory birds, other sensitive species, or floodplain/riparian habitat.</p>	<p>Impacts to ecological resources from could include temporary and permanent disturbances; degradation or loss of habitat from land clearing activities; disturbance or displacement of wildlife due to an increase in noise and human activity; habitat fragmentation; and an increase in human-wildlife interactions. The Proposed Action would follow all BMPs, monitoring plans and measures related to ecological resources established for LANL. Implementing the Proposed Action with identified controls would not result in significant impacts to these species or resources.</p>
Cultural resources	<p>Historic properties would be avoided during activities, including construction,</p>	<p>Historic properties would be avoided to the maximum extent possible during</p>

Resource Area	No Action Alternative ^(a)	Proposed Action
	<p>maintenance, and land application of treated water. Road improvements would be used to minimize the risk of impacts to archaeological sites from road use and maintenance. Stormwater runoff control measures would be employed to minimize erosion.</p>	<p>Proposed Action activities. Erosion control measures would be incorporated to limit direct and indirect impacts to archaeological sites from stormwater runoff or erosion. Regular consultation with Pueblos de San Ildefonso would be implemented to discuss how to best limit impact. No significant impacts to archaeological or historic properties would be anticipated.</p>
Utilities and infrastructure	<p>Electricity to operate project infrastructure would be supplied from existing power lines; impacts to electrical infrastructure would be small. The potable water supply and existing water-supply infrastructure would accommodate project use; effects on water infrastructure would be negligible. Unpaved access roads to new well pads would be constructed and measures would be taken to construct and/or maintain roads in a manner protective of archaeological sites; effects on road infrastructure would be small.</p>	<p>The proposed chromium treatment facility would require a connection to the existing LANL electrical system. No new electrical lines would be required for connection. The potable water supply and existing water-supply infrastructure would accommodate project use. Impacts to electrical and water infrastructure would be minor. The project area is largely in a less frequently travelled area of LANL. Other than construction of new access roads, activities would not affect road infrastructure, and overall effects on the road infrastructure at LANL would be minimal.</p>
Traffic and transportation	<p>Only small amounts of traffic would be generated by the No Action Alternative activities; effects on traffic would be negligible.</p>	<p>The Proposed Action would increase the number of personal commuter vehicles and number of truck deliveries for the construction of the groundwater treatment facility, well pads, wells, and piezometers. Routine daily traffic volumes would be expected to decrease after construction of the proposed groundwater treatment facility is completed. Proposed traffic improvements (a new Pajarito Road roundabout and widening of Diamond Drive) would help alleviate congestion and traffic safety issues on Pajarito Road. As such, adverse traffic impacts are expected to be minor.</p>
Hazardous materials and waste generation	<p>Small quantities of construction debris, approximately 30 gal per year of hazardous waste, and approximately 50,000 gal of treated water annually from maintenance at each injection well would be generated. All waste would be handled in accordance with LANL's waste management procedures. Impacts to on-site waste operations or off-site disposal facilities would be</p>	<p>Small quantities of industrial (i.e., construction debris) and hazardous wastes would be generated. Waste would be handled in accordance with LANL's waste management procedures. The waste quantities generated would be minimal, thus impacts to on-site waste operations or off-site disposal facilities are anticipated to be small.</p>

Resource Area	No Action Alternative ^(a)	Proposed Action
Noise	<p>small.</p> <p>Heavy equipment would be used during some project activities; noise generated would be confined to locations near the project area and effects would be small.</p>	<p>The Proposed Action would generate noise from construction activities and from the use of equipment, machinery, and vehicles, which could affect noise-sensitive receptors. Elevated noise levels would generally be limited to the immediate area of the noise source and are expected to dissipate before reaching publicly accessible areas. Any adverse noise impacts would generally be minor.</p>
Visual resources	<p>There would be no substantial dominant visual change as observed at sensitive viewer locations, no substantial change in visibility caused by predicted air pollutant emissions, no conflict with visual standards identified by a Federal land management agency, and no long-term dominant visual interruption of unique viewsheds; impacts to visual resources would be small.</p>	<p>There would be little to no substantial dominant visual change in Mortadad Canyon or Sandia Canyon as observed from outside vantage points, no substantial change in visibility caused by predicted air pollutant emissions, no conflict with Federal land management agency visual standards, and no long-term dominant visual interruption of existing or unique viewsheds.</p>
Human health and worker safety	<p>Access to the project area is restricted and noise generating activities and air emissions would be unlikely to affect members of the public at the nearest publicly accessible points. Effects on human health would be negligible. Applicable safety and health training and monitoring, personal protective equipment, and work-site hazard controls would be required for workers; activities would not be expected to have any adverse health effects on workers.</p>	<p>The Proposed Action would not involve direct hazards to the public. Chromium in public water supply wells is monitored by LANL and the LADPU, and there is no indication that the chromium plume has affected water supply wells. Access to the project area is restricted and noise-generating activities and air emissions would be unlikely to affect members of the public at the nearest publicly accessible points. Effects on human health would be negligible. Applicable safety and health training and monitoring, personal protective equipment, and work-site hazard controls would be required for workers; activities would not be expected to have any adverse health effects on workers.</p>
Socioeconomics	<p>Activities would require approximately 80 full-time-equivalent employees, primarily existing staff and short-term subcontractors; this is within the annual variability of LANL staffing and would have negligible effects on the local economy.</p>	<p>Activities would require approximately 120 full-time workers. The direct workforce requirements would comprise <0.1% of the existing workforce in the region (0.02%). Similarly, the total population would comprise <0.1% of the total population in the region (0.02%). Potential adverse impacts from the Proposed Action options would be expected to be small on the housing market and</p>

Resource Area	No Action Alternative ^(a)	Proposed Action
Environmental justice	<p>Representatives of Pueblo de San Ildefonso previously anticipated a direct, adverse impact from the proposed Chromium Plume Control Interim Measure and Plume-Center Characterization Project to Tribally important resources and practices associated with the Sacred Area. However, these representatives also understood that the currently proposed ASM implementing options would offset those concerns by reducing the chromium plume contamination. Because the No Action Alternative would reduce risks to human health and welfare in the region by removing contaminants from the environment and containing the off-site migration of groundwater contamination onto Pueblo de San Ildefonso lands, and has no significant environmental impacts, the No Action Alternative would not result in disproportionate and adverse effects to residents of the Pueblo.</p>	<p>community services within the ROI. The small increase in employment would be expected to result in small and beneficial impacts on the local economy. No adverse effects have been identified</p> <p>The Proposed Action would not result in disproportionate and adverse impacts for minority and low-income populations. Representatives of Pueblo de San Ildefonso previously anticipated a direct, adverse impact from the proposed Chromium Plume Control Interim Measure and Plume-Center Characterization Project to Tribally important resources and practices associated with the Sacred Area. However, these representatives also understood that the currently proposed ASM implementing options would offset those concerns by reducing the chromium plume contamination.</p>

Key: < = less than; % = percent; ASM = adaptive site management; BMP = best management practice; gal = gallon; LANL = Los Alamos National Laboratory; LADPU = Los Alamos County Department of Public Utilities; NMED = New Mexico Environment Department; ROI = region of influence

Note:

^(a) (DOE, 2015)

4.0 REGULATORY COMPLIANCE

This section presents the Federal and state laws and regulations applicable, or potentially applicable, to the Proposed Action and No Action Alternatives.

4.1 FEDERAL LAWS AND REGULATIONS

LANL has several Federal permits for wastewater and storm water discharges applicable to Cr(VI) contamination. These permits fall under the Federal regulations identified.

- LANL Industrial Wastewater Permit NPDES Permit No. NM0028355 – EPA regulates discharges under the referenced NPDES individual permit. However, a state Water Quality Certification is required by the Federal CWA Section 401 to ensure that the action is consistent with New Mexico state law (see the State Laws and Regulations section). The NPDES permit was issued August 12, 2014, modified May 1, 2015; reissued by EPA on March 30, 2022; effective May 1, 2022; and expires April 30, 2027. An EPA permit authorizing LANL to discharge industrial and sanitary liquid effluents through outfalls under specific conditions, including water quality and monitoring requirements. (<https://www.epa.gov/nm/los-alamos-national-laboratory-lanl-industrial-wastewater-permit-final-npdes-permit-no-nm0028355>)
- 2021 EPA Multi-Sector General Permit for stormwater discharge applies in areas of the country where EPA is the NPDES permitting authority and has made the permit available for coverage. These areas include New Mexico. This permit was issued on February 19, 2021; effective March 1, 2021; modified September 29, 2021; and expires on February 28, 2026. (https://www.epa.gov/sites/default/files/2021-01/documents/2021_msgp_-_permit_parts_1-7.pdf)
- 2010 EPA Individual Permit authorization under the CWA to discharge (from SMUs and areas of concern [AOCs]) under the NPDES Permit No. NM0030759 into receiving waters: Tributaries or main channels of Mortandad Canyon, Canada del Buey, Los Alamos Canyon, DP Canyon, Sandia Canyon, Ten Site Canyon, Canyon de Valle, Water Canyon, Ancho Canyon, Bayo Canyon, Chaquehui Canyon, Fence Canyon, Pajarito Canyon, Twomile Canyon, Threemile Canyon, Potrillo Canyon, Pueblo Canyon, and Rendija Canyon, in Water Body Segment No. 20.6.4.98, 20.6.4.126, 20.6.4.128 or 20.6.4.114 of the Rio Grande Basin. Current permit reissued on August 1, 2022, and set to expire on July 31, 2027. (<https://www.epa.gov/system/files/documents/2022-06/NM0030759%20-%20Final%20Permit.pdf>)
- U.S. Army Corps of Engineers (USACE) and NMED, Section 404 of the CWA requires LANL to obtain permits from USACE to perform work within perennial, intermittent, or ephemeral watercourses. Section 401 of the CWA requires NMED to certify that Section 404 permits issued by USACE will not prevent attainment of New Mexico-mandated stream standards. NMED reviews Section 404/401 joint permit applications and issues separate Section 401 certification letters, which may include additional permit requirements to meet state stream standards for individual LANL projects. This

1 nationwide Section 404/401 permit was effective January 4, 2021 and expires January 3,
2 2026. The specific portion of the permit that is currently applicable is the Mortandad
3 Wetland Enhancement.

4 (https://cdn.lanl.gov/files/document-23_85e7b.pdf)

- 5 • LANL Hazardous Waste Permit is issued pursuant to the authority of NMED under the
6 New Mexico Hazardous Waste Act, New Mexico Statutes Annotated (NMSA) 1978, §§
7 74-4-1 through 74-4-14, in accordance with the New Mexico Hazardous Waste
8 Management Regulations, 20.4.1 New Mexico Administrative Code (NMAC). Pursuant
9 to the RCRA, 42 U.S.C. §§ 6901 to 6992k, and 40 CFR 271 and 272 Subpart GG, the
10 State of New Mexico, through the NMED, is authorized to administer and enforce the
11 state hazardous waste management program under the Hazardous Waste Act in lieu of the
12 Federal program. The Secretary of the NMED issues this permit for hazardous waste
13 management at LANL to DOE, the owner and co-operator of LANL (EPA ID Number
14 NM 0890010515); and Triad National Security, LLC (Triad) and N3B, co-operators of
15 LANL. ([https://www.env.nm.gov/hazardous-waste/wp-
16 content/uploads/sites/10/2021/10/HWB-LANL-Permit-Parts-1-11_-October-2021.pdf](https://www.env.nm.gov/hazardous-waste/wp-content/uploads/sites/10/2021/10/HWB-LANL-Permit-Parts-1-11_-October-2021.pdf))

17 **4.1.1 NATIONAL ENVIRONMENTAL POLICY ACT**

18 NEPA of 1969, as amended (42 U.S.C. 4321 et seq.), requires Federal agencies to consider the
19 potential impacts to the human and natural environment from their proposed actions before making
20 a decision to undertake such actions. NEPA also requires Federal agencies to solicit and consider
21 public and agency input in the decision-making process, and to document the environmental impact
22 analysis. Where possible, NEPA recommends that Federal agencies implement measures to protect,
23 restore, and enhance the environment. The CEQ has published implementing regulations (40 CFR
24 1500-1508) and DOE has published implementing procedures (10 CFR 1021) that govern DOE's
25 compliance with NEPA. Updated CEQ NEPA regulations became effective on May 20, 2022.
26 DOE's NEPA regulations were revised, effective January 4, 2021, to update CX B5.7, and remove
27 CX B5.8 and classes of action C13, D8, and D9. These changes relate to natural gas export
28 authorizations. To the extent that CEQ guidance issued prior to September 14, 2020, is in conflict
29 with the updated regulations, the provisions of the updated regulations apply.

30 ([https://www.energy.gov/nepa/articles/10-cfr-1021-national-environmental-policy-act-
31 implementing-procedures-doe-2011-rev](https://www.energy.gov/nepa/articles/10-cfr-1021-national-environmental-policy-act-implementing-procedures-doe-2011-rev))

32 **4.1.2 CLEAN WATER ACT**

33 The CWA of 1972, as amended (33 U.S.C. 1251-1387), was enacted to “restore and maintain the
34 chemical, physical, and biological integrity of the Nation’s water.” The CWA prohibits the
35 “discharge of toxic pollutants in toxic amounts” to navigable waters of the United States. Section
36 313 of the CWA requires all branches of the Federal government engaged in any activity that might
37 result in a discharge of runoff of pollutants to surface waters to comply with Federal, state,
38 interstate, and local requirements.

39 Under Section 404 of the CWA, authorization from USACE is required when dredged or fill
40 material is discharged into waters of the United States, including wetlands. This includes
41 excavation activities that result in the discharge of dredged material that could destroy or degrade
42 waters of the United States.

1 The CWA also provides guidelines and limitations for effluent discharges from point-source
2 discharges and establishes the NPDES permit program. In New Mexico, the NPDES program is
3 administered by EPA. In 2012, EPA issued a construction general permit that covers discharges of
4 stormwater from construction sites. The 2012 NPDES General Permit for Storm Water Discharges
5 from Construction Activity includes the following requirements:

- 6 • Conduct a critical habitat and threatened and endangered species study.
- 7 • Develop and implement a SWPPP in accordance with good engineering practices.
- 8 • Submit an NOI.
- 9 • Install and maintain erosion and stormwater controls, and apply BMPs.
- 10 • Perform and document stormwater inspections during construction and site stabilization.
- 11 • Amend the SWPPP as necessary.
- 12 • Submit a notice of termination following project completion and final stabilization of
13 disturbed areas.

14 Authorization to discharge stormwater is required under the construction general permit for both
15 large and small construction projects disturbing more than 1 acre or part of a larger common plan of
16 development that collectively disturbs more than 1 acre.

17 **4.1.3 ENDANGERED SPECIES ACT**

18 The Endanger Species Act of 1973, as amended (16 U.S.C. 1531 et seq.):

- 19 • Protects listed (i.e., threatened and endangered) plants and animals that are threatened by
20 habitat destruction, pollution, overharvesting, disease, predation, or other natural or
21 manmade factors.
- 22 • Stipulates that listed species cannot be taken without a special permit. “Take,” as defined
23 under the Endanger Species Act of 1973, means “to harass, harm, pursue, hunt, shoot,
24 wound, kill, trap, capture, or collect or attempt to engage in any such conduct.” All
25 Federal agencies must ensure that their activities do not jeopardize a listed species or its
26 critical habitat.
- 27 • Provides for review of pesticide formulations and their application methods and rates to
28 determine if pesticide use may have potential adverse effects on listed species or their
29 critical habitats Section 7 of the Endanger Species Act of 1973 requires Federal agencies
30 that have reason to believe that a prospective action may affect an endangered or
31 threatened species or its habitat to consult with the USFWS of the U.S. Department of the
32 Interior or the National Marine Fisheries Service of the U.S. Department of Commerce to
33 ensure the action does not jeopardize the species or destroy its habitat. If despite
34 reasonable and prudent measures to avoid or minimize such impacts the species or its
35 habitat would be jeopardized by the action, a review process is specified to determine
36 whether the action may proceed as an incidental taking.

37 **4.1.4 MIGRATORY BIRD TREATY ACT**

38 The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), protects migratory birds
39 by making it unlawful to pursue, take, attempt to take, capture, possess, or kill any migratory bird,

1 or any part, nest, or egg of any such bird, unless and except as permitted by regulation. The act is
2 intended to protect birds that have common migratory patterns within the United States, Canada,
3 Mexico, Japan, and Russia. Section 704 of the act states that the U.S. Secretary of the Interior is
4 authorized and directed to determine if, and by what means, the take of migratory birds should be
5 allowed and to adopt suitable regulations permitting and governing take.

6 **4.1.5 NATIONAL HISTORIC PRESERVATION ACT**

7 Section 106 of the NHPA, as amended (54 U.S.C. 300101 et seq.), requires Federal agencies to
8 consider the effect of their undertakings on historic properties. The Advisory Council on Historic
9 Preservation regulations that implement Section 106 (36 CFR 800) describe the process for
10 identifying and evaluating resources; assessing effects of Federal actions on historic properties; and
11 consulting to avoid, minimize, or mitigate those adverse effects. NHPA does not mandate
12 preservation of historic properties, but it does ensure Federal agency decisions concerning the
13 treatment of these properties result from meaningful consideration of cultural and historical values
14 and identification of options available to protect the properties. The regulations allow for agencies
15 to develop alternate procedures to implement Section 106, which are subsequently set forth in a PA.

16 **4.1.6 ARCHAEOLOGICAL RESOURCES PRESERVATION ACT**

17 The Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa-mm), secures
18 the protection of archaeological resources and sites on both public and Indian lands. The act
19 prescribes penalties and fines for a detailed list of prohibited acts and sets forth uniform regulations
20 for excavation, removal, disposition, exchange, and information disclosure of archaeological
21 resources.

22 **4.1.7 CLEAN AIR ACT**

23 The CAA and the CAA Amendments of 1990, as amended (42 U.S.C. 7401 et seq.), establish air
24 quality standards for protection of public health and the environment. The ambient air quality in an
25 area is characterized in terms of whether or not it complies with the primary and secondary
26 NAAQS. The CAA, as amended, requires EPA to set NAAQS for pollutants considered harmful to
27 public health and the environment. Within 1 year of starting operations, this permit would need to
28 be incorporated into LANL's Title V Operating Permit, if any activities are applicable.
29 Construction activities and mobile equipment are not regulated under the CAA [20 NMAC
30 2.72.202(3)], and test drilling for characterization is exempt [20 NMAC 2.72.202(7)].

31 **4.1.8 RESOURCE CONSERVATION AND RECOVERY ACT**

32 The RCRA (42 U.S.C. 6901 et seq.) establishes a system for managing nonhazardous and hazardous
33 solid wastes in an environmentally sound manner. Specifically, it provides for the management of
34 hazardous wastes from the point of origin to the point of final disposal (i.e., "cradle to grave").
35 RCRA also promotes resource recovery and waste minimization.

36 **4.1.9 SAFE DRINKING WATER ACT**

37 The Safe Drinking Water Act of 1974 (SDWA), as amended (42 U.S.C. 300f et seq.), manages
38 potential threats of contamination to groundwater. The act instructs the EPA to establish a national
39 program to prevent underground injection of contaminated fluids that would endanger drinking
40 water sources. Drinking water standards established under the SDWA are used to determine

1 groundwater protection regulations under a number of other statutes (e.g., RCRA). Therefore,
2 many of the SDWA requirements apply to DOE activities, especially cleanup of contaminated sites
3 and storage and disposal of materials containing inorganic chemicals, organic chemicals, and
4 hazardous wastes.

5 **4.1.10 NATIVE AMERICAN GRAVES PROTECTION AND REPATRIATION ACT**

6 The Native American Grave Protection and Repatriation Act of 1990 (25 U.S.C. 3001-3013), and
7 its implementing regulations (43 CFR 10), direct the treatment and disposition of recovered Native
8 American human remains, funerary objects, sacred objects, and objects of cultural patrimony.

9 **4.1.11 EXECUTIVE ORDER 11988 AND EXECUTIVE ORDER 11990**

10 Executive Order (EO) 11988, *Floodplain Management*, and EO 11990, *Protection of Wetlands*,
11 require Federal agencies to assess the effects their actions may have on floodplains and wetlands
12 and to consider alternatives to avoid adverse effects and incompatible development on floodplains.

13 **4.1.12 EXECUTIVE ORDER 12898**

14 EO 12898, *Environmental Justice*, directs Federal agencies to identify and address potential
15 disproportionately high and adverse human health or environmental effects of their actions on
16 minority and low-income populations. The order also directs each agency to develop a strategy for
17 implementing environmental justice.

18 **4.1.13 EXECUTIVE ORDER 13007**

19 EO 13007, *Indian Sacred Sites*, directs Federal agencies to accommodate access to, and ceremonial
20 use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the
21 physical integrity of those sacred sites. This EO includes providing reasonable notice of proposed
22 actions or land management policies that may restrict access to, or affect the physical integrity of,
23 sacred sites. This EO also directs Federal agencies to keep confidential information pertaining to
24 such sites.

25 **4.1.14 EXECUTIVE ORDER 13175**

26 EO 13175, *Consultation and Coordination with Indian Tribal Governments*, requires Federal
27 agencies to establish regular and meaningful consultation and collaboration with Tribal officials in
28 the development of Federal policies that have Tribal implications.

29 **4.1.15 EXECUTIVE ORDER 13751**

30 In accordance with EO 13751, *Safeguarding the Nation from the Impacts of Invasive Species*, DOE
31 identifies invasive species and treats isolated invasive plant species populations. Larger, well-
32 established populations of some species like Siberian elm (*Ulmus pumila*), Russian olive
33 (*Elaeagnus angustifolia*), and salt cedar (*Tamarix ramosissima*) are removed opportunistically, in
34 conjunction with other construction projects. A Mitigation Action Plan for LANL Operations
35 (September, 2020) describes the approach to address this issue.

36 (<https://www.energy.gov/nepa/articles/mitigation-action-plan-lanl-operations-september-2020>)

1 **4.1.16 EXECUTIVE ORDER 14008**

2 EO 14008, *Tackling the Climate Crisis at Home and Abroad*, set a goal of conserving 30 percent of
3 land and water by 2030, among other goals. The DOE submitted its first conservation action plan
4 under the America the Beautiful Initiative associated with this executive order in December 2021

5 In July 2021, interim implementation guidance for the Justice40 Initiative was released as a new
6 requirement of EO 14008. The aim of this initiative is to secure environmental justice and spur
7 economic opportunity for disadvantaged communities that have been historically marginalized and
8 overburdened by pollution and underinvestment in housing, transportation, water and wastewater
9 infrastructure, and health care. The Justice40 Initiative provides guidance on how certain Federal
10 investments might be made toward a goal that 40 percent of the overall benefits from Federal
11 investments flow to disadvantaged communities. The Environmental Management – Los Alamos
12 Field Office was selected as one of five DOE pilot programs to implement this requirement of the EO.

13 **4.1.17 EXECUTIVE ORDER 14096**

14 EO 14096, *Revitalizing Our Nation’s Commitment to Environmental Justice for All*, builds on and
15 supplements the foundational efforts of EO 12828, through implementation of a policy to pursue a
16 whole-of-government approach to environmental justice. It fully integrates the consideration of
17 underserved and overburdened communities and populations into all aspects of Federal agency
18 planning and delivery of services, calling for greater collaboration, including with Tribal
19 communities, in evaluating pollutant-causing activities, and better protecting overburdened
20 communities from pollution and environmental harm.

21 **4.1.18 DOE POLICIES AND ORDERS**

22 The Atomic Energy Act authorizes DOE to establish standards to protect health and minimize the
23 dangers to life or property from activities under DOE’s jurisdiction. Through a series of DOE
24 Orders and regulations, an extensive system of standards and requirements has been established to
25 ensure safe operation of DOE facilities. A number of DOE Orders have been issued in support of
26 environmental, safety, and health programs. DOE policies and orders potentially applicable to the
27 Proposed Action and No Action Alternatives are identified below:

- 28 • DOE Order 144, Administrative Change 1—American Indian Tribal Government
29 Interactions and Policy, dated November 6, 2009, establishes responsibilities, and
30 transmits the DOE American Indian and Alaska Native Tribal Government Policy. The
31 policy outlines the principles to be followed by DOE in its interactions with federally
32 recognized American Indian Tribes. It is based on Federal policy treaties, Federal law,
33 and DOE’s responsibilities as a Federal agency to ensure that Tribal rights and interests
34 are identified and considered pertinent during decision-making.
- 35 • DOE Order 422, Change 4—Conduct of Operations, dated February 3, 2022, defines the
36 requirements for establishing and implementing conduct of operations programs at DOE
37 (including NNSA) facilities and projects. A conduct of operations program consists of
38 formal documentation, practices, and actions implementing disciplined and structured
39 operations that support mission success and promote worker, public, and environmental
40 protection.

- 1 • DOE Order 436.1A—Departmental Sustainability, dated April 25, 2023, provides
2 requirements and responsibilities for managing sustainability to ensure DOE carries out
3 its missions in a sustainable manner that addresses national energy security and global
4 environmental challenges.
- 5 • DOE Order 440.1B, Change 4—Worker Protection Program for DOE (including the
6 NNSA) Federal Employees, dated May 2, 2022, establishes the framework for an
7 effective worker protection program to reduce or prevent injuries, illnesses, and
8 accidental losses by providing DOE Federal workers with a safe and healthful workplace.
9 The order also requires contractors to comply with the requirements of 10 CFR 851,
10 Worker Safety and Health Program.
- 11 • DOE Order 451.1—NEPA Compliance Program, dated December 21, 2017, establishes
12 DOE internal requirements and responsibilities for implementing NEPA, the CEQ
13 Regulations Implementing the Procedural Provisions of NEPA, and the DOE NEPA-
14 Implementing Procedures.
- 15 • DOE Policy 141.1, Administrative Change 1—Department of Energy Management of
16 Cultural Resources, dated November 6, 2009, establishes cultural resource management
17 as a necessary part of DOE program implementation and establishes program
18 responsibilities, requirements, and authorities.
- 19 • DOE Policy 450.4A, Change 1—Integrated Safety Management Policy, dated January
20 18, 2018, presents a framework for work to be conducted safely and efficiently and in a
21 manner that ensures protection of workers, the public, and the environment.

22 **4.2 STATE LAWS AND REGULATIONS**

23 Certain environmental requirements have been delegated to state authorities for implementation and
24 enforcement. It is DOE policy to conduct its operations in an environmentally safe manner that
25 complies with all applicable statutes, regulations, and standards, including state laws and
26 regulations. The following State of New Mexico laws are potentially applicable to the Proposed
27 Action and No Action Alternatives:

- 28 • New Mexico Water Quality Act (NMSA 74-6-1 through 74-6-17). Establishes water-
29 quality standards and permit requirements for the construction or modification of a water
30 discharge source.
- 31 • New Mexico Hazardous Waste Act (NMSA 74-4-1 through 74-4-14). Establishes permit
32 requirements for construction, operation, modification, and closure of a hazardous waste
33 management facility.
- 34 • New Mexico Air Quality Control Act (NMSA 74-2-1 through 74-2-17). Establishes air
35 quality standards and requires a permit before construction or modification of an air
36 contaminant source. Also imposes emission standards for HAPs.
- 37 • New Mexico Solid Waste Act (NMSA 74-9-1 through 74-9-43). Establishes a program
38 to ensure protection of groundwater by requiring completion of groundwater monitoring
39 and remediation at solid waste facilities.

1 Compliance Order on Consent (Consent Order) - In accordance with provisions of these acts, in
2 June of 2016 the State of New Mexico and DOE entered into a Consent Order pursuant to Section
3 74-4-10 of the Hazardous Waste Act, 74-9-36(D) of the Solid Waste Act, and 20.9.9.14 of the
4 NMAC. The Consent Order requires DOE to conduct investigations and cleanup contamination at
5 LANL in accordance with the procedures and schedules set forth in the Consent Order. The
6 Consent Order was established for the limited purpose of addressing the corrective action activities,
7 including requirements, concerning groundwater contaminants listed at 20.6.2.3103 NMAC, toxic
8 pollutants listed at 20.6.2.7.WW NMAC. One of these groundwater contaminants and toxic
9 pollutants is Cr(VI).

10 (https://www.energy.gov/sites/prod/files/2020/01/f70/2016%20Consent%20Order_February%202020
11 [17.pdf](https://www.energy.gov/sites/prod/files/2020/01/f70/2016%20Consent%20Order_February%202020))

12 Under the Consent Order under Appendix C: Campaigns (updated January 2023)
13 (<https://www.energy.gov/em-la/2016-consent-order>), there are two campaigns associated with
14 chromium contamination:

- 15 • Campaign “A” is identified as the Chromium Interim Measures and Characterization
16 Campaign
17 “This campaign includes installation and operation of wells and associated equipment
18 necessary to meet three primary objectives: 1) provide interim measures to prevent
19 migration of the plume beyond the Laboratory boundary; 2) perform scientific studies
20 and aquifer testing to obtain data necessary to conduct a Corrective Measures Evaluation;
21 and 3) conduct a Corrective Measures Evaluation. (Solid Waste Management Units
22 [SWMUs]/AOCs: 0)”
- 23 • Campaign “T” is identified as the Chromium Final Remedy Campaign
24 “Building on the Chromium interim measure and Characterization Campaign, following
25 NMED’s selection of a remedy, this campaign includes preparation, submittal, and
26 approval of the Corrective Measures Implementation Plan. This campaign is to install
27 infrastructure and implement the remedy. (SWMUs/AOCs: 0)”

28 Water Resources - In the State of New Mexico, water resources are protected under the CWA (see
29 Section 4.1.2, *Clean Water Act*) and the New Mexico Water Quality Act. The NWQCC regulations
30 (NMAC 20.6.2) implementing the New Mexico Water Quality Act regulate liquid discharges onto
31 or below the ground surface to protect all groundwater in New Mexico. Under the regulations,
32 when required by NMED, a facility must submit a discharge plan and obtain a DP from NMED (or
33 approval from the New Mexico Oil Conservation Division for energy or mineral-extraction
34 activities). Subsequent discharges must be consistent with the requirements of a DP. Under the
35 state’s regulatory programs:

- 36 • A DP (DP-1835) for the discharge of treated groundwater to the regional aquifer from
37 Class V underground injection control wells was issued by NMED on August 31, 2016.
38 On July 21, 2017, NMED approved minor updates to DP-1835. The term of DP-1835 is
39 7 years from the effective date or 5 years from the date the discharge commenced,
40 whichever comes first. Discharge commenced on December 1, 2016, and expired on
41 December 1, 2021. On July 8, 2021, a renewal and modification application was
42 submitted to NMED. Approval of the permit is pending.

- 1 • A DP (DP-1793) for the land application of treated groundwater was originally issued on
2 July 27, 2015. On February 6, 2020, NMED approved the renewal application for this
3 permit keeping conditions as they were in the original application. In order to continue
4 operations under DP-1793, a renewal application will be required within 5 years from the
5 last approval and is required to be submitted to NMED at least 180 days before the DP-
6 1793 expires. This LANL-wide permit requires project-specific work plans to be
7 submitted to NMED for approval prior to operation, each of which requires a 30-day
8 public review period.

- 9 • LANL Industrial Wastewater Permit NPDES Permit No. NM0028355 – EPA regulates
10 discharges under the referenced NPDES individual permit (see the Federal Laws and
11 Regulations section). However, a state Water Quality Certification is required by the
12 CWA Section 401 to ensure that the action is consistent with state law (New Mexico
13 Water Quality Act, New Mexico Statutes Annotated [NMSA] 1978, Sections 74-6-1
14 to -17) and complies with the State of New Mexico Water Quality Standards at 20.6.2
15 and 20.6.4 NMAC, Water Quality Management Plan and Continuing Planning Process,
16 including Total Maximum Daily Loads, and Antidegradation Policy. The NPDES Permit
17 was issued August 12, 2014, modified May 1, 2015, reissued by EPA on March 30, 2022;
18 effective May 1, 2022; and expires April 30, 2027. EPA permit authorizing the
19 Laboratory to discharge industrial and sanitary liquid effluents through outfalls under
20 specific conditions, including water quality and monitoring requirements.

- 21 • LANL’s 2019 Title V Operating Permit from NMED AQB P100-R2M4 (20.2.70
22 NMAC), was previously issued in 2015 and includes facility-wide emission limits and
23 recordkeeping and reporting requirements. The current permit is dated July 18, 2019, and
24 is in effect for 5 years.

5.0 CONSULTATION AND COORDINATION

NEPA drives Federal agencies to evaluate environmental resources, which may include a consultation process in accordance with other environmental laws. This section describes environmental consultations that are associated with the Proposed Action. Additional details on these environmental resources are provided in Chapter 3.

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 meetings, followed by letters regarding public scoping and an offer for in-person consultation. EM-LA also conducted an in-person meeting on the scoping with the Pueblo de San Ildefonso environment department. Additionally, EM-LA CMEs presented at the Accord Technical Exchange Meeting on July 11, 2023, regarding the NEPA process for this EA. Representatives from each of the Accord Pueblos were in attendance for that meeting of the Accord Technical Exchange Meeting.

Prior to releasing the Draft EA, EM-LA would issue additional letters to the Accord Pueblos with an accompanying offer to consult followed by a presentation to the Accord Technical Exchange Meeting on the Draft EA. Pueblo de San Ildefonso has notified EM-LA that they plan to request consultation at that time.

Table 5-1 lists the agencies and organizations to whom EM-LA provided advance letters of notification of DOE’s intent to prepare this EA.

Table 5-1. List of agencies and organizations provided with advance notification of DOE’s intent to prepare the Environmental Assessment

Stakeholder/Accord Pueblos	Title	Name
Los Alamos County	County Manager	Steven Lynn
	County Deputy Manager	Linda Matteson
	County Deputy Manager	Annie Laurent
	Intergovernmental Affairs Manager	Danielle Duran
Santa Fe County	Commission Chair	Anna Hansen
NM State Representative	State Representative District 43	Christine Chandler
Senator Heinrich	Santa Fe Field Representative	Rita O’Connell
Senator Lujan	Santa Fe Field Representative	Eric Chavez
Rep. Leger-Fernandez	Staffer	Matt Miller
New Mexico Environment Department	Director, Water Protection Division	John Rhoderick
New Mexico Environment Department	Director, Resource Protection Division	Rick Shean
Pueblo de Cochiti	Governor	Pete Herrera
	Lieutenant Governor	Kai-t Blue-Sky
	Tribal Administrator	Tracy Codero
	Director, Department of Natural Resources	Jayson Romero
Pueblo of Jemez	Governor	Dominic Gachupin
	Lieutenant Governor	Daryl Lucero
	Director, Department of Natural Resources	Clarice Madalena
Santa Clara Pueblo	Governor	J. Michael Chavarria
	Director, Department Natural Resource	Dino Chavarria
	Department Natural Resource	Rose Suazo
Pueblo de San Ildefonso	Governor	Christopher Moquino
	Governor’s Assistant	Kitty Montoya
	Director, Environmental & Cultural Preservation	Raymond Martinez

6.0 REFERENCES

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3 *Gas Emissions and Climate Change (issued Jan. 9, 2023)*. Council on Environmental
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7.0 GLOSSARY

- 1
- 2 **air pollutant**—Generally, an airborne substance that could, in high enough concentrations, harm
3 living things or cause damage to materials. From a regulatory perspective, an air pollutant is a
4 substance for which emissions or atmospheric concentrations are regulated or for which maximum
5 guideline levels have been established because of its potential harmful effects on human health and
6 welfare.
- 7 **allowable economic drawdown**—The percent of the water column that can be lost before the well
8 loses economic viability. In the absence of more reliable data, a value of 70 percent of the water
9 column may be assumed as the allowable economic drawdown.
- 10 **alluvium**—Sediment deposited by flowing water, as in a riverbed, flood plain, or delta.
- 11 **ambient air**—The surrounding atmosphere as it exists around people, plants, and structures.
12 ambient—Surrounding.
- 13 **ambient air quality standards**—The level of pollutants in the air prescribed by regulations that
14 may not be exceeded during a specified time in a defined area. Air quality standards are used to
15 provide a measure of the health-related and visual characteristics of the air.
- 16 **amendment**—A material added to a medium to alter its chemical or physical properties.
- 17 **aquifer**—An underground geological formation, group of formations, or part of a formation that is
18 capable of yielding a significant amount of water to wells or springs.
- 19 **archaeological site**—Any location where humans have altered the terrain or discarded artifacts
20 during either prehistoric or historic times.
- 21 **area of potential effects**—The area within which impacts to historic properties could occur as the
22 result of a project or undertaking.
- 23 **artifact**—An object produced or shaped by human workmanship of archaeological or historical
24 interest.
- 25 **basalt**—The most common volcanic rock, dark gray to black in color, high in iron and magnesium
26 and low in silica. It is typically found in lava flows.
- 27 **base course**—A layer of material of specified thickness constructed to serve one or more functions,
28 such as distributing loads, providing drainage, or minimizing frost action. Typically, base course
29 consists of compacted gravel and/or crushed mineral aggregate.
- 30 **bedrock**—The solid rock that lies beneath soil and other loose surface materials.
- 31 **best management practices**—Structural, nonstructural, and managerial techniques, other than
32 effluent limitations, to prevent or reduce pollution of surface water. They are the most effective and
33 practical means to control pollutants that are compatible with the productive use of the resource to
34 which they are applied. Best management practices are used in both urban and agricultural areas
35 and may include schedules of activities; prohibitions of practices; maintenance procedures;
36 treatment requirements; operating procedures; and practices to control plant site runoff, spillage or
37 leaks, sludge or waste disposal, or drainage from raw material storage.
- 38 **bounded**—Producing the greatest consequences of any assessment of impacts associated with
39 normal or abnormal operations.

1 **cavate**—A room carved into a cliff face within the Bandelier Tuff geological formation. The
2 category includes isolated cavates, multi-roomed contiguous cavates, and groups of adjacent cavates
3 that together form a cluster or complex.

4 **Compliance Order on Consent (Consent Order)**—An enforcement document signed by the New
5 Mexico Environment Department, the U.S. Department of Energy, and the Regents of the
6 University of California (then the management and operations contractor for Los Alamos National
7 Laboratory) on March 1, 2005, that prescribes the requirements for corrective action at Los Alamos
8 National Laboratory. The purposes of the Consent Order are (1) to fully determine the nature and
9 extent of releases of contaminants at or from Los Alamos National Laboratory; (2) to identify and
10 evaluate, where needed, alternatives for corrective measures, including interim measures, to clean
11 up contaminants in the environment, and to prevent or mitigate the migration of contamination at or
12 from Los Alamos National Laboratory; and (3) to implement such corrective measures.

13 **criteria pollutant**—An air pollutant that is regulated by National Ambient Air Quality Standards.
14 The U.S. Environmental Protection Agency must describe the characteristics and potential health
15 and welfare effects that form the basis for setting, or revising, the standard for each regulated
16 pollutant. Criteria pollutants include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone,
17 lead, and two size classes of particulate matter, less than or equal to 10 micrometers (0.0004 inch)
18 in diameter and less than or equal to 2.5 micrometers (0.0001 inch) in diameter. New pollutants
19 may be added to, or removed from, the list of criteria pollutants as more information becomes
20 available.

21 **critical habitat**—Habitat essential to the conservation of an endangered or threatened species that
22 has been designated as critical by the U.S. Fish and Wildlife Service or the National Marine
23 Fisheries Service following the procedures outlined in the Endangered Species Act and its
24 implementing regulations (50 *Code of Federal Regulations* 424). (See endangered species and
25 threatened species.)

26 **cultural resources**—Archaeological materials (artifacts) and sites that date to the prehistoric,
27 historic, and ethnohistoric periods and that are currently located on the ground surface or buried
28 beneath it; standing structures and/or their component parts that are over 50 years of age and are
29 important because they represent a major historical theme or era, including the Manhattan Project
30 and the Cold War era, and structures that have an important technological, architectural, or local
31 significance; cultural and natural places, select natural resources, and sacred objects that have
32 importance for American Indians; American folklife traditions and arts; “historic properties” as
33 defined in the National Historic Preservation Act; “archaeological resource” as defined in the
34 Archaeological Resources Protection Act; and “cultural items” as defined in the Native American
35 Graves Protection and Repatriation Act.

36 **cumulative impacts**—The impacts on the environment that result from the incremental impacts of
37 the action when added to other past, present, and reasonably foreseeable future actions, regardless
38 of the agency (Federal or non-Federal) or person who undertakes such other actions. Cumulative
39 impacts may result from individually minor but collectively significant actions taking place over a
40 period of time.

41 **decibel (dB)**—A unit for expressing the relative intensity of sounds on a logarithmic scale where 0
42 is below human perception and 130 is above the threshold of pain to humans. For traffic and
43 industrial noise measurements, the A-weighted decibel, a frequency-weighted noise unit, is widely

- 1 used. The A-weighted decibel scale corresponds approximately to the frequency response of the
2 human ear and thus correlates well with loudness.
- 3 **DOE Orders**—Requirements internal to the U.S. Department of Energy that establish its policy and
4 procedures, including those for compliance with applicable laws.
- 5 **downgradient**—The direction that groundwater flows; similar to “downstream” for surface water.
- 6 **drawdown**—The difference in elevation between the level of water in a well and the level of
7 groundwater in the area in which the well is located.
- 8 **dynamic drawdown**—The self-induced decline of water level inside the casing of an existing well
9 as pumps are turned on.
- 10 **ecological resources**—Terrestrial resources, wetlands, aquatic resources, and protected and
11 sensitive species.
- 12 **effluent**—A waste stream flowing into the atmosphere, surface water, groundwater, or soil.
- 13 **endangered species**—Plants or animals that are in danger of extinction through all or a significant
14 portion of their ranges and that have been listed as endangered by the U.S. Fish and Wildlife
15 Service or the National Marine Fisheries Service following the procedures outlined in the
16 Endangered Species Act and its implementing regulations. (See threatened species.)
- 17 **environmental justice**—The fair treatment and meaningful involvement of all people regardless of
18 race, color, national origin, or income with respect to the development, implementation, and
19 enforcement of environmental laws, regulations, and policies. Fair treatment means that no group
20 of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of
21 the negative environmental consequences resulting from industrial, municipal, and commercial
22 operations or the execution of Federal, state, local, and Tribal programs and policies. Executive
23 Order 12898 directs Federal agencies to make achieving environmental justice part of their missions
24 by identifying and addressing disproportionately high and adverse effects of agency programs,
25 policies, and activities on minority and low-income populations. (See minority population and low-
26 income population.)
- 27 **environmental remediation**—Environmental remediation is the process of removing contaminants
28 or pollutants from soil, water, and other components of the natural environment.
- 29 **ephemeral stream**—A stream that flows only after a period of heavy precipitation.
- 30 **extraction well**—A well used to extract fluids from the subsurface. Extraction is
31 usually accomplished by a pump located within the well.
- 32 **field-scale studies**—Deployed studies in an actual work location that include environmental
33 variables conducted at a size that is less than full-scale actual systems but greater than laboratory-
34 scale studies.
- 35 **final remedy**—A regulatory term concluding the method and corresponding activities by which an
36 environmental issue, such as contamination, would be cleaned up, and the final condition of the site.
- 37 **floodplain**—The lowlands and relatively flat areas adjoining inland and coastal waters and the
38 flood-prone areas of offshore islands. Floodplains include, at a minimum, that area with at least a
39 1-percent chance of being inundated by a flood in any given year.

- 1 **formation**—In geology, the primary unit of formal stratigraphic mapping or description. Most
2 formations possess certain distinctive features.
- 3 **grading**—Any stripping, cutting, filling, stockpiling, or combination thereof that modifies the land
4 surface.
- 5 **greenhouse gas**—A gas in an atmosphere that absorbs and emits radiation within the thermal
6 infrared range. This process is the fundamental cause of the greenhouse effect. The primary
7 greenhouse gases in Earth’s atmosphere are water vapor, carbon dioxide, methane, nitrous oxide,
8 and ozone.
- 9 **groundwater**—Water below the ground surface in a zone of saturation.
- 10 **habitat**—The environment occupied by individuals of a particular species, population, or
11 community.
- 12 **hazardous material**—A material, including a hazardous substance, as defined by 49 Code of
13 Federal Regulations 171.8, that poses a risk to health, safety, and property when transported or
14 handled.
- 15 **hazardous waste**—A category of waste regulated under the Resource Conservation and Recovery
16 Act. To be considered hazardous, a waste must be a solid waste under the act and must exhibit at
17 least one of four characteristics described in 40 Code of Federal Regulations 261.20-24 (ignitability,
18 corrosivity, reactivity, or toxicity) or be specifically listed by the U.S. Environmental Protection
19 Agency in 40 Code of Federal Regulations 261.31-33.
- 20 **historic property**—Any prehistoric or historic district, site, building, structure, or object included
21 in, or eligible for inclusion on the National Register of Historic Places; such term includes artifacts,
22 records, and remains that are related to such district, site, building, structure, or object.
- 23 **historic**—After the advent of written history, dating to the time of the first European-American
24 contact in an area.
- 25 **hydraulic conductivity**—A measure of the ability of a rock or soil to transmit a fluid.
- 26 **hydrogeologic**—Pertaining to the distribution and movement of groundwater in the soil and rocks
27 of the Earth’s crust (commonly in aquifers).
- 28 **hydrologic**—Pertaining to the properties, distribution, and circulation of water on and below the
29 Earth’s surface and in the atmosphere.
- 30 **In-situ remedy/treatment**—Chemical, physical, biological, thermal, or electrical processes that
31 remove, degrade, chemically modify, stabilize, or encapsulate contaminants within soil or
32 groundwater (matrices) without removing those matrices from the ground.
- 33 **injection well**—A well that takes water from the surface into the ground, either through gravity or
34 by mechanical means.
- 35 **ion exchange resin**—An organic polymer that functions as an acid or base. These resins are used
36 to remove ionic material from a solution (such as removing dissolved chromium from water).
- 37 **interim measure**—An interim measure is a set of actions that have a high probability of meeting
38 environmental protection goals until a final remedy is implemented.
- 39 **kilowatt**—A unit of power equal to 1,000 watts.

- 1 **legacy contamination**—Contamination of the environment resulting from pre-1999 Los Alamos
2 National Laboratory activities and waste-management practices within environmental management
3 scope.
- 4 **loam**—Soil material that is composed of 7 percent to 27 percent clay particles, 28 percent to
5 50 percent silt particles, and less than 52 percent sand particles.
- 6 **low-income population**—Defined in terms of Bureau of the Census annual statistical poverty
7 levels, may consist of groups or individuals who live in geographic proximity to one another or who
8 are geographically dispersed or transient (such as migrant workers or American Indians), where
9 either group experiences common conditions of environmental exposure or effect. (See
10 environmental justice and minority population.)
- 11 **megawatt**—A unit of power equal to 1,000,000 watts.
- 12 **migration**—The natural movement of a material through the air, soil, or groundwater.
- 13 **minority population**—Minority populations exist where either (a) the minority population of the
14 affected area exceeds 50 percent, or (b) the minority population percentage of the affected area is
15 meaningfully greater than in the general population or other appropriate unit of geographic analysis
16 (such as a governing body’s jurisdiction, a neighborhood, census tract, or other similar unit).
17 “Minority” refers to individuals who are members of the following population groups: American
18 Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.
19 “Minority populations” include either a single minority group or the total of all minority persons in
20 the affected area. They may consist of groups of individuals living in geographic proximity to one
21 another or a geographically dispersed/transient set of individuals (such as migrant workers or
22 American Indians), where either group experiences common conditions of environmental exposure
23 or effect. (See environmental justice and low-income population.)
- 24 **mitigate**—To avoid an impact altogether by not taking a certain action or parts of an action;
25 minimize impacts by limiting the degree or magnitude of an action and its implementation; rectify
26 an impact by repairing, rehabilitating, or restoring the affected environment; reduce or eliminate the
27 impact over time by preservation and maintenance operations during the life of an action; or
28 compensate for an impact by replacing or providing substitute resources or environments.
- 29 **monitoring well**—A well designed and installed to obtain representative groundwater quality
30 samples and hydrogeologic information.
- 31 **natural attenuation**—An approach to remediation that relies on natural processes occurring within
32 the aquifer to reduce concentrations or toxicity of target contaminants.
- 33 **noise**—Undesirable sound that interferes or interacts negatively with the human or natural
34 environment. Noise may disrupt normal activities (hearing, sleep), damage hearing, or diminish the
35 quality of the environment.
- 36 **outfall**—The discharge point of a drain, sewer, or pipe as it empties into the environment.
- 37 **perennial stream**—A stream that flows throughout the year.
- 38 **piezometer**—A device that measures the pressure (more precisely, the piezometric head) of
39 groundwater at a specific point.

- 1 **plume**—The elongated volume of contaminated water or air originating at a pollutant source. A
2 plume eventually diffuses into a larger volume of less contaminated material as it is transported
3 away from the source.
- 4 **power drops**—Electrical power outlets to serve specific pieces of equipment.
- 5 **prehistoric**—Predating written records. Prehistoric archaeological resources generally consist of
6 artifacts that may alone or collectively yield otherwise inaccessible information about the past.
- 7 **Pueblo roomblock**—The remains of a contiguous, multiroom habitation structure (four or more
8 rooms with no enclosed plaza) constructed of adobe, jacal, or masonry.
- 9 **Quaternary**—The second geologic time period of the Cenozoic era, dating from about 2.6 million
10 years ago to the present. It contains two epochs: the Pleistocene and the Holocene. It is
11 characterized by glacial episodes and the first appearance of human beings on Earth.
- 12 **regional aquifer**—An aquifer system of large areal extent, commonly consisting of several layered
13 sedimentary formations that may extend to several kilometers in depth. Regional aquifers typically
14 supply water for industrial, irrigation, and domestic uses in many areas.
- 15 **remediation**—The process, or a phase in the process, of rendering radioactive, hazardous, or mixed
16 waste environmentally safe, whether through processing, entombment, or other methods.
- 17 **runoff**—The portion of rainfall, melted snow, or irrigation water that flows across the ground
18 surface, and eventually enters streams.
- 19 **sediment**—Soil, sand, and minerals washed from land into water that deposit on the bottom of a
20 water body.
- 21 **seismic**—Pertaining to any Earth vibration, especially an earthquake.
- 22 **soils**—All unconsolidated materials above bedrock. Natural earthy materials on the Earth’s surface,
23 in places modified or even made by human activity, containing living matter, and supporting or
24 capable of supporting plants out of doors.
- 25 **Stormwater Pollution Prevention Plan (SWPPP)**—Describes the nature and sequencing of
26 activities, potential sources of pollution, and identifies the best management practices to require
27 stormwater controls to be in place during drilling and until a site is stabilized following well
28 installation. A SWPPP is prepared for activities resulting in ground disturbance of more than
29 1 acre.
- 30 **surface water**—All bodies of water on the surface of the Earth and open to the atmosphere, such as
31 rivers, lakes, reservoirs, ponds, seas, and estuaries.
- 32 **technical area (TA)**—A geographically distinct administrative unit established for the control of
33 Los Alamos National Laboratory operations.
- 34 **threatened species**—Any plants or animals that are likely to become endangered species within the
35 foreseeable future throughout all or a significant portion of their ranges and that have been listed as
36 threatened by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following
37 the procedures set out in the Endangered Species Act and its implementing regulations (*50 Code of*
38 *Federal Regulations* 424). (See endangered species.)

- 1 **tracer**—A substance introduced into groundwater to provide information on the direction of
2 movement and/or velocity of the water and potential contaminants which might be transported by
3 the water. Tracers can also help determine hydrogeologic parameters.
- 4 **treated effluent (or treated water)**—A waste stream flowing into the atmosphere, surface water,
5 groundwater, or soil that has been processed to reduce contaminants to levels meeting regulatory
6 requirements.
- 7 **treatment**—The use of a chemical, physical, or biological agent to preserve or give particular
8 properties to something.
- 9 **tuff**—A fine-grained rock composed of ash or other material formed by volcanic explosion or aerial
10 expulsion from a volcanic vent.
- 11 **vadose zone**—The portion of Earth between the land surface and the water table.
- 12 **viewshed**—The extent of an area that may be viewed from a particular location. Viewsheds are
13 generally bounded by topographic features such as hills or mountains.
- 14 **water column**—The difference between the current non-pumping water level and depth to
15 the base of the well screen within the primary production zone.
- 16 **water table**—The boundary between the unsaturated zone and the deeper, saturated zone. The
17 upper surface of an unconfined aquifer.
- 18 **watt**—A unit of power equal to 1 joule per second.
- 19 **wattle**—A tube, typically of rice straw, used for erosion control, sediment control and stormwater
20 runoff control.
- 21 **wetland**—Wetlands are “... those areas that are inundated or saturated by surface or groundwater at
22 a frequency and duration sufficient to support, and that under normal circumstances do support, a
23 prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally
24 include swamps, marshes, bogs, and similar areas” (33 Code of Federal Regulations 328.3).

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Appendix A Public Scoping Comment Summary Report

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PUBLIC SCOPING COMMENT SUMMARY REPORT

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.

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 the 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

1 responses are summarized in following sections by general comment categories (i.e., NEPA
 2 Process, Purpose and Need, etc.). The numbering after each comment summary corresponds to
 3 tracking numbers assigned to individual comments that were considered in developing the comment
 4 summaries.

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

7 **Table A-1. List of the public scoping comment documents received, commenters’**
 8 **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

9 **A.1.1 NEPA PROCESS**

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

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

17 2. Comment Summary: One commenter suggested that preparation of an EA will not address
 18 the complex technical and policy issues for the hexavalent chromium plume and that
 19 EM-LA needs to prepare an Environmental Impact Statement (EIS). Comments: 7-1, 7-2,
 20 7-7

21 EM-LA Response: In accordance with DOE’s NEPA implementing regulations (10 CFR
 22 1021.321(a)), DOE may prepare an EA at any time for a proposed action. In preparing the
 23 EA, EM-LA will consider the context (setting) and intensity (severity) of any potential
 24 environmental impacts. If no significant environmental impacts are identified, the EA is the
 25 appropriate level of analysis. If DOE determines that there may be potential significant
 26 environmental impacts resulting from a proposed action, then an EIS is appropriate. EM-LA

1 will prepare the EA and include information to determine the potential for significant
2 environmental impact using accepted and appropriate science, technology, and expertise.

- 3 3. Comment Summary: One commenter stated they understand the *Environmental Assessment*
4 *for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los*
5 *Alamos National Laboratory, Los Alamos, New Mexico* (DOE/EA-2005, December 2015)
6 expires at the end of 2023 and they were unable to identify a source of this statement. The
7 commenter suggested that EM-LA include a citation to the document and the statement in
8 this EA. Comment: 7-2

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

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

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

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

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

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

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

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

9 EM-LA Response: This EA will include a description of geology and soils, including a
10 Conceptual Site Model to portray both known and hypothesized site information regarding
11 contaminants, sources, and migration pathways, as well as a description of relevant
12 terminology. Downgradient migration is the movement of a compound or contaminant in
13 the direction of groundwater flow. During the IM, EM-LA estimates that approximately
14 700 pounds of hexavalent chromium has been removed from the regional aquifer.

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

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

26 FEHM is a well-vetted flow and transport code that has been used at LANL and by its
27 collaborators for 50 years, has hundreds of peer-reviewed publications
28 (https://www.lanl.gov/orgs/ees/fehm/pdfs/FEHM_references_list.pdf), and has been
29 benchmarked and verified against many analytical and numerical solutions, including
30 MODFLOW ([https://www.lanl.gov/orgs/ees/fehm/docs/FEHM_VERIFICATION](https://www.lanl.gov/orgs/ees/fehm/docs/FEHM_VERIFICATION_V3.3.0.pdf)
31 [_V3.3.0.pdf](https://www.lanl.gov/orgs/ees/fehm/docs/FEHM_VERIFICATION_V3.3.0.pdf)).

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

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

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

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

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

7 **A.1.2 PURPOSE AND NEED**

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

10 EM-LA Response: This EA is being prepared in accordance with applicable Council on
11 Environmental Quality and DOE NEPA regulations. The purpose of the Proposed Action
12 is to remediate hexavalent chromium-contaminated groundwater below Sandia and
13 Mortandad Canyons. DOE is evaluating potential reasonable alternatives for a final
14 remedy using the threshold criteria and balancing criteria set forth in the 2016 Consent
15 Order. The primary objective of the interim measure is to prevent migration of the
16 hexavalent chromium plume beyond the LANL boundary. In contrast, the final remedy
17 will be focused on groundwater remediation to achieve compliance with groundwater
18 quality standards.

19 **A.1.3 ALTERNATIVES**

- 20 11. Comment Summary: One commenter suggested that all requests from the NMED be
21 analyzed as alternatives and EM-LA analyze all impacts of land applying the treated water
22 as well as all impacts of injecting the water into the ground and/or the plume. Comment:
23 5-22

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

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

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

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

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

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

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

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

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

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

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

- 41 15. Comment Summary: One commenter recommended that EM-LA provide interim measures
42 to prevent migration of the plume beyond the laboratory boundary and that the *Interim*
43 *Measures and Characterization Work Plan* (Work Plan) must be revised to include a

1 discussion of alternative injection scenarios (i.e., shallow infiltration gallery, conversion of
2 existing well outside the plume to an injection well, constructing a new injection well
3 outside the plume boundary, etc.). They also noted that the Work Plan needs to be revised
4 to include a proposal from DOE for an investigation activity that will achieve the regulatory
5 requirement to implement an alternative injection well location for the treated water.

6 Comment: 7-6

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

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

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

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

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

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

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

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

42 EM-LA Response: This EA will include consideration of a No Action Alternative per NEPA
43 regulations. The No Action Alternative is a continuation of the preferred alternative in the

1 *Environmental Assessment for Chromium Plume Control Interim Measure and Plume-*
2 *Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico*
3 (DOE/EA-2005, December 2015) and FONSI (December 2015). Under the No Action
4 Alternative, EM-LA would control plume migration and maintain hexavalent chromium
5 contamination levels within the LANL boundary while long-term corrective action remedies
6 continue to be evaluated, implemented, and continue to further characterize the plume to
7 evaluate the effectiveness and feasibility of implementing a final remedy.

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

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

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

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

27 **A.1.4 ENVIRONMENTAL IMPACTS**

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

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

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

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

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

40 EM-LA Response: This EA will analyze potential impacts on the environment. This
41 includes impacts on threatened and endangered species, water resources, air quality, geology

1 and soils, environmental justice, transportation, socioeconomics, visual resources, land use,
2 and waste management. Although emergency preparedness is not an environmental
3 resource area, an Emergency Operations Plan (LAC, 2018) and a Local Hazard Mitigation
4 Plan (LAC, 2016) were published by Los Alamos County to assess the potential risks
5 associated within the region.

- 6 25. Comment Summary: Several commenters requested EM-LA evaluate impacts to water
7 resources, including hexavalent chromium concentration increases in downgradient
8 monitoring wells in response to injection operations, the ability to adequately control plume
9 migration and maintain hexavalent chromium contamination within the LANL boundary,
10 and the regulatory directive from NMED to cease injection into the plume beginning April
11 1, 2023. They also recommend this EA include information on impacts to the Rio Grande
12 and the springs along the Rio Grande, including the groundwater and surface water
13 connection and methods for offsetting or identifying consumptive uses, cumulative effects
14 from this and other projects on the hydrologic conditions of the analysis area and vicinity,
15 whether specific permits will be needed, and measures that would be taken to protect
16 drinking water for communities. Comments: 1-1, 1-2, 1-3, 2-1, 2-2, 2-3, 6-7, 7-5, 7-15,
17 7-16, 7-17

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

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

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

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

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

30 **A.1.5 HUMAN HEALTH**

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

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

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

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

5 **A.1.6 CONSULTATION AND COORDINATION**

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

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

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

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

25 In addition, the National Nuclear Security Administration (NNSA) is preparing a Site-Wide
26 Environmental Impact Statement (SWEIS) for LANL that will update the analysis in the
27 2008 LANL SWEIS (see Notice of Intent at 87 Federal Register [FR] 51083;
28 <https://www.energy.gov/sites/default/files/2022-08/noi-eis-0552-lanl-site-wide-2022-08.pdf>).
29 The SWEIS will analyze the potential environmental impacts of reasonable
30 alternatives for continuing operations of LANL for approximately the next 15 years. The
31 SWEIS will also analyze environmental impacts of waste remediation activities conducted
32 by DOE-EM.

33 **A.1.7 NATURE AND EXTENT OF THE HEXAVALENT CHROMIUM PLUME**

34 32. Comment Summary: Several commenters noted that EM-LA needs to fill in data gaps and
35 continue to assess the nature and extent of the hexavalent chromium plume. One commenter
36 stated there are differences in professional opinion regarding the depth and extent of the
37 hexavalent chromium plume. Comments: 4-1, 4-2, 5-6, 5-7, 5-8, 5-10, 5-12, 6-3, 6-8, 7-4,
38 7-7, 7-32

39 EM-LA Response: This EA will include a description of hydrology, geology and soils, and
40 water resources, including a Conceptual Site Model to portray both known and hypothesized
41 site information regarding contaminants, sources, migration pathways, and impacts from
42 extraction, injection, land application, etc. The options evaluated for the final remedy

1 include monitoring to address data gaps and continue assessing the nature and extent of the
2 hexavalent chromium plume. Most of the options include installation of additional wells.

- 3 33. Comment Summary: One comment noted in 2020 LANL switched from the Thin-Plate
4 Spline (TPS) interpolation method to the Bayesian Canonical Correlation Regression and
5 reverted to TPS in calendar year 2023 Quarter 1. The commenter requested that NMED
6 require LANL to run the data from 2020 to 2023 in the TPS interpolation method in order to
7 understand the difference between the two models, to create a consistent source of data, and
8 to alleviate public concern about the switch between models. Comment: 7-29

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

13 **A.1.8 PUBLIC PARTICIPATION**

- 14 34. Comment Summary: Several comments requested EM-LA improve engagement with
15 stakeholders, Native American groups, pueblos, local governments, and utilities and for
16 clarification on the mechanism of cooperation with San Ildefonso Pueblo. Comments: 1-7,
17 2-7, 5-9, 6-2

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

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

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

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

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

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

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

1 EM-LA Response: Comments noted.

2 **A.1.9 REGULATORY REQUIREMENTS**

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

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

9 **A.1.10 OUT OF SCOPE**

10 39. Comment Summary: One commenter noted that this EA must be unprejudiced by the fact
11 that hundreds of millions of dollars are spent on nuclear weapons research and production at
12 LANL and voiced their desire for NNSA to diversify its missions away from nuclear
13 weapons programs and move more toward critically needed programs, such as
14 nonproliferation efforts, other new national security priorities (for example, port security),
15 and pure science and energy efficiency programs. Comments: 5-1, 5-2, 5-17

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

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

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

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

39 EM-LA Response: Comment noted. This EA will discuss the environmental impacts,
40 including behavior of the hexavalent chromium plume, under the alternatives evaluated.
41 Whereas a discussion of activities encompassed within the alternatives are factors

1 considered in identifying environmental impacts, work plan development and revision are
2 administrative aspects of the activity that are outside the scope of the environmental impacts
3 evaluated in this EA.

4 **A.2 REFERENCES**

- 5 LAC. (2016). *Los Alamos County Local Hazard Mitigation Plan: Comprehensive Update*. March
6 2016. Developed by the Los Alamos County Hazard Mitigation Planning Committee with
7 professional planning assistance from AMEC.
- 8 LAC. (2018). *Emergency Operations Plan*. Los Alamos County, New Mexico.
- 9 N3B. (2022). *2021 Sandia Wetland Performance Report*. Los Alamos, New Mexico: Newport
10 News Nuclear BWXT-Los Alamos, LLC. EM2022-0012. April 2022.

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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.

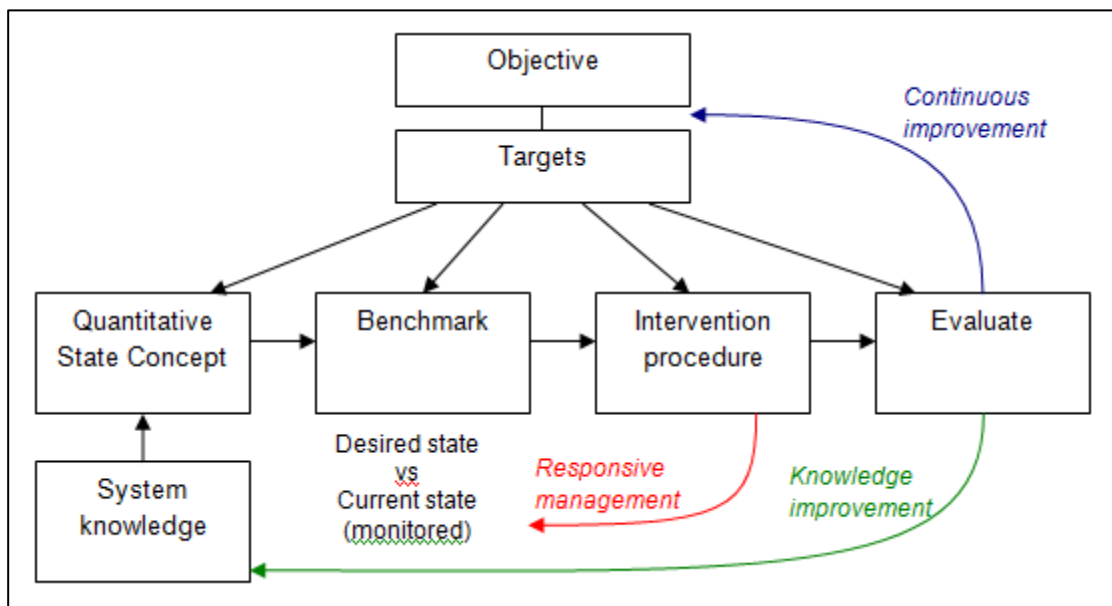
B.2.2 DECOMMISSIONING AND FINAL CONTOURING

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,

1 implementation, and monitoring processes that accommodate new information and changing site
 2 conditions to develop effective and efficient cleanup approaches that achieve required outcomes, as
 3 seen in Figure B-1.



4
5

Figure B-1. Adaptive site management model

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

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

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

19 **B.3.1 OPTION 1: MASS REMOVAL VIA EXPANDED TREATMENT**

20 *Facilities and Infrastructure*

21 Under this option, EM-LA would construct a 10,000-square-foot (ft²) groundwater treatment facility
 22 situated in a previously disturbed area within Mortandad Canyon, as seen in Figure B-2. This
 23 facility would have a designed treatment capacity of 500 gallons per minute (gpm), with expansion
 24 capabilities to 1,000 gpm, and would treat water for hexavalent chromium contamination. The
 25 treatment system would consist of a 1,000-gpm dual ion exchange treatment system with
 26 prefiltration, associated piping, flow controls, and programmable logic controls and monitoring.

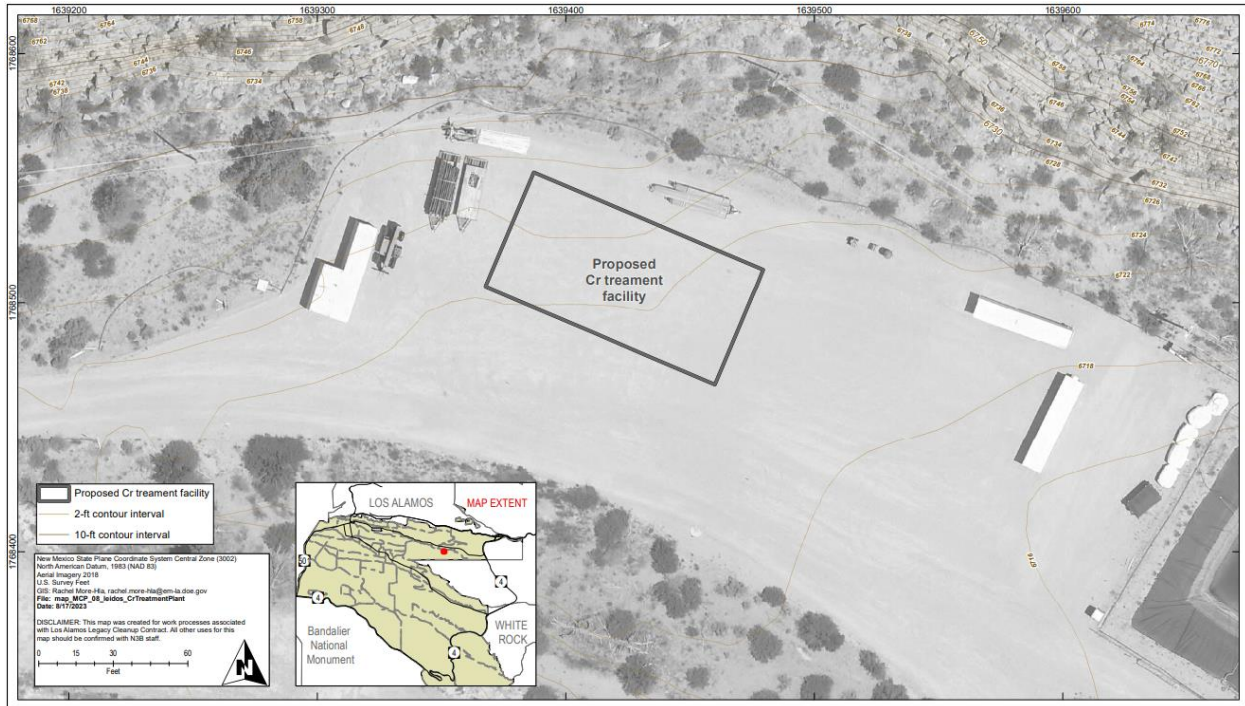


Figure B-2. Proposed hexavalent chromium treatment facility

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

1 application, and evaporation. Monitoring would consist of sampling untreated and treated water
2 and aquifer metering for both extraction and injection to ensure the system is performing as
3 designed.

4 The additional 20 shallow piezometers in and around the Sandia Wetlands and 10 deep vadose zone
5 piezometers in Mortandad Canyon would be installed for water-level monitoring and occasional
6 water-quality sampling. These tests would involve injection at the piezometers and monitoring at
7 nearby monitoring wells. These studies would use tracers, chemicals, or bio-stimulants to evaluate
8 the feasibility of in-situ remedies to convert chromium to the stable, nonmobile, non-toxic trivalent
9 form. The additional piezometers would also be used to characterize lateral and vertical variability
10 in water levels within the shallow alluvium in the canyon floor and the deeper vadose zone and
11 would vary in depth with a maximum depth of approximately 1,400 feet, depending on depth to
12 bedrock.

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

17 ***Facility Piping***

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

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

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

34 ***Hexavalent Chromium Treatment***

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

40 Hexavalent chromium treatment at the new facility would be completed by ion exchange. The ion
41 exchange resin is loaded into vessels. The contaminated groundwater enters the top of the vessel,
42 runs through the resin, which removes the contaminants (in this case chromium), and the treated

1 water exits the vessel at the bottom. Flow rate through the vessel is regulated by valves to ensure
2 there is enough contact time for the ion exchange to take place.

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

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

10 *Facility Influent and Effluent Filtration*

11 Both the influent and effluent filtration would use a duplex bag filter system that may be equipped
12 with automated sequencing based on differential pressure. During preliminary design, alternative
13 influent filtration methods, such as sand filters, may be evaluated. The differences in filtration
14 method are not expected to contribute to differences in environmental consequences.

15 **B.3.2 OPTION 2: MASS REMOVAL VIA LAND APPLICATION**

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

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

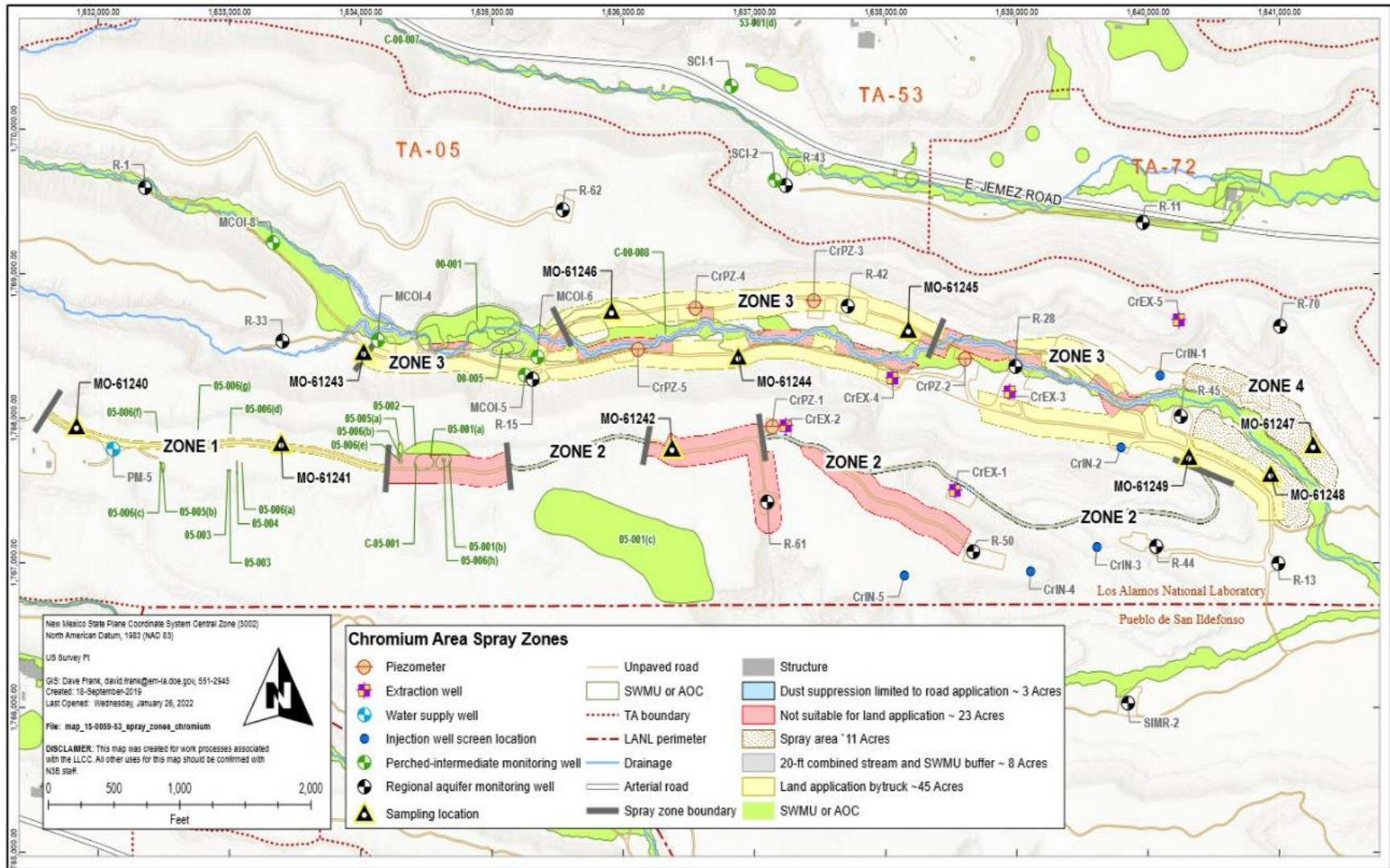


Figure B-3. Treated water land application area

1
2

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

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

10 Potential methods for in-situ treatment include the following:

- 11 • Electrokinetic Treatment
- 12 • In-Situ Chemical Reduction Agents
 - 13 ○ Dithionite
 - 14 ○ Calcium polysulfide
 - 15 ○ Ferrous sulfate
 - 16 ○ Ferrous ammonium sulfate
 - 17 ○ Sodium bi/meta sulfite
 - 18 ○ Sulfur dioxide gas phase
 - 19 ○ Iron-biochar
 - 20 ○ Nano zero-valent iron (ZVI)
 - 21 ○ Activated carbon coated nanoparticles
 - 22 ○ Nano iron sulfide
 - 23 ○ Nano bimetallic ZVI, aluminum coated iron
 - 24 ○ Permeable Reactive Barrier with ZVI, nano ZVI, bimetallic ZVI
 - 25 ○ Metals Remediation Compound TM (Regeneration)
- 26 • In-Situ Biological Reduction Agents
 - 27 ○ Lactate
 - 28 ○ Emulsified vegetable oil
 - 29 ○ Molasses
 - 30 ○ Algae/fungi
 - 31 ○ Bacteria cultures

32 In addition to these Proposed Action options in the regional aquifer, other measures to achieve
33 the final remedy through source removal could be instituted in the shallow and vadose zone
34 groundwater, alluvium, and intermediate groundwater, mostly up-canyon from the currently
35 identified chromium groundwater plume. The discharge of treated waters could be released into

1 Sandia Canyon or through the laboratory's NPDES outfall for treated effluent. The details
2 related to these other measures are shown in Table B-1.

3 **B.3.4 OPTION 4: MONITORED NATURAL ATTENUATION**

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

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

22 *Adaptive Site Management Alternatives*

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

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

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

Table B-1. Description of the proposed adaptive site management alternatives¹

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	<p>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 being constructed per yr.</p> <p>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.</p>	<p>Same as Option 1.</p> <p>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).</p>	<p>Same as Option 1. There are no additional schedule limitations for in-situ treatment.</p>	<p>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.</p> <p>Routine monitoring must be conducted to ensure that MNA is working.</p>
Wells and Piezometers	<p>Existing wells:</p> <ul style="list-style-type: none"> • 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 <p>New Wells:</p> <ul style="list-style-type: none"> • Up to 15 injection wells: 70 gpm (1,000 gpm max capacity) • Up to 15 extraction wells: 70 gpm (1,000 gpm max capacity) • Up to 16 monitoring wells with 1 monitoring well converted from an 	<p>Existing wells: Same as Option 1</p> <p>New Wells: Same as Option 1</p>	<p>Existing wells: Same as Option 1</p> <p>New Wells: Same as Option 1</p> <p>This option introduces amendments in untreated water and rely on chemical processes to immobilize and detoxify contaminants within soil</p>	<p>Existing Wells: Same as Option 1</p> <p>New Wells: Same as Option 1</p> <p>DOE would only implement MNA when it can verify contamination poses relatively low risks, the plume is stable or shrinking, and the natural</p>

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.

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
New Piping	<p>existing well</p> <ul style="list-style-type: none"> • Sandia Wetlands Source area: 20 wells (shallow piezometers) • Deep vadose zone: 10 wells (0–1,400 ft) <p>Piping from the extraction wells to the treatment system would be double-walled pipe. Piping to injection wells would be single-walled pipe.</p> <p>EM-LA estimates that 30,000 ft of double-walled pipe and 30,000 ft of single-walled pipe would be needed.</p> <p>Pipelines supporting any new treatment facility or pumping station would be installed in previously disturbed or developed areas.</p>	<p>Same as Option 1, additional piping to synthetically lined storage basins, irrigation-type sprinklers, and mechanical evaporators already exists.</p>	<p>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.</p> <p>Same as Option 1, additional piping for in-situ treatment would not be needed.</p>	<p>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.</p> <p>New piping would be dependent on what ASM Options EM-LA decides to implement, and in which order.</p>
Maximum Total Annual Extraction, Injection, and Land Application Rates	<p>Extraction Rate: 550,000,000 gpy</p> <p>Injection Rate: 550,000,000 gpy</p>	<p>Extraction Rate: 550,000,000 gpy</p> <p>Injection Rate: 462,500,000 gpy</p> <p>Land Application Rate: 87,500,000 gpy (350,000 gpd * 250 days/yr)</p>	<p>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.</p> <p>Injection Rate: Same as Options 1 and 2. Rates of extraction, injection, and land application would be dependent on</p>	<p>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.</p> <p>Sandia Canyon: There would be no extraction, injection, or land application in Sandia Canyon.</p>

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
Other New Facilities and Infrastructure	<p>New Facilities: Construct a new 10,000 ft² treatment facility situated in a previously disturbed area. The facility would require about 20,000 ft² of land for construction.</p> <p>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.</p> <p>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 needed to connect to the 3-phase 480-volt power.</p>	<p>New Facilities: Same as Option 1</p> <p>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.</p> <p>Permit modification applications for 1835 (injection) and 1793 (land application) are being reviewed by the state.</p>	<p>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.</p> <p>New Facilities: Same as Option 1</p> <p>Option 3 involves injecting amendments into the aquifer and does not itself involve construction of new facilities or infrastructure.</p>	<p>New Facilities: Same as Option 1</p> <p>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.</p>

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
	<p>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.</p>			
	<p>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.</p>			
	<p>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.</p>			
Hexavalent Chromium Treatment and Removal	<p>Untreated groundwater would be delivered to new treatment facility from extraction wells through existing valve in CrEX-5 and new double-walled pipeline.</p> <p>The treatment system would consist of a 1,000-gpm dual ion exchange</p>	<p>Under this option, treated water would be disposed of using an array of sprinkler heads, mechanical evaporators, or trucks with high-pressure sprayers.</p> <p>Land application would only occur in permitted areas per NPDES land</p>	<p>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.</p> <p>In-situ options will be evaluated as technologies emerge and will only</p>	<p>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. DOE would only implement MNA when it can verify contamination</p>

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
	<p>treatment system with prefiltration, associated piping, flow controls, and programmable logic controls and monitoring.</p> <p>Amount of Chromium Removed: Approximately 1,800 lbs/yr assuming 400 ppb Cr in extracted water and the increased pumping rate.</p> <p>Ion Exchange options for Cr treatment system include:</p> <ol style="list-style-type: none"> 1. Exchangeable ion exchange vessels 2. Permanent treatment contactors with ion exchange resin would be regenerated off site and delivered via tanker truck. <p>The use of 60 ft³ contactors is the preferred method for treatment.</p> <p>Current Super 30 vessels contain a media volume of 30 ft³; media weight is 1,685 lbs.</p> <p>When vessels are sent back to the vendor, a total of 3–4 are sent back at a time (90–120 ft³ of media).</p> <p>The media remains in the tanks when sent back and the vendor handles the waste according to state and Federal regulations. The resin is regenerated and reused multiple times. Metals are</p>	<p>permit (not on cultural sites or within waterways/drainages, etc.) and up to land application permitted limits (currently 350,000 gpd).</p>	<p>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.</p>	<p>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.</p>

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
Facility Effluent and Influent	<p>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.</p> <p>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.</p>	<p>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).</p> <p>All areas used for land application of treated effluent would be located to avoid known historic properties.</p>	<p>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.</p> <p>Option 3 involves injecting amendments into the aquifer and does not itself involve facility effluent and influent treatment.</p>	<p>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.</p>
Equipment for Well Drilling and Other Activities	Combustion Equipment for Construction of One Well and Pad (~1,500 ft)			
	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	
	10 deliveries per month for drill pipe, well construction materials, well pad construction materials, frac tanks, etc.			

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
Additional Notes				
This chart applies to all options; however, the following also apply:				
<ul style="list-style-type: none"> • 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	120	120	120
	<p>Personnel for construction of one Well and Pad: 38-person teams working concurrently throughout the year with December off.</p> <ul style="list-style-type: none"> • 8 drilling employees and 30 support/administrative personnel per well (see breakdown) • Total duration of 5 months per well 	<p>Personnel for construction of one Well and Pad: Same as Option 1</p>	<p>Personnel for construction of one Well and Pad: Same as Option 1</p>	<p>Personnel for construction of one Well and Pad: Same as Option 1</p>
	<p>Drilling personnel:</p> <ul style="list-style-type: none"> • 2 Drillers • 4 Hands • 2 Task Managers 	<p>Drilling personnel: Same as Option 1</p>	<p>Drilling personnel: Same as Option 1</p>	<p>Drilling personnel: Same as Option 1</p>
	<p>T2S support/admin:</p> <ul style="list-style-type: none"> • 1 Program Manager • 2 STR • 2 Project Managers • 4 FTL • 1 Engineer • 1 GIS 	<p>T2S support/admin: Same as Option 1</p>	<p>T2S support/admin: Same as Option 1</p>	<p>T2S support/admin: Same as Option 1</p>
	<p>N3B support/admin:</p> <ul style="list-style-type: none"> • 1 Program Manager 	<p>N3B support/admin: Same as Option 1</p>	<p>N3B support/admin: Same as Option 1</p>	<p>N3B support/admin: Same as Option 1</p>

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
	<ul style="list-style-type: none"> • 2 STR • 2 Project manager • 2 FETL • 1 Craft foreman • 10 Crafts Crew • 1 SOM 			
New Land Disturbance	<p>Land disturbance during construction: About 75 ac of total disturbed area for additional wells and access roads (1.33 ac each)</p>	<p>Land disturbance during construction: Same as Option 1, land application areas would not otherwise be increased.</p>	<p>Land disturbance during construction: Same as Option 1</p> <p>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.</p>	<p>Land disturbance during construction: Same as Option 1</p> <p>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.</p>
Excavation and Backfill	<p>Cut/Fill Estimates: Average cut is 550 yd³; average fill is 600 yd³. 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.</p>	<p>Cut/Fill Estimates: Same as Option 1</p>	<p>Cut/Fill Estimates: Same as Option 1</p> <p>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.</p>	<p>Cut/Fill Estimates: Same as Option 1</p> <p>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.</p>

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
	<p>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 yd³ of base course material is needed for each well and access road.</p> <p>Therefore for 45 additional wells, about 36,000 yd³ of base course material would be needed.</p> <p>No additional fill would be needed.</p>	<p>Base Course (crushed stone) Material: Same as Option 1</p>	<p>Base Course (crushed stone) Material: Same as Option 1</p> <p>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.</p>	<p>Base Course (crushed stone) Material: Same as Option 1</p> <p>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.</p>
Utility Usage	<p>Electricity: Well construction would use portable generators.</p> <p>Operations: Wells/treatment facility will be connected to the existing electrical line system in place for the IM – 3-phase 480-volt power</p> <p>Total electricity use for construction and operation under this option would be 473,040 kilowatt-hours per year.</p>	<p>Electricity: Same as Option 1. Land application would require minor additional electricity requirements</p>	<p>Electricity: Same as Option 1. In-situ does not require additional electricity</p>	<p>Electricity: Same as Option 1</p>
	<p>Water: Well construction would use offsite water and portable toilets.</p> <p>Operations: Water is pumped into production lines, and booster pump stations lift this water to reservoir tanks for distribution. DOE purchases water from Los Alamos County for LANL</p>	<p>Water: Same as Option 1</p>	<p>Water: Same as Option 1</p>	<p>Water: Same as Option 1</p>

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
	use.			
Site Access	No Change	No Change	No Change	No Change
Truck Transportation	<p>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)</p>	<p>Estimated number of truckloads of fill: Same as Option 1</p>	<p>Estimated number of truckloads of fill: Same as Option 1</p> <p>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.</p>	<p>Estimated number of truckloads of fill: Same as Option 1</p> <p>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.</p>
	<p>Estimated number of truckloads of crushed stone: 1,788 crushed stone</p>	<p>Estimated number of truckloads of crushed stone: Same as Option 1</p>	<p>Estimated number of truckloads of crushed stone: Same as Option 1</p>	<p>Estimated number of truckloads of crushed stone: Same as Option 1</p>
	<p>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.</p>	<p>Estimated number of truckloads of concrete: Same as Option 1</p>	<p>Estimated number of truckloads of concrete: Same as Option 1</p>	<p>Estimated number of truckloads of concrete: Same as Option 1</p>
	<p>Estimated number of truckloads of well casing: 4,950 total truckloads for 45 wells and 10 deep vadose zone piezometers – 10 deliveries per month per well for drill pipe, well construction</p>	<p>Estimated number of truckloads of well casing: Same as Option 1</p>	<p>Estimated number of truckloads of well casing: Same as Option 1</p>	<p>Estimated number of truckloads of well casing: Same Option 1</p>

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
	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 approximately 50 yd ³ per yr. This waste would be shipped to various	Same as Option 1	Same as Option 1	Same as Option 1

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
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 Nonhazardous Waste Generated: Same as Option 1	Annual Volumes of Nonhazardous Waste Generated: Same as Option 1	Annual Volumes of Nonhazardous Waste Generated: Same as Option 1
	Annual Volumes of Hazardous Waste Generated: 30 gpy	Annual Volumes of Hazardous Waste Generated: Same as Option 1	Annual Volumes of Hazardous Waste Generated: Same as Option 1	Annual Volumes of Hazardous Waste Generated: Same as Option 1
	Annual Volume of Wastewater Generated: 50,000 gpy of treated water from maintenance and monitoring at each injection well.	Annual Volume of Wastewater Generated: Same as Option 1	Annual Volume of Wastewater Generated: Same as Option 1	Annual Volume of Wastewater Generated: Same as Option 1

Table B-1. Description of the proposed adaptive site management alternatives¹

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)
	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; ft² = square feet; ft³ = 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; yd³ = cubic yard; yr = year

1 **B.4 ALTERNATIVES CONSIDERED BUT NOT EVALUATED**

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

7 **B.5 REFERENCES**

8 DOE. (2015). *Environmental Assessment for Chromium Plume Control Interim Measure and*
9 *Plume Center Characterization*. U.S. Department of Energy.

10 LANL. (2009). Investigation Report for Sandia Canyon. *Los Alamos National Laboratory*
11 *document LA-UR-09-6450*. Los Alamos, New Mexico: October.

12 NMED. (2015). *Ground Water Quality Bureau discharge permit DP-1793*. New Mexico
13 Environmental Department.

14 NNSA. (2010, August 24). Final Environmental Assessment for the Expansion of the Sanitary
15 Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia
16 Canyon at Los Alamos National Laboratory Los Alamos, New Mexico. *DOE/EA-1736*.
17 Los Alamos, New Mexico: U.S. Department of Energy National Nuclear Security
18 Administration.

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	-	-	-	-	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).
	Phytoremediation	-	-	+	-	Containment barriers such as capping, grout walls are not needed to limit human or ecological exposure.
	Containment	+	+	-	-	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	+	+	+	+	
	Ion exchange for Cr(VI)	+	+	-	+	
	Reduction, precipitation and coagulation for Cr(VI)	+	+	-	+	Groundwater extraction would be feasible, if the occasional exceedances of Sandia Canyon alluvial groundwater (50–75 g/L range) indicate the need.
	Electrochemical precipitation for Cr(VI)	-	-	-	+	
	Reverse Osmosis/nanofiltration for Cr(VI)	-	-	-	+	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.
	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.

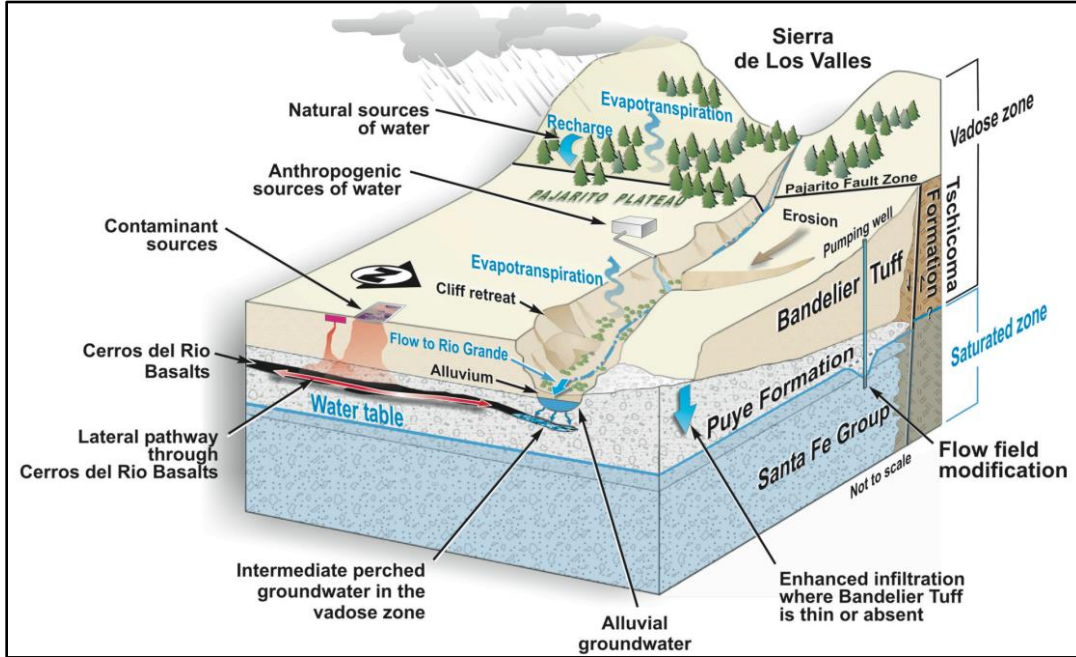


Figure C-1. Groundwater components at Los Alamos National Laboratory (Figure 1-2 from LANL, 2005)

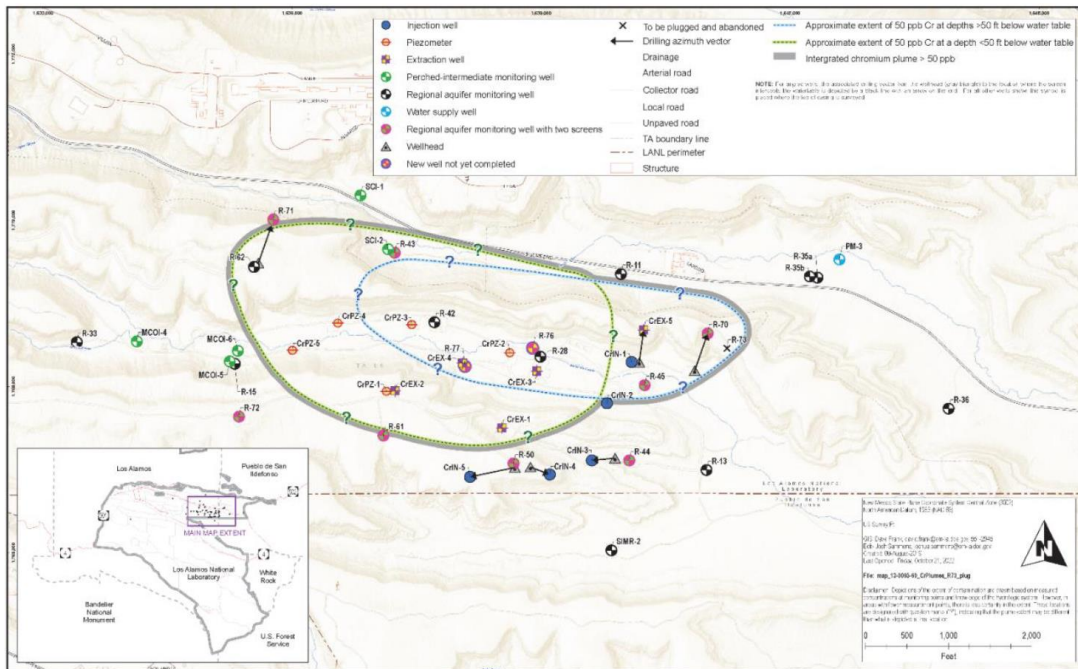
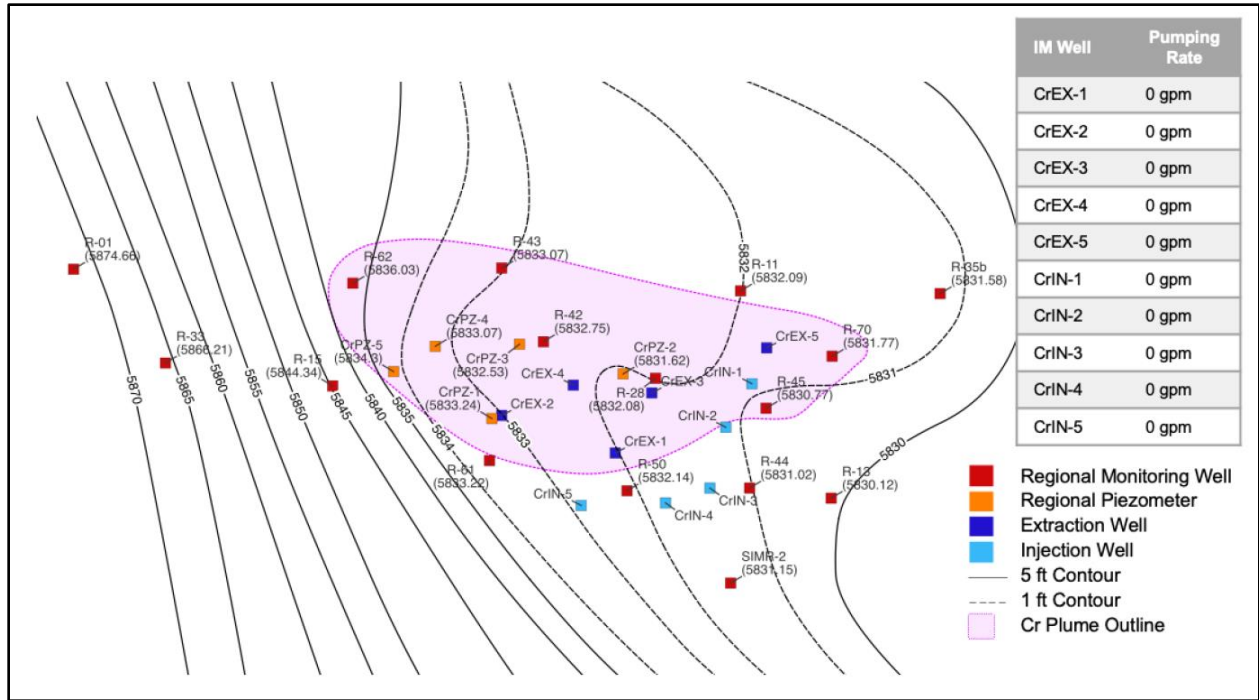
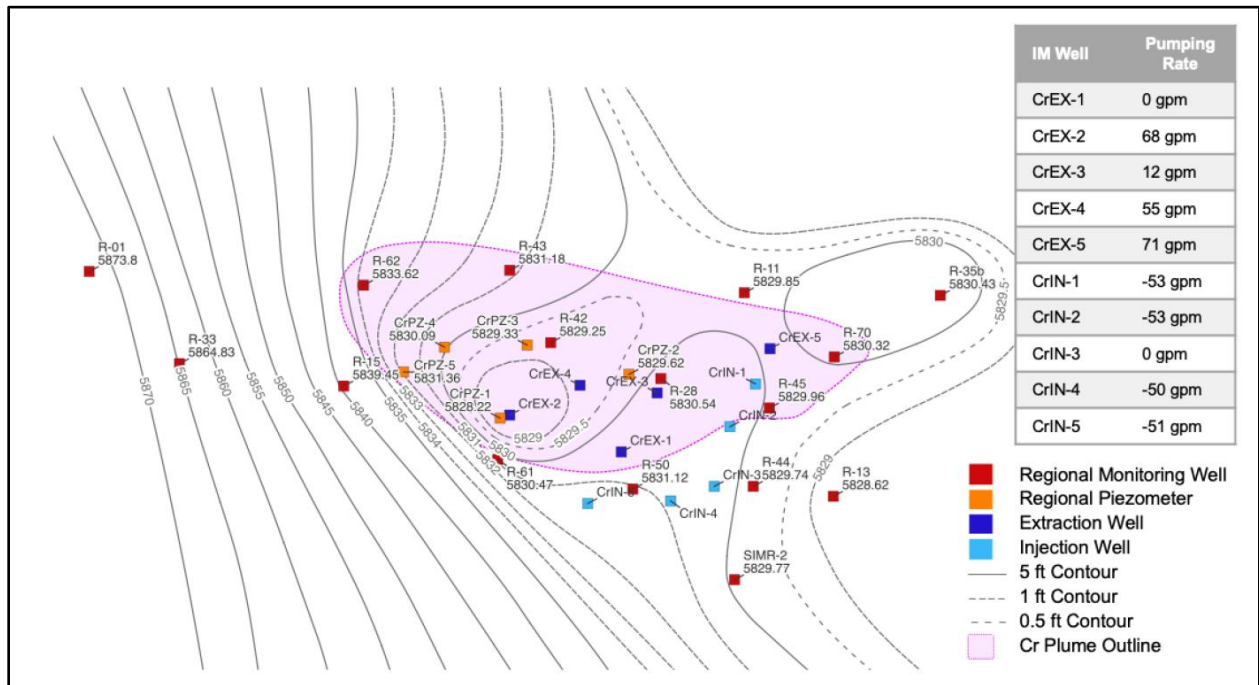


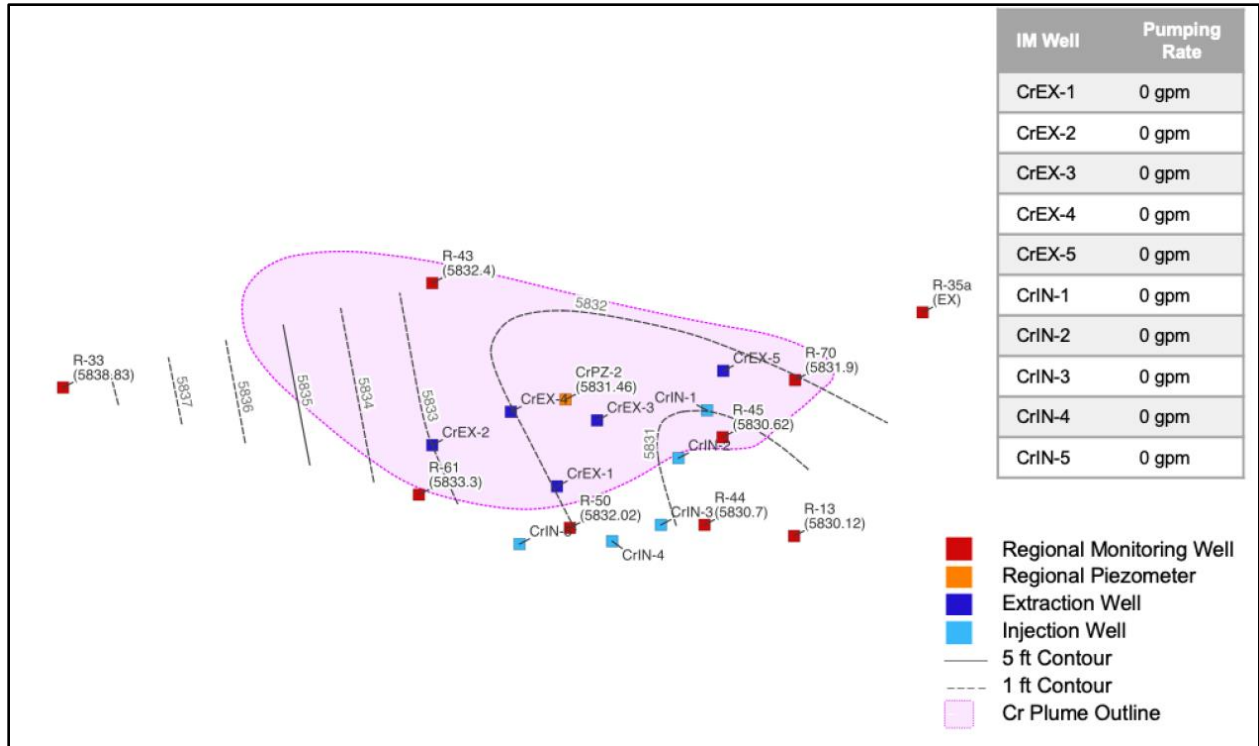
Figure C-2. Approximate iso-concentration contours of Cr(VI) in the regional aquifer with the locations of monitoring, injection, extraction, and water supply wells, and piezometers



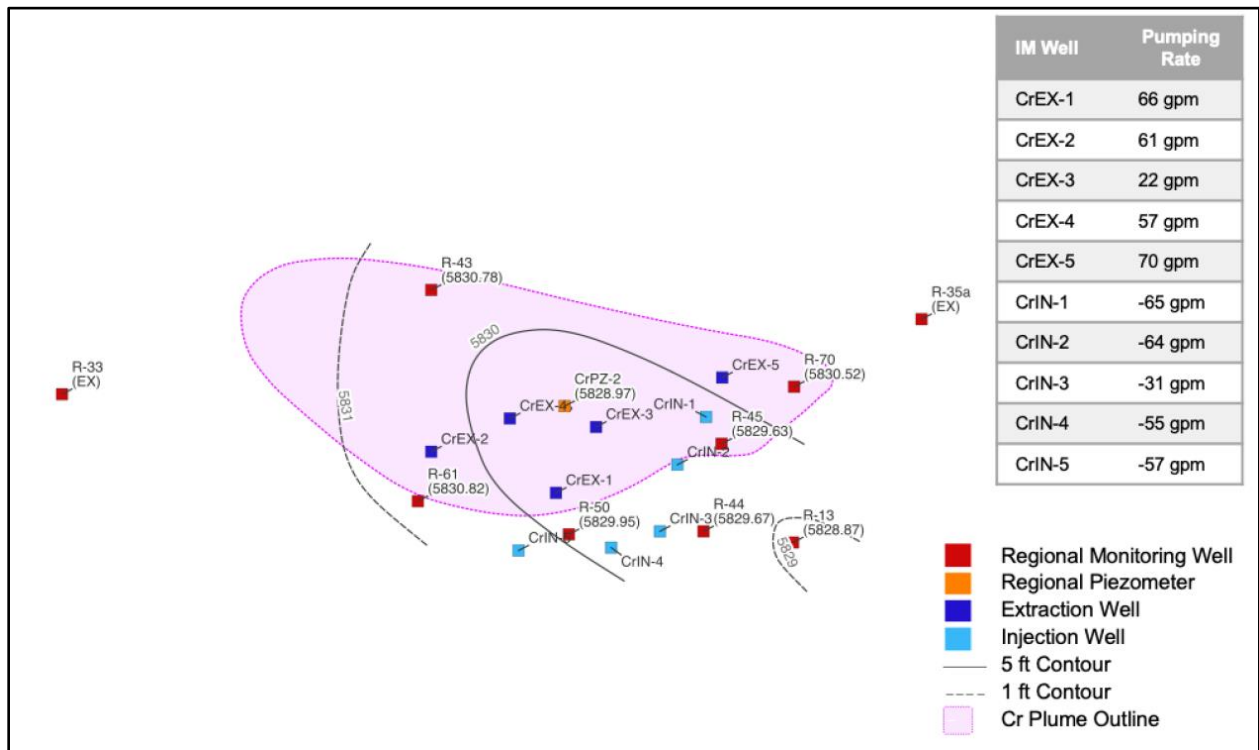
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2
3
Figure C-3. Water table map for May 1, 2020, 1:00 a.m., which represents ambient (“baseline”) conditions (Figure 8 from Neptune, 2023)



4
5
6
7
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)



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



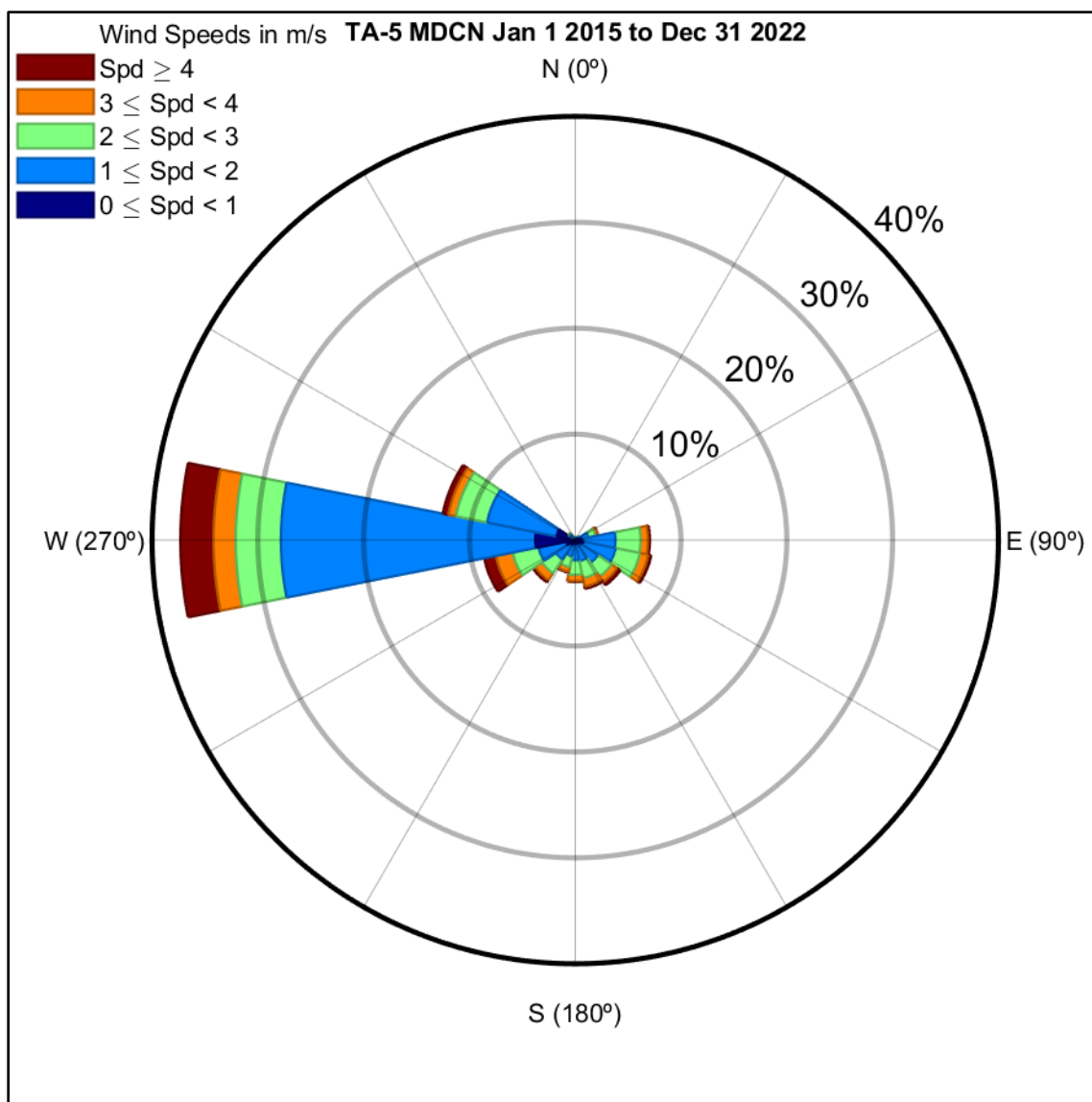
4
5 **Figure C-6. Deep screen hydraulic head map for June 15, 2021, 1:00 a.m., which includes**
6 **full interim measure operation (pumping and injection at all CrIN/CrEX wells)**
7 **(Figure 10 from Neptune, 2023)**

1 **Water Resources Supporting Information References**

2 LANL. (2005). *Los Alamos National Laboratory's Hydrogeologic Studies of the Pajarito*
 3 *Plateau: A Synthesis of Hydrogeologic Workplan Activities (1998-2004)*. LA-14263-MS.
 4 Neptune and Company, Inc. (2023). Chromium Interim Measure Capture Zone Analysis, 16 June
 5 2023.

6 **C.2 AIR QUALITY**

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



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

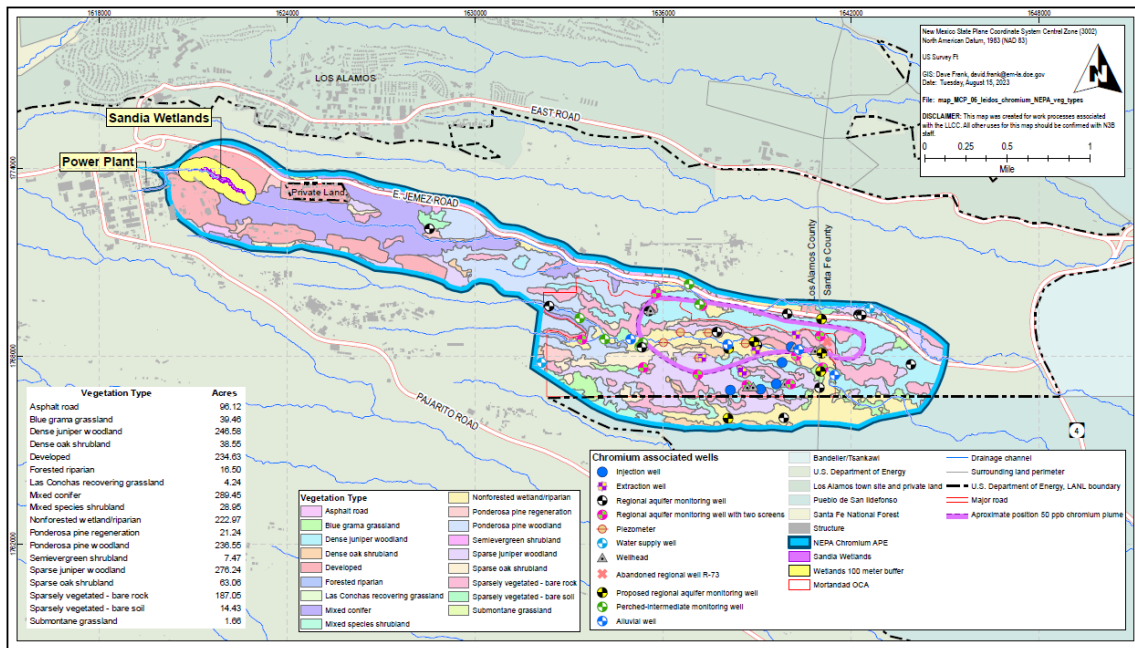
10
 11 The U.S. Department of Energy (DOE) Office of Environment Management (EM) would
 12 implement the following best management practices to minimize fugitive dust emissions during the
 13 proposed installation activities:

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

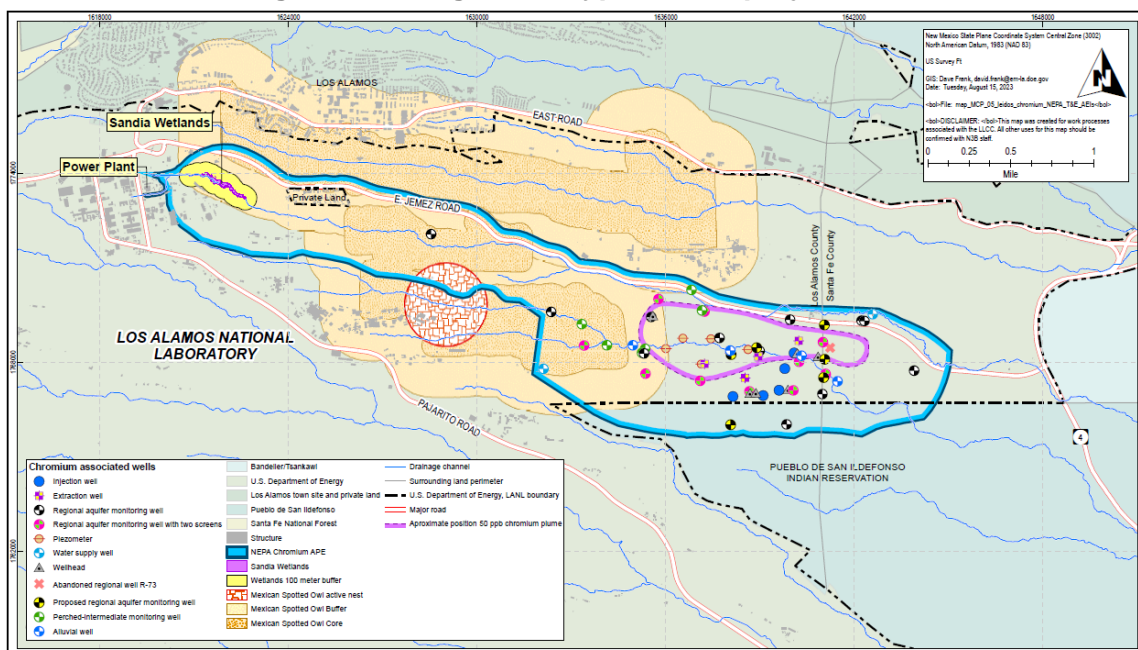
- 1 • Designate personnel to monitor the monitor the dust control program and increase control measures,
 2 as necessary, to minimize the generation of dust. This responsibility would extend to
 3 after-work hours.

4 C.3 ECOLOGICAL RESOURCES

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



7 **Figure C-8. Vegetation types in the project area**



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

1

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	<i>Corynorhinus townsendii pallescens</i>		Susceptible	S3	
Spotted Bat	<i>Euderma maculatum</i>	Threatened	Susceptible	S3	
Gunnison's prairie dog	<i>Cynomys gunnisoni</i>		Immediate priority	S2	
Birds					
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Threatened		S1	
Peregrine Falcon	<i>Falco peregrinus</i>	Threatened		S3	
Northern Goshawk	<i>Accipiter gentilis</i>			S2, S3	
Flammulated Owl	<i>Psilosops flammeolus</i>		Immediate priority	S3	PIFWL
Lewis's Woodpecker	<i>Melanerpes lewis</i>		Immediate priority	S3	PIFWL
Gray Vireo	<i>Vireo vicinior</i>	Threatened	Immediate priority	S3	PIFWL
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>		Immediate priority	S2, S3	PIFWL
Juniper Titmouse	<i>Baeolophus ridgwayi</i>		Immediate priority		
Evening Grosbeak	<i>Coccothraustes vespertinus</i>		Susceptible		PIFWL
Cassin's Finch	<i>Haemorhous cassinii</i>		Susceptible	S3	PIFWL
Black-chinned Sparrow	<i>Spizella atrogularis</i>		Immediate priority	S3	PIFWL
Virginia's Warbler	<i>Leiothlypis virginiae</i>		Immediate priority	S3	PIFWL
Grace's Warbler	<i>Setophaga graciae</i>		Immediate priority	S3	PIFWL
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>		Immediate priority	S3	
Amphibians and Reptiles					
Smooth Green Snake	<i>Opheodrys vernalis</i>			S3	
Plants					
Mountain wood lily	<i>Lilium philidelphicum</i>	Endangered		S3	
Springer's Blazingstar	<i>Mentzelia springeri</i>			S2	
Yellow Lady's Slipper	<i>Cypripedium parviflorum</i>	Endangered		S2	
Giant Helleborine Orchid	<i>Epipactis gigantea</i>			S2	
Sapello canyon larkspur	<i>Delphinium sapellonis</i>			S3	
Invertebrates					
Monarch Butterfly	<i>Danaus plexippus</i>				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 <i>Corynorhinus townsendii pallescens</i>	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 <i>Euderma maculatum</i>	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 <i>Cynomys gunnisoni</i>	Survey known locations before development.
Birds	
Bald Eagle <i>Haliaeetus leucocephalus</i>	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 <i>Falco peregrinus</i>	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 <i>Accipiter gentilis</i>	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 <i>Psiloscops flammeolus</i>	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 <i>Melanerpes lewis</i>	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 <i>Vireo vicinior</i>	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 <i>Gymnorhinus cyanocephalus</i>	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 <i>Baeolophus ridgwayi</i>	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
Evening Grosbeak <i>Coccothraustes vespertinus</i>	<p>paused, and EPC-ES biologists must be notified. Active nests built within structures or equipment are also protected.</p> <p>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.</p>
Cassin's Finch <i>Haemorhous cassinii</i>	<p>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.</p>
Black-chinned Sparrow <i>Spizella atrogularis</i>	<p>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.</p>
Virginia's Warbler <i>Leiothlypis virginiae</i>	<p>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.</p>
Grace's Warbler <i>Setophaga graciae</i>	<p>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.</p>
Black-throated Gray Warbler <i>Setophaga nigrescens</i>	<p>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.</p>
Mexican Spotted Owl <i>Strix occidentalis lucida</i>	<p>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.</p>

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
Southwestern Willow Flycatcher <i>Empidonax traillii extimus</i>	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.
Amphibians and Reptiles	
Smooth Green Snake <i>Opheodrys vernalis</i>	Survey sites with suitable habitat before development.
Jemez Mountain Salamander <i>Plethodon neomexicanus</i>	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 <i>Lilium philadelphicum</i>	Survey sites with suitable habitat before development.
Springer's Blazingstar <i>Mentzelia springeri</i>	Survey sites with suitable habitat before development.
Yellow Lady's Slipper <i>Cypripedium parviflorum</i>	Survey sites with suitable habitat before development.
Giant Helleborine Orchid <i>Epipactis gigantea</i>	Survey sites with suitable habitat before development.
Sapello canyon larkspur <i>Delphinium sapellonis</i>	Survey sites with suitable habitat before development.
Invertebrates	
Monarch Butterfly <i>Danaus plexippus</i>	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
Pollinators	<p>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.</p> <p>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.</p>
Native Bees	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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
	<p>lower-intensity lighting, reducing perimeter lighting, re-scheduling work and night cleaning, establishing interior working areas, and using blinds and curtains.</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<p>The following best management practices will be used to mitigate impacts:</p> <ul style="list-style-type: none"> • 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 will be refueled at least 100 feet from the floodplains and wetland. • 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. • 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.

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
	<ul style="list-style-type: none"> 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; 2023)

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

1 **Biological Resources Supporting Information References**

- 2 LANL. (2020a). *Sensitive Species Best Management Practices Source Document, Revision 5*.
3 Jesse T. Berryhill, Jenna E. Stanek, Elisa J. Abeyta, and Charles D. Hathcock
4 Environmental Protection and Compliance Division Environmental Stewardship Group.
- 5 LANL. (2020b). *Migratory Bird Best Management Practices Source Document for Los Alamos*
6 *National Laboratory, Revised June 2020*. Biological Resources Program Environmental
7 Protection and Compliance Division, Environmental Regulatory Document.
- 8 LANL. (2021). *Pollinator Protection Plan for Los Alamos National Laboratory*. Prepared by
9 Environmental Protection and Compliance Division Environmental Stewardship Group,
10 Resources Management Team Los Alamos National Laboratory.
- 11 LANL. (2022). *Threatened and Endangered Species Habitat Management Plan for Los Alamos*
12 *National Laboratory*. Prepared for Environmental Protection and Compliance Division
13 Resources Management Team Los Alamos National Laboratory.
- 14 LANL (2023). *Floodplain and Wetland Assessment for Chromium Remediation in Sandia and*
15 *Mortandad Canyons, Los Alamos National Laboratory*. Prepared by N3B.

16 **C.4 CULTURAL RESOURCES**

17 **C.4.1 RESOURCE DEFINITION**

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

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

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

35 **C.4.2 REGULATORY FRAMEWORK**

36 A number of Federal laws and Executive Orders (EOs) address cultural resources and Federal
37 responsibilities regarding them. Foremost among these statutory provisions, and most relevant to
38 the current analysis, is the National Historic Preservation Act (NHPA) (54 U.S.C. 300101 et seq.).
39 Section 106 of the NHPA requires Federal agencies to take into account the effect of their

1 undertakings on historic properties. The Advisory Council on Historic Preservation regulations that
2 implement Section 106 (36 Code of Federal Regulations [CFR] 800) describe the process for
3 identifying and evaluating resources; assessing effects of Federal actions on historic properties; and
4 consulting to avoid, minimize, or mitigate those adverse effects. The NHPA does not mandate
5 preservation of historic properties, but it does ensure that Federal agency decisions concerning the
6 treatment of these properties result from meaningful consideration of cultural and historical values
7 and identification of options available to protect the properties.

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

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

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

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

35 **C.4.3 CULTURAL RESOURCE INVESTIGATIONS**

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

41 *Archaeological Survey and Testing*

42 Previous archaeological investigations have been conducted in Mortandad Canyon and surrounding
43 areas. These investigations, dating to as early as 1967, included site recording, surveying, and

1 periodic monitoring. Most recently, an intensive investigation was conducted following the Cerro
2 Grande fire in 2000 (LANL, 2002). The report of this work provides information regarding fire
3 effects on archaeological sites located within and adjacent to Mortandad Canyon. The report
4 recommends annual monitoring, and archaeological sites are periodically revisited by archaeologists
5 and updated as part of ongoing cultural resources site monitoring. For the 2015 Interim Measure
6 Environmental Assessment (EA), all previously identified cultural resources were revisited for the
7 purpose of updating the site recording forms and obtaining additional data for NRHP eligibility
8 determinations.

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

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

22 ***Tribal Consultation***

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

26 Tribes that have shown an interest in, or claimed affiliation to, cultural resources located on LANL
27 property include Pueblo de San Ildefonso, Santa Clara Pueblo, Pueblo de Cochiti, Jemez Pueblo,
28 Acoma Pueblo, Mescalero Apache Tribe, Hopi Tribe, and Jicarilla Apache Tribe (LANL, 2006).
29 Acoma Pueblo, Mescalero Apache Tribe, and the Hopi Tribe have all indicated to DOE that they do
30 not need to be active participants in cultural resource consultations for activities at LANL. Jicarilla
31 Apache Tribe, Jemez Pueblo, Pueblo de Cochiti, and Santa Clara Pueblo all claim cultural
32 affiliation to resources that are located in portions of LANL property, outside of the project area.
33 Representatives from the Pueblo de San Ildefonso view the entire project area to be within their
34 ancestral land use areas and claim cultural affiliation to the Ancestral Pueblo cultural remains
35 within it (LANL, 2006). DOE recognizes the affiliation for all of these Pueblos; however, in this
36 area of LANL property the Pueblo de San Ildefonso is the recognized affiliated Pueblo. For this
37 reason, DOE has focused its Tribal consultation for this project on Pueblo de San Ildefonso.

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

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

4 **C.4.4 EVALUATION OF ARCHAEOLOGICAL SITE SIGNIFICANCE**

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

- 12 A. Association with events that have made a significant contribution to the broad patterns of
13 our history.
- 14 B. Association with the lives of persons significant in our past.
- 15 C. Embody the distinctive characteristics of a type, period, or method of construction, or
16 represent the work of a master, or possess high artistic values, or represent a significant
17 and distinguishable entity whose components may lack individual distinction.
- 18 D. Have yielded, or may be likely to yield, information important in prehistory or history.

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

24 **C.4.5 CULTURAL RESOURCES IN THE APE**

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

28 *Archaeological Sites*

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

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

1 most of the sites, and one site contains adobe blocks; sometimes these are seen in their original wall
2 alignments.

3 The remaining 54 sites in the APE include 10 fieldhouses, 14 prehistoric artifact scatters with no
4 evidence of architecture, 2 game traps carved into bedrock, 10 prehistoric trails and stairways of
5 hand and foot holds carved into bedrock, 2 rock art sites, 3 rock features, 3 rock rings, 1 rockshelter,
6 1 thermal feature, 2 water control features, 4 Homestead period structures, 2 Homestead period
7 wagon roads, and a Homestead period trash scatter.

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

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

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

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

40 ***Historic Buildings***

41 There are 12 historical buildings within the APE, all of which were built during the Cold War
42 between 1959 and 1986 (Table C-3). Five of them have been determined eligible for listing in
43 the NRHP (two under Criterion A, and three under Criterion A and C). The other seven

1 buildings are not evaluated or are currently undergoing assessment for significance and NRHP
2 eligibility, and are managed as NRHP-eligible until a final determination is made.

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

5 **Table C-3. Los Alamos National Laboratory historic buildings in the**
6 **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 Center	1966	Utilities control center for TA-3 and surrounding technical areas.	Under Assessment
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

1 ***Tribal Cultural Resources***

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

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

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

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

35 **C.4.6 ENVIRONMENTAL CONSEQUENCES ANALYSIS METHODOLOGY**

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

1 be regenerated, all physical impacts to historic properties are considered to be permanent in
2 duration.

3 ***Criteria of Adverse Effects***

4 Section 106 of the NHPA requires Federal agencies to take into account the effects of their actions
5 on any district, site, object, building, or structure included in, or eligible for inclusion in, the NRHP.
6 An adverse effect occurs when an undertaking diminishes the integrity of those characteristics of an
7 historic property that qualify it for inclusion in the NRHP. Implementing regulations for Section
8 106 (36 CFR 800) provide specific criteria for identifying effects on historic properties. The types
9 of possible adverse effects include:

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

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

25 ***Tribal Consultation***

26 Consultation with federally recognized Tribes for the Proposed Action commenced during the
27 Public Scoping period. Each of the Accord Pueblos (Pueblo de Cochiti, Pueblo de San Ildefonso,
28 Pueblo of Jemez, Santa Clara Pueblo) received a courtesy phone call to the pueblo environment
29 department ahead of the Public Scoping meeting, followed by letters regarding the scoping with an
30 offer for in-person consultation. DOE Office of Environmental Management Los Alamos Field
31 Office (EM-LA) also had an in-person meeting on the scoping with the Pueblo de San Ildefonso
32 environment department. Additionally, EM-LA Corrective Measures Evaluations presented at the
33 Accord Technical Exchange Meeting (ATEM) on July 11, 2023, regarding the NEPA for the
34 Proposed Action. Representatives from each of the Accord Pueblos were in attendance for that
35 occurrence of the ATEM. EM-LA will send another round of letters to each of the Accord Pueblos
36 when the Draft EA is available, which will include an offer to consult, after which there will be
37 another presentation to the ATEM on the Draft EA. Pueblo de San Ildefonso has responded that
38 they plan to request consultation at that time.

1 **Cultural Resources Supporting Information References**

2 DOE. (2006). *Programmatic Agreement Among the Advisory Council for Historic Preservation,*
3 *the New Mexico State Historic Preservation Officer, and the U.S. Department of Energy*
4 *regarding Section 106 Responsibilities at Los Alamos National Laboratory.*

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6 *Plume Center Characterization.* U.S. Department of Energy.

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11 **C.5 SOCIOECONOMICS**

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

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

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

34 Table C-4 summarizes socioeconomic conditions for the ROI with respect to population, income,
35 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	13,293	53,567	65,856	140,745	797,596
	Owner: 5,963 Rental: 2,066	Owner: 10,342 Rental: 2,951	Owner: 42,549 Rental: 11,018	Owner: 46,974 Rental: 18,882	Owner: 105,828 Rental: 34,917	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

- 1 Population levels fluctuated slightly in Los Alamos County, the ROI, and New Mexico between
- 2 2020 and 2022 (slight decreases between 2020 and 2021), but showed a small increase in 2022.
- 3 The Pueblo of San Ildefonso is a minority-dominated community nearest LANL and the existing
- 4 plume; it had a population of 2,261 in 2021.
- 5 In 2021, there were a total of 161,833 housing units in the four-county area, with 87 percent
- 6 occupied and 13 percent vacant. The median value of owner-occupied homes in Los Alamos
- 7 County (\$343,100) is the greatest of the four counties and nearly twice the median value of
- 8 owner-occupied homes in Rio Arriba County (\$179,800). According to the most recent

1 Supplemental Analysis to the LANL Site-Wide Environmental Impact Statement (SWEIS)
2 (DOE, 2020), Los Alamos County is experiencing a housing shortage that affects the quality of life
3 for individuals who work in Los Alamos, including LANL, and reside elsewhere in the ROI. A
4 2019 housing study indicates that approximately 576 new units would be needed to accommodate
5 new hires to the county, including LANL (LAC, 2019, pp. 44).

6 There are major differences in the income levels among the four counties, especially between Rio
7 Arriba County, at the low end with a median household income in 2021 of \$46,994 and a per capita
8 income of \$25,342, and Los Alamos County, at the upper end with a median household income of
9 \$123,677 and a per capita income of \$64,521. The median household income in Los Alamos
10 County is over twice that of the New Mexico State average (\$54,020 in 2021).

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

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

23 As of 2018, LANL had a total direct labor income of \$1.34 billion. Indirectly, LANL supported
24 19,122 jobs and those jobs equal \$1.57 billion in labor income to the State of New Mexico
25 (UNM, 2019). An update to the 2019 Economic Report identified the annual salary at LANL at
26 1.53 billion (\$689,636,978 in Los Alamos County) and the Laboratory spent \$915,988,873 on
27 procurement in New Mexico (LANL, 2023a).

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

- 29 • No Action Alternative: The total peak workforce that could be on-site at one time for a
30 short duration of the year is estimated at 75 workers; based on up to two wells being
31 drilled at same time (four new wells would be drilled over the course of a year under the
32 No Action Alternative), including 38 relating to construction (8 drillers and 30
33 admin/support staff) and 42 relating to operation (12 drillers and 30 admin/support staff).
- 34 • ASM Proposed Action options: Same breakout per well as No Action Alternative but
35 more wells within a given year and peak workforce up to 120 on-site at one time.
- 36 • Regarding the well and pad construction and operation, a large number of the workers
37 include T2S and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) personnel
38 (e.g., contractor management/admin staff, see Appendix B, *Description of Alternatives*
39 *Supporting Information*, Table B-1), which would be pulled from existing contractor staff
40 (e.g., transition from current positions associated with the ongoing measures to contain
41 the plume boundary or transition over from other LANL activities) or would be local
42 hires if new positions were created.

- 1 • Drilling crews would be subcontractors and hired per job. They would be unlikely to live
2 in the Los Alamos area, as most contractors currently come on site from Albuquerque
3 area, and would relocate to the site on a temporary, per job basis. The drilling crews
4 would comprise the in-migrating workforce for purposes of this analysis.
- 5 • Regarding construction and operation of the new treatment facility, it is assumed that the
6 same employees, counted in the well pad builds, also would construct the facility; and
7 that operation of the facility would be conducted by existing contractor staff.
- 8 • A breakout of an in-migrating workforce associated with the drilling crew would include:
 - 9 ○ ASM options: 24 construction (8 x 3) and 36 (12 x 3) operations workers (assuming
10 up to 3 wells drilled concurrently during a five-month period over course of year.
 - 11 ○ No Action Alternative: 16 construction (8 x 2 wells) and 24 (12 x 2 wells) operations
12 workers, assuming two wells would be drilled concurrently during a 5-month period
13 over the course of a year.
- 14 • It is unlikely that the drilling crews, based on the short-term nature of the work, would
15 bring their families with them. However, the analysis assumes they would bring their
16 families in order to provide a more conservative bounding scenario. In some cases, the
17 same worker may stay on to drill subsequent wells on-site during the course of the project.
- 18 • In-migrating families would consist of 2.59 family members, including the worker, based
19 on average household size in New Mexico in 2021.

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

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

31 ***Socioeconomics Supporting Information References***

- 32 DOE. (2015). *Final Environmental Assessment for Chromium Plume Control Interim Measure*
33 *and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New*
34 *Mexico*. DOE/EA-2005. December 2015.
- 35 DOE. (2020). *Final Supplemental Analysis of the 2008 Site Wide Environmental Impact*
36 *Statement for the Continued Operation of Los Alamos National Laboratory for Plutonium*
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17 U.S. Census Bureau. (2023c). *American Community Survey (5-year average 2017-2021).*
18 *Queries for New Mexico and associated counties. DP04 Selected Housing*
19 *Characteristics*. Retrieved from: <https://data.census.gov/table?tid=ACSDP1Y2021.DP04>.

20 U.S. Census Bureau. (2023d). *American Community Survey (5-year average 2017-2021).*
21 *Queries for New Mexico and associated counties. DP05 ACS Demographic and Housing*
22 *Estimates*. Retrieved from: <https://data.census.gov/table?tid=ACSDP1Y2021.DP05>.

23 UNM. (2019). *The Economic Impact of Los Alamos National Laboratory*. University of New
24 Mexico Bureau of Business and Economic Research report for Los Alamos National
25 Laboratory, June 2019. Retrieved from: [https://www.lanl.gov/community/economic/_](https://www.lanl.gov/community/economic/_assets/doc/unmbber-lanl-impactanalysis.pdf)
26 [assets/doc/unmbber-lanl-impactanalysis.pdf](https://www.lanl.gov/community/economic/_assets/doc/unmbber-lanl-impactanalysis.pdf).

27 **C.6 ENVIRONMENTAL JUSTICE**

28 **C.6.1 REGULATORY BACKGROUND**

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

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

- 1 • **Environmental Justice** – The fair treatment and meaningful involvement of all people
2 regardless of race, color, national origin, or income, with respect to the development,
3 implementation, and enforcement of environmental laws, regulations, and policies (EPA, 2023).
- 4 • **Minority** – Individual(s) who have identified themselves as members of one or more of
5 the following population groups as designated in the U.S. Census Bureau (USCB) data:
6 Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian
7 and Other Pacific Islander, Some Other Race, as well as Hispanic or Latino of any race
8 (USCB now refers to these individuals as people of color).
- 9 • **Low income** – The USCB uses a set of money income thresholds that vary by family size
10 and composition to determine who is in poverty (i.e., classified as “low income”). A family
11 and each individual in the family is considered in poverty if the total family income is less
12 than the family’s threshold or the dollar amount calculated by the USCB to determine
13 poverty status (USCB, 2023a).
- 14 • **Minority or low-income population** – A minority population is a population where either:
15 (a) the minority population of the selected geographic units of analysis (block group) exceeds
16 50 percent, or (b) the minority population percentage of the block group is meaningfully
17 greater (e.g., 10 or 20 percent greater) than the minority population percentage in a reference
18 community (i.e., state). For low-income populations, the presence of the population is
19 determined if the percentage of low-income individuals residing within the selected
20 geographic units of analysis (block groups) is equal to or greater than the percentage of
21 low-income individuals residing within the reference community (in this case the State of
22 New Mexico). In identifying minority or low-income populations, agencies may consider as a
23 community either a group of individuals living in geographic proximity to one another, or a
24 geographically dispersed/transient set of individuals (such as migrant workers or Native
25 Americans), where either type of group experiences common conditions of environmental
26 exposure or effect. The selection of the appropriate unit of geographic analysis may be a
27 governing body’s jurisdiction, a neighborhood, census tract, or other similar unit that is to be
28 chosen so as to not artificially dilute or inflate the affected minority population.

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

35 ***EM-LA Justice40 Initiative***

36 As a part of the Justice40 Initiative, DOE has conducted an analysis to identify disadvantaged
37 communities in the United States, which DOE defines as underserved, overburdened, and front-line
38 communities (DOE, 2022). The Justice40 Initiative focuses on Federal investments to
39 disadvantaged communities in the following areas: clean energy and energy efficiency, clean
40 transit, affordable and sustainable housing, training and workforce development, the remediation of
41 legacy pollution, and the development of critical clean water infrastructure (EM-LA, 2021a).

42 In July 2021 EM-LA in New Mexico was selected as one of five DOE Justice40 Initiative Pilot
43 Programs and it is the only Justice40 Pilot Program in EM. EM-LA’s mission falls under the

1 covered program of “remediation and reduction of legacy pollution.” The focus of EM’s
2 environmental cleanup work under Justice40 is soil and groundwater remediation.

3 EM-LA and its cleanup contractor N3B engage with numerous “disadvantaged communities” in the
4 areas surrounding Los Alamos County. By way of example, these disadvantaged communities
5 include Tribal jurisdictions and Northern New Mexico counties, as well as predominantly Hispanic
6 communities in which there are low incomes and high levels of poverty (EM-LA, 2021b).

7 Tribal jurisdictions include the following Pueblos:

- 8 • Pueblo de San Ildefonso
- 9 • Pueblo of Jemez
- 10 • Santa Clara Pueblo
- 11 • Pueblo de Cochiti
- 12 • Pueblo of Pojoaque
- 13 • Taos Pueblo

14 The (proximate) Accord Tribes, which comprises four New Mexico Pueblo Governments (Santa
15 Clara Pueblo, Pueblo de Cochiti, Pueblo of Jemez and Pueblo de San Ildefonso), have individual
16 cooperative agreements to develop and maintain environmental monitoring programs through the
17 Los Alamos Pueblos Project. These agreements and grants funded by EM-LA (e.g., EM funds the
18 Santa Fe Indian School) enable the Los Alamos Pueblos Project Tribal program personnel to obtain
19 the training to monitor and sample soil, air, groundwater, and other media, and facilitate
20 development of Pueblo environmental programs to analyze and monitor the impact, if any, of DOE
21 operations to Pueblo lands (EM-LA, 2021b). EM-LA also provides numerous educational and
22 training briefings to Pueblo members to enhance awareness of ongoing efforts regarding
23 remediation and reduction of legacy waste. EM-LA continues to pursue additional opportunities to
24 inform, train, and educate these disadvantaged communities regarding ongoing cleanup projects in
25 and around LANL. These opportunities would consist of both presentations and site visits (EM-LA,
26 2021a).

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

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

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

1 Since N3B’s start of contract in April 2018, N3B has donated \$973,444 to workforce development
 2 programs and Northern New Mexico nonprofits (EM-LA, 2021b).

3 Recent Tribal outreach efforts specific to the Proposed Action include the following
 4 (Chandler, 2023):

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

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

17 **C.6.2 AFFECTED ENVIRONMENT AND SUPPORTING DATA**

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

20 The potentially affected area is located primarily in Los Alamos County, New Mexico. The
 21 demographics for Los Alamos County are as follows (2021 data): Non-Hispanic/Latino comprise
 22 81.8 percent of residents. People of Hispanic or Latino ethnicity represent 18.2 percent of the
 23 residents; this percentage is much lower (2.8 times) than New Mexico, which is at 50.2 percent.
 24 Native Americans represent approximately 1.5 percent of residents, while Blacks and African
 25 Americans make up 1.4 percent of residents (USCB, 2023b). The total minority population in New
 26 Mexico in 2021 was 64.3 percent.

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

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

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

1 **Region of Analysis**

2 For purposes of the EM-LA Justice40 Pilot Program, EM-LA determined eight counties are
3 included or partially included in the potentially affected legacy pollution area (Bernalillo, Los
4 Alamos, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe and Taos), based on potential
5 radiological risk from current missions performed at LANL, and as measured within a 50-mile
6 radius from the emissions stack at the Los Alamos Neutron Science Center in Technical Area (TA)-
7 534 (EM-LA, 2021a). These areas include the City of Santa Fe and Indian Reservations in North
8 Central New Mexico; they also are consistent with the ROI defined in past LANL SWEISs and the
9 currently in progress SWEIS. The majority of properties within a 50-mile radius of LANL consist
10 of Federal property without full-time residents.

11 The proposed region of analysis for environmental justice in this EA is significantly smaller than
12 50-miles since no radiological air emissions would be expected from the proposed project. Rather,
13 the project boundary is based on the existing area of (and potential movement of) the contaminated
14 chromium groundwater plume that is better defined and more limited in size. Specifically, it is
15 identified as a 5-mile radius of the plume boundary. This is consistent with the for the ROI for
16 water resources (i.e., groundwater) and potential health effects analyzed in this EA; these resource
17 areas are considered to be the primary drivers for determining potential adverse effects of most
18 concern to any environmental justice populations identified. The ROI lies within a part of Los
19 Alamos County (primarily within LANL site boundary), and very small portions of Rio Arriba,
20 Santa Fe, and Sandoval Counties, New Mexico.

21 **Methodology for Determining Minority and Low-Income Populations**

22 The methodology used for the environmental justice analysis, is described in EPA's *Promising*
23 *Practices for EJ Methodologies in NEPA Reviews* (EPA, 2016) and typically includes both the
24 50 percent and greater meaningful analysis as defined previously. This EA is using only the 50
25 percent analysis in identifying minority populations, consistent with the methodology used in the
26 2008 SWEIS. The analysis of minority and low-income populations focuses on USCB data for
27 geographic units (i.e., block groups) that represent, as closely as possible, the potentially affected
28 areas.

29 **Minority Population in 2021**

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

35 According to 2021 census data, approximately 8,030 minority individuals resided within the 5-mile
36 radius of LANL. This represented 34 percent of the total population within the 5-mile radius. The
37 largest minority group in the study area was the Hispanic population (51.9 percent), followed by
38 American Indians (4.5 percent). Minorities are about 29.2 percent of Los Alamos County's
39 population, with Hispanics being the largest minority group (18.3 percent). Hispanics reside
40 throughout the 50-mile (80-kilometer) radius area, but most are located in the Española Valley and
41 in the Santa Fe metropolitan area.

42 Based on 2021 census data, Table C-5 shows minority population for all block groups within the
43 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.

1 Three block groups (of the 21 block groups within the ROI) have a percentage that would meet the
2 50 percent threshold for minority populations: one block group each in Los Alamos, Santa Fe, and
3 Rio Arriba Counties. None of these block groups include any portion of the groundwater plume
4 itself. While the plume does extend into a small corner of Sandoval County and the Pueblo San de
5 Ildefonso Reservation, there is no population in the block group found within this portion of the
6 reservation according to Census Bureau records.

7 ***Low-Income Population in 2021***

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

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

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

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