



July 2023

NUCLEAR WASTE CLEANUP

DOE Needs to Address Weaknesses in Program and Contractor Management at Los Alamos

Accessible Version

GAO Highlights

Highlights of [GAO-23-105665](#), a report to congressional committees

Why GAO Did This Study

The federal government established the Los Alamos National Laboratory in 1943 to conduct nuclear weapons research and development activities to support our nation's defense. Over the years, these activities have necessitated cleanup in three areas: (1) soil and groundwater remediation, (2) legacy waste removal, and (3) deactivation and decommissioning of contaminated facilities.

In 2014, DOE established EM-LA to clean up waste at Los Alamos. To help address cleanup challenges at Los Alamos and other sites, EM issued a Program Management Protocol in 2020.

The Senate committee report that accompanied a bill for the National Defense Authorization Act for Fiscal Year 2022 includes a provision for GAO to, among other things, assess the status of cleanup at Los Alamos. This report examines issues including (1) the steps EM-LA has taken to implement EM's Program Management Protocol and (2) EM-LA's oversight of contractor performance. GAO reviewed EM-LA documents related to the Program Management Protocol and contractor oversight and interviewed EM and EM-LA officials.

What GAO Recommends

GAO is making six recommendations, including that EM-LA adopt a comprehensive approach to prioritizing cleanup and ensure that contractors have an approved performance baseline. DOE generally concurred with the recommendations.

View [GAO-23-105665](#). For more information, contact Nathan Anderson at (202) 512-3841 or andersonn@gao.gov.

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What GAO Found

The Department of Energy's (DOE) Office of Environmental Management (EM) site office at Los Alamos (EM-LA) has taken steps to establish elements of EM's Program Management Protocol, which contains requirements and expectations for planning, budgeting, executing, and evaluating all work within EM's program. As of March 2023, EM-LA officials said they had submitted program management documents for approval, including a life cycle cost estimate and risk management plan. However, EM-LA has not taken a comprehensive approach to prioritizing cleanup activities in a risk-informed manner. For example, EM-LA has not analyzed different options for achieving site cleanup objectives, as called for in GAO's risk-informed decision-making framework, including optimization analyses that could identify how to most efficiently meet cleanup milestones. Without a comprehensive framework for prioritizing cleanup activities, EM-LA cannot be assured that it is making optimal cleanup decisions.

Weaknesses in EM-LA's oversight of the Los Alamos contractor, which is responsible for the execution of cleanup activities at the site, have limited EM-LA's understanding of cleanup progress and costs. Specifically, the contractor did not meet deadlines to develop a final performance baseline and EM-LA did not use available mechanisms to compel compliance with this requirement. A performance baseline is a measure against which EM-LA can track ongoing cost, scope, and schedule progress. EM-LA officials said that part of the difficulty in developing a baseline was due to the many modifications needed after the contract was awarded. Nonetheless, the delay in finalizing a baseline had consequences, including preventing EM-LA from understanding how much of the work it contracted for in 2018 is complete and at what cost. Without an approved baseline going forward, EM-LA will not have the data it needs to track cleanup progress, which is crucial for effective contract management.

Example of Legacy Waste Cleanup at Los Alamos National Laboratory



Source: Department of Energy's Office of Environmental Management Los Alamos Field Office. | [GAO-23-105665](#)

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Abbreviations

Consent Order	2016 Compliance Order on Consent
D&D	deactivation and decommissioning
DOE	Department of Energy
EM	Office of Environmental Management
EM CBC	Environmental Management’s Consolidated Business Center
EM-LA	Environmental Management Los Alamos Field Office
EPA	Environmental Protection Agency
EVMS	Earned Value Management System
FAR	Federal Acquisition Regulation
Los Alamos	Los Alamos National Laboratory
MDA	material disposal area
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NDAA	National Defense Authorization Act
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
PEMP	Performance Evaluation and Management Plan
Protocol	Environmental Management 2020 Program Management Protocol
RCRA	Resource Conservation and Recovery Act of 1976
RDX	Royal Demolition Explosives
TA-21	Technical Area 21

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July 19, 2023

Congressional Committees

The federal government established the Los Alamos National Laboratory (Los Alamos) in New Mexico in 1943 to conduct nuclear weapons research and development activities to support our nation's defense. Over the years, these activities generated and released radioactive and hazardous waste into the environment.¹ Collectively, this waste is commonly referred to as legacy waste.² The Department of Energy's (DOE) Office of Environmental Management (EM) is responsible for managing cleanup activities, including (1) legacy waste remediation and disposition, (2) soil and groundwater remediation, and (3) deactivating and decommissioning (D&D) excess buildings and facilities. In March 2015, EM established the Environmental Management Los Alamos Field Office (EM-LA). EM-LA expects to complete the cleanup mission at Los Alamos by 2043, at an estimated cost of about \$7 billion.³

¹The radioactive waste falls into several categories, including transuranic waste and mixed low-level waste. The term transuranic means those elements with an atomic number greater than that of uranium. The term transuranic waste is defined in statute as waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for high-level radioactive waste; waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the disposal regulations; or waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with part 61 of title 10, Code of Federal Regulations. Pub. L. No. 102-579, § 2(20), 106 Stat. 4777, 4779 (1992). Mixed low-level waste is low-level radioactive waste that contains both (1) hazardous waste subject to the Resource Conservation and Recovery Act and (2) low-level radioactive waste subject to the Atomic Energy Act of 1954. Low-level radioactive waste is defined by exclusion; that is, it is defined in statute as radioactive material that is not high-level radioactive waste, spent nuclear fuel, or certain by-product materials, such as tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, and that the Nuclear Regulatory Commission classifies as low-level radioactive waste. 42 U.S.C. § 2021b(9).

²EM defines the legacy waste at Los Alamos as all waste generated before 1999.

³The estimate includes costs associated with completing mission activities, additional program costs, contractor fees, escalation, and contingency. As of March 2023, EM-LA's cost and schedule estimates were still under review by EM headquarters and subject to change. DOE originally estimated that it would complete cleanup by 2015 at a cost of \$2.7 billion. However, by 2012, DOE acknowledged that this cost and schedule would not be feasible due to factors such as inadequate funding and technical challenges.

The nature of the remaining cleanup work poses complex challenges for which strengthened program management is needed to ensure that the cleanup is completed in a safe, efficient, and cost-effective manner, according to EM's 2020 Program Management Protocol (Protocol). The Protocol broadly established the requirements and expectations for planning, budgeting, executing, and evaluating all work within EM's cleanup program.⁴ Contractors are largely responsible for managing the day-to-day execution of the cleanup work at each of EM's cleanup sites. Effective contract management is, thus, a critical responsibility of field office managers and their staffs.

The Senate committee report that accompanied a bill for the National Defense Authorization Act (NDAA) for Fiscal Year 2022 includes a provision for GAO to, among other things, assess the status of cleanup at Los Alamos.⁵ This report examines (1) the status of EM-LA's cleanup efforts at Los Alamos, (2) the steps EM-LA has taken to implement EM's 2020 Program Management Protocol, and (3) how EM-LA has overseen contractor performance related to cost and schedule.

To determine the status of EM-LA's cleanup efforts at Los Alamos, we reviewed EM and contractor documents containing scope descriptions and status updates. We also reviewed New Mexico State regulator documents, such as the 2016 Compliance Order on Consent (Consent Order). In addition, we interviewed EM-LA and contractor officials at Los Alamos, DOE headquarters officials, and the New Mexico State regulator officials.

To examine the steps that EM-LA has taken to implement EM's Protocol, we reviewed EM-LA documents called for in the Protocol, including EM-LA's Federal Site Lifecycle Estimate, Integrated Master Schedule, and associated risk management documents. We did not apply GAO's *Cost Estimating and Assessment Guide* because at the time of our review, these documents remained in draft and were undergoing review by EM headquarters.⁶ However, we determined this information to be reliable for our purposes of reporting EM-LA's best estimates of its expected future costs by (1) reviewing available documentation related to the estimates;

⁴EM's program includes completing cleanup at 15 sites used in nuclear weapons research and production.

⁵S. Rep. No. 117-39, at 360 (2021).

⁶GAO, *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, [GAO-20-195G](#) (Washington, D.C.: March 2020).

and (2) interviewing knowledgeable officials to better understand how the agency developed the estimates, including the underlying assumptions. To assess EM-LA's implementation of the prioritization schema included in the Protocol, we reviewed EM-LA documents, such as the Integrated Priority List, and interviewed EM-LA and EM headquarters officials about how they apply the schema.⁷ We compared this information with GAO's risk-informed decision-making framework.

To examine how EM-LA has overseen contractor performance related to cost and schedule, we reviewed documents, including the Los Alamos Legacy Cleanup Contract (with its multiple modifications), annual Performance Evaluation and Measurement Plans, contractor self-assessments, annual award fee determination scorecards, and annual award fee board reports. We compared EM-LA's and the contractor's actions with contract requirements and analyzed EM-LA's assessments of contractor performance. We also interviewed EM-LA and contractor officials.

We conducted this performance audit from February 2022 to July 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

EM Cleanup Mission at Los Alamos

Until 2015, the National Nuclear Security Administration (NNSA) operated both the Los Alamos National Laboratory and the legacy waste cleanup program.⁸ As directed by the Secretary of Energy, EM took over management of legacy cleanup activities in 2015 and created the EM-LA

⁷The EM prioritization schema includes a summary of EM's prioritization of key mission areas in its cleanup scope, as well as additional screening criteria, such as risk reduction and cost effectiveness, that EM sites may use in prioritizing cleanup activities.

⁸EM has funded the legacy waste cleanup at Los Alamos since October 1988. The work was performed by NNSA's Los Alamos management and operations contractor from 2007 through 2018.

field office to manage the cleanup mission.⁹ In 2015, when EM-LA assumed responsibility for the legacy waste cleanup, its immediate primary task, according to an EM-LA official, was to facilitate the acquisition process for a new cleanup contractor. EM-LA completed the acquisition process in December 2017, with the selection of Newport News Nuclear BWXT-Los Alamos, LLC (N3B) as the new cleanup contractor. The new contractor transitioned into its role between January and April 2018. The contract included a 5-year base period, with subsequent 3- and 2-year option periods that EM-LA can choose to exercise. The initial 5-year base period ended on April 30, 2023, and EM-LA exercised the 3-year option.

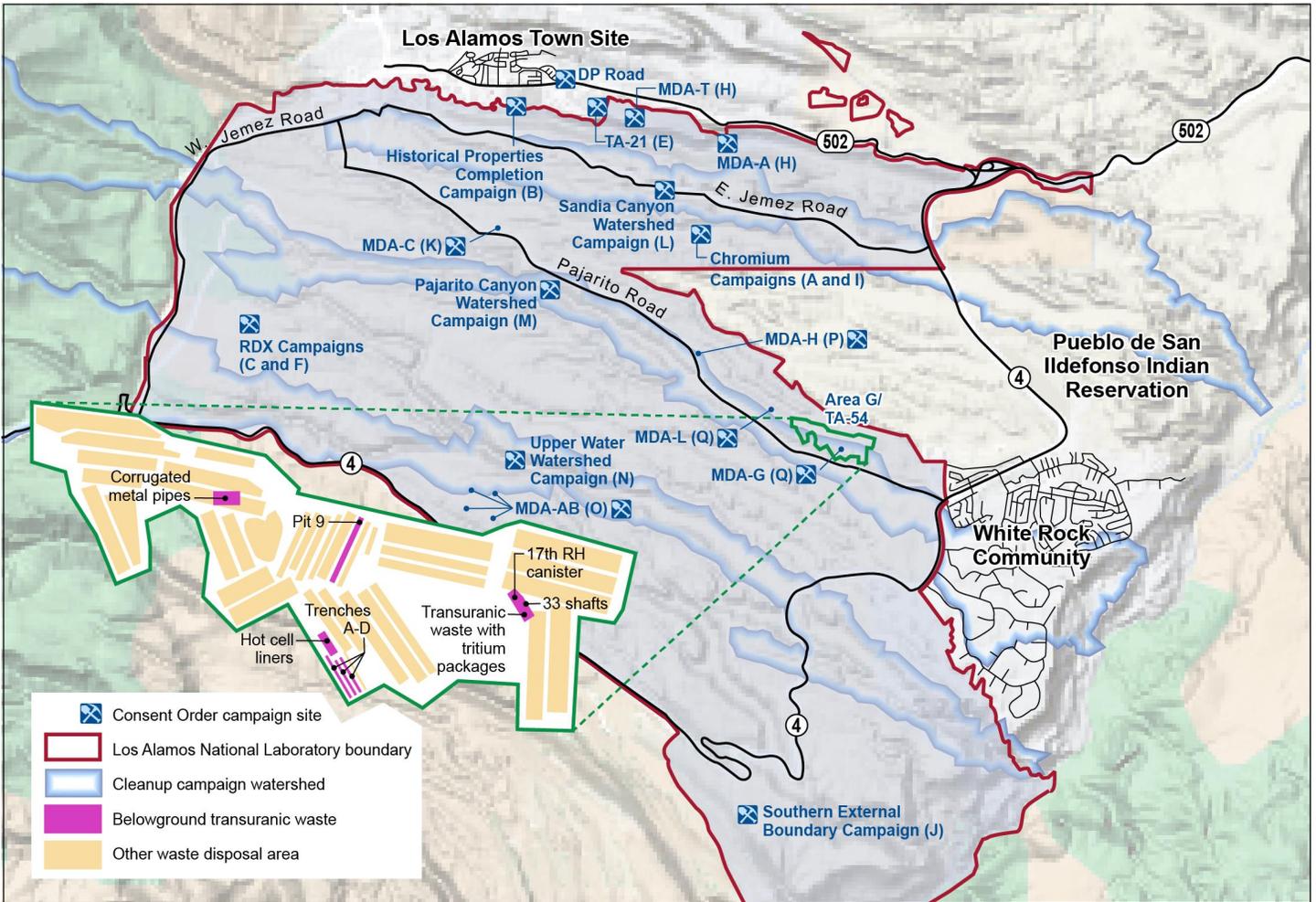
To oversee cleanup at Los Alamos, EM-LA has 40 federal positions and 34.5 additional support positions, including 25.5 technical assistance contractor positions, 8 EM support positions from headquarters and EM's Consolidated Business Center, and one information technology support position. As of February 2023, there were a total of 12 vacancies at EM-LA—two technical assistance contractor positions and 10 federal positions, resulting in a federal-position vacancy rate of 25 percent.

EM-LA oversees both the mission cleanup activities and required mission support activities. Cleanup mission activities include monitoring and remediating surface and groundwater contamination; removing contaminated soil; retrieving, characterizing, and packaging buried and aboveground legacy mixed low-level and transuranic waste for shipment off-site; and deactivating and decommissioning excess contaminated buildings.¹⁰ Cleanup locations include sites of former Los Alamos facilities; hillsides; canyon bottoms; and old landfills, known as material disposal areas (MDAs) (see fig. 1). Mission support activities are routine or recurring activities to support and enable mission activities. These include ensuring site safety and security, site infrastructure operations and maintenance, and quality assurance and control.

⁹The transition of the legacy cleanup mission from NNSA to EM was intended to align the focus and accountability of the cleanup work with EM and enable NNSA's management and operating contractor at Los Alamos to focus on the core national security missions at the lab.

¹⁰Before 1970, transuranic waste generated at Los Alamos was managed as low-level radioactive waste and was generally buried in shallow pits and trenches with hazardous waste.

Figure 1: Los Alamos National Laboratory Cleanup Locations



Sources: Department of Energy (map); ©2023 Google (terrain). | GAO-23-105665

EM-LA's cleanup responsibilities are governed by various federal laws, including the Atomic Energy Act of 1954, as amended, and the Resource Conservation and Recovery Act of 1976, as amended (RCRA), as well as state hazardous waste laws and regulations. The Atomic Energy Act of 1954 authorizes DOE to regulate the radioactive waste, including the radioactive component of mixed wastes. RCRA regulations establish detailed and often waste-specific requirements for the management and disposal of hazardous wastes, including the hazardous waste component

of mixed waste.¹¹ RCRA also prohibits the treatment, storage, or disposal of hazardous waste without a permit from the Environmental Protection Agency (EPA) or a state that EPA has authorized to implement and enforce a hazardous waste management program. EPA has authorized the New Mexico Environment Department (NMED) to administer its own hazardous waste management program under RCRA. Pursuant to this authorization, NMED issues the hazardous waste storage and treatment permit for Los Alamos under the New Mexico Hazardous Waste Act and state regulations.

In addition to these federal and state laws and regulations, EM-LA conducts cleanup under a 2016 Compliance Order on Consent (Consent Order) with NMED.¹² The general purposes of the Consent Order include facilitating the cooperation, exchange of information, and participation of the parties; driving toward cost-effective work resulting in tangible, measurable environmental cleanup; and establishing an effective structure for accomplishing work on a priority basis. The Consent Order organizes cleanup work into campaigns, generally based on a risk-based approach to grouping, prioritizing, and accomplishing corrective actions activities at Solid Waste Management Units and Areas of Concern.¹³ A

¹¹The term mixed waste means waste that contains both (1) hazardous waste subject to RCRA or authorized state programs that operate in lieu of the federal program and (2) radioactive waste subject to the Atomic Energy Act of 1954. Under RCRA or authorized state hazardous waste programs, a state does not have authority over the radioactive waste component of the mixed waste.

¹²In June 2016, NMED and DOE entered into a Consent Order. The requirements of the Consent Order do not apply to radionuclides or the radioactive portion of mixed waste. However, they do apply to the hazardous waste component of mixed waste. The Consent Order was amended in February 2017. As of June 2023, DOE and NMED are negotiating changes to the Consent Order to resolve a lawsuit alleging violations of the order. *New Mexico Env't Dep't v. U.S. Dep't of Energy*, No. 21-cv-00278 (D.N.M.).

¹³A Solid Waste Management Unit refers to any discernible unit at which solid waste has been placed at any time and from which NMED determines there may be a risk of a release of hazardous waste or hazardous waste constituents, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at the facility at which solid wastes have been routinely and systematically released; they do not include one-time spills. An Area of Concern means any area having a known or suspected release of hazardous waste or hazardous constituents that is not from a Solid Waste Management Unit and that the Secretary of NMED has determined may pose a current or potential threat to human health or the environment pursuant to state regulations that incorporate EPA regulations. An Area of Concern may include buildings and structures at which releases of hazardous waste or constituents were not remediated, including one-time and accidental events.

campaign may consist of one or more projects, and campaigns and projects consist of one or more tasks and deliverables.

Under the Consent Order, EM-LA and NMED negotiate and agree to both enforceable milestones for the current fiscal year and targets for the subsequent 2 fiscal years. The Consent Order states that EM-LA and NMED will identify between 10 and 20 enforceable milestones for the current fiscal year that are subject to stipulated penalties if they are not achieved. In addition, EM-LA and NMED will identify between 10 and 20 targets for each of the next 2 fiscal years. Targets are not enforceable and are not subject to such penalties. The Consent Order also identifies the steps through which corrective actions may progress, which can include RCRA Facility Investigations (which include interim measures), Corrective Measures Evaluations, and Certificates of Completion.¹⁴ A Corrective Measures Evaluation identifies, develops, and evaluates potential corrective measure alternatives for removal, containment, or treatment of contamination and culminates in a report to NMED documenting the results and recommending a preferred alternative. In response, NMED selects a remedy, which may differ from the preferred alternative proposed by EM-LA.

¹⁴The Consent Order refers to these steps as status categories. According to the Consent Order, each site may not proceed through each step. The Consent Order requires EM-LA to perform a Corrective Measures Evaluation when NMED notifies EM-LA that such an evaluation is required, based on the relevant RCRA Facility Investigation report. EM-LA conducts the Corrective Measures Evaluation to identify, develop, and evaluate potential corrective measure alternatives for removal, containment, or treatment of contamination and submits a Corrective Measures Evaluation report to NMED documenting the results of the evaluation and recommending a preferred alternative for remediation. In response, NMED selects a remedy based on the information presented in the Corrective Measures Evaluation report, data from previous RCRA Facility Investigation reports, and information provided during the public comment and hearing process. NMED may choose a different remedy from that recommended by EM-LA in the Corrective Measures Evaluation report, but the remedy must meet the threshold criteria in the Consent Order, and NMED must consider the balancing criteria specified in the Consent Order as part of its remedy selection. When EM-LA completes the corrective action work, it must request a Certificate of Completion from NMED. Under the Consent Order, NMED commits to a timely review of EM-LA's requests for such certificates and will issue the certificate if it concurs that the corrective action activities are complete.

EM 2020 Program Management Protocol

EM-LA manages both its mission and mission support activities in accordance with EM's Protocol.¹⁵ The Protocol establishes requirements and expectations for planning, budgeting, executing, and evaluating all work within DOE's EM program. The Protocol also describes EM's risk-based cleanup prioritization approach, which includes EM's prioritization schema and screening criteria.¹⁶ The Protocol states that EM's first priority is addressing issues posing an immediate risk to human health or the environment, followed by addressing issues to achieve the highest risk reduction benefit per unit of radioactive content.¹⁷ Both of these priorities are to be addressed within the framework of regulatory compliance commitments and best business practices. Priorities also take into account the level of radioactive contamination; risks posed by the potential for that contamination to reach surrounding communities; and other matters, including practical matters of scheduling, ease of remediation (availability of an easily deployed, effective known technology), and allowing sites or areas of sites to be fully cleaned up.

Under the Protocol, EM headquarters has various responsibilities, including developing overall EM program management documents, such as the EM Program Plan and EM Program Lifecycle Estimate; issuing guidance on baselines, change control, and acquisition planning; and reviewing and approving federal site baselines and life cycle estimates. Field office managers at EM field offices, such as EM-LA, are responsible for all activities at their sites, including developing the Federal Site Lifecycle Estimate and Site Program Plan, completing risk assessments, and overseeing and evaluating contractor performance.

¹⁵Department of Energy, Office of Environmental Management, *Environmental Management Program Management Protocol* (Washington, D.C.: Nov. 6, 2020). In 2009, EM created the operations activities category to differentiate cleanup work and enable the use of \$6 billion from the American Recovery and Reinvestment Act. In contrast, DOE manages project activities under its project management order, DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets* (Change 6) (Washington, D.C.: Jan. 12, 2021).

¹⁶EM's prioritization schema is a set of seven cleanup activity priorities. The screening criteria allow prioritization of lower-risk activities where they lead to cost savings, key accomplishments, or accelerations of area closures.

¹⁷Activities are focused on wastes that contain the highest concentrations of radionuclides and sites with the highest radionuclide contamination.

EM currently has efforts underway to bring all cleanup sites into compliance with the Protocol requirements. Specifically, in March 2023, EM officials told us they were reviewing documents submitted by sites, such as the Federal Site Lifecycle Estimate and associated program management documents required by the Protocol. EM officials described this review as a two-phase process. As of June 2023, they indicated that EM planned to complete the first phase in summer 2023 and the second phase in fiscal year 2024.

Contract Oversight and Evaluation

The day-to-day execution of EM's scope of work is performed by contractors, which makes effective contract management a primary and critical responsibility of field office federal employees. We first designated aspects of DOE's contract management as a high-risk area for the federal government in 1990, because DOE's record of inadequate contractor management and oversight made the department vulnerable to fraud, waste, abuse, and mismanagement.¹⁸

DOE's contracting activities are subject to the Federal Acquisition Regulation (FAR), the Department of Energy Acquisition Regulation, and internal DOE directives. Furthermore, individual prime contracts may contain additional oversight requirements, such as requirements to obtain certifications of certain business systems. Additional requirements are intended to, among other things, provide reasonable assurance that the contractor is using efficient methods and effective cost controls, ensure that the contractor's accounting and purchasing systems are operating as intended, and that the contractor is following policies and procedures.

DOE has many contracts that include a combination of fee structures. The Los Alamos Legacy Cleanup Contract is a performance-based contract that includes both cost-reimbursement for work and for the contractor to earn an award fee. Under cost-reimbursement contracts, the government reimburses a contractor for allowable costs incurred, to the extent prescribed by the contract, and the contractor agrees to expend its

¹⁸GAO, *Government Financial Vulnerability: 14 Areas Needing Special Review*, [GAO/OCG-90-1](#) (Washington, D.C.: Jan. 23, 1990); *High-Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, [GAO-17-317](#) (Washington, D.C.: Feb. 15, 2017); and *High-Risk Series: Efforts Made to Achieve Progress Need to Be Maintained and Expanded to Fully Address All Areas*, [GAO-23-106203](#) (Washington, D.C.: Apr. 20, 2023).

best efforts to achieve the specified requirement, within the estimated amount established in the contract. Award fees are used to motivate the contractor toward exceptional performance.¹⁹

EM-LA provides quarterly performance feedback and annually evaluates contractor performance based on a Performance Evaluation and Measurement Plan (PEMP).²⁰ The contractor's PEMP's include both adjectival award fee criteria (subjective evaluation of fee) and performance-based incentive award fee criteria (objective evaluation of fee). The adjectival award fee categories of performance for the Los Alamos Cleanup Contract include (1) quality assurance (includes safety), (2) schedule, (3) cost control, (4) management, and (5) regulatory compliance.²¹ Performance Based Incentives are objective incentives that are evaluated based on milestones with clear, measurable completion criteria, such as shipping a certain amount of waste or completing certain regulatory requirements.

¹⁹Using an award fee over other types of incentives involves the government giving the contractor a detailed evaluation of performance, pointing out strengths, deficiencies, and weaknesses. From the contractor's point of view, the award fee is typically advantageous because it usually yields higher fees than other incentives. The trade-off, however, is that government incurs substantial administrative costs through the continual evaluations and processing of award fee decisions.

²⁰All contracts providing for award fees must be supported by an award fee plan that, among other things, identifies the award-fee evaluation criteria and how they are linked to acquisition objectives that will be defined in terms of contract cost, schedule, and technical performance. FAR § 16.401(e)(3)(ii). The plan must also describe how the contractor's performance will be measured against the award-fee evaluation criteria and utilize the adjectival rating and associated description specified in the FAR to determine the amount of any fee to be awarded. FAR § 16.401(e)(3)(iii), (iv). Award fee determinations and the methodology for determining the fees are unilateral decisions made solely at the discretion of the government.

²¹For the adjectival award fee, these categories are rated separately and are measured with a subjective, or adjectival, rating scale that ranges from excellent to unsatisfactory. These criteria give EM-LA the flexibility to evaluate performance and the conditions under which it was achieved.

EM-LA Has Made Progress in the Three Main Cleanup Categories, but Certain Risks Could Increase Scope, Cost, and Time Frames

EM-LA has made progress in its environmental remediation, legacy waste remediation, and deactivation and decommissioning responsibilities at Los Alamos. However, EM-LA has identified risks that may contribute to increased cleanup scope, costs, and schedule, including the strained relationship between EM-LA and the state regulator, unanticipated contamination, and limited staffing capacity.

EM-LA Has Made Progress in Its Environmental Remediation, Legacy Waste Remediation, and Deactivation and Decommissioning Responsibilities

EM-LA has made progress in cleaning up contaminated soil and groundwater (environmental remediation), remediating and disposing of legacy waste, and deactivating and decommissioning excess facilities. As of March 2023, EM-LA estimated that it would cost about \$7 billion to complete remaining cleanup activities at Los Alamos. This estimate includes cleanup across EM-LA's three main cleanup categories as well as other costs, such as program support, contractor fee, and contingency.²²

Environmental Remediation

As of March 2023, EM-LA was undertaking various environmental remediation activities, including managing chromium contamination in groundwater, excavating contaminated soil waste from the site's aggregate areas, and monitoring contamination at the site's MDAs. EM has spent about \$2.3 billion on environmental remediation activities since cleanup began in 1997. As of March 2023, EM-LA's estimated cost to complete its environmental remediation activities was about \$1.6 billion. This estimate is contingent on several assumptions, including that NMED

²²EM-LA's program support activities include the core management, safety, health, quality assurance, regulatory, engineering, and business services required to support cleanup efforts. Contingency includes potential additional costs that are quantified based on EM-LA's identified risks and associated uncertainties.

will select cap-and-cover remedies (which are less costly than other remedies) for several areas of the site.

The Chromium Plume at Los Alamos

In 2004, hexavalent chromium contamination was discovered in groundwater samples taken from the regional aquifer at Los Alamos. This contamination originated as a result of chromium-contaminated water being periodically flushed from cooling towers at a nonnuclear power plant from 1956 to 1972.

The contaminated groundwater created a chromium plume on the eastern edge of Los Alamos property, adjacent to the Pueblo de San Ildefonso's land. In 2018, to prevent the plume from migrating onto this adjacent property before a final cleanup remedy is selected, the Environmental Management Los Alamos Field Office (EM-LA) implemented an interim measure as one of the campaigns under the 2016 Compliance Order on Consent with the New Mexico Environment Department. The interim measure is a modified pump-and-treat remedy that involves extracting contaminated water, treating it, and reinjecting it, to try to reduce the plume's overall footprint. See photo below of treatment area.



As of March 2023, EM-LA had paused operations on the interim measure while working with the state to address potential concerns about the measure's effectiveness in managing the plume.

Sources: Department of Energy's Office of Environmental Management Los Alamos Field Office and New Mexico Environment Department (text); Department of Energy's Office of Environmental Management Los Alamos Field Office (photo). | GAO-23-105665

Much of EM-LA's environmental remediation work is organized into 17 cleanup campaigns that are carried out under the Consent Order. Of the 17 cleanup campaigns, EM-LA has completed one, has work in progress on 11, and has not yet started five, as shown in appendix I. For example,

EM-LA has four cleanup campaigns in progress that focus on investigating and remediating contaminated soil in certain watersheds and canyons across Los Alamos.

Legacy Waste Remediation and Disposition

EM-LA has remediated and disposed of a portion of the legacy waste stored aboveground at the site, including both transuranic waste and mixed and low-level waste, and has begun retrieving belowground transuranic waste for removal.²³ EM-LA estimates that the cost to remove the remaining above- and belowground legacy waste is about \$753 million.

EM-LA has spent about \$1.5 billion on processing and shipping legacy waste off-site since cleanup began in 1997. This has included processing and shipping off-site over 7,000 cubic meters, or 67 percent, of the known aboveground legacy waste (see fig. 2). In fiscal year 2022, EM-LA reported that it had sent 52 shipments of transuranic waste off-site, surpassing its annual goal of 30 shipments.²⁴

²³Unlike EM-LA's environmental remediation activities, EM-LA's legacy waste mission is not governed by the Consent Order. In addition, the Consent Order does not apply to environmental remediation of radionuclides, including source, special nuclear, byproduct material, or the radioactive portion of mixed waste.

²⁴EM-LA officials told us that these shipments included NNSA waste comingled with EM-LA's transuranic waste. EM-LA officials estimated that about 70 percent of the waste across these 52 shipments was EM-LA's transuranic waste, but EM-LA does not specifically track this information. EM-LA officials said that this comingling approach enables them to minimize the wasted space in each shipment.

Figure 2: Total Volume and Proportion of Los Alamos National Laboratory Aboveground Legacy Waste Shipped Off-Site



Source: Department of Energy's Office of Environmental Management Los Alamos Field Office. | GAO-23-105665

Data table for Figure 2: Total Volume and Proportion of Los Alamos National Laboratory Aboveground Legacy Waste Shipped Off-Site

PM Activity	PY Actuals (in cubic meters)	Out year targets (in cubic meters)	Percent complete
Contact-handled transuranic waste	7,188	3,579	67%
Low-level waste and missed low-level waste	7,333	1,722	81%

Source: Department of Energy's Office of Environmental Management Los Alamos Field Office. | GAO-23-105665

Note: The numbers in this figure reflect the total aboveground waste as of March 2023. However, the Environmental Management Los Alamos Field Office will have additional waste to process and ship off-site as it retrieves waste through its five belowground waste projects.

Further, EM-LA has five projects planned to retrieve belowground legacy waste, as described in table 1. After retrievals, the waste will be processed and shipped off-site.

Table 1: Cleanup Status for Retrieving Los Alamos National Laboratory Belowground Legacy Waste at Area G

Project	Description	Status	Estimated cost (dollars in millions)
Corrugated Metal Pipes	Retrieval and size reduction of 158 corrugated metal pipes filled with cemented waste, including americium and plutonium	Retrievals in progress	\$18
Pit 9	Retrieval of 3,882 metal drums, 191 fiberglass-reinforced plywood boxes, and six other containers stored in underground pit	Preliminary investigations underway	\$50
33 shafts	Retrieval of 33 lined shafts containing significant radioactivity, 23 of which have been encased in concrete	Preliminary investigations underway	\$62
Trenches A-D	Retrieval from four trenches of 363 casks used to store transuranic waste	Preliminary investigations underway	\$17
Hot cell liners, tritium packages, and 17th remote handled canister	Retrieval of waste from shafts containing five hot cell liners; five tritium packages; and a single waste package, referred to as the 17th remote handled canister	Preliminary investigations underway	\$4

Source: GAO summary of the Department of Energy's Office of Environmental Management Los Alamos Field Office documents. | GAO-23-105665

EM-LA has initiated one of its five planned projects to retrieve belowground waste. Specifically, in September 2022, EM-LA began excavating 158 corrugated metal pipes containing transuranic waste encased in cement. Figure 3 shows corrugated metal pipe training mockups at Los Alamos. The pipes are each approximately 20 feet long and 30 inches in diameter.

Figure 3: Example of Legacy Waste Cleanup at Los Alamos National Laboratory

Source: Department of Energy's Office of Environmental Management Los Alamos Field Office. | GAO-23-105665

After retrieval, EM-LA plans to process the pipes, which entails cutting them into 4-foot segments, packaging them in standard waste boxes, and shipping them off-site for disposal. EM-LA officials we interviewed told us that the Corrugated Metal Pipes project is less complex than other projects to retrieve belowground waste. For example, the corrugated metal pipes are fairly uniform in size and of a homogenous composition. The Pit 9 project, on the other hand, will entail excavating a larger amount of waste of varying compositions and containment methods. These characteristics, among other things, will require that EM-LA develop a specific type of waste processing line for the project, a complex endeavor that will require replacing existing processing units with new equipment designed for processing and remediating Pit 9 waste, as well as reconfiguring ventilation systems to support this remediation.

Deactivation and Decommissioning

EM-LA currently has minimal ongoing D&D work, and the total scope of D&D work that remains and the associated costs are not fully known. The D&D work that EM has completed thus far took place at the Technical Area 21 (TA-21) site, which housed a plutonium-processing facility and a tritium research facility during the Cold War. At the height of operations,

TA-21 contained 125 buildings. All aboveground structures (except Building 257, the Radiological Liquid Waste Facility), water tanks, and a sewage treatment facility have been decommissioned, decontaminated, and demolished.²⁵ As of March 2023, EM-LA was continuing to conduct sampling and investigation work to prepare for the D&D of Building 257 and other remaining infrastructure.

The scope of EM-LA's D&D work will grow as NNSA transfers responsibility for additional Los Alamos structures to EM. The James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 requires NNSA to issue a plan in 2025 and every 4 years thereafter that identifies all nonoperational defense nuclear facilities. It also transfers to EM by March 31, 2029, the responsibility for decontaminating and decommissioning facilities that NNSA determines are nonoperational as of the end of fiscal year 2024.²⁶ DOE's 2022 report about its D&D plans stated that there are 19 nonoperational facilities at Los Alamos under NNSA control, which may become EM's responsibility by 2029.²⁷

EM officials told us that as EM and NNSA come to agreement regarding which facilities will be transferred to EM-LA, the estimates for the D&D of the facilities will be included in EM-LA's Federal Site Lifecycle Estimate, as appropriate. As of March 2023, only one facility—the Ion Beam Facility—has been transferred to EM-LA and is included in EM-LA's Federal Site Lifecycle Estimate. EM-LA initially estimated that it would cost about \$58 million to complete D&D of this facility, but EM-LA officials we interviewed believe that the total costs will be higher because that estimate is out of date. EM-LA is currently updating its estimates for this work to support the process of selecting a contractor.

²⁵In 2010, EM completed the D&D of 24 buildings and structures at TA-21 with funding from the American Recovery and Reinvestment Act of 2009.

²⁶Pub. L. No. 117-263, § 3114, 136 Stat. 2395, 3053 (2022) (codified at 50 U.S.C. § 2603).

²⁷Department of Energy, *Plan for Deactivation and Decommissioning of Nonoperational Defense Nuclear Facilities – Report to Congress* (July 2022).

Scope, Cost, and Schedules Could Increase, due to a Strained Relationship with the State Regulator, and Other Risks

EM-LA has identified risks that may contribute to increased cleanup scope, costs, and schedule at Los Alamos. Specifically, these risks include a strained relationship with the state regulator, unanticipated contamination, and limited staffing capacity.²⁸

Strained Relationship with the State Regulator

EM-LA has had a strained relationship with the state regulator—NMED—characterized by frustration and distrust over disagreements regarding the remaining cleanup work at several areas of the site. More specifically, EM-LA and NMED do not fully agree on the next steps needed for NMED to reach a decision on a final cleanup remedy for the chromium groundwater plume and the MDAs. The strained relationship between EM-LA and NMED creates risks that may increase cleanup scope, cost, and schedule.

In particular, EM-LA and NMED have had disagreements regarding the remaining work needed to characterize the nature and extent of chromium groundwater contamination before NMED selects a cleanup remedy for the site's chromium plume.²⁹ As part of the fiscal year 2023 negotiations under the Consent Order, EM-LA and NMED agreed to a plan for EM-LA to complete four additional monitoring wells by fiscal year 2024. EM-LA officials told us that they believe that they have gathered sufficient information on the nature and extent of contamination to

²⁸In addition to these potential future impacts to cost, scope, and schedule, EM-LA noted that the COVID-19 pandemic had a direct impact on cleanup activities over several months.

²⁹In December 2022, NMED ordered EM-LA to cease operations on the injection wells for its interim measure, which NMED believes are spreading the chromium contamination deeper into the aquifer rather than mitigating this spread. EM-LA officials disagree with this decision and believe that their groundwater model demonstrates that the interim measure is working as it should. However, NMED officials have expressed frustration because they are unfamiliar with EM-LA's groundwater model and, therefore, unable to validate its results. As of February 2023, EM-LA officials were taking steps to gather modeling data to attempt to demonstrate to NMED that the interim measure could continue to operate safely. EM-LA officials said that modifications to the interim measure could significantly impact the measure's ability to prevent migration of the plume beyond the laboratory boundary.

prepare a Corrective Measures Evaluation report and recommend a final cleanup remedy to NMED concurrently with drilling the four monitoring wells.³⁰ However, NMED officials we interviewed told us that they will not consider a final remedy for the chromium plume until they know the full nature and extent of the contamination. NMED believes that drilling the four additional monitoring wells is necessary to gather data to properly characterize the contamination and inform the development of the Corrective Measures Evaluation.

Additionally, EM-LA and NMED do not have a timeline for NMED's selection of a final remedy for seven MDAs. In June 2021, EM-LA submitted a Correct Measures Evaluation report for MDA-C (the first of the seven MDAs to reach this step in the remedy selection process) to NMED for its review.³¹ As of March 2023, NMED had not reviewed the report or established a time frame for doing so and selecting a final remedy. The Consent Order establishes a target deadline of 280 days for NMED to review a Corrective Measures Evaluation report but requires the parties to reach agreement on a review schedule before DOE submits the report. EM-LA and NMED did not determine an agreed-upon review schedule for the MDA-C Corrective Measures Evaluation report, according to NMED officials. EM-LA officials expressed frustration when they told us that NMED had surpassed the target review timeline of 280 days and had also not established an alternate time frame.³² NMED officials told us that staffing shortages have impeded their ability to achieve reasonable review timelines and that they do not have a planned time frame for reviewing this Corrective Measures Evaluation report. The delay in reviewing the report has stalled progress in remediating MDA-C, according to EM-LA officials.

³⁰EM-LA officials told us that they are likely to recommend a pump-and-treat remedy to NMED as the final remedy for the chromium plume. EM-LA's interim measure to contain the chromium plume within the Los Alamos National Laboratory boundary, which it has been operating since 2018, is a modified pump-and-treat system. This measure involves extracting contaminated groundwater, treating it, and reinjecting the treated water back into the plume.

³¹This is the second time that DOE has submitted a Corrective Measures Evaluation report for MDA-C; the first was in 2012, which NMED did not review because of competing priorities, according to NMED officials. In 2021, EM-LA submitted a revised Corrective Measures Evaluation report for MDA-C with additional information that they believe supports a cap-and-cover final remedy.

³²According to EM-LA, as of June 2023, it has been more than 670 days since it submitted the Corrective Measures Evaluation report for MDA-C to NMED.

In addition, EM-LA and NMED have divergent views on what the final remedy for MDA-C should be. The Corrective Measures Evaluation report that EM-LA submitted for MDA-C includes an analysis of potential remedies based on different criteria, including cost. On the basis of the analysis, EM-LA recommended a cap-and-cover final remedy, with an estimated cost of about \$12 million. By comparison, EM-LA estimated that excavating the waste would cost over \$800 million.³³ However, NMED has signaled that it may want EM-LA to pursue a remedy that involves fully excavating the waste.

Both EM-LA and NMED officials we interviewed said that the nature of their relationship, specifically a lack of trust, has been a source of ongoing challenges in making progress toward NMED's selection of final cleanup remedies. EM-LA indicated that for 2 years, it has used a facilitator for monthly technical team meetings, including those related to chromium cleanup. In addition, EM-LA's field office manager said they have been taking steps to improve the relationship with NMED through regular facilitated meetings as part of EM-LA's ongoing strategic vision process, which began in 2022. One anticipated outcome of the strategic vision process is to improve stakeholder alignment on future end states of the site. NMED officials we interviewed acknowledged that these efforts have the potential to improve their relationship with EM-LA. However, these efforts are in the early stages, and it is unclear if they will have concrete effects on improving the trust between EM-LA and NMED. The Consent Order includes a dispute resolution clause that either entity could invoke to resolve ongoing issues. However, both EM-LA and NMED officials said they feel this step would be premature. Further, EM-LA officials said they would prefer to improve the relationship with NMED rather than pursue dispute resolution, which can be contentious.

According to a September 2012 Memorandum on Environmental Collaboration and Conflict Resolution issued by the Office of Management and Budget and the Council on Environmental Quality, departments and agencies should "increase the appropriate and effective use of third-party assisted environmental collaboration as well as environmental conflict resolution to resolve problems and conflicts that arise in the context of environmental, public lands, or natural resource issues, including matters related to energy, transportation, and water and

³³EM-LA's Federal Site Lifecycle Estimate includes cost estimates to cap and cover the seven MDAs at Los Alamos, including MDA-C. The cost to excavate waste from the other six MDAs is unknown because EM-LA had not yet done the investigation and analysis to determine this information.

land management.” DOE’s draft annual report from March 2018 issued in response to the memorandum’s annual reporting requirement presents information on the department’s use of third parties and other collaborative problem-solving approaches in fiscal year 2017.

In that report, DOE cited the benefits of integrating third-party facilitation into DOE site and program office projects, including expanded and clearer communication that leads to smoother relationships with the regulators and the public.³⁴ Without a mechanism, such as a third-party facilitator, for building trust as they determine the remaining steps needed for NMED to select final cleanup remedies, EM-LA and NMED risk further delaying the schedule for completing the remaining cleanup work. Further, such a delay could result in increased overall cleanup costs, including costs associated with operating interim measures and continuing monitoring for longer than may be needed, as well as increased future costs associated with a final remedy due to inflation.

Unanticipated Contamination

Unanticipated contamination is another risk that may contribute to increased cleanup scope, costs, and schedule at Los Alamos. For example, in 2020, Los Alamos County officials discovered contaminated soil on a parcel of land along Middle DP Road that had been transferred to the county. Since this discovery, EM-LA has been conducting soil sampling and taking remediation actions at the site—activities that had not been part of EM-LA’s planned scope of cleanup at Los Alamos. These emergent cleanup needs have increased estimated cleanup costs and required EM-LA to reallocate resources to address them. As of September 2022, EM-LA expected to complete this work in 2023, at a total cost of about \$19 million. However, since the full scope of contamination at the Middle DP Road site is unclear, the timeline and costs for completing cleanup work are uncertain. EM-LA is conducting

³⁴We have previously made recommendations that DOE use independent, third-party mediators to resolve disagreements between DOE and state regulators. See GAO, *Nuclear Cleanup: Actions Needed to Improve Cleanup Efforts at DOE’s Three Former Gaseous Diffusion Plants*, [GAO-20-63](#) (Washington, D.C.: Dec. 17, 2019); and *Hanford Cleanup: DOE’s Efforts to Close Tank Farms Would Benefit from Clearer Legal Authorities and Communication*, [GAO-21-73](#) (Washington, D.C.: Jan. 7, 2021). As of April 2023, DOE had implemented our recommendation from [GAO-20-63](#) by using an independent facilitator—in conjunction with EPA and state regulators—regarding cleanup priorities, remedies, and cost estimation assumptions. Our recommendation in [GAO-21-73](#) calling for DOE to use an independent, third-party mediator remains open.

ongoing activities to assess and characterize the scope of contamination but has accepted the risk that it may need to remediate additional contamination. EM-LA has also identified risks associated with other unanticipated contamination at Los Alamos, such as at buildings at the TA-21 site, which could contribute to additional costs that are not currently reflected in its cost estimate.³⁵

Staffing Capacity

EM-LA and its site contractor face challenges retaining and recruiting the staff necessary to complete scheduled cleanup work. As of December 2022, one-quarter of the federal positions at EM-LA (10 out of 40) were vacant. In discussing reasons for these staffing challenges, officials we interviewed cited the remote location of Los Alamos and the low pay compared with other employers, including N3B, NNSA, and NNSA's contractor. To mitigate the risks posed by staffing shortages, EM-LA and its contractor have initiated some preliminary efforts to recruit staff, including offering hiring incentives and providing job training to help develop the types of specialized skilled labor that is needed.

EM-LA Has Drafted Key Documents but Has Not Analyzed Causes of Cost and Schedule Increases or Taken a Comprehensive Approach to Prioritizing Cleanup Activities

To implement EM's Protocol, EM-LA developed a range of documents. These documents reveal substantial cost and schedule increases since 2016. However, EM-LA has not conducted, and does not plan to conduct, a root cause analysis of these increases. Further, EM-LA has not taken a comprehensive approach to prioritizing its cleanup activities using a risk-informed decision-making framework, as called for in the Protocol.

³⁵TA-21 includes various sources of belowground contamination (such as buried waste lines and contaminated soils), as well as aboveground structures (including a former Radiological Liquid Waste Treatment Facility) that must be remediated and demolished.

EM-LA Has Drafted Key Program Documents, Which Show Substantial Cost and Schedule Increases since 2016

EM-LA had developed and submitted to EM headquarters for review a range of documents called for in the Protocol, according to EM-LA officials. EM headquarters officials we interviewed said that they anticipated finalizing the first phase of their review of EM-LA's program documents by summer 2023, and planned to complete final reviews to make decisions about whether to approve these documents in fiscal year 2024. As of March 2023, EM-LA officials said they had submitted the following documents:

- **Federal Site Lifecycle Estimate:** The Federal Site Lifecycle Estimate for each site consists of the scope, cost, and schedule profiles for the work activities required to complete the EM mission at a site.
- **Integrated Master Schedule:** An Integrated Master Schedule provides the comprehensive schedule for completing all planned cleanup work and is managed based on available resources.
- **Risk Register:** A Risk Register summarizes risks and opportunities that could affect a site's cost and schedule for completing cleanup work.
- **Risk Assessment Forms:** Risk Assessment Forms accompany the Risk Register and provide additional details on how individual risks are quantified and prioritized by the site.
- **Risk Management Plan:** The Risk Management Plan identifies the site's processes and procedures necessary for effective management of risks associated with site cleanup.

As of March 2023, EM-LA had not finalized a Site Program Plan, a document required by the Protocol that will communicate the plan for work accomplishments over the next 10 years. EM-LA officials told us that they had not finalized this plan because they were awaiting further guidance from EM headquarters.

On the basis of our comparison of the draft Federal Site Lifecycle Estimate submitted to EM headquarters with EM-LA's original 2016 cost estimates, EM-LA is making significant changes, including an estimated cost increase of over \$3 billion and a schedule increase of 7 years. EM-LA officials described several factors that contributed to the increases in the updated estimate, including (1) the start-up costs associated with

transitioning to a new contractor in 2018;³⁶ (2) additional D&D cleanup responsibilities that were added to EM-LA's scope (the Ion Beam Facility as discussed above);³⁷ (3) increased costs and delayed schedules for completing EM-LA's legacy waste removal responsibilities, largely due to additional time needed by the contractor to implement an approved safety plan; and (4) an increased amount of contingency to account for greater uncertainty in cleanup remedies, such as the remedies for the seven MDAs.

EM-LA Has No Plans to Conduct a Root Cause Analysis of Cost and Schedule Increases

EM-LA has not conducted, and does not plan to conduct, a root cause analysis of the changes it is making to its cost and schedule estimates. According to the Protocol, EM sites are required to conduct root cause analyses for any baseline or life cycle changes resulting in increases to cost estimates greater than \$100 million, or schedule increases of more than 6 months, compared with the original estimates.³⁸ EM-LA's \$3 billion estimated cost increase and 7-year schedule increase in the Federal Site Lifecycle Estimate exceed these thresholds. According to the Protocol, conducting a root cause analysis provides EM with a way to identify and address the underlying causes of cost overruns, schedule delays, missed or postponed milestones, and performance shortcomings. Further, this analysis is supported by a corrective action plan to address underlying issues that caused cost and schedule increases, which could prevent the issues from persisting.

While the magnitude of the changes to EM-LA's cost and schedule estimates exceed the thresholds for conducting such an analysis, officials from both EM-LA and EM headquarters said that the Protocol's requirement does not apply to changes stemming from the initial Federal Site Lifecycle Estimate that EMLA developed in response to EM's issuance of the Protocol. Rather, officials said that the requirement for a

³⁶EM-LA originally estimated its transition costs to be about \$4 million, but the actual costs were over \$13 million.

³⁷EM-LA initially estimated about \$58 million to complete the D&D of the Ion Beam Facility, which was added to EM-LA's cleanup scope in fiscal year 2022. However, EM-LA is currently updating this estimate, and EM-LA officials we interviewed believe that the total costs will be higher.

³⁸This requirement applies to sites with a Federal Site Lifecycle Estimate greater than \$1 billion.

root cause analysis applies only to revisions of the estimate going forward.

Additionally, EM headquarters officials we interviewed said their two-phased review process of the documents created under the Protocol will fill the role of a root cause analysis. However, it is not clear that EM's planned review will do so because EM headquarters officials could not provide further information on what their review will entail. In March 2023, EM-LA's field office manager said that EM leadership conducted an integrated project team review of contractor performance and management in July 2022.³⁹ We reviewed a draft report that resulted from this review and found that the purpose of the review was to inform future decisions regarding contract actions. The report also identified various contractor challenges that contributed to increased costs and delays in the schedule originally developed by the contractor.

However, this review did not specifically identify root causes of changes to EM-LA's full life cycle cost and schedule estimates presented in the Federal Site Lifecycle Estimate. Further, it did not include a corrective action plan, which according to the Protocol, supports a root cause analysis. Without conducting a root cause analysis and developing a corrective action plan specifically related to the revised Federal Site Lifecycle Estimate, EM-LA may not have sufficient information about the causes of increases in its cost and schedule estimates. This may allow unidentified or uncorrected issues to persist, putting the agency at risk of further cost overruns and schedule delays.

EM-LA Has Not Taken a Comprehensive Approach to Prioritizing Cleanup Activities

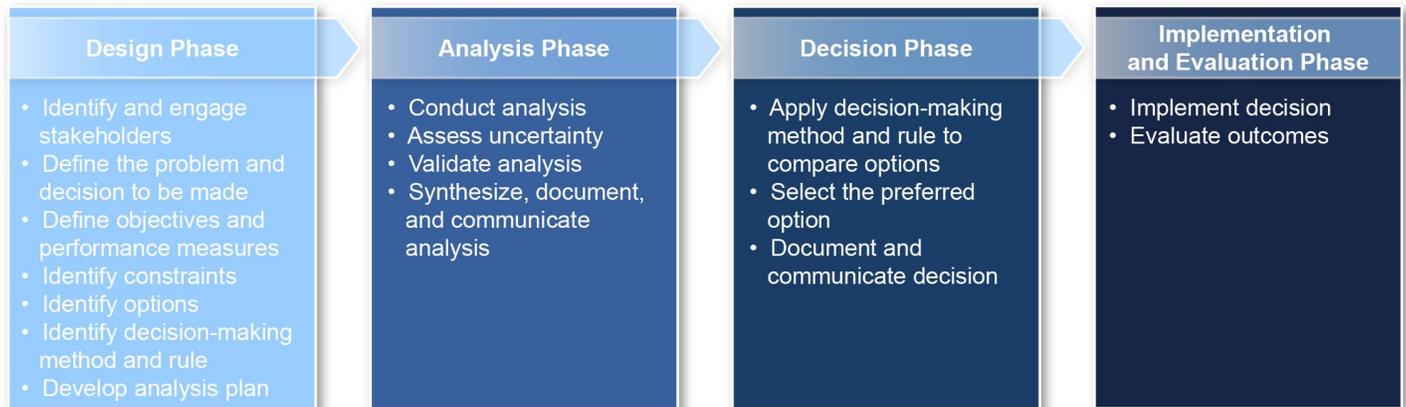
EM-LA considers risk in certain aspects of its decision-making but has not taken a comprehensive approach to prioritizing its cleanup activities using a risk-informed decision-making framework. The Protocol calls for EM sites to apply a risk-informed prioritization approach when doing program planning. The Protocol includes a set of screening criteria to use for

³⁹The Associate Principal Deputy Assistant Secretary for the EM Office of Corporate Services requested this review to examine the efficacy and sustainability of implemented corrective measures for the EM-LA Legacy Cleanup Contract. A senior-level integrated project team supported by various senior advisors and subject matter experts performed the review. The integrated project team was supported by several subject matter experts from EM-LA, EM's Consolidated Business Center, EM headquarters, and the contractor who provided documents and other input to the team.

deciding how to prioritize cleanup actions, such as maintaining minimum safe conditions, reducing risk, and maximizing cost-effectiveness, but they are not listed in priority order. In addition, the Protocol does not include specific details about how sites should implement risk-informed decision-making, such as how to assess and document trade-offs. EM headquarters officials said they have not developed any additional guidance on how to apply the Protocol’s prioritization schema using risk-informed decision-making. Nevertheless, EM-LA officials said that they consider various factors when making prioritization decisions, including the screening criteria in the Protocol as well as site-specific considerations.⁴⁰

In September 2019, we reported that EM would be better positioned to effectively set priorities within and across its cleanup sites, as well as enhance its ability to direct limited resources to address its priorities, by applying a risk-informed decision-making framework.⁴¹ Among other things, we reported that a risk-informed decision-making approach includes (1) identifying a decision-making method and rule to weigh trade-offs and (2) conducting analyses to determine how different cleanup approaches perform with respect to objectives (see fig. 4).

Figure 4: Phases and Steps in GAO’s Risk-Informed Decision-Making Framework



Source: GAO. | GAO-23-105665

⁴⁰EM-LA officials we interviewed said that their site-specific factors include stakeholder values, funding, risk mitigation, regulatory perspective, talent, site readiness, and technical innovation.

⁴¹GAO, *Environmental Liabilities: DOE Would Benefit from Incorporating Risk-Informed Decision-Making into Its Cleanup Policy*, [GAO-19-339](#) (Washington, D.C.: Sept. 18, 2019).

Text of Figure 4: Phases and Steps in GAO’s Risk-Informed Decision-Making Framework

- Design Phase: Identify and engage stakeholders
 - Define the problem and decision to be made
 - Define objectives and performance measures
 - Identify constraints
 - Identify options
 - Identify decision-making method and rule
 - Develop analysis plan
- Analysis Phase:
 - Conduct analysis
 - Assess uncertainty
 - Validate analysis
 - Synthesize, document, and communicate analysis
- Decision Phase:
 - Apply decision-making method and rule to compare options
 - Select the preferred option
 - Document and communicate decision
- Implementation and Evaluation Phase:
 - Implement decision
 - Evaluate outcomes

Source: GAO. | GAO-23-105665

In 2022, the National Academies of Sciences, Engineering, and Medicine recommended that EM develop and implement guidance to apply the Protocol’s prioritization schema as a first step to integrate cleanup across the EM complex. Further, *Standards for Internal Control in the Federal Government* call for management to communicate quality information, which could include information on how to implement program guidance to enable personnel to perform key roles in achieving objectives, addressing risks, and supporting the internal control system.⁴²

⁴²GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: September 2014).

In the absence of guidance on how to implement a risk-informed decision-making approach, EM-LA applies some elements of GAO's risk-informed decision-making framework, such as identifying and engaging stakeholders and identifying constraints for its decision-making. For example, EM-LA solicits and considers input from NMED, tribal communities, and other public entities when making decisions on how to prioritize its cleanup. As part of its stakeholder engagement efforts, EM-LA is currently developing a new strategic vision. Through this process, EM-LA officials are conducting public meetings with various stakeholders, tribal communities, and members of the public to gather input to inform decisions on how to prioritize the remaining cleanup at the site.

In addition, EM-LA has identified constraints for its decision-making. For example, EM-LA officials described several specific constraints that affect how it prioritizes its cleanup activities, including (1) a requirement to allocate a certain amount of its annual budget toward activities to maintain minimum safety and compliance requirements (which limits discretionary spending that can go toward cleanup);⁴³ (2) Consent Order requirements, such as annual cleanup milestones that are enforceable; (3) NMED's responsibility for selecting cleanup remedies; (4) permit requirements; and (5) budget constraints.

However, EM-LA has not taken other steps integral to a risk-informed decision-making approach to prioritizing cleanup activities. For example, EM-LA has not identified a decision-making method or rule for how it will weigh potentially conflicting factors. As mentioned above, EM-LA weighs various site-specific factors, as well as factors from the Protocol, when determining how to prioritize its cleanup work. EM-LA officials said they weigh certain factors more heavily than others and also must prioritize cleanup in accordance with the Consent Order. For example, in the Consent Order, EM-LA and NMED agreed to order the campaigns in a sequence that implements cleanup activities based on risk and other factors. EM-LA officials said that remediating groundwater contaminated by chromium is the top priority because the contamination can migrate, which poses a greater threat to the nearby drinking water supply and, thus, public health, than contamination in other areas of the site. While this is a clear priority, EM-LA has not demonstrated what trade-offs it made to arrive at the current overall prioritization of the 17 Consent Order campaigns. Further, EM-LA does not have a formal rule or method for

⁴³In fiscal year 2022, according to EM-LA's integrated priority list, about 42 percent of EM-LA's budget went toward these minimum-safety and compliance activities, such as program maintenance, groundwater sampling, and various site safety measures.

evaluating trade-offs among risk levels and other factors for EM-LA's cleanup activities not governed by the Consent Order, such as characterizing and shipping transuranic waste off-site.

In addition, EM-LA has not conducted or documented analyses to assess the performance of different cleanup approaches with respect to program objectives, such as minimizing risk and maximizing cost effectiveness, as called for in the risk-informed decision-making framework. For example, EM-LA officials described how they have thought through ways to optimize cleanup when making prioritization decisions for specific, discrete cases. However, they said they have not conducted or documented comprehensive analyses that identify how to optimally achieve cleanup objectives.⁴⁴

In one case, EM-LA has operated ongoing soil remediation projects at certain portions of the site because it is costly to stop and restart remediation work, according to EM-LA officials. In another example, EM-LA officials said that in developing the site's Federal Site Lifecycle Estimate, they worked through different potential funding scenarios for how to complete the legacy waste mission. Through this exercise, they said they concluded that the optimal approach would be to remediate aboveground waste concurrently with retrieving belowground waste, because this would be most efficient for waste processing, according to EM-LA officials. Nevertheless, in both cases, EM-LA officials said they have not developed a formal or documented analysis to support that EM-LA has chosen the optimal approach.

EM headquarters officials said they have not developed any additional guidance on how to apply the Protocol's prioritization schema because they believe that sites are already applying risk-informed decision-making, making further guidance unnecessary. However, without guidance from EM to explain how sites should apply the prioritization schema in a comprehensive, risk-informed manner, EM cannot ensure that sites, such as Los Alamos, are making and documenting decisions using a truly risk-informed approach or doing so consistently across sites. Further, in the absence of more specific guidance or a requirement to

⁴⁴One source defines optimization as an analysis used to achieve the best approach relative to a set of prioritized criteria and constraints. Further, EPA has applied the concept of optimization at some of its Superfund sites, defining optimization as a systematic review by a team of independent technical experts at any phase of a cleanup process to identify opportunities to improve a remedy's protectiveness, effectiveness, and cost efficiency, and to facilitate progress toward completion of site work.

apply the principles of risk-informed decision-making, EM-LA has not implemented a comprehensive approach that incorporates these principles. Without a comprehensive approach to prioritizing cleanup, EM-LA does not have assurance that it is making optimal cleanup decisions and directing limited resources to its highest priorities. Moreover, a comprehensive approach for prioritizing cleanup activities may provide EM-LA with additional evidence to help support its position in negotiating annual cleanup milestones with the state regulator.

Weaknesses in EM-LA's Oversight of Contractor Cost and Schedule Performance Have Limited EM-LA's Understanding of Cleanup Progress and Costs

Weaknesses in EM-LA's oversight of contractor cost and schedule performance have limited its understanding of cleanup progress and costs. Specifically, we found that for most of the initial 5- year period of the contract, the contractor did not meet deadlines to develop a final performance baseline and a certified project control system, and EM-LA did not use available mechanisms to compel compliance with these requirements.⁴⁵ The delays in finalizing a performance baseline and certifying a project control system hindered EM-LA's ability to monitor what portion of the cleanup work it contracted for in 2018 had been completed and how the actual costs and schedule for that work compared with what was planned at the beginning of the contract period.

⁴⁵According to EM-LA's cleanup contract with N3B, the contractor shall implement and maintain an integrated program management system that shall include the processes and implementing procedures necessary to plan, execute, and control all of the work performed under the contract. The performance baseline and project control system are parts of this program management system.

Challenges with Transition of Legacy Waste Cleanup Responsibilities

The Environmental Management Los Alamos Field Office (EM-LA) and its cleanup contractor faced challenges with the transition of responsibilities for the legacy waste cleanup at Los Alamos from the National Nuclear Security Administration (NNSA) and its management and operations contractor. These included issues related to the request for proposal; workforce recruitment and retention; and challenges with cooperation between EM-LA, NNSA, and their respective contractors.

According to an EM-LA review of the transition, there were material differences between EM-LA's request for proposal and the actual conditions at the site, including inaccurate descriptions of the cleanup scope that the contractor was expected to execute. As a result, the contractor submitted several proposed change orders to the contract. These have consumed a significant amount of EM-LA's and the contractor's time to reconcile since 2018 and have resulted in higher costs than the contractor estimated in its proposal, according to EM-LA officials.

EM-LA and the contractor also experienced workforce challenges. For example, initially, the contractor was able to hire less than 20 percent of the staff it expected. In addition, according to EM-LA officials, both EM-LA and the contractor experienced leadership instability, including four different EM-LA field office managers from 2019 through 2021.

Finally, EM-LA had not effectively collaborated with NNSA to plan for the transition by, for example, developing new protocols for all operations and ensuring that the new EM-LA contractor would have access to NNSA databases with information on stored waste drums—essential information for planning and conducting cleanup. In addition, EM-LA and the contractor had to establish business infrastructure, such as procurement and information technology systems, from scratch.

Source: Department of Energy's Office of Environmental Management Los Alamos Field Office. | GAO-23-105665

A performance baseline is a measure against which EM-LA can track ongoing cost, scope, and schedule progress. The contract required the contractor to develop a final performance baseline for the entire length of the contract (base and both option periods) by June 24, 2019. In addition, the contract required the contractor to have the necessary documentation

to certify its project control system—also called an Earned Value Management System (EVMS)—no later than 6 months after the contract transition period, which ended in April 2018.⁴⁶ However, EM-LA and the contractor did not finalize a performance baseline or complete self-certification of the EVMS until September 2022.⁴⁷ In addition, this finalized performance baseline was only for the 5-year base period and not the entire length of the contract, as required.

According to EM-LA officials we interviewed, the contractor had difficulty developing a baseline, in part because of challenges encountered during the transition (see sidebar). In the face of these difficulties, EM-LA told us that they observed the contractor's ongoing challenges and progress toward developing a performance baseline and EVMS. According to DOE's Acquisition Guide, using award-fee incentives requires a judgmental evaluation process that addresses both performance levels and the conditions under which those levels were achieved. In its annual contractor performance reviews from fiscal years 2018 through 2021, EM-LA identified cost and schedule management—and specifically the absence of a performance baseline and a certified EVMS—as areas for improvement. This was reflected, in part, in EM-LA's subjective contractor performance ratings and corresponding earned award fees. Specifically, EM-LA determined that the contractor earned award fees for all subjective criteria ranging from 60 to 74 percent for fiscal years 2018 through 2021, averaging about 70 percent over this period.⁴⁸

However, EM-LA did not explicitly incentivize the contractor to meet these contract requirements until fiscal year 2022. Specifically, EM-LA did not identify any Performance Based Incentives related to finalizing a performance baseline or obtaining EVMS certification in the annual

⁴⁶An Earned Value Management System is a project management tool that effectively integrates the project scope of work with cost, schedule, and performance elements for optimum project planning and control. It accurately records and reports contractor performance against the requirements of the contract and accurately reflects the total estimated cost of the contract exclusive of fee for the authorized work scope and period of performance. The transition period is the time allowed between when EM awards a contract and when the contractor is expected to be at full operational capacity.

⁴⁷Prior to finalizing the baseline, the contractor had been operating under a series of 1-year baselines since 2019.

⁴⁸Schedule and cost control are two of the subjective criteria. The contractor's ratings for these criteria were among the lowest ratings for all categories across fiscal years 2018 through 2021.

PEMPs from fiscal year 2018 through 2021. In the fiscal year 2022 PEMP, EM-LA specified obtaining EVMS certification as a Performance Based Incentive. As a result, the contractor took the necessary actions to obtain EVMS certification, and EM-LA subsequently awarded 90 percent of the available related incentive fee for this performance objective.

Further, EM-LA did not use certain other contract mechanisms available for managing contractor performance. For example, the contract allowed EM-LA to withhold a certain percentage of payments for significant deficiencies in a contractor business system, such as the EVMS.⁴⁹ The contract also allows EM-LA to withhold all fee payments from the contractor until the contractor obtains approval of a final performance baseline. However, EM-LA officials said they have paid annually all of the award fees earned by the contractor through the annual performance evaluation process because the contractor was completing cleanup work and making progress on the performance baseline and EVMS. The officials also told us that they believed it made sense to pay the earned award fee in good faith.

Nevertheless, the delays in finalizing a performance baseline and project control system had negative consequences, including making it difficult for EM-LA to determine cost performance, as needed, for making management decisions. The delays also required multiple rounds of work scope planning for EM-LA, which wasted resources, according to one of EM-LA's contractor performance reviews. For example, since 2019, while the contractor had been working to establish an integrated program management system, EM-LA and the contractor had been developing annual work plans and corresponding annual baselines. The contractor used the annual work plans and baselines to track cost and schedule performance and report information to EM-LA on an annual basis. According to the contract, capital asset projects and operations activities were managed by DOE using annual work plans in the past, but this caused confusion and blurred the necessary focus on the contractor performance baseline as the management tool for planning, executing, and reporting on the work in the contract.

Further, the absence of a finalized performance baseline for the first 4½ years of the contract limited EM-LA's ability to monitor what portion of the cleanup work it contracted for in 2018 has been completed and how the

⁴⁹EM-LA could have withheld a total of 5 percent of payments for one or more significant deficiencies in the EVMS.

actual costs and schedule for that work compares with what was planned at the beginning of the contract period. As of December 2022, EM-LA had modified the contract 86 times for various purposes, including both administrative and financial changes, according to EM-LA officials. As of the December 2022 contract document, the cost of the contract for the 5-year base period had increased by nearly \$250 million (33 percent) since 2018.

As noted above, EM-LA exercised the contract's 3-year option period that began in May 2023. In March 2023, EM-LA officials told us that it had conditionally approved the contractor baseline for the 3-year option period at a cost of about \$661 million.⁵⁰ An EM-LA official noted that some of the conditions are administrative, and some are evaluative, possibly requiring additional baseline changes and contract modifications. It is unclear how long it will take the contractor to satisfy the conditions to enable EM-LA's approval of a final baseline for the option period.

We have previously reported that the absence of established baselines for measuring contractor performance undermines agencies' abilities to identify and mitigate the effects of unfavorable contractor performance.⁵¹ DOE's Acquisition Guide states that sound technical, schedule, and cost baselines are essential for developing realistic and measurable targets to enable effective contract management.⁵² Without an established performance baseline for the 3-year option period, EM-LA will not have the data necessary to facilitate independent assessments of the contractor's work execution plan or the basis of the contractor's cost and schedule estimates for the remaining work to be completed.

Further, as mentioned above, in July 2022, EM conducted an integrated project team review of contractor performance and management at EM-LA. This review concluded, in part, that the contract has not been managed and maintained appropriately at times and that it was unclear if corrective measures were fully effective. The review included 21 recommendations in the areas of contract management and business

⁵⁰This estimated cost for the 3-year option period presented by the contractor in February 2023 is nearly \$230 million more than the December 2022 3-year option period cost estimate of about \$431 million.

⁵¹GAO, *Nuclear Waste: DOE Should Take Actions to Improve Oversight of Cleanup Milestones*, [GAO-19-207](#) (Washington, D.C.: Feb. 14, 2019).

⁵²Department of Energy, *DOE Acquisition Guide Version 2* (Washington, D.C.: April 2022).

administration, contract performance baseline and project management, and technical execution. However, as of March 2023, neither EM headquarters nor EM-LA had determined how EM-LA would implement or oversee implementation, track progress, or report on the effectiveness of the recommendations from the review. Without such accountability measures in place, EM and EM-LA will not have assurance that actions have been taken to address the recommendations or how effective those actions have been.

Conclusions

EM-LA has made progress in cleaning up contaminated soil and groundwater, remediating and disposing of legacy waste, and deactivating and decommissioning excess facilities at Los Alamos. Nevertheless, the remaining cleanup work will require EM-LA to improve relationships with the state regulator, strengthen program management, and enhance contractor oversight to ensure that the cleanup is completed in a safe and effective manner. DOE has previously cited the benefits of using third-party facilitators to enhance communication and improve relationships with regulators. Using a mechanism for rebuilding trust as they work to agree upon the remaining steps needed to enable NMED to select final cleanup remedies could help EM-LA limit the risks of schedule delays and increased costs.

EM-LA developed and submitted for review various documents called for by the Protocol, including a Federal Site Lifecycle Estimate. These documents reveal a substantial cost increase and schedule delays since 2016. However, EM-LA has not conducted, and does not plan to conduct, a root cause analysis of these increases. EM-LA risks adding to schedule delays and cost increases by not conducting a root cause analysis to understand the substantial increases in its cost and schedule estimates for the remaining cleanup work. Moreover, without guidance to explain how sites should apply the prioritization schema in a comprehensive, risk-informed manner, EM cannot ensure that sites, such as Los Alamos, are making and documenting decisions using a truly risk-informed approach or doing so consistently across sites. Furthermore, EM-LA has not taken a comprehensive approach to prioritizing its cleanup activities using a risk-informed decision-making framework. In the absence of more specific guidance or a requirement to apply the principles of risk-informed decision-making, EM-LA cannot be assured that it is making optimal cleanup decisions and directing limited resources to its highest priorities. Moreover, a comprehensive approach for making and documenting

cleanup prioritization decisions may provide EM-LA with additional evidence to help support its negotiations on annual cleanup milestones with NMED.

In addition, weaknesses in EM-LA's oversight of contractor cost and schedule performance has limited its understanding of the progress and costs of cleanup at Los Alamos. Using available mechanisms to incentivize the timely approval of a final contractor performance baseline for the 3-year option period will enhance EM-LA's oversight of contractor performance. Further, neither EM-LA nor EM has determined how EM-LA would track and report progress on implementing the 21 recommendations that the integrated project review team made to improve contractor oversight. Doing so will provide EM and EM-LA with greater assurance that EM-LA has taken actions to address the recommendations from EM and to determine how effective those actions have been.

Recommendations for Executive Action

We are making the following six recommendations to the Department of Energy:

The Secretary of Energy should direct the EM-LA Field Office Manager to work—in conjunction with the New Mexico Environment Department—with a third-party facilitator to improve the relationship and build trust. (Recommendation 1)

The Secretary of Energy should direct the Senior Advisor for the Office of Environmental Management to conduct a root cause analysis and develop and implement a corrective action plan to account for the increases in cost and schedule at EM-LA. (Recommendation 2)

The Secretary of Energy should direct the Senior Advisor for the Office of Environmental Management to develop guidance for its cleanup sites on how to incorporate GAO's essential elements of risk-informed decision-making when applying the prioritization schema referenced in EM's 2020 Program Management Protocol. (Recommendation 3)

The Secretary of Energy should direct the EM-LA Field Office Manager to formalize and document the decision rules it uses and the analyses it conducts to prioritize cleanup actions, as it waits for EM to issue guidance

on how to incorporate risk-informed decision-making when applying EM's prioritization schema. (Recommendation 4)

The Secretary of Energy should direct the Senior Advisor for the Office of Environmental Management to ensure that EM-LA uses available mechanisms to incentivize timely approval of a final contractor performance baseline for the 3-year option period. (Recommendation 5)

The Secretary of Energy should direct the Senior Advisor for the Office of Environmental Management to track and report on the implementation and effectiveness of the recommendations from the July 2022 integrated project team review. (Recommendation 6)

Agency Comments

We provided a draft of this report to DOE for review and comment. In its comments, reproduced in Appendix II, DOE stated that it generally concurred with our recommendations, as it concurred with four recommendations, concurred in principle with one, and partially concurred with another. EM also provided technical comments, which we incorporated as appropriate.

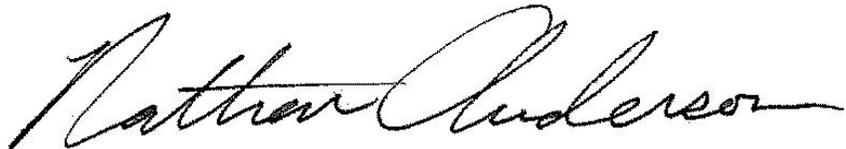
In discussing the first recommendation, with which EM concurred in principle, EM stated that it believes the facilitated discussions conducted over the last 2 years with NMED satisfies the recommendation. However, despite these facilitated discussions, disagreements persist between EM-LA and NMED regarding the remaining work needed to characterize the nature and extent of chromium groundwater contamination, and EM-LA remains without a time frame for when NMED will review the MDA-C Corrective Measures Evaluation report and select a final remedy. In addition, as our report states, some discussions specific to the end state of the site began in 2022, and it is unclear if they will have concrete effects on improving the trust between EM-LA and NMED. We believe further action is needed to build trust—both related to specific cleanup remedies as well as to improve alignment on the site's end state—and an independent, third-party facilitator could meet this need.

In discussing the fourth recommendation, with which EM partially concurred, EM stated that it already incorporates risk-informed decision-making in all aspects of the EM program and documents the results of the decisions. However, as our report states, EM-LA has not developed a formal decision rule for prioritizing cleanup or documented its analyses to

assess the performance of different cleanup approaches. In its response to the recommendation, EM also stated that EM headquarters will work with EM-LA to document the cleanup prioritization decisions. This would help ensure that EM-LA is making optimal cleanup decisions and directing limited resources to its highest priorities.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Energy, and other interested parties. In addition, this report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or andersonn@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made significant contributions to this report are listed in appendix III.

A handwritten signature in black ink that reads "Nathan Anderson". The signature is written in a cursive, flowing style.

Nathan Anderson
Director, Natural Resources and Environment

List of Committees

The Honorable Jack Reed
Chairman
The Honorable Roger Wicker
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Dianne Feinstein
Chair
The Honorable John Kennedy
Ranking Member
Subcommittee on Energy and Water Development
Committee on Appropriations
United States Senate

The Honorable Mike Rogers
Chairman
The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Chuck Fleischmann
Chair
The Honorable Marcy Kaptur
Ranking Member
Subcommittee on Energy and Water Development,
and Related Agencies
Committee on Appropriations
House of Representatives

Appendix I: Status of the 17 Consent Order Cleanup Campaigns to Complete Soil and Groundwater Remediation at Los Alamos

Table 2: Status of the 17 Consent Order Cleanup Campaigns to Complete Soil and Groundwater Remediation at Los Alamos

Cleanup campaign	Description	Status	Estimated cost (as of March 2023)	Estimated year of completion
(A) Chromium Interim Measures and Characterization Campaign	Install and operate wells and other equipment to 1) provide interim measures to prevent migration of contamination, 2) perform studies and testing to gather data, and 3) conduct a Corrective Measures evaluation to propose a final cleanup remedy.	In progress – Conducting interim pump-and-treat remedy, drilling monitoring wells, and collecting samples to determine the nature and extent of the contamination and inform a final remedy.	\$30.7 million	2025
(B) Historical Properties Completion Campaign	Investigate and, as necessary, remediate contaminated soil at four aggregate areas on Los Alamos property.	In progress – Investigation and remediation work in available areas complete (with some work deferred); documentation of completed field work submitted to New Mexico Environment Department (NMED) for review.	\$2.4 million	2041
(C) Royal Demolition Explosives (RDX) Characterization Campaign	Implement interim measures to prevent further migration of contamination, as well as complete the investigation of the nature and extent of contamination using data from wells and other evaluations, and determine the need for a Corrective Measures Evaluation.	In progress – Drilling monitoring wells, conducting risk assessments, and collecting data to gather information on the nature and extent of contamination.	\$17.9 million	2041
(D) Supplemental Investigation Reports Campaign	Submit supplemental investigation reports defining the nature and extent of contamination at 10 aggregate areas on Los Alamos National Laboratory property. ^a	In progress – Investigation and remediation work complete; requests for certification of completed cleanup submitted to NMED for review.	\$315,000	2024

**Appendix I: Status of the 17 Consent Order
Cleanup Campaigns to Complete Soil and
Groundwater Remediation at Los Alamos**

Cleanup campaign	Description	Status	Estimated cost (as of March 2023)	Estimated year of completion
(E) TA-21 Deactivation and Decommissioning and Cleanup Campaign ^b	Remove and remediate buried waste lines and contaminated soils as part of investigating related sites that will be demolished. Investigate contamination at Material Disposal Area T.	In progress – Conducting sampling and investigation activities to characterize contamination.	\$101.6 million	2028
(F) RDX Remedy Campaign	Install remediation infrastructure and implement a final cleanup remedy to address RDX contamination.	Not started	\$29.7 million	2041
(G) Known Cleanup Sites (Above Soil Screening Levels) Campaign	Remove soil from six sites with hazardous contaminants.	Completed	Unknown	Complete
(H) Material Disposal Areas A and T Remedy Campaign ^c	Characterize contamination at Material Disposal Areas A and T, install moisture monitoring at Material Disposal Area T, and implement final remedies selected by NMED to address contamination.	In progress – Conducting investigation activities to characterize contamination.	\$47.7 million	2031
(I) Chromium Final Remedy Campaign	Install infrastructure and implement a final cleanup remedy to remediate chromium contamination	Not started	\$98.6 million	2040
(J) Southern External Boundary Campaign	Investigate, remediate contaminated soil as appropriate, and conduct risk assessments at six aggregate areas on Los Alamos National Laboratory property.	In progress – Conducting investigation activities to characterize contamination.	\$13.1 million	2024
(K) Material Disposal Area C Remedy Campaign	Implement a cleanup remedy selected by NMED to address contamination.	In progress –Corrective Measures Evaluation report submitted to NMED for review	\$37.6 million	2029
(L) Sandia Canyon Watershed Campaign	Investigate and remediate, as appropriate, contaminated soil at five aggregate areas in the central portion of Los Alamos National Laboratory property.	Not started	\$8.3 million	2031
(M) Pajarito Watershed Campaign	Investigate and remediate, as appropriate, contaminated soil at four aggregate areas in the central portion of Los Alamos National Laboratory property.	In progress – Conducting investigation and risk assessment activities to characterize contamination.	\$39.9 million	2026

**Appendix I: Status of the 17 Consent Order
Cleanup Campaigns to Complete Soil and
Groundwater Remediation at Los Alamos**

Cleanup campaign	Description	Status	Estimated cost (as of March 2023)	Estimated year of completion
(N) Upper Water Watershed Campaign	Investigate and remediate, as appropriate, contaminated soil at three aggregate areas in the central portion of Los Alamos National Laboratory property.	Not started	\$35 million	2030
(O) Material Disposal Area AB Remedy Campaign	Characterize contamination of the site's shaft areas, complete a Corrective Measures Evaluation, and implement a cleanup remedy selected by NMED to address contamination.	Not started	\$28.5 million	2033
(P) Material Disposal Area H Remedy Campaign	Complete a Corrective Measures Evaluation and implement a cleanup remedy selected by NMED to address contamination.	In progress	\$10.8 million	2031
(Q) Material Disposal Areas G and L Remedy Campaign	Complete Corrective Measures Evaluation reports and implement cleanup remedies selected by NMED at both Material Disposal Areas. Conduct soil vapor extraction as an interim remedy at Material Disposal Area L.	In progress – Conducting ongoing monitoring and soil vapor extraction activities at Material Disposal Area L.	\$190.9 million	2041

Source: GAO summary of information from the Department of Energy's Office of Environmental Management Los Alamos Field Office and the New Mexico Environment Department. | GAO-23-105665

^aThe Consent Order defines the aggregate area for purposes of the campaigns as an area within a single watershed or canyon made up of one or more Solid Waste Management Units or Areas of Concern and the media (such as soil) affected or potentially affected by releases from those units or areas and for which investigation or remediation is conducted for the area as a whole to address area-wide contamination, ecological risk assessment, and other factors.

^bTA-21 is one of many technical areas at Los Alamos, which are defined as administrative units of area established to encompass operations at the facility.

^cMaterial disposal areas are Cold War-era waste disposal sites for various types of legacy waste. These are found at various locations across the Los Alamos property.

Appendix II: Comments from the Department of Energy



Department of Energy

Washington, DC 20585

June 29, 2023

Mr. Nathan Anderson
Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Anderson:

As required by 31 U.S.C. 720, this letter provides the U.S. Department of Energy (DOE) Office of Environmental Management's (EM) response to the U.S. Government Accountability Office (GAO) draft report, GAO-22-105665, *Nuclear Waste Cleanup: DOE Needs to Address Weaknesses in Program and Contractor Management at Los Alamos*.

EM's mission represents the government's strong commitment to cleaning up the environmental legacy of the national defense programs that helped end World War II and the Cold War. From managing one of the largest groundwater and soil remediation efforts in the world to opening the only deep geological repository for transuranic (TRU) waste, to constructing the entire tank waste treatment system at Savannah River, significant progress has been achieved. These accomplishments reflect EM's strong focus on risk reduction and safely completing the mission.

This focus is evident at Los Alamos, where our team is making notable progress in drawing down inventories of legacy TRU waste for disposal, remediating soil and groundwater, decommissioning excess facilities, and building stronger relationships with the community, Tribal Nations, stakeholders, and others. Of the more than 2,100 areas of concern of potential contamination originally identified at Los Alamos, 60 percent have been investigated, remediated, and closed. To enable future progress at Los Alamos, EM is employing the EM Program Management Protocol, to develop an updated cost and schedule estimate and incorporate EM's risk-informed prioritization schema into the site planning process. In parallel, EM's Los Alamos office is conducting a comprehensive Strategic Vision development process to create a clear prioritization framework. That process includes extensive engagement with and feedback from Tribal nations, regulators, stakeholders, the public, and others. The Los Alamos office is also taking deliberate steps to strengthen oversight of the cleanup contractor, improve contract incentives for cleanup performance, and strengthen performance feedback.

The Department appreciates GAO's recognition of the remediation and other progress at Los Alamos as we address the challenges and risks to efficiently and effectively complete cleanup at this site. EM has implemented, and continues to implement, actions that are responsive to the recommendations in GAO's report. As such, DOE generally concurs

**Appendix II: Comments from the Department
of Energy**

2

with GAO's recommendations in the report. EM's response to all six recommendations is provided in the enclosure. Technical comments on the draft report are also enclosed.

If you have any questions, please contact me or Mr. Dae Y. Chung, Associate Principal Deputy Assistant Secretary for Corporate Services, at (202) 586-9636.

Sincerely,



William I. White
Senior Advisor for Environmental Management

Enclosures

2

Enclosure 1

**Management Response to
Recommendations GAO-22-105665 GAO Draft Report
*Nuclear Waste Cleanup: DOE Needs to Address Weaknesses
in Program and Contractor Management at Los Alamos***

Recommendation 1: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to work - in conjunction with the New Mexico state regulator - with an independent, third-party facilitator to improve the relationship and build trust.

Management Response: Concur in Principle.

The Office of Environmental Management (EM) Los Alamos Field Office (EM-LA) has engaged with an independent third-party facilitator for meetings with the New Mexico Environment Department (NMED) over the past two years. As disagreements over cleanup priorities, remedies, and cost estimation assumptions arise, EM-LA will work with NMED to determine the feasibility and benefit of using additional facilitators on a case-by-case basis, particularly regarding the definition of the site's end state.

Estimated Completion Date: Complete.

Recommendation 2: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to conduct a formal root cause analysis and develop and implement a corrective action plan to account for the increases in cost and schedule at EM-LA.

Management Response: Concur.

As part of the review of EM-LA's draft Federal Site Lifecycle Estimate (FSLE), an analysis of the drivers for the increases in cost and schedule will be conducted and a corrective action plan will be developed, if necessary. This supplements the annual causal analyses that are performed on changes of the baselines in support of the annual financial statement reporting and audit. The review of the EM-LA draft FSLE is expected to be complete in fiscal year (FY) 2024.

Estimated Completion Date: September 30, 2024.

Recommendation 3: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to develop guidance for its cleanup sites on how to incorporate the Government Accountability Office's (GAO) essential elements of risk-informed decision-making when applying the prioritization schema referenced in EM's Program Management Protocol.

Management Response: Concur.

EM incorporates risk-informed decision-making in all aspects of the EM Program. The

Enclosure 1

EM Program Management Protocol defines the risk-informed prioritization schema, which emphasizes the importance of first addressing issues posing an immediate risk to human health or the environment and then addressing issues based on achieving the highest risk reduction benefit per radioactive content. In accordance with the EM Program Management Protocol, site strategic documents (the Site Strategic Vision, the Site Program Plan, and the FSLE) are informed by EM's prioritization schema, life cycle estimates and strategic alternatives analyses, anticipated impacts from funding levels, and actual performance, as well as lessons learned from planning and execution. Furthermore, decisions at the site level also incorporate the risk-informed prioritization schema. As part of implementing the EM Program Management Protocol, EM is developing further detailed guidance based on the lessons learned to include GAO's essential elements of risk-informed decision-making framework when applying the prioritization schema.

Estimated Completion Date: March 31, 2024.

Recommendation 4: The Secretary of Energy should direct the EMLA Office Manager to formalize and document the decision rules it uses and the analyses it conducts to prioritize cleanup actions, as it waits for EM to issue guidance on how to incorporate risk-informed decision-making when applying EM's prioritization schema.

Management Response: Partially Concur.

EM already incorporates risk-informed decision-making in all aspects of the EM Program and documents the results of the decisions. While guidance described in Recommendation 3 is being developed for its cleanup sites to include further detailed incorporation of GAO's essential elements of risk-informed decision-making, EM Headquarters will work with EM LA to document the decisions and bases for the prioritization of cleanup activities at the site.

Estimated Completion Date: March 31, 2024.

Recommendation 5: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to ensure that EMLA uses available mechanisms to incentivize timely approval of a final contractor performance baseline for the 3-year option period.

Management Response: Concur.

EM LA required a contractor performance baseline for the three years of the option period. The cleanup contractor submitted a draft performance baseline and it has been conditionally approved. Final review and approval of the baseline is anticipated later this year.

Estimated Completion Date: December 31, 2023.

Enclosure 1

Recommendation 6: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to track and report on the implementation and effectiveness of the recommendations from the July 2022 integrated project team review.

Management Response: Concur.

An independent team of subject matter experts conducted a review in FY 2022 of the efficacy and sustainability of corrective measures implemented from prior reviews. Actions to address key observations and recommendations are already underway by EM LA. The completion of the actions will be tracked and documented.

Estimated Completion Date: September 30, 2024.

Text of Appendix II: Comments from the Department of Energy

June 29, 2023

Mr. Nathan Anderson Director

Natural Resources and Environment

U.S. Government Accountability Office Washington, DC 20548

Dear Mr. Anderson:

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This focus is evident at Los Alamos, where our team is making notable progress in drawing down inventories of legacy TRU waste for disposal, remediating soil and groundwater, decommissioning excess facilities, and building stronger relationships with the community, Tribal Nations, stakeholders, and others. Of the more than 2,100 areas of concern of potential contamination originally identified at Los Alamos, 60 percent have been investigated, remediated, and closed. To enable future progress at Los Alamos, EM is employing the EM Program Management Protocol, to develop an updated cost and schedule estimate and incorporate EM's risk-informed prioritization schema into the site planning process. In parallel, EM's Los Alamos office is conducting a comprehensive Strategic Vision development process to create a clear prioritization framework. That process includes extensive engagement with and feedback from Tribal nations, regulators, stakeholders, the public, and others. The Los Alamos office is also taking deliberate steps to strengthen oversight of the

cleanup contractor, improve contract incentives for cleanup performance, and strengthen performance feedback.

The Department appreciates GAO's recognition of the remediation and other progress at Los Alamos as we address the challenges and risks to efficiently and effectively complete cleanup at this site. EM has implemented, and continues to implement, actions that are responsive to the recommendations in GAO's report. As such, DOE generally concurs with GAO's recommendations in the report. EM's response to all six recommendations is provided in the enclosure. Technical comments on the draft report are also enclosed.

If you have any questions, please contact me or Mr. Dae Y. Chung, Associate Principal Deputy Assistant Secretary for Corporate Services, at (202) 586-9636.

Sincerely,

William I. White

Senior Advisor for Environmental Management

Enclosures - Management Response to Recommendations GAO-22-105665 GAO Draft Report Nuclear Waste Cleanup: DOE Needs to Address Weaknesses in Program and Contractor Management at Los Alamos

Recommendation 1: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to work - in conjunction with the New Mexico state regulator - with an independent, third-party facilitator to improve the relationship and build trust.

Management Response: Concur in Principle.

The Office of Environmental Management (EM) Los Alamos Field Office (EM-LA) has engaged with an independent third-party facilitator for meetings with the New Mexico Environment Department (NMED) over the past two years. As disagreements over cleanup priorities, remedies, and cost estimation assumptions arise, EM-LA will work with NMED to determine the feasibility and benefit of using additional facilitators on a case-by-case basis, particularly regarding the definition of the site's end state.

Estimated Completion Date: Complete.

Recommendation 2: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to conduct a formal root cause analysis and develop and implement a corrective action plan to account for the increases in cost and schedule at EM-LA.

Management Response: Concur.

As part of the review of EM-LA's draft Federal Site Lifecycle Estimate (FSLE), an analysis of the drivers for the increases in cost and schedule will be conducted and a corrective action plan will be developed, if necessary. This supplements the annual causal analyses that are performed on changes of the baselines in support of the annual financial statement reporting and audit. The review of the EM-LA draft FSLE is expected to be complete in fiscal year (FY) 2024.

Estimated Completion Date: September 30, 2024.

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Management Response: Concur.

EM incorporates risk-informed decision-making in all aspects of the EM Program. The EM Program Management Protocol defines the risk-informed prioritization schema, which emphasizes the importance of first addressing issues posing an immediate risk to human health or the environment and then addressing issues based on achieving the highest risk reduction benefit per radioactive content. In accordance with the EM Program Management Protocol, site strategic documents (the Site Strategic Vision, the Site Program Plan, and the FSLE) are informed by EM's prioritization schema, life cycle estimates and strategic alternatives analyses, anticipated impacts from funding levels, and actual performance, as well as lessons learned from planning and execution.

Furthermore, decisions at the site level also incorporate the risk-informed prioritization schema. As part of implementing the EM Program Management Protocol, EM is developing further detailed guidance based on the lessons learned to include GAO's essential elements of risk-informed decision-making framework when applying the prioritization schema.

Estimated Completion Date: March 31, 2024.

Recommendation 4: The Secretary of Energy should direct the EMLA Office Manager to formalize and document the decision rules it uses and the analyses it conducts to prioritize cleanup actions, as it waits for EM to issue guidance on how to incorporate risk-informed decision-making when applying EM's prioritization schema.

Management Response: Partially Concur.

EM already incorporates risk-informed decision-making in all aspects of the EM Program and documents the results of the decisions. While guidance described in Recommendation 3 is being developed for its cleanup sites to include further detailed incorporation of GAO's essential elements of risk-informed decision-making, EM Headquarters will work with EM LA to document the decisions and bases for the prioritization of cleanup activities at the site.

Estimated Completion Date: March 31, 2024.

Recommendation 5: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to ensure that EMLA uses available mechanisms to incentivize timely approval of a final contractor performance baseline for the 3-year option period.

Management Response: Concur.

EM LA required a contractor performance baseline for the three years of the option period. The cleanup contractor submitted a draft performance baseline and it has been conditionally approved. Final review and approval of the baseline is anticipated later this year.

Estimated Completion Date: December 31, 2023.

Recommendation 6: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to track and report on the implementation and effectiveness of the recommendations from the July 2022 integrated project team review.

Management Response: Concur.

An independent team of subject matter experts conducted a review in FY 2022 of the efficacy and sustainability of corrective measures implemented from prior reviews.

Actions to address key observations and recommendations are already underway by EM LA. The completion of the actions will be tracked and documented.

Estimated Completion Date: September 30, 2024.

GAO Contact

Appendix III: GAO Contact and Staff Acknowledgments

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Staff Acknowledgments

In addition to the individual named above, Janice Poling (Assistant Director), Jamie Meuwissen (Analyst in Charge), and Rachel Pittenger made key contributions to this report. Also contributing to this report were John Delicath, Cindy Gilbert, Katherine Killebrew, Amanda Kolling, Dan C. Royer, and Jeanette Soares.

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