United States Government Accountability Office

Report to Congressional Addressees

May 2022

ENVIRONMENTAL CLEANUP

Status of Major DOE Projects and Operations

GAO-22-104662

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GAO Highlights

Highlights of GAO-22-104662, a report to congressional addressees

Why GAO Did This Study

EM is responsible for the cleanup of hazardous and radioactive waste at sites and facilities that have been contaminated from decades of nuclear weapons production and nuclear energy research. EM divides its cleanup work into capital asset projects—those with defined start and end points—and operations activities—recurring facility or environmental operations. GAO has identified DOE project management as a high-risk area because the department's record regarding management and oversight has left DOE vulnerable to fraud, waste, abuse, and mismanagement. GAO's 2021 High-Risk Report identified numerous recommendations to EM to address this high-risk area. However, as of December 2020, 45 of these recommendations have not been implemented, including 19 that were made since GAO's 2019 High-Risk Report.

GAO initiated a review to examine EM's performance and progress in managing its nuclear cleanup projects. This report (1) describes EM's largest capital asset projects, (2) describes EM's largest operations activities at selected sites, and (3) provides summary observations across the largest projects and operations activities GAO reviewed.

To conduct its review, GAO developed a questionnaire and collected associated data; analyzed cost, schedule, project risk, and other data; reviewed project status reports, project peer reviews, and other documents; and interviewed EM headquarters and officials at the 11 sites of the selected capital asset projects and operations activities.

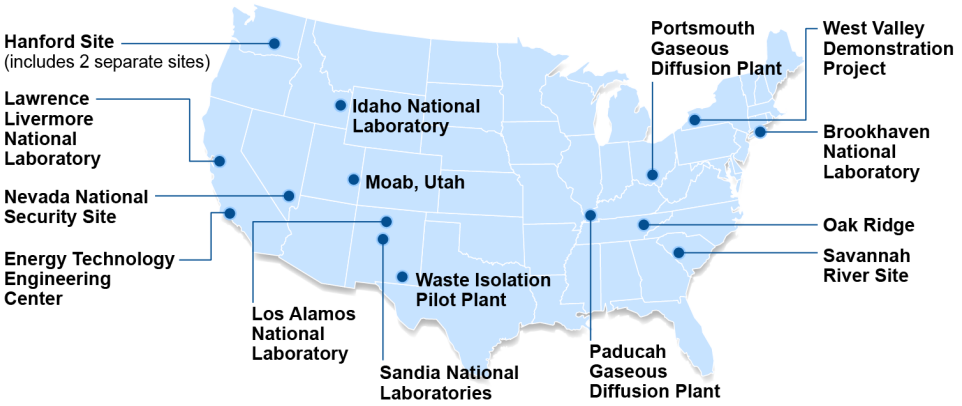
View GAO-22-104662. For more information, contact Nathan Anderson at (202) 512-3841 or andersonn@gao.gov.

What GAO Found

The Department of Energy's (DOE) Office of Environmental Management (EM) manages DOE's radioactive and hazardous waste cleanup program across 16 sites (see fig.), using both capital asset projects and operations activities.

- According to EM data, there were 23 active capital asset projects as of December 2020, 15 of which GAO selected for this review. The 15 capital asset projects are located at seven sites and had total project costs ranging from $127 million to $16.8 billion. These projects include a variety of cleanup activities, ranging from constructing the Waste Treatment Plant at the Hanford, WA, site to demolishing a contaminated building at Portsmouth, OH.
- According to EM officials, as of September 2021, the agency is managing 76 operations activities at the 16 active cleanup sites. GAO selected 11 EM operations activities—one at each of 11 sites—with estimated costs ranging from $1 billion to $180.5 billion. These operations activities cover a variety of mission activities, such as deactivating and decommissioning a nuclear facility and remediating soil and groundwater.

Department of Energy Office of Environmental Management Cleanup Sites



Sources: GAO analysis of Department of Energy information; Map Resources (map). | GAO-22-104662

Note: Hanford contains two sites—the Office of River Protection and the Richland Operations Office.

According to GAO's review of the 15 capital asset projects and 11 operations activities, GAO had five summary observations including the following:

- For the projects GAO selected, 13 of the 15 had progressed far enough to have established cost and schedule baselines. GAO found that nine of the 13 projects are expected to be completed within initial baseline estimates. However, the other four are expected to exceed estimates, including two projects at the Hanford Site.
- Officials for three of the projects cited staffing capacity as a contributing factor to cost and schedule overruns.
- EM had not always updated its cost and schedule estimates for operations activities. However, EM now requires that such estimates be updated annually; officials stated they are now working on these updates.

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Abbreviations

AOA	analysis of alternatives
AOC	Area of Concern
BCP	baseline change proposal
CD	critical decision
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DOE	Department of Energy
D&D	decontamination and decommissioning
DFLAW	Direct-Feed Low-Activity Waste
DWPF	Defense Waste Processing Facility
EM	Office of Environmental Management
EPA	Environmental Protection Agency
HLW	high-level radioactive waste
INTEC	Idaho Nuclear Technology and Engineering Center
IPABS	Integrated Planning, Accounting, and Budgeting System
LAW	low-activity waste
LAWPS	Low-activity Waste Pretreatment System
NMED	New Mexico Environment Department
NNSS	Nevada National Security Site
ORP	Office of River Protection
OSWDF	On-Site Waste Disposal Facility
PARS	Project Assessment and Reporting System
PFP	Plutonium Finishing Plant
PPPO	Paducah Portsmouth Project Office
PT	Pretreatment
RCRA	Resource Conservation and Recovery Act
SDU	Saltstone Disposal Unit
SRS	Savannah River Site
SSCVS	Safety Significant Confinement Ventilation System
SWMU	Solid Waste Management Unit
SWPF	Salt Waste Processing Facility
TPA	Tri-party agreement
TSCR	Tank-Side Cesium Removal
WIPP	Waste Isolation Pilot Plant
WTP	Waste Treatment and Immobilization Plant

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May 4, 2022

Congressional Addressees

The Department of Energy's (DOE) Office of Environmental Management (EM) is responsible for addressing hazardous and radioactive waste at sites and facilities that have been contaminated from decades of nuclear weapons production and nuclear energy research. EM's cleanup mission includes deactivating and decommissioning contaminated buildings; remediating contaminated soil and groundwater; and designing, constructing, and operating facilities to treat millions of gallons of radioactive liquid waste.

EM divides its cleanup work into capital asset projects and operations activities. A capital asset project has a defined start and end point and can include the construction of new facilities for treating and disposing of waste, as well as environmental remediation of lands. Operations activities include reoccurring facility or environmental operations, as well as activities that are project like, with defined start and end dates, such as soil and groundwater remediation activities. As we reported in 2019, capital asset projects accounted for 18 percent (about $1.3 billion) of EM's approximately $7.2 billion fiscal year 2019 budget, and operations activities accounted for 77 percent (about $5.5 billion) of EM's fiscal year 2019 budget.[1] As of December 2021, there were 16 EM sites across the country where cleanup work was ongoing.[2] At that time, EM had 23 active capital asset projects and 76 operations activities across the 16 sites.

EM has specific policies and guidance for managing capital asset projects, including DOE Order 413.3B on Program and Project

[1]GAO, *Nuclear Waste Cleanup: DOE Could Improve Program and Project Management by Better Classifying Work and Following Leading Practices,* GAO-19-223 (Washington, D.C.: Feb. 19, 2019). EM used the remaining $347 million to fund its operations at headquarters for program direction and support.

[2]In December 2020, EM passed control of the Separations Process Research Unit to the National Nuclear Security Administration's Office of Naval Reactors. EM divides the Hanford, WA, site into two distinct sites: The Office of River Protection and the Richland Operations Office. For the purposes of this report, we also considered the Hanford Site as two separate sites to arrive at a total of 16 EM sites where cleanup work was ongoing. See fig.1 for a map of EM's active cleanup sites.

Management for the Acquisition of Capital Assets.[3] Capital asset projects go through management reviews and approval processes called "critical decisions," as projects move forward from planning and design to construction. In 2019, we reported that the project management requirements for capital asset projects were more stringent than the applicable requirements for operations activities.[4] We recommended that DOE revise the requirements for operations activities to include project management leading practices related to scope, cost, schedule performance, and independent reviews. In response to our recommendation, EM has developed the 2020 Environmental Management Program Management Protocol (Protocol).[5] The Protocol established new management requirements for operations activities, including the requirement to develop and maintain life-cycle cost estimates for each site.[6]

Federal laws—including the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA); the Resource Conservation and Recovery Act of 1976, as amended (RCRA); and the Atomic Energy Act of 1954, as amended—govern cleanup at EM's 16 sites. The cleanup at these sites is also governed by dozens of agreements that DOE negotiated with various regulatory entities, which establish hundreds of milestones that specify actions EM must take as it carries out its cleanup work. EM uses these milestones, along with other

[3]Department of Energy, *Program and Project Management for the Acquisition of Capital Assets*, DOE Order 413.3B (Change 6) (Washington, D.C.: Jan. 12, 2021).

[4]GAO-19-223.

[5]Department of Energy, Office of Environmental Management, *Environmental Management Program Management Protocol* (Washington, D.C.: Oct. 30, 2020). This document supersedes the 2017 *Requirements for Management of the Office of Environmental Management's Cleanup Program.*

[6]The Federal Site Life-Cycle Estimate includes the scope, cost, and schedule profiles for the work activities required to complete EM's mission at specific sites (including costs that have already been incurred). The Federal Site Life-Cycle Estimate also includes a Risk Management Plan and a risk register. Individual site estimates are to be integrated into EM's overall Program Life-Cycle Estimate.

metrics, as a tool for managing and tracking the progress of on-site cleanup activities.[7]

GAO has previously identified DOE project management as a high-risk area because the department's track record regarding management and oversight of contractors has left DOE vulnerable to fraud, waste, abuse, and mismanagement.[8] We initiated this review of EM's performance and progress in managing certain nuclear cleanup capital asset projects and operations activities under the authority of the U.S. Comptroller General. This report (1) describes EM's largest capital asset projects, (2) describes EM's largest operations activities at selected sites, and (3) provides summary observations across the largest projects and operations activities we reviewed.

To determine which capital asset projects to review, we selected projects that were (1) far enough along in the planning process to have at least selected an approach for meeting the project's mission need (critical decision 1, CD-1) and (2) have an estimated total project cost of at least $100 million. We identified 15 capital asset projects that have reached at least CD-1 and have an estimated total project cost of at least $100 million.

To determine which EM operations activities to review, we determined that 11 of EM's 16 cleanup sites had at least one operations activity with a total life-cycle cost estimate of at least $1 billion. We then selected the operations activity with the highest life-cycle cost at each of those sites.

[7]These agreements include federal facility agreements generally negotiated between DOE, state regulators, and the U.S. Environmental Protection Agency, as well as additional compliance agreements, compliance orders, and consent orders, and consent decrees. Federal facility agreements, also known as tri-party agreements (TPA), generally set out a sequence for accomplishing cleanup work, tend to cover a relatively large number of cleanup activities, and can include milestones that DOE must meet. Compliance agreements, consent orders, and consent decrees can vary significantly but include agreements negotiated at a site subsequent to the initial federal facility agreement or other agreements with the state. These agreements may impose penalties for missing milestones and may amend or modify earlier agreements, including extending or eliminating milestone dates. Compliance orders are issued by regulators and require DOE to take specific actions to correct violations of laws, regulations, permits, or agreements. As we reported in 2019, 12 of the 16 sites are governed by federal facility agreements and additional compliance agreements, compliance orders, consent orders, and consent decrees. See GAO, *Nuclear Waste: DOE Should Take Actions to Improve Oversight of Cleanup Milestones,* GAO-19-207 (Washington, D.C.: Feb. 14, 2019).

[8]GAO, *High Risk Series: Dedicated Leadership Needed to Address Limited Progress in Most High-Risk Areas*, GAO-21-119SP (Washington, D.C.: Mar. 2, 2021).

We chose a $1 billion threshold to focus on operations activities with the highest dollar value. Using these criteria also allowed us to review a diversity of operations activities at a range of cleanup sites.

To develop summary observations across the 15 capital asset projects and 11 operations activities, we obtained relevant information on their performance from DOE and EM databases and documents. We then used a data collection instrument to corroborate the performance information and reviewed documents on issues and risks the projects and operations had already encountered or could encounter in the future. We also conducted interviews with EM project and site officials who oversee this work. On the basis of our corroboration of the information we collected, we determined that the data were reliable for the purposes of selecting the projects and operations and describing their performance. We developed our summary observations using an analysis of the information we gathered and identified, including (1) whether the capital asset projects were expected to be completed within their baselines, (2) whether the projects that were expected to exceed their baselines encountered similar issues, and (3) other similarities in the information and responses we gathered and analyzed for the projects and operations. A description of our full scope and methodology is included in appendix I.

We conducted this performance audit from December 2020 to April 2022, 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

This section describes (1) the types of radioactive waste that may be present at EM's 16 active cleanup sites, (2) EM's 16 active cleanup sites, (3) project management requirements that govern EM's execution of its capital projects and operations activities, and (4) GAO's high-risk designation for EM's project and contract management.

EM Sites Have Various Types of Radioactive Waste

There are several types of radioactive waste that EM is responsible for managing. DOE Order 435.1, and Manual 435.1-1, first issued in July 1999, and subsequently revised, set forth the procedures and requirements related to DOE's management of high-level radioactive

waste (high-level waste), transuranic waste, low-level radioactive waste (low-level waste), and the radioactive component of mixed waste.[9]

- High-level waste is defined by the Atomic Energy Act of 1954, as amended, and the Nuclear Waste Policy Act of 1982, as amended, as the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation. There is currently no repository for the permanent disposal of DOE's high-level waste.
- Transuranic waste is defined by the Waste Isolation Pilot Plant Land Withdrawal Act 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 (EPA), 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.

  DOE disposes of defense-origin transuranic waste at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico.
- Low-level radioactive waste is defined by the Nuclear Waste Policy Act of 1982, as amended, as radioactive material that (1) is not high-level radioactive waste, spent nuclear fuel, transuranic waste, or byproduct material; and (2) the Nuclear Regulatory Commission, consistent with existing law, classifies as low-level radioactive waste. DOE disposes of government-owned low-level waste in authorized waste disposal facilities at DOE sites or at certain off-site commercial waste disposal facilities.

[9]Department of Energy, *Radioactive Waste Management*, Order 435.1, Chg 2(Admin Chg) (Washington, D.C.: Jan. 11, 2021); and *Radioactive Waste Management Manual,* Manual 435.1-1 Chg 3 (LtdChg) (Washington, D.C.: Jan. 11, 2021).

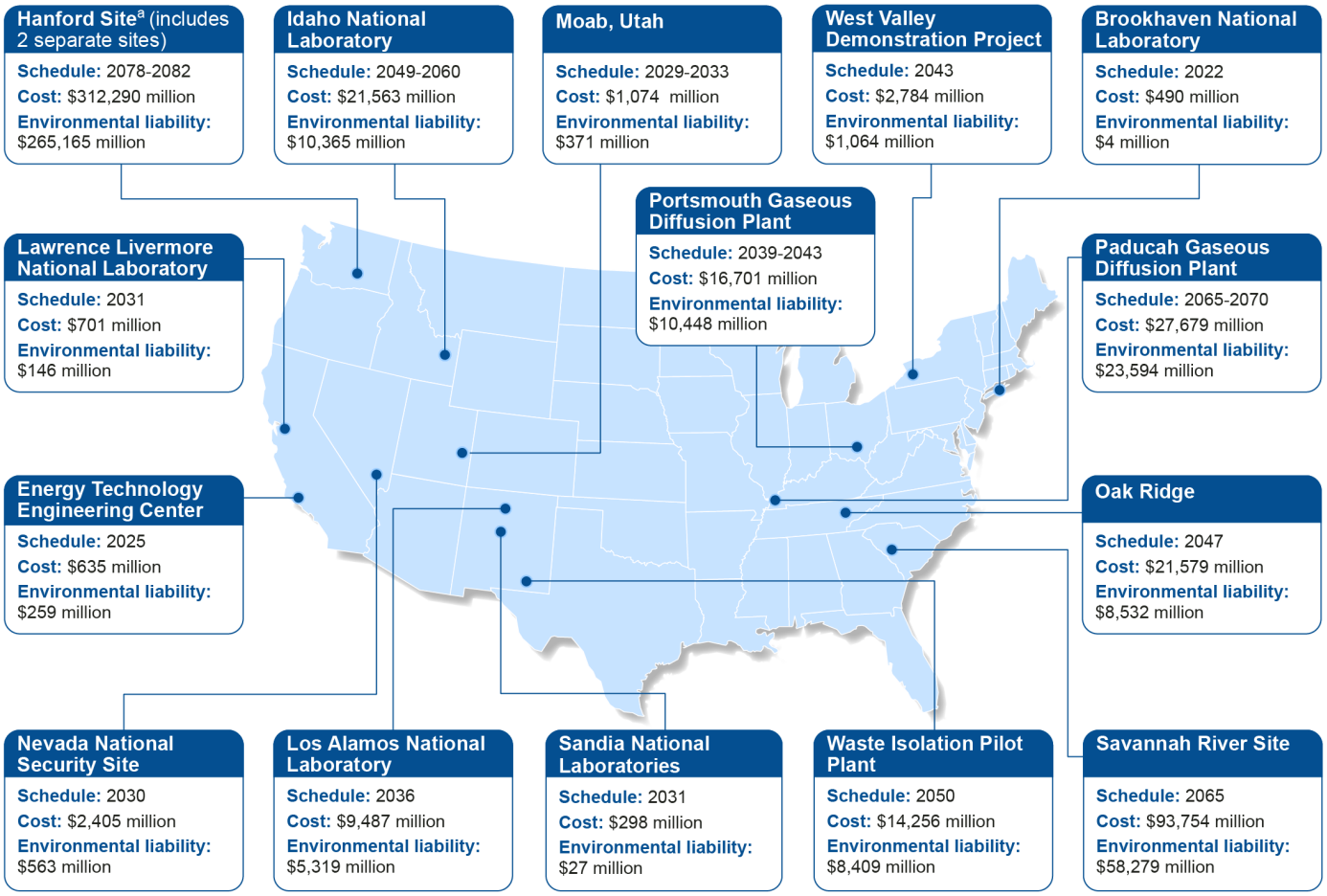
- RCRA defines mixed waste as radioactive waste that contains both source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954, as amended; and a hazardous component subject to RCRA, as amended.[10] DOE manages this waste in accordance with the requirements of RCRA and DOE Order 435.1.

EM's 16 Active Cleanup Sites

There are 16 sites where EM was actively conducts cleanup activities. EM has estimated the life-cycle cost and schedule for completing the cleanup work at each site, which, according to EM officials, includes the estimated cost of future cleanup and costs already incurred. EM also annually updates the estimated cost for future cleanup as part of calculating DOE's environmental liability. Background information on each of EM's active cleanup sites is included in appendix II. Figure 1 provides information on each site's life-cycle cost and scheduled completion, and environmental liability.

[10]See 42 U.S.C. § 6903(41).

Figure 1: Cleanup Costs and Activities at the Office of Environmental Management's 16 Active Cleanup Sites



Sources: GAO analysis of Department of Energy information; Map Resources (map). | GAO-22-104662

Note: The cost estimates for each site represent the life-cycle estimates developed by the Office of Environmental Management, which include costs for work that has already been completed and remaining costs. The environmental liability for each site includes only the remaining costs for future work.

[a]The Office of Environmental Management's (EM) Hanford Site is counted as two separate sites and is managed by two separate site offices: the Office of River Protection and the Richland Operations Office.

EM Project Management Requirements

EM relies on two policies that establish requirements for managing its capital asset projects and operations activities, DOE Order 413.3B and EM's Protocol. Generally, these policies establish procedures for developing the cost and schedule estimates for each capital asset project and operations activity; tracking the performance of projects and

operations activities; and updating project and operations activities' cost and schedule estimates, as necessary.

DOE Project Management Order for Capital Asset Projects

EM is required to manage capital asset projects with an estimated total cost greater than or equal to $50 million, in accordance with DOE Order 413.3B.[11] The goal of DOE Order 413.3B is to deliver projects within their original cost and schedule baselines and that meet mission performance and other requirements. Specifically, Order 413.3B establishes five critical decision processes over the life of a project, each of which is marked by a major approval milestone—or CD point—at the end of the process. These CD points are:

- CD-0: Approve mission need.
- CD-1: Approve alternative selection and cost range.
- CD-2: Approve project performance baseline (i.e., cost and schedule estimates).
- CD-3: Approve start of construction.
- CD-4: Approve start of operations or project completion.

When a capital asset project achieves CD-2, EM management approves the cost and schedule estimates for the project, which serve as the baseline used to assess project performance. In developing these estimates, EM conducts an analysis of the risks that might result in cost increases and schedule delays and develops mitigation strategies to lessen or eliminate these risks. To address the risks that remain after mitigation, EM adds to the cost and schedule estimates additional costs and days as a contingency, in case these risks were to occur. EM refers to the costs included for risks that the contractor is responsible for as "management reserve," and the time included for such risks as "contractor schedule reserve." The costs and time applied for risks related to factors outside of the contractor's control, which include changes to regulations or funding below expected levels, according to EM officials, are referred to as "contingency." For the purposes of this report, we combine the management reserve, contractor schedule reserve, and contingency for each capital asset project and present this information in our summaries labeled as "costs and days added for risk."

[11]According to the Order, Under Secretaries may lower this threshold to $10 million during the project development phase for nuclear projects or complex first-of-a-kind projects.

EM's Policy for Managing Operations Activities

In 2017, EM issued a policy entitled "Requirements for Management of the Office of Environmental Management's Cleanup Program," which established new requirements for all operations activities within EM's cleanup program. For example, the policy established the concept of "segments"—defined as the scope of work that would typically be completed over 5 to 10 years at a site under a specific contract. According to EM officials, the scope of work established in these segments could include multiple capital asset projects and operations activities. In 2019, we reported that the 2017 cleanup policy did not follow multiple leading practices for program and project management.[12]

To better define its program management process, in November 2020, EM issued the Protocol, which superseded the 2017 cleanup policy. The Protocol requires that EM site offices develop their own life-cycle cost and schedule estimates for completing the cleanup of their respective sites and that these estimates go through an internal review process to ensure that the estimating process followed best practices. According to EM officials, prior to the Protocol, EM sites each had life-cycle estimates for their cleanup work, which included a baseline developed by the contractors for the work included in the contract and an estimate developed by EM for the activities after the contract. As of February 2022, EM officials told us that they are still in the process of implementing the new requirements in the Protocol.

GAO's High-Risk Designation for EM's Project and Contract Management

In 1990, we designated DOE's contract management—including contract administration and project and program management—as a high-risk area. We took this action because DOE's record of inadequate management and oversight of contractors left the department vulnerable to fraud, waste, abuse, and mismanagement. This high-risk area includes programs (functions or activities that typically involve broad objectives) and projects (temporary efforts with defined scopes). In the 2021 update to our High-Risk Series report, we provided a separate rating specific for EM and assessed it as having partially met all five high-risk criteria.[13] In that report, we explained that 45 of our recommendations related to the high-risk area remained open, including 19 that had been made since the prior high-risk report, which was published in 2019.

[12]GAO-19-223.

[13]The high-risk criteria form a road map for efforts to improve and ultimately address high-risk issues. These criteria are leadership commitment, capacity, action plan, monitoring, and demonstrated progress. GAO-21-119SP.

These recommendations included

- incorporate project management leading practices for operations activities,
- take steps to ensure cost and schedule estimates meet best practices, and
- identify and fully analyze additional flexibilities that could be used to address staffing vacancies at DOE's site office response for the Waste Isolation Pilot Plant.

EM Has 15 Active Capital Asset Projects at Seven Sites, with an Estimated Cost Over $100 Million Each

According to EM data, as of December 2020, EM was actively managing 23 capital asset projects.[14] Of these 23 projects, 15 had reached at least the CD-1 milestone and had an estimated total project cost of $100 million or greater, with total project costs ranging from $127 million to $16.8 billion. Most of these 15 projects involved ongoing cleanup work in one of three areas: treatment and disposal of radioactive liquid waste, demolition of excess facilities, or waste disposal. Summaries of the status and performance for each of the projects are included in appendix III. Table 1 outlines the 15 capital asset projects we selected.

Table 1: Office of Environmental Management (EM) Capital Asset Projects with Estimated Costs of at Least $100 million, by EM Site

EM site	Capital asset projects	Project cost estimate as of December 2021 (costs in millions of dollars)
Hanford Site: Office of River Protection	Waste Treatment and Immobilization Plant(WTP)/WTP LBL Direct-Feed Low-Activity Waste	16,813[a]
	Tank-Side Cesium Removal System	164
Hanford Site: Richland Operations Office	Plutonium Finishing Plant	209
Oak Ridge Reservation	Sludge Processing Facility Buildouts	127-171[b]
	On-Site Waste Disposal Facility	175-375[b]
	Outfall 200 Mercury Treatment Facility	224
Portsmouth Site	X-326 Process Building Demolition Project	160
	On-Site Waste Disposal Facility (CAP-1)	275
	On-Site Waste Disposal Facility (CAP-2)	373

[14]One of the 23 projects, the Direct-Feed Low Activity Waste project at the Hanford Site, is identified as a "segment." According to DOE officials, this project is a segment of Hanford's WTP project.

EM site	Capital asset projects	Project cost estimate as of December 2021 (costs in millions of dollars)
Savannah River Site	Saltstone Disposal Unit 7	127
	Saltstone Disposal Units 8 and 9	280
	Saltstone Disposal Units 10 through 12	496
Waste Isolation Pilot Plant	Safety Significant Confinement Ventilation System	288
	Utility Shaft	197
West Valley Site	Main Plant Processing Building	206

Legend: CAP = capital asset project, WTP LBL = the Low Activity Waste Facility, the Balance of Facilities, and the Analytical Laboratory.

Source: GAO analysis of Department of Energy information and comments from agency officials. | GAO-22-104662

Note: The cost estimates included in this table are in escalated dollars as costs in EM's critical decision documents are also presented in this form.

[a]This cost estimate comes from the most recent baseline change proposal for the entire WTP project. EM has created a segment of the project, referred to as Direct-Feed Low-Activity Waste, whose estimated cost is $8.3 billion. Further, EM is currently conducting an analysis of alternatives that will determine the cost for the remaining scope of the project and will need to update the cost estimate for the entire project once this analysis is completed.

[b]These projects are in the design phase at critical decision 1 and have not started work. Cost estimates for projects in the design phase are presented as a range.

Eleven EM Sites Have an Ongoing Operations Activity with a Life-cycle Cost of at Least $1 Billion

According to EM officials, as of September 2021, EM was managing 76 operations activities at its 16 sites. We found that there are 11 EM sites that have an ongoing operations activity with a life-cycle cost of at least $1 billion each, and we selected for detailed review the operations activity with the highest life-cycle cost at each of these 11 sites. The life-cycle costs for these 11 operations activities range from $1 billion to $180.5 billion, according to EM officials. These operations activities cover a variety of mission activities, such as nuclear facility deactivation and decommissioning, radioactive liquid waste stabilization and disposition, and soil and groundwater remediation. Summaries of the status and performance for each of the operations activity are included in appendix III. Table 2 outlines the 11 operations activities we selected.

Table 2: Office of Environmental Management (EM) Nuclear Cleanup Sites with an Operations Activity with an Estimated Cost over $1 Billion

EM Site	Name of Operations Activity	Life-cycle cost estimate as of December 2021 (in billions of dollars)
Hanford Site: Office of River Protection	Radioactive Liquid Tank Waste Stabilization and Disposition	180.5
Hanford Site: Richland Operations Office	Hanford Central Plateau	22.9
Idaho National Laboratory	Idaho Nuclear Technology and Engineering Center Infrastructure	2.2

EM Site	Name of Operations Activity	Life-cycle cost estimate as of December 2021 (in billions of dollars)
Los Alamos National Laboratory	Los Alamos Soil and Water Remediation	3.8
Moab Site	Moab Uranium Mill Tailings Project	0.93
Oak Ridge Reservation	Nuclear Facility Deactivation and Decommissioning-Y-12	3.08
Paducah Site	Paducah Gaseous Diffusion Plant Deactivation and Decommissioning	35
Portsmouth Site	Nuclear Facility Deactivation and Decommissioning	12.2
Savannah River Site	Radioactive Liquid Waste Stabilization and Disposition	43.3
Waste Isolation Pilot Plant	Waste Disposal Facility Operations	2.94
West Valley Site	West Valley Nuclear Facility Deactivation and Decommissioning	2.8

Source: GAO analysis of Department of Energy information and comments from agency officials. | GAO-22-104662

Note: These estimates are presented in constant year 2021 dollars and at the 80 percent confidence level, meaning that additional costs have been added to the estimate based on the results of an analysis of the likelihood and consequence of identified project risks.

Most Capital Asset Projects are Performing within Baseline Estimates, but EM Faces Challenges Measuring Operations Activities' Performance

Based on our review of EM's 15 largest capital asset projects and 11 selected operations activities, we made the following observations:

Observation 1: *Nine of EM's largest capital asset projects were completed or are expected to be completed within their initial baseline cost and schedule estimates.*

Of the 15 EM capital asset projects we reviewed, 13 had progressed far enough to have established cost and schedule baselines, and nine are expected to be completed within those baselines. This determination is based on our review of EM documents and interviews with project officials. Table 3 outlines which of the 9 out of 13 projects are expected to be completed within their initial baselines.

Table 3: Performance of 13 Office of Environmental Management's Capital Asset Project's Performance against Cost and Schedule Baselines

Site	Project Title	Completed or expected to be completed within original baselines
Hanford Site: Office of River Protection	Waste Treatment and Immobilization Plant/WTP LBL Direct-Feed Low-Activity Waste	No
Hanford Site: Office of River Protection	Tank-Side Cesium Removal System	Yes
Hanford Site: Richland Operations Office	Plutonium Finishing Plant	No
Oak Ridge Reservation	Outfall 200 Mercury Treatment Facility	Yes
Portsmouth Site	X-326 Process Building Demolition Project	Yes
Portsmouth Site	On-Site Waste Disposal Facility (CAP-1)	Yes
Portsmouth Site	On-Site Waste Disposal Facility (CAP-2)	Yes
Savannah River Site	Saltstone Disposal Unit 7	Yes[a]
Savannah River Site	Saltstone Disposal Units 8 and 9	Yes
Savannah River Site	Saltstone Disposal Units 10 through 12	Yes
Waste Isolation Pilot Plant	Safety Significant Confinement Ventilation System	No
Waste Isolation Pilot Plant	Utility Shaft	No
West Valley Site	Main Plant Processing Building	Yes

Legend: WTP LBL= the Low Activity Waste Facility, the Balance of Facilities, and the Analytical Laboratory.

Source: GAO analysis of Department of Energy data. | GAO-22-104662

[a]The Saltstone Disposal Unit 7 project was completed within its cost and schedule baselines in July 2021.

According to our review of EM documents for the 13 projects with established cost and schedule baselines, one project was completed within its baseline cost and schedule estimates, and eight projects are expected to be completed within their baseline estimates.[15] Of the four projects that are not expected to be completed within their baselines, the Waste Treatment and Immobilization Plant project and the Plutonium Finishing Plant project have completed the baseline change proposal process, and EM has approved updated cost and schedule estimates for these two projects.[16] EM officials stated that two projects at WIPP—the Safety Significant Confinement Ventilation System (SSCVS) and the

[15]For the eight projects expected to be completed within their baselines, there remains the risk that the projects will encounter problems in the future that result in them exceeding their baselines.

[16]The baseline change proposal for the WTP only included estimates for completing the Direct- Feed Low-Activity Waste Treatment portion of the project's scope.

Utility Shaft—will not be completed within their baselines, and baseline change proposals are under review for both projects.

Observation 2: *EM did not have sufficient staffing capacity to properly manage three capital asset projects, two of which are expected to overrun their cost and schedule baselines.*

Three capital asset projects—two at WIPP and one at the Oak Ridge Reservation—experienced issues during either their design or construction phases that were, in part, due to the capacity of federal and contractor staff, according to EM officials. We have previously reported that the Carlsbad Field Office, which oversees WIPP, had experienced staffing shortages for multiple years, and an EM document cited this problem as a factor contributing to problems with the SSCVS project.[17] Specifically, the original subcontractor working on the SSCVS project submitted a large number of changes to the design of the facility, which a review from the U.S. Army Corps of Engineers determined were unnecessary and resulted in increased project costs. However, according to U.S. Army Corps of Engineers and DOE documents, the Carlsbad Field Office and the WIPP Management and Operating contractor did not have sufficient staff with the necessary expertise to identify this problem until after it had occurred. As a result, the SSCVS project is expected to overrun its cost and schedule baselines. In our 2021 report, we recommended that EM identify and fully analyze what additional flexibilities could be used to address the staffing vacancies at this office. As of January 2022, EM officials stated that they had made some progress addressing vacancies at the Carlsbad Field Office and that they expected the work on this recommendation to be completed by May 2022.

Regarding the Utility Shaft project at WIPP, we previously reported that the project experienced problems during its planning phase with analyzing the alternatives for the project.[18] We recommended that DOE include a cost-benefit analysis in its analysis of alternatives, as is consistent with best practices. DOE concurred with our recommendation. DOE officials told us that they identified several key technical flaws in the

[17]GAO, *Nuclear Waste Disposal: Better Planning Needs to Avoid Potential Disruptions at Waste Isolation Pilot Plant,* GAO-21-48 (Washington, D.C.: Nov. 19, 2020).

[18]GAO, *Nuclear Waste: Waste Isolation Pilot Plant Recovery Demonstrates Cost and Schedule Requirements Needed for DOE Operations,* GAO-16-608 (Washington, D.C.: Aug. 4, 2016).

original analysis. According to EM site officials we interviewed in 2019, the flaws in the original analysis were caused, in part, by the limited number of staff with sufficient expertise at the Carlsbad Field Office to assist with the design work for the project. Further, the priority for staff at the Carlsbad Field Office at the time was the project to resume waste disposal operations at WIPP. The Utility Shaft project is expected to overrun its cost and schedule baselines, although the delays that resulted in the cost and schedule increases were caused by COVID-19 issues, according to EM officials.

Lastly, the Outfall 200 Mercury Treatment Facility project at the Oak Ridge Reservation encountered bedrock and soils problems during construction of the foundations of the project's two main buildings. EM officials said that the project staff did not have the necessary technical expertise to address these problems, so the U.S. Army Corps of Engineers and other outside contractors were brought on to provide EM and the site Management and Operating Contractor with the necessary technical expertise. While the project experienced delays, EM officials said that the project did not expect cost overruns because the construction contractor was performing its work under a firm fixed-price contract, so costs incurred due to changes to the scope of work were primarily borne by the contractor.

Observation 3: *EM has not completed updates to life-cycle estimates for operations activities, and prior data have limitations, which impacts EM's ability to accurately measure operations activities' performance.*

The initial source of the cost and schedule data we collected on the 11 selected operations activities was the life-cycle estimates developed prior to the 2020 Protocol. The EM sites had not yet completed new estimates using the process established in the new Protocol.[19] Several of the estimates we collected had not been updated in several years, though there have been significant changes to the conditions at certain sites. For example, the estimate for the operations activity at WIPP has not been updated since 2013 and EM officials stated that the estimate does not take into account how operations at the site have changed following a radiological release in 2014. According to EM officials, this is because

[19]According to officials at the Savanah River Site, the December 2020 update to the cost and schedule estimates for the operations activity we selected was not developed following the requirements of the new Protocol as it was developed during the period before the Protocol was approved.

prior requirements for operations activities, such as the 2017 Cleanup Policy, did not require regular updates for life-cycle estimates for each operations activity. EM officials also told us that these estimates also relied on estimating work performed by the site contractors and had not been independently reviewed or verified, as is recommended under GAO's cost estimating best practices.[20]

EM's Protocol requires sites to update their life-cycle estimates for operations activities annually as part of a broader process for maintaining the overall life-cycle cost and schedule estimates for completing cleanup at each site. Specifically, the Protocol requires that operations activities' estimates and site life-cycle estimates are to be a federal product maintained independently from estimates developed by the contractors performing the work. These estimates are also expected to be reviewed by an independent team comprised of EM officials and consultants to ensure that they were developed following cost and schedule estimating best practices.

Officials at 10 of the 11 sites in our review told us that they were in the process of updating their cost and schedule estimates for their operations activities, per the Protocol. According to EM officials at Moab, the one site that is not updating its estimates, it was unnecessary to update the estimates for Moab because the existing estimates that were developed by the current contractor are considered by EM to be of sufficient detail in order to manage the remaining work, which is expected to be completed in about 2029.

In 2019, we reported that the tools EM uses to measure contractors' performance on operations activities do not provide a clear picture of performance for EM leadership, Congress, and other stakeholders.[21] EM's ability to have the information EM needs to assess the performance of cleanup work managed as operations activities will depend, in part, on whether updates to the cost and schedule estimates for all operations activities are completed in accordance with EM's Protocol.

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

[21]GAO-19-223.

Observation 4: *EM officials at multiple sites identified examples of ways in which current and future EM cleanup funding could affect cleanup costs.*

EM officials we interviewed regarding capital asset projects and operations activities identified scenarios in which funding increases or shortfalls could have significant impacts on the costs for completing cleanup work. Examples of such scenarios included:

- At Hanford, EM officials stated that annual appropriations are not sufficient to meet certain legal requirements for high-level waste treatment currently set forth in the Amended Consent Decree. Various analyses, including an assessment performed by the U.S. Army Corp of Engineers in 2018, indicate that achieving certain Amended Consent Decree milestones for the high-level waste and pretreatment facilities are improbable, according to EM officials, given the imbalance of reasonably anticipated congressional appropriations and the current anticipated funding requirements to complete the Waste Treatment and Immobilization Plant (WTP) project. EM officials also said that the Hanford Lifecycle Scope, Schedule and Cost Report forecasts a significant increase in life-cycle cost and schedule for completing the cleanup of the entire Hanford Site, including the activities necessary to support the tank waste treatment mission and the activities associated with the WTP. To determine the best path forward, EM is conducting an analysis of potential alternatives for high-level waste treatment. According to EM officials, annual funding levels are a key variable in identifying potential alternatives, as they could affect the schedule for completing cleanup and the risks to human health and environment.
- EM officials at the Portsmouth Site stated that one of their goals is to achieve cost savings through the timely transition of experienced contractors from one decontamination or demolition project to the next. However, according to these officials, funding to support these transitions is not always available when work on one project is completed. As a result, some of the experienced workforce has to be demobilized and is potentially lost to other work. In this case, EM will likely incur additional costs to transition a contractor to other projects once funds become available. Additionally, EM officials at the Paducah Site stated that the life-cycle estimate for cleanup at their site assumes that funding for the Portsmouth cleanup will be redirected to the Paducah Site once cleanup activities at the Portsmouth Site near completion in the 2030s. This shift in funding is expected to increase the pace of cleanup efforts at the Paducah Site.

- According to EM officials at the Oak Ridge Reservation and the Idaho National Laboratory, the operations activities with the highest estimated life-cycle cost involve surveillance and maintenance activities and support cleanup activities at their respective sites. EM officials at both sites stated that the life-cycle cost and schedule estimates for site operations activities are directly dependent on the schedule for completing the cleanup activities they are supporting. For example, if additional funding were prioritized for completing deactivation and decommissioning of excess facilities at the Oak Ridge Reservation, the cost for that work would likely decrease, as the schedule could be accelerated. This would also likely reduce the life-cycle cost for the operations activity with the highest estimated cost because EM would likely shorten the period it had to maintain surveillance and maintenance activities, according to EM officials.
- In 2019, we reported on the growth in the environmental liability managed by EM and recommended that DOE direct EM to develop a program-wide strategy that outlines how EM will direct available resources to address human health and environmental risks within and across sites.[22] As of February 2022, EM had not developed a program-wide strategy. The examples we cited above reflect ways in which a program-wide strategy could help evaluate various funding priorities that have the potential to reduce the department's environmental liability.

Observation 5: *The extent of cost increases for EM capital asset projects and operations activities due to COVID-19 are not fully known.*

According to EM officials at multiple sites, contractors have tracked the costs incurred from implementing safety measures to address COVID-19, and EM had reimbursed contractors for some of these costs. As authorized by a provision of the 2020 CARES Act, DOE established a program in which contractors could be paid for the time that their employees could not perform their duties as a result of COVID-19 precautions.[23] EM officials at several sites we interviewed told us that EM incurred other costs as a result of COVID-19, such as costs from new sanitization programs, installing new workspaces for social distancing,

[22]GAO, *Department of Energy: Program-Wide Strategy and Better Reporting Needed to Address Growing Environmental Cleanup Liability,* GAO-19-28 (Washington, D.C.: Jan. 29, 2019).

[23]We reported in 2021 that the potential costs DOE accrued from January 31, 2020, through March 31, 2021, for this program were $760.7 million. See GAO*, COVID-19 Contracting: Contractor Paid Leave Reimbursements Could Provide Lessons Learned for Future Emergency Responses,* GAO-21-475 (Washington, D.C.: July 28, 2021).

and higher commodity prices, and that the full extent of these other costs is not yet known. For example, EM officials at WIPP and the Oak Ridge Reservation stated that the total costs will not be known until negotiations regarding contract modifications related to steps taken in response to COVID-19 are complete.

Agency Comments

We provided a draft of this report to DOE for comment. DOE provided us with technical comments that we incorporated as appropriate.

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 V.

Nathan Anderson,
Director, Natural Resources and Environment

List of Addressees

The Honorable Jack Reed
Chairman
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The Honorable Angus King
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United States Senate

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The Honorable John Kennedy
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Subcommittee on Energy and Water Development
Committee on Appropriations
United States Senate

The Honorable Marcy Kaptur
Chairwoman
Subcommittee on Energy and Water Development, and Related Agencies
Committee on Appropriations
House of Representatives

Appendix I: Objectives, Scope, and Methodology

Our report (1) describes the Department of Energy (DOE) Office of Environmental Management's (EM) largest capital asset projects, (2) describes EM's largest operations activities at selected sites, and (3) provides summary observations across the largest projects.

To select the largest capital asset projects, we identified those projects that had at least chosen an approach for meeting the project's mission need critical decision (CD-1) and had an estimated total project cost of at least $100 million. DOE's Order 413.3B requires projects of $100 million total estimated cost or higher to take additional oversight steps, including the development of an independent cost estimate to validate the project's cost and schedule baselines prior to the approval of CD-2. We determined that projects at or above the $100 million estimated total project cost threshold would be included in our scope because this would include all projects subject to the additional oversight mechanisms outlined in Order 413.3B. Using these criteria, we determined that there were 15 capital asset projects that had reached CD-1 and have a total project cost of at least $100 million. Furthermore, we excluded any projects that have achieved CD-4 project completion.[24] We made these selections using data from DOE's Project Assessment and Reporting System (PARS).

To select operations activities, we identified the largest operations activities by life-cycle cost estimate at each cleanup site that had a total cost estimate of at least $1 billion. We chose the $1 billion threshold in order to focus on operations activities that would cover activities with the highest dollar value. This approach also allowed us to review a diversity of operations types at a range of geographic locations. EM identified 76 ongoing operations activities at its 16 sites, and 11 of the 16 sites had an operations activity with a life-cycle cost estimate of at least $1 billion. In total, these 11 operations activities represent $158.5 billion (55 percent) of the $289.8 billion in estimated total life-cycle costs for all EM operations activities. We made these selections using data from DOE's Integrated Planning, Accounting, and Budgeting System (IPABS).

To assess the cost and schedule performance of capital assets projects, we collected relevant information from PARS and analyzed monthly project status reports and project summary data obtained from PARS. We then developed a data collection instrument to compile cost and schedule

[24]The Saltstone Disposal Unit 7 project at the Savannah River Site is included within our scope, as it reached CD-4 in July 2021, while our engagement was still ongoing.

information for each project, identify whether it matched the data in PARS, and gathered information on risks to completing the project within its baselines from project risk registers. These risk registers include information on the type of risks or opportunities, their probability, and the potential magnitude of the consequences if it were to be realized. We provided these tools to the Federal Project Director for each of the 15 capital asset projects for corroboration of the data we had gathered and to understand any reasons for discrepancies on cost, schedule, or scope information between data sources. We also interviewed the Federal Project Directors for each of the capital asset projects to understand any reasons for discrepancies between data sources and to gather information on recent project activities, impacts from COVID-19, and other information. We also reviewed project documentation, including project execution plans, and baseline change proposal documents detailing any changes to project cost, scope, and schedule and the reasons for these changes. In addition, we reviewed assessments on the status of the projects from EM officials outside of the integrated project team, such as independent cost reviews, independent cost estimates, peer reviews, external independent reviews, and any related corrective action plans. Finally, we corroborated the project summary information by providing each project summary to EM to provide us with corrections and updates to the data, as appropriate. After performing this step, we determined that the data we had gathered on the 15 capital asset projects were sufficiently reliable for the purpose of making our project selections and describing their status and performance.

To assess cost and schedule performance for operations activities, we reviewed information from IPABS that pertained to life-cycle cost estimates for all 11 selected operations activities. We then developed a data collection instrument to compile cost and schedule information for each operations activity to determine whether it matched the data in IPABS and gathered information on project risks. We provided these tools to officials at each of the 11 sites for the selected operations activity for corroboration of the data we had gathered and to understand any reasons for discrepancies, such as different life-cycle cost and schedule estimates, between data sources. We also interviewed EM site officials identified as most knowledgeable for each of the operations activities to gather more information on the status of the projects and to understand any reasons for discrepancies in cost, schedule, or scope information between data sources. In the cases where the information we gathered on the life-cycle estimates for operations activities indicated that they had not been updated in the last several years, we interviewed EM headquarters and site officials to determine why they had not been

updated and to obtain the most recently updated estimates. Our work also included a review of relevant documentation, including risk analysis documents and documents detailing the full scope of the operations activity until the end of the operations' life-cycle. Finally, we corroborated the summary information by providing each operations activity summary to EM to provide us with corrections and updates to the data, as appropriate. After performing this validation step, we determined that the data were sufficiently reliable for the purpose of selecting which operations activities to review and describing the status and performance of the 11 operations activities we selected

To develop summary observations across the performance of the 15 capital asset projects and 11 operations activities, we analyzed project and operations information we gathered on performance, issues, and risks. Next, we determined whether the capital asset projects were expected to be completed within their baselines by examining whether the project had undergone or was undergoing DOE's baseline change process. We then reviewed DOE's assessment of project performance and compared that to information on project issues and risks gathered from interviews with project officials. For those projects not expected to be completed within their baselines or that had experienced performance issues, we identified whether there were common contributing factors to those issues, such as insufficient staffing capacity, problems with the project's design, or other factors. In our review of life-cycle cost and schedule information on operations activities and interviews with site officials, we identified a common issue that was consistent with prior report findings on how these estimates were developed. We also identified in our interviews, with site officials for both capital asset projects and operations activities, that officials responded with specific examples of ways in which changes in funding would affect the estimated costs for future cleanup work. Finally, we compared responses regarding COVID-19 impacts to projects and operations and found that multiple sites that several sites stated that their costs would be dependent on future negotiations with contractors and, therefore, all costs were not yet known.

We conducted this performance audit from December 2020 to April 2022 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.

Appendix II: Office of Environmental Management (EM) Nuclear Waste Cleanup Sites: Background Information

The Department of Energy's (DOE) Office of Environmental Management (EM) is responsible for addressing hazardous and radioactive waste at sites that have been contaminated from decades of nuclear weapons production and nuclear energy research. This section contains information on the legal framework governing the cleanup of these sites and background information on each of the 16 active EM cleanup sites.[25]

Legal Framework Governing Cleanup at EM Sites

Various federal laws, agreements, compliance orders, consent orders, and consent decrees govern cleanup projects at EM sites. The relevant federal laws include, but are not limited to, the following:

- The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, authorizes the federal government to respond to releases or threatened releases of hazardous substances. Under CERCLA, the Environmental Protection Agency (EPA) has certain oversight authorities for cleaning up releases of hazardous substances on federal properties. DOE often enters into federal facility agreements with EPA regarding the cleanup of hazardous substances at DOE sites.[26]
- The Resource Conservation and Recovery Act of 1976 (RCRA), as amended, governs the treatment, storage, and disposal of hazardous waste and the nonradioactive hazardous waste component of mixed waste.[27] Under RCRA, EPA may authorize states to administer their own hazardous waste regulatory program in lieu of the federal program, so long as the state program is at least as stringent as the federal program. The act requires owners or operators—including federal agencies—of facilities that treat, store, or dispose of

[25]EM divides the Hanford site into two distinct offices: The Office of River Protection and Richland Operations Office. For the purposes of this report, we also considered the Hanford site as two separate sites to arrive at a total of 16 EM sites where cleanup work was ongoing.

[26]For DOE sites listed on the National Priorities List—EPA's list of the most seriously contaminated sites—section 120 of CERCLA requires DOE to enter into an agreement with EPA regarding the necessary cleanup actions at sites. 42 U.S.C. § 9620(e)(2). Tri-Party Agreements (TPA) between DOE, EPA, and the relevant state integrate DOE's CERCLA response action obligations at a site with its Resource Conservation and Recovery Act corrective action obligations

[27]The 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, as amended. Under RCRA or authorized state hazardous waste programs, neither EPA nor a state has authority over the radioactive waste component of mixed waste; that authority is reserved for DOE.

hazardous waste to obtain a permit for such activities from EPA or a state authorized to implement a hazardous waste program. Under RCRA's corrective action provisions, DOE must clean up contamination caused by hazardous waste at its sites by implementing remedial measures that protect human health and the environment. When states are authorized to implement a hazardous waste program, they can issue compliance orders to DOE regarding hazardous waste cleanup at DOE sites.[28] Tri-party agreements (TPA) between DOE, EPA, and the relevant state integrate DOE's CERCLA response action obligations at a site with its RCRA corrective action obligations.

Brookhaven National Laboratory

Brookhaven National Laboratory was established in 1947 on the eastern end of Long Island, New York, at the former site of the U.S. Army's Camp Upton to explore the peaceful applications of atomic energy. Over its history, Brookhaven has housed three research reactors, numerous one-of-a-kind particle accelerators, and other cutting-edge research facilities.

Cleanup of legacy contamination at Brookhaven is governed in large part by a 1992 federal facility agreement among DOE, EPA, and the New York State Department of Environmental Conservation. The agreement establishes a framework and schedule for developing, implementing, and monitoring response actions at the site in accordance with CERCLA and RCRA.

Response activities at Brookhaven include remediation of groundwater contamination on and off federally owned property, excavation and disposal of contaminated soils and river sediments, removal of above- and below-ground storage tanks, capping of landfills, decommissioning activities, and long-term surveillance and maintenance at the former Brookhaven Graphite Research Reactor and High Flux Beam Reactor. EM is also in the procurement process to perform demolition, decommissioning, and site clearance of the High Flux Beam Reactor and related buildings at Brookhaven.

Energy Technology Engineering Center

The Energy Technology Engineering Center occupies 90 acres within the 290 acre Santa Susana Field Laboratory 30 miles north of Los Angeles, California. The area was primarily used for DOE research and development activities. In the mid-1950s, part of the area was set aside

[28]Authorized states can issue compliance orders to DOE for violations of the state RCRA law, regulations, or permits at a DOE site that are not addressed in a TPA or a settlement agreement for the site.

for nuclear reactor development and testing, primarily related to the development of nuclear power plants and space power systems, using sodium and potassium as coolants. In the mid-1960s, the Energy Technology Engineering Center was established as a DOE laboratory for the development of liquid metal heat transfer systems to support the Office of Nuclear Energy Liquid Metal Fast Breeder Reactor program. DOE is now involved in the deactivation, decommissioning, and dismantlement of contaminated facilities on the site.

Hanford Site

The Hanford Site was established in Washington State during World War II to produce plutonium for the nation's nuclear weapons. From 1944 through 1988, plutonium production at Hanford generated about 525 million gallons of radioactive and hazardous waste. Some of the waste was dumped directly into the soil, some was encased in drums or other containers and buried, and about 54 million gallons were stored on-site in 177 underground tanks.

Cleanup of the Hanford Site is governed by two main agreements. First, the Hanford Federal Facility Agreement and Consent Order of 1989, as amended—or Tri-Party Agreement—is an agreement among DOE, EPA, and the State of Washington Department of Ecology, which lays out legally enforceable milestones for completing major cleanup activities at Hanford, among other things. Second, a 2010 Consent Decree, as amended, was established as a result of litigation brought against DOE by the State of Washington Department of Ecology for missing certain clean-up milestones in the TPA that, among other things, sets milestones for specific cleanup activities. The Office of River Protection manages the cleanup of the Hanford Site associated with the Tank Farms and the Waste Treatment and Immobilization Plant. The Richland Operations Office manages the remaining work at the site, including cleanup, infrastructure, and services. The Office of River Protection and the Richland Operations Office work together to facilitate mutual mission success at Hanford.

EM currently plans to treat much of Hanford's tank waste in the Waste Treatment and Immobilization Plant, which consists of facilities that are designed to separate high-level and low-level waste so they can treated. The Waste Treatment and Immobilization Plant is the largest, most technically complex construction project within EM. It has been under construction for over 20 years, cost over $11 billion to date, and has faced numerous technical challenges, cost overruns, and schedule delays.

Idaho National Laboratory

The Idaho National Laboratory site, an 890-square-mile DOE site located in eastern Idaho, was established in 1949 as the National Reactor Testing Station. Initially, the lab's missions included development of civilian and defense nuclear reactor technologies and management of spent nuclear fuel. Fifty-two reactors were built at the site, including the Navy's first prototype nuclear propulsion plant. Of the 52 reactors, three remained in operation as of February 2020.

Cleanup work at Idaho National Lab is governed in part by a series of agreements and consent orders, including the 1991 Federal Facility Agreement and Consent Order, which establishes a framework and schedule for response actions in accordance with CERCLA, RCRA, and state law. In addition, a 1995 settlement agreement, as amended, sets out further cleanup requirements at the site for DOE.

The Idaho Cleanup Project was created to help accelerate cleanup of the environment at the Idaho National Laboratory Site. The Idaho Cleanup Project is addressing contamination from wastes generated from World War II-era conventional weapons testing, government-owned research and defense reactors, spent nuclear fuel reprocessing, laboratory research, and defense missions. The project is focused on safely remediating the Idaho site, including dispositioning transuranic waste, managing spent nuclear fuel, and treating high-level waste to protect the underlying aquifer and comply with federal and state agreements.

Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory is a multidisciplinary research and development center focusing on weapons development, stewardship, and homeland security that was founded in 1952 in Livermore, California.

Cleanup at Lawrence Livermore National Lab is proceeding in part under two federal facility agreements among DOE, EPA, and several California state agencies. The two agreements address the Livermore site and Site 300, respectively, and set forth a site cleanup framework and schedule pursuant to CERCLA, RCRA, and applicable state law.

Soil and groundwater contamination was discovered at two sites at the lab—the Livermore site and Site 300—in the 1980s. This contamination resulted from early research activities. In the case of the Livermore site, a portion of the soil and groundwater contamination also has been attributed to solvents and degreasers that were used to clean airplane engines while the site served as a U.S. Naval Air Station in the early 1940s.

Los Alamos National Laboratory

Work at Los Alamos National Laboratory began in 1943 as part of the Manhattan Project, with the mission of conducting nuclear weapons research and development. Efforts at Los Alamos resulted in the release of radioactive and hazardous materials. In particular, from 1956 to 1972, Los Alamos flushed water that contained chromium (a corrosion inhibitor) from cooling towers into Sandia Canyon and underlying aquifers. As a result, a plume of chromium built up in the aquifer that poses a health hazard to nearby Los Alamos County groundwater supplies.

According to DOE, the principal regulatory driver for legacy cleanup activities at Los Alamos is the 2016 Compliance Order on Consent, as amended, between DOE and the New Mexico Environment Department, which sets requirements and milestones for cleanup activities, pursuant to RCRA and state law.

Cleanup areas at Los Alamos include former Los Alamos facilities, hillsides, canyon bottoms, and old landfills. Legacy cleanup activities include monitoring and remediating surface and groundwater, removing contaminated soil, and decontaminating and decommissioning surplus process-contaminated facilities. As of May 2021, more than half of the 2,100 contaminated sites originally identified have been investigated and remediated. To dispose of radioactive waste, Los Alamos ships most low-level and mixed low-level waste to off-site commercial disposal facilities and sends transuranic waste to the Waste Isolation Pilot Plant located in Carlsbad, New Mexico, for disposal.

Moab

DOE's site at Moab, Utah, is a former commercial mill constructed in 1956 to produce yellowcake, a uranium concentrate that was sold to the U.S. Atomic Energy Commission through December 1970 for use in national defense programs. After 1970, mill production was primarily for commercial sales to nuclear power plants, until processing operations were ceased in 1984. Moab milling operations created process-related wastes and mill tailings.[29] While a majority of the uranium was removed during processing, radium and other decay products remained in the mill tailings. These tailings were placed at a storage impoundment on the property, accumulating into a pile that is over 80 feet thick. Due to a lack of lining at the storage site, coupled with the already high water content

[29]Under the *Uranium Mill Tailings Radiation Control Act of 1978*, "tailings" are the remaining portion of a metal- bearing ore after some or all of such metal—such as uranium—has been extracted. 42 U.S.C. § 7911(8).

present in the tailings, excess water in the pile drained into underlying soils and contaminated groundwater.

Title I of the Uranium Mill Tailings Radiation Control Act of 1978 required DOE to remediate certain uranium ore processing sites across the country but not the Moab site. In 2000, the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001 was enacted, which gave DOE responsibility for remediating the Moab site generally in accordance with title I of the 1978 act. DOE assumed ownership of the Moab site on October 25, 2001.

The major cleanup actions ongoing at Moab today fall under two broad categories. The first is the relocation, primarily by rail, of approximately 16 million tons of uranium mill tailings and other residual radioactive material from the Moab site to the permanent disposal site. The second is the remediation of contaminated groundwater through both contaminated groundwater extraction and injection of freshwater to form a hydraulic barrier.

Nevada National Security Site

In 1950, President Truman established what is now known as the Nevada National Security Site (NNSS) to perform nuclear weapons testing activities. In support of national defense initiatives, atmospheric and underground nuclear weapons tests, totaling 928, were conducted at the NNSS between 1951 and 1992, when a moratorium on nuclear testing went into effect. Today, the NNSS is a large, geographically diverse research, evaluation, and development complex that supports homeland security, national defense, and nuclear nonproliferation.

EM activities at the Nevada site include

- disposal of low-level, mixed low-level, and classified waste in support of DOE cleanup and activities at federal sites across the U.S.;
- groundwater corrective actions,[30] including identifying contaminant boundaries, restricting access to contamination, and implementing a comprehensive monitoring program, with sampling locations on and off the site; and

[30]The 1996 Federal Facility Agreement and Consent Order defines corrective actions are actions or series of actions taken to correct deficiencies in the disposal or containment of pollutants, hazardous wastes, and solid wastes to prevent releases and/or potential releases into the environment or discharges and/or potential discharges of such materials into waters of the state in accordance with the approved corrective action plan.

- environmental corrective actions, to include ongoing demolition and disposal work, at historically contaminated, industrial-type facilities at the NNSS.

In 2020, EM completed the transfer of long-term stewardship responsibilities for 70 closed corrective action sites on and around the historic Tonopah Test Range to the DOE Office of Legacy Management. The transition was a 2020 EM Strategic Vision Mission Priority item and represented the first EM to Legacy Management transfer in more than a decade.

Oak Ridge Reservation

In 1942, the U.S. Army Corps of Engineers began acquiring the 56,000 acres that would make up the Oak Ridge Reservation in Oak Ridge, Tennessee, in service of the Manhattan Project. In 1992, DOE, EPA, and the Tennessee Department of Environment and Conservation entered into a federal facility agreement that established a framework and schedule for cleanup of the site in accordance with CERCLA, RCRA, and applicable state laws. EM began cleanup at Oak Ridge in 1989 prior to the agreement, and decontamination and decommissioning of the uranium enrichment process buildings began later in 1998. In 2003, the Transuranic Waste Processing Facility was constructed to treat certain waste found around the Oak Ridge Reservation.

There are three major cleanup areas at the Oak Ridge Reservation—the East Tennessee Technology Park, Oak Ridge National Laboratory, and the Y-12 National Security Complex. The original K-25 plant, now known as the East Tennessee Technology Park, used gaseous diffusion to produce weapons-grade enriched uranium. In 2020, EM completed removal of all facilities at the site. Ongoing cleanup activities on site include remediation of remaining soil and groundwater contamination. During the Cold War, Y- 12 focused on producing lilithium-6 for nuclear weapons, which created large amounts of mercury that entered the environment. Cleanup activities at Y-12 center on mercury concentrations exceeding regulatory standards, in both contaminated facilities and the surrounding environment. Current cleanup activities at Oak Ridge National Laboratory include demolition of contaminated facilities, processing and disposal of legacy transuranic debris waste and sludge, and remediation of soil and groundwater. EM is nearing completion of the treatment of legacy transuranic debris waste. Once this effort is completed, EM will then focus on treating 500,000 gallons of legacy transuranic sludge.

Paducah

In 1950, the U.S. Atomic Energy Commission selected a former WWII munitions plant near Paducah, Kentucky, to serve as the second of three uranium enrichment plants in the U.S., alongside plants at Portsmouth, Ohio, and Oak Ridge, Tennessee. The Paducah Gaseous Diffusion Plant was originally used to enrich uranium for military reactors and nuclear weapons, though later the site was used to supply enriched uranium for commercial power plants.

Uranium enrichment activities occurred at the site between 1952 and 2013, and it was the last government-owned uranium enrichment facility operating in the U.S. Today, Paducah continues to operate a Depleted Uranium Hexafluoride Conversion Facility, which converts depleted uranium hexafluoride into a more stable chemical form suitable for reuse or disposition.

More than 60 years of uranium enrichment and support activities at Paducah generated hazardous and radioactive waste and resulted in soil, groundwater, and surface water contamination. In 1998, DOE; EPA; and the Commonwealth of Kentucky, Department for Environmental Protection, entered into a federal facilities agreement to govern cleanup at the site. That agreement, as amended, established the framework for cleanup at Paducah and instituted enforceable milestones for achieving comprehensive site remediation in accordance with CERCLA, RCRA, and state law. The overall cleanup strategy at Paducah is focusing on near-term actions to eliminate or control ongoing sources of contamination, while continuing to investigate other potential sources and develop a long-term cleanup plan.

As we reported in 2019, deactivation of the uranium processing buildings began in 2014.[31] In January 2019, EM reached a milestone—deactivation of the C-400 building. EM is now focusing its cleanup efforts on decontamination and decommissioning of the C-400 building and remediation. In addition to efforts at the process buildings, EM will also need to conduct decontamination and decommissioning on hundreds of other buildings and facilities. EM has yet to decide on whether the waste produced from the cleanup will be shipped offsite or if it will construct an on-site waste facility. EM estimates the cleanup of Paducah will be completed between fiscal years 2065 and 2070. Once cleanup at

[31]GAO, *Nuclear Cleanup: Actions Needed to Improve Cleanup Efforts at DOE's Three Former Gaseous Diffusion Plants,* GAO-20-63 (Washington, D.C.: December 2019).

Paducah is complete, DOE anticipates that the most likely future use scenario is a combination of industrial and recreational use.

Portsmouth

Construction of the Portsmouth Gaseous Diffusion Plant in Ohio was completed in 1956. The mission of the site was to produce enriched uranium used to bolster the nuclear weapons program and the U.S. Navy during the Cold War. Gaseous Diffusion Plant operations generated hazardous and radioactive wastes. DOE established the Portsmouth cleanup program in 1989 to identify, control, and remediate environmental contamination at the site.

Cleanup at Portsmouth, which is overseen by the Ohio Environmental Protection Agency, is proceeding according to several agreements, including (1) a 1989 consent decree between DOE and the state, which guides the cleanup process, pursuant to RCRA and state hazardous waste law; and (2) the Ohio Environmental Protection Agency's 2010 Director's Final Findings and Orders for Removal Action and Remedial Investigation and Feasibility Study and Remedial Design and Remedial Action, as amended.[32] These Findings and Orders address the cleanup of certain structures and buildings and site-wide waste disposition under CERCLA processes. Broadly, cleanup activities at the site include the decontamination and decommissioning of inactive contaminated facilities; remediation of groundwater, soil, and burial grounds; and continued environmental monitoring.

Near-term decontamination and decommissioning activities at Portsmouth concern three uranium enrichment-processing buildings. In addition, EM must conduct decontamination and decommissioning on hundreds of other support buildings and facilities. Waste and debris from these decontamination and decommissioning activities that meet the approved acceptance criteria will be disposed of in an On-Site Waste Disposal Facility. Ongoing soil and groundwater cleanup activities at the site include the monitoring and remediation of five groundwater plumes.

Sandia National Laboratory

The Sandia National Laboratory is comprised of 2,820 acres within the boundaries of the Kirtland Air Force Base in New Mexico. Sandia was established in 1945 for nuclear weapons development, testing, and assembly for the Manhattan Project. This mission continued until, beginning in 1980, the mission shifted toward research and development

[32]According to EPA officials, EPA is not involved in regulating the CERCLA or RCRA components of cleanup at Portsmouth.

for nonnuclear components of nuclear weapons. Subsequently, the mission was expanded to research on and development of nuclear safeguards and security, and multiple areas in science and technology.

Historical operations generated hazardous, radioactive, and mixed waste that requires remediation. In 2004, DOE, the New Mexico Environment Department, and others signed the Compliance Order on Consent, which outlines requirements and milestones for site cleanup work, pursuant to state hazardous waste law. As of July 2018, corrective actions were complete at 308 of 314 cleanup sites at Sandia. Of the six remaining sites, three have contaminated groundwater that is being addressed, and the other three are deferred from cleanup activities, due to being located on an active site at Sandia.

Savannah River Site

The Savannah River Site in South Carolina was constructed during the early 1950s to produce the basic materials for nuclear weapons. Five reactors were built to produce these materials, as well as a number of support facilities, including two chemical separations plants, a heavy water extraction plant, a nuclear fuel and target fabrication facility, a tritium extraction facility, and waste management facilities. Irradiated materials were moved from the reactors to one of the two chemical separations plants. In these facilities, known as “canyons,” the irradiated fuel and target assemblies were chemically processed to separate useful products from waste. After refinement, nuclear materials were shipped to other DOE sites for final application. The site produced about 36 metric tons of plutonium from 1953 to 1988.

Nuclear material production at Savannah River produced unusable by-products, such as liquid radioactive waste, which was stored on site in million-gallon tanks. Savannah River has closed seven such tanks. The 43 remaining high-level waste tanks at Savannah River contain approximately 35 million gallons of waste and are in various stages of the waste removal, cleaning, and closure process.

Under RCRA, EPA has authorized the state of South Carolina to administer its own hazardous waste regulatory program. The state of South Carolina elected to manage DOE’s tanks at the Savannah River Site as wastewater treatment units under the Clean Water Act, an option that RCRA regulations authorize under certain conditions. Cleanup at the Savannah River Site is carried out under industrial wastewater permits issued by the state of South Carolina; a Site Treatment Plan approved by

the state of South Carolina; the Consent Order for the treatment and disposal of mixed waste; and the amended 1993 federal facility agreement among DOE, EPA, and the state of South Carolina.[33]

Since approximately 2003, extensive cleanup and closure work has been completed at Savannah River under a concept known as Area Completion, which streamlines and accelerates the cleanup process. Area Completion focuses on cleaning up contamination in the environment by treating or immobilizing the source of the contamination to mitigate transport through soil and groundwater and to clean up or slow the movement of contamination that has already migrated from the source.

West Valley

West Valley was established as a commercial facility in New York State for spent nuclear fuel reprocessing in response to an initiative of the U.S. Atomic Energy Commission—a predecessor federal agency to DOE and the Nuclear Regulatory Commission. The Atomic Energy Commission guaranteed a supply of spent nuclear fuel from government facilities to keep the West Valley facility operating because a sufficient number of commercial nuclear power reactors were not operating to supply spent fuel for reprocessing.

When the West Valley site operator decided to withdraw from the nuclear fuel reprocessing business, a significant amount of radioactive waste remained at the West Valley facility, including

- 600,000 gallons of liquid high-level waste in two underground steel storage tanks—part of a series of four tanks known as the Waste Tank Farm;
- the highly contaminated Main Plant Process Building; and
- more than 2 million cubic feet of solid radioactive waste in the site's two disposal areas—one area principally designed for disposal of wastes from the reprocessing plant known as the Nuclear Regulatory

[33]The federal facility agreement lays out a series of legally enforceable milestones for the comprehensive remediation of the site to ensure that cleanup activities comply with RCRA and CERCLA.

Commission-licensed Disposal Area, and one commercial waste area known as the State-licensed Disposal Area.[34]

The West Valley Demonstration Project Act, enacted in 1980, brought DOE to West Valley to carry our certain cleanup activities.[35] In 1982, DOE took possession of the West Valley Demonstration Project site to carry out those activities. DOE has demolished a majority of the contaminated structures at the project site and has made progress in disposing of low-level waste offsite and processing greater-than-class C like and high-level waste for interim on-site storage.[36]

Waste Isolation Pilot Plant

Located near Carlsbad, New Mexico, WIPP serves as the only deep geologic repository in the U.S. for the disposal of a specific type of defense-related nuclear waste. WIPP is designed to safely dispose of defense-related transuranic waste generated by DOE's nuclear weapons research, production, and cleanup activities at sites across the country. The waste is disposed of in underground rooms mined out of an ancient salt formation more than 2,000 feet below the earth's surface. Since WIPP began to accept waste in 1999, DOE has depended on WIPP's capability to accept transuranic waste shipments.

EPA and the New Mexico Environment Department both play a role in regulating WIPP. Specifically, EPA regulates the radiological safety of WIPP. As required by the Waste Isolation Pilot Plant Land Withdrawal Act, EPA issued final regulations regarding the disposal of transuranic waste that apply to WIPP. The act also requires EPA to certify that WIPP will comply with disposal regulations every 5 years. New Mexico has regulatory authority over WIPP because EPA has authorized the state to

[34]DOE's West Valley Demonstration Project includes the Waste Tank Farm, the Main Plant Process Building, and the Nuclear Regulatory Commission-licensed Disposal Area but does not include the State-licensed Disposal Area.

[35]The Western New York Nuclear Service Center is an approximately 3,300-acre area. The federal portion of the cleanup area, where DOE is conducting the West Valley Demonstration Project, is 160 acres.

[36]NRC identifies four classes of low-level waste in its regulations for disposal purposes on the basis of the concentrations of specific long- and short-lived radionuclides: Class A, B, C, and greater-than-Class C (GTCC). GTCC waste has radionuclide concentrations exceeding the limits for Class C low-level waste, as provided in 10 C.F.R. § 61.55(a)(2)(iii), and requires isolation from the human environment for a longer period of time than do Class A, B, and C wastes, which are disposed of in existing commercial disposal facilities. The NRC's low-level waste classification system does not apply to DOE because DOE is not an NRC licensee. However, DOE often describes West Valley transuranic waste as GTCC or GTCC-like because it has characteristics similar to those of GTCC waste.

administer its own hazardous waste management program under RCRA. Pursuant to this authorization, the state issues the hazardous waste storage and disposal permit for WIPP under state law and regulations. DOE must obtain approval from the state for any modifications to the WIPP permit.

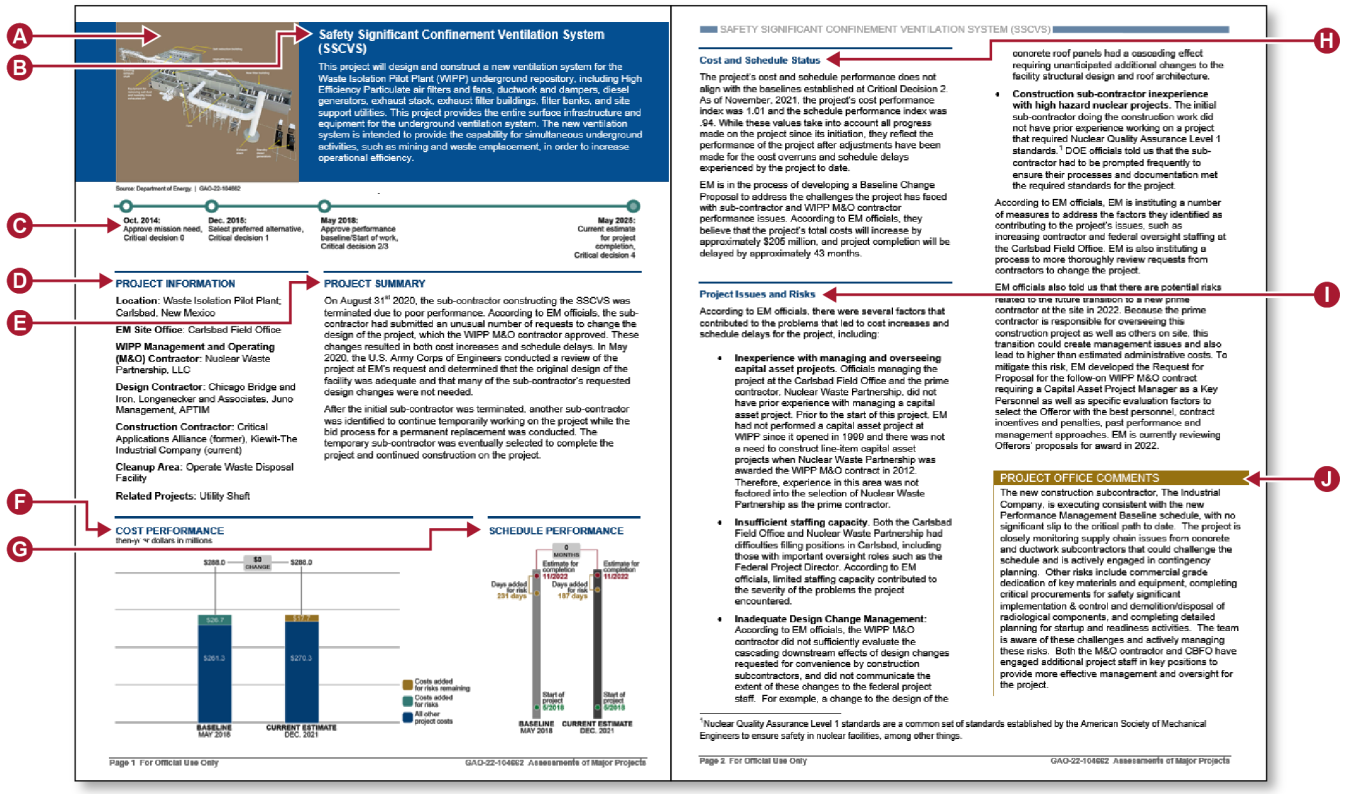
In 2014, two accidents occurred in the underground area at WIPP. First, a salt truck fire created substantial smoke and soot that damaged key equipment and facilities. Second, a transuranic waste container breach, caused by a chemical reaction inside the container between materials that DOE later determined should not have been packaged together, resulted in a release of radiological material that contaminated a portion of the facility. DOE was forced to halt waste disposal operations while it worked to recover from the accidents.

In 2017, DOE resumed waste disposal operations at WIPP on a limited basis, due to persistent airflow and ventilation issues resulting from the 2014 accidents. To provide the capabilities needed to resume full disposal operations at WIPP, DOE has initiated two capital asset projects—the Safety Significant Confinement Ventilation System and the Utility Shaft. Together, these projects will act as one complete ventilation system to facilitate the return to full disposal operations and the planned increase in physical space at WIPP.

Appendix III: Summaries of Selected Office of Environmental Management (EM) Projects and Operations Activities

This appendix provides individual summaries of the 15 capital asset projects and 11 operations activities we selected. The summaries include information on selected issues the projects have faced or currently face, future risks, or future opportunities that could impact their respective cost and schedule estimates. The information in the summaries come from data collection instruments that were filled out by officials at each of the sites. We also conducted subsequent interviews with EM site officials, which highlighted key issues the projects had faced and future risks and opportunities. The summaries for capital asset projects vary slightly from those for operations activities because of differences in available status and performance information. Furthermore, three of the capital asset project summaries include limited information, as they were in the design phase when we reviewed them. Included with the project summaries are figures that explain what content is included in each type of summary.

Figure 2: Description of the Content of the Capital Asset Project Summaries



- **A** A photo of the project.
- **B** A description of the project's scope.
- **C** A time line of critical decision milestones for the project including those that have already occurred and estimates for remaining milestones.
- **D** Information on the location, site office, contractor, and type of work the project is part of.
- **E** A summary of recent activities undertaken, including reaching key milestones and interactions with regulatory bodies.
- **F** A figure showing the baseline cost for the project established at critical decision 2 and the current project cost estimate. The costs added for risks reflect the amount added to the project baseline to account for both contractor and EM controlled risks. All other project costs include costs for performing the work, EM administrative costs, and contractor award fee.
- **G** A figure showing the baseline schedule for the project established at critical decision 2 and the current project schedule estimate. The days added for risks reflect the amount added to the project baseline to account for both contractor and EM-controlled risks.
- **H** A narrative description of whether EM is estimating that the project will be completed within its baseline cost and schedule estimates. Included in this information will be DOE's calculation of the project's cumulative Cost Performance Index (CPI) and Schedule Performance Index (SPI). A CPI below 1.00 indicates cost overruns and above 1.00 indicates lower than estimated costs. Likewise, an SPI below 1.00 indicates schedule delays and above 1.00 indicates performance ahead of schedule. CPI and SPI values are determined by using Earned Value Management data, which assign a cost for each portion of work within the project and are determined by comparing whether the earned value data for the work completed to date match what was estimated in the cost and schedule baseline established at critical decision 2.
- **I** A narrative description of issues the project has faced or currently faces, future risks the project could face, or future opportunities to reduce costs or shorten the schedule for the project.
- **J** Comments from the EM site office and headquarters officials regarding the project.

Source: GAO analysis of Department of Energy projects. | GAO-22-104662

Waste Treatment and Immobilization Plant

The Waste Treatment and Immobilization Plant (WTP) project scope is to design, procure, build, and commission a plant to immobilize an estimated 56 million gallons of hazardous and radioactive waste stored in 177 aging underground tanks at the Department of Energy's (DOE) Hanford Site near Richland, Washington. The waste stored at the Hanford site is the result of decades of reactor operations and plutonium production for nuclear weapons. The WTP includes three primary processing facilities that will treat and separate the waste into low-activity waste (LAW)—DOE's term for the portion of the waste with comparatively low levels of radioactivity—and high-level waste (HLW) and prepare it for final disposition. These three facilities are the pretreatment plant, LAW facility, and the HLW facility.

Source: Department of Energy. | GAO-22-104662

Sept. 1995: Approve mission need, Critical decision 0

Sept. 1996: Select preferred alternative, Critical decision 1

Apr. 2003: Approve performance baseline/Start of work, Critical decision 2/3

Aug. 2023: Current estimate for completion of DFLAW portion of project

PROJECT INFORMATION

Location: Hanford site; Richland, Washington

Environmental Management (EM) Site Office: Hanford Office of River Protection

Site Contractor: Bechtel National, Inc.

Cleanup Area: Radioactive liquid tank waste stabilization and disposition

Related Capital Asset Projects: Tank-Side Cesium Removal

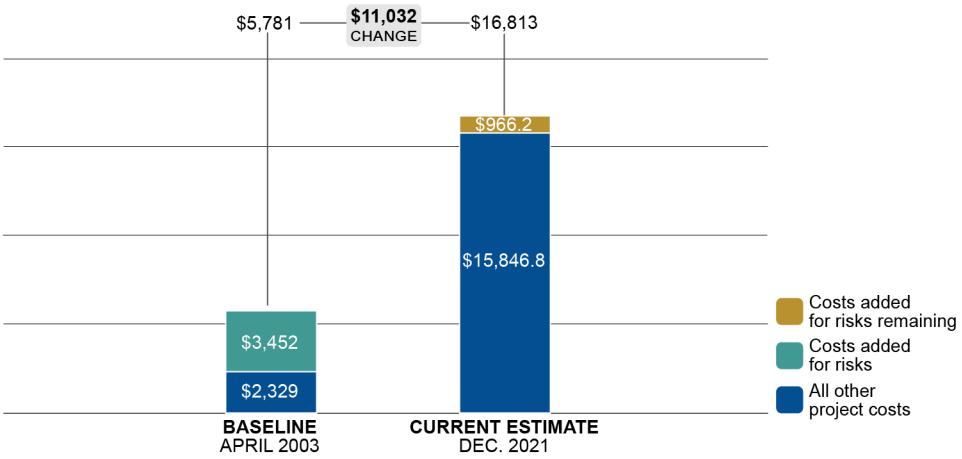
PROJECT SUMMARY

The WTP has been under construction for over 20 years and has faced many challenges, including significant technical challenges with the Pretreatment (PT) facility, such as facility ventilation and explosion prevention during waste treatment. Due to these challenges, DOE stopped design and construction of the PT facility in 2012.

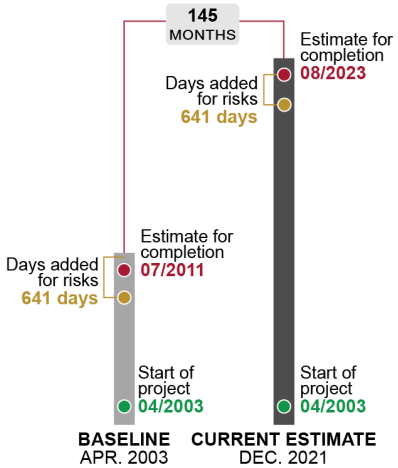
To begin treating LAW by December 2023, as was required by an amended consent decree with the state of Washington,[37] DOE began work on a strategy to bypass the PT facility and instead separate some of the LAW to remove most of the radioactivity from the tank waste so that it can be fed directly to the LAW facility for immobilization. This approach is known as Direct-Feed Low-Activity Waste (DFLAW). In December 2016, the DFLAW concept was formally approved for full implementation. The subsequent completion of the HLW and PT facilities will be at a later date, depending on future DOE priorities and funding.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



[37] *Washington v. Granholm, et al.,* No. 2:08-cv-05085 (E.D. Wash), ECF No. 222. In 2020, the consent decree was again amended due to COVID-19. *Washington v. Granholm, et al.,* No. 2:08-cv-05085 (E.D. Wash), ECF No. 251. Among other things, the amendment extends the December 2023 deadline based on work interruptions due to COVID-19 and remobilization at Hanford.

Cost and Schedule Status

The project's cost and schedule performance does not align with the baselines established at critical decision 2. As of October 2021, the project's cost performance index was 1.01, and the schedule performance index was .98.

The performance on the WTP Project continues to diverge from the approved Performance Baseline (scope, schedule, and cost), primarily due to technical challenges with the PT and HLW scope of the project.

While the scope of DFLAW was determined with the approval of the baseline change proposal (BCP)-02 in 2016, the scope for HLW and PT has yet to be defined. Subsequent BCPs will be required to rebaseline the HLW and PT facilities once DOE completes the analysis of alternatives (AOA) and determines a path forward.

Project Issues, Risks, or Opportunities

The issues the project has faced or currently faces include the following:

- As we reported in 2020, the design and construction of the PT facility have been on hold since 2012.[38] DOE and its contractor considered technical challenges associated with the facility to be conceptually resolved. However, DOE had not yet designed, engineered, or tested solutions to the challenges. Additionally, DOE did not plan to develop these designs until a decision is made on the future of the facility.
- In April 2019, DOE initiated an AOA to assess viable alternatives for HLW treatment at Hanford. As of June 2021, site officials stated that this AOA contains about 17 alternatives. During negotiations between the Washington State Department of Ecology (Ecology) and DOE, Ecology requested that additional alternatives be added to the analysis. Officials stated that, with the addition of Ecology's alternatives, the goal to finish the AOA was moved from September 2021 to mid-2022 and then to submit it through the DOE review and approval process.
- The WTP project team has primarily been focused on work associated with achieving the DFLAW milestone to begin vitrifying LAW in compliance with the December 2023 deadline in the amended consent decree that was extended in December 2020. At the same time, the project team continues to preserve and maintain the PT and HLW facilities, pending the results of the HLW AOA. According to site officials, as of October 2021, only minimal sustainment work is physically ongoing for the PT and HLW facilities, along with some design work for HLW scope.
- The DFLAW baseline was updated in October 2021, incorporating recommendations from the integrated baseline review conducted in April 2021, such as the inclusion of 5 months of schedule risk, which moved the baseline end date from March 2023 to August 2023. The objectives of the DFLAW rebaseline were to: (1) ensure that the Performance Measurement Baseline would represent the current work execution strategy, (2) incorporate the assumed impacts from the partial stop work order for COVID-19 impacts, and (3) incorporate corrective actions resulting from the June 2019 Earned Value Management System surveillance.

PROJECT OFFICE COMMENTS

DFLAW is currently on schedule to achieve the regulatory milestones and the startup of DFLAW, although COVID-19 has caused increased risk. During fiscal year 2021, DFLAW completed all startup testing and the handover of plant systems to plant management to support the transition to commissioning. On October 31, 2021, the first significant commissioning test for loss of offsite power was complete and the project will be performing water runs throughout the plant in December 2021. Startup of a major piece of vitrification equipment, Melter 1, is forecast in early calendar year 2022 with cold commissioning forecast in late summer. For the PT and HLW scope, design reviews are progressing with HLW in parallel with the AOA. Following AOA approval, the necessary contractual changes and baseline updates will be established to implement the approved alternative and to meet regulatory commitments.

[38]GAO, *Hanford Waste Treatment Plant: DOE Is Pursuing Pretreatment Alternatives, but Its Strategy Is Unclear While Costs Continue to Rise*, GAO-20-363 (Washington, D.C.: May 12, 2020).

Tank-Side Cesium Removal System

The Tank-Side Cesium Removal (TSCR) System Demonstration subproject is to design and fabricate cesium removal process enclosures to accommodate three ion exchange columns and construct facilities necessary to provide the initial delivery of radioactive waste to the Waste Treatment and Immobilization Plant (WTP). The overall objective of the TSCR subproject is to demonstrate a potentially low-cost, safe, and efficient near tank treatment technology to remove cesium and other radionuclides from tank waste. The resulting treated tank waste will then be fed to the Low-Activity Waste Vitrification Facility in the WTP for vitrification.

Source: Department of Energy. | GAO-22-104662

Feb. 2020: Approve performance baseline/Start of work, Critical decision 2/3

July 2022: Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Hanford Site; Richland, Washington

Environmental Management Site Office: Office of River Protection

Construction Contractor: Washington River Protection Solutions

Cleanup Area: Radioactive liquid tank waste stabilization and disposition

Related Capital Asset Projects: Waste Treatment and Immobilization Plant

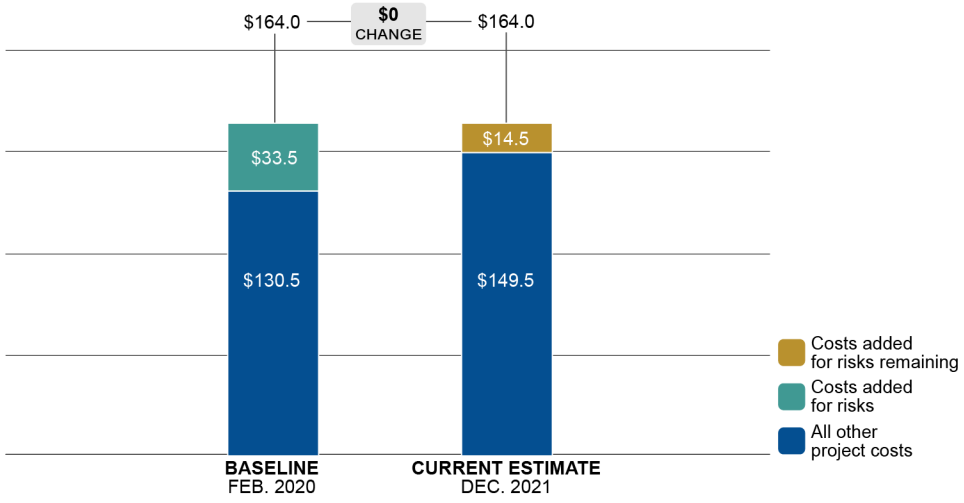
PROJECT SUMMARY

The TSCR Demonstration subproject was created under the Low-Activity Waste Pretreatment System (LAWPS) project. The LAWPS project is intended to connect the Hanford tank farms with the WTP Low-Activity Waste (LAW) facility to supply a direct feed of waste that meets the WTP waste acceptance criteria for the LAW facility. In 2018, Department of Energy's (DOE) Office of River Protection (ORP) approved the TSCR subproject as a new and more rapid strategy for delivering LAW to the WTP.

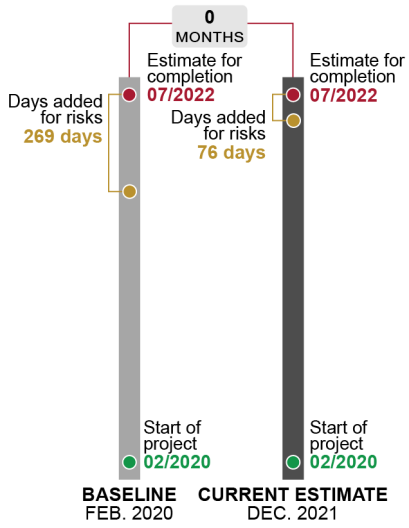
EM spent about $6 million on the TSCR Demonstration Subproject in fiscal year 2018, after work toward a permanent LAWPS capability was put on hold. TSCR is being built next to an underground, double-shelled waste tank and will filter waste directly from the tank to remove solids and cesium. The resulting treated waste will be pumped to a different underground tank for storage until it can be sent to the LAW facility for vitrification. ORP plans to complete this demonstration project in 2022. According to site officials, after sufficient operating data are available, an analysis of alternatives will be conducted to determine the path forward for a permanent LAW pretreatment option.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The project's cost and schedule performance aligns with the baselines established at critical decision 2. As of October 2021, the project's cost performance index was .93 and the schedule performance index was .99.

In October 2020, ORP approved the use of $3.4 million of ORP contingency funding for the TSCR subproject to partially address the impacts that COVID-19 safety measures had on the project. According to site officials, as of May 2021, the TSCR Demonstration project had fully realized the COVID-19 schedule impacts, and the project will not recover the schedule delays incurred due to COVID-19.

Project Issues, Risks, or Opportunities

According to site officials, there are no additional operational risks anticipated. In 2021, TSCR began operation to treat tank waste at Hanford. Site officials said that the holding tanks could serve as a buffer for feeding pretreated waste to the LAW Vitrification facility in the event that TSCR encountered operational issues. According to officials, a full double-shelled waste tank of pretreated LAW feed and operational TSCR would support 5 years of WTP LAW operations.

PROJECT OFFICE COMMENTS

The TSCR system is a new capability on the Hanford Site for treating tank wastes. It demonstrates the DOE's commitment to an affordable, safe, and efficient waste treatment technology to remove cesium from tank waste supernatant, the most mobile component of the tank wastes and the most likely to affect the environment. Delivery of the $164 million facility as part of Hanford's operational capability is a significant achievement and is a significant step forward toward Direct-Feed Low-Activity Waste site-wide operations.

Plutonium Finishing Plant Demolition Project

This project involves the demolition of Hanford's Plutonium Finishing Plant (PFP), the facility that produced nearly two-thirds of the nation's plutonium stockpile. The PFP Demolition Project covers the complete demolition of PFP and ancillary facilities to the ground-level concrete slab to enable transition of the PFP Complex into a safe and stable surveillance and maintenance mode. The scope for this project also involves transporting waste for disposition and disposal, including shipping generated low-level waste and debris to Hanford's Environmental Restoration Disposal Facility and shipping transuranic waste staged at Hanford's Central Waste Complex to the Waste Isolation Pilot Plant in New Mexico.

Source: Department of Energy. | GAO-22-104662

Jan. 2008:
Approve mission need, Critical decision 0

Sept. 2015:
Select preferred alternative, Critical decision 1

Sept. 2015:
Approve performance baseline/Start of work, Critical decision 2/3

Sept. 2021:
Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Hanford site; Richland, Washington

Environmental Management (EM) Site Office: Richland Operations Office

Site Contractor: Central Plateau Cleanup Company

Cleanup Area: Nuclear facilities deactivation and demolition

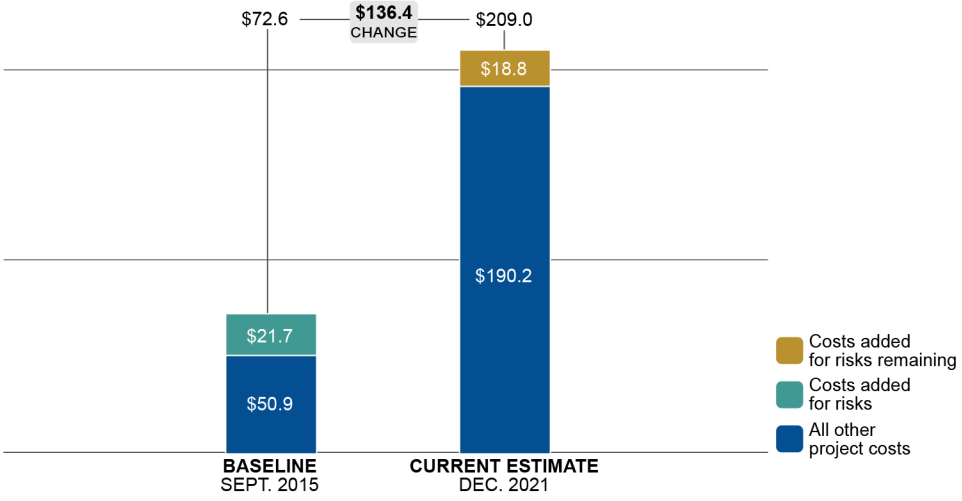
PROJECT SUMMARY

The PFP Demolition Project was initially scheduled to be completed in 2018, but schedule delays from two events resulted in the project being rebaselined twice. The first baseline change proposal (BCP-01) was necessitated by the release of radiological contamination that caused the site to shut down in December 2017. In addition, due to the COVID-19 pandemic, field work was paused in March 2020, which resulted in cost and schedule impacts and led to the second baseline change (BCP-02).

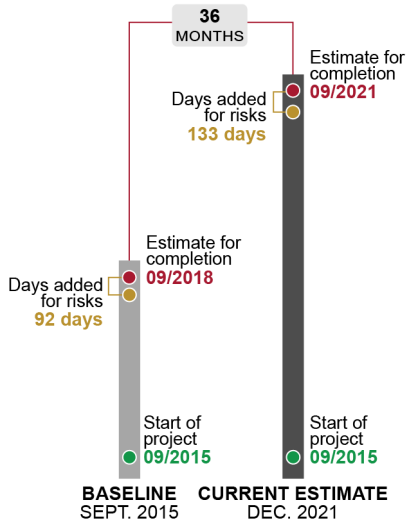
Final debris removal was scheduled to be completed by the end of July 2021. However, this work was delayed due to inaccurate estimates of the number of waste debris containers needed to complete the disposal of the debris pile. Consequently, the EM approved a third baseline change proposal (BCP-03) on January 19, 2022, to address changes to project cost and schedule. Additionally, according to agency officials, EM approved CD-4 project completion, on January 19, 2022.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The project's cost and schedule performance does not align with the baselines established at critical decision 2. As of May 2021, the project's cost performance index was .73 and the schedule performance index was .90. Due to the effects of COVID-19 and other site priorities, EM submitted BCP-02, which was approved in December 2020. BCP-02 increased the total project cost to $209 million and revised the critical decision 4 date to September 30, 2021.

As of July 2021, site officials determined that the critical decision 4 date will not be met. Site officials submitted a performance deviation memorandum to the Project Management Executive and are working to establish a new performance baseline and conduct a root cause analysis to determine the reason that the project exceeded the approved critical decision 4 date.

In August 2021, the performance deviation memorandum was approved, and site officials were given 3 months to submit a new BCP. The Office of Project Management performed a combined Independent Cost Review and External Independent Review that validated the proposed BCP-03.

Project Issues, Risks, or Opportunities

The issues the project has faced or currently faces includes the following:

- In December 2017, an extensive spread of contamination from the PFP demolition site occurred. According to site officials, the project was engaged in several high risk activities at the same time, which led to a buildup of contaminated debris and a lack of appropriate debris management procedures. Consequently, one of the lessons learned that officials are applying to future work is that the project will only perform one high risk activity at a time. The project also increased air and surface monitoring to identify potential contamination. Prior to the December 2017 incident, project officials were relying on the assumption that checks for surface contamination would only be needed if there was an air monitor warning. This assumption proved to be inaccurate, as no air monitor alarm was triggered during the December 2017 incident. As a result, the site now does more extensive surface monitoring.

The future project risks identified by EM project officials include the following:

- **Environmental concerns**. The desert environment of the site creates significant heat and wind challenges. When temperatures exceed 80 degrees Fahrenheit, workers can only work 15-minute shifts, with 45-minute breaks, because they have to work in a hot facility while wearing protective equipment. Another concern is that the high winds require debris to be carefully managed to prevent the spread of contamination.
- **COVID-19 uncertainties**. The risk of a COVID-19 reemergence leading to a return to minimum on-site work is possible. The site contractor is tracking the spread of COVID-19, and related controls have not been relaxed.

PROJECT OFFICE COMMENTS

The PFP Demolition Project is basically complete. All structures have been demolished and waste disposed of. One remaining legacy waste container is awaiting disposition, and the project will request a project completion approval from the Acquisition Executive. The estimate at completion is currently projected to be $5 million under the current approved total project cost. The Office of Project Management performed a combined Independent Cost Review and External Independent Review that validated the proposed BCP-03 which extended the project completion date to March 2022. The approval is expected in mid-January.

Source: Department of Energy. | GAO-22-104662

Sludge Processing Facility Buildouts

The Sludge Processing Facility Buildouts project is to design and construct a treatment facility to solidify ~2,000 cubic meters of transuranic waste that are in the form of sludge and supernate. This process is expected to produce a low-level waste form suitable for disposal at a low-level waste disposal facility. The scope of the project is to include the development and construction of a Sludge Test Area, testing technologies at off-site vendor facilities, demonstration of prototypes, and startup testing. For startup testing, the plans are to use sludge surrogates to ensure that the systems function as required to mobilize and process sludge and supernate prior to operations.

Aug. 1998: Approve mission need, Critical decision 0

Oct. 2014: Select preferred alternative, Critical decision 1

2027: Current estimate for approve performance baseline/Start of work, Critical decision 2/3

2030: Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Oak Ridge Reservation; Oak Ridge, Tennessee

Environmental Management (EM) Site Office: Oak Ridge Office of Environmental Management

Design Contractor: URS/CH2M Oak Ridge, LLC

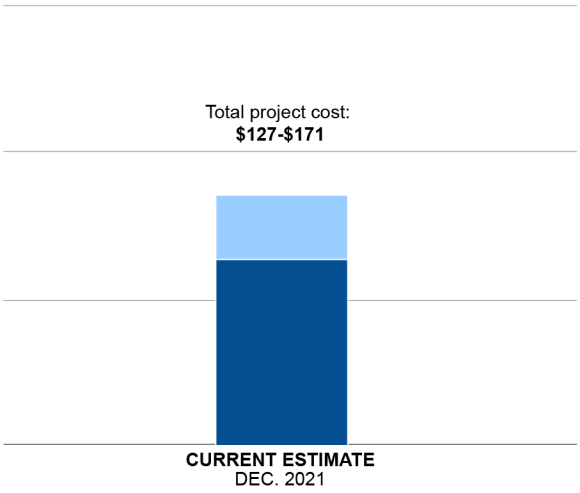
Cleanup Category: Radioactive liquid tank waste stabilization and disposition

PROJECT SUMMARY

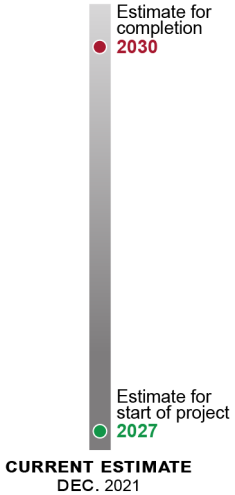
After an alternative was selected and design work towards critical decision 2 began in 2014, the Sludge Processing Facility Buildouts project encountered delays during the project's design process. EM officials stated that these delays were due to a change to the contractor working on the design in 2015 and changes to the design based on recommendations from Savannah River National Laboratory in 2016. According to EM officials, in 2017, the project halted further design work after the Department of Energy's (DOE) Project Management Risk Committee recommended that the project focus on technology maturation and testing efforts. EM officials we interviewed stated that work is underway to address all critical technology elements for the project and that work on two of the six critical technology elements has been completed. The remaining four critical technology elements that are still in development are technologies for (1) mobilizing the sludge out of the storage tanks, (2) mixing the waste to ensure that it reaches a sufficient level of homogeneity to meet regulatory standards, (3) preventing the spread of contamination as the final waste product is discharged, and (4) sampling the final waste form.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



PROJECT OFFICE COMMENTS

Oak Ridge Reservation site officials provided technical comments, which we incorporated as appropriate.

Oak Ridge On-Site Waste Disposal Facility

This project is for the design and construction of the On-Site Waste Disposal Facility, which will be constructed on or in the vicinity of the Y-12 National Security Complex in Oak Ridge, Tennessee. The facility is to provide on-site disposal for low-level and mixed low-level wastes generated through the cleanup of legacy facilities on the Oak Ridge Reservation. The On-Site Waste Disposal Facility is expected to provide a disposal capacity of up to 2,200,000 cubic yards. The scope of this project is to plan, design, and construct one-third of the capacity of the engineered waste disposal facility, including all necessary site development, infrastructure improvements, and support facilities, but does not include the cost of operations and final closure of the waste disposal facility.

Source: Department of Energy. | GAO-22-104662

May 2016: Approve mission need, Critical decision 0

Aug. 2018: Select preferred alternative, Critical decision 1

2026: Current estimate for approve performance baseline/Start of work, Critical decision 2/3

Apr. 2028: Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Oak Ridge Reservation; Oak Ridge, Tennessee

Environmental Management (EM) Site Office: Oak Ridge Office of Environmental Management

Design Contractor: URS/CH2M Oak Ridge, LLC

Cleanup Category: Operate waste disposal facility

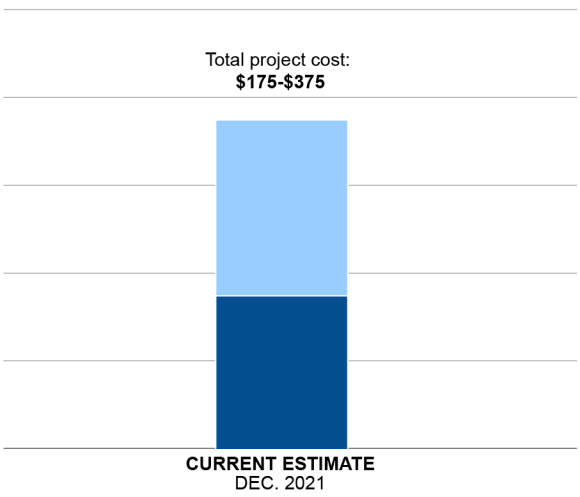
PROJECT SUMMARY

The On-Site Waste Disposal Facility is the first of three projects planned for a new waste disposal facility on the Oak Ridge Reservation. The first phase of the project will include the construction of supporting infrastructure for the facility and one-third of the expected disposal capacity. Initially, according to EM officials, the Department of Energy (DOE) planned to construct the entire facility as one capital asset project. However, it was broken into three projects following a 2018 DOE independent cost review that identified concerns regarding the amount of contingency funding required for a project that could take over a decade to construct.

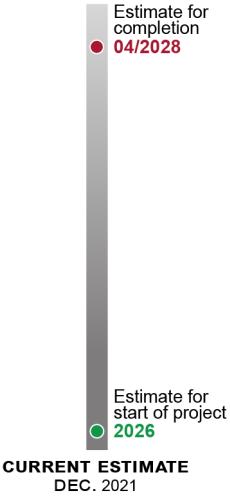
In December 2020, the EPA issued a decision in a dispute among EPA, DOE, and the Tennessee Department of Environment and Conservation over effluent limits for radionuclide-contaminated wastewater discharges from the waste disposal facility. This dispute delayed design work on the facility. Following the December 2020 decision, in June 2021, DOE elected to issue a draft record of decision for disposal of waste at the facility. According to EM officials, the project schedule calls for final approval of the record of decision in 2022.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



PROJECT OFFICE COMMENTS

Oak Ridge Reservation site officials provided technical comments, which we incorporated as appropriate.

Outfall 200 Mercury Treatment Facility

To address residual mercury that will move through the environment during cleanup operations at the Y-12 National Security Complex, this project is to design and construct a Mercury Treatment Facility for an area known as the Outfall 200 flow. The project is comprised of two primary facilities—the headworks and the treatment facility. The headworks facility plans to capture creek flow on the west end of Y-12, store excess stormwater, remove grit from the water, and pump it through a pipeline to the treatment plant on the east side of Y-12. The treated water is then to flow into the East Fork Poplar Creek. The treatment facility is to have a through-put capacity of 3,000 gallons of water per minute.

Source: Department of Energy. | GAO-22-104662

Sept. 2014: Approve mission need, Critical decision 0

May 2015: Select preferred alternative, Critical decision 1

Oct. 2018: Approve performance baseline/Start of work, Critical decision 2/3

Sept. 2025: Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Oak Ridge Reservation; Oak Ridge, Tennessee

Environmental Management Site Office: Oak Ridge Office of Environmental Management

Design Contractor: URS/CH2M Oak Ridge, LLC

Construction Contractor: APTIM-Northwind Construction JV LLC

Cleanup Area: Soil and groundwater cleanup

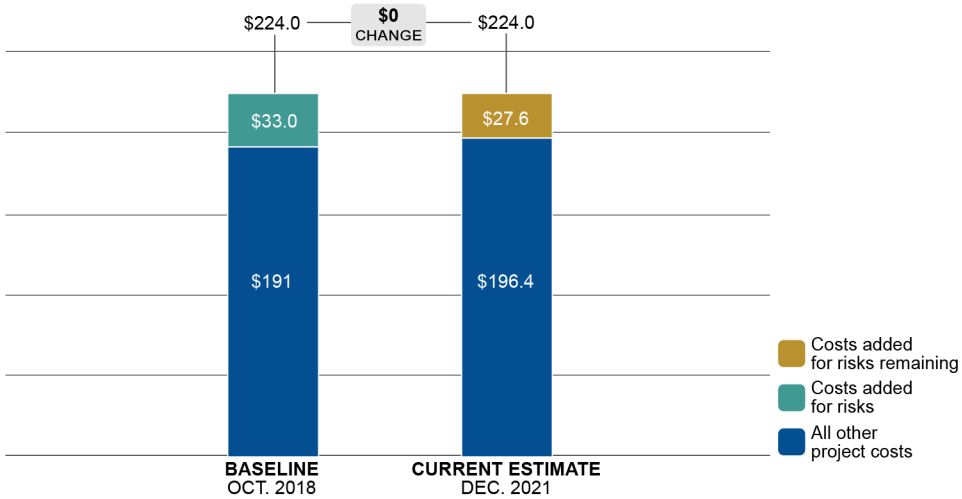
PROJECT SUMMARY

The initial construction work for this project was scheduled to begin in late 2018, but was delayed for multiple reasons. During excavation at the headworks facility, the contractor found that the bedrock was closer to the surface than estimated, which required a redesign of certain elements of the project. Construction at the headworks facility also produced more contaminated water than was initially estimated and a temporary water treatment system had to be added to the project scope. At the treatment facility, during initial excavation, the contractor found soils that could cause structural stability problems that needed to be removed and replaced.

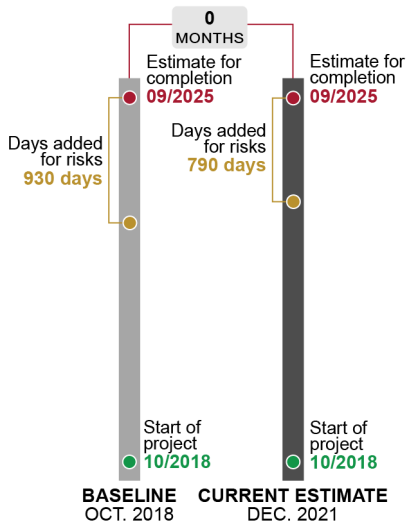
The project also experienced delays due to the stop-work order issued by the Department of Energy (DOE) in response to COVID-19 in March 2020. After identifying how to address the issues found during excavation, and after resuming work after the partial stop-work order was lifted in late 2020, EM officials estimate that they will complete the project by September 2025.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The project's cost performance aligns with the baselines established at critical decision 2, though its schedule performance does not fully align. As of October 2021, the project's cost performance index was 1.04, and the schedule performance index was .74. Although the project has experienced delays due to issues identified during excavation and the COVID-19 work stoppage, some of the added costs resulting from these issues will be covered by the construction contractor instead of EM because the project is being executed under a firm fixed-price contract. According to EM officials at the site, the project has sufficient contingency to cover those costs that are not covered by the scope of the firm fixed-price contract without exceeding the baseline.

Project Issues, Risks, or Opportunities

The issues the project has faced or currently faces include the following:

- In the process of addressing the issues with bedrock and soils at the headworks and treatment facility, EM determined that their current staff did not have sufficient expertise to properly oversee the necessary changes to the project's scope. To address this, additional contract staff and experts from the U.S. Army Corps of Engineers were brought on in order to assist management with the corrective measures.
- The project also experienced issues with poor performance from a concrete subcontractor in early 2020. EM identified problems with the concrete installation and notified the construction contractor that it was conducting insufficient oversight. According to EM officials, once the construction contractor was notified, these problems were resolved.

PROJECT OFFICE COMMENTS

Oak Ridge Reservation site officials provided technical comments, which we incorporated as appropriate.

Portsmouth X-326 Process Building Demolition Project

This project involves the demolition of building X-326 at the Portsmouth, Ohio, site, which was constructed in 1952 and used to enrich uranium. The deactivation process has been ongoing for several years as an operations-funded activity, and the demolition project is the culmination of this multiyear process. Building X-326 is the first of three process buildings to be demolished. The primary project scope is the controlled open-air demolition of the building, down to the ground-level concrete slab, and related site work. The removal of the concrete slab will be addressed in a subsequent project.

Source: Department of Energy. | GAO-22-104662

June 2019:
Approve mission need, Critical decision 0

June 2019:
Select preferred alternative, Critical decision 1

Feb. 2021:
Approve performance baseline/Start of work, Critical decision 2/3

Oct. 2025:
Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Portsmouth, Ohio

Environmental Management (EM) site office: Portsmouth/Paducah Project Office (PPPO)

Site/Demolition Contractor: Fluor- BWXT Portsmouth LLC

Design Contractor: American DND

Cleanup Area: Nuclear facilities deactivation and decommissioning

Related Capital Asset Projects: Portsmouth On-Site Waste Disposal Facility CAP-1 and CAP-2

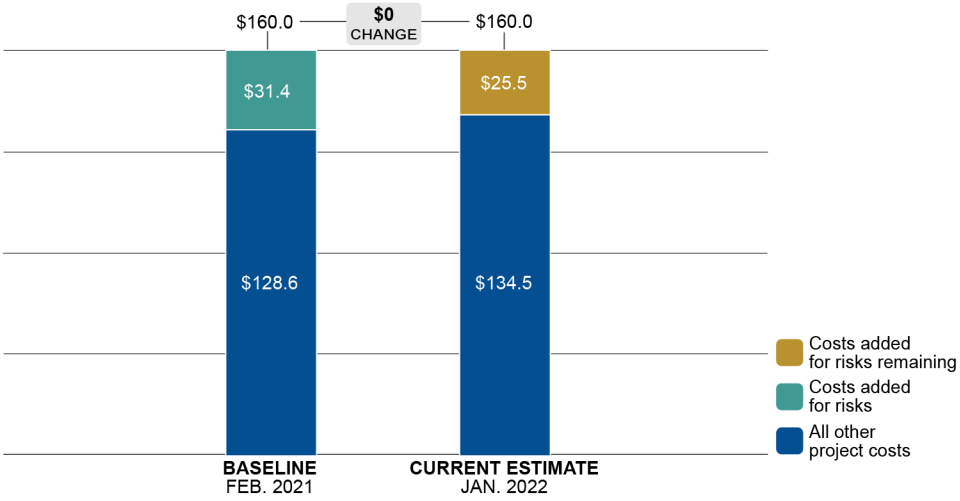
PROJECT SUMMARY

With critical decision 2/3 approval, the controlled demolition of building X-326 began in May 2021. Activities for this project include adhesive fixative application for contamination control, transite siding removal,[39] facility and equipment demolition to the concrete slab, and size reduction of demolition debris to meet requirements of the On-Site Waste Disposal Facility (OSWDF).

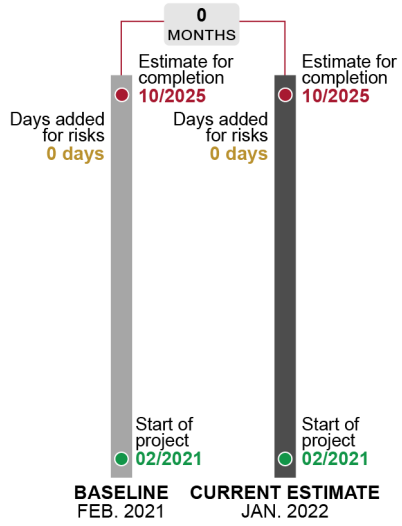
Transite removal began on February 24, 2021, and as of April 1, the contractor had completed the removal of 1,700 transite panels. In June 2021, 84 transite bundles were shipped to the OSWDF and were used as the base level for disposal cell 1 at the OSWDF. The transite removal was completed in November 2021.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



[39]Adhesive fixative is a substance that immobilizes potential loose contamination that could be disturbed during demolition. Transite is siding that typically contains asbestos and therefore requires special removal and disposal processes.

Cost and Schedule Status

The project's cost and schedule performance aligns with the baselines established at critical decision 2. As of May 2021, the project's cost performance index was 1.16 and the schedule performance index was 1.18.

According to site officials, the effects of COVID-19 on the project were minimal. To estimate the overall productivity loss to project schedules and budgets, the contractor planned to evaluate discrete activities, work environment, and applicable controls. The contractor's draft Productivity Loss Guidelines as of June 2020 estimated a total estimated productivity loss of 9 percent based on such factors, as work stoppages, inefficiencies due to social distancing requirements, and further breaks associated with additional personal protective equipment. Site officials we interviewed stated that this estimated productivity loss applied specifically to near term demolition work conducted while COVID-19 measures were still in place.

As of April 2021 project was estimated to be completed below its baseline cost due to positive cost performance to date, as well as forecasting lower-than-expected equipment rates based on the recently awarded American DND equipment contract. It also has lower than expected forecasts for labor costs, one the basis of implementing a new workforce strategy.

Project Issues, Risks, or Opportunities

The future project risks identified by EM project officials include the following:

- According to project officials, potential future risks include possible contamination release to the public following the resumption of project activities, contamination release escaping Radiological Boundary Areas inside the site boundary, the Ultra High Reach Demolition excavator tipping over during demolition, and possible serious accident or injury involving demolition equipment. PPPO site officials indicated that there are mitigation plans in place to address each of these risks. These officials said that deactivation efforts that were done prior to the start of demolition have significantly reduced risks of contamination release during demolition work. According to these officials, this project has applied lessons learned from other demolition projects across the EM complex. For example, the work on this project is very similar to the work done on the gaseous diffusion plant at Oak Ridge, and the X-326 demolition project has staff that have experience from the Oak Ridge project. Project officials stated that they have worked closely with the Ohio Environmental Protection Agency and the Ohio Department of Health on monitoring possible contamination. The implementation of independent state monitors is an example of a lesson learned from previous demolition work at Hanford. If an offsite release were to occur, it would require a rebaseline of the project because it would very likely result in a full work stoppage. Site officials stated that they also use various methods to mitigate the spread of contamination from demolition work. For example, during deactivation in the building, large areas of the building were sprayed with latex paint to mitigate dust. In addition, an adhesive fixative was sprayed on the transite siding. During structural demolition, workers sprayed dust suppression water and applied a fixative on the exterior and interior of the building at the end of the day. Small debris piles are inspected on a daily basis and fixative is also applied. According to site officials, data as of June 2021 showed that these measures have been effective. Other mitigation tactics include personnel training and daily equipment inspections.

PROJECT OFFICE COMMENTS

Department of Energy officials stated that the demolition of the X-326 Building remains ahead of schedule and under cost. Demolition has continued in a systematic and controlled fashion since initiation on May 17, 2021. The air monitoring systems and the Water Treatment System have supported the demolition work as planned. The Demolition Project had been removing exterior transite panels from the building on night shift since May following the initiation of structural demolition. On the evening of November 23, 2021, the transite removal contractor removed the last two panels of exterior transite from the X-326 Building. The demolition work exceeded the EM strategic goal of four sections (or 40 percent of the footprint) demolished by the end of the calendar year on December 10, 2021 with 40.3 percent demolition complete. As of December 13, 2021, 1,963 truckloads of demolition debris have been loaded and shipped to the OSWDF. The project has completed loading and shipping of the waste from the first demolished section, and the project is currently size reducing demolition debris, continuing demolition of section 5, and preparing for the spring load-out activities. Currently, the demolition of the fifth section continues to be performed on the day shift, and at the end of each work day, the building structure and waste piles are trimmed up and then sprayed with an adhesive fixative to minimize potential airborne contamination.

Portsmouth On-Site Waste Disposal Facility (CAP-1)

The mission of the On-Site Waste Disposal Facility (OSWDF) CAP-1 is the design, construction, and startup of three engineered disposal cells (Cells 1, 4, & 5) with multilayer liners and leachate collection, transmission, and treatment systems.[40] Also included are the support facilities and services (e.g., raw water and electrical services) to begin waste placement operations. OSWDF CAP-1 is to provide disposal capacity for the first Gaseous Diffusion Plant process building demolition project: Building X-326.

Source: Department of Energy. | GAO-22-104662

Aug. 2015:
Approve mission need, Critical decision 0

Apr. 2018:
Select preferred alternative, Critical decision 1

Apr. 2018:
Approve performance baseline/Start of work, Critical decision 2/3

May 2023:
Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Portsmouth, Ohio

Environmental Management (EM) site office: Portsmouth/Paducah Project Office

Site/Construction Contractor: Fluor-BWXT Portsmouth LLC

Design Contractor: Geosyntec and Arcadias for Water Treatment System

Cleanup Area: Operate waste disposal facility

Related Capital Asset Projects: On-Site Waste Disposal Facility CAP-2 and X-326 Process Building Demolition Project

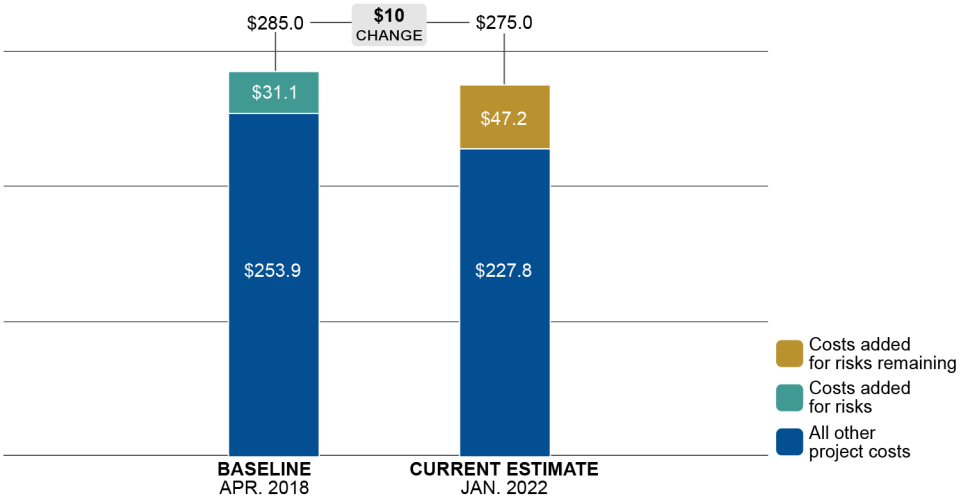
PROJECT SUMMARY

The scope of the Portsmouth OSWDF was divided between two capital asset projects: OSWDF CAP-1 and OSWDF CAP-2. The separation of scope between the two projects was in response to funding being considerably lower than planned, coupled with lower anticipated future funding, which would have delayed the first placement of decontamination and decommissioning (D&D) debris in the OSWDF. This would have, in turn, affected the demolition schedule for the first Portsmouth process building, X-326. This scope realignment strategy was intended to resequence the OSWDF project schedule to accelerate the completion of the first three cells, which are required to support disposal of D&D debris from the demolition of X-326.

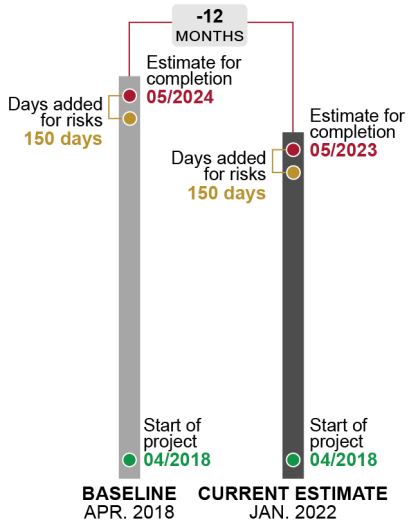
The OSWDF CAP-1 project successfully achieved the first waste placement at the Portsmouth site in late May 2021. On June 23, 2021, the first structural debris from X-326 was placed in cell 1. The contractor is continuing to place debris in that cell.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



[40]Leachate refers to liquid filtered through waste. When liquid passes through the waste, it leaches out chemicals and constituents in the waste.

Cost and Schedule Status

The project's cost and schedule performance align with the baselines established at critical decision 2. As of May 2021, the project's cost performance index was .96 and the schedule performance index was .98. These numbers reflect slight schedule delays and cost increases because of the effects of COVID-19. However, according to project assessments, the cost and schedule indices were recovering and the overall project was on track to be completed 12 months ahead of schedule.

According to site officials, the original critical decision 4 date, set for 2024, was established prior to work beginning on the project, and was shortened in light of accelerated project progress. Much of this accelerated progress is attributed to the use of firm fixed price (FFP) contracts. All FFP contract awards were less than originally anticipated, resulting in cost savings. These additional savings were used to address further project scope. Project performance was also accelerated, due to changes to the contract's Cost Accounting Standard Practice Disclosure Statement. The prime contractor adjusted how it calculated the overhead cost rate, shifting the allocation to only apply to direct labor as opposed to all elements of the contract. These changes resulted in savings that were also used to address additional project scope.

Since baselines were established, the project added around $21 million in credits to Management Reserve. Site officials stated that much of these credits were due to the use of FFP. In addition, these officials stated that the accelerated pace of field work resulted in reduced costs for project support activities, which then went back into Management Reserve.

Project Issues, Risks, or Opportunities

The future project risks identified by EM project officials include the following:

- EM officials identified major project risks regarding construction, including weather and supply chain risks. They also cited additional risks associated with completing final project reviews and readiness assessments for Cell Liners 4 and 5. Officials stated that after the contractor completed its self-readiness assessment, project officials requested an additional independent readiness assessment that was fully comprehensive. According to officials, both assessments found that the project was ready.

PROJECT OFFICE COMMENTS

The project continues to make significant progress. Cell 1 and Leachate Treatment System operations were initiated in May 2021. The project successfully completed construction of Cell Liner 4 and Cell Liner 5 in December 2021.

Source: Department of Energy. | GAO-22-104662

Portsmouth On-Site Waste Disposal Facility (CAP-2)

The On-Site Waste Disposal Facility (OSWDF) CAP-2 project scope includes the construction of significant supporting infrastructure and three disposal cells—Cells 2, 3, and 6. This is the supporting infrastructure that was not included in OSWDF CAP-1, which is required to accommodate full-scale OSWDF operations. OSWDF CAP-2 will provide a disposal capacity for the demolition of the second Process Building, X-333, which will be demolished as a capital asset project.

Aug. 2016:
Approve mission need, Critical decision 0

Feb. 2020:
Select preferred alternative, Critical decision 1

Feb. 2020:
Approve performance baseline/Start of work, Critical decision 2/3

Sept. 2027:
Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Portsmouth, Ohio

Environmental Management (EM) Site Office: Portsmouth/Paducah Project Office

Site/Construction Contractor: Fluor-BWXT Portsmouth LLC

Design Contractor: Geosyntec and Arcadias for Water Treatment System

Cleanup Area: Operate waste disposal facility

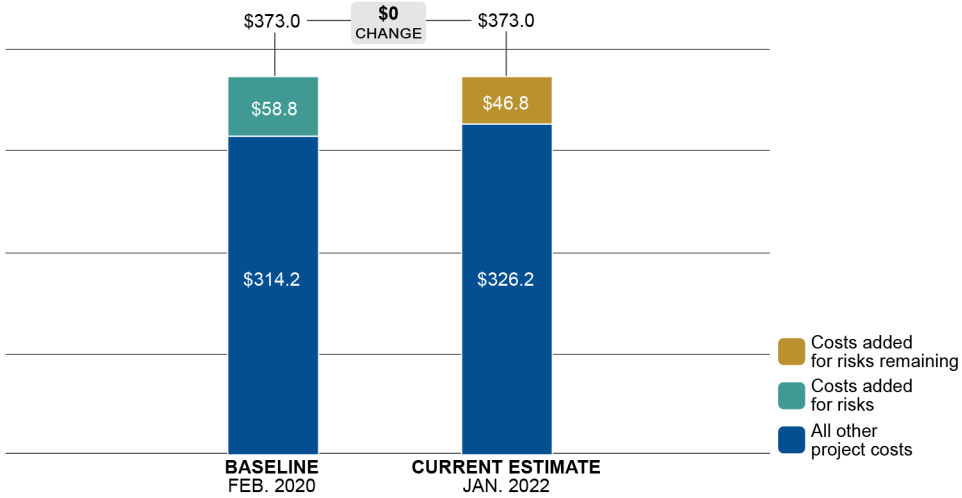
Related Capital Asset Projects: On-site Waste Disposal Facility CAP-1 and X-326 demolition

PROJECT SUMMARY

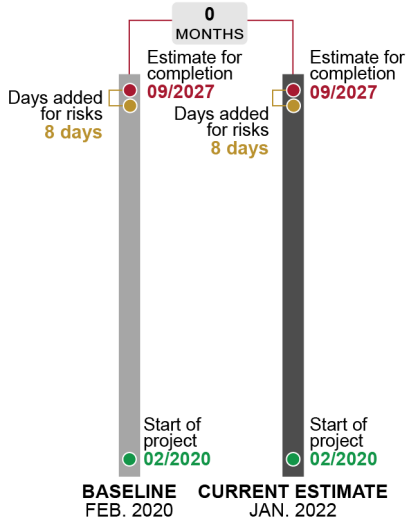
The OSWDF CAP-2 project has undergone many scope realignment strategies, including adding the deferred infrastructure work that was originally included in the CAP-1 scope. Because the deferred infrastructure work—which is needed to support future cell function and development—was added to the CAP-2 scope, EM elected to transfer Cells 4 and 5 from the CAP-2 scope to the CAP-1 project. In the original critical decision 0 approval, these cells were in the CAP-2 scope. EM then added Cells 2, 3, and 6 to the CAP-2 scope to maximize project performance and support the Portsmouth site mission of decontamination and decommissioning. The Portsmouth OSWDF Capital Asset Projects have been aligned with the schedule and timeframe set forth to demolish the Portsmouth process buildings X-326 and X-333. In May 2021, field construction for the East Maintenance Building began. Construction of the East Maintenance Building was scheduled to be completed in September 2021.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The project's cost and schedule performance align with the baselines established at critical decision 2. As of May 2021, the project's cost performance index was 1.04 and the schedule performance index was .92.

Since baselines were established, the project has expended approximately $12 million of its Management Reserve. Site officials stated that changes to the overhead allocation—from 42 percent to 46 percent—resulted in increased expenditures. These were due to an increase in planned direct labor costs tied to self-performing contracts.

Project Issues, Risks, or Opportunities

The issues the project has faced or currently faces include the following:

- On March 23, 2020, the Portsmouth site shifted operations to focus on minimum mission-critical activities and to maximize telework, due to COVID-19. During this period, OSWDF CAP-2 primarily focused on engineering design and preconstruction planning and procurement. However, after EM authorized the site to begin return to work activities, the CAP-2 project resumed activities on July 7, 2020 and work has continued without pause due to COVID-19.

The future project risks identified by EM project officials include the following:

- As of May 2021, major project risks included those associated with construction, including weather and supply chain risks; and completing final project reviews and readiness assessments for Cell Liners 2, 3, and 6.

Opportunities for cost savings EM project officials identified include the following:

- EM officials decided to use an acquisition strategy that supports both self-performing and Firm Fixed Price (FFP) contracting. According to site officials, the scope of OSWDF CAP-2 is more straightforward and well defined as a result of the work that had already been done on OSWDF CAP-1. These officials stated that as a result, the project is able to use its own workforce and resources, with greater flexibility than under a different contracting model. While there will be some FFP contracts in CAP-2, most of the work will be done with a workforce from the existing site contract instead of hiring additional workers through a subcontract.

PROJECT OFFICE COMMENTS

The project made progress on the advancement of the construction of the East Heavy Equipment Maintenance Building by performing the installation of interior electric and communication systems. Significant progress in the construction of Sedimentation Pond 1B was made by completing installation of the sheet pile wall.

Saltstone Disposal Unit 7

Saltstone Disposal Unit (SDU) 7 is the next in a series of projects designed to treat and dispose of liquid radioactive waste at the Department of Energy's (DOE) Savannah River Site. SDU 7 is being constructed to store the decontaminated salt solution (a concrete-like substance referred to as "saltstone grout") generated by the waste treatment process.

The SDU 7 project is to construct a 32-million gallon cylindrical tank, measuring 375 feet in diameter and 43 feet high. The project plans to also include all of the infrastructure necessary to address all of the saltstone grout estimated to be produced by the site's Saltstone Production facility, as outlined in the Savannah River Site Liquid Waste System Plan.

Source: Department of Energy. | GAO-22-104662

Feb. 2016: Approve mission need, Critical decision 0

May 2017: Select preferred alternative, Critical decision 1

Mar. 2018: Approve performance baseline/Start of work, Critical decision 2/3

July 2021: Project completion, Critical decision 4

PROJECT INFORMATION

Location: Savannah River Site: Aiken, South Carolina

Environmental Management (EM) Site Office: Savannah River Operations Office

Design Contractor: Savannah River Remediation

Construction Contractor: Savannah River Remediation (prime contractor); DN Tanks (subcontractor)

Cleanup Category: Radioactive liquid tank waste stabilization and disposition

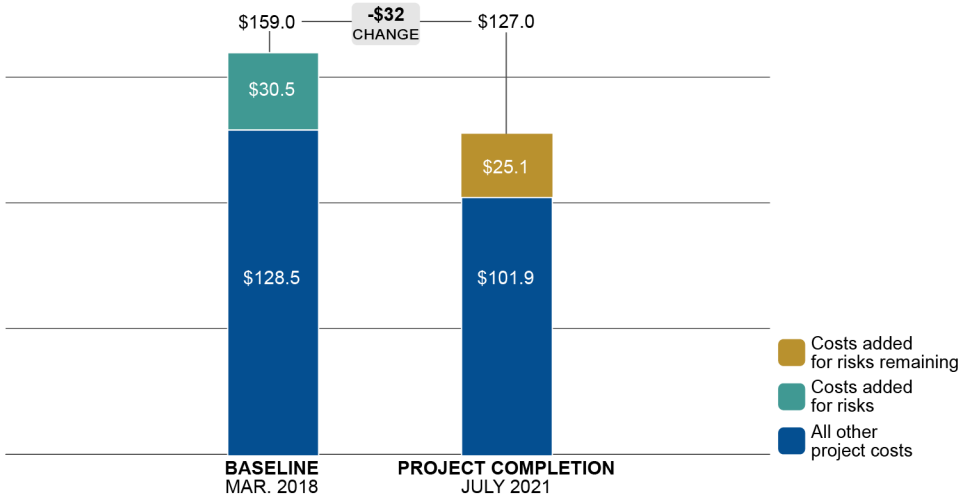
Related Projects: Saltstone Disposal Units 8 and 9;Saltstone Disposal Units 10 through 12

PROJECT SUMMARY

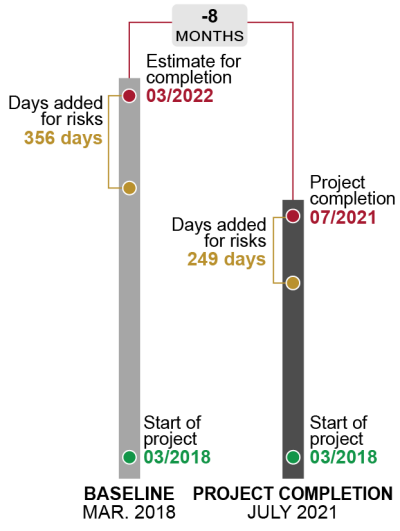
In January 2019, Savannah River Remediation, a DOE contractor, issued version 21 of its Liquid Waste System Plan, outlining the processes for treating, storing, and disposing of liquid waste held in tanks at the Savannah River Site. According to EM officials, it was estimated that SDU 6 would be full and SDU 7 would need to start accepting saltstone grout by October 2021. However, the project's completion date was set at March 2022 due to funding constraints and the need to include sufficient contingency time to reach an 80 percent confidence level in the schedule estimate, according to an EM official. The project received approval for the critical decision 4 milestone in July 2021, ahead of the date the Liquid Waste System Plan estimated it would be needed.

COST PERFORMANCE

(then- year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The SDU 7 project's cost and schedule performance is in line with the baselines established at Critical Decision 2. As of July 2021, the project's cost performance index was 1.02, and the schedule performance index was 1.00, according to EM officials. The project was completed 8 months ahead of its baseline completion date and the total project cost was $32 million below the baseline estimate.

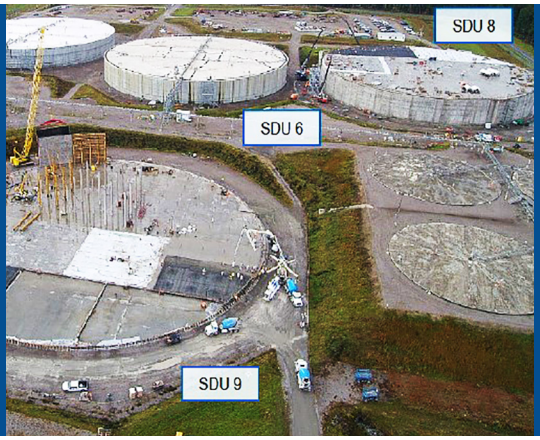
Project Issues, Risks, or Opportunities

The opportunities identified by EM site officials include the following:

- The SDU 7 project was able to take advantage of opportunities on this project by making changes to the project design based on lessons learned from the SDU 6 project, which was completed in July 2017. The two most prominent changes EM made to the SDU 7 project were the addition of tank liners to help prevent leaks and eliminating curved floors, which increased the tank's storage capacity and simplified the construction process.

PROJECT OFFICE COMMENTS

The SDU 7 Construction Project, one of the Office of Environmental Management's top three projects for 2021, was considered a success. The project was completed and became operational on July 21, 2021, approximately 8 months ahead of the approved schedule of March 31, 2022. The final cost of the project was $127 million, which is $32 million under the approved total project cost of $159 million.



Saltstone Disposal Units 8 and 9

Saltstone Disposal Units (SDU) 8 and 9 are the next in a series of projects being constructed for the containment and disposition of decontaminated salt solution (in the form of saltstone grout) generated by the treatment of liquid radioactive waste at the Savannah River Site.

The SDU 8 and 9 project is to construct two 32-million gallon cylindrical tanks called disposal cells. Each will be 375 feet in diameter and 43 feet high. This project will include all the infrastructure necessary to accept saltstone grout produced by the Saltstone Production facility with sufficient capacity to meet the estimated production rates identified in the latest Savannah River Site Liquid Waste System Plan.

Source: Department of Energy. | GAO-22-104662

Mar. 2017: Approve mission need, Critical decision 0

Dec. 2017: Select preferred alternative, Critical decision 1

May 2019: Approve performance baseline/Start of work, Critical decision 2/3

Sept. 2024: Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Savannah River Site; Aiken, South Carolina

Environmental Management (EM) Site Office: Savannah River Operations Office

Design Contractor: Savannah River Remediation

Construction Contractor: Savannah River Remediation

Cleanup Category: Radioactive liquid tank waste stabilization and disposition

Related Projects: Saltstone Disposal Unit 7, Saltstone Disposal Units 10 through 12

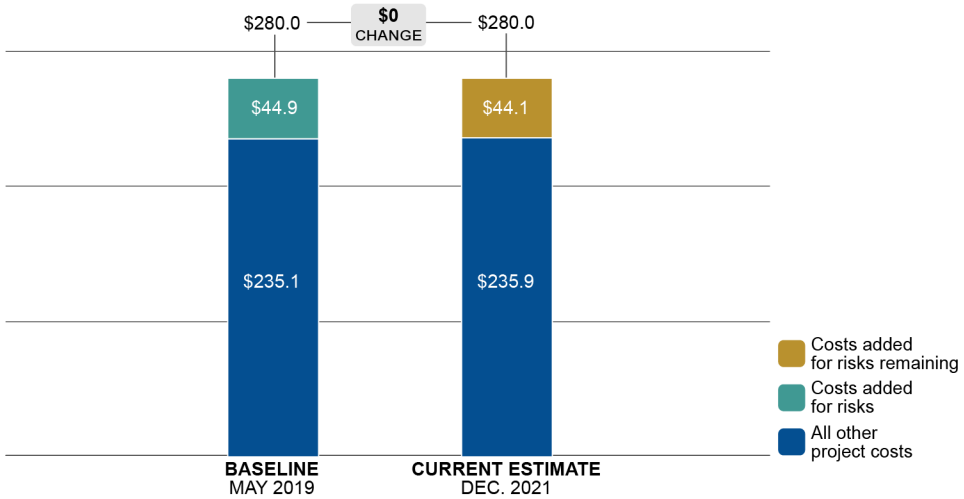
PROJECT SUMMARY

According to site officials, EM is working on construction of SDU 8 and SDU 9 nearly in parallel so that once certain activities are completed on one unit, the experienced workforce and equipment can be moved to perform those activities on the next unit. Officials also stated that as of December 2021, construction of the tank for SDU 8 is complete and additional work to prepare the tank for operations is ongoing. Progress is continuing on SDU 9 with 14 of 14 floor slabs, five of 25 walls, and 48 of 208 columns complete.

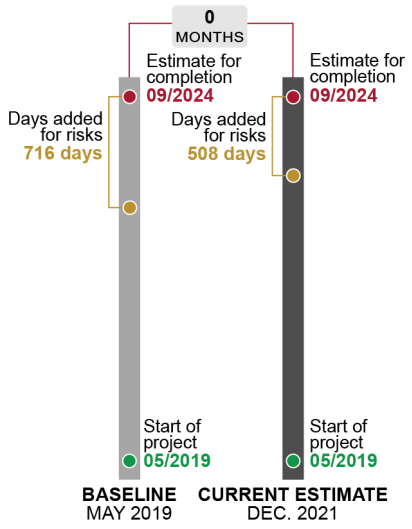
EM project officials said that project activities were suspended for a period of 2 months due to COVID-19. EM officials said the project has sufficient contingency to cover these delays and do not expect additional delays on the project. EM officials currently estimate that SDU 8 will be completed prior to January 2023 and SDU 9 will be completed by September 2024. These dates align with the estimated dates for when the units will be needed, according to the site's Liquid Waste System Plan.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The project's cost and schedule performance align with the baselines established at critical decision 2. As of October 2021, the project's cost performance index was 1.07, and the schedule performance index was .97. Since the baselines were established, the project has added over $5 million in credits to the costs added for risks for the project. According to EM officials, most of these credits came from the lower than estimated bid prices for the construction contract.

While the project was approved to begin construction in May 2019, funding was not provided at the levels assumed in the baseline estimate in fiscal years 2019 or 2020. EM officials told us that the funding shortfall was a result of delays in completing the Salt Waste Processing Facility. The funding shortfalls over these 2 fiscal years caused a 6 month delay in construction activities. This delay has consumed all of the project's schedule contingency. EM project officials, however, stated that they are making efforts to regain lost schedule and still believe that the project can be completed by the current estimated completion date of September 2024.

Project Issues, Risks, or Opportunities

The issues the project has faced or currently faces include the following:

- EM officials stated that the project had issues with schedule delays resulting from funding shortfalls in fiscal years 2019 and 2020.

The future project risks identified by EM project officials include the following:

- The project faces risks from a significant rise in the cost of construction commodities, such as concrete and steel.
- As each SDU nears completion, EM will need to conduct a leak tightness test for the tank. This risk has been reduced due to prior successes with this test on SDU 6 and SDU 7. However, EM officials believe that it is important to maintain their focus on this risk, as a failure of the leak tightness test could result in significant project delays.

PROJECT OFFICE COMMENTS

The SDU 8/9 project remains on track to complete at, or ahead of, the approved schedule and at or under the approved cost baseline. To the extent practical, lessons learned from SDU 6 and SDU 7 are implemented and the use of the same tank subcontractor has yielded efficiencies even during the COVID-19 pandemic. As of December 1, 2021, all concrete placements are complete on SDU 8, and wrapping activities are underway. Construction on SDU 9 has progressed, as the floor is complete, and walls and columns are being placed at an ahead-of-schedule pace.

Saltstone Disposal Units 10 Through 12

Saltstone Disposal Units (SDU) 10-12 follow SDUs 8 and 9 in the series of projects to contain and dispose of decontaminated salt solution (in the form of saltstone grout) generated by the treatment of liquid radioactive waste at the Savannah River Site. The Saltstone Disposal Units 10-12 project is to construct three 32 million gallon cylindrical tanks, called disposal cells. Each tank will be 375 feet in diameter and 43 feet high. This project is to include all the infrastructure necessary to accept saltstone grout produced by the Saltstone Production facility, with sufficient capacity to meet the estimated production rates identified in the Savannah River Site Liquid Waste System Plan.

Source: Department of Energy. | GAO-22-104662

Sept. 2017: Approve mission need, Critical decision 0

Dec. 2018: Select preferred alternative, Critical decision 1

Sept. 2021: Approve performance baseline/Start of work, Critical decision 2/3

July 2030: Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Savannah River Site; Aiken, South Carolina

Environmental Management (EM) Site Office: Savannah River Operations Office

Design Contractor: Savannah River Remediation

Cleanup Category: Radioactive liquid tank waste stabilization and disposition

Related Projects: Saltstone Disposal Unit 7, Saltstone Disposal Units 8 and 9

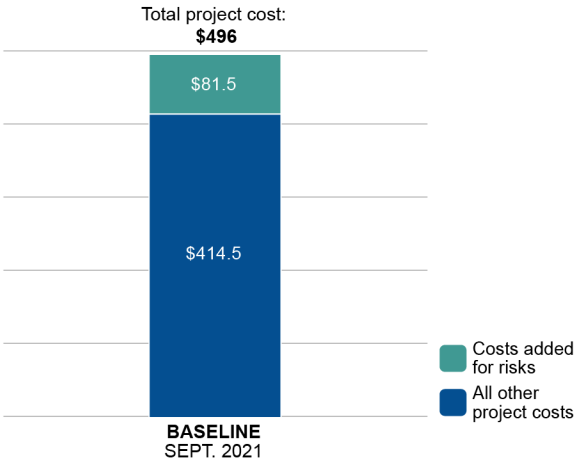
PROJECT SUMMARY

EM initially planned to start construction of the SDU 10 through 12 project in 2019. However, similar to what occurred with the funding for the SDU 8 and 9 project, funding at the Savannah River Site was prioritized for addressing delays with the Salt Waste Processing Facility, and design work on this project was delayed by approximately 2 years, EM officials told us. According to EM officials, the new schedule for this project still aligns with the estimated dates when the units will be needed.

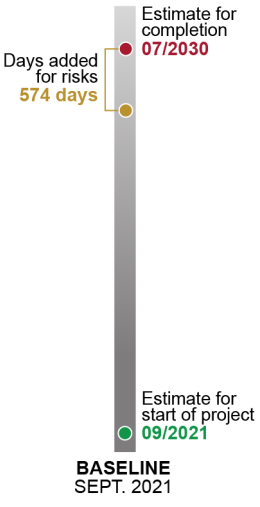
The Department of Energy's (DOE) Office of Project Management recommended that officials at the site consider whether this project could be performed by a contractor working for EM directly rather than having the site's contractor hire a subcontractor, as was done for the prior two SDU projects. EM site officials stated that this option was considered, but they determined that the site office did not have sufficient staff to manage and directly oversee a contractor for the SDU 10 through 12 project. Further, these officials wanted to retain the experience of the site contractor that had managed the subcontractors on the prior SDU projects.

COST PERFORMANCE

(then-year dollars in millions)

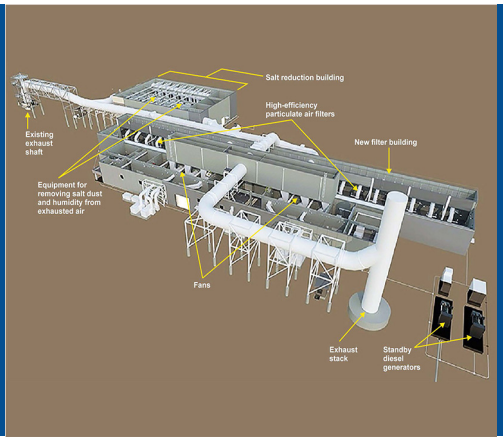


SCHEDULE PERFORMANCE



PROJECT OFFICE COMMENTS

The SDU 10 – 12 project achieved critical decision 2/3 on September 13, 2021. The TPC was approved at $496 million and a critical decision 4 date of July 8, 2030. Lessons learned from previous SDU projects (6, 7 and 8/9) will be used to the extent practical. Upon receipt of a fiscal year 22 budget, site preparation activities in the field will commence.



Safety Significant Confinement Ventilation System (SSCVS)

This project is to design and construct a new ventilation system for the Waste Isolation Pilot Plant (WIPP) underground repository, including High Efficiency Particulate air filters and fans, ductwork and dampers, diesel generators, exhaust stack, exhaust filter buildings, filter banks, and site support utilities. This project is to provide the entire surface infrastructure and equipment for the underground ventilation system. The new ventilation system is intended to provide the capability for simultaneous underground activities, such as mining and waste emplacement, in order to increase operational efficiency.

Source: Department of Energy. | GAO-22-104662

Oct. 2014: Approve mission need, Critical decision 0

Dec. 2015: Select preferred alternative, Critical decision 1

May 2018: Approve performance baseline/Start of work, Critical decision 2/3

May 2025: Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Waste Isolation Pilot Plant; Carlsbad, New Mexico

Environmental Management (EM) Site Office: Carlsbad Field Office

WIPP Management and Operating (M&O) Contractor: Nuclear Waste Partnership, LLC

Design Contractor: Chicago Bridge and Iron, Longenecker and Associates, Juno Management, APTIM

Construction Contractor: Kiewit-The Industrial Company

Cleanup Area: Operate waste disposal facility

Related Projects: Utility Shaft

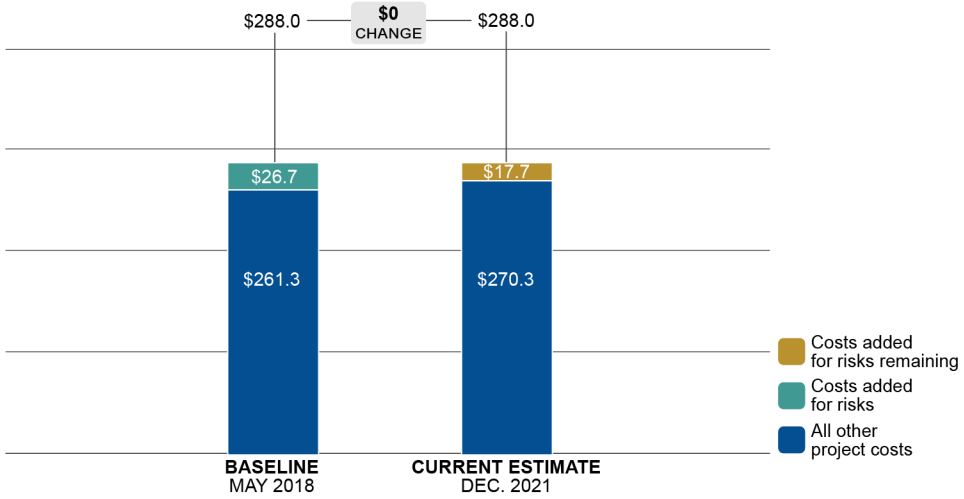
PROJECT SUMMARY

On August 31, 2020, the subcontractor constructing the SSCVS was terminated due to poor performance. According to EM officials, the subcontractor had submitted an unusual number of requests to change the design of the project, which the WIPP M&O contractor approved. These changes resulted in both cost increases and schedule delays. In May 2020, the U.S. Army Corps of Engineers conducted a review of the project at EM's request and determined that the original design of the facility was adequate and that many of the subcontractor's requested design changes were not needed.

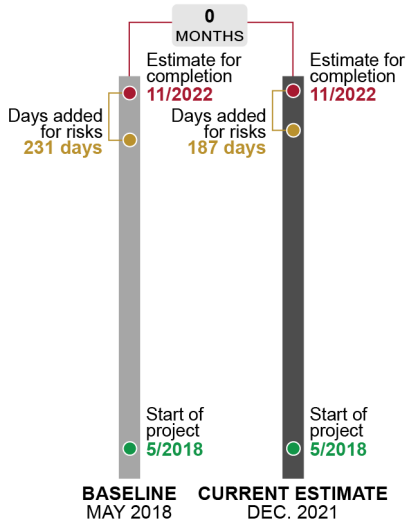
After the initial subcontractor was terminated, another sub-contractor was identified in October 2020 to complete the project.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The project's cost and schedule performance does not align with the baselines established at critical decision 2. As of November, 2021, the project's cost performance index was 1.01 and the schedule performance index was .94. While these values take into account all progress made on the project since its initiation, they reflect the performance of the project after adjustments have been made for the cost overruns and schedule delays experienced by the project to date.

EM is in the process of developing a baseline change proposal to address the challenges the project has faced with subcontractor and WIPP M&O contractor performance issues. In March 2020, we reported that EM was estimating that the project's total costs will increase by approximately $198 million, and project completion will be delayed by 3 years.[41]

Project Issues, Risks, or Opportunities

The issues the project has faced or currently faces include the following:

- DOE officials said that officials managing the project at the Carlsbad Field Office and the prime contractor, Nuclear Waste Partnership, did not have prior experience with managing a capital asset project. Prior to the start of this project, EM had not performed a capital asset project at WIPP since it opened in 1999 and there was not a need to construct line-item capital asset projects when Nuclear Waste Partnership was awarded the WIPP M&O contract in 2012. Therefore, officials stated that experience in this area was not factored into the selection of Nuclear Waste Partnership as the prime contractor.
- The Carlsbad Field Office had difficulties filling positions in Carlsbad, including those with important oversight roles such as the Federal Project Director. According to EM officials, limited staffing capacity contributed to the severity of the problems the project encountered.
- According to EM officials, the WIPP M&O contractor did not sufficiently evaluate the cascading downstream effects of design changes requested for convenience by construction subcontractors, and did not communicate the extent of these changes to the federal project staff. For example, a change to the design of the concrete roof panels had a cascading effect requiring unanticipated additional changes to the facility structural design and roof architecture.
- The initial subcontractor doing the construction work did not have prior experience working on a project that included the required quality assurance qualifications. DOE officials told us that the subcontractor had to be prompted frequently to ensure that their processes and documentation met the required standards for the project.

The future risk identified by EM project officials included the following one:

- The future transition to a new prime contractor at the site in 2022 could introduce a project risk. The prime contractor is responsible for overseeing this construction project as well as others on site, so this transition could create management issues and also lead to higher-than-estimated administrative costs. To mitigate this risk, EM officials told us that they developed the Request for Proposal for the follow-on WIPP M&O contract requiring a Capital Asset Project Manager as key personnel as well as specific evaluation factors to select the contractor with the best personnel, contract incentives and penalties, and past performance and management approaches. EM is currently reviewing proposals for award in 2022.

PROJECT OFFICE COMMENTS

Nuclear Waste Partnership is executing the project consistent with the new baseline. The project is closely monitoring supply chain issues from concrete and ductwork subcontractors that could challenge the schedule and is actively engaged in contingency planning. Nuclear Waste Partnership and the Carlsbad Field Office have engaged additional project staff in key positions to provide more effective management and oversight. With construction execution well underway, commissioning is being planned with more fidelity including hiring of additional personnel for these activities.

[41]GAO, *Waste Isolation Pilot Plant: Construction Challenges Highlight the Need for DOE to Address Root Causes*, GAO-22-105057 (Washington, D.C.: Mar. 15, 2022).

Source: Department of Energy. | GAO-22-104662

Utility Shaft

This project is to construct a 2,150-foot vertical shaft and two horizontal pathways (hallways) connected to the existing Waste Isolation Pilot Plant (WIPP) underground repository to support a new underground ventilation system. The shaft is to replace the existing air intake shaft and allow the Office of Environmental Management (EM) to reconfigure how the ventilation system moves air through the underground repository. As part of this reconfiguration, the existing air intake shaft is to be converted into an exhaust shaft that will provide EM with an unfiltered pathway to discharge air that contains salt dust from mining operations.

Oct. 2014: Approve mission need, Critical decision 0

Dec. 2015: Select preferred alternative, Critical decision 1

June 2019: Revision of selected preferred alternative, Approve performance baseline/Start of work, Critical decision 1/2/3

Dec. 2023: Current estimate for project completion, Critical decision 4

PROJECT INFORMATION

Location: Waste Isolation Pilot Plant Carlsbad, New Mexico

EM Site Office: Carlsbad Field Office

Design Contractor: Vigil Engineering, Cementation, RPKA Engineering, RJR Engineering, SRK Consulting, NWP Engineering

Construction Contractor: Harrison Western-Shaft Sinkers

Cleanup Category: Operate waste disposal facility

Related Projects: Safety Significant Confinement Ventilation System

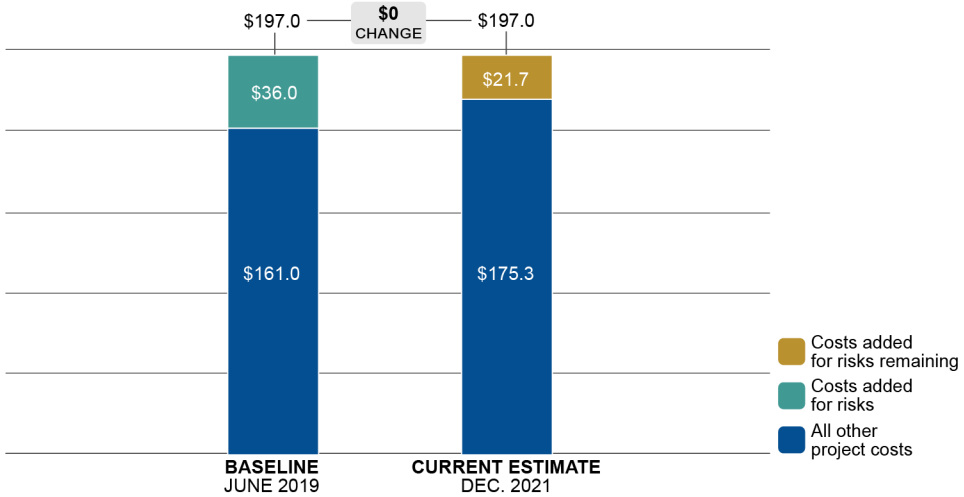
PROJECT SUMMARY

In August 2019, EM applied to the New Mexico Environment Department (NMED) for a modification to WIPP's Hazardous Waste Facility Permit to construct the Utility Shaft. In April 2020, NMED approved a temporary authorization that allowed DOE to begin excavation work for 180 days while it awaited NMED's approval of the permit modification request. In September 2020, DOE requested a second temporary 180-day authorization, which NMED denied in November 2020. As a result, most work on the Utility Shaft ceased in November 2020. EM officials said that work continued some limited construction work aboveground, such as the installation of ductwork and tasks needed to convert the air intake shaft into an exhaust shaft.

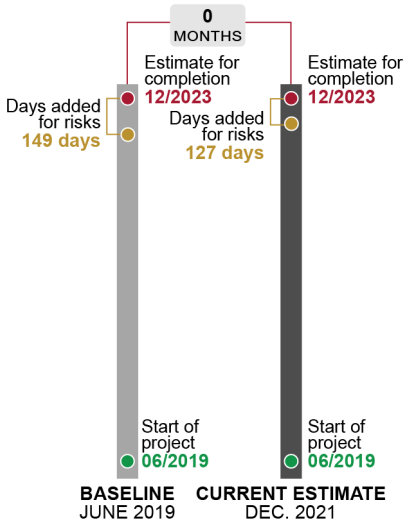
NMED approved the permit modification for the Utility Shaft in October 2021 but nongovernmental organizations have challenged the approval in court. However, in 2022 we reported that the construction contractor will not resume excavating the shaft until August 2022 because of the time needed to negotiate with a subcontractor, remobilize the workforce and commission the equipment.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The project's cost and schedule performance does not align with the baselines established at critical decision 2. As of November 2021, the project's cost performance index was 1.00 and the schedule performance index was .97. While these values take into account all progress made on the project since its initiation, they reflect the performance of the project after adjustments have been made for the cost overruns and schedule delays experienced by the project to date, according to an EM official.

EM is in the process of developing a baseline change proposal to address the cost and schedule effects from stopping most work on the project in November 2020. According to EM officials, they believe that the project's total costs will increase by more than $20 million and that the schedule will be delayed by more than a year.

Project Issues, Risks, or Opportunities

The issues the project has faced or currently faces include the following:

- EM encountered issues in developing the design for the Utility Shaft. As part of the planning process for this project, in 2015 EM's contractor performed an analysis of alternatives to determine whether the project should include an additional exhaust shaft, among other things. On the basis of that analysis, DOE initiated the project. In our August 2016 report, we found significant problems with this analysis of alternatives and recommended that EM include a cost-benefit analysis, as is consistent with best practices, or document why the analysis is not needed.[42] DOE concurred with our recommendation and analyzed the alternatives again. According to EM officials, the second analysis identified several key technical flaws in the first analysis, including that the selected location for the new exhaust shaft was too close to the existing underground area and would not meet standards established by the Mine Safety and Health Administration. EM made revisions to the project, including changes to address the flaws in the first analysis, and changed the name from Exhaust Shaft to Utility Shaft to better reflect its purpose.

The future risk we identified was the following:

- In November 2021, nongovernmental organizations appealed NMED's approval of the permit modification for the Utility Shaft project.[43] If this appeal is successful, it could result in further cost increases and schedule delays for the project.

PROJECT OFFICE COMMENTS

The New Mexico Environment Department approved the Class III Permit Modification Request for the shaft and drifts with an effective date of November 27, 2021, which allows resumption of shaft sinking activities. Nuclear Waste Partnership is finalizing negotiations with the shaft sinking subcontractor to resume work and adjust the project costs to account for unplanned holding cost, remobilization and supply chain issues as a result of the delay in permitting. Quantification of the impacts due to the COVID-19 driven delays in the permitting process are being analyzed and the Baseline Change Proposal is anticipated for submittal in late Fiscal Year 2022.

[42]GAO, *Nuclear Waste: Waste Isolation Pilot Plant Recovery Demonstrates Cost and Schedule Requirements Needed for DOE Cleanup Operations*, GAO-16-608 (Washington, D.C.: August 4, 2016.

[43]*Southwest Rsch. and Info. Ctr. v. New Mexico Env't Dep't.,* No. A-1-CA-40030 (N.M. Ct. App. Nov. 8, 2021); *Concerned Citizens for Nuclear Safety v. New Mexico Env't Dep't*, No. A-1-CA-40074 (N.M. Ct. App. Nov. 29, 2021). One organization has requested a stay of the permit modification while the appeal is pending. *New Mexico Env't Dep't. v. Southwest Rsch. and Info. Ctr.,* No. A-1-CA-40030 (N.M. Ct. App. Jan. 12, 2022). As of April 14, 2022, the court has not issued a stay.

West Valley Main Plant Process Building (MPPB) Demolition Project

The MPPB is contaminated with radioactive and hazardous materials from past operations involving reprocessing spent nuclear fuel. The scope of this project is the demolition of the above grade portions of the MPPB and includes the transportation and disposal of low-level and industrial waste generated during the demolition. Any transuranic waste generated during the project will be packaged and transported to an on-site storage facility to await a final decision on its disposal.

Source: Department of Energy. | GAO-22-104662

July 2016: Approve mission need/Select preferred alternative, Critical decision 0/1

Feb. 2021: Approve performance baseline/Start of work, Critical decision 2/3

Nov. 2021: Estimated demolition start

July 2025: Current estimated date for project completion, Critical decision 4

PROJECT INFORMATION

Location: West Valley, New York

Environmental Management (EM) Site Office: Environmental Management Consolidated Business Center

Site/Demolition Contractor: CH2M Hill - BWXT West Valley, LLC

Cleanup Category: Nuclear facilities deactivation and decommissioning

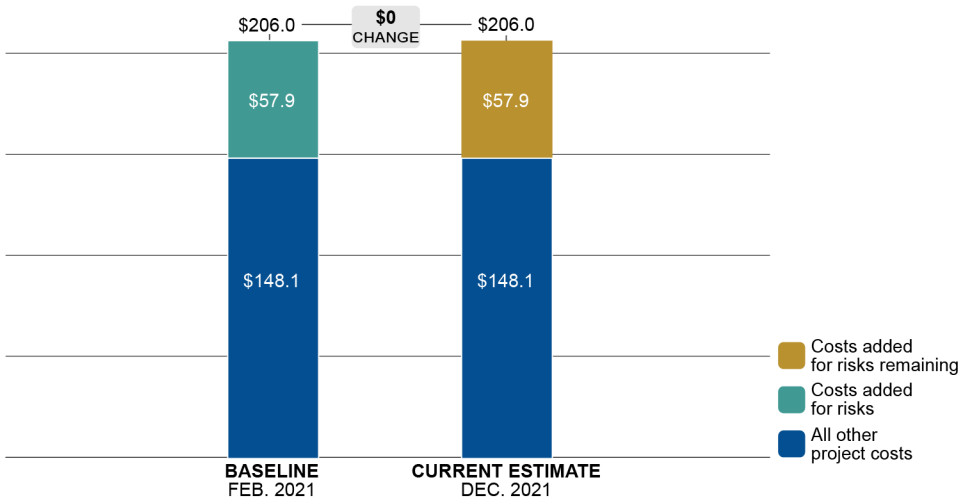
PROJECT SUMMARY

DOE planned to begin demolition of the MPPB in 2018. However, DOE officials stated that the department delayed the project in order to apply lessons learned from a 2017 contamination incident that occurred during the demolition of a facility at the Hanford Site in Washington. The officials said that the lessons learned from that incident that have been applied to the MPPB include: maintaining a measured pace of demolition, minimizing debris pile accumulation, applying better methods for dust suppression, and providing greater oversight of fieldwork. Demolition had been expected to be completed by 2023.

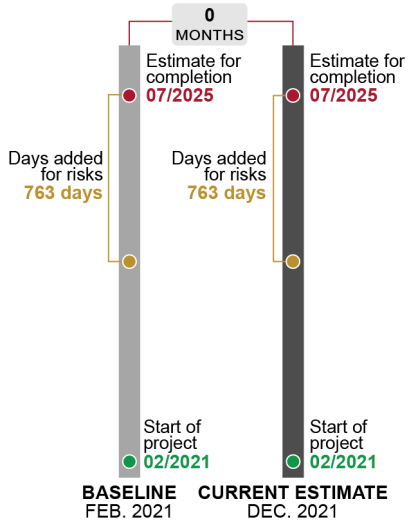
In February 2021, DOE approved critical decision 2/3 for the project and demolition was expected to start in July 2021. However, COVID-19 related impacts delayed deactivation activities, which are essential precursors to demolition. According to the monthly project assessment as of June 2021, demolition was expected to begin in fiscal year 2021.

COST PERFORMANCE

(then-year dollars in millions)



SCHEDULE PERFORMANCE



Cost and Schedule Status

The project's cost and schedule performance align with the baselines established at critical decision 2. As of April 2021, the project's cost performance index was .65, and the schedule performance index was .66. DOE officials stated that about 20 percent of the deactivation work had been completed as of April 2021. According to a DOE project assessment, despite the delays in the deactivation work necessary to begin demolition work, the project is expected to be completed within its approved project cost and critical decision 4 completion date.

Project Issues, Risks, or Opportunities

The issues the project has faced or currently faces includes the following:

- The project has experienced schedule delays resulting from the suspension of deactivation activities due to COVID-19 safety measures. Deactivation activities include removing equipment, reducing radioactive material released to the environment, and decontamination. Because the rate of local community spread of COVID-19 was significant and deactivation activities require workers to be in close proximity, this work had to be halted until the COVID-19 risk was reduced. Deactivation activities were planned to resume in July 2021, as COVID-19 restrictions are lessened.

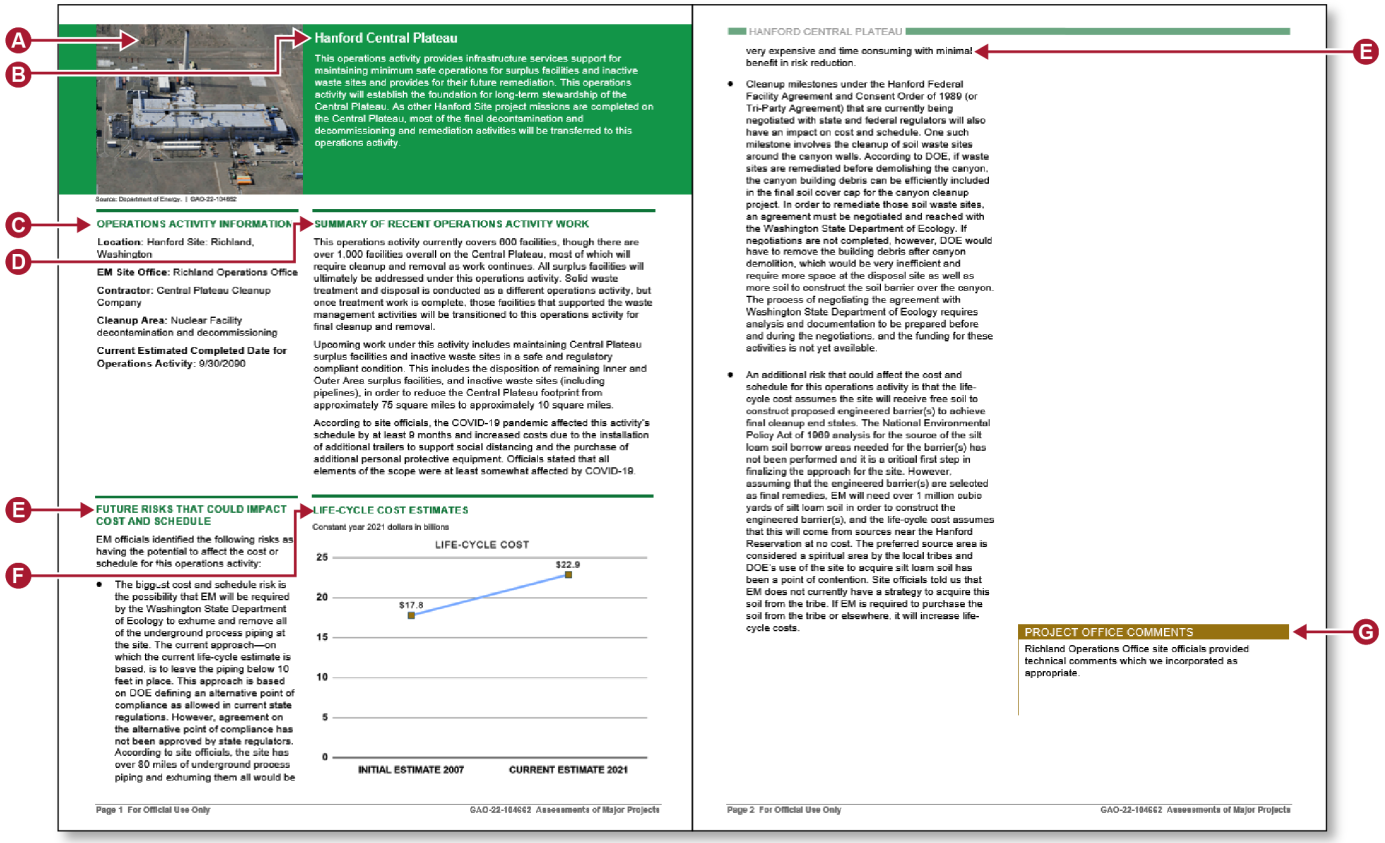
The future project risks identified by EM project officials include the following:

- EM officials also cited other potential systemic risks that cover issues the project may experience that are broader than any particular portion of the project. For example, needing a workforce with the proper level of demolition skill and experience, and the accuracy of all estimated assumptions. Including these systemic risks in the project raised the amount of DOE contingency to approximately $50 million.

PROJECT OFFICE COMMENTS

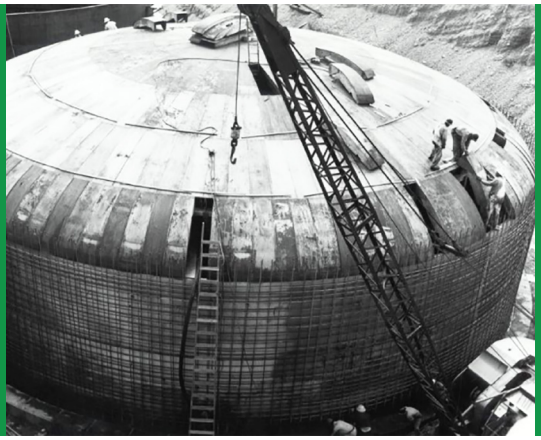
West Valley site officials provided technical comments, which we incorporated as appropriate.

Figure 3: Description of the Content of the Operations Activity Summaries



- A A photo of facilities or activities at the site related to the operations activity.
- B A description of the operations activity's scope.
- C Information on the location, site office, contractor, type of work the operations activity is part of, and the estimated completion date for the operations activity.
- D A summary of recent activities undertaken, including reaching key milestones and interactions with regulatory bodies.
- E A description of potential risks that could increase the cost and schedule for the operations activity and current or future mitigation steps that EM could take to address these risks. This section will also include issues identified with the accuracy of the life-cycle cost and schedule estimate.
- F A figure showing the life-cycle cost estimate for the operations activity when it was first created by EM and the current estimate provided by site officials.
- G Comments from the EM site office and headquarters officials regarding the operations activity.

Source: GAO analysis of Department of Energy operations activities. | GAO-22-104662



Source: Department of Energy. | GAO-22-104662

Radioactive Liquid Tank Waste Stabilization and Disposition

The scope of this operations activity includes actions required to manage and stabilize approximately 56 million gallons of radioactive and hazardous waste stored in 177 underground tanks, including waste retrieval, treatment, and disposal. Operations provide for safe storage of waste, reduce the volume of waste through evaporation, and provide laboratory and other support activities.

OPERATIONS ACTIVITY INFORMATION

Location: Hanford Site: Richland, Washington

Environmental Management (EM) Site Office: Office of River Protection (ORP)

Contractors: Washington River Protection Solutions (WRPS), Hanford Laboratory Management and Integration (HLMI)

Cleanup Area: Radioactive liquid tank waste stabilization and disposition

Current Estimated Completion Date: 9/30/2069

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

In fiscal years 2019 and 2020, several tasks necessary for operating the radioactive liquid waste stabilization and disposition program at the Hanford Site were performed. These tasks included installing infrastructure to support waste retrieval from tanks, fabricating the tank-side cesium removal system, and conducting visual inspections of tanks.

In fiscal year 2020, the contractors implemented their COVID-19 Execution Plan and Work Resumption Plans to provide a foundation for the maintenance of at least minimum safe operations during the COVID-19 pandemic. At the same time, the contractor established a roadmap for a controlled and deliberate increase in operations where possible, considering COVID-19 requirements, contractual guidance, and federal or state restrictions. The effectiveness of COVID-19 controls was closely monitored by ORP to support the contractors, in alignment with the Work Resumption Plan, while maintaining the safety and health standards established for Hanford Site operations. By September 30, 2020, all contractor staff with nonportable work had returned to support on-site activities. This enabled the contractor to continue to ensure that feed for the Waste Treatment and Immobilization Plant (WTP) from the underground tanks remains on track.

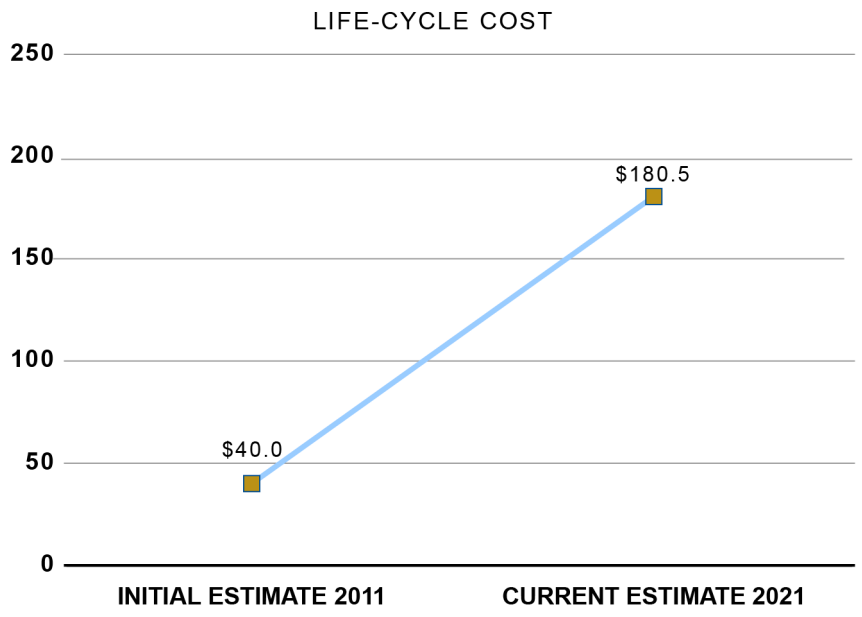
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- According to EM officials, legal requirements in the Tri-Party Agreement (TPA) do not take funding

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



limitations into account.[44] These officials stated that the TPA's requirements are not feasible in light of the annual funding that would be required to meet the planned schedule. Within the analysis of alternatives (AOA) for high-level waste treatment at the WTP, EM is including different funding scenarios for the liquid waste processing mission. The AOA includes alternatives that have both constrained and unconstrained funding scenarios, along with different treatment alternatives.

- According to site officials, revised assumptions resulting from the System Plan 8 implementation and projected delays in key project activities will have significant cost and schedule effects for completing the overall mission.[45] In order of magnitude, the key effects include

  (1) extending WTP Operations duration and revising the operations estimate basis;

  (2) direct impacts resulting from the delay in WTP Operations startup from 2018 to 2033. These impacts include lifecycle delays and the corresponding escalation of costs resulting from the delays, supplemental treatment of waste in support of Direct Feed Low Activity Waste, and extended Tank Farm Operations through completion of the WTP mission;

  (3) updates to the Supplemental Low Activity Waste (LAW) Facility estimate based on the latest construction and operations information available from the System Plan 8, which was revised on the basis of an analysis of the actual costs of constructing the WTP LAW Facility; and

  (4) addition of a Tank Waste Characterization and Staging facility, which is required to support high-level waste processing at the WTP.

PROJECT OFFICE COMMENTS

Excellent progress is being made through the collaborative process of the AOA and System Planning in which DOE Hanford is working with stakeholders to find the best solutions for waste treatment for the tank waste that will most effectively reduce tank waste risk while meeting both fiscal and legal requirements. Part of those alternatives include opportunities to accelerate the low-activity waste mission through other than glass technologies, as well as opportunities to pretreat/condition tank waste in facilities other than the WTP Pretreatment facility.

[44]Hanford Federal Facility Agreement and Consent Order of 1989 (or Tri-Party Agreement) is an agreement among DOE, the Environmental Protection Agency, and the Washington State Department of Ecology that lays out a series of legally enforceable milestones for completing major activities in Hanford's waste treatment and cleanup process.

[45]Department of Energy, Office of River Protection, *River Protection Project System Plan,* ORP-11242 Revision 8 (Richland, WA: October 2017). System Plan 8 is a computer modeling exercise, which evaluates a set of 11 technical scenarios and provides rough cost and schedule estimates for completing the tank waste retrieval and closure mission at the Hanford Site.

Source: Department of Energy. | GAO-22-104662

Hanford Central Plateau

This operations activity provides infrastructure services support for maintaining minimum safe operations for surplus facilities and inactive waste sites and provides for their future remediation. This operations activity is to establish the foundation for long-term stewardship of the Central Plateau. As other Hanford Site project missions are completed on the Central Plateau, most of the final decontamination and decommissioning and remediation activities are planned to be transferred to this operations activity.

OPERATIONS ACTIVITY INFORMATION

Location: Hanford Site: Richland, Washington

Environmental Management (EM) Site Office: Richland Operations Office

Contractor: Central Plateau Cleanup Company

Cleanup Area: Nuclear Facility decontamination and decommissioning

Current Estimated Completed Date for Operations Activity: 9/30/2090

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

According to site officials, this operations activity currently includes active surveillance and maintenance for approximately 200 surplus facilities and approximately 650 inactive waste sites, though there are over 1,000 facilities and 800 waste sites overall on the Central Plateau, most of which will require cleanup and removal as work continues. Officials stated that solid waste treatment and disposal is conducted as a different operations activity, but once treatment work is complete, those facilities that supported the waste management activities are to be transitioned to this operations activity for final cleanup and removal.

Upcoming work under this activity includes maintaining Central Plateau surplus facilities and inactive waste sites in a safe and regulatory compliant condition. This includes the disposition of remaining Inner and Outer Area surplus facilities, and inactive waste sites (including pipelines), in order to reduce the Central Plateau footprint from approximately 75 square miles to approximately 10 square miles.

According to site officials, the COVID-19 pandemic affected this activity's schedule by at least 9 months and increased costs due to the installation of additional trailers to support social distancing and the purchase of additional personal protective equipment. Officials stated that all elements of the scope were at least somewhat affected by COVID-19.

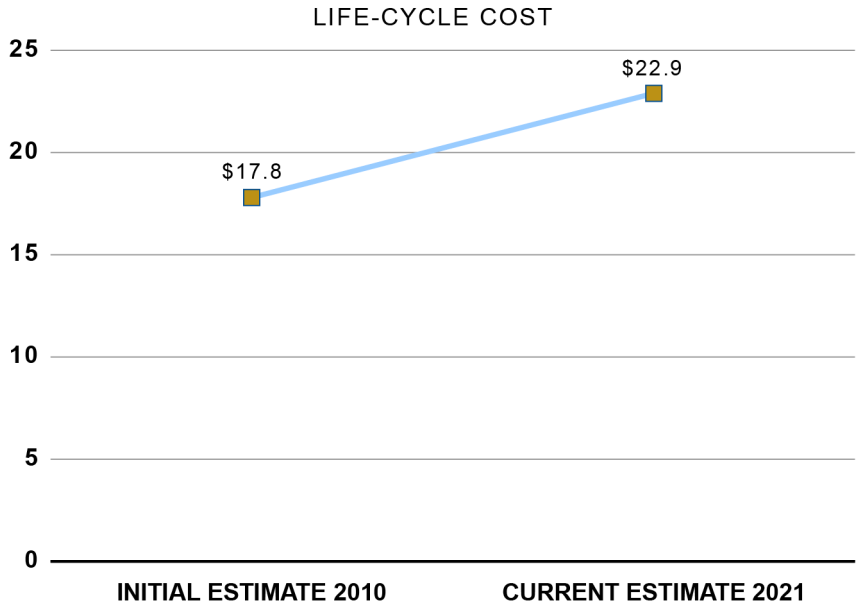
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- The biggest cost and schedule risk is the possibility that EM will be required by the Washington State Department of Ecology to exhume and remove all of the underground process piping at the site. The current approach—on which the current life-cycle estimate is based—is to leave the piping below 10 feet in place. This approach is based on the Department of Energy (DOE) defining an alternative point of compliance, but state regulators have not approved this approach. According to site officials, the site has over 80 miles of underground process piping, and exhuming them all would be very expensive and time consuming with minimal benefit in risk reduction.

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



- Cleanup milestones under the Hanford Federal Facility Agreement and Consent Order of 1989 (or Tri-Party Agreement) that are currently being negotiated with state and federal regulators will also have an impact on cost and schedule. One such milestone involves the cleanup of soil waste sites around the canyon walls. According to DOE, if waste sites are remediated before demolishing the canyon, the canyon building debris can be efficiently included in the final soil cover cap for the canyon cleanup project. If DOE has to remove the building debris after canyon demolition, it would be very inefficient and require more space at the disposal site, as well as more soil to construct the soil barrier over the canyon. The process of negotiating this cleanup milestone requires analysis and documentation and the funding for these activities is not yet available.
- An additional risk that could affect the cost and schedule for this operations activity is that the life-cycle cost assumes the site will receive free soil to construct proposed engineered barrier(s) to achieve final cleanup end states. Assuming that the engineered barrier(s) are selected as final remedies, EM will need over 1 million cubic yards of silt loam soil in order to construct the engineered barrier(s), and the life-cycle cost assumes that this will come from sources near the Hanford Reservation at no cost. According to site officials, the preferred source area is considered a spiritual area by the local tribes and DOE's use of the site to acquire silt loam soil has been a point of contention. Site officials told us that EM does not currently have a strategy to acquire this soil from the tribe. If EM is required to purchase the soil from the tribe or elsewhere, it will increase life-cycle costs.

PROJECT OFFICE COMMENTS

Richland Operations Office site officials provided technical comments, which we incorporated as appropriate.

Source: Department of Energy. | GAO-22-104662

Idaho Nuclear Technology and Engineering Center Infrastructure

This operations activity covers the maintenance and support operations at the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Laboratory. The Office of Environmental Management (EM) needs to conduct preventive and corrective maintenance of the facilities to support cleanup and other activities, such as spent nuclear fuel management, that are ongoing at INTEC. This operations activity includes providing the electricity and fuel oil for all of INTEC, as well as the personnel necessary for maintaining INTEC facilities, such as engineers, support personnel (quality assurance personnel, safety personnel, etc.), and management.

OPERATIONS ACTIVITY INFORMATION

Location: Idaho National Laboratory: Idaho Falls, Idaho

EM Site Office: Idaho Operations Office

Contractor: Fluor Idaho, LLC

Cleanup Category: Radioactive liquid waste stabilization and disposition

Current Estimated Completion Date: 9/30/2060

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

In fiscal years 2019 and 2020, this operations activity performed several tasks necessary for maintaining the operations of the radioactive liquid waste stabilization and disposition program at the Idaho National Laboratory. These tasks included replacing the roof at the New Waste Calcining Facility, removing the concrete batch plant near the Integrated Waste Treatment Unit, and conducting the initial phase of upgrades for INTEC's utility tunnels.

In response to COVID-19, costs were incurred to implement numerous measures to protect the workforce at INTEC. Some of these measures included upgrading facilities to provide touchless fixtures, increasing the custodial staff to support further sanitization efforts, making adjustments to workspaces to allow for social distancing, and creating temperature check stations. COVID-19-related costs that were incurred for this operations activity, through December 2021, totaled approximately $10.3 million. In addition to the COVID-19 impact on costs, certain tasks were not completed on schedule due to personnel issues stemming from quarantining, and delays in procuring needed materials.

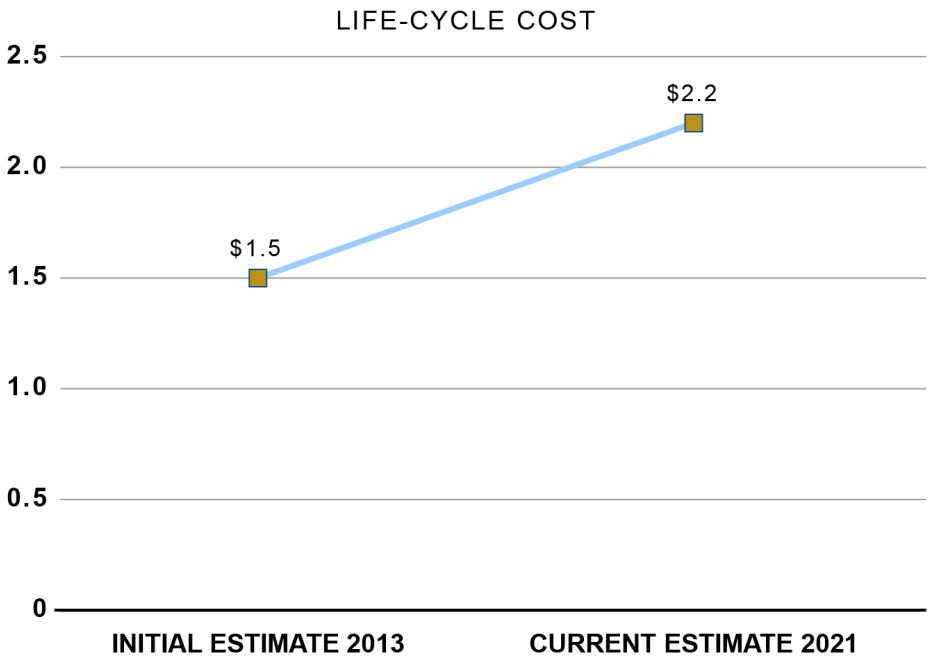
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- The most significant risk, according to officials, is for facilities, systems, equipment, and infrastructure to fail due to age or inadequate legacy maintenance practices. Many facilities at INTEC are nearing the end of their expected lifespan and site officials told us that there is insufficient funding to update facilities, systems, equipment, and infrastructure or to recover from significant system failures. Site officials also told us that they regularly review maintenance needs at INTEC and discuss how to prioritize available resources to meet their needs.

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



- The cost and schedule for the INTEC Infrastructure operations activity is driven by the programs it supports. We have reported on risks that some of these programs face, such as the Integrated Waste Treatment Unit and Calcine Waste, which could delay their completion.[46] If these programs experience delays, the cost and schedule for this operations activity would also increase, as EM would need to continue to maintain the support facilities for these programs.

PROJECT OFFICE COMMENTS

The Idaho site office provided technical comments, which we incorporated as appropriate.

[46]GAO, *Nuclear Waste Cleanup: DOE Faces Project Management and Disposal Challenges with High-Level Waste at Idaho National Laboratory,* GAO-19-494 (Washington D.C.: Sept. 9, 2019).

Source: Department of Energy. | GAO-22-104662

Los Alamos Soil and Water Remediation

The Los Alamos National Laboratory Soil and Water Remediation operations activity includes the investigation and remediation of contamination attributable to past operations and practices. The activity also includes the characterization and monitoring of surface water and groundwater at the Laboratory and approximately 888 Solid Waste Management Units (SWMU) and Areas of Concern (AOC) under the Resource Conservation and Recovery Act of 1976, as amended. These areas are left to be investigated, remediated, or closed following the evaluation of human health and ecological risks. SWMUs and AOCs at the site include areas where hazardous wastes, hazardous constituents, or solid wastes, may have been disposed.

OPERATIONS ACTIVITY INFORMATION

Location: Los Alamos National Laboratory: Los Alamos, New Mexico

Environmental Management (EM) Site Office: Los Alamos Field Office

Contractor: Newport News Nuclear BWXT Los Alamos, LLC

Cleanup Category: Soil and groundwater remediation

Current Estimated Completion Date: 9/30/2031

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

EM is continuing its efforts to address a chromium plume in the groundwater on the site using multiple methods to control the migration of the plume and reduce its footprint, such as pumping out water for treatment and injecting it back into the aquifer. While these interim measures are in place, EM is gathering additional data to characterize the extent of the groundwater contamination so that a final remedy can be agreed to with the New Mexico Environment Department.

EM has a variety of ongoing cleanup actions to address the 888 SWMUs and AOCs on the site. For example, on the portion of the site that hosted Cold War-era plutonium processing facilities—Technical Area 21— EM is in the planning process for removal of buried piping and contaminated soil as well as the demolition of remaining facilities. EM has placed 134 of the 888 SWMUs and AOCs in deferred status because the sites are actively in use or are underneath existing buildings. According to EM officials, more SWMUs and AOCs will be added in 2022 and placed in this deferred category because they are located in the town of Los Alamos.

Recently, EM has also accelerated sampling work in Technical Area 16, so that remediation work in this area can be completed and the National Nuclear Security Administration (NNSA) can begin construction of a new fire station.

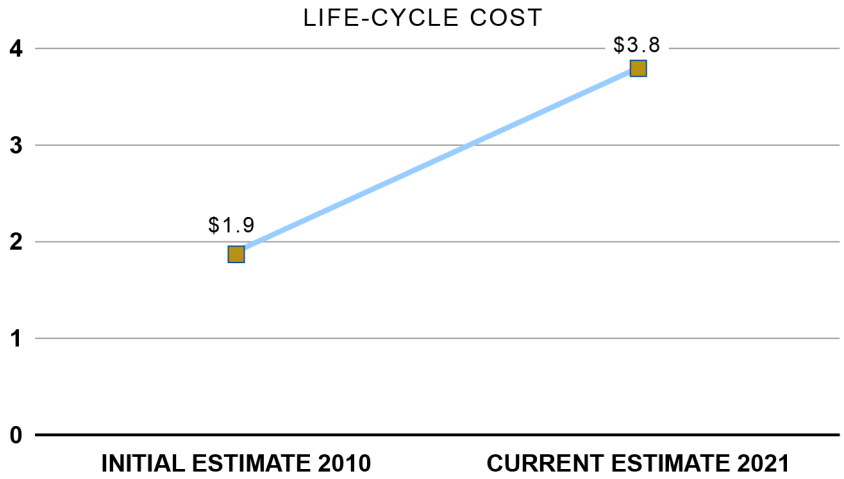
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- EM officials at the site told us that they do not currently have an updated life-cycle cost estimate for this operations activity, in part, because there have been changes to the management of cleanup work at the site. The changes include the standing up of the EM field office in 2015 and the establishment of a separate cleanup contractor in 2018. These officials stated that they are in the process of updating the life-cycle estimates for all portions of cleanup at the site and that this will include updated cost and schedule estimates.
- EM has established cleanup campaigns for large portions of the site

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



Note: The life-cycle cost estimates in this figure represent the costs for all cleanup activities at the site. The life-cycle costs for the soil and water remediation operations activity are part of this total, however, EM officials were unable to provide a specific breakout of costs for this operations activity.

where contamination is expected to be present. According to EM officials, however, there are many smaller areas scattered across the site for which work has not yet begun, and these smaller sites could be more contaminated than expected or pose challenges to sampling the groundwater. This could result in increased costs for cleanup.

- EM officials identified future transfers of site property from NNSA to nonfederal entities and possible subsequent discovery of contamination at those transferred sites as a risk. In 2020, for example, a construction crew discovered contamination in the Middle DP Road site that had been transferred from the Los Alamos National Laboratory to Los Alamos County. EM then had to conduct additional sampling and cleanup work at the Middle DP Road site to ensure that it was safe for construction to continue. EM officials stated that there is a process for verifying that all cleanup requirements have been met on a site prior to its transfer, but the risk that additional contamination could be discovered still exists.

- According to EM officials, having sufficient funding to address all portions of the cleanup mission at the site has been a problem in the past and could be so again in the future. For example, following a large wildfire that threatened Los Alamos, New Mexico's Governor negotiated with the Department of Energy for a reprioritization of cleanup activities at Los Alamos National Laboratory to focus first on transuranic waste stored above ground that was threatened by potential future wildfires. According to EM site officials, this change in priorities pulled funds away from cleanup work on most of the SWMUs and AOCs. As a result, when work resumed on the SWMUs and AOCs, the contractors performing the work had to be remobilized, and EM officials told us that some contractors were wary of bidding on the work because of the prior work interruption. EM officials stated that this work could be interrupted again in the future, if other cleanup work at the site, such as solid waste management or deactivation and decommissioning of facilities, becomes a higher priority and annual funding remains limited

- EM officials stated that the life-cycle estimates for cleanup at Los Alamos do not include estimates for deactivation and decommissioning of contaminated facilities currently operated by NNSA. Officials also stated that once NNSA declares these facilities to be excess facilities, EM will then be responsible for their cleanup and removal, and the cost for doing so will increase the site's life-cycle cost estimate for cleanup.

- EM officials stated that ongoing efforts by New Mexico to enforce, terminate, and replace the Compliance Order on Consent between DOE and the state, which addresses cleanup of legacy hazardous and mixed waste at the site, could introduce additional costs to EM in the form of new fines and penalties that would be tied to cleanup milestones in a potential future legal agreement between the two entities.

PROJECT OFFICE COMMENTS

Los Alamos site officials provided technical comments, which we incorporated as appropriate.

Source: Department of Energy. | GAO-22-104662

Moab Uranium Mill Tailings Project

The scope of the work for the Moab Uranium Mill Tailings Project includes transporting mill tailings and debris to the Crescent Junction (CJ) disposal cell, primarily via rail. Under the Uranium Mill Tailings Radiation Control Act of 1978, as amended, "tailings" are the remaining portion of a metal-bearing ore after some or all such metal, such as uranium, has been extracted. This operations activity also includes construction of an engineered disposal cell and disposal cell cover; active groundwater remediation, including freshwater injection and extraction of contaminated water; and demolition and disposal of site infrastructure and equipment.

OPERATIONS ACTIVITY INFORMATION

Location: Grand County, Utah

Environmental Management (EM) Site Office: Moab

Remedial Action Contractor: NorthWind Portage Inc.

Technical Assistant Contractor: S&K Logistics Services

Cleanup Area: Soil and groundwater remediation

Current Estimated Completion Date: 9/30/2034

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

EM currently has two contractors to perform the work related to the Moab Uranium Mill Tailings Project. The Remedial Action Contractor is responsible for constructing the CJ disposal cell; transporting tailings to the CJ disposal cell; placing the tailings in the cell; and handling the day-to-day operations and maintenance at the Moab and CJ sites. The Technical Assistance Contractor provides technical and administrative support services to EM, operates the groundwater interim remedial action system, conducts environmental compliance and air monitoring activities, and performs radiological surveys in the vicinity of the site.

In fiscal year 2021, the Remedial Action Contractor excavated, transported, and disposed of 1 million tons of mill tailings. This contractor also expanded the CJ disposal cell by 1,256,000 cubic yards, and added over 20,000 cubic yards of soil and rock cover to the disposal cell. During this period, the Technical Assistance Contractor performed the planned interim remedial action to address groundwater contamination at the Moab site, including extracting 4 million gallons of contaminated groundwater and injecting 6.5 million gallons of freshwater (diverted river water) into wells to minimize the discharge of ammonia to the Colorado River.

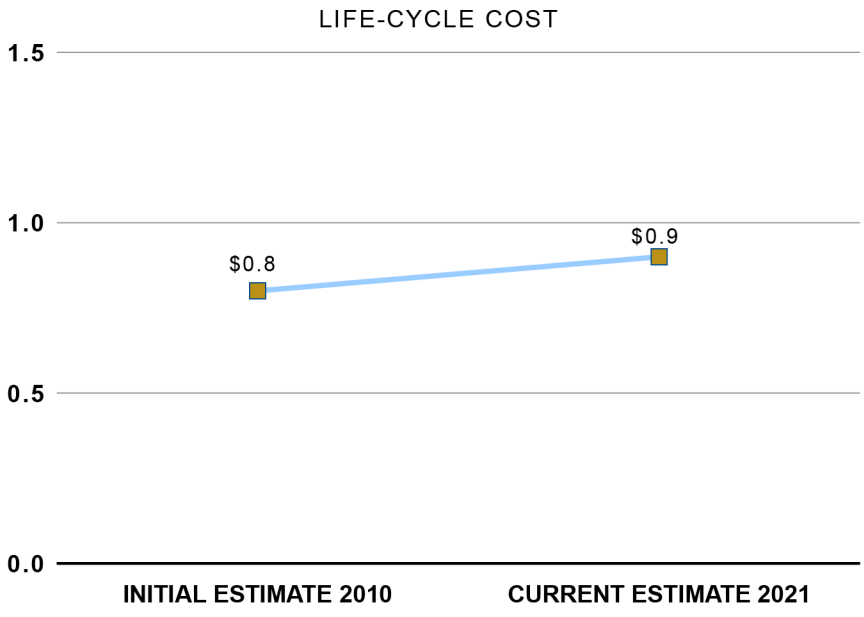
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- The most significant risk, according to EM officials, is the possibility of increased amounts of tailings or residual radioactive material. The current cleanup plan is based on the assumption that EM will remove all above-grade tailings. The likelihood of below-grade contamination is currently unknown, but EM has plans to conduct drilling to evaluate potential below-surface contamination. EM officials told us that that regulatory standards require that below-surface radium content must not exceed 5 picocuries per gram for the top 15 centimeters of soil after cleanup. If there is below-surface contamination that requires

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



further cleanup, there could be significant impacts to cost and schedule.

- Another risk involves the decision on the future use of the Moab site. The site office has the obligation to clean up the site sufficiently to turn it over to legacy management for long-term monitoring. Officials stated that they have developed a closure integrative project team to determine the future use for the land. The local community has suggested various end uses for the land, including community recreational and residential uses. Approval of such uses could require additional cleanup and result in increased costs and schedule impacts. Since the full extent of contamination under the existing tailings pile is unknown, the integrative project team has discussed placing a cover over the entire site.
- EM site officials that we interviewed told us that the project team has also discussed the benefits of building a groundwater treatment system. The current groundwater treatment approach is to extract the contaminated water that is used to control dust during the tailings removal process. If EM is unable to clean up the groundwater sufficiently before project completion, an extended groundwater treatment system will be needed. This groundwater remedy would add additional cost. EM officials said that, in August 2021, the project team will begin work on the groundwater compliance action plan, which will detail how EM will address groundwater cleanup.

PROJECT OFFICE COMMENTS

The Moab UMTRA Project is making excellent progress towards cleanup of the remaining four million tons of residual radioactive material. An Integrated Project Team (IPT) has been formed including outside stakeholders to help define what final site closure looks like. The biggest effort of the IPT is to define the Groundwater Compliance Action plan.

Source: Department of Energy. | GAO-22-104662

Oak Ridge Nuclear Facility Deactivation and Decommissioning-Y-12

This operations activity includes surveillance and maintenance of the excess facilities awaiting future deactivation and decommissioning (D&D) at the Y-12 National Security Complex-(Y-12) and two related activities. This activity also includes management of the water resources restoration program, which monitors groundwater and surface water to assess the effectiveness of cleanup actions. The water resources restoration program encompasses the entire Oak Ridge Reservation. Operation of the Environmental Management Waste Management Facility (EMWMF) low-level waste disposal site at Oak Ridge, and several other landfills, are also included in the scope of this operations activity.

OPERATIONS ACTIVITY INFORMATION

Location: Oak Ridge Reservation: Oak Ridge, Tennessee

Environmental Management (EM) Site Office: Oak Ridge Office of Environmental Management

Contractor: URS/CH2M Hill Oak Ridge

Cleanup Category: Nuclear facilities deactivation & decommissioning

Current Estimated Completion Date: 9/30/2045

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

The two most prominent aspects of this activity undertaken over the last 2 years are the operations of landfills on the Oak Ridge Reservation, including the EMWMF, and the water resources restoration program. EM operates multiple landfills at the site that each accept different waste streams, including low-level radioactive waste, industrial waste, facility demolition debris, and hazardous waste. These landfills accept waste from multiple cleanup efforts, including from the demolition projects at the East Tennessee Technology Park and the Biology Complex at Y-12. According to site officials, the water resources restoration program continued its efforts to collect data on groundwater and surface water.

The work conducted under this operations activity supports a larger D&D effort, referred to as the Oak Ridge Integrated Facilities Disposition Program. The majority of D&D work conducted at Y-12 is part of this separate operations activity; however, EM does remove smaller buildings at the site as part of this operations activity's surveillance and maintenance work.

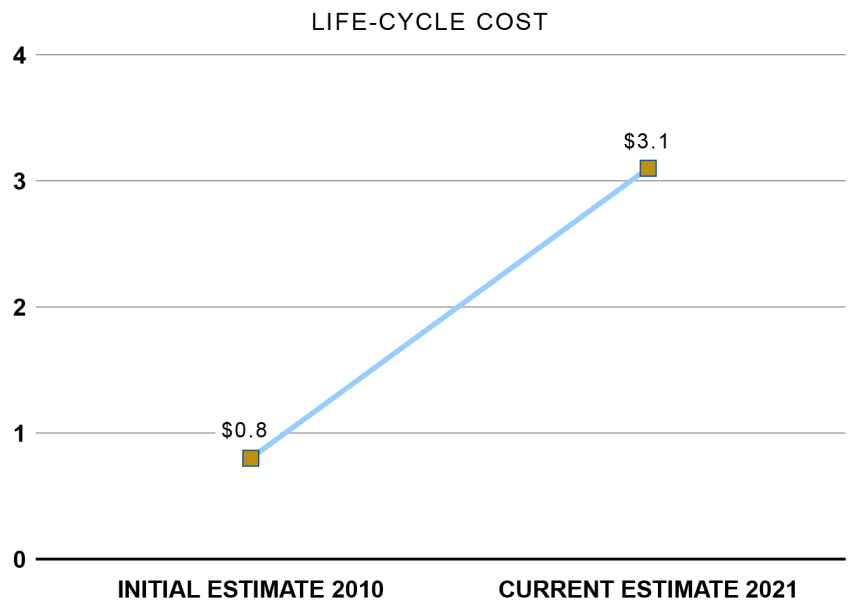
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- The largest risk to this operations activity comes from delays to the deactivation and decommissioning of facilities at Y-12. Any delays to this work will result in cost and schedule overruns because support activities, such as surveillance and maintenance and waste disposal, will need to continue for a longer period.
- Potential delays in completing a new On-Site Waste Disposal Facility capital asset project also pose a risk to this operations activity. EM officials stated that the EMWMF will be full before D&D work is completed and additional low-level waste disposal space will be needed. The On-Site Waste Disposal Facility has already experienced delays in the regulatory review process, though EM officials stated

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



that they still expect the facility to be available by the time additional disposal space is needed. EM officials also said that they can sequence D&D activities based on the estimated availability of disposal space so that low-level waste will only be generated when disposal space is available.

PROJECT OFFICE COMMENTS

Oak Ridge Reservation site officials provided technical comments, which we incorporated as appropriate.

Source: Department of Energy. | GAO-22-104662

Paducah Gaseous Diffusion Plant Decontamination and Decommissioning

The Paducah Gaseous Diffusion Plant Decontamination and Decommissioning operations activity includes deactivation, remediation, and operations work. The deactivation work includes the removal of equipment at the C-400 Cleaning Building and at the C-333 Process Building. The scope of the remediation work includes the C-400 Complex Operable Unit Remedial Investigation fieldwork, conducting a feasibility study, and final remedial actions. The operations work includes general activities, such as project management support, utility operations and optimization, waste operations, landfill operation, pump and treat operations, environmental monitoring and surveillance, and maintenance.

OPERATIONS ACTIVITY INFORMATION

Location: Paducah, Kentucky

Environmental Management (EM) Site Office: Portsmouth/Paducah Project Office (PPPO)

Site Contractor: Four Rivers Nuclear Partnership, LLC (FRNP)

Cleanup Area: Nuclear facilities decontamination and decommissioning

Current Estimated Completed Date for Operations Activity: September 30, 2070

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

According to EM officials, key activities completed over the last two fiscal years include equipment removal at the C-400 Cleaning Building, some deactivation activities for the C-333 Process Building, partial disposition of R-114, deactivation of the C-533 Switchyard, and the demolition and disposition of 33 excess trailers/facilities. Current ongoing work includes completing deactivation of the C-400 Cleaning Building and continued deactivation of the C-333 Process Building.

Upcoming work includes disposition of out-of-service trailers and storage sheds, optimization and reduction of surveillance and maintenance costs by minimizing the overall size/footprint of occupied facilities, completion of the remedial investigation and feasibility study for the C-400 Operable Unit, and initiation of the final remedial actions.

EM officials told us that Paducah operations have incurred $26 million in COVID-19 costs across the site as of July 2021. However, officials stated that schedule impacts have been minimal and that schedule slip due to COVID-19 impacts has been recovered.

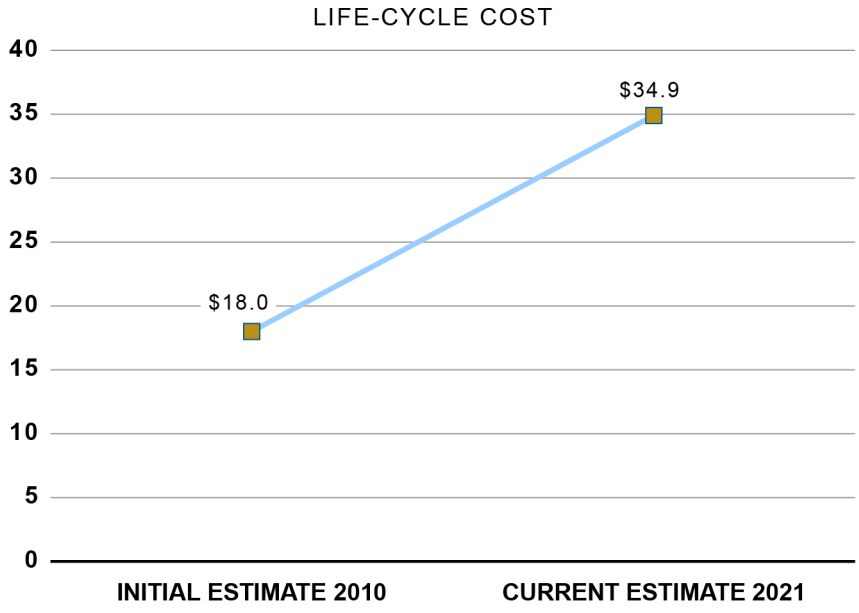
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- The lifecycle cost for this operation has increased from $18 billion to $34.9 billion and the lifecycle schedule was extended from 2019 to 2070. Project officials stated that these increases were the result of several issues stemming from the original project baseline. The original $18 billion was based on estimates from the U.S. Army Corps of Engineers for Paducah's cleanup in 2006, and that value was derived from the limited knowledge of a similar demolition project that had just began at the Oak Ridge site. Since then, operation costs and schedule have been rebaselined to better reflect the actual costs of

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



cleanup, based both on work that has been completed to date at Paducah and on additional experience with demolition projects at the Oak Ridge and Portsmouth sites.

- According to officials, the rebaselining was based on an assumption of escalated funding. PPPO integrates and coordinates planning and budget support for EM activities at both the Portsmouth and Paducah sites. Because both sites draw their cleanup funding through PPPO funding, Paducah site officials stated that they believe that, based on the assumption that PPPO funding would remain constant, funding for the Paducah site would increase because the Portsmouth site will need less funding as its cleanup mission nears completion.

- Site officials said that they are conducting a remedial investigation under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, regarding the C-400 facility that should continue until April 2022. The completion of this remedial investigation will result in a feasibility study that identifies potential remedies for the site, which will likely vary based on the underground distance that needs to be treated. According to DOE officials, this study will refine prior estimates of planned remedial actions. The magnitude of the impact on these estimates will vary based on the type and extent of potential remedial actions listed in the feasibility study. For example, changes to the size of the treatment area could produce cost impacts in the tens of millions.

- Officials stated that the majority of buildings—roughly over 200 facilities—still need to undergo decontamination and decommissioning. There will likely be five buildings for which decontamination and decommissioning will cost over $50 million each, marking them as capital asset projects under the Department of Energy's Order 413.3B. The facilities are: C-331, C-333, C-335, C-337, and C-720.

PROJECT OFFICE COMMENTS

Paducah site officials stated that progress is on track for the remediation of the C-400 Chemical Cleaning Facility Complex. The investigation has been completed, and data are being evaluated with the regulatory agencies to complete the evaluation of remedies that will establish the future cleanup plans for this complex. Disposition of smaller facilities that are no longer needed continues, helping to reduce site risk and maintenance costs. Deactivation of the C-333 building is underway, while also developing processes and installation of systems for the characterization and disposition of thousands of tons of uranium enrichment equipment to facilitate future building demolition. These processes and systems are being established using lessons learned from the Portsmouth site and other applicable EM sites. Project leaders continuously look for ways to streamline and integrate the deactivation, demolition, and environmental remediation efforts to achieve a less costly and safe cleanup end state for the Paducah Site.

Source: Department of Energy. | GAO-22-104662

Portsmouth Gaseous Diffusion Plant Decontamination and Decommissioning

The Portsmouth Gaseous Diffusion Plant Decontamination and Decommissioning work includes remedial actions to address contamination resulting from the plant's historical uranium enrichment operations, facility decontamination and decommissioning, and surveillance and maintenance activities at the Portsmouth Gaseous Diffusion Plant. Also included in the scope are support activities, such as utilities operations, infrastructure support, land transfer, developing plans and procedures, groundwater treatment, and maintaining permits.

OPERATIONS ACTIVITY INFORMATION

Location: Piketon, Ohio

Environmental Management (EM) Site Office: Portsmouth/Paducah Project Office (PPPO)

Site Contractor: Fluor- BWXT Portsmouth LLC

Cleanup Area: Nuclear facilities decontamination and decommissioning

Current Estimated Completed Date for Operations Activity: 9/30/2043

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

Portsmouth Gaseous Diffusion Plant Decontamination and Decommissioning includes deactivation and decommissioning for uranium processing buildings as well as the demolition of unused facilities. This work involves preparing the uranium processing buildings for demolition, including removing high-risk radioactively contaminated equipment and hazardous materials from the buildings. According to EM officials, work completed within the last 2 fiscal years includes: removal of asbestos-containing materials from the X-326 processing building and completion of the X-622-1 water treatment system. With the start of the demolition of the X-326 building as a separate capital asset project in May 2021, operations will focus on deactivation of the next processing building, X-333.

EM officials told us that Portsmouth has incurred $58.3 million in COVID-19 costs across the site as of June 2021.

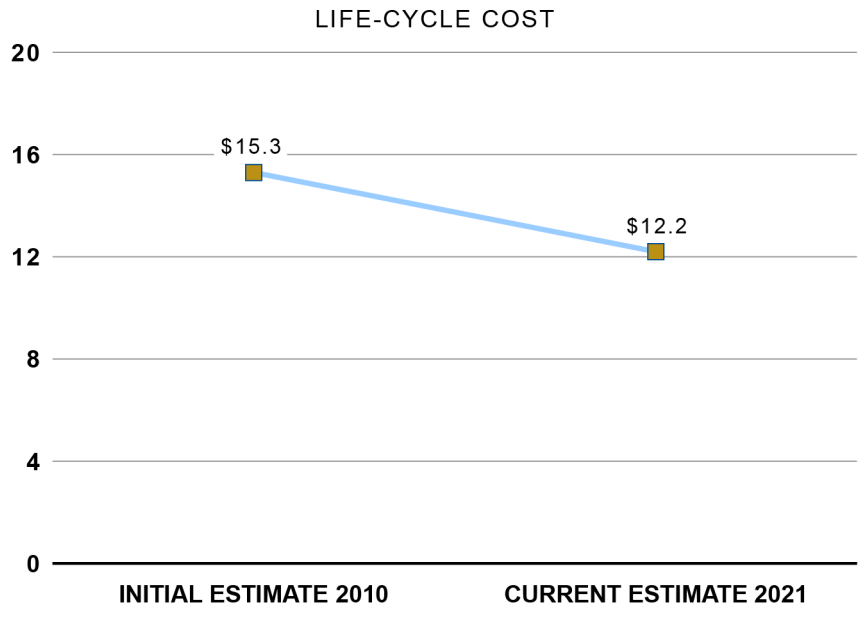
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- Site officials identified the possible release of contamination to the public as a significant risk because the site is currently engaged in open-air demolition of a former uranium enrichment facility. While the facility has been deactivated and radiologically downgraded, there is still radiological contamination present. According to site officials, demolition is proceeding using best practices and lessons learned to control and immobilize contamination. A monitoring network is also in place to detect any release at the work site before it approaches a site boundary. If a release occurs, EM would shut down the project while the cause is being

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



evaluated, and a new path forward identified. In the worst-case scenario, the site may need to clean up additional properties.

- According to site officials, another risk is having the funding to transfer of equipment and staff from one decontamination or demolition project to another without demobilizing and remobilizing, in order to create cost savings. The challenge to achieving this transfer is that the budget is not being enacted as a multiyear budget and is often enacted after the beginning of the fiscal year. Funding for the site work is often provided through continuing resolutions, which is typically different than the requested amount. Funding provided by a continuing resolution requires the site to replan the near-term activities.

PROJECT OFFICE COMMENTS

There is a continued focus on completion of X-326 process building demolition, soil excavation to support waste placement, X-333 Process Building deactivation, and the On-Site Waste Disposal Facility (CAP-2) infrastructure and cell preparation project. Additionally, the site Infrastructure Support Services Contract was awarded to North Wind Dynamic, LLC, and a 45-day transition period will proceed in January 2022. Finally, the Fluor-BWXT Portsmouth LLC contract extension was completed to extend the contract by 12 months from March 29, 2021 through March 28, 2022 with an option to exercise two 6 month options.

Source: Department of Energy. | GAO-22-104662

Savannah River Radioactive Liquid Waste Stabilization and Disposition

This operations activity covers the liquid waste program at the Savannah River Site (SRS), which seeks to treat and dispose of legacy high level and low-level waste. As of July 2021, there were 43 storage tanks that contained approximately 35 million gallons of salt and sludge waste at SRS. To address this waste, EM constructed the Salt Waste Processing Facility (SWPF), Defense Waste Processing Facility (DWPF), and Saltstone Production Facility. Each facility treats portions of the waste to be disposed of as either (1) vitrified high-level waste, which must be stored while awaiting the development of a permanent repository, or (2) solid low-level waste disposed of on site in the Saltstone Disposal units.

OPERATIONS ACTIVITY INFORMATION

Location: Savannah River Site: Aiken, South Carolina

Environmental Management (EM) Site Office: Savannah River Operations Office

Contractor: Savannah River Mission Completion

Cleanup Category: Radioactive liquid tank waste stabilization and disposition

Current Estimated Completion Date: 9/30/2040

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

EM reached a key milestone for this operations activity with the start of operations at the SWPF in October 2020.

According to EM officials, other key activities completed in fiscal year 2021 at SRS include: constructing a fourth melter for vitrification of waste at the DWPF, processing waste sent from the SWPF to the DWPF, and implementing a new process to address problems with foam forming during waste treatment at the DWPF. In addition, EM officials told us they have done work to demonstrate that the canisters it uses to store vitrified high-level waste can be double-stacked in the second glass-waste storage building at SRS. Because there is currently no permanent repository for disposing of high-level waste, EM needs to double-stack the canisters to make more efficient use of its existing storage facilities at SRS. EM officials told us that if they can double-stack canisters in the second glass-waste storage building, they should no longer need to construct a third storage facility at SRS.

EM officials told us that, through November 2021, SRS experienced approximately $23.3 million in unexpected costs related to implementing COVID-19 safety protocols.

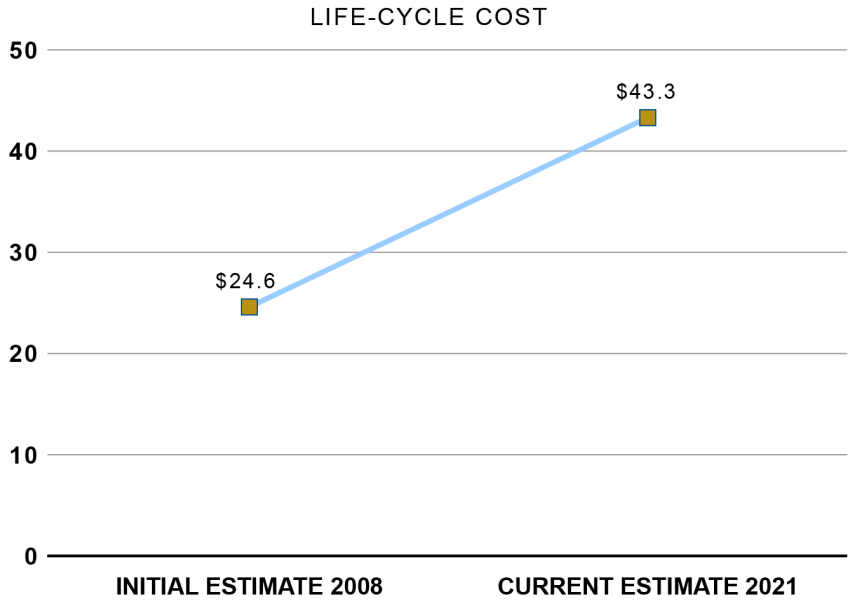
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- The most significant risk, according to officials we interviewed, is the failure of aging infrastructure and equipment. The DWPF, in particular, has been operating since 1996 and uses multiple components that currently require maintenance or will need to be replaced in the near future. EM officials at SRS stated that they have an infrastructure maintenance plan, but that it cannot fully mitigate the risks of infrastructure or equipment failure.
- There are two potential risks related to removing waste from storage tanks. First, EM has already experienced problems with nonsoluble waste found in the salt dissolution process, which

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



slowed the agency's progress in retrieving waste from the storage tanks. EM plans to compensate for the slowdown in waste retrieval by removing waste from multiple tanks simultaneously in order to produce a sufficient waste feed for the SWPF. Second, EM has only limited experience with removing residual sludge waste, called heels, from the bottom of storage tanks—a difficult process to perform where issues could result in cost and schedule impacts.

PROJECT OFFICE COMMENTS

The entire liquid waste system is operational with the start of operations of the SWPF. The SWPF processed over 2 million gallons of waste in fiscal year 2021. Assembly of the fourth melter, which is part of the vitrification system for the DWPF, is complete. A new antifoam has been introduced into the DWPF addressing problems with foam carryover during processing. Plans are in development to initiate double stacking operations in glass waste storage building 2, eliminating the need for a third storage facility.

Source: Department of Energy. | GAO-22-104662

Carlsbad Waste Disposal Facility Operations

This operations activity includes all activities necessary for the disposal of specified transuranic waste at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. This includes (1) mining, waste handling, and the maintenance and repair of infrastructure to safely maintain the WIPP facility in compliance with all federal and state laws and regulations; and (2) monitoring and verifying the performance of the WIPP facility to ensure that the Department of Energy (DOE) remains in compliance with the certification issued by the Environmental Protection Agency. This operations activity also covers support provided by the Los Alamos National Laboratory and the Sandia National Laboratories for the development of the Annual Transuranic Waste Inventory Report, Performance Assessment work, and other activities.

OPERATIONS ACTIVITY INFORMATION

Location: Waste Isolation Pilot Plant: Carlsbad, New Mexico

Environmental Management (EM) Site Office: Carlsbad Field Office

Contractor: Nuclear Waste Partnership (site contractor), Navarro Research and Engineering (technical support to the Carlsbad Field Office)

Cleanup Category: Operate waste disposal facility

Current Estimated Completion Date: 12/31/2050

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

After restarting waste disposal activities at WIPP in 2017, EM has worked to increase the number of waste shipments disposed of each year, according to EM officials. In fiscal year 2019, WIPP disposed of 292 waste shipments. However, in fiscal year 2020, this number decreased to 192 waste shipments due, in part, to the COVID-19 safety precautions put into place at WIPP and the DOE sites that ship waste to WIPP, according to EM officials. These same precautions carried over into fiscal year 2021, resulting in WIPP disposing of 199 waste shipments as of September 30, 2021.

In order to increase the number of waste shipments per year disposed of at WIPP in the future, EM is constructing a new ventilation system. This project, however, has experienced delays, leading EM to restart ventilation equipment that was shut down after a radiological accident in the underground portion of the WIPP facility in 2014. By restarting this equipment, EM hopes to provide sufficient ventilation in the underground portion of the WIPP facility, which would allow for an increase in the number of workers and pieces of equipment working underground prior to and until the completion of the new ventilation system which will replace the existing ventilation equipment that was restarted.

EM is also engaged with state and federal regulators regarding several proposals, including the mining of additional waste disposal areas.

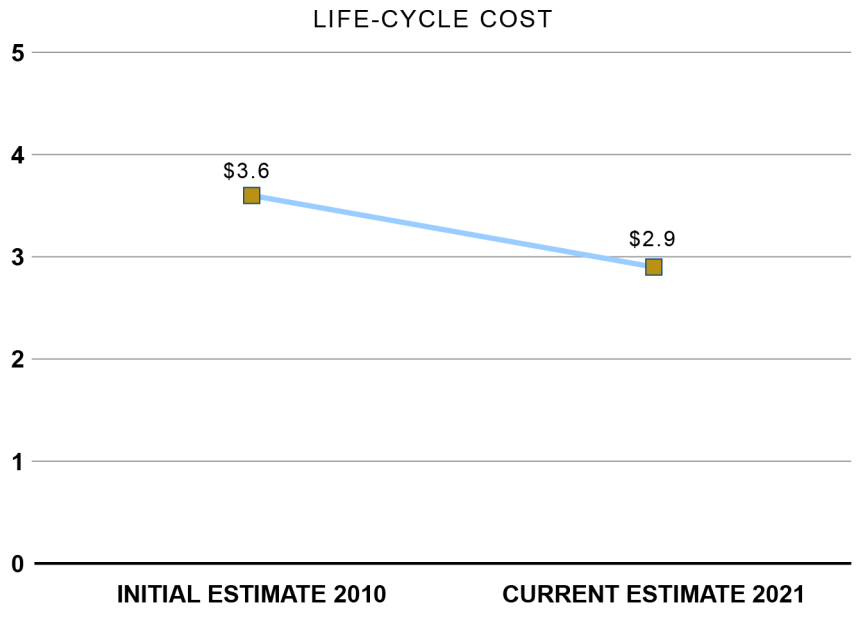
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- The life-cycle cost estimate for this operations activity has not been updated since before the radiological accident in 2014. According to officials, prior to the accident, EM estimated that the cost of this operations activity was approximately $12.5 billion, with a completion date of fiscal year 2055. After the accident, EM chose not to complete the approval process for the update to the life-cycle estimate. As of December 2021, EM officials were still in the process of updating the life-cycle estimate for this operations activity and expect to complete the estimate in 2022. According to EM officials, they expect the cost estimate to be higher

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



than the $12.5 billion they previously estimated, due to changes in WIPP operations after the 2014 accident.

- There are several risks related to the failure to obtain regulatory approval of activities that EM plans to conduct at WIPP in the future. For instance, EM officials estimate that the existing waste disposal space at WIPP will be full by 2025 and that there are significant quantities of waste that will still require disposal. In order to increase the amount of disposal space at WIPP, EM will need approval from both the Environmental Protection Agency and the New Mexico Environment Department. We have reported that these approvals may not come in time to prevent an interruption to disposal operations at WIPP.[47] Delays in completing the approval process, or if this approval is not given, have the potential to significantly impact the cost and schedule of this operations activity.
- EM officials identified that there is a potential risk that their plans for using additional shielded containers may not receive the necessary approvals. EM has submitted designs for four additional shielded container types (beyond the one approved shielded container design currently being used) for disposing of a more radioactive category of transuranic waste, referred to as “remote-handled waste”. If these shielded containers are approved for use, this could reduce the life-cycle cost and schedule for this operations activity, according to EM officials. Shielded containers can be disposed of on the floors of the underground disposal rooms instead of requiring the more time-consuming process of disposing of the waste in boreholes in the walls of the rooms.
- Although EM restarted waste disposal operations at WIPP in 2017, we reported in 2020 that it had not yet restarted the disposal of remote-handled waste in boreholes in the walls of the underground disposal rooms. Even if additional shielded containers are approved, approximately 10 percent of remote-handled waste needs to be disposed of using the borehole method. According to EM officials, if they are unable to resume borehole disposal of remote-handled waste in the near future, the cost and schedule estimate for this operations activity could be affected, and the delays could prevent some DOE cleanup sites from meeting their legally enforceable deadlines because WIPP will not be able to accept their waste in a timely fashion.

There are several current risks related to the operation of the WIPP facility. Officials highlighted four of the largest areas of concern:

- The hoist that carries waste into the underground could break down, resulting in the suspension of waste disposal operations.
- A rock fall in the accessible areas of the WIPP underground could result in the suspension of mining or waste disposal operations.
- The salt hoist, which carries mined salt, could malfunction, resulting in a suspension of mining.
- The fire suppression water system could malfunction, resulting in the suspension of surface operations.

PROJECT OFFICE COMMENTS

The primary mission of the Carlsbad Field Office is to protect human health and the environment by operating WIPP for safe disposal of defense-related transuranic waste and by establishing an effective system for management of transuranic waste from generation to permanent disposal. Risks to WIPP operations are continually assessed, and mitigating actions and strategies are applied to reduce overall project risks.

[47]GAO, Nuclear Waste Disposal: Better Planning Needed to Avoid Potential Disruptions at the Waste Isolation Pilot Plant, GAO-21-48 (Washington, D.C. Nov. 19, 2021).

Source: Department of Energy. | GAO-22-104662

West Valley Nuclear Facility Deactivation and Decommissioning

This operations activity includes site operations, maintenance, and the demolition of all facilities at the West Valley Demonstration Project site, including operating several facilities that are to be closed-in-place. These include the Remote Handled Waste Facility, Main Plant Process Building, State Licensed Disposal Area, Nuclear Regulatory Commission Licensed Disposal Area, and Waste Tank Farm.

OPERATIONS ACTIVITY INFORMATION

Location: West Valley, New York

Environmental Management (EM) Site Office: West Valley

Contractor: CH2MHill-Babcock and Wilcox West Valley, LLC

Cleanup Area: Nuclear facilities deactivation and decommissioning

Current Estimated Completion Date: Fiscal year 2024

SUMMARY OF RECENT OPERATIONS ACTIVITY WORK

According to EM officials, key activities completed over the last two fiscal years include demolition of the old Sewage Treatment Plant facility, restoration and waste disposition, demolition and removal of the liquid pretreatment system, Vitrification Vaults 2 and 3, and Waste Tank Farm Equipment Shelter & Condensers. Work that was to be completed in 2021 included full demolition of the Vitrification Facility.

Site officials told us that a contract modification is under review that will address changes to the contract scope of work resulting from COVID-19 restrictions stalling work on the main plant decontamination and DOE identifying other work that could be done despite those restrictions. Following this contract modification, DOE plans to negotiate a request for equitable adjustment related to COVID-19 impacts that was submitted by the contractor. Site officials expected the negotiations for the request for equitable adjustment to begin in September 2021.

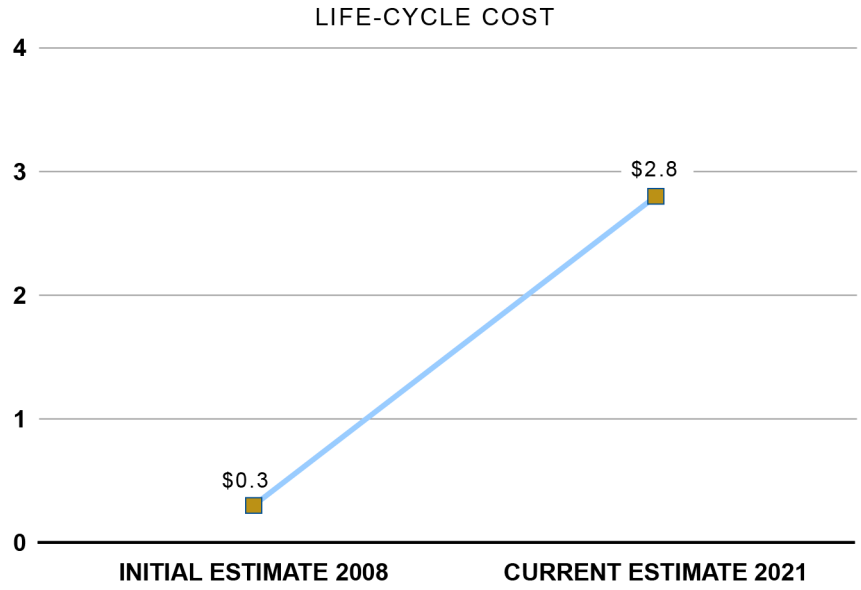
FUTURE RISKS THAT COULD IMPACT COST AND SCHEDULE

EM officials identified the following risks as having the potential to affect the cost or schedule for this operations activity:

- As we previously reported, the remaining cleanup of the West Valley Demonstration Project site includes approximately $1 billion in environmental liabilities based on the assumption of project completion in 2043 and an annual funding profile of $75 million.[48] This cost represents DOE's selection of the lowest-cost cleanup option, which was the close-in-place option. However, the project cost could increase to as much as approximately $10.6 billion if DOE decides to undertake a more extensive cleanup option in Phase 2. Site officials told us that, as of August 2021, they had not yet determined the Phase 2

LIFE-CYCLE COST ESTIMATES

(constant year 2021 dollars in billions)



[48]GAO, *Nuclear Waste: Congressional Action Needed to Clarify a Disposal Option at West Valley Site in New York*, GAO-21-115 (Washington, D.C.: January 13, 2021).

remedy. These officials stated that the Phase 2 decision is anticipated in fiscal year 2024.

- DOE's initial plan for demolition of the Main plant was to use trucks to remove debris until they could get a rail system prepared. However, due to delays in decontamination, DOE was able to prepare the rail system and start using it to haul away contaminated soils and debris from a soil containment structure installed around 2010 using American Recovery and Reinvestment Act of 2009 appropriations. These activities are a proof of concept for using the old rail system for waste removal and may help the community get comfortable with its use. In the long term, according to DOE officials, using the rail system will reduce the waste removal costs for the Main Plant Demolition Project.

PROJECT OFFICE COMMENTS

West Valley site officials provided technical comments, which we incorporated as appropriate.

Appendix IV: Image Sources

This section contains source information for figures in this product when that information was not listed adjacent to the figure.

Page 39: GAO analysis of Office of Environmental Management (EM) documentation and information provided by EM officials (time line, cost performance, schedule performance).

Page 41: GAO analysis of EM documentation and information provided by EM officials (time line, cost performance, schedule performance).

Page 43: GAO analysis of EM documentation and information provided by EM officials (time line, cost performance, schedule performance).

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Page 67: GAO analysis of EM documentation and information provided by EM officials (life-cycle estimate).

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Appendix V: Acknowledgments

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Staff Acknowledgments

In addition to the contact named above, Wyatt R. Hundrup (Assistant Director), Eli Lewine (Analyst-in-Charge), Brianna Taylor, and Edward Young made key contributions to this report. Also contributing to this report were Mark Braza, John Delicath, Claudia Hadjigeorgiou, Danny Royer, and Jeannette Soares.

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