



Report to the Chairman of the
Subcommittee on Strategic Forces,
Committee on Armed Services,
U.S. Senate

January 2019

DEPARTMENT OF ENERGY

Program-Wide Strategy and Better Reporting Needed to Address Growing Environmental Cleanup Liability

Accessible Version

GAO Highlights

Highlights of [GAO-19-28](#), a report to the Chairman of the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate

Why GAO Did This Study

DOE is tasked with cleaning up legacy waste from nuclear weapons produced during the Cold War era. Since it began its cleanup program in 1989, EM has spent about \$170 billion, but its most challenging and costly cleanup work remains, according to agency documents. EM's cleanup of legacy defense waste is annually funded through discretionary appropriations, so difficult trade-offs will have to be made between cleanup and other nuclear-related defense spending.

In 2017, GAO added federal government environmental liabilities to its High-Risk List. GAO was asked to review EM's environmental liability. This report examines (1) what is known about EM's environmental liability, (2) the extent to which EM balances risks and costs when addressing its cleanup responsibilities, and (3) the extent to which EM's budget materials provide required and accurate information on needed funding. GAO reviewed DOE financial statements, DOE documents, and reports by independent experts; visited three EM sites with three-quarters of the liability; and interviewed EM headquarters and site officials.

What GAO Recommends

GAO is making three recommendations to DOE: (1) develop a program-wide strategy that outlines how it will balance risks and costs across sites; (2) submit its mandated annual cleanup report that meets all requirements; and (3) disclose the funding needed to meet all scheduled milestones called for in compliance agreements, either in required annual reports or other supplemental budget materials. DOE agreed with all three recommendations.

View [GAO-19-28](#). For more information, contact David C. Trimble at (202) 512-3841 or trimbled@gao.gov.

January 2019

DEPARTMENT OF ENERGY

Program-Wide Strategy and Better Reporting Needed to Address Growing Environmental Cleanup Liability

What GAO Found

The Department of Energy's (DOE) Office of Environmental Management (EM) faces an environmental liability of \$377 billion, according to DOE's fiscal year 2018 financial statement. This amount largely reflects estimates of future costs to clean up legacy radioactive tank waste and contaminated facilities and soil. From fiscal years 2011 through 2018, EM's environmental liability grew by about \$214 billion—outpacing its cleanup spending of about \$45 billion for that time period. Contract and project management problems and other factors have led to this growth. For example, EM's environmental liability increased by nearly \$130 billion from fiscal year 2014 to 2018 at the Hanford Site in Washington State, in part because of contract and project management problems with waste cleanup. GAO found that EM's liability will likely continue to grow, in part because the costs of some future work are not yet included in the estimated liability. For example, EM's liability does not include more than \$2.3 billion in costs associated with 45 contaminated facilities that will likely be transferred to EM from other DOE programs in the future.

EM relies primarily on individual sites to locally negotiate cleanup activities and establish priorities. GAO's analysis of DOE documents identified instances of decisions involving billions of dollars where such an approach did not always balance overall risks and costs. For example, two EM sites had plans to treat similar radioactive tank waste differently, and the costs at one site—Hanford—may be tens of billions more than those at the other site. EM sites generally do not consider other sites' risks and priorities when making cleanup decisions. This is not consistent with recommendations by GAO and others over the last 2 decades that EM develop national priorities to balance risks and costs across and within its sites. However, EM has not developed such a program-wide strategy. Instead, according to agency officials, it continues to prioritize and fund cleanup activities by individual site. Without a strategy that sets national priorities and describes how DOE will address its greatest risks, EM lacks assurance that it is making the most cost-effective cleanup decisions across its sites.

EM's recent budget materials have not provided required or accurate information on funding needed to meet future cleanup responsibilities. For example, under the National Defense Authorization Act for Fiscal Year 2011, EM must annually report estimated costs and detailed funding needs for future cleanup activities. EM's 2017 submission to Congress—only the second one since 2011—did not include a detailed list of upcoming activities or funding needed to meet those activities. Additionally, EM's recent budget materials have not reflected the funding needed to meet schedule milestones called for in site-specific compliance agreements with states. These agreements are legally enforceable documents defining cleanup activities that DOE must achieve by specified dates. By reflecting the funding it needs to meet all of its scheduled milestones called for in compliance agreements—for example, in its annual report noted above or in supplemental budget materials—EM could better ensure that Congress has complete information to assess the full costs of long-term cleanup.

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Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CRESP	Consortium for Risk Evaluation with Stakeholder Participation
DOE	Department of Energy
EIS	environmental impact statement
EM	Office of Environmental Management
EPA	Environmental Protection Agency
IG	inspector general
IPA	independent public accountant
National Academies	National Academies of Sciences, Engineering, and Medicine
NDAA	National Defense Authorization Act
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
RCRA	Resource Conservation and Recovery Act

WIPP

Waste Isolation Pilot Plant

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January 29, 2019

The Honorable Deb Fischer
Chairman
Subcommittee on Strategic Forces
Committee on Armed Services
United States Senate
Dear Madam Chairman,

The Department of Energy (DOE) has the difficult task of cleaning up legacy defense waste and waste from energy research at 16 sites across the country.¹ Legacy defense waste is the hazardous and radioactive byproduct of nuclear weapons production during the Cold War era. DOE's cleanup mission includes remediating contaminated soil and groundwater; deactivating and decommissioning contaminated buildings; and designing, constructing, and operating facilities to treat millions of gallons of radioactive liquid waste.

The department's Office of Environmental Management (EM) manages most of DOE's cleanup activities for legacy defense waste and energy research. EM has spent more than \$170 billion since it began its cleanup program in 1989, but its most challenging and costly cleanup work remains, according to DOE documents. EM's estimate of the probable costs for the future cleanup of legacy defense waste is known as its environmental and disposal liability (or environmental liability).² The agency generally provides Congress with information on its future cleanup costs by submitting annual budget materials—including budget requests and associated reports. Notably, because most of EM's cleanup of legacy defense waste is annually funded through annual discretionary

¹Legacy defense waste includes waste left over from weapons production and energy research.

²The federal government is financially liable for cleaning up areas where federal activities have contaminated the environment. Various federal laws, agreements with states, and court decisions require the federal government to clean up environmental hazards at federal sites and facilities—such as nuclear weapons production facilities and military installations. Federal accounting standards require agencies responsible for cleaning up contamination to estimate future cleanup and waste disposal costs and to report such costs as environmental liabilities in their annual financial statements.

appropriations, difficult trade-offs will have to be made between cleanup and other nuclear-related defense spending.³

For years, we and others have reported that EM has not established priorities for addressing its cleanup responsibilities across its numerous sites or balanced the relative human health and environmental risks it must address with available funding. For example, in March 1995, we found that EM's practice of negotiating compliance agreements for individual sites—which establish the schedule for work at each site, among other things—without considering other sites' agreements or available resources did not ensure that limited cleanup resources were allocated in a manner to best address the greatest risks to human health and the environment.⁴ Also, in 2011, the DOE Inspector General (IG) noted that DOE's practice of determining cleanup priorities at individual sites was driving costs and that the department should instead consider addressing environmental concerns on a national, complex-wide risk basis.⁵ Further, in 2015, an independent review organized by the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) found that it was unclear if DOE was optimally using available resources to reduce the human health and environmental risks posed by legacy defense waste.⁶ According to the report, DOE allocated disproportionate resources to lower priority risks. The report called for a more systematic effort to assess and rank risks within and among sites and to allocate federal taxpayer moneys to remedy the highest-priority risks through the most cost-efficient means.

³Annual discretionary appropriations are limited by caps that were specified in the Budget Control Act of 2011 (Pub. L. No. 112-25) and modified by subsequent legislation. Under current law, separate caps exist for defense and nondefense spending through 2021.

⁴GAO, *Department of Energy: National Priorities Needed for Meeting Environmental Agreements*, [GAO/RCED-95-1](#) (Washington, D.C.: Mar. 3, 1995).

⁵Department of Energy, Office of Inspector General, *Management Challenges at the Department of Energy*, DOE/IG-0858 (Washington, D.C.: November 2011).

⁶Omnibus Risk Review Committee, *A Review of the Use of Risk-Informed Management in the Cleanup Program for Former Defense Nuclear Sites* (prepared for the U.S. Senate Committee on Appropriations and the U.S. House of Representatives Committee on Appropriations, August 2015). Language attached to the Consolidated Appropriations Act, 2014 (H.R. 3547) directed DOE to retain a respected outside group to undertake an analysis of, among other things, how effectively DOE identifies, programs, and executes its plans to address risks to public health and safety from DOE's remaining environmental cleanup liability. EM requested that CRESP, an independent multidisciplinary consortium of universities led by Vanderbilt University, organize this review, following congressional direction provided in the omnibus legislation.

In February 2017, we added the federal government's environmental liabilities to our High-Risk List of agencies and program areas that are vulnerable to fraud, waste, abuse, and mismanagement or that are most in need of transformation.⁷ In our 2017 High-Risk Series, we noted that DOE's fiscal year 2016 environmental liability constituted the largest share of the federal government's total environmental liability.⁸ We added that this liability had been growing over the past 20 years and was likely to increase. Further, we noted that DOE did not have complete information about its cleanup responsibilities and that inconsistent approaches to making cleanup decisions prevented DOE from fully addressing its environmental liability in ways that reduce the risks to human health and the environment in a cost-effective manner. We stated that future progress in addressing the federal government's environmental liability depends, among other things, on how effectively DOE and other federal departments and agencies set priorities under increasingly restrictive budgets to balance risks and costs when selecting cleanup remedies.

You asked us to review issues related to EM's environmental liability and DOE's approaches to cleaning up legacy defense waste. This report examines (1) what is known about EM's environmental liability, (2) the extent to which EM balances risks and costs when addressing its long-term cleanup responsibilities, and (3) the extent to which EM's recent budget materials provide required and accurate information on the funding needed for its future cleanup responsibilities.

To answer all three objectives, we reviewed DOE's annual financial statements for fiscal years 2011 through 2017, as well as DOE's guidance for developing its annual environmental liability estimate.⁹ DOE issued its fiscal year 2018 financial statement in December 2018, while our draft report was at DOE for review and comment; where possible, we updated our analysis to reflect the fiscal year 2018 information. We also interviewed officials at DOE headquarters as well as EM officials at three

⁷GAO, *High-Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, [GAO-17-317](#) (Washington, D.C.: Feb. 15, 2017).

⁸DOE's fiscal year 2017 environmental liability totaled \$384 billion, or 83 percent of the federal government's reported \$465 billion fiscal year 2017 environmental liability.

⁹We chose this time because data from these fiscal years were comparable, whereas, according to an EM official, data from before fiscal year 2011 were not comparable with implementation of the sequestration cuts and American Recovery and Reinvestment Act of 2009 funding.

sites we visited: the Hanford site in Richland, Washington; the Savannah River site in Aiken, South Carolina; and the Oak Ridge Reservation in Oak Ridge, Tennessee. We selected these sites because they constituted more than 75 percent of EM's fiscal year 2017 environmental liability and involved a variety of cleanup activities. We also reviewed and analyzed reports by DOE and others on its environmental liability, including reports on DOE's previous strategies to address long-term cleanup costs. We took additional steps to address each objective:

- To examine what is known about EM's environmental liability, we reviewed information on EM's environmental liability from DOE's financial statements from fiscal years 2011 through 2017, as well as 58 past reports by us and others. From these reports, we categorized factors contributing to growth in EM's environmental liability. We then reviewed DOE documentation associated with DOE's environmental liability for these fiscal years. We identified changes in the environmental liability for these fiscal years for selected EM sites and the key factors contributing to those changes. Certain information, such as specific documentation of changes in EM's environmental liability at EM sites, was not yet available for 2017. In such cases, we reported information for fiscal years 2011 through 2016. We created a summary of this information and corroborated it with EM officials.¹⁰
- To examine the extent to which EM balances risks and costs when addressing its long-term cleanup responsibilities, we interviewed EM headquarters officials and independent experts involved in a multiyear study organized by CRESP on risk-informed decision-making in DOE's cleanup program. We also reviewed reports by us; DOE's IG; the National Academies of Sciences, Engineering, and Medicine (National Academies); CRESP; and others to identify information on the ways EM considers risks and costs in making cleanup decisions. We discussed past cleanup strategies with EM headquarters officials, as well as with the independent experts and two former DOE Assistant Secretaries for EM.

¹⁰In May 2018, DOE's independent public accountant (IPA) reported that in its opinion, DOE's fiscal year 2017 consolidated financial statements present fairly, in all material respects, the agency's financial position as of September 30, 2017, and 2016, and its net costs, changes in net position, budgetary resources, and custodial activities for the years then ended in accordance with U.S. generally accepted accounting principles. Our performance audit was not intended to express, and accordingly we do not express, an opinion on DOE's financial statements. Rather, we examined what future costs are included in the environmental liability estimate and what costs are not included.

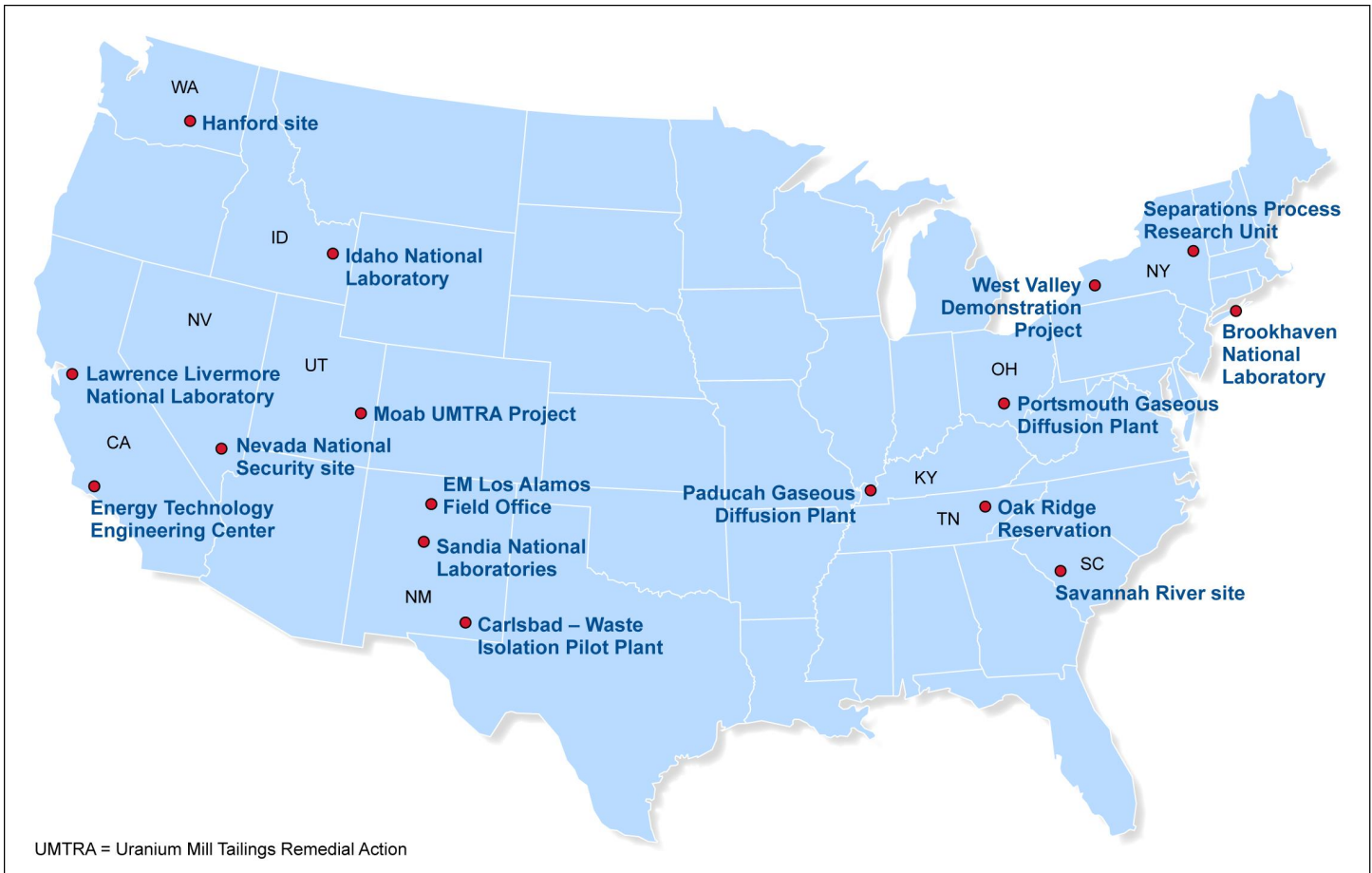
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- To examine the extent to which EM's recent budget materials provided required and accurate information on the funding needed for its future cleanup responsibilities, we reviewed EM's recent budget materials provided to Congress for fiscal years 2016, 2017, and 2018. These materials included the annual budget submissions and the Future-Years Defense Environmental Management Plan for fiscal year 2017, which is required to be submitted annually by the National Defense Authorization Act (NDAA) for Fiscal Year 2011. We also interviewed officials in EM's Budget Office on funding needs for EM's future cleanup responsibilities, among other things. For a fuller discussion of our methodology, see appendix I.

We conducted this performance audit from February 2016 to January 2019 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

Since 1989, EM has been cleaning up radioactive and hazardous waste left over from nuclear weapons production and energy research at DOE sites and facilities across the country. EM has completed cleanup at 91 of its 107 sites, but 16 sites remain, some of which are the most challenging to address, according to EM documents (see fig. 1).

Figure 1: Department of Energy Office of Environmental Management (EM) Sites Where Cleanup Remains



Sources: GAO analysis of Department of Energy information; Map Resources (map). | GAO-19-28

According to EM documents, EM's cleanup responsibilities generally include (1) storing and treating about 90 million gallons of radioactive and hazardous waste located in nearly 240 large underground tanks at three sites across the country; (2) remediating millions of cubic meters of soil and more than 1 billion gallons of groundwater; (3) preparing and disposing of 2,400 metric tons of spent nuclear fuel and about 21 metric tons of surplus highly enriched uranium materials; and (4) deactivating and decommissioning about 1,700 excess facilities, some of which are highly contaminated.

In selecting specific cleanup remedies EM officials work at the site level with federal and state regulators and other local stakeholders, including

county and local governmental agencies, advisory boards, Native American tribes, and citizen groups, to select remedies that address the site's cleanup responsibilities. EM officials and regulators generally consider several factors in selecting remedies, including the following:

- **Application of environmental laws and regulations.** One of EM's main considerations in selecting cleanup remedies is compliance with applicable federal and state environmental laws and regulations.¹¹ Key laws include the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended;¹² the Resource Conservation and Recovery Act of 1976 (RCRA), as amended;¹³ and the Atomic Energy Act.¹⁴ Under these laws, DOE has entered into federal facility agreements with the Environmental Protection Agency (EPA) and the relevant states that govern cleanup activities at many DOE sites. For cleanups it carries out under CERCLA, DOE conducts a two-part study of each site: (1) a remedial investigation to characterize site conditions and assess the risks to human health and the environment, among other actions, and (2) a feasibility study to evaluate various cleanup options to address the problems identified in the remedial investigation. DOE carries out a similar process at sites it is cleaning up under RCRA.
- **Sequencing and scheduling cleanup activities.** Based on DOE documents, EM cleanup work has been governed by compliance

¹¹William M. Levitan, Associate Deputy Assistant Secretary, Office of Site Restoration, DOE-EM, "Presentation to the Environmental Council of States: Risk and Cleanup Decision Making," (slides) (Mar. 4, 2013).

¹²42 U.S.C. 9601 et seq. CERCLA authorizes the federal government to respond to releases or threatened releases of hazardous substances. For DOE sites subject to CERCLA, DOE, among other things, identifies, assesses, and remedies releases of hazardous substances, pollutants, and contaminants.

¹³42 U.S.C. 6901 et seq. RCRA, as amended, regulates the management of facilities that treat, store, or dispose of hazardous wastes and requires a permit for such facilities. Permits must require corrective action for all releases of hazardous waste from such facilities and contain relevant compliance schedules. Under RCRA, EPA may authorize a state to implement its own hazardous waste management program in lieu of the respective federal program, so long as the state program is at least as stringent. State programs may be more stringent than the federal program. The Federal Facilities Compliance Act of 1992 specifically makes DOE subject to state regulation under RCRA. 42 U.S.C. § 6961(a).

¹⁴42 U.S.C. § 2011 et seq. The Atomic Energy Act governs the radioactive component of mixed waste, which is waste that contains both hazardous and certain radioactive components. 42 U.S.C. § 6903(41); see *Washington v. Chu*, 558 F.3d 1036, 1038 n.2 (9th Cir. 2009). RCRA governs the hazardous component of such waste.

agreements between DOE and its regulators since at least 1985. These compliance agreements establish the scope of work and legally enforceable schedule milestones. We have reported that DOE must meet thousands of milestones associated with more than 70 site-specific agreements that define the scope and sequencing of cleanup.¹⁵

- **Planning for sites' future use after cleanup work is completed.** In addition to laws and site-specific agreements, EM officials are to consider plans for the future uses of DOE lands when selecting cleanup remedies.¹⁶ According to the 2015 report resulting from the independent review organized by CRESP, anticipated future land use is one of the key factors influencing site remedy selection.¹⁷ As CRESP noted in its 2015 report, anticipated future land uses that necessitate lower residual contaminant levels result in site remedies that are generally more costly.¹⁸ For example, areas that are designated for future residential uses would likely undergo more extensive cleanup than areas designated for future industrial use.

¹⁵A compliance agreement is a legally enforceable document containing milestones defining cleanup activities that DOE must achieve by specified or ascertainable dates. The term includes, but is not limited to, federal facility agreements, interagency agreements, settlement agreements, consent orders, and compliance orders. See GAO, *Waste Cleanup: Status and Implications of DOE's Compliance Agreements*, [GAO-02-567](#) (Washington, D.C.: May 30, 2002).

¹⁶Section 3153 of the National Defense Authorization Act for Fiscal Year 1997 required DOE to develop future land use plans for the Hanford, Rocky Flats, Savannah River, and Idaho National Engineering Laboratory sites by March 15, 1998, § 3153, Pub. L. No. 104-201, 110 Stat. 2839 (1996). DOE was to develop these plans in consultation with citizens advisory boards at each site, to cover future land uses for a period of at least 50 years. *Id.* The law authorized DOE to develop such plans at sites other than those specifically listed in the law. *Id.*

¹⁷Omnibus Risk Review Committee, *A Review of the Use of Risk-Informed Management in the Cleanup Program for Former Defense Nuclear Sites* (prepared for the U.S. Senate Committee on Appropriations and the U.S. House of Representatives Committee on Appropriations, August 2015).

¹⁸According to a 2003 report by CRESP on land use designation and cleanup, in the early 1980s the prevailing view was that contaminated sites, such as Superfund sites, should be cleaned up to residential standards and returned to productive uses. Residential standards are sufficiently stringent to ensure that there are no risks to adults or children living or working near the site. However, since the 1990s and into the 2000s, the realities of cost and technology constraints raised questions about the affordability of cleaning sites to residential standards. See Consortium for Risk Evaluation With Stakeholder Participation II, *The Role of Risk and Future Land Use In Cleanup at the Department of Energy*, CRESP Report 03-001 (New Brunswick, N.J.: March 2003).

Federal accounting standards require agencies responsible for cleaning up contamination to estimate future cleanup and waste disposal costs and to report such costs in their annual financial statements as environmental liabilities.¹⁹ According to these standards, environmental liability estimates are to include probable and reasonably estimable costs of cleanup work. Where DOE is legally responsible for environmental cleanup but no technology is known to clean up a particular site, the known costs for which DOE is responsible, such as a remedial investigation, feasibility studies, and costs to contain the contamination, are recorded as a liability.²⁰ Environmental liability estimates do not include cost estimates for work for which reasonable estimates cannot currently be generated, such as cleanup costs at sites where no feasible remedy exists, according to federal accounting standards.

EM's Environmental Liability Was Estimated at \$377 Billion in Fiscal Year 2018 and May Grow

EM's reported environmental liability for fiscal year 2018 was \$377 billion, based on our review of DOE's fiscal year 2018 financial statement, and this estimate may grow.²¹ The fiscal year 2018 estimate includes the costs of treating radioactive waste, among other things. We found that EM's environmental liability has outpaced its cleanup spending for fiscal years 2011 through 2018, in part, because of key factors, such as contract and project management problems.

¹⁹Federal Accounting Standards Advisory Board, *FASAB Handbook of Federal Accounting Standards and Other Pronouncements, as Amended* (Washington, D.C.: June 30, 2017).

²⁰Remedial investigations are to characterize site conditions and assess the risks to human health and the environment, among other actions, and feasibility studies are to evaluate various options to address the problems identified through the remedial investigation.

²¹This estimate was reported in DOE's financial statements, which were to be developed in accordance with federal accounting standards.

EM's Environmental Liability Largely Reflects the Costs of Treating Radioactive Tank Waste, Addressing Contaminated Facilities, and Remediating Soil and Water

In DOE's fiscal year 2017 financial statement, DOE's overall environmental liability was \$384 billion, of which EM had an environmental liability estimate of \$268 billion. This includes the costs of treating radioactive waste currently stored in underground tanks, decommissioning and tearing down contaminated facilities, and remediating soil and water contamination, among other things, according to agency documents. In DOE's fiscal year 2018 financial statement, EM's estimate increased to \$377 billion out of DOE's overall liability of \$494 billion. Under federal accounting standards, EM is to annually develop an environmental liability estimate for each of its sites. To do this, according to EM guidance for developing its environmental liability, EM is to use the approved life cycle costs for all cleanup projects at each of its sites and add any adjustments,²² such as probable future cost increases from new work scope or likely changes in regulatory approaches, as well as potential cost decreases.²³

In developing its environmental liability, EM estimates the costs of addressing a variety of waste types and performing certain activities to

²²According to DOE guidance, life cycle costs are all the anticipated costs associated with a project or program alternative throughout its life. This includes costs from pre-operations through operations or to the end of the alternative.

²³In May 2018, DOE's IPA noted that in its opinion, the department's financial statements fairly present, in all material respects, the agency's financial position as of September 30, 2017, and 2016, and its net costs, changes in net position, budgetary resources, and custodial activities for the years then ended in accordance with U.S. generally accepted accounting principles. However, the IPA also noted that the audit revealed a significant deficiency in internal controls related to the accounting for environmental liabilities. It stated that DOE had not implemented effective internal controls for identifying and recording its environmental liability accurately, completely, and in a timely manner. The IPA identified misstatements, which were corrected as of September 30, 2017, that resulted from management basing estimates on assumptions that were incorrect, as well as inadequate field office management reviews of cost estimates, including contingency estimates. Most of the errors resulted from control deficiencies at field offices, according to the report. Department of Energy, Office of Inspector General, *Audit Report on the Department of Energy's Fiscal Year 2017 Consolidated Financial Statements*, DOE-OIG-18-30 (Washington, D.C.: May 2018). In this report, we are not commenting on the reasonableness of the department's environmental liability estimate in meeting federal accounting standards. We address the reasons why EM's environmental liability estimate has grown and may grow in the future.

clean up that waste. Specifically, according to DOE documents, EM estimates the costs and cleanup activities associated with the following:

- **Radioactive tank waste.** DOE has about 90 million gallons of waste managed as high-level radioactive waste stored in underground tanks at the Hanford site, Idaho National Laboratory, and Savannah River site.²⁴ EM site offices monitor tank waste to ensure that radioactivity stays at safe levels, among other reasons. The site offices also develop plans to retrieve and treat the tank waste to ensure that it is put in a safe and stable form for eventual disposal. At the Hanford site, as of the end of fiscal year 2017, very little of the site's tank waste had been treated.²⁵ At the Savannah River site, nearly 7 million gallons had been treated, as of this date. At the Idaho site, EM partially treated some of the waste through a thermal process that converted the liquid waste into a solid granular substance (called calcine) and stored the waste in silos at the Idaho National Laboratory. This waste may need additional treatment for it to be packaged and shipped off-site. The Idaho site also has about 1 million gallons of radioactive waste left in tanks needing to be treated, as of the end of fiscal year 2017.
- **Soil and groundwater remediation.** Soil and groundwater at most sites across the DOE complex are contaminated with hazardous chemicals, metals, and radionuclides.²⁶ Cleanup of contaminated soil and groundwater involves sampling, testing, and monitoring to understand the nature and extent of the contamination, as well as applying treatments—such as pumping contaminated water from the ground to a treatment facility, treating it to remove contamination, and returning the treated water to the ground.

²⁴The treatment process increases the volume of the waste to be disposed because water and other constituents are added during the process. The Nuclear Waste Policy Act of 1982 directed DOE to investigate sites for a federal deep geologic repository to dispose of spent nuclear fuel. In June 2008, DOE submitted a license application to the Nuclear Regulatory Commission (NRC) for authorization to construct a permanent geologic repository at Yucca Mountain, which DOE proposed to open by 2020. In 2011, in response to a DOE motion, NRC suspended the application process. The President's fiscal year 2019 budget contained \$120 million to restart activities at Yucca Mountain and provide for interim storage of treated waste.

²⁵In December 2017, EM conducted a demonstration of technology to treat tank waste. Three gallons of Hanford's tank waste were treated in this test.

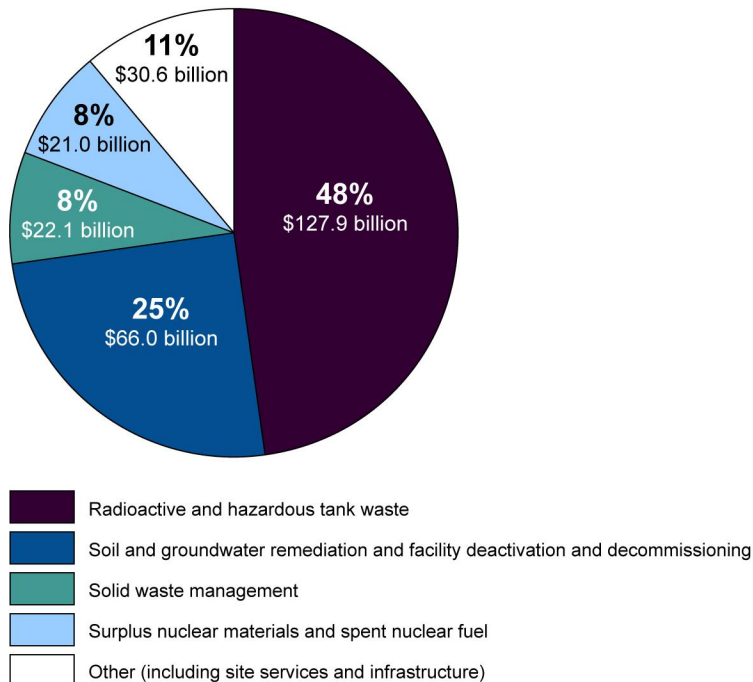
²⁶A nuclide is a particular atomic form of an element distinguished from other nuclides by its number of neutrons and protons, as well as by the amount of energy it contains. A radionuclide is an unstable, radiation-emitting nuclide.

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- **Facility deactivation and decommissioning.** According to DOE documents, facility deactivation includes removing nuclear materials from facilities no longer in use, shutting down systems, and other activities to convert a facility from actively operating to a nonfunctioning mode. A nonfunctioning mode requires only low levels of surveillance and routine or necessary maintenance. Decommissioning includes activities necessary to achieve a required end state (e.g., demolition or entombment) for a facility or group of facilities.
 - **Waste management.** Waste management includes management and treatment of low-level radioactive waste, transuranic wastes, and other wastes.²⁷ Transuranic solid waste can include contaminated clothing and tools that were used to operate nuclear reactors and associated facilities used to process uranium and to produce plutonium.
 - **Surplus nuclear materials and spent nuclear fuel.** Management and disposition of surplus nuclear materials and spent nuclear fuel, which includes materials no longer needed for national security or other purposes, includes activities to place these materials in safe packaging, and disposing of them at a designated disposal site or storing them pending disposal. Nuclear materials include excess plutonium, uranium, and spent nuclear fuel rods.
 - **Other activities.** Other activities related to supporting cleanup activities involve maintenance and repair activities, as well as regulatory and community support.

EM's responsibilities for storing and treating radioactive tank waste accounted for nearly \$128 billion—or almost half—of its fiscal year 2017 environmental liability, according to agency documentation. Its responsibilities for addressing contaminated facilities and remediating soil and groundwater contamination accounted for nearly \$66 billion—or about 25 percent—of its fiscal year 2017 environmental liability. Figure 2 shows the percentage and dollar amount of EM's environmental liability by cleanup activity.

²⁷The term transuranic means those elements with an atomic number greater than that of uranium. Transuranic waste generally includes radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years.

Figure 2: Office of Environmental Management’s Portion of the Department of Energy’s Fiscal Year 2017 Environmental Liability by Cleanup Activity and Waste Type



Source: GAO analysis of Department of Energy information. | GAO-19-28

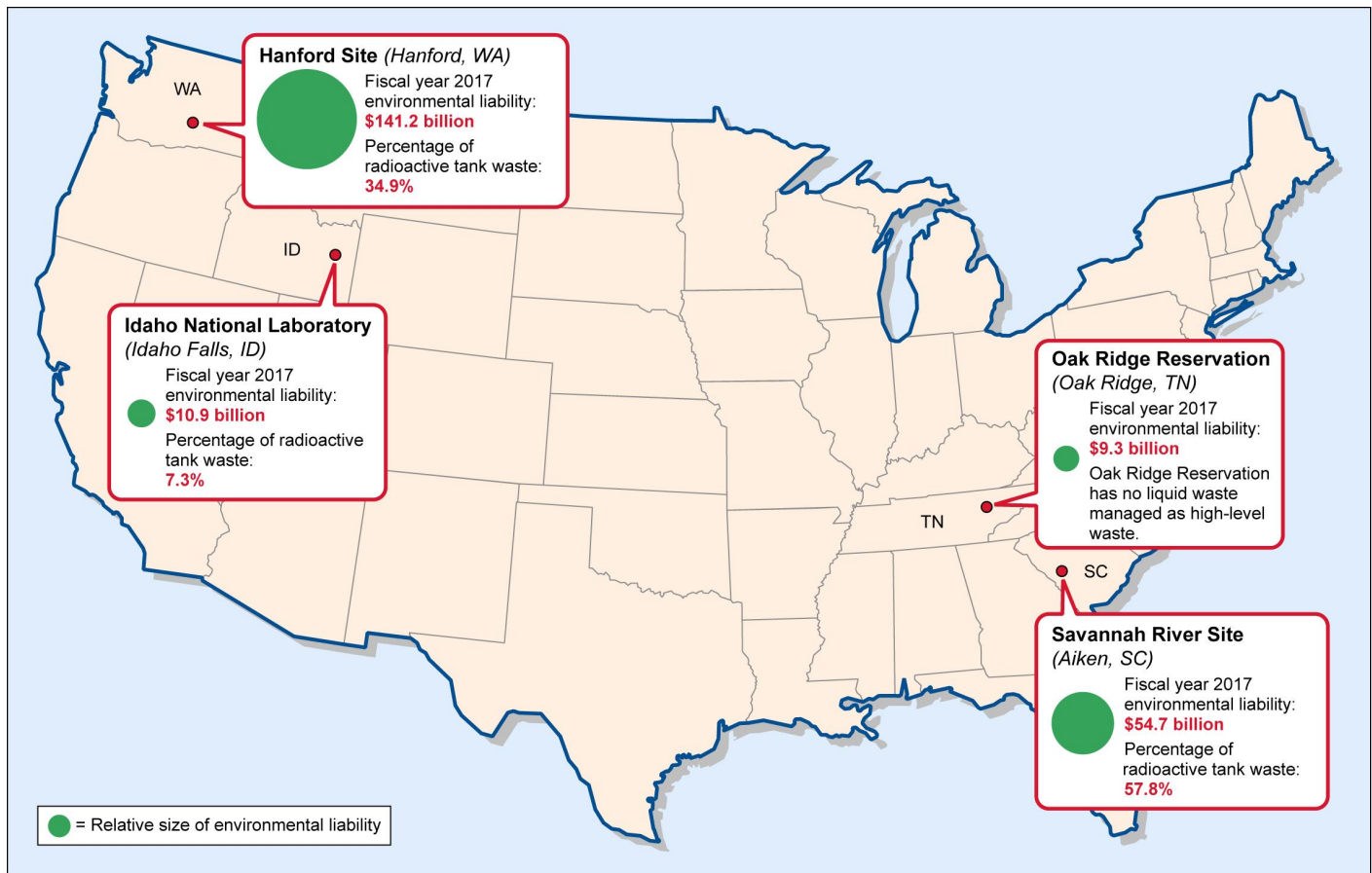
Of the 16 sites across the United States at which EM has cleanup responsibilities, 4 sites account for more than 80 percent of EM’s fiscal year 2017 environmental liability: the Hanford site in Washington State, Idaho National Laboratory in Idaho, the Oak Ridge Reservation in Tennessee, and the Savannah River site in South Carolina, according to documentation provided by EM (see fig. 3). According to materials for a 2013 presentation by a senior EM official and documentation provided by DOE,²⁸ two sites include the majority of EM’s radioactive tank waste and the majority of radioactive contamination, which is measured in curies—the Hanford site and the Savannah River site.²⁹ The Hanford site has 177

²⁸Department of Energy, Office of Environmental Management, Ken Picha, Deputy Assistant Secretary for Tank Waste, *Nuclear Waste Technical Review Board Overview: Office of Environmental Management* (Washington, D.C.: Apr. 16, 2013).

²⁹A curie is a unit of measurement of radioactivity. According to EM officials, EM sites do not maintain information on the amount of curies in their liquid waste tanks. Information from the 2013 presentation was the most recent available.

tanks containing 55 million gallons of waste and 176 million curies. The Hanford site accounted for \$141 billion (more than 52 percent) of EM's fiscal year 2017 environmental liability. The Savannah River site has 43 tanks containing 36 million gallons of waste and 292 million curies. The Savannah River site accounted for nearly \$55 billion (about 20 percent) of EM's fiscal year 2017 environmental liability.

Figure 3: Comparison of Four Office of Environmental Management (EM) Sites with the Majority of EM's Fiscal Year 2017 Environmental Liability with Corresponding Tank Waste Radioactivity



Sources: GAO analysis of Department of Energy information; Map Resources (map). | GAO-19-28

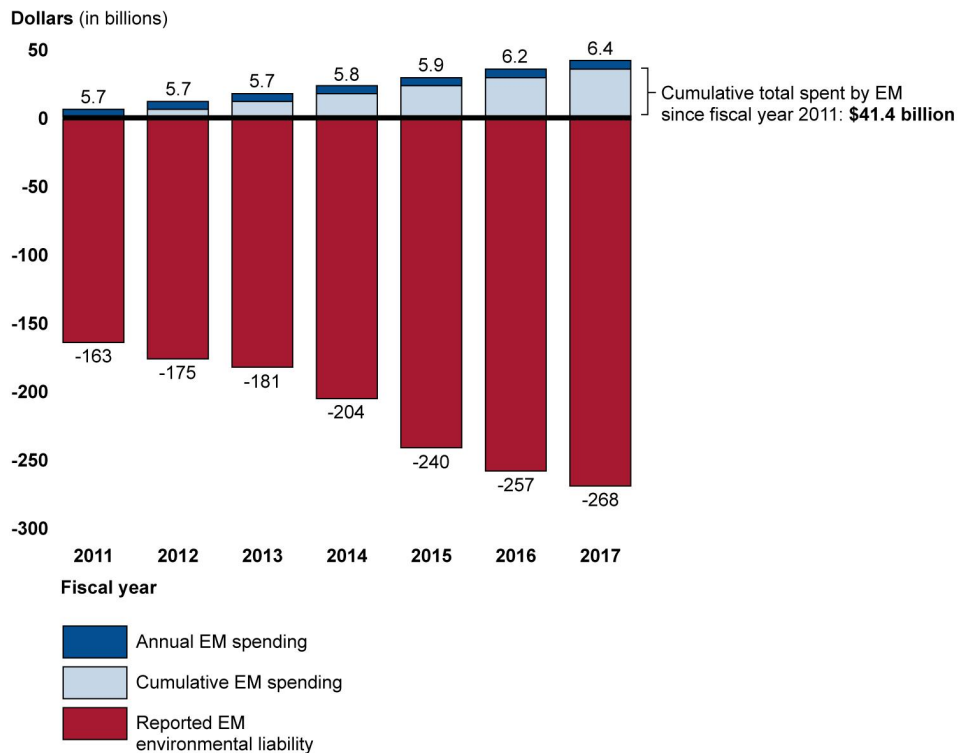
Key Factors Led to Growth in EM's Environmental Liability, Which Has Outpaced EM Cleanup Spending

In recent years, EM's environmental liability has grown annually at a level that has outpaced the agency's annual spending on cleanup activities. From fiscal years 2011 through 2017, EM spent approximately \$40 billion, primarily to address radioactive tank waste, including constructing Hanford's Waste Treatment and Immobilization Plant, as well as to treat and dispose of other nuclear and hazardous materials, according to DOE documents.³⁰ During this same time period, EM's environmental liability grew by almost \$105 billion, from \$163 billion to \$268 billion, according to our analysis of DOE financial data and documents (see fig. 4).³¹

³⁰ In fiscal year 2018, EM received about \$5.4 billion for defense environmental cleanup, bringing the total from fiscal years 2011 through 2018 to more than \$45 billion.

³¹ From fiscal years 2011 to 2017, EM added \$105 billion to its environmental liability. Of that amount, about \$26 billion was added for inflationary adjustments in those years.

Figure 4: Department of Energy Office of Environmental Management's (EM) Annual Spending and Environmental Liability, Fiscal Years 2011 through 2017



Source: GAO analysis of Department of Energy financial and budget data. | GAO-19-28

According to EM headquarters officials we interviewed, they are aware of the increases to the environmental liability from year to year, as well as the areas in which the liability changed, but acknowledged that they have not done a detailed analysis of the root causes of the growth. The officials said EM's environmental liability changes each year as the updated estimate incorporates changes to cleanup projects that occurred throughout the previous year, as well as changes to account for inflation, among other things. Officials noted that they believe that among the key drivers of the environmental liability increases were the uncertainties associated with doing complex cleanup work and project management challenges. They told us that environmental liability estimates change over time as new information becomes available and new cost estimates for projects are added. Officials said that in the early stages of cleanup projects, cost estimates can be difficult to develop because of uncertainties, including the extent and types of hazardous substances at a site, reaching agreement on the range of technologies that can be used

for remediation, and when an agreement is reached with stakeholders on what constitutes an acceptable level of remediation.

In reviewing past reports by us and others, as well as DOE documents, we identified key factors that have led to growth in EM's environmental liability in recent years, including contract and project management problems, accidents, and changes to the scope of cleanup projects.³² For example, EM's environmental liability increased by nearly \$48 billion from fiscal years 2014 through 2017 because of these factors. These factors include contract and project management problems associated with cleanup of high-level radioactive tank waste at EM's Hanford site in Washington State, according to DOE documents.³³ In its fiscal year 2018 financial statement, EM added \$82 billion to the environmental liability at DOE's Hanford site, meaning EM's liability increased from fiscal year 2014 through 2018 by nearly \$130 billion and, as of October 2018, is \$242 billion. Table 1 describes the key factors we identified that contributed to the growth in EM's environmental liability from fiscal years 2011 to 2017.

Table 1: Key Factors Contributing to Growth in the Office of Environmental Management's (EM) Environmental Liability for Fiscal Years 2011 through 2017

Factor contributing to growth in EM's environmental liability	Description of factor	Examples
Contract and project management problems	Contract and project management problems led to delays in projects, sometimes resulting in disputes with regulators, which, in turn resulted in environmental liability growth.	Delays at Savannah River's Salt Waste Processing Facility added nearly \$2.7 billion to EM's environmental liability in fiscal year 2013. Technical and performance problems with DOE's Waste Treatment and Immobilization Plant at Hanford increased EM's liability by \$11 billion in fiscal year 2016.

³²We conducted this work based on fiscal year 2011 through 2017 data from DOE. While our draft report was at DOE for review and comment, DOE released its fiscal year 2018 financial statement, which reported, among other things, a \$109 billion increase to EM's environmental liability. According to DOE's 2018 financial statement, the increase is primarily due to updated estimates for the Waste Treatment and Immobilization Plant construction, operating costs, and tank farm retrieval and closure costs at the Hanford site.

³³The costs to cleanup EM's high-level tank waste across all sites increased about \$44 billion from fiscal year 2014 to fiscal year 2017. While the environmental liability to clean up high-level tank waste at Hanford increased during this period, the environmental liability to clean up high-level waste at the Savannah River site and Idaho site decreased over this same time period.

Factor contributing to growth in EM's environmental liability	Description of factor	Examples
Regulator changes	Regulators could select remedies that were different—and sometimes more costly—than what was assumed in EM's estimated environmental liability.	In fiscal year 2013, Hanford regulators selected a higher cost remedy for contaminated soils that was different from the remedy assumed in the environmental liability estimate. The higher cost remedy added approximately \$280 million to the environmental liability.
Accidents, work stoppages, or disruptions	Accidents, work stoppages, and other forms of delay or disruption to cleanup activities affected environmental liability growth and can potentially lead to ripple effects at other sites.	Waste Isolation Pilot Plant operations were suspended from 2014 to 2017 because of two incidents. The costs of getting the plant operating increased EM's liability by about \$280 million in fiscal year 2014.
Technical challenges	Sites faced technical challenges in the treatment of complex waste that affected the environmental liability.	In fiscal year 2012, Oak Ridge's solid waste disposition liability grew by approximately \$71 million because of technical challenges with processing transuranic sludge waste.
Scope, cost, or schedule changes	Changes in a cleanup project's scope, cost, or schedule added to environmental liability growth.	In fiscal year 2012, Hanford's environmental liability increased by \$100 million when the site discovered that the extent of soil contamination for a particular area was greater than originally assumed.
Repository uncertainty	A delay in opening a permanent geologic repository for spent fuel and high-level waste has increased EM's environmental liability.	Delay in opening of a permanent geologic repository to store defense high-level and spent nuclear waste increased EM's liability by \$230 million in fiscal year 2016.

Source: GAO analysis of Department of Energy documents. | GAO-19-28.

Note: All amounts are reported in nominal dollars, which are not adjusted for inflation.

Recently, Congress tasked the National Academies with conducting two studies that may help EM better understand and manage its environmental liability, as mandated by the fiscal year 2017 NDAA. These studies were both ongoing as of September 2018. They are (1) an analysis of approaches for treating a certain portion of the Hanford site's low-activity waste and (2) an independent assessment of the technology development efforts of the cleanup program. In addition, in the fiscal year 2019 NDAA, the Congress mandated that DOE work with the National Academies to review, among other things, DOE's project management practices for EM's cleanup activities.

Based on our analysis of DOE documents, the key factors that have led to the growth in EM's environmental liability can also cause delays that can extend cleanup project completion dates and thereby further increase EM's total environmental liability. In addition, these key factors may not always occur in isolation, and may have a ripple effect, causing delays with other projects at the same site or other sites across the EM complex. For example, as the result of two separate incidents involving a fire and release of radioactivity, DOE had to suspend operations at its Waste Isolation Pilot Plant (WIPP)—the agency's geologic disposal facility for transuranic waste at Carlsbad, New Mexico—from 2014 to 2017. The suspension of operations at WIPP resulted in delays of waste shipments to the facility from EM sites, thereby increasing EM's overall environmental liability, according to EM documents. For example, the suspension of WIPP operations led to increases in the environmental liability of DOE's Idaho, Los Alamos, and Oak Ridge sites to account for prolonged waste storage at these sites. Since 2014, EM officials reported environmental liability increases of \$110 million at Idaho, \$61 million at Los Alamos, and \$420 million at Oak Ridge, stemming from shipping delays caused by the incidents at WIPP.

EM's Environmental Liability Does Not Include All Costs for Which EM May Be Responsible in the Future

In addition to key factors that have led to growth in EM's environmental liability, EM's fiscal year 2017 environmental liability does not include the costs of all cleanup activities for which EM will likely be responsible in the future.³⁴ EM's reported environmental liability estimates are prepared according to federal accounting standards, which require that agencies' environmental liability estimates include probable and reasonably estimable costs of cleanup work. We found that EM's future costs may grow beyond the \$268 billion fiscal year 2017 environmental liability because of costs for work that may be transferred from other program offices in the future and costs for work if assumed cleanup remedies change.³⁵ For example:

- **Costs of work to address contaminated facilities from other DOE offices.** EM's environmental liability does not include costs to decontaminate and decommission facilities currently managed by other DOE program offices that are no longer operational and will eventually be transferred to EM.³⁶ In March 2015, we reported that DOE's National Nuclear Security Administration (NNSA) had identified 83 facilities to transfer to EM for disposition and that the condition of many of these facilities was deteriorating.³⁷ For example, we found

³⁴EM's management is responsible for developing its fiscal year 2017 environmental liability in accordance with federal accounting standards. As described earlier, federal accounting standards state that agencies' environmental liability estimates are to include probable and reasonably estimable costs of cleanup work. Therefore, the EM environmental liability does not include the cleanup activities for which EM may be responsible in the future but that are not yet probable, not yet reasonably estimable, or both. Also, EM is only required to report on its program's environmental liability, not the environmental liabilities of other programs.

³⁵DOE's fiscal year 2018 financial statement shows that EM's environmental liability increased by about \$109 billion over the previous year to \$377 billion.

³⁶EM is not required to account for the costs of facilities owned by other programs in its environmental liability. Environmental liability estimates for these facilities are reflected in DOE's overall environmental liability and are recorded as placeholder estimates under the non-EM program offices that own the facilities. Once a contaminated facility is nonoperational, and DOE finds that it is not needed by other program offices, it may be eligible for transfer to EM. Once these facilities are transferred to EM, the environmental liability also transfers to EM.

³⁷GAO, *DOE Facilities: Better Prioritization and Life Cycle Cost Analysis Would Improve Disposition Planning*, [GAO-15-272](#) (Washington, D.C.: Mar. 19, 2015).

that deteriorating conditions at the Alpha-5 facility at NNSA's Y-12 site in Tennessee had caused annual maintenance costs to increase substantially. In a December 2016 report on excess facilities, DOE estimated that the costs associated with addressing 45 high-risk contaminated facilities from other DOE program offices, many of which will likely be transferred to EM for disposition, is over \$2.3 billion, and that EM may be responsible for the future costs of decommissioning many of these facilities.³⁸ Similarly, according to DOE documentation, EM's environmental liability does not include about \$780 million for future work for disposition of eight of the nine nuclear reactors at the Hanford site.³⁹ The costs for both the 45 high-risk contaminated facilities and the eight reactors will eventually be transferred to EM and will likely increase EM's environmental liability.

- **Costs for certain activities where cleanup remedies may change.** For certain cleanup responsibilities, EM and stakeholders have not reached final decisions on the cleanup remedy to be used, according to agency documentation. Changes to assumed cleanup remedies could cause the actual costs for future cleanup to be higher than DOE estimates, according to DOE environmental liability documentation.

For example, at the Hanford site, a final decision on how to clean up the underground tanks storing radioactive and hazardous waste has not yet been approved by regulators, according to Hanford site officials.⁴⁰ As we previously reported, nuclear waste is suspected to have leaked from 62 of the underground storage tanks at Hanford, and waste is suspected to have intruded into the outer shell of one

³⁸Department of Energy, *Report to Congress: Plan for Deactivation and Decommissioning of Nonoperational Defense Nuclear Facilities* (Washington, D.C.: December 2016).

³⁹Department of Energy, *2016 Hanford Lifecycle Scope, Schedule, and Cost Report*, DOE/RL-2015-10 (Richland, Wash.: December 2015). The \$780 million to decontaminate eight of the nine reactors is part of a different category with DOE's environmental liability, known as the Restructured Environmental Liability, which is a component of DOE's environmental liability containing estimated costs of, among other things, soil and water remediation and disposition of wastes and contaminated equipment for which EM is not currently responsible.

⁴⁰DOE's Hanford site has 177 underground tanks containing radioactive and hazardous waste. One-hundred forty-nine of these tanks hold waste in a single containment system; these are known as single-shell tanks. The remaining 28 tanks have a double containment system and are known as double-shell tanks.

double-shell tank.⁴¹ According to DOE documents, the two main remedies that were considered were (1) to close the tanks in place by filling them with a cement-like material—called grout—and covering them with soil or (2) to exhume, dismantle, and prepare the tanks for disposal after removing all of the radioactive waste. According to a 2014 DOE analysis, closing Hanford’s 149 single-shell tanks—those tanks with a single container—in place would cost \$19 billion, or \$18 billion less than the costs of removing the waste and preparing the 149 tanks for disposal (\$19 billion versus \$37 billion, respectively).⁴²

Although DOE selected the option to close the tanks in place, the state regulator must approve the tank closure remedy and, according to DOE site officials, has not yet done so. Washington State Department of Ecology officials we interviewed told us that they were willing to consider granting DOE approval to close the tanks in place, but they are concerned that the state may be sued if they grant such approval. According to the state officials, if DOE were given the same legal authority at Hanford as it has at its Savannah River site and Idaho National Laboratory, state regulators would be able to approve closing Hanford’s tanks in place without the threat of litigation.⁴³ As of November 2018, the state regulator had not given approval to close the tanks in place, according to these officials.

⁴¹GAO, *Nuclear Waste: Opportunities Exist to Reduce Risks and Costs by Evaluating Different Waste Treatment Approaches at Hanford*, [GAO-17-306](#) (Washington, D.C.: May 3, 2017).

⁴²Department of Energy, Office of River Protection, *Clean Closure Practicability Demonstration for the Single-Shell Tanks*, DOE/ORP-2014-02 (May 2014). According to Hanford site officials, the analysis looked at costs for work scope that in addition to addressing the tanks included related cleanup activities, such as removal of contaminated soil around the tanks.

⁴³Under Section 3116 of the fiscal year 2005 NDAA, the Secretary of Energy, in consultation with the Nuclear Regulatory Commission, may determine that certain waste from reprocessing at two DOE sites—Savannah River and Idaho National Laboratory—is not high-level radioactive waste if the criteria in Section 3116 are satisfied. The criteria of Section 3116 include, among other things, removal of highly radioactive radionuclides to the maximum extent practical. In a 2015 letter to DOE, Washington State and Oregon State officials noted that state regulators had approached DOE in 2011 with a willingness to support extending the Section 3116 provisions to apply to the Hanford site. In the 2015 letter, state officials said that DOE elected not to pursue the extension of the Section 3116 provisions with Congress.

EM Does Not Always Balance Risks with Costs When Planning to Address Its Long-Term Cleanup Responsibilities

EM relies primarily on officials at its individual sites to work with state and federal stakeholders to select cleanup remedies, which involves considering both risks and costs, according to EM headquarters officials we interviewed.⁴⁴ According to EM documents, EM site officials generally work with stakeholders to select cleanup remedies on the basis of factors such as (1) the application of environmental laws and regulations, (2) the sequencing and scheduling of cleanup activities required in compliance agreements, and (3) plans for sites' future use after cleanup work is completed.

However, we found several examples of EM sites' decisions involving billions of dollars where EM site officials and stakeholders did not always balance risks and costs. Specifically, see the following:

- **EM sites used different remedies for similar cleanup needs, which can affect the costs of cleanup.** In May 2017,⁴⁵ we reported that DOE chose to treat low-level, or low-activity, waste differently at the Hanford and Savannah River sites, primarily to address input from Washington and South Carolina, respectively, and the different environmental laws that state regulators chose to apply to tank waste management at each site.⁴⁶ While experts view the risks to human

⁴⁴In commenting on a draft of this report, DOE officials stated that DOE reached agreement with EPA in May 1988 on 10 policy-related provisions for inclusion in interagency agreements. These provisions were designed to help ensure consistent approaches when negotiating interagency agreements, while recognizing there are site-specific considerations. These officials also noted that no agreement is signed without headquarters review and input.

⁴⁵[GAO-17-306](#).

⁴⁶At EM's Hanford site, EPA has authorized the state of Washington to administer its own hazardous waste regulatory program. The state has issued a dangerous waste permit under its authorized RCRA program that establishes requirements for the treatment, storage, and disposal of mixed waste, including the construction and operation of the Waste Treatment and Immobilization Plant complex. At EM's Savannah River site, EPA has also 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.

health and the environment from the use of these remedies as similarly low, the costs of the different approaches are significantly different. We found that at Hanford, DOE planned to treat a portion of the low-activity waste using vitrification, a method that immobilizes the waste in glass. In contrast, at the Savannah River site, the waste was being treated using grout, a method that immobilizes the waste in concrete-like material. According to South Carolina officials, grout could be used to immobilize the waste faster than vitrification, thereby lessening the risk of leaks from the underground tanks where the waste is stored. Moreover, we found that there were significant cost differences to these remedies and that DOE could save tens of billions of dollars by using grout to treat a portion of the low-activity waste at Hanford rather than vitrification, based on the best available cost information.⁴⁷

- **EM site officials may not always schedule cleanup activities that can reduce risks sooner.** In a 2015 report on DOE's management of high-risk excess facilities, DOE's IG found weaknesses in the department's effort to address the risks associated with its inventory of contaminated facilities, noting that DOE was assuming increasing levels of risk by not scheduling cleanup of these facilities.⁴⁸ Transfer of many of these contaminated facilities from other DOE program offices to EM for deactivation and decommissioning had not been scheduled as of September 2014, and the date would be pushed out to 2025 at the earliest, possibly extending to 2035, according to the IG report.⁴⁹ A December 2016 DOE study determined that significant life cycle cost savings—and reductions in risk—could be achieved by

⁴⁷The fiscal year 2017 NDAA requires DOE to study the risks, benefits, and costs of immobilizing low-activity waste at Hanford with different methods, such as vitrification and grout. DOE contracted this study to the Savannah River National Laboratory. The fiscal year 2017 NDAA also calls for the National Academies to review the study. As of October 2018, the National Academies had issued the first of four reports reviewing the laboratory's analysis.

⁴⁸Department of Energy, Office of Inspector General, *The Department of Energy's Management of High-Risk Excess Facilities*, DOE/IG-0931 (Washington, D.C.: Jan. 23, 2015). According to the IG's report, among these facilities are those contaminated with dangerous elements, such as uranium, mercury, and beryllium, constituents that are known to have leached to soil and groundwater during weather-related events.

⁴⁹Site officials we interviewed in August 2016 told us that some of these facilities are not scheduled for cleanup until the 2040s and that their maintenance costs will continue to rise over time. Site officials told us that the site annually spends \$6 million to \$7 million to maintain one contaminated building while it awaits decontamination and demolition.

accelerating cleanup of these aging and deteriorating facilities.⁵⁰ According to our analysis of information in the study, DOE noted that it spends \$156 million each year for maintenance, repair, and operations costs for 203 of the higher-risk facilities, and concluded that accelerating the cleanup of such facilities could reduce the number of years DOE would have to continue to fund maintenance activities—potentially saving up to \$2.7 billion in life cycle costs.

Despite the potential savings, according to EM's fiscal year 2019 budget request, deactivating and decommissioning excess facilities was EM sites' lowest funding priority. EM officials we interviewed acknowledged that deteriorating facilities pose a risk, but they stated that other cleanup activities with milestones in site-specific agreements are a higher priority for funding. In 2015, DOE formed the Excess Contaminated Facilities Working Group to provide options on possible ways to more effectively prioritize and transfer the excess facilities owned by DOE's other program offices to EM. However, as of April 2018, according to EM officials, they had not identified any options that they could share with us. According to EM officials, DOE is prioritizing its existing work and opportunities for risk reduction, particularly cleanup activities with milestones in site-specific agreements. Officials added that if additional funds were to become available, DOE may consider accelerating the acceptance and decontamination and decommissioning of those facilities.

- **EM site officials may choose cleanup remedies that are more extensive—and costly—than required.** For example, DOE Hanford officials and stakeholders designated the land around the Columbia River where nonoperational nuclear reactors are located—known as the Columbia River Corridor—primarily for future “conservation/mining” use. DOE made this designation in a 1999 CERCLA record of decision,⁵¹ which was based on the 1999 *Comprehensive Land-Use Plan Environmental Impact Statement*

⁵⁰Department of Energy, *Plan for Deactivation and Decommissioning of Nonoperational Defense Nuclear Facilities*, Report to Congress (Washington, D.C.: December 2016).

⁵¹A CERCLA record of decision describes, among other things, how the selected remedy protects human health and the environment and the federal and state requirements that are applicable or relevant and appropriate to the site that the remedy will attain.

An Upcoming Opportunity for the Office of Environmental Management (EM) to Balance Risks and Costs

Another issue related to tanks at the Hanford site presents an opportunity for EM to make a cleanup decision balancing risk and cost. Under its agreement with federal and state regulators, the Department of Energy's (DOE) Hanford site is generally required to remove up to 99 percent of the waste in a group of 149 tanks built with a single shell.^a In an August 2015 report commissioned by DOE, independent experts questioned the need to remove 99 percent of the waste from all 149 single-shell tanks, noting that 90 percent of the risk of radioactive contamination to the surrounding groundwater came from only 58 of the 149 single-shell tanks. In a letter responding to the 2015 report, Washington State regulators said that the requirement to remove 99 percent of the waste was a temporary requirement put in place until DOE completed an evaluation to determine the amount of waste that could safely be left in the tanks. They noted that DOE had not completed its evaluation.

In August 2017, EM considered an internal proposal on tank retrieval that was submitted under an EM management initiative to improve mission operations. The tank retrieval proposal, which proposed to address tank retrieval in a risk-based manner, stated that developing a risk-based plan targeting removal of waste from higher-risk single-shell tanks and allowing more low-level waste to be left in other single-shell tanks could potentially save billions of dollars.

Source: GAO analysis of DOE and other documents. | GAO 19-28

^aThe 149 tanks are commonly referred to as "single-shell tanks." The remaining 28 tanks at Hanford have two shells—an inner shell holding waste and an outer containment shell. These are known as "double-shell tanks." Under the Tri-Party Agreement, DOE is required to retrieve as much tank waste as technically possible, with tank waste residues not to exceed 360 cubic feet in the so-called "100" series of tanks, 30 cubic feet in the "200" series tanks, or the limit of waste retrieval technology capability, whichever is less. (Tri-Party Agreement Action Plan, appendix D, milestone M-045-00.) These quantities represent 99 percent waste retrieval for each single shell tank. (Tri-Party Agreement Action Plan, appendix H, p. H-5 n.2) If DOE believes that waste retrieval to these levels is not possible for individual tanks, DOE may request an exception.

for the Hanford site.⁵² According to the 2015 report resulting from the CRESP-organized independent review, although DOE designated the future land use of the area as primarily conservation/mining, from 2010 through 2013, DOE cleaned up an area the size of 15 football fields to the depth of 85 feet, which was more extensive than what was required by the future land use designation.⁵³ DOE Hanford officials told us that they remediated the soil to a greater depth because they discovered that the contamination was more extensive than originally estimated. However, the 2015 report raised concerns that DOE's justification for cleanup of the River Corridor was questionable as a cost-effective risk reduction measure at the site.⁵⁴

In relying on each of its individual sites to negotiate cleanup remedies and establish cleanup priorities with state regulators, EM sites generally do not consider other sites' risks and priorities or the financial resources available for cleanup nationwide, according to our interviews with EM site and headquarters officials. This is not consistent with our recommendations over the last 2 decades and those of others. Specifically, see the following:

- In March 1995, we found that DOE's practice of negotiating agreements for individual sites without considering other agreements or available resources did not ensure that limited resources would be allocated in ways that could reduce the greatest environmental risks.⁵⁵

⁵²The Hanford Comprehensive Land-Use Plan environmental impact statement (EIS) evaluated the potential environmental impacts associated with implementing a comprehensive land-use plan for at least the next 50 years from 1999, the date of the EIS. In the EIS, DOE analyzed land use plan alternatives, selected its preferred alternative, and documented its decision in a record of decision. Department of Energy, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, DOE/EIS-0222 (Washington, D.C.: 1999), and DOE, *Record of Decision: Comprehensive Land-Use Plan Environmental Impact Statement*, 64 Fed. Reg. 61615 (Nov. 12, 1999). DOE reviewed the Hanford Comprehensive Land-Use Plan in two Supplement Analyses (DOE/EIS-0222-SA-01; June 2008, and DOE/EIS-0222-SA-02; April 2015), issuing an amended ROD in 2008 to clarify certain procedural matters. 73 Fed. Reg. 55824 (Sept. 26, 2008). According to the 2008 Supplement Analysis, for the conservation (mining) use "limited public access would be consistent with resource conservation."

⁵³Omnibus Risk Review Committee, August 2015.

⁵⁴According to a DOE document, DOE and its regulators selected this more stringent cleanup to contain the threat of contamination getting into the nearby river. However, according to the 2015 report, for other projects near the river that have threats of contamination—such as the nonoperational, contaminated nuclear reactors—DOE considers addressing them a lower priority.

⁵⁵[GAO/RCED-95-1](#).

At that time, we recommended that EM develop national cleanup priorities for contaminated sites using data gathered during DOE's ongoing risk evaluation as a starting point and found that by doing so, DOE could better direct its resources to address those priorities while selecting effective and affordable cleanup remedies. In commenting initially on a draft of the report, DOE noted that it could not implement our recommendation because of certain impediments, such as the need for a change in the law. In a second response to our report, DOE noted that it was changing its funding priorities to address higher-risk activities and had taken interim steps to develop a national strategy. However, while our report acknowledged the interim actions DOE took, its interim steps were limited and, ultimately, did not lead to implementation of the recommendation.

- In May 2002, we found that DOE had not developed a comprehensive, relative ranking of the risks that it faces across its sites and, as a result, could not systematically make decisions among sites based on risk. According to our report, DOE's compliance agreements, upon which sites prioritize cleanup activities, are site specific and not intended as a way to manage environmental risks across the DOE complex and do not provide a basis for prioritizing across sites. We found that compliance agreements reflect local DOE and community priorities for addressing environmental contamination at individual sites and were not developed to consider environmental risks from a DOE-wide perspective.⁵⁶
- In 2011, DOE's IG recommended that EM address its environmental responsibilities on a national, complex-wide basis and direct resources to high-risk activities that threaten human health and safety or the environment.⁵⁷
- In 2015, the report resulting from the independent review organized by CRESPP recommended that DOE develop an approach to compare priorities across the complex based on risk and direct resources to better address higher-risk activities.⁵⁸ A former Assistant Secretary of Environmental Management with whom we spoke echoed this finding, noting that EM does not direct resources within and among its sites on

⁵⁶[GAO-02-567](#).

⁵⁷Department of Energy, Office of Inspector General, *Special Report: Management Challenges at the Department of Energy*, DOE/IG-0858 (Washington, D.C.: November 2011).

⁵⁸Omnibus Risk Review Committee, August 2015.

the basis of the human health and environmental risks that EM must address but rather on historical levels of funding. According to the 2015 report, DOE needed a more systematic approach to assess and rank risks within and among EM sites, including developing headquarters-level guidance and strategies to allocate funds targeting the highest-priority risks.

Since its inception in 1989, EM has tried several times to develop overarching strategies to address and prioritize risks nationwide in a way that achieves cleanup within budgetary constraints. For example, see the following:

- In 1996, the Assistant Secretary for Environmental Management initiated a plan to complete as much cleanup as possible by 2006.⁵⁹ According to the plan, cleanup priorities were selected in part based on risk to help ensure that EM was addressing the most urgent risks first. The plan, known as *Paths to Closure*, estimated the costs, scope, and schedule to complete cleanup work on an accelerated schedule. According to DOE officials, the plan was also to be used to better understand the potential trade-offs of cleanup choices across the EM complex.
- In 2002, EM undertook an initiative known as its Top-to-Bottom Review.⁶⁰ According to EM officials, this initiative was aimed, in part, at setting national priorities for cleaning up legacy defense waste, with the goal of more efficiently reducing the human health and environmental risks that EM is responsible for addressing. The initiative noted that only about one-third of the EM program budget was directed toward actual cleanup and risk reduction work—the remainder was spent on maintenance, fixed costs, and other activities for safety and security. The initiative also stated that lengthy cleanup schedules lead to more prolonged and potentially severe public health and environmental risks. The initiative recommended that EM realign its program to be consistent with an accelerated, risk-based cleanup and closure mission. According to EM officials we interviewed, the agency fulfilled some of the Top-to-Bottom Review recommendations, including consolidating certain nuclear materials at EM's Savannah

⁵⁹Department of Energy, Office of Environmental Management, *Accelerating Cleanup: Paths to Closure*, DOE/EM-0362 (Washington, D.C.: June 1998).

⁶⁰Department of Energy, *A Review of the Environmental Management Program*, (Washington, D.C.: Feb. 4, 2002).

River site, which enhanced safety and security, reduced risk, and saved money.⁶¹

Despite EM's efforts, these strategies were either short-lived or never fully implemented. A 1999 report by CRESP noted that EM's Paths to Closure effort was not fully implemented in part because EM did not have a clear basis for understanding risks.⁶² EM and the sites defined risk as risks to projects' cost and schedule performance, rather than risks to human health and the environment. CRESP noted that this management tool did not prove useful for comparing the human health and environmental risks across sites. Regarding the Top-to-Bottom Review initiative, according to EM officials, many of the recommendations were not implemented in part because the initiative was based on overly optimistic and aggressive assumptions about the efficiency of the cleanup effort.

EM's Director of Budget and Planning acknowledged that EM does not have a program-wide strategy that sets national priorities and balances risks and costs across and within sites, but it does have a general strategy for requesting and allocating annual funding that considers sites' risks and legal requirements. He said that after taking many variables into account, EM has generally prioritized its cleanup by first funding activities that comply with safety and security requirements. After such activities are funded, EM then prioritizes activities to address radioactive tank waste treatment and disposal, followed by activities such as soil and groundwater remediation and excess facility deactivation and decommissioning.⁶³ Nevertheless, in the context of EM's \$377 billion environmental liability, EM continues to prioritize funding for activities on a

⁶¹EM's cleanup of the Rocky Flats site near Denver, which was a nuclear weapons production complex for 40 years, shows the benefits that can accrue from a risk-based cleanup approach, such as the one recommended by the Top-to-Bottom Review initiative. According to EM and other documents, at the Rocky Flats site, a risk-based management approach helped EM clean up the site ahead of the original schedule, transform it into a wildlife refuge, and save millions below the original cost estimate.

⁶²Peer Review Committee of the Consortium for Risk Evaluation with Stakeholder Participation, *Peer Review of the U.S. Department of Energy's Use of Risk In Its Prioritization Process* (New Brunswick, N.J.: Dec. 15, 1999).

⁶³According to EM's Director of Budget and Planning, EM has generally prioritized and funded its cleanup activities as follows: (1) activities to maintain a safe, secure, and compliant posture in the EM complex; (2) radioactive tank waste stabilization, treatment, and disposal; (3) spent (used) nuclear fuel storage, receipt, and disposition; (4) nuclear material consolidation, stabilization, and disposition; (5) transuranic and mixed/low-level waste disposition; (6) soil and groundwater remediation; and (7) excess facilities deactivation and decommissioning.

site-by-site basis, rather than on the basis of a program-wide strategy, as we and others have recommended over the last 2 decades. Without developing a program-wide cleanup strategy that sets national priorities and describes how DOE will direct available resources to address the greatest human health and environmental risks across and within sites, EM cannot be assured that it is effectively setting priorities within and across sites.

EM's Recent Budget Materials Have Not Provided Required or Accurate Information on the Funding Needed to Meet Its Future Cleanup Responsibilities

EM's recent budget materials have not provided Congress with required or accurate information on the funding needed to clean up legacy defense waste. Under the Atomic Energy Defense Act, EM must annually develop and report to Congress—at or about the same time that it submits its budget request—a Future-Years Defense Environmental Management Plan that reflects estimated expenditures and proposed appropriations included in the DOE budget for defense environmental cleanup activities.⁶⁴ The plan is to cover the fiscal year for which that budget is submitted and not less than the 4 succeeding fiscal years. EM's plan is to contain a detailed description of the cleanup activities to be carried out during the time period specified by the plan, estimated expenditures and proposed appropriations necessary to support them, and a description of each milestone in an enforceable agreement governing the cleanup activity. For each milestone, EM is to identify whether it will be met and, if not, provide an explanation of why the milestone will not be met and the date by which EM expects to meet it.

EM submitted the required plan in fiscal year 2012 but did not submit plans from fiscal year 2013 through fiscal year 2016.⁶⁵ EM's most recent Future-Years Defense Environmental Management Plan, which was submitted to Congress in August 2017, included little of the information required by the fiscal year 2011 NDAA.⁶⁶ For example, EM's 2017 plan does not contain a detailed description of the cleanup activities to be carried out during the time period specified by the plan, the activities' estimated costs or appropriations necessary to support them, or a description of the milestones that are at risk of not being met. In addition, where the plan provides required information, it does not always appear

⁶⁴50 U.S.C. § 2582a.

⁶⁵DOE submitted its first plan in September 2012, but according to EM officials, did not submit another plan until 2017. EM officials told us that they provided oral briefings to Congress for fiscal years 2013 through 2016 to fulfill this requirement.

⁶⁶Department of Energy, *Future-Years Defense Environmental Management Plan, FY2018 to FY2070* (Washington, D.C.: August 2017).

to be accurate. For example, the plan is required to describe the estimated future costs of cleanup activities. EM's 2017 plan, however, shows that the long-term cost to clean up the Hanford site is about \$90 billion, whereas EM's fiscal year 2017 environmental liability for the Hanford site shows the cost to be \$141 billion—and, as stated previously, this amount does not include all costs.⁶⁷

EM headquarters officials acknowledged these differences between the 2017 plan and the environmental liability estimates but told us that in their view, the Future-Years Defense Environmental Management Plan submitted to Congress in August 2017 met the statutory requirements of the fiscal year 2011 NDAA. Table 2 shows our assessment of the information EM provided in its 2017 Future-Years Defense Environmental Management Plan against the reporting requirements.

⁶⁷The life cycle cost estimate in the budget submission may contain different costs than the environmental liability estimate. For example, life cycle estimates may include pension costs, while the environmental liability does not.

Table 2: Comparison of the Office of Environmental Management’s (EM) Fiscal Year 2017 Future-Years Defense Environmental Management Plan against the Reporting Requirements of National Defense Authorization Act for Fiscal Year 2011

Reporting requirement	Extent to which the plan met requirement	Explanation and observations
Timeliness: Submit annually at or around President’s budget submission	Did not meet	The plan was first mandated in 2011, but EM only submitted it twice since then—once in 2012 and most recently in August 2017, 3 months after the fiscal year 2018 budget was submitted.
Expenditures/estimate future costs: Estimated expenditures and proposed appropriations in budget year and no less than 4 succeeding fiscal years.	Did not meet	Plan provides general life cycle cost estimates that are lower than the costs reflected in EM’s environmental liability estimate, rather than specifying estimated expenditures and proposed appropriations for the budget year plus 4 succeeding fiscal years.
List of cleanup activities and projects: Provide a detailed list of activities planned for the budget year plus 4 succeeding fiscal years	Partially met	Budget year activities are explained at a high level in a “highlights” section for each site. Although activities for fiscal year 2018 are discussed, activities for fiscal years 2019 through 2021 are outlined at a high level but not detailed.
Funding needs for cleanup activities and projects: For detailed list of activities/projects, provide for funding year plus 4 succeeding years proposed budget authority, estimated expenditures, and proposed appropriations.	Did not meet	Plan does not contain a detailed list of projects and activities and does not specify how overall budget year funding request was to be apportioned to specific project activities. In the case of activities for 4 succeeding fiscal years, there is no description of funding needs, estimated expenditures, or proposed appropriations.
Milestones: List all milestones for budget submission year plus 4 succeeding years, due date, and statement of whether milestone will be met and if not why not.	Partially met	Plan shows milestones by site. However, out of 154 milestones listed, the plan shows only one milestone may be missed; yet for another milestone—at Hanford—DOE noted publicly that there is a high risk of this target being missed.

Source: GAO analysis of EM’s 2017 Future-Years Defense Environmental Management Plan. | GAO-19-28

According to EM officials, EM’s plan is intended to provide Congress with visibility on long-term funding needs. However, the costs EM included were less than those reflected in EM’s environmental liability, and EM did not provide estimated expenditures and proposed appropriations in the budget year and no less than 4 succeeding fiscal years, as required by the fiscal year 2011 NDAA. Having this information would give Congress visibility on whether EM was on track to meet or exceed its life cycle cost targets. By including information on annual growth in its environmental liability estimates by site, the key factors causing that growth, and an explanation of significant differences between life cycle cost estimates in its annually required Future-Years Defense Environmental Management Plan, EM would provide Congress with a more complete picture of long-term cleanup costs.

EM's Recent Budget Materials Did Not Reflect the Funding It Needs to Meet Required Time Frames for Certain Cleanup Activities

We found that the information EM provided in its fiscal years 2016, 2017, and 2018 budget requests did not reflect the funding it says it needs to meet its schedule milestones for legacy defense waste cleanup. In a December 2015 presentation on cleanup priorities, EM's Deputy Assistant Secretary noted that EM's anticipated long-term funding needs for the full costs of cleanup far exceeded the office's annual budget requests.⁶⁸ The 2015 presentation noted that in fiscal years 2016, 2017, and 2018, EM anticipated that it needed nearly \$8 billion annually to meet schedule milestones called for in compliance agreements. These agreements are legally enforceable documents defining cleanup activities that DOE must achieve by specified dates. DOE's budget requests for those fiscal years were \$5.8 billion, \$6.1 billion, and \$6.5 billion, respectively.⁶⁹ In the December 2015 presentation, EM's Deputy Assistant Secretary stated that in the coming 2 decades, if EM continued to receive about \$6 billion per year, it would face a funding shortfall of about \$28 billion. Without obtaining the additional funding, according to the 2015 presentation, the time frame for EM's cleanup mission would likely be extended for years, thereby increasing cleanup costs and raising the environmental liability, according to DOE audit documentation.

Similarly, at an October 2017 EM Site-Specific Advisory Board meeting for the Hanford site, EM's Associate Principal Deputy Assistant Secretary for Field Operations said that for EM to meet all of the cleanup requirements reflected in agreements with federal and state regulators, EM would need a much larger budget than what was requested in fiscal year 2018. For example, she said that EM's Hanford site, which received about \$2.5 billion in fiscal year 2018, needs more than \$4 billion per year just to meet scheduled milestones to construct and operate the Waste Treatment and Immobilization Plant—one of many cleanup activities at the site—for the duration of its planned mission. She added that EM's

⁶⁸Mark Gilbertson, Deputy Assistant Secretary, Office of Site Restoration, Office of Environmental Management, Department of Energy, *Risk-Informing Environmental Cleanup Priorities* (Richland, Wash.: Dec. 15, 2015).

⁶⁹According to DOE's fiscal year 2017 budget justification, EM's fiscal year 2016 enacted appropriation was \$6.2 billion. DOE's fiscal year 2018 budget justification noted that EM's fiscal year 2017 appropriation, under a continuing resolution, was \$6.3 billion.

annual budget will not cover all needs, particularly as infrastructure maintenance, repair, and replacement needs are growing and pushing the end of cleanup further into the future, thereby increasing EM's environmental liability.

EM's Director for Budget and Planning said that funding requests in EM's annual budget submission reflect departmental priorities and are sufficient to fund activities planned for the budget year. EM Budget Office officials said that if funding were to increase, the sites may not have capacity, such as a sufficient workforce and technology available, to achieve the cleanup activities called for in the schedule milestones.

Where agencies' budget submissions do not provide policymakers with the information necessary to assess the full costs and benefits of programs, we have recommended that agencies provide supplemental reports. For example, in October 2013, we found that for some fiscal exposures—those responsibilities, programs, and activities that legally obligate the federal government to future spending—agency budget submissions may provide incomplete information or potentially misleading signals about the government's future financial obligations.⁷⁰ We found that supplemental reporting—that is, providing information about the financial state of programs in addition to information reported in budget submissions—could provide policymakers a more complete understanding of fiscal exposures and potential changes in future spending that enhance the ability to evaluate trade-offs in allocating federal resources.

In DOE's case, Congress has required similar information in the annual Future-Years Defense Environmental Management Plan. However, as we noted above, the agency has not fully provided the information required in the plan, nor has it provided in the plan the realistic amount that is annually needed to meet cleanup obligations and reduce the environmental liability. By disclosing the funding it needs to meet all of its schedule milestones called for in compliance agreements in, for example, supplemental reporting or the annual Future-Years Defense Environmental Management Plan, EM would have better assurance that it provides policymakers with the information necessary to assess the full costs of long-term cleanup.

⁷⁰GAO, *Fiscal Exposures: Improving Cost Recognition in the Federal Budget*, [GAO-14-28](#) (Washington, D.C.: Oct. 29, 2013).

Conclusions

EM has the difficult task of cleaning up legacy defense waste—much of which is radioactive or hazardous—at 16 sites across the country. The federal government’s environmental liability associated with cleaning up legacy defense waste is substantial and growing. As the gap between the costs of cleanup and available funds widens, it is increasingly important for EM to ensure that taxpayer dollars are used to address the environmental and human health risks from legacy defense waste in a cost-effective manner. We and others have previously recommended that DOE direct its resources to address the greatest risks by developing national cleanup priorities and directing funding to high-risk activities that threaten human health and safety or the environment. EM has tried at various times to develop and implement a program-wide strategy that balances the costs of cleanup actions with the level of health and environmental risks they are designed to address, but it does not currently have one. Without developing such a strategy that sets national priorities and describes how DOE will direct available resources to address the greatest human health and environmental risks across and within sites, EM cannot be assured that it is effectively setting priorities within and across sites.

Although DOE provides budget materials to help Congress understand the long-term costs of the cleanup program, EM’s recent submissions did not include sufficient details about the agency’s long-term cleanup plans or future funding requirements necessary to fulfill its cleanup mission, and did not account for realistic, future budget scenarios. By including information on annual growth in its environmental liability estimates by site, the key factors that caused that growth, and an explanation of significant differences between life cycle cost estimates in its annually required Future-Years Defense Environmental Management Plan, EM would provide Congress with a more complete picture of long-term cleanup costs. In addition, DOE has not submitted realistic estimates of current and future funding needs in addition to its annual budget materials, such as through supplemental reporting. As a result, the agency’s budget materials alone do not provide policymakers with the information necessary to assess the full costs and benefits of specific programs at the time when funding decisions are made. By disclosing the funding it needs to meet all of its schedule milestones called for in compliance agreements in, for example, supplemental reporting or the annual Future-Years Defense Environmental Management Plan, EM

would have better assurance that it provides policymakers with the information necessary to assess the full costs of long-term cleanup.

Recommendations for Executive Action

We are making three recommendations to DOE.

The Secretary of Energy should direct DOE's Office of Environmental Management to develop a program-wide strategy that outlines how DOE will direct available resources to address human health and environmental risks across and within sites. (Recommendation 1)

The Secretary of Energy should direct DOE's Office of Environmental Management to submit in EM's annually required Future-Years Defense Environmental Management Plan all mandated requirements, as well as information on annual growth in environmental liability estimates by site, the key factors causing that growth, and an explanation of significant differences between environmental liability estimates and life cycle cost estimates. (Recommendation 2)

The Secretary of Energy should direct DOE's Office of Environmental Management to disclose the funding EM needs to meet all of its schedule milestones called for in compliance agreements in, for example, supplemental reports or the annual Future-Years Defense Environmental Management Plan. (Recommendation 3)

Agency Comments

We provided a draft of this report to the Department of Energy for comment. In its comments, reproduced in appendix II, DOE agreed with our three recommendations. DOE also provided technical comments, which 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, the report is available at no charge on the GAO website at <http://www.gao.gov>.

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

Sincerely yours,

A handwritten signature in black ink that reads "David C. Trimble". The signature is written in a cursive style with a large, stylized 'D' and 'T'.

David C. Trimble
Director, Natural Resources and Environment

Appendix I: Objectives, Scope, and Methodology

The objectives of our review were to examine (1) what is known about the Office of Environmental Management's (EM) environmental liability, (2) the extent to which EM balances risks and costs when addressing its long-term cleanup responsibilities, and (3) the extent to which EM's recent budget materials provide required and accurate information on the funding needed for its future cleanup responsibilities.

For the purpose of this review, we focused on three EM cleanup sites: the Hanford site in Richland, Washington; the Savannah River site in Aiken, South Carolina; and the Oak Ridge site in Oak Ridge, Tennessee. We selected these sites because they represented more than 75 percent of EM's fiscal year 2017 environmental liability and contained a mix of cleanup activities. During our review, we visited the three sites. During site visits, we met with EM site officials, state regulators, and officials from the Defense Nuclear Facilities Safety Board who conduct safety oversight at EM sites to discuss that site's environmental liability. We also toured each site.

To answer these objectives, we reviewed the Department of Energy's (DOE) annual financial statements for fiscal years 2011 through 2017.¹ DOE issued its fiscal year 2018 financial statement in December 2018, while our draft report was at DOE for review and comment; where possible, we updated our analysis to reflect the fiscal year 2018 information. We also reviewed DOE's guidance on developing its annual environmental liability estimate. We interviewed knowledgeable officials at DOE headquarters about the development of its annual environmental liabilities estimate. Specifically, we discussed the source of the data used to develop the environmental liability and how the environmental liability estimates are reviewed for accuracy by an independent third-party reviewer. The DOE Inspector General (IG) and the IG office's contractor annually review EM's environmental liability estimates and conduct testing at specific sites. We also interviewed knowledgeable experts,

¹We chose this time period because data from these fiscal years were comparable, whereas, according to an EM official, data from before fiscal year 2011 were not.

including members of the Omnibus Risk Review Committee and two former Assistant Secretaries of Environmental Management on issues relating to EM's environmental liability and causes for growth, as well as EM's current cleanup strategy and how it makes risk-based decisions balancing risk versus cost.

To examine what is known about EM's environmental liability, we reviewed past reports by GAO and others, including DOE reports and the Omnibus Risk Review Committee 2015 report. To identify reports, we pursued several avenues. First, we scanned the GAO reports database from 1990 to present to identify reports about DOE. We scanned the titles of these reports to determine their potential relevance to DOE's environmental liability. We also discussed and obtained documentation relating to EM's environmental liability from internal GAO experts in cost accounting. In addition, we reviewed reports from DOE that were relevant. From this list of 58 reports, we examined the findings and recommendations to identify general types of factors contributing to changes in EM's environmental liability, and we then categorized them as follows:

- contract and project management problems;
- regulator changes;
- accidents, work stoppages, or disruptions;
- technical challenges;
- scope, cost, or schedule changes; and
- repository uncertainty.

We discussed these key factors with site officials and others. These key factors were corroborated by an independent GAO analyst.

To identify what is known about EM's environmental liability, we followed several steps. First, we reviewed information on EM's environmental liability, including information from DOE's financial statements from fiscal years 2011 through 2017. We also reviewed DOE documentation on changes to DOE's environmental liability for these fiscal years. Based on this review, we identified changes to the environmental liability by site. We corroborated the site environmental liability changes with EM

officials.² We also obtained from EM officials the total environmental liability estimate for selected EM sites for fiscal years 2011 through 2017 and the dollar amounts of change from the previous year. We also obtained from EM officials fiscal year 2017 environmental liability, broken down by waste type. We also reviewed documentation prepared by DOE's independent public accountant as part of the audit of DOE's fiscal years 2011 through 2016 financial statements, taken as a whole, which include DOE's estimated environmental liability. Based on the steps we performed, we determined that the information we obtained was sufficiently reliable to conduct a performance audit, that is, to describe what the environmental liability estimate is and how it has changed over time as well as what key factors have contributed to increases.

To examine the extent to which EM balances risks and costs when addressing its long-term cleanup responsibilities, we interviewed EM headquarters and site officials about the process used to make cleanup decisions. At sites we visited, we gathered examples of cleanup decisions that addressed risk and cost. We also spoke with state regulators to obtain their views on how DOE makes cleanup decisions balancing cost and risk. We also discussed EM's cleanup strategy and process for making cleanup decisions with independent experts, including those authoring a 2015 report on cleanup and risk, as well as two former Assistant Secretaries for Environmental Management. We also reviewed reports by GAO and others to identify findings and recommendations pertaining to EM developing a cleanup strategy based on national priorities. We discussed with EM headquarters officials how sites prioritize cleanup activities and how EM headquarters uses input from sites to prioritize activities for funding requests. We did not include documentation associated with EM's prioritization of cleanup activities for funding because EM officials told us that this information was considered embargoed.

To examine the extent to which EM's recent budget materials provide required and accurate information on the funding needed for its future cleanup responsibilities, we reviewed DOE budget documents and other documents provided to Congress, including the 2017 Future-Years

²According to an EM budget official we interviewed, EM does not formally analyze annual changes to its environmental liability in a way that would identify key changes at each site and underlying reasons for those changes. Based on our review of DOE's financial statement documentation, we worked with EM to obtain information on key environmental liability changes at the sites we examined.

Defense Environmental Management Plan, containing budgetary information. We also reviewed audit documentation associated with EM's environmental liability. We also discussed with EM headquarters officials how they develop budget estimates and how these compare to environmental liability estimates. For the Future-Years Defense Environmental Management Plan, we compared the requirements of the legislation mandating this report to the information provided in this report. Based on supporting evidence, we determined whether DOE "met," "partially met," or "did not meet" each requirement mandated in the legislation.

We conducted this performance audit from February 2016 to January 2019 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: Comments from the Department of Energy



Department of Energy
Washington, DC 20585

January 16, 2019

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

Dear Mr. Trimble:

The U.S. Department of Energy (DOE) has reviewed the U.S. Government Accountability Office's (GAO) draft report, GAO-19-28, *Department of Energy: Program-wide Strategy and Better Reporting Needed to Address Growing Environmental Cleanup Liability*. We appreciate the opportunity to respond to this draft report and its recommendations.

DOE agrees with the premise of the recommendations included in the report. DOE is currently identifying and evaluating opportunities across the complex to reduce risk and life-cycle costs through more efficient and innovative approaches. For example, DOE is implementing end-state contracting approaches at several sites to accelerate cleanup, reduce risk and reduce environmental liabilities. As EM evaluates and presents alternative opportunities at our sites, information regarding the environmental liability estimates and lifecycle costs, as well as funding needed to meet the Department's environmental compliance agreements will be included.

Thank you for the opportunity to provide the DOE perspective on the draft GAO-19-28 report regarding DOE's environmental cleanup liability. If you have any further questions, please contact Steve Trischman, Budget and Planning Director, at (301) 903-7478.

Sincerely,

A handwritten signature in blue ink, appearing to read "Anne Marie White", is located below the "Sincerely," text.

Anne Marie White
Assistant Secretary
for Environmental Management



Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

David C. Trimble, (202) 512-3841 or trimbled@gao.gov.

Staff Acknowledgments

In addition to the contact named above, Nathan Anderson (Assistant Director), Arkelga Braxton, Mark Braza, John Delicath, Nicole Dery, Charlotte E. Hinkle, Richard Johnson, Nancy Kintner-Meyer, Courtney Krebs, and Kiki Theodoropoulos made key contributions to this report.

Appendix IV: Accessible Data

Data Tables

Accessible Data for Figure 2: Office of Environmental Management's Portion of the Department of Energy's Fiscal Year 2017 Environmental Liability by Cleanup Activity and Waste Type

Activity/Waste Type	Percent of EM's Liability	Dollar amount of EM Liability (in Billions)
Radioactive and hazardous tank waste	48%	\$127.9
Soil and groundwater remediation, and facility deactivation and decommissioning	25%	\$66.0
Solid waste management	8%	\$22.1
Surplus nuclear materials and spent nuclear fuel	8%	\$21.0
Other (including site services and infrastructure)	11%	\$30.6

Accessible Data for Figure 3: Comparison of Four Office of Environmental Management (EM) Sites with the Majority of EM's Fiscal Year 2017 Environmental Liability with Corresponding Tank Waste Radioactivity

Site	FY16 Environmental Liability (billions of dollars)	% of EM's FY17 Environmental Liability	Curies (in millions)	% of Total Curies
Hanford site	141.2	52.8%	176	34.9%
Savannah River Site	54.7	20.46%	292	57.8%
Idaho National Laboratory	10.9	4.07%	37	7.3%
Oak Ridge Reservation	9.3	3.49%	N/A	N/A

Accessible Data for Figure 4: Department of Energy Office of Environmental Management's (EM) Annual Spending and Environmental Liability, Fiscal Years 2011 through 2017

(\$ billion)	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017
Annual EM Spending	\$5.7	\$5.7	\$5.7	\$5.8	\$5.9	\$6.2	\$6.40
Cumulative	\$5.7	\$11.4	\$17.1	\$22.9	\$28.8	\$35.0	\$41.40
Reported EM Environmental Liability	-\$163	-\$175	-\$181	-\$204	-\$240	-\$257	-\$268

Agency Comment Letter

Accessible Text for Appendix II Comments from the Department of Energy

January 16, 2019

Mr. David Trimble

Director, Natural Resources and Environment

U.S. Government Accountability Office

Washington, DC 20548

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Sincerely,

Anne Marie White

Assistant Secretary for Environmental Management

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