



December 2019

NUCLEAR CLEANUP Actions Needed to Improve Cleanup Efforts at DOE's Three Former Gaseous Diffusion Plants

Accessible Version

GAO Highlights

Highlights of [GAO-20-63](#), a report to the Committee on Armed Services, U.S. Senate

Why GAO Did This Study

Cleaning up DOE's former uranium enrichment sites will cost billions of dollars and span decades. These sites, near Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio, are contaminated with radioactive and hazardous materials. EM is responsible for their cleanup.

This report examines (1) the extent to which EM has managed cleanup of the GDPs compared with relevant program management leading practices and the status of the cleanup effort; (2) what EM has spent on cleanup at the GDPs, and the extent to which EM's cost estimates for completing GDP cleanup are reliable; and (3) the extent to which the D&D Fund is sufficient to cover EM's estimated cleanup costs of the GDPs and challenges, if any, that could affect the sufficiency of the fund. GAO reviewed relevant legislation and DOE reports to Congress on GDP cleanup; compared program management to relevant leading practices; assessed EM expenditure and cost estimation documents; and interviewed EM and state regulatory officials at the three GDPs.

What GAO Recommends

GAO is making five recommendations, including that DOE (1) manage the cleanup of the three GDPs as an integrated program and follow program management leading practices, (2) ensure cost estimates fully incorporate cost estimating best practices, and (3) report regularly on the status of the D&D Fund and cleanup efforts at the three GDPs. DOE agreed with four of them and partially agreed with one. GAO believes all of the recommendations should be implemented at all three sites.

View [GAO-20-63](#). For more information, contact David C. Trimble at (202) 512-3841 or trimbled@gao.gov.

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NUCLEAR CLEANUP

Actions Needed to Improve Cleanup Efforts at DOE's Three Former Gaseous Diffusion Plants

What GAO Found

Since 2007, the Department of Energy (DOE) has stated in reports to Congress that it intends to manage its three former gaseous diffusion plants (GDP) in an integrated manner. Also, a Decontamination and Decommissioning (D&D) Fund was established by law to pay for the cleanup costs of the GDP sites, so that DOE's Office of Environmental Management (EM) must coordinate and make trade-offs in its use of resources among the three GDPs. However, EM has managed the cleanup of the three GDPs as three individual sites. In addition, EM is not following relevant leading practices GAO reviewed for managing the cleanup as a program (having a program management plan; a reliable integrated master schedule; and a reliable, integrated, comprehensive life-cycle cost estimate. By managing the three GDPs as an integrated program and following these program management leading practices, EM would have more reasonable assurance that it is taking every opportunity to increase the efficiency and effectiveness of its management activities.

EM has reported spending a total of about \$15.5 billion on GDP cleanup as of fiscal year 2018. However, EM's cost estimates for completing cleanup at the three sites are not reliable. GAO assessed EM's cost estimates for the GDPs individually by comparing them with best practices for developing high-quality, reliable cost estimates. EM's cost estimates for completing cleanup of the GDPs do not fully or substantially meet all of the characteristics of a reliable cost estimate. Until EM ensures that its site-specific cost estimates fully incorporate best practices for cost estimation, EM, DOE, regulators, and Congress will not have the information needed to understand the level of resources required to achieve cleanup of the three GDPs.

Under EM's current cost estimates, remaining GDP cleanup costs exceed the balance of the D&D Fund by at least \$25 billion and EM faces challenges that could affect cleanup progress and the sufficiency of the fund. For example, DOE's reporting to Congress on the sufficiency of the D&D Fund is based on old financial data, incomplete information, and unclear scope. These limitations reduce the quality of the information Congress receives for making decisions about the sufficiency of the fund and allocating resources to the fund. For example, DOE reported to Congress on the status of the D&D fund and GDP cleanup in May 2019. The report was based on financial data as of September 2016 and on cost estimates prepared in 2013 for one GDP and in 2014 for the other two. Given that DOE estimates the fund will be exhausted in 2020, there is urgency for DOE to communicate current information on the fund on a timely basis to Congress. By regularly reporting on the status of the D&D Fund and cleanup efforts at the three GDPs with current information that contains details on challenges in reaching agreement with regulators and a clear scope of work, DOE will be able to provide better information for congressional decision-making on the sufficiency of the fund.

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Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
D&D	Decontamination and Decommissioning
DOE	Department of Energy
EM	Office of Environmental Management
EPA	U.S. Environmental Protection Agency
GDP	Gaseous Diffusion Plant
IPABS	Integrated Planning, Accountability, and Budgeting System
National Academies	National Academies of Sciences, Engineering, and Medicine
OMB	Office of Management and Budget
PMI	Project Management Institute
RCRA	Resource Conservation and Recovery Act of 1976
STARS	Standard Accounting and Reporting System
USEC	United States Enrichment Corporation

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December 17, 2019

The Honorable James M. Inhofe
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

Completing cleanup at the Department of Energy's (DOE) three former uranium enrichment sites will cost billions of dollars and span decades. Located near Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio, these former uranium enrichment sites—referred to as gaseous diffusion plants (GDP) because they relied on gaseous diffusion technology to enrich uranium—were built starting in the 1940s. Contaminated with radioactive and hazardous materials, the three GDPs encompass more than 30 million square feet of floor space, use miles of interconnecting pipes, and thousands of acres of land. All three GDPs ceased operations by 2013, and DOE's Office of Environmental Management (EM) is responsible for their cleanup. Cleanup activities include assessing, treating, and disposing of contamination; decontaminating and decommissioning (D&D) buildings and facilities; and cleaning up soil, surface water, and groundwater, which are considered remediation activities.¹ EM conducts GDP cleanup activities under the requirements of several federal environmental laws as well as site-specific agreements with the Environmental Protection Agency (EPA) and state regulatory agencies.

¹Terminology in the D&D process includes (1) deactivation, (2) decontamination (3) decommissioning, and (4) demolition. According to EM officials, these terms are defined as follows. Deactivation refers to the process of placing a facility in a stable and known condition including the removal of hazardous and radioactive materials to ensure adequate protection of workers, public health and safety, and the environment. Decontamination is the removal or reduction of residual chemical, biological, or radiological contaminants and hazardous materials by mechanical, chemical, or other techniques to achieve a stated objective or end condition. Decommissioning refers to the process of closing and securing a nuclear facility or nuclear materials storage facility to provide adequate protection from radiation exposure and to isolate radioactive contamination from the human environment. It takes place after deactivation and includes surveillance, maintenance, decontamination, and/or dismantlement. Demolition is the destruction and removal of physical facilities or systems.

The Energy Policy Act of 1992, as amended, established the Uranium Enrichment Decontamination and Decommissioning Fund (D&D Fund) to pay for cleanup at the three GDP sites.² In its 2019 Triennial Report to Congress (hereafter referred to as the 2019 triennial report), DOE stated that as of September 2016—the financial reporting period end date of the report—the D&D Fund had a projected shortfall of \$26.6 billion and was predicted to be exhausted by 2020.³ EM's GDP cleanup costs represent one aspect of the federal government's overall environmental liabilities, which are the costs the federal government bears for cleaning up legacy contamination for which it is responsible.

In February 2017, we placed the federal government's environmental liabilities on our high-risk list of agencies and program areas vulnerable to fraud, waste, abuse, and mismanagement or most in need of transformation.⁴ In fiscal year 2018, DOE reported that its total environmental liabilities were \$494 billion (in constant fiscal year 2018 dollars), representing more than 85 percent of the U.S. government's overall environmental liability. The GDP cleanup accounts for a portion of this overall liability.

You asked us to review the D&D Fund and the status of cleanup at the three GDPs. This report examines (1) the extent to which DOE's EM has managed the cleanup of the three GDPs compared with relevant program management leading practices and the status of the cleanup effort; (2) what EM has spent on cleanup at the three GDPs and the extent to which EM's cost estimates for completing GDP cleanup are reliable; and (3) the extent to which the D&D Fund is sufficient to cover EM's estimated cleanup costs of the GDPs and challenges, if any, that could affect the sufficiency of the fund.

²The Energy Policy Act of 1992, Pub. L. No. 102-486, § 1101. 106 Stat. 2953-2955 (1992). All further references to the Energy Policy Act of 1992 refer to the Energy Policy Act, as amended.

³DOE, *Uranium Enrichment: Decontamination and Decommissioning Fund Report to Congress* (Washington, D.C.: May 2019). The Energy Policy Act, as amended, required the Secretary of Energy to report within 3 years of enactment, and at least once every 3 years thereafter, on the progress of the GDP cleanup effort. This reporting requirement was eliminated pursuant to the Federal Reports Elimination and Sunset Act of 1995 and a House Report naming the DOE reporting requirement. Nonetheless, DOE has continued to issue the triennial report on a periodic basis. EM officials told us that although this triennial report was issued in May 2019, the report is based on 2016 data and that they therefore consider it the 2016 triennial report. However, because it was issued in 2019, we refer to it as the 2019 triennial report.

⁴GAO, *High Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, [GAO-17-317](#) (Washington, D.C.: Feb. 15, 2017).

To inform all three objectives, we reviewed the Energy Policy Act of 1992, as amended; DOE triennial reports to Congress on GDP cleanup efforts; and prior reports issued by us, DOE's Office of Inspector General (both performance audits and financial statement audits on the D&D Fund), and the National Academies of Sciences, Engineering, and Medicine (National Academies).⁵ We also interviewed officials from DOE's Office of Inspector General, EPA, and representatives of the National Academies, regarding their knowledge of EM's cleanup progress at the GDPs and any past, ongoing, or future work they have conducted or are planning on the GDP cleanup. We visited all three GDP sites to observe the cleanup work and interviewed EM officials responsible for the cleanup, representatives of the DOE contractor responsible for D&D activities, state regulators working with EM on environmental compliance activities (from Kentucky, Ohio, and Tennessee), members of GDP site-specific advisory boards, and representatives of community reuse organizations.⁶ Following these interviews, we conducted a content analysis of all responses to our interview questions to determine any key challenges EM faces in completing cleanup of the GDPs.

To examine the extent to which EM has managed the cleanup of the GDPs compared with program management leading practices and the status of the cleanup effort, we reviewed documents, including site-specific GDP cleanup plans and GDP cleanup progress briefings, as well as reports issued by the National Academies, us, and DOE. We interviewed EM officials and contractor representatives on their past, present, and future plans for cleanup. We also interviewed EPA and state regulatory agency representatives at each of the GDPs regarding their role in the cleanup and interactions with EM. We assessed the

⁵Reports we reviewed included: GAO, *Uranium Enrichment: Decontamination and Decommissioning Fund Is Insufficient to Cover Cleanup Costs*, [GAO-04-692](#) (Washington, D.C., July 2004); GAO, *Nuclear Waste Cleanup: DOE Could Improve Program and Project Management by Better Classifying Work and Following Leading Practices*, [GAO-19-223](#) (Washington, D.C.: Feb. 19, 2019); Committee on Decontamination and Decommissioning of Uranium Enrichment Facilities, National Research Council of the National Academies, *Affordable Cleanup? Opportunities for Cost Reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities* (Washington, D.C.: National Academies Press, 1996); DOE Office of Inspector General, *Audit Report: The Status of Cleanup at the Department of Energy's Paducah Site*, DOE/IG-0937 (Washington, D.C., June 2015).

⁶Site-specific advisory boards are composed of local citizens whose role is to involve the public and make cleanup recommendations to EM. Community reuse organizations are entities recognized by DOE to help minimize the social and economic impacts of workforce restructuring at DOE facilities such as by obtaining government-owned property for the purpose of economic development.

information from our document reviews and all interviews (content analysis from interview responses) and aligned the assessed information with relevant program management leading practices. We identified the three program management leading practices by reviewing our prior work and the Project Management Institute's (PMI) *The Standard for Program Management—Fourth Edition*.⁷ The three leading practices were having (1) a program management plan, (2) an integrated master schedule, and (3) a reliable, integrated, comprehensive life-cycle cost estimate. We compared EM's management of the GDPs with these leading practices. To examine the status of cleanup at the GDPs, we reviewed EM's documentation of the cleanup work completed and the work remaining at each GDP.

To examine what EM has spent on cleanup at the three GDP sites, and the extent to which EM's cost estimates for completing GDP cleanup are reliable, we reviewed historical funding and cleanup expenditure data for all three sites for fiscal years 1994 through 2018 and analyzed EM documentation supporting cost estimates for each of the three GDPs. We reviewed financial statement audit reports issued on the D&D Fund for fiscal years 2005 to 2012. We also met with relevant headquarters and field financial management, budget, and planning staff. In addition, we assessed the reliability of the historical funding and expenditure data provided by EM by obtaining, from EM officials familiar with DOE's financial management system, responses to a series of data reliability questions on data entry access, quality control procedures, and the accuracy and completeness of the data. Based on these responses, we found the data to be sufficiently reliable for purposes of our reporting objective. To examine the reliability of EM's cost estimates for completing cleanup at the three GDPs, we reviewed EM's cost estimate documentation, interviewed EM site officials, and compared GDP cost estimates against characteristics of reliable cost estimates contained in our *Cost Estimating Guide*.⁸ We reviewed agency documents that established the basis and assumptions for site contractors' contributions to the cost estimates; the contractors' work breakdown structures; and

⁷PMI is a not-for-profit organization that has established standards for program and project management that are generally recognized as leading practices for most programs and projects. These standards are used worldwide and provide guidance on how to manage various aspects of projects, programs, and portfolios.

⁸GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, [GAO-09-3SP](#) (Washington, D.C.: Mar. 2, 2009). The *Cost Estimating Guide* contains cost estimating best practices drawn from across industry and government.

presentations on the contractors' cost estimating models. We shared our draft assessment for each GDP cost estimate with EM officials and then revised those assessments based on EM's written comments and the additional documentation they provided, as appropriate.

To examine the extent to which the D&D Fund is sufficient to cover EM's estimated cleanup costs of the GDPs and challenges, if any, that could affect the sufficiency of the fund, we reviewed information on the balance of the D&D Fund and compared it to EM cost estimate information, past reports that describe the balance of the fund, and our prior report on the fund.⁹ We reviewed DOE's triennial reports from 1996 to 2019 to determine the extent to which the information provided was presented consistently across reports. In addition, we interviewed key stakeholders, including EM and EPA officials; Kentucky, Ohio, and Tennessee regulators; members of GDP site-specific advisory boards; and representatives of community reuse organizations as discussed above regarding challenges that could affect the sufficiency of the D&D Fund.

We conducted this performance audit from April 2018 to December 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

The GDPs were constructed in the 1940s and 1950s and were used to enrich uranium for the U.S. military as well as the nation's domestic nuclear power industry. The GDPs are located near Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio (see fig. 1). The GDPs were rendered obsolete due to the emergence of newer, more efficient technologies and the globalization of the uranium enrichment market. All three GDPs eventually ceased uranium enrichment activities, with Paducah being the last to stop enriching by 2013.

⁹[GAO-04-692](#).

Figure 1: Location of the Department of Energy's (DOE) Former Gaseous Diffusion Plants



Source: DOE. | GAO-20-63

The GDP sites are similar in many ways. For example, the primary structures at each GDP are large buildings for uranium enrichment processing using the same gaseous diffusion technology. In addition, at each of the sites, these large buildings all housed similar equipment, such as compressors, converters, and other equipment necessary for enriching uranium. EM measures these buildings in acres rather than square feet (see fig. 2). For example, the five uranium enrichment processing buildings that once stood at Oak Ridge measured a total of 114 acres. Each GDP site also consists of hundreds of other similar buildings and facilities used to fabricate, service, repair, and clean machinery as well as

additional infrastructure, such as electrical switchyards and cooling towers.¹⁰

Figure 2: Photograph of a Uranium Enrichment Processing Building at the Department of Energy's (DOE) Former Gaseous Diffusion Plant in Paducah, Kentucky



Source: DOE. | GAO-20-63

The following provides a brief overview of each GDP.

¹⁰A switchyard is a collection of electrical components used to control and condition electrical power (as for the gaseous diffusion plants). DOE officials clarified that for facilities that consume a massive amount of power, switchyards include step-down transformers that convert very high transmission voltage to useable site voltage—the converse of power generating facilities, which likewise have transformers within their switchyards. The switchyards at the GDPs do contain transformers and do reduce voltages for further distribution into the plant. Cooling towers are heat exchangers designed to aid in the cooling of water that was used to cool exhaust steam exiting the turbines of a power plant. Cooling towers transfer exhaust heat into the air instead of into a body of water.

Rescission of the USEC Fund

The Energy Policy Act of 1992 created the United States Enrichment Corporation (USEC) as a government corporation authorized to, among other things, acquire, market, and enrich uranium. The 1992 Act also established a revolving fund in the U.S. Treasury—the USEC Fund—for carrying out USEC’s purposes. In 1996, Congress enacted the USEC Privatization Act authorizing establishment of a private, for-profit corporation. The act provided that “expenses of privatization” were to be paid from certain accounts, including the USEC Fund. One week before privatization, Congress enacted the “McCConnell Act,” which reserved approximately \$373 million from certain accounts, including the USEC Fund, for the disposition of depleted uranium stored at government-owned enrichment plants operated by USEC. USEC was privatized on July 28, 1998. After privatization, the USEC Fund balance of \$1.2 billion was retained on the books of the Treasury. Since then, the balance of the USEC Fund has grown to an estimated \$1.695 billion as of fiscal year 2020.

In 2015, we found that the entire balance of the USEC Fund is available for permanent rescission since the two statutorily authorized uses for the USEC Fund have been fulfilled: (1) environmental clean-up expenses pursuant to the “McCConnell Act,” and (2) expenses of privatization. In the fiscal year 2017 federal budget, the Administration proposed using the balances of the USEC Fund to carry out purposes authorized to be funded by the Uranium Enrichment Decontamination and Decommissioning Fund. This is not one of the authorized purposes of the USEC Fund. We have previously found that DOE’s effort to utilize USEC Fund monies instead of general fund appropriations to support efforts other than the authorized purpose of the USEC Fund would diminish transparency in budgeting. In May 2019, we highlighted this issue in our annual report on fragmentation, overlap, and duplication.

As of September 2019, Congress had not passed legislation to permanently rescind the balance of the USEC Fund, as we suggested in April 2015. Rescission may increase the transparency of federal agencies’ budget presentations and help Congress have a clear understanding of how new funding requests relate to funding decisions for existing projects with continuing resource needs.

Sources: GAO analysis of the Budget of the United States Government for Fiscal Years 2017 and 2020; [GAO-15-404SP](#); [GAO-19-285SP](#); and B-286661. | [GAO-20-63](#)

- **Oak Ridge.** The Oak Ridge GDP is located on 5,000 acres of land, just outside of Oak Ridge, Tennessee, and formerly housed five uranium enrichment processing buildings along with over 500 additional buildings and facilities, such as cooling towers and electrical switchyards.¹¹ The Oak Ridge GDP is the oldest of the three GDPs and was built as part of the Manhattan Project to enrich uranium for the first atomic bombs ever produced by the United States. In the 1960s, Oak Ridge began enriching uranium for civilian nuclear power reactors and enrichment continued until 1985. The Oak Ridge GDP permanently closed in 1987.¹²
- **Portsmouth.** The Portsmouth GDP, a 3,778-acre site located north of Portsmouth, Ohio, operated from 1954 until 2001. The GDP enriched uranium for both commercial reactor fuel and military applications. The Portsmouth GDP includes three uranium enrichment processing buildings, as well as over 300 other buildings and facilities. Management of both Portsmouth and Paducah has changed over time. Specifically, the Energy Policy Act, as amended, established the United States Enrichment Corporation (USEC) as a government corporation to, among other things, provide uranium enrichment services and take over operations of the GDPs in Portsmouth and Paducah beginning in 1993 (see sidebar). By 1998, USEC was privatized under the USEC Privatization Act and became a subsidiary of the newly created USEC, Inc.¹³ USEC produced low-enriched uranium for commercial power plants until 2001, when it ceased operations at the Portsmouth GDP. Later that year, the plant was placed on cold standby—a dormant condition that would allow operations to be resumed within 18 to 24 months if needed—and

¹¹The Oak Ridge GDP is now known as East Tennessee Technology Park.

¹²In addition to the Oak Ridge GDP, EM manages two other cleanup efforts on the Oak Ridge Reservation—one effort at the Oak Ridge National Laboratory and another at the Y-12 National Security Complex. These two cleanup efforts are not paid for by the D&D Fund. We do not address cleanup of the Oak Ridge National Laboratory and the Y-12 National Security Complex in this report because the focus of this report is on cleanup of the GDPs.

¹³See USEC Privatization Act, 42 U.S.C. §§ 2297h-2297h-13. In September 2014, following Chapter 11 bankruptcy proceedings, USEC, Inc. changed its name to Centrus Energy Corp.

USEC, under contract with DOE, maintained the site.¹⁴ In 2011, USEC returned the Portsmouth GDP to DOE and EM's contractor initiated deactivation activities of the uranium enrichment processing buildings.¹⁵

- **Paducah.** The Paducah GDP, located on 3,556 acres of land west of Paducah, Kentucky, initially produced enriched uranium for nuclear weapons from 1952 until 1993. From 1993 through 2013, USEC leased and operated the facilities to produce enriched uranium for the commercial nuclear power sector. Similar to the Portsmouth GDP site, management of the Paducah site has changed over time. The Paducah GDP has four uranium enrichment processing buildings as well as more than 500 other buildings and facilities. After shutting down operations in 2013, USEC returned the Paducah GDP to DOE in 2014.

Table 1 provides additional detail on the GDPs, including the date when cleanup began, the site size, and the size of the contractor workforce performing the cleanup activities.

¹⁴From 2001 to 2005, the Portsmouth GDP was placed in cold standby—the status achieved by removing the inventory of uranium hexafluoride from enrichment cells and maintaining those cells in a negative pressure, moisture-free environment—so that production could be restarted if necessary. At the end of 2005, DOE and USEC jointly terminated the cold standby and in 2006 placed the GDP on cold shutdown—where GDP systems are permanently disengaged and equipment is prepared for eventual decommissioning.

¹⁵According to EM officials, deactivation refers to the process of placing a facility in a stable and known condition including the removal of hazardous and radioactive materials to ensure adequate protection of workers, public health and safety, and the environment. Actions include the removal of fuel, draining and/or de-energizing nonessential systems, removal of stored radioactive and hazardous materials, and related actions. Deactivation of the uranium processing buildings began at Portsmouth in 2011.

Table 1: Information about the Department of Energy’s (DOE) Former Gaseous Diffusion Plants (GDP)

GDP location	Years of operation	Year remediation began^a	Year D&D initiated at processing buildings^b	Parties to the regulatory agreements^c	Size of site (in acres)	Size of contractor workforce^d
Oak Ridge, Tennessee	1945-1985	1989	1998	DOE, EPA, Tennessee regulator	5,000	935
Portsmouth, Ohio	1954-2001 ^e	1989	2011	DOE, Ohio regulator ^f	3,778	2,047
Paducah, Kentucky	1952-2013	1988	2014 ^g	DOE, EPA, Kentucky regulator	3,556	992

Source: GAO analysis of DOE documentation, DOE’s GDP site websites, triennial reports to Congress, and DOE officials. | GAO-20-63

^aAccording to DOE, remediation involves assessing the site, including subsurface soils and groundwater contaminated by past GDP operation and addressing the sources of contamination. Remediation activities started while the Portsmouth and Paducah plants were still operational.

^bThe Decontamination and Decommissioning (D&D) initiation date specifically pertains to the start of D&D activities on the uranium enrichment processing buildings. This date does not include D&D that was conducted on smaller support buildings and facilities at the GDPs.

^cCertain federal sites are required to have an interagency agreement for expeditious completion of all remedial action at the facility. The interagency agreement, termed a Federal Facility Agreement, guides the cleanup process and sets enforceable milestones for priority cleanup activities as agreed to by all the parties to the agreement. The parties to the regulatory agreements are those entities responsible for the regulatory guidance and compliance of the GDP cleanup.

^dAccording to officials in the Office of Environmental Management (EM), the size of the contractor workforce represents the workforce funded by the D&D Fund as of April 2019. According to EM officials, differences in employment levels across the GDPs reflect current work scope differences. Officials noted that, as of spring 2019, Oak Ridge is nearly finished with D&D activities, while Paducah is in the initial stages of D&D, and Portsmouth is entrenched in the deactivation of two of the three major uranium enrichment processing buildings and constructing an on-site waste disposal facility.

^eCommercial operations of the Portsmouth GDP ceased in 2001; however, the plant was not returned to DOE’s ownership until 2011.

^fThe Portsmouth GDP is not listed on the National Priorities List from the Environmental Protection Agency (EPA)—a list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. This is due to an agreement among regulators and, therefore, does not have a Federal Facility Agreement—a document that guides the cleanup process. Instead, the Ohio regulator is responsible for overseeing cleanup under a State of Ohio Consent Decree under the Resource Conservation and Recovery Act of 1976 (RCRA) and an Ohio Environmental Protection Agency Directors Final Findings and Orders for Decontamination and Decommissioning, which guide the cleanup process at Portsmouth. Under Presidential Executive Order 12580, DOE is the lead federal agency for implementation of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) at Portsmouth. According to EPA officials, EPA is not involved in regulating the CERCLA or RCRA components of the cleanup at the Portsmouth GDP.

^gAccording to EM officials, deactivation of the processing buildings at Paducah began in 2014. Officials further specified that stabilization activities, including the removal of lube oils, were initiated as part of the deactivation process in 2014. During our site visit to Paducah, EM officials provided us a life-cycle baseline schedule showing a deactivation initiation date of 2035. EM officials later explained that the deactivation shown in the life-cycle baseline schedule was meant to be a high-level representation for the public that represents the deactivation activities once the processing buildings have been stabilized.

The GDP Cleanup Process

Cleanup of the GDPs is a complex process that involves multiple, coordinated activities: surveillance and maintenance, D&D, and site remediation. Throughout the cleanup process, EM must conduct surveillance and maintenance activities at the GDPs to ensure public and worker safety. This includes maintaining and repairing site infrastructure, such as buildings and facilities and electrical and water supplies.

The D&D process involves the following activities: deactivation, decontamination, decommissioning, and demolition. According to the National Academies and DOE, these cleanup activities are encompassed within the detailed processes described below:

- **Characterization and measurement of the contaminants present.** During this process, cleanup workers determine the identities, forms, amounts, and locations of hazardous and radioactive substances. According to DOE, common contaminants found at the GDPs include radioisotopes stemming from the historical enrichment process (e.g., uranium and technetium-99); hazardous chemicals (e.g., trichloroethylene, polychlorinated biphenyls, and beryllium); asbestos, and other hazardous materials typical of industrial facilities. When the GDPs were in operation, workers used volatile organic compounds in large quantities to clean and degrease equipment, which resulted in the release of such compounds, specifically trichloroethylene, into the environment. These compounds contaminated soil, surface water, and groundwater when they were spilled, burned in pits, discharged in holding ponds, or placed in trenches for disposal.
- **Removal of large uranium deposits.** During this process cleanup workers remove large deposits of enriched uranium from the process equipment and piping. This step is necessary at some of the uranium processing buildings to reduce the possibility of nuclear criticality—an event in which an assemblage of enriched uranium produces a short-duration (millisecond) burst of heat and radiation.¹⁶ This step is also necessary to resolve security concerns regarding the protection and handling of special nuclear materials.

¹⁶Such an event is usually self-limiting because the energy release disrupts the geometric configuration of the enriched material that caused the criticality. See Committee on Decontamination and Decommissioning of Uranium Enrichment Facilities, National Research Council of the National Academies, *Affordable Cleanup? Opportunities for Cost Reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities* (Washington, D.C.: National Academies Press, 1996).

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- **Disassembly and decontamination of equipment and building structural components.** Hundreds of large process equipment components, such as converters, compressors, and motors may need to be disassembled and decontaminated. In addition, the floors, walls, and other structural components of buildings that housed such equipment must be decontaminated.
 - **Demolition of buildings and facilities.** Hundreds of structures—including analytical laboratories, electrical switch yards, and uranium enrichment processing buildings that are many acres in size—must be demolished at the GDP sites.
 - **Management or disposal of waste.** The D&D process generates significant amounts of waste, including building materials and hazardous and radioactive waste removed from equipment and piping. Waste management activities include treatment, storage, transportation, and disposal of low-level radioactive waste, hazardous waste, mixed radioactive and hazardous waste, and sanitary waste.

In addition to surveillance and maintenance activities and the D&D of buildings and facilities, remediation of contaminated soils, surface water, and groundwater is a part of GDP cleanup and is an important aspect of protecting human health and the environment.¹⁷ According to DOE, remediation of contaminated soils, surface water, and groundwater involves assessing the site, including subsurface soils and groundwater contaminated by past GDP operation, and addressing the sources of contamination. According to EM, the Paducah GDP has the most groundwater and soil contamination of the three GDPs, and the Portsmouth GDP has the least amount of contamination.¹⁸

EPA and State Regulators' Roles in GDP Cleanup

At each GDP site, EM is required to consult and reach agreement with federal and state regulatory agencies in determining cleanup

¹⁷According to DOE, remediation also includes the cleanup of areas where contaminated materials were buried, known as burial grounds. For the purposes of this report, we consider burial grounds part of soil and groundwater cleanup.

¹⁸EM officials stated that the groundwater contamination at Paducah was originally discovered in 1988, but the contamination plumes have spread offsite. The groundwater is contaminated by technetium-99, a radioisotope stemming from the historical enrichment process, and trichloroethylene, a solvent for degreasing metal. According to DOE officials, workers used tanks containing trichloroethylene to clean equipment, and those tanks and associated piping leaked trichloroethylene and contaminated the groundwater beneath an onsite building, which then spread.

requirements, strategies, and priorities. Federal laws, including the Resource Conservation and Recovery Act of 1976 (RCRA), as amended; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended; and cleanup agreements with state regulatory agencies in Kentucky, Ohio, and Tennessee govern cleanup at the three GDPs.¹⁹ RCRA establishes the framework for the management of hazardous and non-hazardous solid waste. CERCLA authorizes the federal government to respond directly to releases or threatened releases of hazardous substances, pollutants, or contaminants that may endanger public health or the environment. CERCLA requires that EPA maintain a National Priorities List that includes some of the most seriously contaminated sites that EPA identifies for long-term cleanup of hazardous substances, pollutants, or contaminants throughout the United States and its territories. Federal sites on this list are required to have an interagency agreement for expeditious completion of all remedial action at the facility. The interagency agreement, termed a Federal Facility Agreement, guides the cleanup process and sets enforceable milestones for priority cleanup activities as agreed to by all the parties to the agreement.

The Oak Ridge and Paducah GDPs are both included on EPA's National Priorities List under CERCLA. As a result, both sites have negotiated tri-party Federal Facility Agreements signed by DOE, EPA, and the relevant state regulator. Under the terms of these agreements, DOE must reach agreement with EPA and Tennessee and Kentucky state regulators to establish cleanup priorities and schedules for work with enforceable milestones subject to the agreements' dispute resolution procedures. In addition, the agreements state that DOE must consult with these regulators in making budget requests to Congress for the GDPs.

The Portsmouth GDP is not listed on EPA's National Priorities List due to an agreement among regulators and, therefore, does not have a Federal Facility Agreement. Instead, the Ohio regulator is responsible for overseeing cleanup under a State of Ohio Consent Decree under RCRA and an Ohio Environmental Protection Agency Directors Final Findings and Orders for Decontamination and Decommissioning, which guide the cleanup process at Portsmouth. Under Presidential Executive Order 12580, DOE is the lead federal agency for implementation of CERCLA at

¹⁹The three state regulatory agencies are the Tennessee Department of Environment and Conservation, the Ohio Environmental Protection Agency, and the Kentucky Energy and Environment Cabinet. DOE officials added that DOE must comply with other regulations, such as EPA Toxic Substances Control Act rules, that can affect work schedules.

Portsmouth. According to DOE's Fiscal Year 2020 Congressional Budget Justification, the Ohio regulator used the CERCLA framework in developing the Orders. According to EPA officials we interviewed, EPA is not involved in regulating the CERCLA or RCRA components of the cleanup at the Portsmouth GDP.²⁰

The D&D Fund

In 1992, the Energy Policy Act established the D&D Fund to pay for the cleanup of the three GDPs. The act authorized \$480 million in annual contributions to the D&D Fund (annually adjusted for inflation) for a period of 15 years—from fiscal years 1993 through 2007. According to the act, of the \$480 million in annual contributions originally authorized, up to \$150 million was to come from a special assessment collected from domestic utility companies that used the enriched uranium produced by the GDPs for nuclear power generation, and the remainder was authorized to be appropriated by the federal government for a period of 15 years. While domestic utility payments were discontinued in 2007, as prescribed by the 1992 Energy Policy Act, additional sums have continued to be appropriated for the D&D Fund.

The act specified that any unused balances in the D&D Fund be invested in Treasury securities and any interest earned be made available to pay for activities covered under the D&D Fund. The act also authorizes reimbursements to uranium and thorium processing site licensees who provided raw materials to the GDPs for their cleanup costs (see sidebar).

The Energy Policy Act, as amended, authorizes the D&D Fund to pay for the costs of all D&D and remediation activities at the GDPs.²¹ Specifically, according to EM officials, the D&D Fund is used to pay for the following cleanup activities: (1) D&D of inactive facilities either by cleaning up the facilities so they could be reused or by demolishing them; (2) remedial actions such as assessing and treating groundwater or soil contamination; (3) waste management, such as the transport and disposal of hazardous waste; (4) the surveillance and maintenance of the GDPs, such as general repairs to keep the buildings and facilities in a

Decontamination and Decommissioning Fund: Uranium and Thorium Reimbursements

Title X of the Energy Policy Act, as amended, authorizes the Decontamination and Decommissioning (D&D) Fund to reimburse licensees of uranium and thorium processing sites for their portion of D&D activities, reclamation efforts, and other cleanup costs attributable to the uranium and thorium materials they sold to the federal government. These sites became contaminated with radon and other decay products of uranium over time. According to a DOE report, as of 2017, there were ten sites that were continuing remedial activities and where DOE was continuing to provide reimbursements.

According to the 2017 DOE report, DOE had at the time issued about \$716 million in reimbursement payments since inception of the D&D Fund. The largest recipient is West Chicago Environmental Response Trust, with over \$380 million in reimbursement payments through fiscal year 2017. As of fiscal year 2016, DOE estimates that the total remaining payouts to uranium and thorium producers will be approximately \$164 million.

Source: DOE, Fiscal Year 2017 Status Report, Reimbursements to Licensees of Active Uranium and Thorium Processing Sites (December, 2017). | GAO-20-63

²⁰According to EPA officials, at the Portsmouth GDP, EPA is involved with regulating the Federal Facilities Compliance Agreements under the Toxic Substances Control Act.

²¹With regard to payment of remedial actions, the act states that to the extent that the amount in the D&D Fund is insufficient to cover remedial action costs, DOE will be responsible for such costs.

safe condition; (5) uranium and thorium licensee reimbursements; (6) training for contractor personnel who work on D&D activities; and (7) other activities, such as legal costs associated with the GDPs, funding to support site-specific advisory boards at Portsmouth and Paducah, and pension costs of workers involved in uranium enrichment or D&D.

Other Funding Sources Used for Cleanup

Decontamination and Decommissioning (D&D) Fund and Funding for Depleted Uranium Hexafluoride Conversion



Depleted uranium hexafluoride—referred to as depleted uranium “tails”—is a byproduct of the uranium enrichment process. The uranium enrichment process involves concentrating uranium-235, which is the isotope of uranium that undergoes fission to release enormous amounts of energy. Natural uranium contains 0.7 percent of the uranium-235 isotope, and tails contain less uranium-235 than natural uranium (i.e., less than 0.7 percent of uranium-235). Tails have historically been considered waste because the enrichment process required to extract the remaining useful quantities of uranium-235 is significant and can be costly. In addition, tails may be dangerous to human health and the environment and can form extremely corrosive and potentially lethal compounds when in contact with water. Therefore, the Department of Energy (DOE) has opted to convert its inventory of tails into a more stable chemical form, such as uranium oxide, that would allow for long-term storage and minimize environmental impacts and costs.

The Portsmouth and Paducah gaseous diffusion plants (GDP) each store their inventories of tails in thousands of cylinders, and both GDPs have an onsite conversion facility. As of March 2018, DOE estimated that the combined tails stockpile at the Portsmouth and Paducah GDPs was estimated at 62,000 cylinders. DOE estimates the Portsmouth GDP will complete conversion of its tails inventory by 2034 and Paducah by 2047. Most of the tails inventory at the Oak Ridge GDP (approximately 7,200 cylinders) has been shipped to Portsmouth for conversion.

According to DOE officials, the D&D Fund is not used to pay for conversion of the tails.

Source: [GAO-14-291](#) and DOE officials. | GAO-20-63

According to EM officials, there are additional cleanup-related activities taking place at the GDPs that are not covered by the D&D Fund, which include: (1) security—which provides services to protect nuclear materials, sensitive uranium enrichment technology, equipment, and facilities; (2) operation of the onsite waste disposal facility at Oak Ridge; and (3) conversion of depleted uranium hexafluoride—a byproduct of the enrichment process—into a more stable form, such as uranium oxide, that will require eventual disposal (see sidebar).

To pay for these additional cleanup-related activities, EM officials reported that EM has used the Defense Environmental Cleanup and the Non-Defense Environmental Cleanup Appropriation Accounts.²²

At Portsmouth, EM has also transferred natural uranium to site contractors in exchange for cleanup services—a practice EM refers to as “barter.” Additional details on this practice are discussed later in the report.

Program Management

As we reported in February 2019, effective program and project management are important to the success of efforts like the EM program.²³ According to PMI, a program is defined as “related projects, subsidiary programs, and program activities managed in a coordinated way to obtain benefits not available from managing them individually.” According to a PMI conference paper, to reach the ultimate goal from a

²²In addition to the D&D Fund, EM officials we interviewed identified these appropriations as the primary historical funding sources used for the cleanup of the three GDPs. According to EM officials, other identified sources of funding used for GDP cleanup include: the American Recovery and Reinvestment Act, uranium facilities maintenance and remediation funds, environmental management waste management facility funds, and Technetium-99 cleanup funds.

²³[GAO-19-223](#).

program—to obtain benefits not available from managing the related projects and program activities individually—a structured way of working has to be established.²⁴

The Program Management Improvement Accountability Act requires the Office of Management and Budget (OMB) to adopt and oversee implementation of government-wide standards, policies, and guidelines for program and project management in executive branch agencies.²⁵ In June 2018, OMB issued a memorandum on the implementation of this law that includes initial implementation guidance and calls for agencies to generally align their own program management standards to the management practices and principles found in the memorandum. The memorandum states that the act aims to improve program and project management practices within the federal government. The OMB memorandum also states that agencies may use program management leading practices developed by us, other agencies, and external voluntary consensus standard-setting bodies, such as PMI.

²⁴Dengiz, B. F. (2013). Program - project management, relations, commonalities, differences. Paper presented at PMI® Global Congress 2013—North America, New Orleans, LA. Newtown Square, PA: Project Management Institute.

²⁵Pub. L. No. 114-264, 130 Stat. 1371 (Dec. 14, 2016) codified at 31 U.S.C. § 503(c)(1)(B). The act also requires us to review the effectiveness of key efforts under the act to improve federal program management.

EM Has Managed Cleanup of the GDPs as Three Individual Sites and Estimates That Cleanup at All Sites Will Not Be Completed Until 2070 at the Latest

EM has managed cleanup of the GDPs as three individual sites, rather than as an integrated program, and has not managed the cleanup of the GDPs consistent with relevant program management leading practices. For over a decade, DOE has reported to Congress in its triennial reports that its intent is to manage the GDPs in an integrated manner but has not developed an integrated program management plan, integrated master schedule, and a reliable, integrated, comprehensive life-cycle cost estimate. In addition, EM estimates that cleanup of the Oak Ridge GDP is nearing completion, that Portsmouth will be completed by 2041, and that Paducah will be completed between 2065 and 2070.

EM Has Managed Cleanup of the GDPs as Three Individual Sites

The Energy Policy Act, as amended, establishes a single, shared D&D Fund to pay for the D&D costs of the GDP sites, such that EM must coordinate and make trade-offs in its use of limited resources among the three GDPs. In addition, since 2007, DOE has stated in its triennial reports to Congress that its intent is to manage the GDPs in an integrated manner. While neither EM nor DOE explicitly refers to the management of the GDP cleanup as a program, DOE's stated intent is consistent with PMI's definition of a program—"related projects, subsidiary programs, and program activities managed in a coordinated way to obtain benefits not available from managing them individually."

However, we compared EM's management of the cleanup of the three GDPs to the three relevant PMI program management leading practices that we examined—those addressing planning, scheduling, and cost

estimating—and found that EM is not managing the cleanup of the GDPs consistent with these practices:²⁶

- **Planning—Having a program management plan.** We found that EM does not have a GDP-wide program management plan. According to PMI, a program management plan formally expresses an organization’s concept, vision, mission, and expected benefits produced by the program; it also defines program-specific goals and objectives. In a 1996 report, the National Academies recommended that DOE develop a GDP-wide program management plan for cleanup of the three GDPs that would help coordinate decisions across the three GDPs.²⁷ Representatives from the National Academies told us in December 2018 that they continue to believe this recommendation is valid. Furthermore, EPA and state regulators have criticized EM for not having a long-term vision for GDP cleanup.²⁸

According to EM officials, EM developed site-level plans for each of the three GDPs over time as the GDPs ceased operating and became available for cleanup at different times—Oak Ridge ceased operating in 1987, Portsmouth in 2011, and Paducah in 2013.²⁹ However, in reviewing what EM officials refer to as GDP program management plans, we found that the documents were created for different purposes and do not contain comparable information. For example,

- The Oak Ridge plan was created in 2017 as an update of a fiscal year 2014 through 2024 site-level plan for the three EM cleanup

²⁶Our prior work has identified these three program management leading practices as critical to the success of program management. See [GAO-19-223](#). In addition, issues related to planning, schedules, and costs were highlighted in our 2019 High Risk report as issues that DOE needs to address. See GAO, *High-Risk Series: Substantial Efforts Needed to Achieve Greater Progress on High-Risk Areas*, [GAO-19-157SP](#) (Washington, D.C.: Mar. 6, 2019). GAO’s high-risk program identifies government operations with greater vulnerabilities to fraud, waste, abuse, and mismanagement or the need for transformation to address economy, efficiency, or effectiveness challenges.

²⁷The National Academies refer to this plan as a complex-level master plan for the three GDPs as a whole.

²⁸EPA officials and the Kentucky state regulatory official we interviewed said that EM reprioritizes the cleanup effort every few years, which has led to delays in approving the site management plan, disputes, and strained relations at the Paducah GDP.

²⁹The Oak Ridge GDP ceased operations in 1985 and permanently closed in 1987. The Portsmouth GDP ceased operations in 2001, but it was not available for D&D until 2011, because it was in cold standby and cold shutdown status from 2001 to 2011. In cold standby, buildings and facilities are maintained in the event that DOE needs the GDPs to begin operations again. In cold shutdown, GDP systems are permanently disengaged, and equipment is prepared for eventual decommissioning.

sites located at Oak Ridge reservation—the GDP, the Oak Ridge National Laboratory, and the Y-12 National Security Complex.³⁰ This document presents a high-level picture of cleanup activities. EM officials told us that the Oak Ridge plan is intended to be high-level because cleanup of the Oak Ridge GDP is further along than cleanup of the Portsmouth and Paducah GDPs and because the Oak Ridge plan covers all three cleanup efforts at the Oak Ridge Reservation. EM officials also noted that other specific planning materials on the Oak Ridge GDP could be found in other documentation, but such documentation was not in the plan or in a usable form.

- The document EM provided as the Portsmouth plan contains a series of PowerPoint presentations for a March 2018 symposium on waste management. The PowerPoint slides were presented by both DOE officials and contractor representatives about different projects at the Paducah and Portsmouth sites. However, the slides contain contradictory information on when the Paducah GDP began deactivation—one slide indicates that deactivation began in 2014, but another shows deactivation will begin in 2035.
- EM officials at the Paducah GDP provided the 2015 site management plan for the Paducah GDP, which was signed by DOE and the contractor. This plan includes actions taken to date, site prioritization information (i.e., risk prioritization criteria), and key planning assumptions. The Paducah plan is the most comprehensive and detailed.

The individual GDP plans differ in their level of detail; do not present comparable information, such as milestones that each GDP is to meet; and do not reference past, ongoing, or planned work at the other GDPs. As a result, they are not useful as plans for decision-making on the three GDPs in an integrated manner. Further, EM does not have a document that contains a concept, vision, mission, and expected benefits from GDP cleanup or that defines program-specific goals and objectives. By developing a GDP-wide program management plan, EM would have a comprehensive and consistent roadmap to achieve GDP cleanup and would be in a better position to leverage resources among the three GDPs.

- **Scheduling—Having a reliable, integrated master schedule.** We found that EM does not have an integrated master schedule for cleanup of the GDPs. According to PMI’s Program Management

³⁰The latter two cleanup efforts are not paid for by the D&D Fund.

Standard, a program master schedule is the top-level program planning document that defines the individual component schedules and dependencies among program components (individual components and program-level activities) required to achieve the program goals. It should include those component milestones that represent an output to the program or share interdependency with other components. The program master schedule should also include activities that are unique to the program including, but not limited to, activities related to stakeholder engagement, program-level risk mitigation, and program-level reviews. The program master schedule determines the timing of individual components, enables the program manager to determine when benefits will be delivered by the program, and identifies external dependencies of the program.

EM officials told us that the agency's corporate database—the Integrated Planning, Accountability, and Budgeting System (IPABS)—contains the integrated master schedule for all of EM's cleanup work, including the GDPs. The purpose of IPABS is to provide information on (1) changes to the life-cycle scope, cost, and schedule and (2) performance data such as earned value, performance metrics, and cleanup milestones. While IPABS provides a top-line planned completion date as well as other information, including cleanup milestones negotiated with regulators and performance metrics, it does not provide all of the information needed to build up to that date,³¹ including sequences clearly showing how related portions of work depend on one another. Without information such as sequences, it will not be possible for EM to identify the consequences of changes or possible managerial action to respond to them. An integrated master schedule makes it possible to help coordinate cleanup across the GDPs by establishing each GDP site's schedule and identifying how related portions of work, such as funding profiles and workforce and equipment requirements that tie the sites together, depend on one another. For example, EM officials stated that certain demolition equipment, such as high-reach excavators, are in limited supply and

³¹In February 2019 we reported that certain IPABS data, including expenditure data, are not reliable. Specifically, we reported that the three tools that EM uses to measure its overall program performance and contractors' performance on the majority of its activities—earned value management, performance metrics, and cleanup milestones—do not provide a clear, reliable picture of performance for EM leadership, Congress, and other stakeholders. In particular, EM's earned value management systems—contained within a module in IPABS—for those activities are not comprehensive and do not provide reliable data. [GAO-19-223](#). In addition, in February 2019, we reported on EM's limitations in tracking cleanup-related milestones and reporting them to Congress. *GAO, Nuclear Waste: DOE Should Take Actions to Improve Oversight of Cleanup Milestones*, [GAO-19-207](#) (Washington, D.C.: Feb. 14, 2019).

may be shared among the three GDPs. By creating an integrated master schedule, EM would be in a better position to coordinate individual project activities across the three GDPs and thus help achieve program goals.

- **Cost Estimating—Having a reliable, integrated, comprehensive life-cycle cost estimate.** We found that EM does not have a reliable, integrated, comprehensive life-cycle cost estimate for cleanup of the GDPs consistent with PMI’s Program Management Standard, which calls for estimating a program’s full life-cycle costs. According to PMI, calculating full life-cycle costs and including transition and sustainment costs results in total cost of ownership. Total cost of ownership is considered to be relative to the expected benefit of one program against another to derive a funding decision. There are numerous estimating techniques to derive program cost estimates. Program cost estimates should also identify any critical assumptions upon which the estimates are made, as these assumptions may prove unfounded in the course of program delivery and require reconsideration of the program business case or revision of the program management plan. Finally, program cost estimation can support or guide cost estimation at the component level. Any prevailing program level cost estimation guidance intended for use at the component level should be documented and communicated to component managers.

Instead, EM has, over time, developed separate cost estimates for each of the three GDPs that do not reference historic costs at the other GDPs. EM officials stated that IPABS contains the life-cycle cost estimate for EM’s cleanup work, including the GDPs. However, IPABS only provides a top-line cost estimate. It does not provide details on what information is included in developing that estimate, such as any critical assumptions upon which the estimates are made. Moreover, in February 2019 we reported that certain IPABS data, including expenditure data, were not reliable.³² By developing an integrated, comprehensive life-cycle cost estimate, EM management, Congress, and stakeholders would have information on total cleanup costs, including underlying costs, enabling more informed decision-making on funding and resource allocations from the shared D&D Fund across the three GDPs.

EM officials acknowledged that cleanup work at the GDPs is managed independently by the three sites and not as an integrated program. However, the officials noted that the GDP cleanup work is managed as

³²[GAO-19-223](#).

part of EM's overall work to clean up radioactive and other hazardous waste that remains at 16 different sites across the nation, which they explained was all managed as one program. Further, according to EM officials, since the cleanup work is part of EM's overall cleanup program it is able to make decisions at a high-level to support overall funding priorities, reduce the greatest risks, and effectively use taxpayer dollars. However, in February 2019, we reported on EM's cleanup program and found that EM's cleanup policy—which governs its cleanup work—does not follow any of the relevant program management leading practices related to a program's management of scope, cost, schedule performance, and independent review of performance.³³

The benefits of managing the work at the GDPs as a program have long been recognized. In 1996, the National Academies in its report to Congress recognized GDP cleanup as having the characteristics of a program noting that the repetitive and common design of the GDPs would allow for economies of scale in performing D&D.³⁴ The report recommended that DOE develop a GDP-wide program management plan that integrates the D&D of the facilities and environmental remediation activities, as previously mentioned. According to the National Academies report, coordinating efforts across the GDPs at the complex level would help to ensure that D&D is integrated at the three sites and that resources, including disbursements from the shared D&D Fund, would be used effectively. Moreover, the report noted that delays would lead to substantial expenditures for surveillance and maintenance; deterioration of the facilities would exacerbate these costs; risks to individuals would increase; and the costs for safeguards and security for the sites would continue. In December 2018, representatives from the National Academies told us that they continue to believe that managing the GDPs as an integrated program would benefit cleanup efforts.

By taking steps to manage the three GDPs as an integrated program and following relevant program management leading practices (developing a program management plan; an integrated master schedule; and a reliable, integrated, comprehensive life-cycle cost estimate), EM would

³³[GAO-19-223](#).

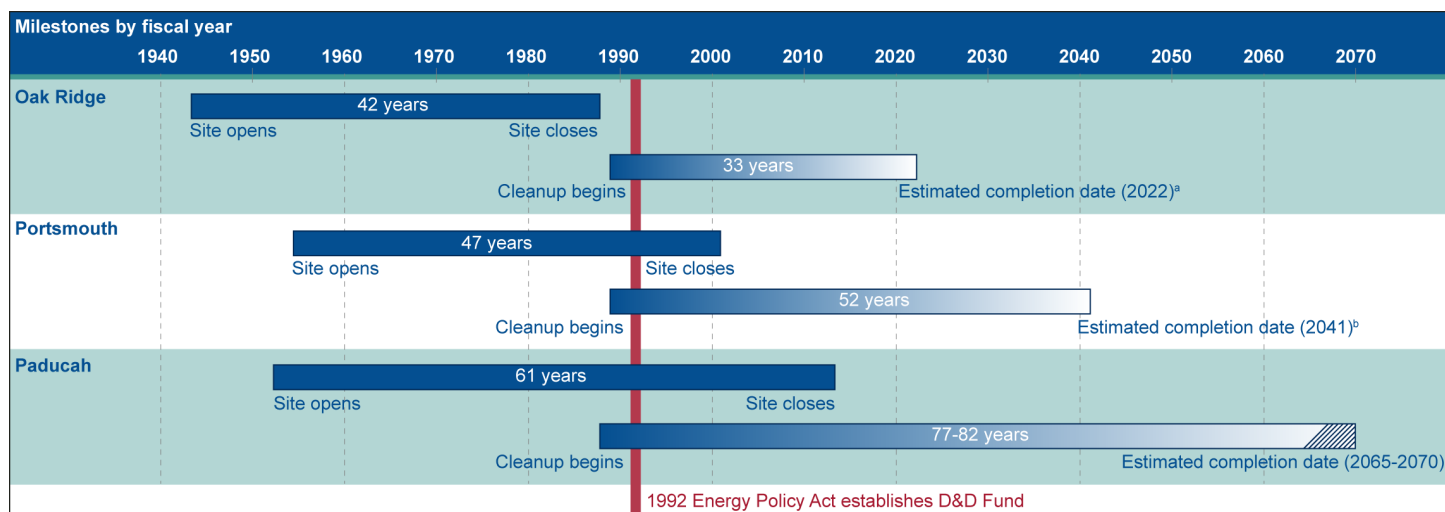
³⁴Committee on Decontamination and Decommissioning of Uranium Enrichment Facilities, National Research Council of the National Academies, *Affordable Cleanup? Opportunities for Cost Reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities* (Washington, D.C.: National Academies Press, 1996).

have more reasonable assurance that it is taking every opportunity to increase the efficiency and effectiveness of its management activities.

EM Estimates That Cleanup of All Three GDPs Will Not Be Completed Until 2070 at the Latest

EM estimates that cleanup of the Oak Ridge GDP is nearing completion, that Portsmouth will be completed by 2041, and that Paducah will be completed between 2065 and 2070.³⁵ Cleanup of the three GDPs—primarily remediation efforts—began in the late 1980s, and EM estimates that cleanup of the last GDP, Paducah, will be completed by 2070 at the latest. As figure 3 shows, based on DOE’s estimates, cleanup from start to completion will take 33 years at Oak Ridge, 52 years at Portsmouth, and 77 to 82 years at Paducah.

Figure 3: Cleanup Timeline for the Department of Energy’s (DOE) Former Gaseous Diffusion Plants (GDP)



Source: DOE 2019 Uranium Enrichment Decontamination and Decommissioning (D&D) report to Congress and other DOE documentation. | GAO-20-63

^aAccording to officials at the Office of Environmental Management (EM), cleanup of the Oak Ridge GDP is unlikely to be complete by fiscal year 2022. Officials stated that fiscal year 2024 is a more accurate completion date. Officials at the Environmental Protection Agency (EPA) and Tennessee regulators also told us that they do not believe EM’s current estimated completion date is realistic. They noted that based on their understanding of the scope of remaining work, cleanup of the Oak Ridge GDP may not be completed until the late 2020s. EPA believes cleanup completion could go out as far out as the 2040s.

³⁵According to EM officials, there is some uncertainty in the estimated completion dates EM provided. We did not perform a schedule analysis to validate these estimated completion dates.

^bEM officials informed us in June 2019 that their revised estimated date for cleanup of the Portsmouth GDP is 2043.

Each GDP site still has varying levels of cleanup work remaining, mainly relating to when the site was closed. For example, the majority of cleanup work began at Portsmouth and Paducah after the contractor operating the GDPs—USEC—returned the site to DOE (in 2011 and 2014, respectively). The following provides a brief overview of the work remaining and estimated cleanup completion dates for each of the GDPs. See appendix II for a summary of the cleanup work completed as of June 2019.

- **Oak Ridge.** At Oak Ridge, the work remaining includes cleaning up surface and groundwater contamination, remediating soils on approximately 800 acres, and conducting D&D on more than 130 remaining facilities. DOE reported in its 2019 triennial report that it intends to complete cleanup of the Oak Ridge GDP by fiscal year 2022.³⁶ However, according to EM documentation and officials, EPA officials, and state regulators, EM is unlikely to complete the cleanup by this date. In information provided to us in 2018 and in documentation supporting its cost estimate, EM cited fiscal year 2024 as the completion date for the Oak Ridge cleanup. In addition, in March 2019, EM officials said that all facilities at the Oak Ridge GDP will be demolished by fiscal year 2020 and remediation activities will be completed by fiscal year 2024, stating that the fiscal year 2022 date in the 2019 triennial report is based on outdated data. EPA and Tennessee regulators also told us they do not believe that EM's current estimated completion date is realistic for the Oak Ridge GDP cleanup based on their understanding of the scope of remaining work, particularly cleanup of groundwater contamination. They said it is more realistic that cleanup of the Oak Ridge GDP will not be completed until the late 2020s and EPA believes cleanup completion could go out as far out as the 2040s, due to the lack of an agreed approach to address contaminated groundwater. The completion date for the Oak Ridge GDP has slipped in the past. Oak Ridge was previously scheduled to be completed in fiscal year 2009 and then in fiscal year 2012.

³⁶According to DOE's 2019 triennial report, the Oak Ridge GDP site cleanup is expected to be completed in fiscal year 2020, and remaining closure activities are to be completed in fiscal year 2022. EM officials explained to us that site cleanup refers to "knocking buildings down and cleaning dirt," while remaining closure activities include completing regulatory documents, taking post-remediation samples to verify areas are clean, and ensuring that the roads are in good condition and the underground storm sewer is clean to the regulatory agencies' standards.

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- **Portsmouth.** At Portsmouth, EM must complete D&D for three uranium enrichment processing buildings. Specifically, the first of three processing buildings is undergoing the final stages of deactivation, and the contractor is scheduled to begin demolition in fiscal year 2020. EM has started deactivation procedures at the second of the processing buildings, where EM is scheduled to start demolition in fiscal year 2024. At the third processing building, deactivation has yet to begin, and EM estimates the building will be ready for demolition in fiscal year 2031. In addition, EM must conduct D&D on hundreds of other support buildings and facilities. EM also plans to continue to remediate groundwater plumes at Portsmouth and to complete construction of an onsite waste disposal facility, which is scheduled to be operational by fiscal year 2020. According to the 2019 triennial report, cleanup of the Portsmouth GDP will be completed in 2041 based on scope and funding projections. However, in June 2019, EM officials told us that the Portsmouth cleanup will more likely be completed in 2043.
 - **Paducah.** At Paducah, EM is focusing its near-term cleanup efforts on D&D of the C-400 building—a building that was used to clean machinery parts and test equipment and has been identified as the primary source of groundwater contamination at the site. After the demolition of this building, EM plans to dig up the slabs underneath the building to remove contaminants that EM believes are the source of the contamination, according to EM officials. According to EPA, EM is also focusing its near-term cleanup efforts on other activities, such as stabilization and deactivation of uranium enrichment and support buildings across the GDP, infrastructure optimization activities (including railroad upgrades for safe waste transport and downsizing the electrical power grid network), and new facility construction. According to an EM document and officials, deactivation of the processing buildings began in 2014, after USEC returned the site to DOE.³⁷ In addition to the process buildings, EM will also need to conduct D&D on hundreds of other buildings and facilities. In addition, according to EM officials, EM has yet to decide on whether the waste produced from the GDP cleanup will be shipped offsite or if it will construct an onsite waste facility. EM estimates the cleanup of the

³⁷According to EM officials, stabilization activities, including the removal of lube oils, were initiated as part of the deactivation process at Paducah in 2014. EM officials provided a life-cycle baseline schedule to us during our site visit to Paducah showing a deactivation initiation date of fiscal year 2035. EM officials later explained that the deactivation shown in the life-cycle baseline schedule was meant to be a high-level representation for the public that represents the deactivation activities once the processing buildings have been stabilized.

Paducah GDP will be completed between fiscal years 2065 and 2070. The completion date for the Paducah GDP has slipped in the past. Paducah was previously scheduled to be completed in fiscal year 2040, and then in fiscal year 2047.

EM's Past Expenditure Data Are Limited, and Its Future Cost Estimates Are Unreliable

EM reported it has spent at least \$15.5 billion on GDP cleanup as of 2018, including approximately \$5.1 billion on the Oak Ridge cleanup, approximately \$6.7 billion on the Portsmouth cleanup, and approximately \$3.7 billion on the Paducah cleanup.³⁸ However, EM has limited detailed expenditure information on the cleanup activities carried out at the GDPs. Moreover, EM's cost estimates for completing cleanup at the three GDPs are not reliable because they do not fully or substantially meet all of the characteristics of a high-quality, reliable cost estimate as described in our *Cost Estimating Guide*.

EM Reported It Has Spent at Least \$15.5 Billion on Cleanup of the Three GDPs as of Fiscal Year 2018 but Has Limited Detailed Expenditure Data

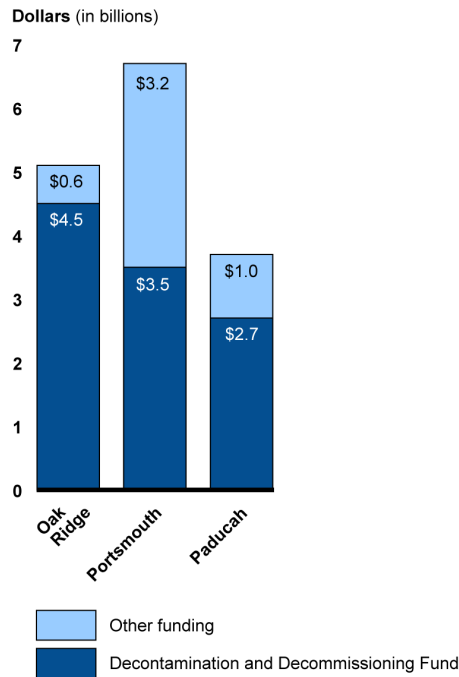
Based on our analysis of data from DOE's Standard Accounting and Reporting System (STARS) and its predecessor system,³⁹ EM has spent at least \$15.5 billion on GDP cleanup as of fiscal year 2018.⁴⁰ Of this amount, about \$10.7 billion, or 69 percent, came from the D&D Fund. The additional \$4.8 billion, or 31 percent, came from other funding sources, such as the Defense Environmental Cleanup Account and American Recovery and Reinvestment Act of 2009 funding (see fig. 4).

³⁸For the purposes of this report, "as of 2018" refers to expenditures as of the end of fiscal year 2018. In addition, the expenditures we present in this report are not adjusted for inflation.

³⁹STARS is DOE's financial management system that provides financial accounting, financial reporting, and performance measurement. According to EM officials, the predecessor system was the Departmental Integrated Standardized Core Accounting System. According to EM officials, all expenditure data they provided prior to 2005 came from the Departmental Integrated Standardized Core Accounting System and all data from 2005 forward came from STARS.

⁴⁰The reported amount of \$15.5 billion spent on GDP cleanup does not include the reported \$716 million spent from the D&D Fund for reimbursing uranium and thorium licensees as of 2017.

Figure 4: Department of Energy (DOE) Gaseous Diffusion Plant (GDP) Cleanup Expenditures by Site and Funding Source as of September 30, 2018



Source: GAO analysis of DOE expenditure data. | GAO-20-63

Note: The expenditure information is not adjusted for inflation. Other funding consists of the following sources: Defense Environmental Cleanup Appropriation Account, Non-Defense Environmental Cleanup Appropriation Account, American Recovery and Reinvestment Act of 2009, Uranium Facilities Maintenance and Remediation funds, Environmental Management Waste Management Facility funds, and Technetium-99 Cleanup funds. DOE identified these as the historical funding sources used for the cleanup of the three GDPs. In addition, the Portsmouth funding includes \$1.4 billion from the transfer of uranium to site contractors in exchange for cleanup services—a practice the Office of Environmental Management refers to as “barter”.

- Oak Ridge.** As of 2018, EM reported it has spent about \$5.1 billion on the Oak Ridge GDP cleanup. Most of the funding—about \$4.5 billion—came from the D&D Fund. The remaining \$600 million came from several other sources: for example, \$334 million came from the Defense Environmental Cleanup Appropriation Account.
- Portsmouth.** As of 2018, EM reported it has spent about \$6.7 billion on the cleanup at Portsmouth. About half of the funding for Portsmouth—or about \$3.5 billion—came from the D&D Fund. The remainder of the funding—about \$3.2 billion—came from multiple funding sources. The largest of these sources has been the transfer of natural uranium to site contractors in exchange for cleanup services—

Efforts to Supplement the Decontamination and Decommissioning Fund: Transfer of Natural Uranium for Cleanup

As we reported in September 2011, from 2009 through 2011, the Department of Energy (DOE) used 1,473 metric tons of natural uranium to pay for \$194 million in cleanup services performed by a contractor—the United States Enrichment Corporation (USEC)—at the Portsmouth gaseous diffusion plant (GDP). USEC then sold the natural uranium and retained the proceeds. The cleanup services provided by USEC included removing chemical and hazardous material from the GDP. DOE has in the past referred to this practice as “barter.”

We found in our September 2011 report that DOE mischaracterized certain transactions with USEC as barter. From December 2009 through March 2011 DOE’s uranium transactions with USEC were sales authorized by the USEC Privatization Act, but they did not comply with federal fiscal law. The USEC Privatization Act requires that before a uranium sale, DOE must determine: the materials are surplus to national security needs; the department is receiving fair market value; and the sales will not adversely affect the domestic uranium mining, conversion, and enrichment industries. We found that DOE met these requirements. Nevertheless, by not depositing the value of the net proceeds from the sales of uranium into the Treasury, we found that DOE violated the miscellaneous receipts statute. This statute requires an official or agent of the government receiving money from any source on the government’s behalf to deposit the money into the Treasury. By not depositing an amount equal to the value of the uranium into the Treasury, DOE inappropriately circumvented the power of the purse granted to Congress under the Constitution.

DOE disagreed that its actions did not comply with federal fiscal law. We suggested that Congress consider authorizing DOE to, among other things, retain the proceeds of future uranium transactions. Pursuant to direction from Congress, in March 2018, DOE suspended this practice through fiscal year 2019. In its fiscal year 2020 budget request, DOE indicated that it would resume this practice to help pay for cleanup at Portsmouth.

Source: GAO-11-846 and DOE documentation. | GAO-20-63

a practice EM refers to as “barter.” According to data provided by EM officials in 2018, from December 2009 through March 2018, EM transferred uranium valued at about \$1.4 billion. According to an EM official, EM has used this transfer process exclusively at Portsmouth (see sidebar). Among other sources, the Non-Defense Environmental Cleanup Appropriation Account supplied over \$1.2 billion in cleanup funding at Portsmouth for activities such as the operation of the depleted uranium hexafluoride conversion facility.

- **Paducah.** EM also reports that it has spent about \$3.7 billion on the Paducah cleanup as of 2018. Similar to the Oak Ridge and Portsmouth GDPs, the D&D Fund paid for the majority of the cleanup costs at the Paducah GDP—approximately \$2.7 billion. The remaining \$1 billion in cleanup expenditures were funded by aforementioned appropriation accounts, including \$138 million from the Defense Environmental Cleanup Appropriation Account on activities such as security and safeguards.

EM tracks annual expenditures for cleanup activities at each GDP site in STARS, according to EM officials. However, EM does not track detailed expenditure information by GDP site on specific cleanup activities—such as remediation, waste management, or surveillance and maintenance—in that system. For example, EM officials provided data from STARS indicating that EM spent about \$262 million on D&D at the Oak Ridge GDP in fiscal year 2007, but officials could not provide a breakdown of what specific cleanup activities the funds were used for, such as remediation or waste management. EM headquarters and site officials explained that they do not track detailed expenditure information of GDP cleanup activities in STARS because they are not required to do so.

EM has previously provided a detailed breakdown of expenditures. For example, in our July 2004 report, in addition to expenditures on D&D, EM provided expenditures for the following categories: remedial actions, surveillance and maintenance, uranium and thorium reimbursements,⁴¹ waste management, and other activities. In addition, DOE’s 2007 triennial report has an appendix on GDP future costs that provided a similar

⁴¹The Energy Policy Act provides that the D&D Fund be used to reimburse licensees of active uranium and thorium processing sites for the portion of their D&D activities, reclamation efforts, and other cleanup costs attributable to the uranium and thorium materials they sold to the federal government. The act, as amended, authorizes these reimbursements to uranium licensees not to exceed \$350 million and reimbursements to the thorium licensee not to exceed \$365 million for the portion of their cleanup costs associated with the sale of these materials to the federal government. The remaining unused authorized amounts are adjusted annually based on the Consumer Price Index.

breakout. However, EM officials could not provide current expenditure information similar to these prior reports. EM site officials told us that EM tracks more detailed expenditure data on certain categories by project, including demolition activities, and that these data were available in various project management systems maintained across the three sites. However, according to these officials, the various project management systems do not consistently track expenditures across the three GDP sites.⁴² EM headquarters officials stated that EM tracks more detailed expenditure data centrally in IPABS. However, in February 2019, we reported that the earned value management data in IPABS, which contain the expenditure data, were unreliable.⁴³

Detailed expenditure data are important for developing reliable cost estimates, according to our *Cost Estimating Guide*. The *Cost Estimating Guide* states that it is always better to use actual costs rather than estimates as data sources, since actual costs represent the most accurate data available. EM officials told us that they used expenditure data at Oak Ridge, supplemented by other information, to help develop cost estimates at Portsmouth and Paducah. However, according to EM officials, EM does not track detailed expenditure data consistently across the three GDPs, therefore its ability to develop accurate and informed cost estimates for future work at the three GDP sites is limited.⁴⁴ By tracking consistent and detailed expenditure information on cleanup activities across the GDPs, EM management would be better able to develop reliable cost estimates to plan for future work.

⁴²Site officials told us these project management systems are not audited.

⁴³[GAO-19-223](#).

⁴⁴GAO's *Cost Estimating Guide* discusses the importance of historical cost data, such as the actual data from the Oak Ridge GDP. [GAO-09-3SP](#). In our March 2019 High-Risk report, we reported that DOE's National Nuclear Security Administration had made progress in its cost estimation capabilities. Specifically, we reported that through its Office of Cost Estimating and Program Evaluation, the National Nuclear Security Administration has enhanced its capability to estimate costs and schedules, as well as to assess alternatives, for programs and projects, among other things. The National Nuclear Security Administration also made progress by implementing best practices in several areas, such as those for estimating costs and schedules in nuclear weapons refurbishment activities and capital asset acquisitions. GAO, *High-Risk Series: Substantial Efforts Needed to Achieve Greater Progress on High-Risk Areas*, [GAO-19-157SP](#) (Washington, D.C.: March 2019).

EM's Cost Estimates for Completing Cleanup of the Three GDPs Are Not Reliable

EM's cost estimates for cleanup of the three GDPs (about \$28-\$30 billion, according to DOE's 2019 triennial report to Congress) are not reliable and likely underestimate the future cleanup costs.⁴⁵ EM has developed individual cost estimates for each of the three GDPs over time and has presented those cost estimates in the triennial reports to Congress. EM prepared the latest cost estimate for Oak Ridge in 2013, for Portsmouth in 2014, and for Paducah in 2017.

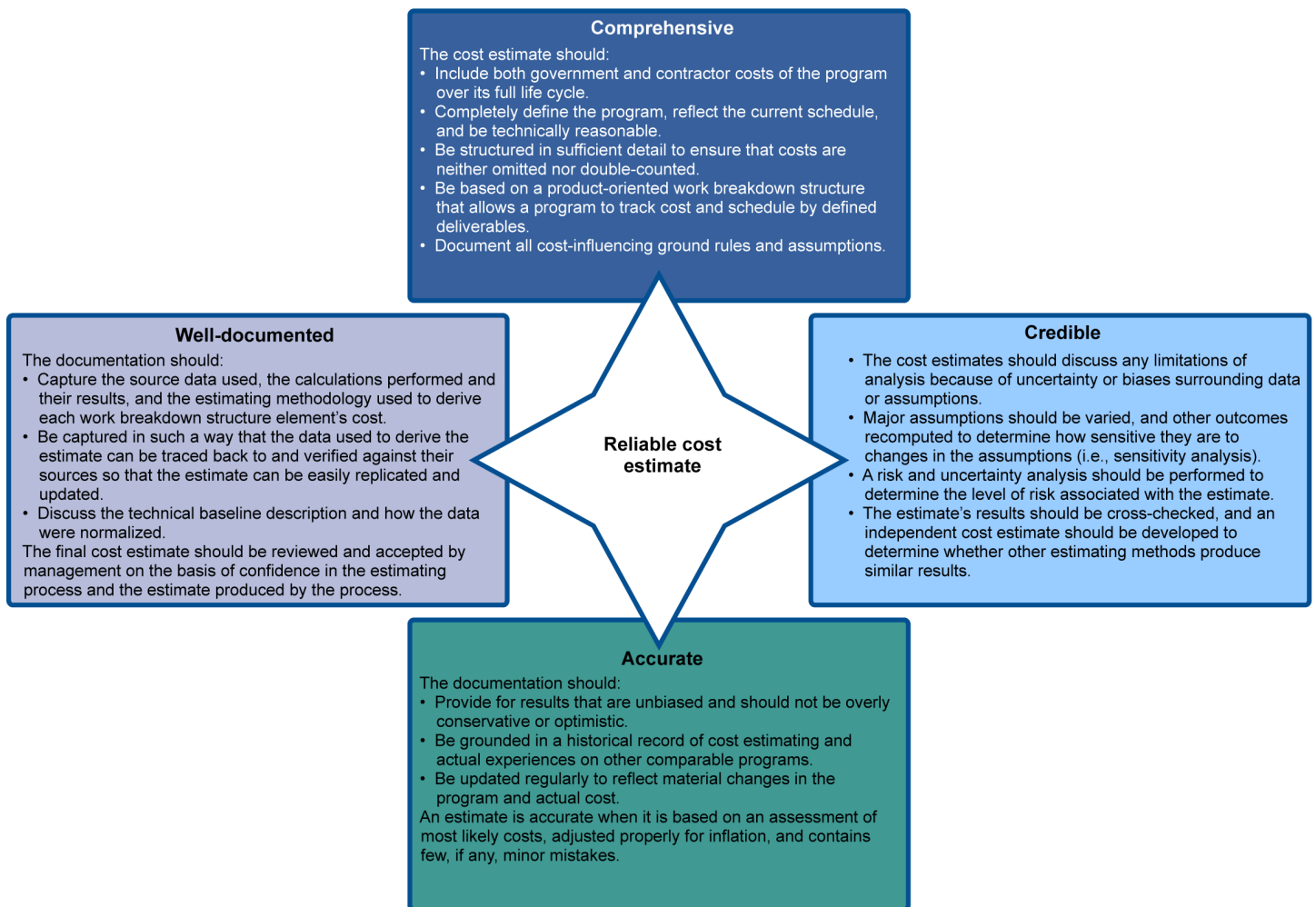
We assessed EM's cost estimates for the three GDPs individually by comparing them with the best practices identified in our *Cost Estimating Guide*.⁴⁶ The guide outlines best practices for developing a high-quality, reliable cost estimate and identifies four characteristics of such an estimate: comprehensive, well-documented, accurate, and credible (see fig. 5 for a depiction of the four characteristics and some of the best practices that underlie them).⁴⁷ A cost estimate is considered reliable if the assessment for each of the four characteristics are substantially or fully met. If any of the characteristics are not met, minimally met, or partially met, then the cost estimate does not fully reflect the characteristics of a high-quality estimate and cannot be considered reliable.

⁴⁵In the 2019 triennial report, DOE provides the Oak Ridge and Portsmouth cost estimates in future costs, although DOE provides the Paducah cost estimate in life-cycle costs, meaning it contains both past expenditures and future costs. As previously stated, EM reports that it had spent about \$3.7 billion on the Paducah cleanup as of 2018.

⁴⁶We determined the overall assessment rating by assigning each individual best practice a rating and number. We then took the average of those individual assessment ratings to determine the overall rating for each of the four characteristics. According to our scale, "fully met" means that the agency provided complete evidence that satisfies the criteria. "Substantially met" means that the agency provided evidence that satisfies a large portion of the criteria. "Partially met" means that the agency provided evidence that satisfies about half of the criteria. "Minimally met" means that the agency provided evidence that satisfies a small portion of the criteria. "Not met" means that the agency provided no evidence that satisfies any of the criteria.

⁴⁷[GAO-09-3SP](#).

Figure 5: GAO's Four Characteristics of a High-Quality, Reliable Cost Estimate



Source: GAO. | GAO-20-63

We found that the Portsmouth and Paducah cost estimates fully or substantially met some of the characteristics of a reliable cost estimate, but none of the three cost estimates fully or substantially met all of the characteristics, so EM's cost estimates for completing cleanup of the three GDPs are not reliable. Specifically, EM's cost estimate for Portsmouth fully met the comprehensive characteristic and substantially met the well-documented and accurate characteristics. EM's cost estimate for Paducah fully met the accurate characteristic and substantially met the comprehensive characteristic. However, in all other instances, the cost estimates partially or minimally met the characteristics, with Oak Ridge obtaining the lowest scores. Figure 6

provides a summary of our assessment of the cost estimates for Oak Ridge, Portsmouth, and Paducah for each characteristic. Appendix III provides additional information on our assessment. We also found that the cost estimates likely underestimate the cleanup costs because of challenges in reaching consensus on cleanup decisions with regulators that we discuss later in this report.

Figure 6: GAO’s Assessment of the Department of Energy’s (DOE) Cost Estimates for Cleanup of the Gaseous Diffusion Plants (GDP) Against the Characteristics of a High-quality, Reliable Cost Estimate in GAO’s Cost Estimation Guide

GDP location	Characteristics	GAO assessment				
		Not met	Minimally met	Partially met	Substantially met	Fully met
Oak Ridge	Comprehensive			●		
	Well-documented			●		
	Accurate			●		
	Credible		●			
Portsmouth	Comprehensive					●
	Well-documented				●	
	Accurate				●	
	Credible			●		
Paducah	Comprehensive				●	
	Well-documented			●		
	Accurate					●
	Credible		●			

Source: GAO analysis of DOE cost estimate documentation. | GAO-20-63

In commenting on our assessment of the GDPs’ cost estimates, EM officials stated that they disagreed with our findings. According to EM officials, the cost estimates for the three GDPs have been audited numerous times and contain thousands of pages of support.⁴⁸ Officials also questioned how the cost estimate for Oak Ridge scored the lowest of the three sites, when the documentation supporting that cost estimate was prepared by the same contractor that prepared the Paducah cost estimate using the same processes, practices, and procedures. We use the same criteria—our *Cost Estimating Guide*—to assess cost estimates

⁴⁸EM officials did not provide us with copies of the audit results.

throughout the federal government, and we follow the same process for assessing cost estimates. As we do for all agencies, we provided EM the opportunity to review the detailed analysis that we prepared as part of our assessment and the opportunity to provide additional documentation that may fill gaps identified in that assessment.

While EM had documentation for the Paducah GDP cost estimate, which included a project life-cycle summary schedule and life-cycle baseline work breakdown structure, EM did not include such documentation for the Oak Ridge GDP cost estimate. In addition, many of the documents EM officials provided to support the Oak Ridge cost estimate were more than 5 years older than the cost estimate itself, a point by which EM should have had actual expenditure data rather than proposed data to inform the estimate. Because these documents did not contain actual expenditure data, we determined they were out of date for Oak Ridge's 2013 cost estimate. We met with EM officials a second time to discuss our assessment of the Oak Ridge GDP cost estimate and reviewed additional documents provided by officials and modified the assessment to reflect that additional information. However, this information did not change our overall assessment. Until EM ensures the site-specific life-cycle cost estimates for the cleanup of each of the GDPs fully incorporate best practices for cost estimation, EM, DOE, regulators, and Congress will not have the information needed to understand the level of resources required to achieve cleanup of the GDPs.

EM Faces Estimated Cleanup Costs Exceeding the 2018 D&D Fund Balance by at Least \$25 Billion and Challenges to the Sufficiency of the D&D Fund

Under EM's current cost estimates, remaining GDP cleanup costs exceed the balance of the D&D Fund by at least \$25 billion, and EM faces challenges that could affect cleanup progress and the sufficiency of the fund. According to EPA and state regulatory officials from Kentucky and Tennessee, negotiations with EM regarding various cleanup decisions have strained relations between EM and the regulators and present challenges to the GDP cleanup progress that could affect cleanup progress and put additional demands on the D&D Fund. Finally, EM's reporting to Congress on the sufficiency of the D&D Fund is based on old data and is not always complete or clear, which presents challenges to

Congress's ability to be fully informed in taking actions to address the sufficiency of the Fund.

EM's Estimated Costs to Complete Cleanup of the GDPs Exceed the 2018 Balance of the D&D Fund by at Least \$25 Billion

EM's estimated costs of about \$28 billion to \$30 billion to complete cleanup of the GDPs—cited in DOE's 2019 triennial report—exceed the \$2.7 billion balance of the D&D Fund cited in a 2018 document agency officials provided.⁴⁹ Most recently, in its 2019 triennial report, DOE stated that, as of September 2016, estimated cleanup costs exceeded the balance of the D&D Fund by \$26.6 billion. DOE has therefore estimated that the D&D Fund would be exhausted by fiscal year 2020. Prior triennial reports have made similar estimations. However, according to EM data, this shortage is likely to be billions more. In 2017, EM prepared a revised cost estimate for Paducah, revising Paducah's life-cycle cost estimate for completing cleanup to \$34 billion from \$15 to \$16 billion in 2016 data. EM did not include this revision or note it in any way in the final 2019 triennial report provided to Congress.⁵⁰ Based on this revision, EM's estimated costs would be about \$47 billion to \$48 billion to complete cleanup of the GDPs.

The sufficiency of the D&D Fund has been a long-standing issue. In July 2004, we reported that based on projected costs and revenues at the time, the D&D Fund would be insufficient to cover the cleanup activities at the three GDPs.⁵¹ To better ensure that the fund would be sufficient to cover the projected costs for authorized activities, we recommended that Congress consider reauthorizing the fund for an additional 3 years—to 2010—and require DOE to reassess the fund's sufficiency before it expired in 2007 to determine if further extensions would be necessary beyond 2010. In November 2007, the U.S. Senate Committee on Energy and Natural Resources held a hearing on a bill which would have reauthorized the fund and required DOE to continue to assess the fund's

⁴⁹In the 2019 triennial report, DOE provides the Oak Ridge and Portsmouth cost estimates in future costs, whereas DOE provides the Paducah cost estimate in life-cycle costs, meaning it contains both past expenditures and future costs. As previously stated, EM reports that it has spent about \$3.7 billion on the Paducah cleanup as of 2018. Further, DOE's 2019 triennial report was issued in May 2019 and is based on September 2016 financial reporting data.

⁵⁰EM headquarters officials said they did not include the updated Paducah cost estimate in the final 2019 triennial report because they had already completed an extensive field and headquarters review process of that report and did not want to repeat that process.

⁵¹[GAO-04-692](#).

sufficiency.⁵² Although the committee did not take further action on that bill, Congress has continued providing appropriations to the D&D Fund.

Negotiations with EPA and Regulators from Two States over Key Cleanup Decisions Present Challenges that Could Affect Cleanup Progress and Further Strain the Fund

According to EPA and state regulatory officials from Kentucky and Tennessee, negotiations with EM regarding key cleanup decisions have strained relations between EM and the regulators and present challenges to the GDP cleanup progress.⁵³ If EM is unable to reach agreement with the regulators on its preferred outcomes, there will likely be further delays and increases in GDP cleanup costs. The EPA and state regulatory officials said that their negotiations over pending cleanup decisions have raised concerns regarding EM's priorities, cleanup remedies, and cost estimates. Because both the Oak Ridge and Paducah GDPs are included on EPA's National Priorities List, both sites are required to have a Federal Facility Agreement—an agreement that guides the cleanup process and establishes cleanup priorities and schedules with enforceable milestones as agreed to by EM, EPA, and state regulators. Disagreements among the parties at both the Oak Ridge and Paducah GDPs present challenges to EM's assumptions regarding the acceptance of its preferred cleanup strategy and will likely lead to delays and increases in EM's estimated cleanup costs if that strategy is not followed.

- **Disagreements over cleanup priorities.** EPA and state regulatory officials disagree with EM's cleanup priorities at Oak Ridge and Paducah. EM officials we interviewed told us their priority is

⁵²U.S. Senate Committee on Energy and Natural Resources, S. Hrg. No. 110-307, 110th Cong., *Hearing to Receive Testimony on S. 2203, A Bill to Reauthorize the Uranium Enrichment Decontamination and Decommissioning Fund, and For Other Purposes*, Nov. 15, 2007.

⁵³Portsmouth is not on the National Priorities List and does not have a Federal Facility Agreement. The Ohio regulator is responsible for overseeing cleanup under a State of Ohio Consent Decree under RCRA, and an Ohio Environmental Protection Agency Directors Final Findings and Orders for Decontamination and Decommissioning, which guide the cleanup process at Portsmouth. Under Presidential Executive Order 12580, DOE is the lead federal agency for implementing CERCLA at Portsmouth. EPA officials told us that EPA is not involved in regulating the RCRA or CERCLA components of cleanup at Portsmouth. We did not identify challenges between EM and the Ohio regulator reaching consensus.

characterizing, decontaminating, and demolishing buildings and facilities. EPA and state regulatory officials said that their priority is soil and groundwater remediation to address contamination. The Tennessee regulatory official said that the state agrees that the D&D of buildings is valuable and beneficial but that those operations must be followed by management and mitigation of soil and groundwater impacts. EPA officials also told us that EM needs to better balance D&D and remediation efforts by conducting more remediation activities. EM officials stated that at the Oak Ridge GDP, EM balances D&D with remediation activities, but they did not provide documentation about these efforts. The Tennessee regulatory officials added that EM has been reluctant to commit to milestones that regulators identify as a priority.⁵⁴ In addition, EPA officials and the Kentucky state regulatory official said that EM reprioritizes the cleanup effort every few years. The Kentucky regulator added that this has led to delays in approving the site management plan. These issues have led to disputes, and strained relations at the Paducah GDP. Specifically, per the terms of their Federal Facility Agreement, EM, EPA, and the Kentucky regulator must annually agree to a site management plan that establishes enforceable milestones. However, the parties have not agreed to such a plan since 2015, and in its draft 2018 plan, EM changed its priorities from the 2015 plan by moving a number of enforceable milestones to non-enforceable planning dates.⁵⁵ As of February 2019, these and other technical disputes between EM and EPA and state regulatory officials had delayed demolition of the C-400 building—the primary source of groundwater contamination at the Paducah site—by a year and led to cost increases. In commenting on a draft of this report, both DOE and EPA officials stated that disputes associated with the C-400 building demolition were resolved in a memorandum of agreement signed in August 2019.

- **Differences in preferred cleanup remedies at Oak Ridge.** The Oak Ridge Federal Facility Agreement requires EM to reach agreement with the regulators on cleanup remedies. According to EM, EPA, and

⁵⁴In February 2019, we reported on EM's limitations in tracking cleanup-related milestones and reporting them to Congress. [GAO-19-207](#).

⁵⁵The Federal Facility Agreement for the Paducah GDP states that pre-GDP milestones (meaning the milestones in place before the GDP was closed down) for surface water, groundwater, soils, burial grounds, and D&D shall be considered enforceable timetables and deadlines. However, in its 2018 draft site management plan, EM moved the pre-GDP milestones to planning dates. In a letter commenting on the draft 2018 site management plan, EPA said that this change placed DOE out of compliance with the Federal Facility Agreement and suggested changes to remedy that.

Tennessee regulatory officials we interviewed, EM and the regulators differ in their choice of preferred cleanup remedies at the Oak Ridge GDP, an issue subject to dispute under the Federal Facility Agreement.⁵⁶ At Oak Ridge, EM officials we interviewed said that their cost estimate for all of the groundwater cleanup assumes that regulators will agree to a waiver for active cleanup across the site, relying on a cleanup remedy called monitored natural attenuation—allowing natural processes to decrease or “attenuate” concentrations of contaminants in the groundwater and monitoring that progress over time. EM officials acknowledged that they have not reached agreement with regulators on groundwater cleanup remedies. The officials noted that their proposed approach is based on their analysis of what remedies are cost effective, technically practicable, technically feasible, fully protective, and likely to be agreed upon by the state. EM officials also noted that their cost estimates are developed following federal standards that require EM to assume the lowest cost remedy if no remedy is more likely than another.⁵⁷ However, DOE’s preferred cleanup remedy may not be accepted by regulators. EPA and Tennessee regulators told us that while they may agree to a waiver for specific areas at Oak Ridge, they would not agree to a “blanket” waiver covering the entire site.⁵⁸ They added that they would prefer that EM more actively address contamination, for example, by installing a pump-and-treat system at Oak Ridge.⁵⁹ Without the blanket waiver included in their cost estimate, EM officials said that cleanup would likely be delayed by several years, and costs would likely increase by as much as hundreds of millions of dollars. EM

⁵⁶In commenting on a draft of this report, DOE officials described areas in which EM and the regulators are in agreement, including end state remedies for the remediation of soils at the Oak Ridge GDP.

⁵⁷Specifically, EM officials told us they are following Federal Accounting Standards Advisory Board Statement of Federal Financial Accounting Standards Number 5; EM said it states that for cleanup estimates, if no point in a range is more likely than any other, the low end of the range must be used.

⁵⁸EPA officials told us that EM is developing a feasibility study that will address technological issues for cleanup and will have a section addressing potential waivers. The study is due to be issued by September 30, 2019.

⁵⁹According to EPA officials, EPA groundwater guidance requires the evaluation of active remedy remediation. The Tennessee regulator added that other cleanup options may include, but are not limited to, bioremediation—the use of microbes to clean up contaminated soil and groundwater—and permeable reactive barriers—walls created below ground to clean up contaminated groundwater. The wall is “permeable,” meaning that groundwater can flow through it. Water must flow through the barrier to be treated. The “reactive” materials that make up the wall either trap harmful contaminants or make them less harmful. The treated groundwater flows out the other side of the wall.

officials later said that they are not seeking a blanket waiver and do not believe a blanket waiver will be required for all groundwater remediation requirements, but rather that focused waivers may be necessary for certain areas that cannot be restored by available technology. Notably, in reviewing EM's most recent cost estimate, we found that the estimate continues to assume a waiver for the entire site.

- **Concerns about EM's cost estimation assumptions.** EPA and the Kentucky and Tennessee state regulatory officials we interviewed told us that EM generally shares information under the terms of the Federal Facility Agreement. However, the officials said they were concerned that the assumptions behind EM's cost estimates for GDP cleanup are not transparent and that EM has not worked with them to develop the estimates. EPA officials told us that EM does not adequately or transparently include EPA on technical scope and cleanup schedule considerations that underlie EM's cost estimates. Tennessee regulatory officials added that EM's cost estimates do not reflect the state's assumptions about the technical scope and schedules for the remedies for soil and groundwater remediation. In commenting on a draft of this report, DOE officials stated that estimates for the Oak Ridge GDP reflect the technical scope and schedules to accomplish the end state remedies that the Tennessee regulator has agreed to for soil remediation. The officials added that they are working with the regulator on the remedy for groundwater remediation. Similarly, at the Paducah GDP, the Kentucky state regulatory official expressed concern that EM's cost estimates were unrealistic—especially EM's assumption that Paducah would receive over \$1 billion in funding (in escalated dollars) for most years starting in 2036 and ending in 2050. Total enacted appropriations for Paducah in fiscal year 2019 were about \$274 million; EM's assumption would constitute a significant increase in Paducah's funding.⁶⁰ Without these increased funding levels, Paducah's cleanup would likely extend beyond the 2065 to 2070 time frame, and EM's estimates for completion and cleanup costs would likely increase. EM site officials at Oak Ridge disagreed that they have not been transparent with EPA and Tennessee state regulators, emphasizing that they have complied with all Federal Facility Agreement requirements regarding regulator participation in the budget process.

⁶⁰EM officials told us that this is based on the assumption that all D&D Fund resources would be shifted to Paducah once work is completed at Oak Ridge and Portsmouth. They further stated that this is a reasonable funding assumption based on current target levels and the fact that it is adjusted for inflation.

At Paducah, the challenges between EM, EPA, and the Kentucky regulator are not new. In April 2004, we reported that EM, EPA, and the Kentucky regulator had difficulty agreeing on an overall cleanup approach as well as on the details of specific projects.⁶¹ Further, we found that over time, these disagreements had undermined trust and damaged the parties' working relationship. We recommended that EM involve EPA and the Kentucky regulator early in the development of the annual site management plan and specific projects—before submitting formal cleanup proposals for regulatory approval—so that the parties can identify and resolve their concerns and reach consensus on cleanup decisions in a more timely manner. EM stated it believed at the time that it had been successful in fostering constructive relationships with its regulators and through its intent to involve regulators early in the decision-making process. In commenting on a draft of this report, DOE officials stated that every year DOE conducts scoping meetings with EPA and the Kentucky regulator to establish the strategy, planning schedules, and milestones for the annual site management plan prior to it being transmitted to the regulators in November.

According to a September 2012 Memorandum on Environmental Collaboration and Conflict Resolution issued by OMB and the Council on Environmental Quality, departments and agencies should “increase the appropriate and effective use of third-party assisted environmental collaboration as well as environmental conflict resolution to resolve problems and conflicts that arise in the context of environmental, public lands, or natural resource issues, including matters related to energy, transportation, and water and land management.”⁶²

Pursuant to the memorandum's annual reporting requirement, DOE's draft annual report from March 2018 presents information on the department's use of third parties and other collaborative problem-solving approaches in fiscal year 2017. In that report, DOE cites the benefits of integrating third-party facilitation into DOE site and program office projects, including expanded and clearer communication that leads to smoother relationships with the regulators and the public. EM officials told

⁶¹[GAO-04-457](#).

⁶²Office of Management and Budget and the Council on Environmental Quality, *Memorandum on Environmental Collaboration and Conflict Resolution*, (Washington, D.C.: Sep. 7, 2012). The memorandum further states that with the magnitude of environmental challenges facing the nation, coupled with the need for careful stewardship of tax dollars and budgets, federal departments and agencies should leverage all environmental collaboration and conflict management techniques to improve environmental governance.

us that they, in conjunction with the regulators, have used outside facilitators to help scope site management plans, work plans, and other project documents over the past few years. They said that they have engaged the services of a facilitator at Paducah on two significant efforts, and in both cases the facilitator added value and was effective. In addition, Tennessee state regulatory officials told us that they have used a mediator with EM at the Oak Ridge GDP site in the past, and they believe the process had a positive result. However, EM is currently not engaging the services of a facilitator at the three GDP sites to help the parties address differences in setting priorities, agreeing on remedies, and ensuring the cost estimates reflect regulator assumptions.⁶³ By working with an independent, third-party facilitator to help resolve disagreements over cleanup priorities, cleanup remedies, and cost estimation assumptions, EM would be in a better position to achieve stakeholder concurrence on these issues and avoid future cleanup delays.

Limitations in EM's Reporting to Congress Present Challenges to Congress's Ability to Take Actions to Address the Sufficiency of the D&D Fund

EM's reporting to Congress on the sufficiency of the D&D Fund is based on old data, incomplete information, and unclear scope, presenting challenges to Congress's ability to be fully informed in taking actions to address the sufficiency of the fund. The Energy Policy Act, as amended, required the Secretary of Energy to report within 3 years of enactment, and at least once every 3 years thereafter, on the progress of the GDP cleanup effort.⁶⁴ DOE has continued to prepare triennial reports on the status of the D&D Fund and GDP cleanup for Congress. However, DOE's 2019 triennial report is based on outdated information, provides limited information on the challenges EM faces in reaching agreement with EPA and state regulators, and is not clear on the scope of work. These limitations reduce the quality of the information Congress receives for making decisions about allocating resources to the D&D Fund at the same time that Congress will have to address a continued need for

⁶³In commenting on a draft of this report, DOE officials stated that facilitators are being used at Paducah for the annual site management plan and for the scoping of the C-400 building complex.

⁶⁴This reporting requirement was eliminated in 1995 pursuant to the Federal Reports Elimination and Sunset Act of 1995 and a House Report naming the DOE reporting requirement.

resources for GDP cleanup given the fund is estimated to be exhausted by 2020.

- **The 2019 triennial report is based on outdated information.** The latest triennial report, issued in May 2019, is based on financial information as of September 2016 and on cost estimates prepared in 2013 (Oak Ridge) and 2014 (Portsmouth and Paducah).⁶⁵ In addition, the report does not contain information on an updated cost estimate for the Paducah site. Specifically, for Paducah, the report cites a cost estimate—prepared in 2014—of \$15 billion to \$16 billion and a completion date of 2047. However, EM prepared a revised cost estimate in 2018 that estimated costs to be \$34 billion and estimated completion dates ranging from 2065 to 2070. EM had initially included information from this 2018 estimate in a draft of the 2019 triennial report, but ultimately did not include this information or note it in any way in the final report provided to Congress. EM headquarters officials told us that they did not include the updated 2018 Paducah cost estimate in the final 2019 report because they had already completed an extensive field and headquarters review process of the 2019 triennial report and did not want to repeat that process.
- **The 2019 triennial report does not discuss the challenges EM faces in reaching agreement with EPA and state regulators.** The 2019 triennial report has a section on challenges and uncertainties for each GDP. For the Oak Ridge and Paducah GDPs, this section does not discuss the challenges EM faces in reaching agreement with regulators on cleanup remediation decisions. For example, the Oak Ridge challenges and uncertainties section of the 2019 triennial report mentions that some groundwater treatment may be required, but the report does not disclose EM's assumption in its cost estimate that it will receive a waiver allowing it to avoid active groundwater remediation activities or that this is an area of disagreement with the regulators. Similarly, the report's discussion of challenges and uncertainties at Paducah mentions that several CERCLA decisions regarding groundwater need to be made, but does not discuss disagreements with the regulators over priorities or the implications of those decisions on cost or schedule.
- **Information in triennial reports is not always clear on scope of work.** Some information in the triennial reports has not always been clear. For example, when reporting its cost estimates in its three most

⁶⁵EM officials told us that although this report was issued in May 2019, the report is based on 2016 data and that they therefore consider it the 2016 triennial report. However, because it was issued in 2019, we refer to it as the 2019 triennial report.

recent triennial reports (2010, 2016, and 2019), DOE reports only future costs for Oak Ridge; whereas for Portsmouth and Paducah it reports either total costs (past plus future estimated costs), or future costs, or does not clearly indicate if the cost estimate represents total or future costs. These differences make it difficult to make comparisons among the three GDPs. In addition, in six triennial reports, DOE reported similar estimated future costs for completing the Oak Ridge GDP cleanup—\$1.2 billion in the 1998 report; \$1.3 billion in 2001; \$1.6 billion in 2007; \$2.1 billion in 2010; \$1.4 billion in 2016; and \$950 million in 2019. Estimated costs to complete cleanup would likely be reduced over time as work scope is completed, unless the scope of work is increasing, costs for materials are increasing, or prior estimates were incorrect; however, DOE has not clearly explained the factors contributing to these similar future cost estimates in any of its reports since 2007 (2007, 2010, 2016, 2019).

Standards for Internal Control in the Federal Government state that management should externally communicate the necessary quality information to achieve the entity's objectives.⁶⁶ Quality information is appropriate, current, complete, accurate, accessible, and provided on a timely basis. Given that DOE estimates the D&D Fund will be exhausted in 2020, there is an urgency for DOE to communicate current and accurate information on the fund on a timely basis to Congress. By regularly reporting on the status of the D&D Fund and cleanup efforts at the three GDPs with current information that contains details on challenges in reaching agreement with regulators and a clear scope of work, DOE will be able to provide better information for congressional decision-making on the sufficiency of the fund.

Conclusions

EM has made progress in cleaning up DOE's three former GDPs—particularly at Oak Ridge where contractors have demolished all five uranium enrichment processing buildings measuring a combined 114 acres as well as most other supporting buildings and facilities—but future work remains. Although DOE has stated its intent to manage cleanup of the GDPs in an integrated manner, EM is not managing the cleanup as an integrated program, even though cleanup of the GDPs meets the definition of a program as defined by PMI and Congress established a single, shared D&D Fund to pay for the cleanup. By taking steps to

⁶⁶[GAO-14-704G](#).

manage the three GDPs as an integrated program and following relevant program management leading practices we examined (developing a program management plan, an integrated master schedule, and a reliable, integrated, comprehensive life-cycle cost estimate), EM would have more reasonable assurance that it is taking every opportunity to increase the efficiency and effectiveness of its management activities.

Further, EM has limited expenditure data and its cost estimates for completing cleanup are not reliable. Detailed expenditure data are important for developing reliable cost estimates. However, according to EM officials, EM does not track detailed expenditure data consistently across the three GDPs. As a result, EM's ability to develop accurate and informed cost estimates for future work at the three GDP sites is limited. By tracking consistent and detailed expenditure information on cleanup activities across the three GDPs, EM management will be better able to develop reliable cost estimates to plan for future work. Moreover, EM does not have reliable cost estimates for completing cleanup of the three GDPs. Until EM ensures the site-specific life-cycle cost estimates for the cleanup of each of the GDPs fully incorporate best practices for cost estimation, EM, DOE, regulators, and Congress will not have the information needed to understand the level of resources required to achieve cleanup of the GDPs.

According to EPA and state regulatory officials from Kentucky and Tennessee, negotiations with EM regarding various cleanup decisions have strained relations between EM and regulators and present challenges to the GDP cleanup progress that will likely cause further delays and increase GDP cleanup costs if EM is unable to reach agreement on its preferred outcomes. EM officials said they have used third-party facilitators with the regulators in the past but are not currently engaging the services of a facilitator at the three GDP sites. By working with an independent, third-party facilitator to help resolve disagreements over cleanup priorities, cleanup remedies, and cost estimation assumptions, EM would be in a better position to achieve stakeholder concurrence on these issues and avoid future cleanup delays.

Finally, DOE's 2019 triennial report is based on outdated information, provides limited information on the challenges EM faces in reaching agreement with EPA and state regulators, and is not clear on the scope of work, thereby reducing the quality of the information Congress receives about the sufficiency of the fund. Given that DOE estimates the fund will be exhausted in 2020, there is an urgency for the department to communicate current information on the fund on a timely basis to

Congress. By regularly reporting on the status of the D&D Fund and cleanup efforts at the three GDPs with current information that contains details on challenges in reaching agreement with regulators and a clear scope of work, DOE will be able to provide better information for congressional decision-making on the sufficiency of the fund.

Recommendations for Executive Action

We are making five recommendations to DOE:

- The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to take steps to manage the three GDPs as an integrated program and follow relevant program management leading practices (developing a GDP-wide program management plan; an integrated master schedule; and a reliable, integrated, comprehensive life-cycle cost estimate.) (Recommendation 1)
- The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to track consistent and detailed expenditure information on cleanup activities across the three GDPs. (Recommendation 2)
- The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to ensure the site-specific life-cycle cost estimates for the cleanup of each of the GDPs fully incorporate best practices for cost estimation. (Recommendation 3)
- The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to work—in conjunction with EPA and Kentucky and Tennessee state regulators—with an independent, third-party facilitator to help resolve disagreements over cleanup priorities, cleanup remedies, and cost estimation assumptions. (Recommendation 4)
- The Secretary of Energy should regularly report on the status of the D&D Fund and cleanup efforts at the three GDPs with current information that contains details on challenges in reaching agreement with regulators and a clear scope of work. (Recommendation 5)

Agency Comments and Our Evaluation

We provided a draft of this report to DOE and EPA for comment. In DOE's comments, reproduced in appendix IV, the agency generally

agreed with our findings and recommendations, and described actions that DOE intends to take in response to our recommendations. Specifically, of our five recommendations, DOE concurred with four and partially concurred with one. DOE also provided technical comments, which we incorporated as appropriate. EPA did not provide written comments but provided technical comments, which we incorporated as appropriate.

DOE concurred with our first and second recommendations that the Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to (1) take steps to manage the three GDPs as an integrated program and follow relevant program management leading practices and (2) track consistent and detailed expenditure information on cleanup activities across the three GDPs. In its response to the first recommendation, DOE stated that EM will develop a program management master plan, to include site integrated master schedules and life cycle costs for the remaining cleanup at the Portsmouth and Paducah GDPs, and that the plan will incorporate program management leading practices as appropriate. In response to the second recommendation, DOE stated that EM will assess and identify an appropriate mechanism for tracking expenditures for both the Portsmouth and Paducah GDPs, using a standardized approach with an Earned Value Management System reporting on, at a minimum, an annual basis. We appreciate DOE's commitment to improve cleanup at the Portsmouth and Paducah sites; however, we emphasize that these two recommendations are directed at all three GDPs, including the Oak Ridge GDP. We reported that DOE intends to complete cleanup of the Oak Ridge GDP by fiscal year 2022, but according to EM documentation we reviewed and EM officials we interviewed, as well as EPA officials and state regulators we interviewed, EM is unlikely to complete the cleanup by this date. EPA officials and Tennessee regulators stated that it is more realistic that cleanup of the Oak Ridge GDP will not be completed until the late 2020s, and EPA officials told us that cleanup may not be completed until the 2040s. Given the potential for Oak Ridge cleanup to continue for at least another decade, we continue to believe it is important that DOE include Oak Ridge in its implementation of these two recommendations.

DOE partially concurred with our third recommendation that the Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to ensure the site-specific life-cycle cost estimates for the cleanup of each of the GDPs fully incorporate best practices for cost estimation. DOE stated that EM will direct the


Portsmouth and Paducah sites to review and incorporate practices from our *Cost Estimating Guide*, as appropriate, into the next revisions of each site's life-cycle cost baselines. DOE also stated that the remaining scope for the Oak Ridge GDP will become part of the performance baseline for the next Oak Ridge contractor. We appreciate DOE's commitment to improve cost estimation for the Portsmouth and Paducah GDPs. However, we continue to believe that improving cost estimation for the Oak Ridge GDP is also important, given that cleanup of Oak Ridge may continue for at least another decade, as described above. As such, we continue to believe it is important that DOE include Oak Ridge in implementing this recommendation.

DOE concurred with our fourth recommendation that the Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to work—in conjunction with EPA, and Kentucky and Tennessee state regulators—with an independent, third-party facilitator to help resolve disagreements over cleanup priorities, cleanup remedies, and cost estimation assumptions. DOE stated that as disagreements over cleanup priorities, remedies, and cost estimation assumptions arise, EM will work with all parties to determine the feasibility and benefits of using a facilitator on a case by case basis to help resolve issues. DOE also concurred with our fifth recommendation that the Secretary of Energy should regularly report on the status of the D&D Fund and cleanup efforts at the three GDPs with current information that contains details on challenges in reaching agreement with regulators and a clear scope of work. DOE management stated that EM will produce its next triennial Uranium Enrichment Decontamination and Decommissioning Fund Report following closeout of fiscal year 2019, and release of the most recent environmental liability estimate associated with the remaining challenges and scope of cleanup at the GDPs.

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

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or trimbled@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last

page of this report. GAO staff who made significant contributions to the report are listed in appendix VI.

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

Our report examined: (1) the extent to which the Department of Energy's (DOE) Office of Environmental Management (EM) has managed cleanup of the three gaseous diffusion plants (GDP) compared with relevant program management leading practices and the status of the cleanup effort; (2) what EM has spent on cleanup at the three GDPs and the extent to which EM's cost estimates for completing GDP cleanup are reliable; and (3) the extent to which the Decontamination and Decommissioning (D&D) Fund is sufficient to cover EM's estimated cleanup costs of the GDPs and challenges, if any, that could affect the sufficiency of the D&D Fund.

To inform all three objectives, we reviewed the Energy Policy Act of 1992, as amended;¹ DOE triennial reports to Congress on GDP cleanup efforts; and prior reports issued by us, DOE's Office of Inspector General (both performance audits and financial statement audits on the D&D Fund), and the National Academies of Sciences, Engineering, and Medicine (National Academies).² We also interviewed officials from DOE's Office of Inspector General, the Environmental Protection Agency (EPA), and representatives from of the National Academies, regarding their knowledge of EM's cleanup progress at the GDPs and any past, ongoing, or future work they have conducted or are planning on the GDP cleanup. We visited all three GDP sites to observe the cleanup work and meet with EM officials responsible for the cleanup, representatives of the DOE contractor responsible for D&D activities, state regulators working with

¹The Energy Policy Act of 1992, Pub. L. No. 102-486, § 1101, 106 Stat. 2953-2955 (1992).

²Reports we reviewed included: GAO, *Uranium Enrichment: Decontamination and Decommissioning Fund Is Insufficient to Cover Cleanup Costs*, [GAO-04-692](#) (Washington, D.C., July 2004); GAO, *Nuclear Waste Cleanup: DOE Could Improve Program and Project Management by Better Classifying Work and Following Leading Practices*, [GAO-19-223](#) (Washington, D.C.: Feb. 19, 2019); Committee on Decontamination and Decommissioning of Uranium Enrichment Facilities, National Research Council of the National Academies, *Affordable Cleanup? Opportunities for Cost Reduction in the Decontamination and Decommissioning of the Nation's Uranium Enrichment Facilities* (Washington, D.C.: National Academies Press, 1996); DOE Office of Inspector General, *Audit Report: The Status of Cleanup at the Department of Energy's Paducah Site*, DOE/IG-0937 (Washington, D.C., June 2015).

EM on environmental compliance activities (from Kentucky, Ohio, and Tennessee), members of GDP site-specific advisory boards, and representatives of community reuse organizations.³ During our interviews, we discussed topics including funding for the GDP cleanup, cleanup progress to date, and any challenges facing the cleanup effort. We selected these interviewees because we determined, based on input from EM officials, that they would be the most knowledgeable about GDP cleanup status, funding, and challenges. Following these interviews, we conducted a content analysis of all responses to our interview questions to determine any key challenges that EM faces in completing cleanup of the GDPs. We then grouped, coded, and verified the content in our analysis and performed second-rater review. Through our content analysis, we found that stakeholders primarily cited three key challenges related to EM's program management; relations between EM, EPA, and state regulators; and transitioning the local communities to cleanup completion.⁴

To examine the extent to which EM has managed the cleanup of the GDPs compared with relevant leading practices for program management, and the status of the cleanup effort, we reviewed documents, including site-specific GDP cleanup plans and GDP cleanup progress briefings, as well as reports issued by the National Academies, us, and DOE. We interviewed EM officials and contractor representatives on their past, present, and future plans for cleanup. We also interviewed EPA and state regulatory agency representatives at each of the GDPs regarding their role in the cleanup and interactions with EM. We assessed the information from these reviews and all interviews (content analysis from interview responses) and identified the relevant program management leading practices that aligned with the assessed information. We identified the three program management leading practices by reviewing our prior work and the Project Management Institute's (PMI) *The Standard for Program Management—Fourth*

³Site-specific advisory boards are composed of local citizens whose role is to involve the public and make cleanup recommendations to EM. Community reuse organizations are entities recognized by DOE to help minimize the social and economic impacts of workforce restructuring at DOE facilities such as by obtaining government-owned property for the purpose of economic development.

⁴We report on DOE's management of cleanup efforts in our first objective and EM's relationship with EPA and state regulators in our third objective. We asked interviewees for their perspectives on what challenges, if any, EM faces in completing cleanup of the GDP sites and challenges to the sufficiency of the fund. We did not report directly on challenges related to transitioning the local communities to cleanup completion because it was outside the scope of our review regarding the sufficiency of the D&D Fund.

*Edition.*⁵ The three leading practices were having (1) a program management plan, (2) an integrated master schedule, and (3) a reliable, integrated, comprehensive life-cycle cost estimate. We compared EM's management of the GDPs with these leading practices.

Specifically, during our interviews with EM, the DOE Office of Inspector General, and EPA officials; Kentucky, Ohio, and Tennessee regulators; representatives of the National Academies; and members of the site-specific advisory board from all three sites, we asked about challenges EM faces in completing cleanup of the three GDP sites. As discussed above, we conducted a content analysis of their responses to our interviews and found that stakeholders primarily cited three key challenges, including EM's poor program management. Under poor program management, stakeholders cited three sub-challenges: (1) frequent changes in EM's cleanup priorities and staff turnover, which most closely aligns with the program planning leading practice; (2) lack of integrated schedules across the GDPs, which most closely aligns with the scheduling leading practice; and (3) lack of transparency in EM's cost estimation processes, which most closely aligns with the program cost estimating leading practice. As a result, we assessed the three leading practices that aligned with those issues: (1) program management plan, (2) integrated master schedule, and (3) integrated comprehensive life-cycle cost estimate. To examine the status of cleanup at the GDPs, we reviewed EM's documentation of the work completed and the work remaining at each GDP.

To examine what EM has spent on cleanup at the three GDP sites, and the extent to which EM's cost estimates for completing GDP cleanup are reliable, we reviewed historical funding and cleanup expenditure data for all three sites for the period from fiscal year 1994 through 2018 and analyzed EM documentation supporting its cost estimates for each of the three GDPs. The data the sites provided include expenditures from the D&D Fund as well as from other funding sources including: the American Recovery and Reinvestment Act, Uranium Facilities Maintenance and Remediation funds, Environmental Management Waste Management Facility funds, and Technetium-99 cleanup funds. We reviewed financial statement audit reports issued on the D&D Fund for fiscal years 2005 to 2012 and met with relevant headquarters and field staff in financial

⁵PMI is a not-for-profit organization that has established standards for program and project management that are generally recognized as leading practices for most programs and projects. These standards are used worldwide and provide guidance on how to manage various aspects of projects, programs, and portfolios.

management, budget, and planning. In addition, we assessed the reliability of the historical funding and expenditure data provided by EM. Specifically, we obtained from EM officials familiar with DOE's financial management system responses to a series of data reliability questions such as data entry access, quality control procedures, and the accuracy and completeness of the data. During our review of the GDP expenditure data, we identified a number of inconsistencies between the data received from EM site officials and the data reported in DOE's 2019 triennial report to Congress. EM officials were able to provide satisfactory responses and documentation to address the identified inconsistencies. We therefore found the data to be reliable for our purposes.

To examine the reliability of EM's cost estimates for completing cleanup at the three GDPs, we reviewed EM's cost estimate documentation, interviewed EM site officials, and compared GDP cost estimates against characteristics of reliable cost estimates contained in our *Cost Estimating Guide*.⁶ Our review included documents that established the basis and assumptions for site contractors' contributions to the cost estimate, documents that established the contractors' work breakdown structures, and presentations on contractors' cost estimating models. We interviewed EM site officials and contractor staff responsible for producing the cost estimates to understand the methods, assumptions, information, and data EM used to produce the estimates. Our cost estimation specialists assessed this information against the best practices for cost estimating found in our *Cost Estimating Guide* that we developed to establish a consistent methodology that can be used across the federal government to develop, manage, and evaluate capital program cost estimates. We shared our draft assessment for each GDP cost estimate with EM officials and then revised those assessments based on EM's written comments and additional documentation they provided as appropriate. At EM's request, we met with Oak Ridge officials a second time to discuss our assessment of the Oak Ridge GDP cost estimate and reviewed additional documents provided by officials, and we reflected that additional information into our assessment of the Oak Ridge cost estimate.

To examine the extent to which the D&D Fund is sufficient to cover EM's estimated cleanup costs of the GDPs and challenges, if any, that could affect the sufficiency of the D&D Fund, we reviewed information on the

⁶GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, [GAO-09-3SP](#) (Washington, D.C.: Mar. 2, 2009). The *Cost Estimating Guide* contains cost estimating best practices drawn from across industry and government.

balance of the D&D Fund and compared it to EM cost estimate information, past reports that describe the balance of the fund, and our prior report on the fund.⁷ Despite our findings that the three cost estimates were unreliable, we were able to report on the cost estimates provided in DOE's 2019 Triennial Report by presenting an "at least" cost estimate. In addition, we interviewed key stakeholders, including officials from EM, the DOE Office of Inspector General, and EPA; regulators from the states of Kentucky, Ohio, and Tennessee; representatives of the National Academies; and members of the site-specific advisory boards and representatives of the community reuse organizations from all three sites, regarding challenges EM faces in completing cleanup of the three GDP sites and challenges that could affect the sufficiency of the D&D Fund. As noted above, we conducted a content analysis of their response and found that stakeholders primarily cited three challenges that could affect cleanup progress and further strain the D&D Fund, including challenges with negotiations with EPA and state regulators. We also reviewed DOE's triennial reports from 1996 to 2019 and compared information included in each of these triennial reports to determine the extent to which the information provided was presented consistently across reports and consistent with other documentation provided, such as site-specific plans and DOE's cost estimates. We also interviewed DOE officials about the sufficiency of the D&D Fund and factors affecting the sufficiency of the fund.

We conducted this performance audit from April 2018 to December 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.

⁷[GAO-04-692](#).

Appendix II: Information on Cleanup Work Completed at the Department of Energy's Former Gaseous Diffusion Plants as of June 2019

This appendix provides information on cleanup work completed at the Department of Energy's (DOE) former gaseous diffusion plants (GDP) as of June 2019. DOE's Office of Environmental Management (EM) is responsible for their cleanup.

Oak Ridge

EM began cleanup at Oak Ridge in 1989 and Decontamination and Decommissioning (D&D) of the uranium enrichment process buildings in 1998. Since that time, EM has characterized the levels and types of contamination for most of the site and conducted D&D on all five uranium enrichment process buildings. EM has also demolished over 390 additional buildings and facilities, including a fire water tower and the Central Neutralization Facility that was used to treat the site's industrial wastewater. In addition, EM has remediated nearly 1,400 acres of contaminated soils and has used an onsite waste disposal facility to dispose of much of the waste generated from cleanup. Some specific cleanup work EM has completed at Oak Ridge includes:

- Removed slabs from two uranium enrichment process buildings and completed cleanup of contaminated soils beneath the slab, clearing the way for transition to industrial reuse.
- Excavated and disposed of approximately 100,000 cubic yards of contaminated materials from a burial ground.
- Remediated an area considered to be a primary source of organic contamination in area soils and groundwater and treated the resulting approximately 175 cubic meters of contaminated soil.
- Removed more than 48,000 tons of scrap metal from two scrap yards.

EPA and Tennessee state regulators agree that the end use for the site will be a commercial industrial park, and several businesses are already leasing portions of former GDP lands. In addition, more than 3,000 acres of the former GDP lands have been cleared for conservation and recreational use. EM has partnered with the Community Reuse Organization of East Tennessee to attract businesses to operate on the available lands.¹ According to a representative of the Community Reuse Organization of East Tennessee, EM has transferred over 1,000 acres of land and 14 buildings to the reuse organization, who has in turn sold over 300,000 square feet to the private sector. There are 20 private companies operating at the site.

Portsmouth

EM began cleanup at the Portsmouth GDP in 1989 and D&D of the uranium enrichment process buildings in 2011, after the contractor that operated the site—the United States Enrichment Corporation (USEC) returned the buildings to DOE in 2010. As of May 2019, EM is preparing the first of three uranium enrichment process buildings for demolition and is starting to characterize contamination in the second. EM is also conducting ongoing remediation activities and constructing an on-site waste disposal facility, where EM intends to dispose of D&D waste that meets the approved acceptance criteria of the disposal facility. Several site support facilities, including a large electric switchyard, have been demolished. Some specific cleanup work EM has completed at Portsmouth includes:

- Completed sampling and removal for off-site disposal of all 7,020 uranium enrichment components (converters, compressors, and coolers) from one of the uranium enrichment process buildings.
- Closed five on-site landfills covering 60 acres.
- Removed more than 37,000 pounds of trichloroethylene—a solvent for degreasing metal that contaminated the groundwater at the site—through groundwater remediation.

EM contractors at Portsmouth told us that they are cleaning up the site for future industrial use.

¹The Community Reuse Organization of East Tennessee is a 501(C)(3) non-profit organization that works with DOE management at Oak Ridge to market former GDP lands to private industry.

Paducah

EM began cleanup at the Paducah site in 1988. USEC officially returned the GDP to DOE in 2014 and according to an EM document and officials, deactivation of the uranium processing buildings began that same year. In January 2019, EM reached a milestone—deactivation of the C-400 building—by completing the cleanup of legacy materials in the building. C-400 was a cleaning facility used to clean machinery parts and test equipment and has been identified as the primary source of groundwater contamination at the site. According to EM officials, EM has primarily been using a pump-and-treat method to control the high concentration portion of the groundwater plumes at Paducah. EM officials stated that EM is focusing its cleanup efforts on D&D of the C-400 building and remediation from now until the early 2030's. According to EM officials, EM is continuing to treat large contamination plumes and demolish inactive facilities. Some specific cleanup work EM has completed at Paducah includes:

- Demolished and removed 43 inactive facilities including a 210,000 square foot uranium hexafluoride feed plant and a 60,000 square foot metals plant.
- Treated over four billion gallons of contaminated groundwater from two operating pump-and-treat facilities and, as part of this treatment, removed approximately 3,700 gallons of trichloroethylene.
- Removed more than 850,000 cubic feet of low-level and mixed low-level legacy wastes and material storage area waste.
- Resurfaced 74 acres of roofs at the site and rerouted roof drains in order to reduce infiltration of water into the facilities.

Officials at Paducah told us that they are cleaning up the site for future industrial use.

Appendix III: Summary of GAO's Assessment of DOE's Cost Estimates for Cleanup of the GDPs Compared with Best Practices

Table 2: Summary of GAO's Assessment of the Department of Energy's (DOE) Cost Estimates for Cleanup of the Gaseous Diffusion Plants (GDP) Against the Characteristics of a High-quality, Reliable Cost Estimate in GAO's Cost Estimation Guide

GDP location	Characteristic	Summary of GAO's assessment
Oak Ridge	Comprehensive	<p>Partially Met</p> <p>The documentation provided showed sunk costs, estimated to go costs, and long-term sustainment costs. However, the sunk costs are mixed with sunk costs from two other cleanup sites at Oak Ridge (the Y-12 National Security Complex and the Oak Ridge National Laboratory) and did not include government costs, so the amount of the total Oak Ridge GDP life-cycle costs is unclear. The baselines provided include a project specific work breakdown structure and work breakdown structure description; however, there was no work breakdown structure for the overall Oak Ridge GDP cleanup and comparing the baseline work breakdown structures across projects shows that there was not a consistent lower level work breakdown structure that could allow Oak Ridge to use data from completed tasks to inform their estimates of future tasks. Furthermore, there was a lack of consistency between planning and reporting documents.</p>
	Well-documented	<p>Partially Met</p> <p>For the Oak Ridge cost estimate, a contractor prepared a number of underlying baseline documents to estimate the costs for various cleanup activities such as Infrastructure and General Program Activities and Surveillance and Maintenance. The baselines documented the inflation and listed the source data and judgements applied to the source data. Two of the baselines examined included a description of the methodology, deliverables, assumptions, and detailed build-up of costs by work breakdown structure element. However, the working files to develop the estimates were not available for review, the baselines did not address data reliability concerns or data normalization, and supporting data was not included. Additionally, the baselines do not represent the most recent milestone dates in their Federal Facility Agreement—a document that guides the cleanup process—as there is a five year gap in the dates between the baselines and the Federal Facility Agreement. Finally, the baselines were not signed to signify management approval.</p>

**Appendix III: Summary of GAO's Assessment
of DOE's Cost Estimates for Cleanup of the
GDPs Compared with Best Practices**

GDP location	Characteristic	Summary of GAO's assessment
	Accurate	<p>Partially Met</p> <p>The baselines document an inflation rate, but examination of the escalated and un-escalated costs documented in the baselines showed a disparity between the current year costs documented in the baselines and our calculated costs using the constant year costs and documented inflation rate. Moreover, while some of the projects have been updated when they reached certain milestones, the entire Oak Ridge GDP estimate has not been updated since 2013.</p>
	Credible	<p>Minimally Met</p> <p>No sensitivity analysis or cross checks were completed for either the underlying estimates or the overall Oak Ridge GDP estimate. Additionally, while risk analysis was performed, the Office of Environmental Management (EM) used varying levels of rigor for different projects without explaining how those levels of rigor were developed in either the estimates' documentation or in their risk assessment plan. Additionally, while the Army Corps of Engineers developed an independent cost estimate in 2011, EM did not have an independent cost estimate performed for the 2013 estimate.</p>
Portsmouth	Comprehensive	<p>Fully Met</p> <p>The cost estimate, consisting of a 2018 time-phased estimate and a 2014 cost model, captures costs through the completion of decontamination and decommissioning. According to the acting program manager, the estimate relies on a basis of estimate document constructed by a technical team. Each work breakdown structure element supporting the cost estimate is clearly marked and can be traced to the basis of estimate. Ground rules and assumptions for the program as a whole are tracked in one document. The inflation adjusted estimate uses a uniform percent rate. The techniques used are mature. No outside agency is involved in execution of the program.</p>
	Well-documented	<p>Substantially Met</p> <p>The cost estimate ties closely to the basis of estimate. EM management approved portions of the estimate as they approach execution.</p>
	Accurate	<p>Substantially Met</p> <p>The cost estimate was adjusted properly for inflation. The program office stated that the estimate is regularly updated and the program office reviews differences between planned and actual costs. The program office also stated that historical data support the current estimate; however, the office did not supply supporting documentation. It was not possible to check the detailed cost estimate, but spot checks of the cost model did not reveal any errors.</p>
	Credible	<p>Partially Met</p> <p>The cost estimate includes a sensitivity analysis and management has created a risk mitigation strategy and set aside risk dollars accordingly. An independent cost estimate was completed by the DOE Office of Project Management. Although management shows the relative contribution of various factors to the cost estimate, it does not report the net effect in dollars. The estimate includes a risk and uncertainty analysis based on a Monte Carlo simulation. Major cost elements were not cross-checked to see if the resulting estimated values were similar.</p>

**Appendix III: Summary of GAO's Assessment
of DOE's Cost Estimates for Cleanup of the
GDPs Compared with Best Practices**

GDP location	Characteristic	Summary of GAO's assessment
Paducah	Comprehensive	<p>Substantially Met</p> <p>The time-phased estimate dated 2017 captures costs through the completion date in 2065. Each work breakdown structure element supporting the estimate is clearly marked and elements trace to the basis of estimate, which documents assumptions specific to each cost element. Ground rules and assumptions for the program are listed in individual basis of estimate documents. The inflation adjusted estimate uses a uniform percent rate. However, the documentation did not include all the detailed technical information, did not discuss personal qualifications, and evidence of approval of the technical baseline itself was not provided.</p>
	Well-documented	<p>Partially Met</p> <p>The cost estimate is documented in a series of basis of estimate documents for each work breakdown structure element. DOE management recorded approval of the estimate in their budget tracking software system. However, there are not enough details provided in the documentation to recreate the estimate.</p>
	Accurate	<p>Fully Met</p> <p>The cost estimate was adjusted properly for inflation. The estimate has been updated and the new schedule dates and costs were provided. The program office stated that it reviews differences between planned and actual costs and that historical data support the current estimate; they provided briefings and other documentation to support this.</p>
	Credible	<p>Minimally Met</p> <p>The cost estimate includes a risk and uncertainty analysis based on a Monte Carlo simulation and a sensitivity tornado chart and management created a risk mitigation strategy and set aside risk dollars accordingly. However, the estimate does not provide details of a sensitivity analysis and major cost elements were not cross-checked to see if the resulting estimated values were similar.</p>

Source: GAO analysis of DOE cost estimate documentation. | GAO-20-63

Appendix IV: Comments from the Department of Energy



Department of Energy
Washington, DC 20585

November 19, 2019

David C. Trimble
Director
Natural Resources and Environment
U.S. Government Accountability Office
441 G Street, N.W.
Washington, DC 20548

Dear Mr. Trimble:

The Department of Energy (DOE) appreciates the opportunity to provide a response to the Government Accountability Office (GAO) draft report, *Nuclear Cleanup: Actions Needed to Improve Efforts at DOE's Three Former Gaseous Diffusion Plants*, GAO-20-63. The Department has reviewed the draft report and concurs or partially concurs with the five recommendations. The Department's response and detailed actions are enclosed.

The Office of Environmental Management commits to developing an integrated program plan, master schedule, and life-cycle cost for both the Portsmouth and Paducah gaseous diffusion plants (GDP), incorporating best practices and using lessons learned from the cost, schedule, and risk from the East Tennessee Technology Park (ETTP) GDP cleanup.

The cleanup of the ETTP GDP is a separate activity from the cleanup of other parts of the Oak Ridge Reservation. Although issues are still being resolved with regulators concerning other parts of the Oak Ridge cleanup, there is substantial agreement for ETTP GDP cleanup. Specific comments on the remaining issues and other suggested clarifications are enclosed for consideration in finalizing the report.

If you have any questions, please contact me or Ms. Elizabeth A. Connell, Associate Principal Deputy Assistant Secretary for Regulatory and Policy Affairs, at (202) 586-0637.

Sincerely,

A handwritten signature in black ink, appearing to read "Will White".

William I. White
Senior Advisor for Environmental Management
to the Under Secretary for Science

Enclosures:

1. EM Response to Report Recommendations
2. EM and Support Organization Technical Comments



Management Response

GAO Draft Report, *Nuclear Cleanup: Actions Needed to Improve Efforts at DOE's Three Former Gaseous Diffusion Plants*, GAO-20-63

Recommendation 1: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to take steps to manage the three GDPs as an integrated program and follow relevant program management leading practices (developing a GDP-wide program management plan; an integrated master schedule; and a reliable, integrated, comprehensive life-cycle cost estimate.)

Management Response: Concur.

The Office of Environmental Management (EM) relies on the Portsmouth/Paducah Project Office (PPPO) to manage the Department of Energy (DOE) cleanup efforts at two gaseous diffusion plant (GDP) sites – Portsmouth GDP and the Paducah GDP. PPPO will develop a program management master plan, to include site integrated master schedules and life cycle costs, for the remaining cleanup at the two GDPs. The plan will incorporate program management leading practices as appropriate.

The GDP buildings and special nuclear materials at the Oak Ridge East Tennessee Technology Plant (ETTP) have been removed. The remaining cleanup is nearing completion. The remaining scope for ETTP will become part of the performance baseline for the next Oak Ridge cleanup contractor. EM will direct PPPO to use actual collected cost and schedule information for integration of relevant lessons learned from ETTP cleanup into integrated program plans, schedules, and estimates.

Estimated Completion Date: December 31, 2020

Recommendation 2: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to track consistent and detailed expenditure information on cleanup activities across the three GDPs.

Management Response: Concur.

EM will assess and identify an appropriate mechanism for tracking expenditures for both Portsmouth and Paducah GDPs, using a standardized approach with an Earned Value Management System reporting on, at a minimum, an annual basis.

To the extent that ETTP/Oak Ridge collected data can be aligned, PPPO will be directed to use data as a basis of comparison for contractor estimates, and potentially to develop cost estimating tools for independent cost estimating.

Estimated Completion Date: December 31, 2020

Recommendation 3: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to ensure the site-specific life-cycle costs estimates for the cleanup of each of the GDPs fully incorporate best practices for cost estimation.

Management Response

GAO Draft Report, *Nuclear Cleanup: Actions Needed to Improve Efforts at DOE's Three Former Gaseous Diffusion Plants*, GAO-20-63

Management Response: Partially Concur.

EM will direct the Portsmouth and Paducah GDP sites to review and incorporate practices from GAO's *Cost Estimating Guide*, as appropriate, into the next revisions of each site's life-cycle cost baselines.

The remaining scope for ETPP will become part of the performance baseline for the next Oak Ridge cleanup contractor.

Estimated Completion Date: December 31, 2020

Recommendation 4: The Secretary of Energy should direct the Assistant Secretary of the Office of Environmental Management to work – in conjunction with EPA, and Kentucky and Tennessee state regulators – with an independent, third party facilitator to help resolve disagreements over cleanup priorities, cleanup remedies, and cost estimation assumptions.

Management Response: Concur.

As disagreements over cleanup priorities, remedies, and cost estimation assumptions arise, EM will work with all parties to determine feasibility, and benefit of using a facilitator on a case by case basis to help resolve issues.

Estimated Completion Date: December 31, 2020

Recommendation 5: The Secretary of Energy should regularly report on the status of the D&D Fund and cleanup efforts at the three GDPs with current information that contains details on challenges in reaching agreement with regulators and a clear scope of work.

Management Response: Concur.

EM will produce its next triennial Uranium Enrichment Decontamination and Decommissioning Fund Report following closeout of fiscal year 2019, and release of the most recent environmental liability estimate associated with remaining challenges and scope of cleanup at the GDPs.

Estimated Completion Date: March 31, 2020

Text of Appendix IV: Comments from the Department of Energy

Page 1

Department of Energy
Washington, DC 20585
November 19, 2019

David C. Trimble Director
Natural Resources and Environment
U.S. Government Accountability Office 441 G Street, N.W.
Washington, DC 20548

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The cleanup of the ETTP GDP is a separate activity from the cleanup of other parts of the Oak Ridge Reservation. Although issues are still being resolved with regulators concerning other parts of the Oak Ridge cleanup, there is substantial agreement for ETTP GDP cleanup. Specific comments on the remaining issues and other suggested clarifications are enclosed for consideration in finalizing the report.

If you have any questions, please contact me or Ms. Elizabeth A. Connell, Associate Principal Deputy Assistant Secretary for Regulatory and Policy Affairs, at (202) 586-0637.

Sincerely,

William I. White

Senior Advisor for Environmental Management to the Under Secretary for
Science

Enclosures:

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- 2 .EM and Support Organization Technical Comments

Page 2

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Estimated Completion Date: December 31, 2020

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Estimated Completion Date: December 31, 2020

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Page 3

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Estimated Completion Date: March 31, 2020

Appendix V: GAO Staff and Acknowledgements

GAO Contact

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

Staff Acknowledgments

In addition to the individual named above, Amanda K. Kolling, Assistant Director; Luqman Abdullah; Mark Braza; Jennifer Echard; Emile Etedgui; Juan C. Garay; Mark Keenan; Jennifer Leotta; Gregory Marchand; Kiki Theodoropoulos; and Lauren Woodard made key contributions to this report. Also contributing to this report were Alexandra Edwards; Keegan Maguigan; Anne Stevens; and Doris Yanger.

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