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Energy, Committee on Energy and
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DEPARTMENT OF ENERGY

Continued Actions Needed to Modernize Nuclear Infrastructure and Address Management Challenges

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GAO Highlights

Highlights of [GAO-18-374T](#), a testimony before the Subcommittee on Energy, Committee on Energy and Commerce, House of Representatives

Why GAO Did This Study

DOE's NNSA is responsible for managing the nuclear weapons stockpile and supporting nuclear nonproliferation efforts. DOE's Office of Environmental Management's mission includes decontaminating and decommissioning facilities that are contaminated from decades of nuclear weapons production.

Over the last few years, GAO has reported on a wide range of challenges facing DOE and NNSA. These challenges contribute to GAO's continuing inclusion of DOE's and NNSA's management of major contracts and projects on the list of agencies and program areas that are at high risk of fraud, waste, abuse, and mismanagement, or are in need of transformation. GAO also recently added the U.S. government's environmental liabilities to this list.

This statement is based on 25 GAO reports issued from April 2011 through January 2018 and discusses (1) challenges related to the affordability of NNSA's nuclear modernization plans; (2) challenges related to DOE's environmental liability; (3) the status of DOE's efforts to improve its management of contracts, projects, and programs; and (4) challenges facing NNSA's nonproliferation programs.

What GAO Recommends

GAO has previously suggested that Congress consider changes to the laws governing environmental cleanup activities. In addition to these suggestions, GAO has made numerous recommendations to DOE to address its management challenges.

View [GAO-18-374T](#). For more information, contact David Trimble at (202) 512-3841 or trimbled@gao.gov.

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DEPARTMENT OF ENERGY

Continued Actions Needed to Modernize Nuclear Infrastructure and Address Management Challenges

What GAO Found

The Department of Energy's (DOE) National Nuclear Security Administration (NNSA) faces challenges related to the affordability of its nuclear modernization programs. In April 2017, GAO found a misalignment between NNSA's modernization plans and the estimated budgetary resources needed to carry out those plans. Specifically, GAO found that NNSA's estimates of funding needed for its modernization plans sometimes exceeded the budgetary projections included in the President's planned near-term and long-term modernization budgets by billions of dollars. GAO also found that the costs of some major modernization programs—such as for nuclear weapon refurbishments—may also increase and further strain future modernization budgets. GAO recommended in April 2017 that NNSA include an assessment of the affordability of its modernization programs in future versions of its annual plan on stockpile stewardship; NNSA neither agreed nor disagreed with that recommendation.

DOE also faces challenges with addressing its environmental liabilities—the total cost of its cleanup responsibilities. In February 2017, GAO found that DOE was responsible for over 80 percent (\$372 billion) of the U.S. government's estimated \$450 billion environmental liability. However, this estimate does not reflect all of DOE's cleanup responsibilities. Notably, this estimate does not reflect all of the future cleanup responsibilities that DOE may face. For example, in January 2017, GAO found that the cost estimate for DOE's proposal for separate defense and commercial nuclear waste repositories excluded the costs and time frames for site selection and site characterization, and therefore full costs are likely to be billions of dollars more than DOE's reported environmental liabilities. To effectively address cleanup, GAO has made at least 28 recommendations to DOE and other federal agencies, which could reduce long-term costs as well as environmental risks more quickly. Of these, 13 remain not implemented.

DOE has taken several important steps that demonstrate its commitment to improving contract and project management, but challenges persist. Specifically, DOE's revised project management order, issued in May 2016, made several changes in response to recommendations GAO made in prior years, such as requiring that projects develop cost estimates and analyses of alternatives according to our best practices. However, DOE's recent efforts do not address several areas, such as acquisition planning for major contracts and aspects of program and project management, where the department continues to struggle. GAO has made several recommendations related to these areas, and DOE has generally agreed with and begun to take action on most of them.

Finally, NNSA faces challenges in implementing its nonproliferation programs. For example, in September 2017, GAO found that selected programs in NNSA's Office of Defense Nuclear Nonproliferation (DNN) did not measure performance against schedule and cost baselines, as recommended by program management leading practices because DNN's program management policy did not require programs to measure performance in this way. GAO recommended that DNN revise its policy to require programs to measure performance against cost and schedule baselines. NNSA indicated it plans to take action to revise its policy.

Chairman Upton, Ranking Member Rush, and Members of the Subcommittee:

Thank you for the opportunity to discuss our recent work on some of the pressing management challenges facing the Department of Energy's (DOE) National Nuclear Security Administration (NNSA) and Office of Environmental Management (EM).¹ NNSA is responsible for managing the nation's three nuclear security missions: ensuring a safe, secure, and reliable nuclear deterrent; achieving designated reductions in the nuclear weapons stockpile; and supporting the nation's nuclear nonproliferation efforts. In support of these missions, NNSA's February 2016 budget justification for the Weapons Activities appropriations account included about \$49.4 billion for fiscal years 2017 through 2021 to implement its weapons modernization plans. More recently, in November 2017, NNSA issued its *Stockpile Stewardship and Management Plan*, which included about \$10.2 billion for weapons activities for fiscal year 2018.

In support of its missions, NNSA implements a range of nonproliferation programs under its Office of Defense Nuclear Nonproliferation.² These programs include efforts to secure, consolidate, and dispose of weapons-usable nuclear materials and radiological sources;³ reduce the risks of nuclear smuggling; enhance international export controls and International Atomic Energy Agency nuclear safeguards;⁴ and support research and development of new nonproliferation technologies.

¹NNSA is a separately organized agency within the Department of Energy. It was created under Title 32 of the National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65, §§ 3201-3299, 113 Stat. 512, 953-971 (1999) (codified as amended at 50 U.S.C. §§ 2401-2484 (2017)).

²DOE defines a program as an organized set of activities directed toward a common purpose or goal in support of an assigned mission area.

³Weapons-usable nuclear materials are highly enriched uranium, uranium-233, and any plutonium containing less than 80 percent of the isotope plutonium-238. Such materials are also often referred to as fissile materials or strategic special nuclear materials.

⁴The International Atomic Energy Agency is an independent international organization based in Vienna, Austria, that is affiliated with the United Nations and has the dual mission of promoting the peaceful uses of nuclear energy and verifying that nuclear material subject to safeguards is not diverted to weapons development efforts or other proscribed purposes. Safeguards allow the agency to independently verify that nuclear material and other specified items are not diverted by, among other things, inspecting all facilities and locations containing nuclear material declared by countries to verify its peaceful use.

EM is responsible for decontaminating and decommissioning nuclear facilities and sites that are contaminated from decades of nuclear weapons production and nuclear energy research. In February 2017, we reported that, since its inception in 1989, EM has spent over \$164 billion on cleanup efforts, which include retrieving, treating, and disposing of nuclear waste.⁵

Both NNSA and EM face critical challenges in fulfilling their missions. Since the end of the Cold War, key portions of the nuclear security enterprise's weapons production infrastructure have become outdated, prompting congressional and executive branch decision makers to call on DOE to develop plans to modernize this infrastructure.⁶ The Department of Defense's (DOD) 2010 Nuclear Posture Review identified long-term modernization goals and requirements, including sustaining a safe, secure, and effective nuclear arsenal through increasing investments to rebuild and modernize the nation's nuclear infrastructure, some of which dates back to the 1940s.⁷ In January 2017, the President directed the Secretary of Defense to initiate a new Nuclear Posture Review to ensure that the U.S. nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st-century threats and reassure our allies. This review was released in February 2018.⁸

As NNSA works to modernize the nuclear security enterprise, EM must address the legacy of 70 years of nuclear weapons production and energy research by DOE and its predecessor agencies. These activities generated large amounts of radioactive waste, spent nuclear fuel, excess plutonium and uranium, and contaminated soil and groundwater. They also contaminated thousands of sites and facilities, including land, buildings, and other structures and their systems and equipment. Various federal laws, agreements with states, and court decisions require the federal government to clean up environmental hazards at federal sites

⁵GAO, *High-Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, [GAO-17-317](#) (Washington, D.C.: Feb. 15, 2017).

⁶The end of the Cold War caused a dramatic shift in how the United States approaches nuclear weapons. Instead of designing, testing, and producing new nuclear weapons, U.S. strategy shifted to maintaining the existing nuclear weapons stockpile indefinitely.

⁷Department of Defense, *Nuclear Posture Review Report* (Washington, D.C.: Apr. 6, 2010). The Nuclear Posture Review establishes the nation's nuclear weapons requirements and policy.

⁸Department of Defense, *Nuclear Posture Review* (Washington, D.C.: Feb. 2018).

and facilities, such as nuclear weapons production facilities. DOE's approach to addressing these environmental liabilities is often influenced by numerous site-specific factors, stakeholder agreements, and legal provisions. For years, we and others have reported on shortcomings in DOE's approach to addressing its environmental liabilities, including incomplete data on the extent of cleanup needed.

DOE relies primarily on contractors to carry out its programs, and it is the largest civilian contracting agency in the federal government. In fiscal year 2017, it spent approximately 90 percent of its \$32 billion in annual funding on contracts and major capital asset projects.⁹ We designated DOE's contract management—which has included both contract administration and project management—as a high-risk area in 1990 because DOE's record of inadequate management and oversight of contractors had left it vulnerable to fraud, waste, abuse, and mismanagement. In our 2017 high-risk update, we reported that NNSA and EM continued to demonstrate a strong commitment and top leadership support to improve contract and project management—a key criterion for removing agencies and program areas from our High-Risk List.¹⁰ However, we also found that DOE still needs to make more progress on the other four criteria for removal: organizational capacity, corrective action planning, monitoring effectiveness, and demonstrating progress.

Further, in our 2017 high-risk update, we added the federal government's environmental liabilities to our High-Risk List. More than 80 percent of these liabilities are DOE's responsibility.¹¹ In our 2017 high-risk update, we reported that because of incomplete information and often inconsistent approaches to making cleanup decisions, DOE does not always approach environmental cleanup using a risk-informed approach to reduce health and safety risks in a cost-effective manner.

⁹Those are projects estimated to cost of \$750 million or more. DOE defines a capital asset project as a project with defined start and end points required in the acquisition of capital assets.

¹⁰[GAO-17-317](#). 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.

¹¹[GAO-17-317](#).

My testimony today discusses (1) challenges related to the affordability of NNSA's nuclear weapons modernization plans; (2) challenges in addressing DOE's environmental liabilities; (3) the status of DOE's efforts to improve its management of contracts, projects, and programs; and (4) challenges facing NNSA's nonproliferation program. My statement is based primarily on our work from 25 GAO reports issued from April 2011 to January 2018—including 5 reports issued since I last testified on this issue in May 2017 (see the end of this testimony for a list of related reports).¹² Detailed information about the scope and methodology we used to conduct our prior work can be found in each of our issued reports. The work upon which this testimony is based was conducted 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.

Misalignment between NNSA's Modernization Budget Estimates and Plans Raises Affordability Concerns

In April 2017, we issued our latest report on NNSA's 25-year plans to modernize the nation's nuclear weapons stockpile and its supporting infrastructure.¹³ In that report, we identified two areas of misalignment between NNSA's modernization plans and the estimated budgetary resources needed to carry out those plans, which could result in challenges to NNSA in affording its planned portfolio of modernization programs. First, we found that NNSA's estimates of funding needed for its modernization plans sometimes exceeded the budgetary projections included in the President's planned near- and long-term modernization budgets. In the near-term (fiscal years 2018 through 2021), we found that NNSA may have to defer certain modernization work beyond that time period to execute its program within the planned budget, which could increase modernization costs and schedule risks. This is a pattern we have previously identified as a "bow wave"—an increase in future years' estimated budget needs that occurs when agencies are undertaking more programs than their resources can support. In the long-term (fiscal years 2022 through 2026), we found that NNSA's modernization program

¹²GAO, *Department of Energy: Continued Actions Needed to Address Management Challenges*, [GAO-17-651T](#) (Washington, D.C.: May 24, 2017).

¹³GAO, *National Nuclear Security Administration: Action Needed to Address Affordability of Nuclear Modernization Programs*, [GAO-17-341](#) (Washington, D.C.: Apr. 26, 2017).

budget estimates sometimes exceeded the projected budgetary resources planned for inclusion in the President's budget, raising additional questions about whether NNSA will be able to afford the scope of its modernization program. Second, the costs of some major modernization programs—such as for nuclear weapon refurbishments—may also increase and further strain future modernization budgets. We are currently reviewing NNSA's *Fiscal Year 2018 Stockpile Stewardship and Management Plan*.¹⁴

Misalignment between Estimates and Plans May Result in Increased Cost and Schedule Risks and Raises Affordability Concerns

Near-term Misalignment between Modernization Plans and Estimated Budgetary Resources

As we reported in April 2017, NNSA estimates of funding needed for its modernization plans sometimes exceeded the budgetary projections included in the President's planned near- and long-term modernization budgets.¹⁵

We found that NNSA may have to defer certain modernization work planned for fiscal years 2018 through 2021 beyond its current 5-year planning period, called the Future-Years Nuclear Security Program (FYNSP). As we reported in April 2017, this is caused by a misalignment between NNSA's budget estimates for certain nuclear modernization programs and the President's budgets for that period.¹⁶ We concluded that this deferral could exacerbate a significant bow wave of modernization funding needs that NNSA projects for the out-years

¹⁴The National Defense Authorization Act for Fiscal Year 2013 includes a provision that we annually review a joint DOE-DOD report which addresses, among other things, the plan for the nuclear weapons stockpile and its delivery systems.

¹⁵[GAO-17-341](#).

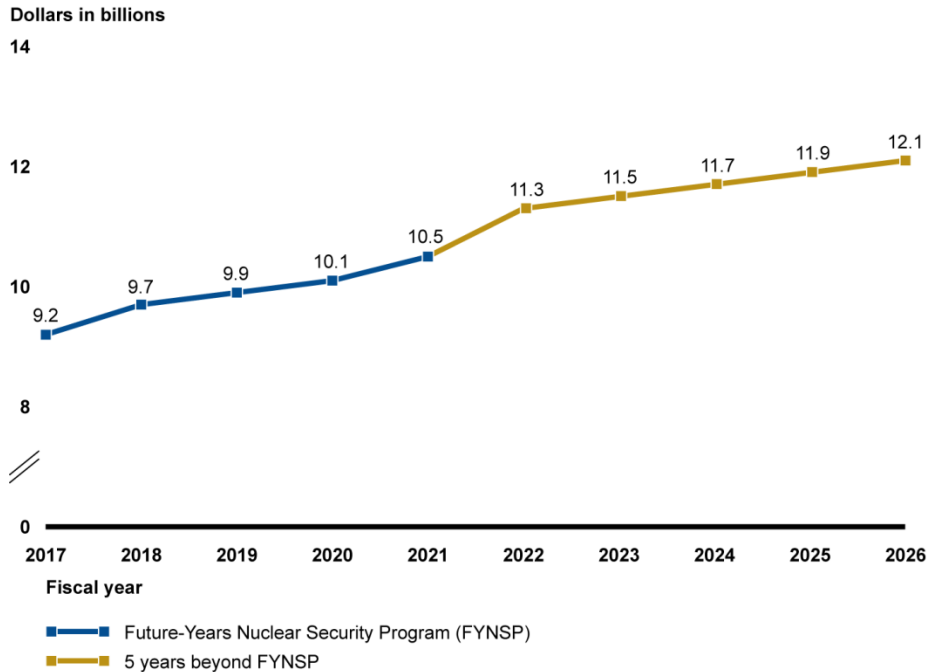
¹⁶[GAO-17-341](#). Two key documents, updated annually, describe NNSA's operations, modernization plans, and budget estimates for implementing these plans; these documents comprise NNSA's nuclear security budget materials. First, the *Stockpile Stewardship and Management Plan* is NNSA's formal means of communicating to Congress information on modernization and operations plans and budget estimates over the next 25 years. Second, NNSA's annual justification of the President's budget provides program information and budget estimates for the next 5 years. This 5-year plan is called the Future-Years Nuclear Security Program (FYNSP), and the budget estimates in this plan reflect funding levels approved by the Office of Management and Budget. The budget estimates for years included in the FYNSP must align with the 5-year overall federal budget estimates in the President's budget. The budget estimates for years beyond the FYNSP are not subject to this requirement.

beyond the FYNSP and could potentially increase modernization costs and schedule risks.

As we have previously reported, such bow waves occur when agencies defer costs of their programs to the future, beyond their programming periods, and they often occur when agencies are undertaking more programs than their resources can support.¹⁷ As NNSA's fiscal year 2017 budget materials show, its modernization budget estimates for fiscal years 2022 through 2026—the first 5 years beyond the FYNSP—may require significant funding increases. For example, in fiscal year 2022, NNSA's estimates of its modernization budget needs are projected to rise about 7 percent compared with the budget estimates for fiscal year 2021, the last year of the FYNSP, as shown in figure 1.

¹⁷GAO, *Orion Multi-Purpose Crew Vehicle: Action Needed to Improve Visibility into Cost, Schedule, and Capacity to Resolve Technical Challenges*, [GAO-16-620](#) (Washington, D.C.: Jul. 27, 2016) and *Weapon System Acquisitions: Opportunities Exist to Improve the Department of Defense's Portfolio Management*, [GAO-15-466](#) (Washington, D.C.: Aug. 27, 2015).

Figure 1: Comparison of the National Nuclear Security Administration's Fiscal Year 2017 Budget Estimates for the Future-Years Nuclear Security Program and 5 Years Beyond



Source: GAO analysis of National Nuclear Security Administration data. | GAO-18-374T

Note: Amounts are presented in nominal dollars, which are not adjusted for the effects of inflation.

The analysis in our April 2017 report showed that NNSA has shifted this modernization bow wave to the period beyond the FYNSP time frame in each of the past four versions of the annual *Stockpile Stewardship and Management Plan*. For example, in the *Fiscal Year 2014 Stockpile Stewardship and Management Plan*, NNSA's budget estimates for its modernization programs increased from a total of about \$9.3 billion in fiscal year 2018, the last year of the FYNSP, to about \$10.5 billion in fiscal year 2019, the first year after the FYNSP—an increase of about 13 percent. Similar patterns showing a jump in funding needs immediately after the last year of the FYNSP are repeated in the funding profiles contained in the fiscal year 2015, 2016, and 2017 plans. As we have previously reported, deferring more work to future years can increase cost and schedule risks and can put programs in the position of potentially facing a backlog of deferred work that grows beyond what can be accommodated in future years.

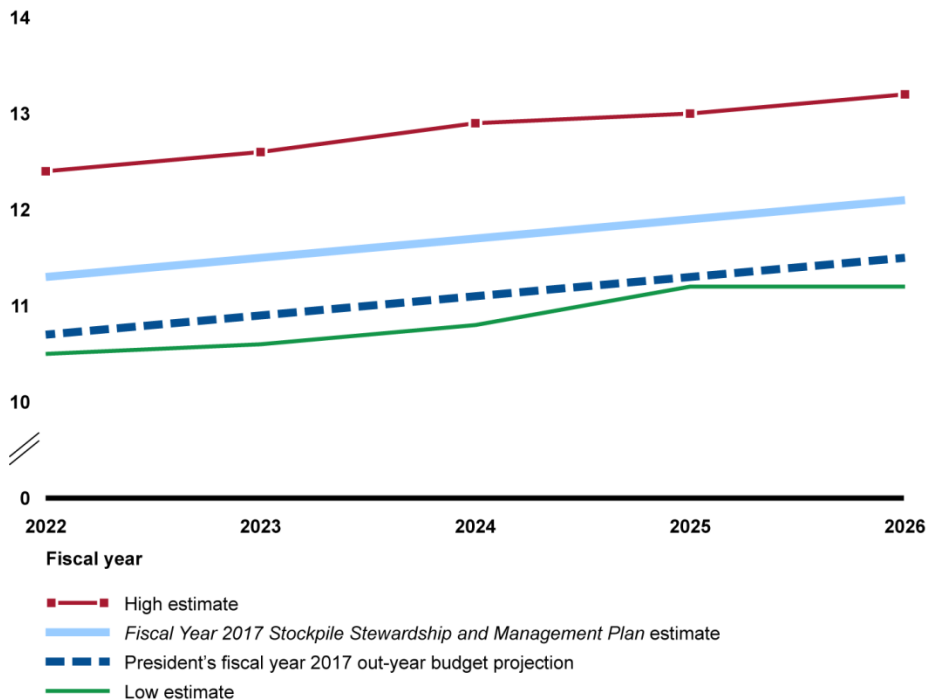
Long-term Misalignment
between Modernization Plans
and Estimated Budgetary
Resources

The *Fiscal Year 2017 Stockpile Stewardship and Management Plan* shows that NNSA's overall modernization budget estimates for fiscal years 2022 through 2026—the out-years beyond the FYNSP—may exceed the projected funding levels in the President's budgets for that period, raising further questions about the affordability of NNSA's nuclear modernization plans. According to NNSA's data, the agency's estimated budget needed to support modernization totals about \$58.4 billion for fiscal years 2022 through 2026, and the out-year funding projections contained in the President's fiscal year 2017 budget for the same period total about \$55.5 billion. The President's out-year funding projections, therefore, are approximately \$2.9 billion, or about 5.2 percent, less than NNSA estimates it will need over the same period.

Despite this potential shortfall, NNSA's *Fiscal Year 2017 Stockpile Stewardship and Management Plan* concludes that the modernization program is generally affordable in the years beyond the FYNSP for two reasons. First, the President's out-year funding projections are sufficient to support NNSA's low-range cost estimates for its modernization programs for fiscal years 2022 through 2026. Based on NNSA data, the low-range cost estimates for fiscal years 2022 through 2026 total approximately \$54.4 billion and the President's out-year funding projections total about \$55.5 billion. Figure 2 illustrates data from the 2017 plan showing NNSA's budget estimates in nominal dollars, including high- and low-range cost estimates for its modernization program, along with the out-year funding projections from the President's fiscal year 2017 budget, for fiscal years 2022 to 2026. Second, NNSA concludes that its modernization programs are generally affordable beyond the FYNSP because the agency's estimated modernization budget needs will begin to decrease in fiscal year 2027.

Figure 2: Comparison of the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*'s Budget Estimates and High- and Low-Range Cost Estimates with the President's Fiscal Year 2017 Out-Year Budget Projections, Fiscal Years 2022 through 2026

Dollars in billions



Source: GAO analysis of National Nuclear Security Administration data. | GAO-18-374T

Note: Amounts are presented in nominal dollars, which are not adjusted for the effects of inflation.

In our April 2017 report, we noted that NNSA's conclusion—that its modernization program is affordable because the President's out-year funding projections fall within NNSA's modernization cost ranges—is overly optimistic. This is because the conclusion is predicated on optimistic assumptions regarding the cost of the modernization program beyond the FYNSP, particularly for fiscal years 2022 through 2026. For the program to be affordable, NNSA's modernization programs would need to be collectively executed at the low end of their estimated cost ranges. The plan does not discuss any options NNSA would pursue to support or modify its modernization program if costs exceeded its low-range cost estimates. In addition, the *Fiscal Year 2017 Stockpile Stewardship and Management Plan* states that the nominal cost of NNSA's modernization program is expected to decrease by approximately \$1 billion in fiscal year 2027. In that year, according to the 2017 plan, it is anticipated that NNSA's estimated budgets for its

modernization program will begin to fall in line with projections of future presidential budgets. However, as we noted in our April 2017 report, the decrease that NNSA anticipates in its modernization funding needs beginning in fiscal year 2027 may not be achievable if the projected mismatch between NNSA's estimates of its modernization budget needs and the projections of the President's modernization budget for fiscal years 2022 through 2026 is not resolved. This mismatch creates concerns that NNSA will not be able to afford planned modernization costs during fiscal years 2022 through 2026 and will be forced to defer them to fiscal year 2027 and beyond, continuing the bow wave patterns discussed above.

Potential Rising Costs of Some Modernization Programs May Further Strain NNSA's Modernization Budgets

Our April 2017 report identified misalignment between NNSA's estimate of its budget needs and NNSA's internal cost range estimates for several of its major modernization programs. Further, we found that the costs of some major life extension programs (LEP) may increase in the future, which may further strain NNSA's planned modernization budgets.

With respect to the alignment of NNSA's estimate of its budget needs and NNSA's internal cost range estimates, in April 2017 we found that NNSA's budget estimates were generally consistent with NNSA's high- and low-range cost estimates.¹⁸ However, for some years, NNSA's low-range cost estimates exceeded the budget estimates for some of the programs, suggesting the potential for a funding shortfall for those programs in those years. Specifically, we found that the low-range cost estimates for the W88 Alteration 370 program and all LEPs discussed in our April 2017 report exceeded their budget estimates for some fiscal

¹⁸According to NNSA officials, two approaches are used to estimate the costs of the LEPs, except for the W76-1. Under the first approach, according to officials, NNSA develops specific budget estimates by year through a "bottom-up" process. NNSA officials described this as a detailed approach to developing the LEP budget estimates that, among other things, integrates resource and schedule information from site participants. Under the second approach, which NNSA refers to as a "top-down" process, NNSA uses historical LEP cost data and complexity factors to project high- and low-range cost estimates for each LEP distributed over the life of the program using an accepted cost distribution method. According to NNSA, the W76-1 LEP, which is the only weapon program that has been through the development phase and the majority of the production phase, is used as the primary basis for modeling cost ranges for all future LEPs. NNSA does not prepare high- and low-range cost estimates for it. Officials noted that the values in these cost ranges reflect idealized funding profiles and do not account for the actual detailed schedule of program activities, planning for risk in the project, or the results of execution to date.

years within the 10-year time period from fiscal year 2017 to 2026.¹⁹ As we reported in 2013 and 2016, this misalignment indicates that NNSA's estimated budgets may not be sufficient to fully execute program plans and that NNSA may need to increase funding for these programs in the future.²⁰

Additionally, in April 2017 we found that the costs of two ongoing nuclear weapon LEPs and the W88 Alteration 370 program may increase in the future, based on NNSA information that was produced after the release of the fiscal year 2017 budget materials.²¹ These potential cost increases could further challenge the extent to which NNSA's budget estimates support the scope of modernization efforts. The LEPs facing potential cost increases include:

- **B61-12 LEP.** An independent cost estimate for the program completed in October 2016 exceeded the program's self-conducted cost estimate from June 2016 by \$2.6 billion.²²
- **W80-4 LEP.** Officials from NNSA's Office of Cost Policy and Analysis told us that this program may be underfunded by at least \$1 billion to meet the program's existing schedule.
- **W88 Alteration 370.** According to officials from NNSA's Office of Cost Policy and Analysis, this program's expanded scope of work may result in about \$1 billion in additional costs.

To help NNSA put forth more credible modernization plans, we recommended in our April 2017 report that the NNSA Administrator include an assessment of the affordability of NNSA's portfolio of modernization programs in future versions of the *Stockpile Stewardship and Management Plan*, such as by presenting options (e.g., potentially

¹⁹See [GAO-17-341](#) for greater detail on these and other examples.

²⁰GAO, *Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Increased but May Not Align with All Anticipated Costs*, [GAO-16-290](#) (Washington, D.C.: Mar. 4, 2016) and *Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Do Not Fully Align with Plans*, [GAO-14-45](#) (Washington, D.C.: Dec. 11, 2013).

²¹NNSA's fiscal year 2017 budget materials include two key documents: the *Fiscal Year 2017 Stockpile Stewardship and Management Plan*, which was issued in March 2016, and the agency's annual justification of the President's budget, which was issued in February 2016.

²²We are conducting ongoing work to determine how NNSA has, if at all, reconciled this difference.

deferring the start of or canceling specific modernization programs) that NNSA could consider taking to bring its estimates of modernization funding needs into alignment with potential future budgets. In commenting on our report, NNSA neither agreed nor disagreed with our recommendation.

DOE Annually Spends Billions on Cleanup, but the Cost of Its Environmental Liabilities Continues to Increase

DOE also faces challenges with addressing its environmental liabilities and its cleanup mission. In February 2017, we added the federal government's environmental liabilities to our High-Risk List.²³ Specifically, we found that the federal government's environmental liability has been growing for the past 20 years—and is likely to continue to increase—and that DOE is responsible for over 80 percent (\$372 billion) of the nearly \$450 billion reported environmental liability. Notably, this estimate does not reflect all of the future cleanup responsibilities that DOE may face.²⁴ In addition, DOE has not consistently taken a risk-informed approach to decision-making for environmental cleanup, and DOE may therefore be missing opportunities to reduce costs while also reducing environmental risks more quickly. Our recent work in this area has also identified opportunities where DOE may be able to save tens of billions of dollars.

As we have previously reported, DOE's total reported environmental liability has generally increased over time. Since 1989, EM has spent over \$164 billion to retrieve, treat, and dispose of nuclear and hazardous waste and, as of 2017, it had completed cleanup at 91 of 107 sites across the country (the 91 sites were generally viewed by DOE as the smallest and least contaminated sites to address). Despite billions spent on environmental cleanup, DOE's environmental liability has roughly doubled from \$176 billion in fiscal year 1997 to the fiscal year 2016 estimate of \$372 billion.²⁵ Between 2011 and 2016, EM spent \$35 billion, primarily to treat and dispose of nuclear and hazardous waste and construct capital asset projects to treat the waste (see fig. 3 for EM's annual spending and growing environmental liability). According to documents related to DOE's

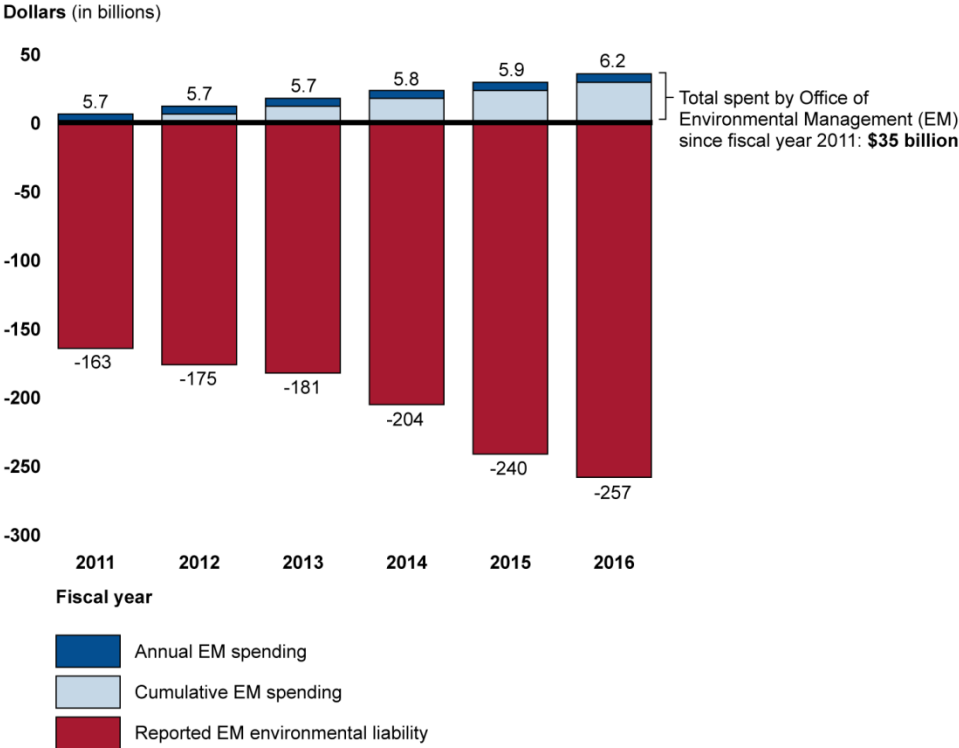
²³GAO-17-317.

²⁴Federal accounting standards require agencies responsible for cleaning up contamination to estimate future cleanup and waste disposal costs and to report such costs in their annual financial statements as environmental liabilities. Per federal accounting standards, federal agencies' environmental liability estimates are to include probable and reasonably estimable costs of cleanup work.

²⁵We did not adjust environmental liability estimates for inflation because information about the amount of the liability applicable to each future fiscal year was not available.

fiscal year 2016 financial statements, half of DOE’s environmental liability resides at two cleanup sites: the Hanford Site in Washington State and the Savannah River Site in South Carolina.

Figure 3: Department of Energy’s Office of Environmental Management’s Annual Spending and Growing Environmental Liability



Source: GAO analysis of Department of Energy budget data. | GAO-18-374T

Note: EM is the organization within the Department of Energy responsible for managing environmental cleanup and is responsible for cleaning up 107 sites across the country. To date, EM has completed cleanup at 91 of these sites. EM spending includes money to treat and dispose of nuclear and hazardous waste and to construct capital asset projects to treat the waste. We did not adjust environmental liability estimates for inflation because information about the amount of the liability applicable to each future fiscal year was not available.

In its fiscal year 2016 financial statement, DOE attributed recent environmental liability increases to (1) inflation adjustments for the current year; (2) improved and updated estimates for the same scope of work, including changes resulting from deferral or acceleration of work; (3) revisions in technical approach or scope for cleanup activities; and (4) regulatory and legal changes. Notably, in recent annual financial reports, DOE has cited other significant causes for increases in its liability. Other

causes have included the lack of a disposal path for high-level radioactive waste—because of the termination of the Yucca Mountain repository program—and delays and scope changes for major construction projects at the Hanford and Savannah River sites.

We also reported in February 2017 that DOE’s estimated liability does not include billions in expected costs.²⁶ According to federal accounting standards, environmental liability estimates should include costs that are probable and reasonably estimable, meaning that costs that cannot yet be reasonably estimated should not be included in total environmental liability.²⁷ Examples of costs that DOE cannot yet estimate include the following:

- DOE has not yet developed a cleanup plan or cost estimate for the Nevada National Security Site and, as a result, the cost of future cleanup of this site was not included in DOE’s fiscal year 2015 reported environmental liability. The nearly 1,400-square-mile site has been used for hundreds of nuclear weapons tests since 1951. These activities have resulted in more than 45 million cubic feet of radioactive waste at the site. According to DOE’s financial statement, since DOE is not yet required to establish a plan to clean up the site, the costs for this work are excluded from DOE’s annually reported environmental liability.
- DOE’s reported environmental liability includes an estimate for the cost of a permanent nuclear waste repository, but these estimates are highly uncertain and likely to increase. In March 2015, in response to the termination of the Yucca Mountain repository program, DOE proposed separate repositories for defense high-level and commercial waste. In January 2017, we reported that the cost estimate for DOE’s new approach excluded the costs and time frames for site selection and site characterization.²⁸ As a result, the full cost of these activities is likely billions of dollars more than what is reflected in DOE’s environmental liability. In our annual report on Fragmentation, Overlap, and Duplication in the federal government that we issued in

²⁶[GAO-17-317](#).

²⁷Federal Accounting Standards Advisory Board, *FASAB Handbook of Federal Accounting Standards and Other Pronouncements, as Amended* (Washington, D.C.: June 30, 2016).

²⁸GAO, *Nuclear Waste: Benefits and Costs Should Be Better Understood Before DOE Commits to a Separate Repository for Defense Waste*, [GAO-17-174](#) (Washington, D.C.: Jan. 31, 2017).

May 2017, we reported that DOE may be able to save billions of dollars by reassessing the rationale for its March 2015 proposal.²⁹ In June 2017, a bill that could result in renewed efforts to open the Yucca Mountain repository was introduced in the House of Representatives.³⁰

In addition, according to the DOE Inspector General, DOE may have insufficient controls in place to accurately account for its environmental liabilities. In November 2016, the DOE Inspector General reported a significant deficiency in internal controls related to the reconciliation of environmental liabilities.³¹

Moreover, DOE does not consistently take a risk-informed decision-making approach to its environmental cleanup mission to more efficiently use resources. As our reports and those by other organizations issued over the last 2 decades have found, DOE's environmental cleanup decisions have not been risk-based, and there have been inconsistencies in the regulatory approaches followed at different sites. We and others have pointed out that DOE needs to take a nation-wide, risk-based approach to cleaning up these sites, which could reduce costs while also reducing environmental risks more quickly.

- In 2006, the National Research Council reported that the nation's approach to cleaning up nuclear waste—primarily carried out by DOE—was complex, inconsistent, and not systematically risk-based.³² For example, the National Research Council noted that the current regulatory structure for low-activity waste is based primarily on the waste's origins rather than on its actual radiological risks. The National Research Council concluded that by working with regulators, public authorities, and local citizens to implement risk-informed

²⁹GAO, *2017 Annual Report: Additional Opportunities to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits*, [GAO-17-491SP](#) (Washington, D.C.: Apr. 26, 2017).

³⁰Nuclear Waste Policy Amendments Act of 2017, H.R. 3053, 115th Cong. (2017).

³¹The U.S. Department of Energy Office of the Inspector General, *The Department of Energy's Fiscal Year 2016 Consolidated Financial Statements*, OAI-FS-17-02 (Washington, D.C.: November 15, 2016).

³²National Research Council of the National Academies, *Improving the Regulation and Management of Low-Activity Radioactive Wastes* (Washington, D.C.: National Academies Press, 2006).

practices, waste cleanup efforts can be done more cost-effectively. The report also suggested that statutory changes were likely needed.

- In 2015, a review organized by the Consortium for Risk Evaluation with Stakeholder Participation reported that DOE was not optimally using available resources to reduce risk.³³ According to the report, factors such as inconsistent regulatory approaches and certain requirements in federal facility agreements caused disproportionate resources to be directed at lower-priority risks. The report called for a more systematic effort to assess and rank risks within and among sites, including through headquarters guidance to sites, and to allocate federal taxpayer monies to remedy the highest priority risks through the most efficient means.
- In May 2017, we reported on DOE's efforts to treat a significant portion of the waste in underground tanks at the Hanford Site.³⁴ We found that DOE chose different approaches to treat the less radioactive portion of its tank waste—which DOE refers to as “low-activity waste” (LAW)—at the Hanford and Savannah River Sites. At the Savannah River Site, DOE has grouted about 4 million gallons of LAW since 2007. DOE plans to treat a portion of the Hanford Site's LAW with vitrification, but it has not yet treated any of Hanford's LAW and faces significant unresolved technical challenges in doing so.³⁵ In addition, we found that the best available information indicates that DOE's estimated costs to grout LAW at the Savannah River Site are substantially lower than its estimated costs to vitrify LAW at Hanford, and DOE may be able to save tens of billions of dollars by reconsidering its waste treatment approach for a portion of the LAW at Hanford. Moreover, according to experts that attended a meeting we convened with the National Academies of Sciences, Engineering, and Medicine, both vitrification and grout could effectively treat Hanford's LAW. Experts at our meeting also stated that developing updated information on the effectiveness of treating a portion of Hanford's

³³The Consortium for Risk Evaluation with Stakeholder Participation is a multi-university consortium organized in 1995 that provides several types of independent, multi-disciplinary reviews of DOE documents, projects, and reports. See: Omnibus Risk Review Committee, *A Review of the Use of Risk-Informed Management in the Cleanup Program for Former Defense Nuclear Sites* (August 2015).

³⁴About 90 percent of the waste at Hanford is considered to be low-activity, meaning that it is much less radioactive than high-level waste. See GAO, *Nuclear Waste: Opportunities Exist to Reduce Risks and Costs by Evaluating Different Waste Treatment Approaches at Hanford*, [GAO-17-306](#) (Washington, D.C.: May 3, 2017).

³⁵Grout immobilizes waste in a concrete-like mixture. Vitrification immobilizes waste in glass.

waste, called supplemental LAW, with other methods, such as grout, may enable DOE to consider waste treatment approaches that would accelerate DOE's tank waste treatment mission, thereby potentially reducing certain risks and lifecycle treatment costs. We recommended that DOE (1) develop updated information on the performance of treating supplemental LAW with alternate methods, such as grout, before it selects an approach for treating supplemental LAW; and (2) have an independent entity develop updated information on the lifecycle costs of treating Hanford's supplemental LAW with alternate methods. DOE agreed with both recommendations.

Since 1994, we have made at least 28 recommendations related to addressing the federal government's environmental liability to DOE and others and 4 suggestions to Congress to consider changes to the laws governing cleanup activities. Of these, 13 recommendations remain unimplemented. If implemented, these steps would improve the completeness and reliability of the estimated costs of future federal cleanup responsibilities and lead to more risk-based management of the cleanup work.³⁶ We believe these recommendations are as relevant, if not more so, today.

DOE Has Taken Steps to Improve Management of Contracts, Projects, and Programs, but Challenges Remain

The Secretary of Energy has taken several important steps that demonstrate DOE's commitment to improving management of contracts and projects. However, our recent work indicates that, even with these efforts, NNSA and EM continue to face long-standing challenges in several areas.

DOE Has Made Progress in Managing Contracts and Projects

As we noted in our 2017 high-risk report, DOE has made progress in its contract and project management. DOE continued to meet the criterion for demonstrating a strong commitment and top leadership support for improving project management.³⁷ The Secretary of Energy issued two

³⁶We have ongoing work examining the consistency of DOE's compliance agreements, looking specifically at the extent to which milestones within select compliance agreements are tailored to the environmental and human health risks that DOE is faced with addressing and the extent to which DOE's cleanup remedies are based on up-to-date assessments of conditions at sites and of DOE's technical capabilities.

³⁷[GAO-17-317](#).

memorandums, in December 2014 and June 2015, that lay out a series of changes to policies and procedures to improve project management. These changes were included in DOE's revised project management order, DOE Order 413.3B, issued in May 2016. As noted in the memorandums, some of these changes are in response to recommendations we made in prior years, such as requiring that projects develop cost estimates and analyses of alternatives according to our best practices.

DOE also made significant efforts to improve its performance in monitoring and independently validating the effectiveness and sustainability of corrective measures and now partially meets our monitoring criterion for removing agencies and program areas from our High-Risk List. For example, the Secretary improved the department's senior-level monitoring capability. The Secretary strengthened the Energy Systems Acquisition Advisory Board by changing it from an ad hoc body to an institutionalized board responsible for reviewing all capital asset projects with a total project cost of \$100 million or more. The Secretary also created the Project Management Risk Committee, which includes senior DOE officials and is chaired by a new departmental position—the Chief Risk Officer. The committee is chartered to assess the risks of projects across DOE and advise DOE senior leaders on cost, schedule, and technical issues for projects.³⁸

Challenges Persist in Several Areas

DOE's recent efforts do not address several areas where it continues to have challenges including (1) acquisition planning for its major contracts, (2) the quality of enterprise-wide cost information available to DOE managers and key stakeholders, (3) program and project management, and (4) major legacy projects.

Acquisition Planning for Major Contracts

As we have previously reported, during the acquisition-planning phase for contracts, DOE makes critical decisions that have significant implications

³⁸As we stated in our 2017 High-Risk List update, additional time is needed for us to assess how effectively these recent monitoring improvements will validate the sustainability of corrective measures. We have not yet evaluated the operations of the newly created Project Management Risk Committee. In addition, DOE's new oversight and monitoring efforts are not comprehensive, as certain activities within EM are not subject to review by the committee, even though together they cost billions of dollars and last for numerous years. Finally, the effectiveness of DOE's monitoring of its contracts, projects, and programs depends upon the availability of reliable enterprise-wide cost information on which to base oversight activities. See [GAO-17-317](#).

for the cost and overall success of an acquisition. The size and duration of DOE's management and operating (M&O) contracts³⁹—22 M&O contracts with an average potential duration of 17 years, representing almost three-quarters of DOE's spending in fiscal year 2015—underscore the importance of planning for every M&O acquisition. In August 2016, we examined DOE's use of M&O contracts.⁴⁰ According to DOE officials we interviewed at that time, one of the primary reasons DOE uses M&O contracts is because they are easier to manage with fewer DOE personnel because they are less frequently competed and have broadly written scopes of work, among other attributes. We found that DOE did not consider acquisition alternatives beyond continuing its long-standing M&O contract approach for 16 of its 22 M&O contracts. We concluded that without considering broader alternatives in the acquisition planning phase, DOE cannot ensure that it is selecting the most effective scope and form of contract, raising risks for both contract cost and performance. We recommended in our August 2016 report that DOE establish a process to analyze and apply its experience with contracting alternatives. DOE generally concurred with our recommendation, and, in November 2016, issued updated guidance requiring acquisition planning documents to contain a thorough discussion of alternatives beyond simply extending or competing M&O contracts.⁴¹

Quality of Enterprise-Wide Cost Information

We have previously reported that the effectiveness of DOE's monitoring of its contracts, projects, and programs depends upon the availability of reliable enterprise-wide cost information on which to base oversight activities. For example, reliable enterprise-wide cost information is needed to identify the cost of activities, ensure the validity of cost estimates, and provide information to Congress to make budgetary decisions. However, we have found that meaningful cost analyses across programs, contractors, and sites are not usually possible because

³⁹M&O contracts are agreements under which the government contracts for the operation, maintenance, or support, on its behalf, of a government-owned or government-controlled research, development, special production, or testing establishment wholly or principally devoted to one or more of the major programs of the contracting federal agency. Federal Acquisition Regulation § 17.601.

⁴⁰GAO, *Department of Energy: Actions Needed to Strengthen Acquisition Planning for Management and Operating Contracts*, [GAO-16-529](#) (Washington, D.C.: Aug. 9, 2016).

⁴¹We currently have four ongoing reviews related to contract management, including (1) performance management of DOE's management and operating contracts, (2) DOE and NNSA's subcontractor management, (3) NNSA's contract document management, and (4) NNSA's support service contracts.

NNSA's contractors use different methods of accounting for and tracking costs. NNSA developed a plan to improve and integrate its cost reporting structures; however, we found in January 2017 that this plan did not provide a useful road map for guiding NNSA's effort.⁴² For example, we found that NNSA did not define strategies and identify resources needed to achieve its goals, which is a leading practice for strategic planning. NNSA's plan contained few details on the elements it must include, such as its feasibility assessment, estimated costs, expected results, and an implementation timeline. We concluded that, until a plan is in place that incorporates leading strategic planning practices, NNSA cannot be assured that its efforts will result in a cost collection tool that produces reliable enterprise-wide cost information that satisfies the information needs of Congress and program managers. We recommended that NNSA develop a plan for producing cost information that fully incorporates leading planning practices. NNSA agreed with our recommendation.

In addition, as we have previously noted, quality data are needed for DOE to manage its risk of fraud. The Fraud Reduction and Data Analytics Act of 2015 establishes requirements aimed at improving federal agencies' controls and procedures for assessing and mitigating fraud risks through the use of data analytics.⁴³ In a March 2017 report, however, we found that because DOE does not require its contractors to maintain sufficiently detailed transaction-level cost data that are reconcilable with amounts charged to DOE, it is not well positioned to employ data analytics as a fraud detection tool.⁴⁴ We found that the data were not suitable either because they were not for a complete universe of transactions that was reconcilable with amounts billed to DOE or because they were not sufficiently detailed to determine the nature of costs charged to DOE. We concluded that, without requiring contractors to maintain such data, DOE will not be well positioned to meet the requirements of the Fraud Reduction and Data Analytics Act of 2015 and manage its risk of fraud and other improper payments. We recommended that DOE require

⁴²GAO, *National Nuclear Security Administration: A Plan Incorporating Leading Practices Is Needed to Guide Cost Reporting Improvement Effort*, [GAO-17-141](#) (Washington, D.C.: Jan. 19, 2017).

⁴³Data analytics enable an organization to analyze transactional data to obtain insights into the operating effectiveness of internal controls and to identify improper cost charges, potential indicators of fraud, or actual fraudulent payments or activities.

⁴⁴GAO, *Department of Energy: Use of Leading Practices Could Help Manage the Risk of Fraud and Other Improper Payments*, [GAO-17-235](#) (Washington, D.C.: Mar. 30, 2017).

contractors to maintain sufficiently detailed transaction-level cost data that are reconcilable with amounts charged to the government.

DOE did not concur with our recommendation. This is because, according to DOE, the recommendation establishes agency-specific requirements for DOE contractors that are more prescriptive than current federal requirements and that its M&O contractors, not DOE, are responsible for performing data analytics and determining what data are needed to do so. DOE's response to our recommendation is concerning because it demonstrates that DOE does not fully appreciate its responsibility for overseeing contractor costs. We believe that the use of data-analytic techniques by DOE employees could help mitigate some of the challenges that limit the effectiveness of DOE's approach for overseeing M&O contractor costs. However, effectively applying data-analytics depends on the availability of complete and sufficiently detailed contractor data. Therefore, by implementing our recommendation DOE could take the important steps necessary to require contractors maintain sufficiently detailed transaction-level cost data that are reconcilable with amounts charged to the government.

Program and Project Management

Although, as mentioned previously, DOE has taken some steps to improve program and project management, our recent work has shown that DOE continues to face several challenges in these areas. Specifically on program management:

- In November 2017, we found that NNSA had established program management requirements, such as developing cost and schedule estimates for its uranium, plutonium, tritium, and lithium programs and had established managers' roles and responsibilities for these programs.⁴⁵ However, officials told us that the programs had not fully met these requirements primarily because of staff shortages. We recommended that NNSA determine the critical staff skills it will need for these programs and use that information to address staffing shortages. NNSA agreed with our recommendation.⁴⁶

⁴⁵GAO, *Nuclear Weapons: NNSA Needs to Determine Critical Skills and Competencies for Its Strategic Materials Programs*, [GAO-18-99](#) (Washington, D.C.: Nov. 14, 2017).

⁴⁶We have ongoing work on NNSA's enriched uranium program and its efforts to extend the supply of enriched uranium for tritium production, including reviewing NNSA's plans and cost estimates of potential options.

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- In a September 2017 report on the NNSA's uranium program, we found that NNSA had not developed a complete scope of work, a life-cycle cost estimate, or an integrated master schedule for the overall uranium program—all of which are considered leading practices—and it had no time frame for doing so.⁴⁷ We reported that NNSA plans to do so for the specific Uranium Processing Facility project,⁴⁸ as required by DOE's project management order. However, NNSA had not developed a complete scope of work for key program requirements, including important and potentially costly repairs and upgrades to existing buildings in which NNSA intends to house some uranium processing capabilities. We concluded that because NNSA had not developed a complete scope of work for the overall uranium program, it did not have the basis to develop a life-cycle cost estimate or an integrated master schedule for the entire uranium program, which runs counter to best practices identified in GAO's cost estimating and scheduling guides. We recommended that NNSA set a time frame for completing the scope of work, life-cycle cost estimate, and integrated master schedule for the overall uranium program. NNSA generally agreed with this recommendation and has ongoing efforts to complete these actions.
 - In September 2017, we found that DOE's program to re-establish the production of a plutonium isotope used to provide electrical power for the National Aeronautics and Space Administration missions had made progress but that it faced a number of technical and organizational challenges to meeting production goals.⁴⁹ Specifically,

⁴⁷GAO, *Modernizing the Nuclear Security Enterprise: A Complete Scope of Work Is Needed to Develop Timely Cost and Schedule Information for the Uranium Program*, [GAO-17-577](#) (Washington, D.C.: Sept. 8, 2017). The scope of work reflects all activities as defined in the program's work breakdown structure, which defines in detail the work necessary to accomplish a project's objectives. A life-cycle cost estimate provides an exhaustive and structured accounting of all resources and associated cost elements required to develop, produce, deploy, and sustain a particular program. An integrated master schedule is a document that integrates the planned work, the resources necessary to accomplish that work, and the associated budget for a program, as called for in best practices.

⁴⁸In 2004, NNSA initiated plans for the construction of a new Uranium Processing Facility, a more modern facility that would consolidate some of its uranium processing facilities—located at the Y-12 National Security Complex in Oak Ridge, Tennessee, and built in the 1940s and 1950s—which are outdated and deteriorating, into a single, more modern facility that would consolidate Y-12's uranium processing capabilities into a single facility.

⁴⁹GAO, *Space Exploration: DOE Could Improve Planning and Communication Related to Plutonium-238 and Radioisotope Power Systems Production Challenges*, [GAO-17-673](#) (Washington, D.C.: Sept. 8, 2017).

we found that NNSA had not developed an implementation plan that identifies milestones and interim steps that can be used to demonstrate progress in meeting production goals. Our prior work has shown that plans that include milestones and interim steps help an agency to set priorities, use resources efficiently, and monitor progress in achieving agency goals. In our September 2017 report, we made three recommendations, including that DOE develop such a plan for its plutonium isotope production approach and that DOE assess the long-term effects of known production challenges and communicate these effects to the National Aeronautics and Space Administration. DOE concurred with our recommendations.

Our prior work also demonstrates that DOE continues to face project management challenges in terms of having reliable performance data or conducting reliable analyses of alternatives. Specifically,

- In a January 2018 report, we found management challenges associated with NNSA's life extension programs (LEP).⁵⁰ For example, we found that NNSA had begun implementing requirements for using earned value management (EVM)⁵¹—a tool used across industry and government for conducting cost and schedule performance analysis—in three LEPs, but it had not adopted a key best practice that could help the agency better manage risk for LEPs. Specifically, we found that NNSA does not require an independent team to validate the EVM systems used by NNSA's contractors for LEPs against the national EVM standard. We concluded that without requiring validation of EVM systems, NNSA may not have assurance that its LEPs are obtaining reliable EVM data for managing their programs and reporting their status. We recommended that NNSA require an independent team to validate contractor EVM systems used for LEPs. NNSA agreed with our recommendation but stated that it already relies on a DOE project management office to independently validate contractor EVM systems. However, as we reported, DOE has not independently validated contractor EVM systems at six of the seven contractor sites that are responsible for conducting LEP activities.

⁵⁰GAO, *Nuclear Weapons: NNSA Should Adopt Additional Best Practices to Better Manage Risk for Life Extension Programs*, [GAO-18-129](#) (Washington, D.C.: Jan. 30, 2018).

⁵¹EVM measures the value of work accomplished in a given period and compares it with the planned value of work scheduled for that period and the actual cost of work accomplished.

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- In May 2015, we reported that DOE initiated a new project, the Low Activity Waste Pretreatment System project,⁵² to accelerate waste treatment at Hanford.⁵³ We found that this project was selected on the basis of similar past proposals without consideration of other potentially viable alternatives, contrary to requirements in DOE's project management order. We also reported that DOE's cost and schedule estimates for completion of the project were not conducted according to best practices and were therefore not reliable. We recommended that DOE re-evaluate alternatives and that it revise the cost and schedule estimates in line with best practices. DOE generally agreed with our recommendations but not some of the conclusions. In September 2017, amid concerns about project cost growth and schedule delays, DOE directed the contractor to conduct a new analysis of alternatives to identify options that will allow the project to be completed within current cost and schedule estimates. The department has suspended work on the project pending a decision on its design.

We will continue to monitor EM's management and oversight of its operations activities and DOE's risk-informed cleanup decisions to address environmental liabilities, as part of our ongoing work for this subcommittee.

Major Legacy Projects

As previously mentioned, in response to a 2015 memorandum on project management policies from the Secretary of Energy, DOE instituted project management reforms that—if fully implemented—will help ensure that future projects are not affected by the challenges that have persisted for DOE's major legacy projects. Although DOE has taken action on certain major projects, we found that it has not consistently applied these reforms, and in particular, DOE has not applied such reforms to its largest legacy cleanup project at its Hanford Site in Washington state. As we found in a May 2015 report, DOE continues to allow construction of certain Waste Treatment and Immobilization Plant (WTP) facilities at DOE's Hanford Site before designs are 90 percent complete.⁵⁴ This

⁵²The Low Activity Waste Pretreatment System will receive and treat radioactive liquid waste from the radioactive waste tanks in preparation for direct-feed to the Waste Treatment Plant's Low Activity Waste facility.

⁵³GAO, *Hanford Waste Treatment: DOE Needs to Evaluate Alternatives to Recently Proposed Projects and Address Technical and Management Challenges*, [GAO-15-354](#) (Washington, D.C.: May 7, 2015).

⁵⁴[GAO-15-354](#). The WTP is DOE's current planned approach to treating some of Hanford's radioactive tank waste.

contrasts with DOE's revised project management order that now requires a facility's design to be at least 90 percent complete before establishing cost and schedule baselines and cost and schedule estimates that meet industry best practices. The WTP is DOE's largest project, and it has faced numerous technical and management challenges that have added decades to its schedule and billions of dollars to its cost. We recommended in May 2015 that DOE (1) consider whether to limit construction on the WTP until risk mitigation strategies are developed to address known technical challenges, and (2) determine the extent to which the quality problems exist, in accordance with its quality assurance policy, for the facilities' systems that have not been reviewed to determine if additional vulnerabilities exist. However, as of September 2016, DOE had not yet implemented our recommendations. In December 2016, DOE announced that the cost estimate for one portion of the WTP—the part needed to treat a fraction of the low-activity waste—had increased to nearly \$17 billion.⁵⁵ We are currently in the process of completing a report on DOE's WTP quality assurance program.

NNSA's Nonproliferation Program Faces Performance Measurement and Program Management Challenges

Our previous work has found that NNSA also faces challenges implementing its nonproliferation programs under its Office of Defense Nuclear Nonproliferation (DNN), which implements nuclear nonproliferation programs worldwide. In recently completed reviews of DNN programs, we have identified several challenges NNSA faces in how it measures performance and conducts program management of these efforts. Specifically,

- In September 2017, we found that four DNN programs did not have schedule and cost estimates covering their planned life cycles and did not measure performance against schedule and cost baselines as is recommended by program management leading practices.⁵⁶ NNSA

⁵⁵This cost estimate does not include the costs for a majority of the WTP's waste treatment scope, including high-level waste treatment. In light of longstanding challenges with major projects, such as with the WTP, we believe DOE must begin to apply project management reforms to the projects that need them the most. We also have ongoing work examining the Mixed Oxide Fuel Fabrication Facility, the Uranium Processing Facility, and the Waste Treatment and Immobilization Plant.

⁵⁶GAO, *Nuclear Nonproliferation: NNSA Needs to Improve Its Program Management Policy and Practices*, [GAO-17-773](#) (Washington, D.C.: Sept. 28, 2017). We reviewed the following four selected DNN programs: Nuclear Material Removal, Highly Enriched Uranium Reactor Conversion, Radiological Security, and the International Nuclear Security.

officials explained that in general this is due in part to high levels of uncertainty in planning the selected programs' work scope or schedules, particularly in working with partner countries; however, we noted that uncertainty should not prevent these programs from establishing more complete or longer-term estimates to account for the time and resources they need to achieve their goals and track their performance. In addition, we observed that DOE's cost estimating guide, which applies to NNSA programs, describes approaches for programs to incorporate risk and uncertainty in estimates. But we found that DNN's program management policy, which was updated in February 2017, did not outline requirements for programs to establish life-cycle estimates or measure performance against schedule and cost baselines. We recommended that DNN revise its program management policy to require DNN programs to follow life-cycle program management, such as requiring life-cycle estimates and measuring against baselines. Updating the DNN policy to include requirements and guidance on cost estimating and tracking performance against schedule and cost baselines could help ensure that NNSA managers and Congress have better information on (1) how much DNN programs may cost, (2) the time they may need to achieve their goals, and (3) how effectively they are being executed compared to plans. Although NNSA neither agreed nor disagreed with the recommendation, it indicated that it plans to take action to revise its policy to address the recommendation.

- In February 2017, we found that NNSA was unable to demonstrate the full results of its research and development technology for preventing nuclear proliferation.⁵⁷ Specifically, we reported that DNN's Research and Development program did not consistently track and document projects that result in technologies being transitioned or deployed. Furthermore, we found that DNN's Research and Development project performance was difficult to interpret because the program's performance measures did not define criteria or provide context justifying how the program determined that it met its targets. We concluded that this, in turn, could hinder users' ability to determine the program's progress. NNSA officials said that final project reports did not document their assessment of performance against baseline

⁵⁷ GAO, *Nuclear Nonproliferation: Better Information Needed on Results of National Nuclear Security Administration's Research and Technology Development Projects*, [GAO-17-210](#) (Washington, D.C.: Feb. 3, 2017). A transitioned technology is provided to users outside of the project team for further development or deployment. A deployed technology is one that is being actively used in the field by a federal agency or foreign partner.

targets and that there was no common template for final project reports. We noted that documenting assessments that compare final project performance results against baseline targets for scope of work and completion date could enhance NNSA's ability to manage its programs in accordance with these standards. We also concluded that more consistently tracking and documenting the transitioned and deployed technologies that result from DNN's projects could also facilitate knowledge sharing within DNN. This would also provide a means by which to present valuable information to Congress and other decision makers about the programs' results and overall value. We recommended that NNSA consistently track and document results of DNN Research and Development projects and document assessments of final project results against baseline performance targets. NNSA agreed to take actions in response to both recommendations.

- In June 2016, we found that the Nuclear Smuggling Detection and Deterrence (NSDD) program had developed a program plan but that the plan did not include measurable goals and performance measures aligned to the goals.⁵⁸ As a result, we concluded that the NSDD program may not be able to determine when it has fully accomplished its mission and risked continuing to deploy equipment past the point of diminishing returns. We recommended that NSDD develop a more detailed program plan that articulates when and how it will achieve its goals, including completing key activities, such as the deployment of radiation detection equipment to partner countries. NNSA agreed with this recommendation.

Chairman Upton, Ranking Member Rush, and Members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions you may have at this time.

⁵⁸GAO, *Combating Nuclear Smuggling: NNSA's Detection and Deterrence Program is Addressing Challenges but Should Improve Its Program Plan*, [GAO-16-460](#) (Washington, D.C.: Jun. 17, 2016).

GAO Contact and Staff Acknowledgements

If you or your staff members have any questions about this testimony, 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 statement. GAO staff who made key contributions to this testimony are Nico Sloss, Assistant Director; Nathan Anderson; Allison Bawden; Natalie Block; Mark Braza; Antoinette Capaccio; Jenny Chow; Ricki Gaber; Jonathan Gill; William Hoehn; Cristian Ion; Amanda Kolling; and Diane LoFaro.

Related GAO Products

The following is a selection of GAO's recent work assessing the Department of Energy's management efforts, including at the National Nuclear Security Administration and at the Office of Environmental Management:

Nuclear Weapons: NNSA Should Adopt Additional Best Practices to Better Manage Risk for Life Extension Programs. [GAO-18-129](#). Washington, D.C.: January 30, 2018.

Nuclear Weapons: NNSA Needs to Determine Critical Skills and Competencies for Its Strategic Materials Programs. [GAO-18-99](#). Washington, D.C.: November 14, 2017.

Nuclear Nonproliferation: NNSA Needs to Improve Its Program Management Policy and Practices. [GAO-17-773](#). Washington, D.C.: September 28, 2017.

Modernizing the Nuclear Security Enterprise: A Complete Scope of Work Is Needed to Develop Timely Cost and Schedule Information for the Uranium Program. [GAO-17-577](#). Washington, D.C.: September 8, 2017.

Space Exploration: DOE Could Improve Planning and Communication Related to Plutonium-238 and Radioisotope Power Systems Production Challenges. [GAO-17-673](#). Washington, D.C.: September 8, 2017.

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

2017 Annual Report: Additional Opportunities to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits. [GAO-17-491SP](#). Washington, D.C.: April 26, 2017.

National Nuclear Security Administration: Action Needed to Address Affordability of Nuclear Modernization Programs. [GAO-17-341](#). Washington, D.C.: April 26, 2017.

Department of Energy: Use of Leading Practices Could Help Manage the Risk of Fraud and Other Improper Payments. [GAO-17-235](#). Washington, D.C.: March 30, 2017.

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

Nuclear Nonproliferation: Better Information Needed on Results of National Nuclear Security Administration's Research and Technology Development Projects. [GAO-17-210](#). Washington, D.C.: February 3, 2017.

Nuclear Waste: Benefits and Costs Should Be Better Understood Before DOE Commits to a Separate Repository for Defense Waste. [GAO-17-174](#). Washington, D.C.: January 31, 2017.

National Nuclear Security Administration: A Plan Incorporating Leading Practices Is Needed to Guide Cost Reporting Improvement Effort. [GAO-17-141](#). Washington, D.C.: January 19, 2017.

Program Management: DOE Needs to Develop a Comprehensive Policy and Training Program. [GAO-17-51](#). Washington, D.C.: November 21, 2016.

Department of Energy: Actions Needed to Strengthen Acquisition Planning for Management and Operating Contracts. [GAO-16-529](#). Washington, D.C.: August 9, 2016.

DOE Project Management: NNSA Needs to Clarify Requirements for Its Plutonium Analysis Project at Los Alamos. [GAO-16-585](#). Washington, D.C.: August 9, 2016.

Orion Multi-Purpose Crew Vehicle: Action Needed to Improve Visibility into Cost, Schedule, and Capacity to Resolve Technical Challenges. [GAO-16-620](#). Washington, D.C.: July 27, 2016.

Department of Energy: Whistleblower Protections Need Strengthening. [GAO-16-618](#). Washington, D.C.: July 11, 2016.

Combating Nuclear Smuggling: NNSA's Detection and Deterrence Program Is Addressing Challenges but Should Improve Its Program Plan. [GAO-16-460](#). Washington, D.C.: June 17, 2016.

Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Increased but May Not Align with All Anticipated Costs. [GAO-16-290](#). Washington, D.C.: March 4, 2016.

Weapons System Acquisitions: Opportunities Exist to Improve the Department of Defense's Portfolio Management. [GAO-15-466](#). Washington, D.C.: August 27, 2015.

Hanford Waste Treatment: DOE Needs to Evaluate Alternatives to Recently Proposed Projects and Address Technical and Management Challenges. [GAO-15-354](#). Washington, D.C.: May 7, 2015.

DOE and NNSA Project Management: Analysis of Alternatives Could Be Improved by Incorporating Best Practices. [GAO-15-37](#). Washington, D.C.: December 11, 2014.

Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Do Not Fully Align with Plans. [GAO-14-45](#). Washington, D.C.: December 11, 2013.

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