OFFICE OF INSPECTOR GENERAL
U.S. Department of Energy

Management Challenges at the Department of Energy — Fiscal Year 2022

DOE-OIG-22-11   November 2021

Department of Energy
Washington, DC 20585

November 19, 2021

MEMORANDUM FOR THE SECRETARY OF ENERGY

SUBJECT: <u>INFORMATION</u>: Special Report on Management Challenges at the Department of Energy — Fiscal Year 2022

In compliance with the Reports Consolidation Act of 2000, the Office of Inspector General annually identifies what it considers to be the most significant management challenges facing the Department of Energy. The Office of Inspector General's goal is to focus attention on significant issues with the objective of working with Department officials to enhance the effectiveness of agency programs. The Management Challenges Report should be a valuable tool to assist the Department to successfully fulfill its mission of ensuring America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions.

Beginning with fiscal year (FY) 2021 management challenges, the Office of Inspector General significantly revised how the Management Challenges Report was compiled and presented to focus on more specific goals and challenges that the Department is facing. We coordinated with Department mission elements to identify the most pressing challenges, with an eye toward better focusing on practical issues where near-term progress is achievable. Our intent is to provide the Secretary and other policymakers with a more useful document containing specific and actionable challenge areas where meaningful improvements may be realized in the near term. For FY 2022, we are continuing to report in this manner, addressing all of the challenges identified in FY 2021 and providing updates pertaining to those challenges.

We believe that this report will help the Secretary and senior Department officials address its challenges, as well as illustrate the progress made over the last year.

Teri L. Donaldson
Inspector General

cc: Deputy Secretary
     Chief of Staff
     Acting Under Secretary for Science and Energy
     Under Secretary for Nuclear Security and Administrator, National Nuclear Security
       Administration
     Chief Information Officer
     Acting Chief Financial Officer

Table of Contents

Management Challenges at the Department of Energy — Fiscal Year 2022 At a Glance

What Are Management Challenges?

In accordance with the Reports Consolidation Act of 2000, the Office of Inspector General (OIG) reports annually on the most serious management challenges facing the Department of Energy. The management challenges process is an important tool for focusing the Department's finite resources on its most significant risks and vulnerabilities.

The Department's Mission

The Department's mission is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. Through 17 national laboratories, almost 130,000 Federal and contractor personnel, and an annual appropriation of approximately $41 billion, the Department engages in cutting-edge research that expands the frontiers of scientific knowledge, generates new technologies to address the country's greatest energy challenges, and strengthens national security by maintaining and modernizing the nuclear stockpile.

What the OIG Did

In coordination with Department mission elements, we are addressing and providing updates to the challenges previously identified in fiscal year (FY) 2021. Our intent is to provide the Secretary and other policymakers with a useful document containing specific, practical, and actionable challenge areas where meaningful improvements can be achieved over the next FY.

What the OIG Identified

Based on our work this past year, and in collaboration with Department officials, the FY 2021 management challenges have been updated in this FY 2022 report. These challenges include:

Cross-Cutting Challenges — Reducing Fraud, Waste, and Abuse
- Modernizing Oversight by Continuing to Access Systems for the Purpose of Running Data Analytics
- Improving Audits of Costs Incurred and Claimed
- Building a Stronger Suspension and Debarment Program
- Enforcing the Mandatory Disclosure Rule
- Using All Available Tools to Combat the Theft of Intellectual Property — Research Security

Key Mission Element Challenges
- National Nuclear Security Administration — Restoring Plutonium Pit Production Capability
- Office of Environmental Management — Managing Tank Waste
- Office of Science/Artificial Intelligence and Technology Office — Establishing the Department as a Federal Enterprise Leader in Developing and Deploying Artificial Intelligence

As the largest civilian contracting agency in the Federal Government, the Department of Energy spends approximately 90 percent of its annual budget on contracts to operate its scientific laboratories, engineering and production facilities, and environmental restoration sites. Due to Department reliance on contractors to execute much of its mission, we continue focusing on cross-cutting management challenges to modernize and improve Department oversight of its contractors. Realizing improvements within these areas will help protect the Department from fraud, waste, and abuse.

Modernizing Oversight by Continuing to Access Systems for the Purpose of Running Data Analytics

Photo courtesy of Shutterstock.com, 2021

"As research tools like computers or microscopes have gotten more powerful, the amount of data they can gather has gotten overwhelming—and scientists need new capabilities to make sense of it all. Advanced analysis methods will help them unlock the full potential behind all this data, so that we can solve even our most complex challenges."
– Jennifer M. Granholm, Secretary of Energy

The Fraud Reduction and Data Analytics Act of 2015 (FRDAA) was passed to improve Federal agency financial and administrative controls and procedures to assess and mitigate fraud risks. Additionally, the FRDAA was enacted to improve agencies' development and use of data analytics to identify, prevent, and respond to fraud, including improper payments. In March 2020, the Payment Integrity Information Act of 2019 was enacted and replaced the FRDAA. The Payment Integrity Information Act of 2019 incorporated select provisions from the FRDAA, as well as the Improper Payments Information Act of 2002, the Improper Payments Elimination and Recovery Act of 2010, and the Improper Payments Elimination and Recovery Improvement Act of 2012 into a single subchapter in the United States Code. To comply with the Payment

Integrity Information Act of 2019, the Department has undertaken the development and implementation of a Fraud Risk and Data Analytics Framework (Framework). Using a three-phased approach, the Department will continue to implement this Framework over the next 4 years in the planned phases.

An immediate challenge complicating Department implementation of the Framework is its limited oversight resources, including limited personnel with the associated skill sets needed to operate a data analytics program. To address this, the Department intends to leverage industry best practices through training staff, sharing resources, contracting services, participating in interagency working groups, and applying analytic software.

The Department faces another significant challenge in identifying which data systems and sources are being used by the Department and its contractors. Once the relevant data systems are identified, the next challenge is assessing the data and determining how to analyze it. The potential use of artificial intelligence in this area is an exciting prospect, which could save the taxpayers millions and perhaps billions of dollars in the long term.

Although much work remains, the Department has taken initial steps towards establishing and implementing the Framework. Officials have defined the Framework and its placement within the organization and established a leadership hierarchy to guide the effort. To assist in Framework development, the Department awarded a contract to incorporate industry best practices and has begun to establish collaborative relationships with its management and operating (M&O) contractors and non-M&O contractors to identify the available data. Personnel have been attending basic to mid-level Data Analytics courses. Moving forward, the Department is actively working on utilizing current year fraud risk occurrences and control test failures to develop its Fraud Risk Profile. This is slated to be completed by mid-FY 2022. The Department is also creating a Planning, Programming, Budgeting, and Execution process (multi-year budgeting) that includes consideration of the Department's most significant risks. The Planning, Programming, Budgeting, and Execution process will be a data-driven, resource-allocation process to apply leadership priorities, provide transparency, and direct resources to mitigate risks. Further, the Department proposes to construct an Antifraud Strategy that will consider recommended actions from risk owners and supporting offices, provide annual updates to the Fraud Risk Profile, and identify newly confirmed fraudulent activities.

As part of the Department's Governance, Risk, and Compliance project that is being implemented in two phases within the financial management system, Standard Accounting and Reporting System, analytics are utilized to monitor financial transactional data and identify business process exceptions. Analytics through Governance, Risk, and Compliance provide the Department with the ability to identify business process breakdowns, as well as manage and remediate exceptions. Remediation of the exceptions is expected to improve data quality and reduce fraud.

Similarly, the OIG is moving swiftly into the area of data analytics. Over the past 3 years, we have developed and implemented a data analytics function focusing on two initial goals: (1) to identify and directly access relevant Department and contractor systems, and (2) to analyze high-risk areas such as labor, pay, grants, subcontracts, and contract charges.

Historically, the OIG relied on Federal and contractor employees to provide records and data supporting audits, inspections, and investigations. This hands-off approach resulted in the OIG's complete lack of knowledge as to the systems being utilized and the data available. Since its inception in 2019, the OIG Office of Technology, Financial, and Analytics has identified federally owned business systems containing data that can be leveraged to expand the capabilities of the OIG in its oversight role. These include, but are not limited to, payroll, human resource, badging, financial, and inventory systems. The Office of Technology, Financial, and Analytics is currently working to gain direct "read only" access to Federal and contractor systems. Notably, direct access is the only path that has the potential to identify fraud, waste, and abuse in real time. Real time, or near-immediate detection of fraud, is the most powerful use of data analytics.

Moving forward, the OIG Data Analytics team will continue to perform analyses of the highest areas of risk within the Department and implement risk models to identify adverse trends and possible fraud, waste, and abuse. During FY 2021, the Data Analytics team supported more than 31 ongoing audits, inspections, and investigations, including the largest fraud investigation in the Department's history.

Improving Audits of Costs Incurred and Claimed

Photo courtesy of Shutterstock.com, 2021

"Learn from yesterday, live for today, hope for tomorrow. The important thing is not to stop questioning."
– Albert Einstein

The Cooperative Audit Strategy, adopted by the Department in 1994, gave M&O contractors the responsibility to perform required incurred cost audit work, with minimal oversight from both the Federal Contracting Officer and the OIG. Over the course of the 26 years that the Cooperative Audit Strategy was in place, stakeholders, such as the United States (U.S.) General Accountability Office and the Department of Defense, expressed concerns about independence, conflict of interest, and the appropriateness of contractors auditing their own incurred costs.

For several years, we evaluated whether the Cooperative Audit Strategy had been functioning as intended. From FY 2016 through FY 2020, we performed several audits of incurred costs, essentially performing the work that would normally be performed by M&O contractor internal audit groups. Based on the findings in these incurred cost audits, the OIG began performing additional work pertaining to the Cooperative Audit Strategy in FY 2020. In FY 2021, a compilation of these audit reports and many other investigation, inspection, and audit reports were published in an OIG Special Project Report, *The Transition to Independent Audits of Management and Operating Contractors' Annual Statement of Costs Incurred and Claimed,* (DOE-OIG-21-26, April 2021), which identified significant findings demonstrating that the Cooperative Audit Strategy was not functioning as intended.

We discovered several foundational challenges with the Cooperative Audit Strategy including a flawed legal framework and an impact to OIG auditor independence caused by over-reliance on

internal audit organizations. In addition, we found that not all internal audit groups adequately evaluated incurred costs for allowability, allocability, and reasonableness. Further, we noted weaknesses in internal audit's design of the audit risk assessment and sampling approach. We also found that M&O contractors were not always compliant with Cost Accounting Standards. The Department agreed with our recommendation to transition to an independent audit strategy and supports our transition plan to conduct, or arrange for, independent incurred cost audits for 23 M&O contractors across the Department enterprise beginning in FY 2022.

Building a Stronger Suspension and Debarment Program

"The government is operating in a new environment under a more aggressive set of rules that allows it to zealously pursue, prosecute, and suspend and debar contractors for alleged fraud."
– Reginald Jones,
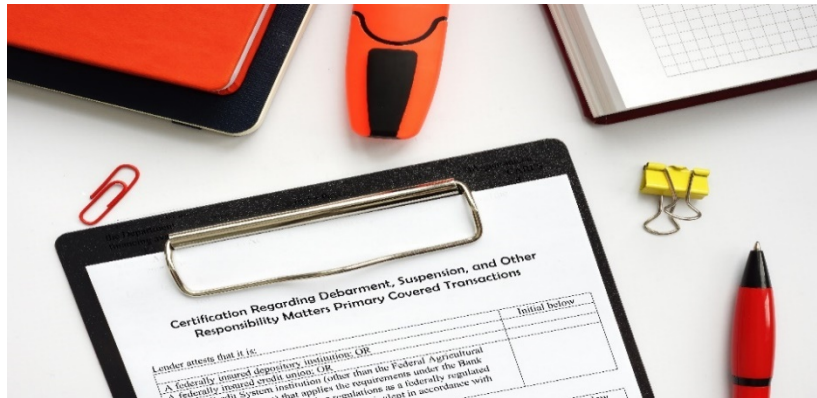*Partner, Fox Rothschild LLP*

Photo courtesy of Shutterstock.com, 2021

In our prior *Management Challenges Report*, we identified an opportunity to improve suspension and debarment processes at the Department. Suspension and debarment are the primary means the Government uses to mitigate risk from parties that have shown themselves not to be responsible participants in Federal procurements, grants, agreements, programs, and transactions. These measures are not punishment but rather seek to exclude irresponsible parties from future transactions. The typical use of these remedies is based on a criminal conviction or a serious civil offense. The Department is second only to the Department of Defense in the amount of Federal dollars annually spent on contractors. The Department spent more than $40 billion in FY 2020 contracting for services and supplies or acquiring assets.[1]

The prior *Management Challenges Report* noted other Federal agencies with a smaller contracting presence operate robust suspension and debarment programs. These programs protect the rest of the Government from continuing to do business with contractors that have committed criminal or civil offenses or have otherwise lost the trust of the Federal Government. Specifically, our prior report noted that the General Services Administration suspended 49 parties and debarred 84 in FY 2019. During the same period, the Department of Housing and Urban Development suspended 40 parties and imposed 97 debarments, and the Department of Defense suspended 267 parties and debarred 442. In comparison, the Department of Energy issued only 5 suspensions and 19 debarments in FY 2019.[2] Similarly, the Department of Energy issued only 25 suspensions and 30 debarments in FY 2018.[3] The Interagency Suspension and Debarment Committee has not released official numbers for FY 2020. However, we anticipate that once released, the numbers will be relatively consistent.

---

[1] Based on USASpending.gov agency-specific detail reviewed in September 2021.
[2] *Interagency Suspension and Debarment Committee FY 2019 Report* issued under Section 873 of P.L. 110-417. https://www.acquisition.gov/sites/default/files/page_file_uploads/ISDC%20FY19%20873%20Report.pdf. (last accessed September 13, 2021).
[3] *Interagency Suspension and Debarment Committee FY 2018 Report* issued under Section 873 of P.L. 110-417. https://www.acquisition.gov/sites/default/files/page_file_uploads/FY%202018%20873%20Report%20-%20Final%2010%2030%202019.pdf. (last accessed October 18, 2021).

We are working to enhance our capabilities in making suspension and debarment referrals in a timely manner. We established an Administrative Remedies Division and appointed a Special Counsel for Administrative Remedies in March 2021. In the following months, we reviewed and updated our internal policies to ensure increased consideration of available remedies and streamlined our referral practices. The early reviews and streamlined referrals seek to identify evidence and produce an actionable referral as early and efficiently as possible. We also received helpful input from the Department's two suspension and debarment offices when refining referral processes. Among other things, the Department acted upon our referral of suspension, which was evidenced by search and arrest warrants. Using material previously submitted to a court to meet the evidentiary threshold of pursuing a suspension did not appreciably increase the burden on Federal entities but did allow for proper consideration of risk while an underlying criminal matter proceeded.

We have also enhanced our existing training program to ensure that all employees likely to encounter evidence that may support administrative remedies know how to identify the significance of any such evidence and engage with the proper parties charged with acting on that evidence.

In addition, we are further developing complimentary administrative remedies such as the Program Fraud Civil Remedies Act. To support this endeavor, OIG personnel have begun training and reaching out to stakeholders.

Enforcing the Mandatory Disclosure Rule
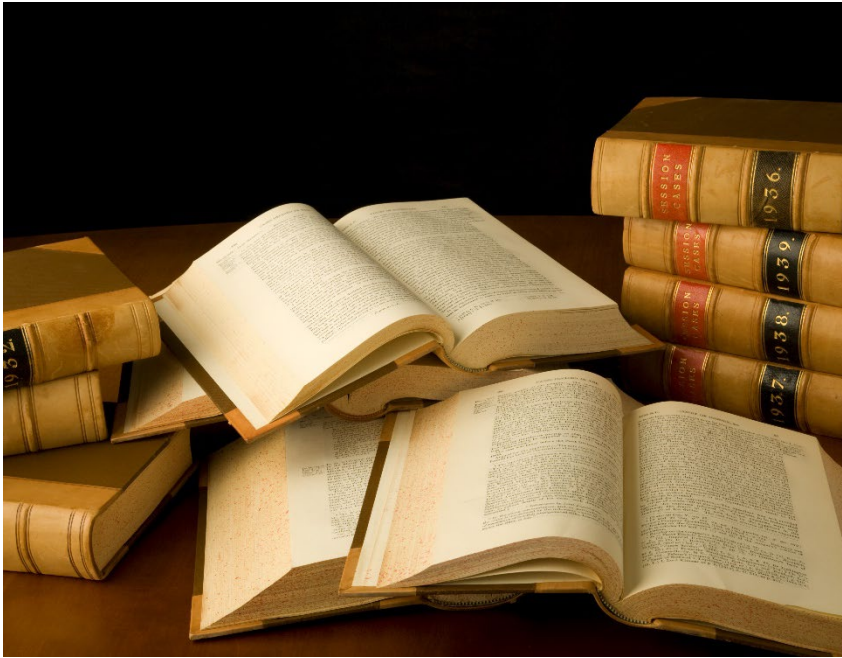
"All the work of the government comes to the art of being honest."
– Thomas Jefferson

Photo courtesy of Shutterstock.com, 2021

Given Department reliance on contractors to execute its mission, it is imperative that Department contractors conduct business operations with integrity. For this reason, the Federal Acquisition Regulation requires contractors' internal programs to include an ethics and compliance system with practices aimed at preventing and detecting misconduct and promoting an organizational culture that encourages ethical conduct and a commitment to compliance with the law. Contractors who conduct work for the Department must establish and maintain an Employee Concerns Program suitable for the organization to accept, process, and resolve employee concerns related, but not limited to, fraud, waste, and abuse. A critical feature of this compliance strategy is the Mandatory Disclosure Rule (MDR).

The Federal Acquisition Regulation MDR was implemented through two mechanisms: (1) by establishing a suspension and debarment mechanism that was immediately enforceable, and (2) by utilizing a contractual provision that was enforceable when agencies included it in specific contracts. Under the suspension and debarment mechanism, a contractor may be suspended or debarred for failing to "timely disclose to the Government […] credible evidence of" certain violations and overpayments. Additionally, under the contract provision mechanism, the MDR requires a contractor to timely disclose, in writing, to the Agency OIG whenever the contractor has credible evidence of violations of Federal criminal law involving fraud, conflict of interest, bribery, gratuity violations, or violations of the civil False Claims Act.

In July 2020, we initiated inspections to determine how contractors have been managing specific employee concerns that appear to trigger MDR requirements. We are currently compiling the

results of these inspections and developing a strategy to address lapses the inspections uncovered. Those lapses include cases in which the contractors documented credible evidence of potential violations of Federal criminal law or the civil False Claims Act but did not disclose these matters to us. Even where the contractors engaged outside counsel to handle an inquiry, or took remedial action, they did not always report the cases to us, as required. In other instances, the contractors reported later than required by the contract clause.

The contractors' failure to report these issues denied us the opportunity to conduct timely, independent investigations. Timely, independent investigations are crucial to procurement integrity. Such violations of the MDR may expose the Department to additional fraud, waste, and abuse.

Using All Available Tools to Combat the Theft of Intellectual Property — Research Security

Photo courtesy of the Department

"I wish to note that intellectual property theft by a government represents the very essence of organized crime."
– Howard Berman

The Department is the largest Federal sponsor of basic research in the physical sciences and awards approximately $6.6 billion in grants and contracts annually that support 25,000 researchers at over 300 institutions and its 17 national laboratories. The Department funds cutting-edge research and the deployment of innovative technologies, and it encourages collaboration between industry, academia, and Government to create a vibrant scientific ecosystem.

The Department's prominent role in advanced research and development (R&D) across multiple scientific disciplines, combined with its key role in nuclear weapons development, makes it particularly attractive to theft from adversaries of the U.S. Government. Due to the economic and scientific value of the research and intellectual property developed within the Department, foreign governments and their proxies intensified their efforts to extract information from our institutions.

Foreign governments attempt to acquire U.S.-funded research through "talent recruitment" programs, often targeting scientists, engineers, academics, researchers, and entrepreneurs working or studying in the U.S. Targeted individuals are offered rewarding and prominent opportunities at leading foreign research institutions in exchange for transferring their knowledge and expertise, often funded with Department dollars, to foreign countries. Talent recruitment programs are sponsored by many countries designated by the Department as "countries of risk." Such programs threaten the economic interests of the U.S. Government by steering cutting-edge, taxpayer-funded research to foreign adversaries for the benefit of their economies.

To highlight the magnitude of this challenge, we have numerous active investigations directly involving threats to intellectual property by foreign adversaries. We have seen an increase in caseload of 114 percent since 2016 regarding instances of the theft of intellectual property. In response, we have been aggressive in the enforcement of this crime, working with our partners in the law enforcement community, and in concert with the Department of Justice, to carry out a variety of enforcement actions nationwide.

Due to the open nature of the scientific community, R&D conducted for the Department is inherently vulnerable to the unauthorized transfer of intellectual property to foreign governments. It is critical that the Department takes appropriate actions to mitigate these risks. For this reason, we have initiated a Special Project, led by the OIG Office of Counsel, to review the most effective legal and practical strategies being used by other Federal agencies vulnerable to this type of theft. We will be working with other stakeholders in the Federal research integrity community throughout this project. In the coming months, we will advise on the status of our efforts. These efforts will likely include recommendations to ensure that the Department is using a "whole-of-government" approach to improve its management of these issues and utilize the full range of available tools, including criminal, civil, and administrative remedies.

KEY MISSION ELEMENT CHALLENGES

National Nuclear Security Administration
Office of Environmental Management
Office of Science/Artificial Intelligence and Technology Office

In coordination with Department mission elements, the OIG identified the Department's most pressing management challenges, focusing on more specific issues where near-term progress is measurable and achievable. The three areas identified for FY 2022 are restoring plutonium pit production, managing tank waste, and developing and deploying Artificial Intelligence (AI).

National Nuclear Security Administration – Restoring Plutonium Pit Production Capability

Molten Plutonium

"Bottom line, re-establishing plutonium pit production is a 'must do' and is foundational to stockpile modernization."
– Charles A. Richard, Commander, United States Strategic Command

Photo courtesy of Los Alamos National Laboratory,
https://creativecommons.org/licenses/by-nc-nd/2.0/legalcode

The National Nuclear Security Administration (NNSA) is responsible for maintaining a safe, secure, reliable, and effective nuclear weapons stockpile. Plutonium pits are a vital component in all U.S. nuclear weapons. During the Cold War, the Nation produced more than 1,000 plutonium pits per year (PPY) at the Rocky Flats Plant in Colorado. Since the closure of the Rocky Flats Plant in 1992, the U.S. has lacked the capability to produce significant quantities of new plutonium pits.

Maintaining confidence in the nuclear warheads that compose our Nation's nuclear deterrent requires the Department to reestablish a plutonium pit manufacturing capability. Newly

manufactured pits are required to improve warhead safety and security, mitigate the risk of confidence in the deterrent posed by plutonium/pit aging, and support potential changes to future warheads due to threats posed to the U.S. nuclear deterrent from renewed peer competition.

The Department of Energy works closely with the Department of Defense to meet the requirement of manufacturing no fewer than 80 war reserve (WR) PPY by 2030. To achieve this manufacturing capacity, the Department implemented a two-site solution with the objective of producing 30 WR PPY at Los Alamos National Laboratory (LANL) utilizing the existing Plutonium Facility-4 and 50 WR PPY at the Savannah River Site (SRS) using the existing facility previously referred to as the Mixed Oxide Fuel Fabrication Facility. Both facilities already meet the stringent building design standards necessary to support pit manufacturing; however, only the facility located at LANL is currently capable of producing plutonium pits. The Department's assessment continues to be that utilizing two facilities is the most effective approach in terms of schedule, cost, and meeting the 80 WR PPY deliverable. Additionally, the two-site approach provides the needed resilience against unplanned outages, particularly important for implementing modest production capacity.

To meet these production objectives, the Department faces challenges associated with staffing and the construction and modernization of the LANL and SRS facilities. Due to the significant lapse in pit production following the closure of Rocky Flats, the Nation lost much of its expertise in pit manufacturing. Therefore, the Department must develop and maintain an expert workforce of sufficient size and quality to meet the challenging and changing needs of new processes, prototype demonstrations, capacity production, and the building of special items for the growing subcritical plutonium experiment program. Additionally, the Department must simultaneously complete the modernization of the LANL Plutonium Facility via the Los Alamos Plutonium Pit Production Project (LAP4), while repurposing the former Mixed Oxide Fuel Fabrication Facility at SRS through the Savannah River Plutonium Processing Facility (SRPPF) project.

Major capital acquisition projects at both sites reached key milestones in FY 2021. At LANL, in April 2021, the LAP4 project achieved Critical Decision-1 (CD-1) and Alternative Selection and Cost Range, and work has begun on developing the 90 percent design package needed for CD-2, Performance Baseline. At SRS, in June 2021, the SRPPF project achieved CD-1, and the project is maturing the design and refining cost and schedule estimates to support CD-2 in FY 2024.

Based on the 30 percent design, which includes complete information from the LAP4 and SRPPF CD-1 submissions, the Department assessed that achieving the 30 PPY by 2026 at LANL is achievable, while producing 50 PPY by 2030 at SRS to meet the overall 80 PPY objective is not. The SRPPF assessment is based on considerations that to produce WR[4] pits at the required rate necessitates successful completion of the following three activities: (1) complete SRPPF construction and receive startup authorization (CD-4); (2) demonstrate a WR-quality pit

---

[4] War reserve pits have been certified to meet the stringent quality assurance requirements necessary to enter the U.S. nuclear weapons stockpile.

manufacturing capability; and (3) demonstrate the ability to manufacture at full rate capacity while maintaining WR quality control. The total time duration for achieving steps two and three is several years based on past and current experience. Since LANL already has an operating plutonium facility, these three efforts, to a large extent, are overlapped. At SRS, since the SRPPF must undergo commissioning to authorize startup of plutonium operations, the three key activities to achieve 50 WR PPY will occur sequentially. To support warhead production needs and minimize total SRPPF costs, the Department has identified a target range from FY 2032 through FY 2035 for achieving 50 WR PPY at SRS. The development of the CD-2 package (including 90 percent complete SRPPF design) will identify and develop options for accelerating the CD-4 completion date from those established at the time of CD-1 approval (from the first quarter of FY 2032 through the fourth quarter of FY 2035).

The Department plans to utilize information from: the SRPPF CD-2 package; ongoing work at LANL and Lawrence Livermore National Laboratory to minimize the time required for demonstrating WR manufacturing capacity; and lessons learned from LANL as it ramps up rate production to refine and establish the target date for CD-4 and for achieving 50 WR PPY at SRS. In addition, the Department anticipates the delivery of the SRPPF CD-2 package in the first quarter of FY 2024, which will include two implementation schedules developed with information obtained from LANL and Lawrence Livermore National Laboratory based on prior experience manufacturing pits at LANL. The two implementation schedules will include: (1) a plan for meeting 50 WR PPY as soon as possible, and (2) a plan emphasizing the reduction of overall risk in meeting the schedule.

This approach will provide options for the Nation's decision makers on how to proceed with the implementation of the SRPPF.

Office of Environmental Management – Managing Tank Waste

An employee moving a waste container at the Defense Waste Processing Facility at SRS
Photo courtesy of the Savannah River Site via Flickr.com, 2021

"Building on past success, the EM program is entering a new era of cleanup accomplishments. The FY 2022 request supports a ramp up in EM's ability to tackle tank waste—one of the Department's largest environmental challenges and financial liabilities."
– Jennifer M. Granholm, Secretary of Energy

The Department's Office of Environmental Management (Environmental Management) is responsible for addressing the environmental legacy of decades of nuclear weapons production and government-sponsored nuclear energy research. This mission includes the safe, effective, and cost-efficient management, treatment, and disposition of waste (known as "tank waste") generated through legacy-spent nuclear fuel reprocessing and other plutonium processing activities. Environmental Management manages a total inventory of approximately 92 million gallons of tank waste, which is a primary environmental risk at most sites where it is located. At the Hanford Site (Hanford), SRS, and Idaho National Laboratory Site (INL), the remaining tank waste is stored in aging underground tanks, many of which are well past their design life. At Hanford, as many as 58 tanks are considered to have leaked into the underlying soil.

In addition to environmental risks, tank waste also represents a significant financial burden to the U.S. Government. The Department is the top contributor to the Federal Government's overall environmental liabilities. Environmental Management's current total environmental liability is approximately $406 billion (in current year dollars) according to the Department FY 2020 Agency Financial Report. As such, the Department expends significant resources to safely and effectively treat the Nation's tank waste. Since Environmental Management was established, the Department has taken noteworthy steps to address tank waste at sites across the U.S. For

instance, at the West Valley Demonstration Project, the Department has vitrified 600,000 gallons of reprocessing waste into 275 canisters for long-term storage and eventual disposal. Additionally, in 2019, the Department successfully completed the demolition of the West Valley Site Vitrification Facility, marking the first time in Department history that such a facility has been successfully constructed, operated, and demolished. At SRS, the Defense Waste Processing Facility (DWPF) has produced approximately 4,266 canisters of vitrified tank waste, representing about half of the anticipated total. Further, approximately 16.5 million gallons of salt solution taken from SRS underground tanks have been decontaminated and processed for onsite disposal through stabilization via grout.

In addition, the Department continues constructing and commissioning complex, first of its kind, multi-billion-dollar facilities to treat tank waste. The Department successfully completed verification of operational readiness and obtained CD-4 and Authorization to Operate the Salt Waste Processing Facility (SWPF) in August 2020. The Department initiated hot commissioning of the SWPF in October 2020 and began full operations of the facility in January 2021. Since the introduction of radioactive salt waste to the SWPF, it has processed approximately 2 million gallons of salt waste. As the SWPF increases efficiency and optimizes its operations, process rates of up to 6 million gallons annually are projected with current technologies. This facility will significantly ramp up the ability to treat the remaining tank waste at SRS, which includes enhancing the balance of tank waste systems to support higher treatment rates. Such treatment includes the DWPF, the Saltstone Production Facility, and the tank farms that prepare and batch the waste for treatment. At INL, the Department is in its final stages of startup and commissioning of the Integrated Waste Treatment Unit (IWTU), which will treat the remaining liquid tank waste. The Department anticipates the IWTU will be operational in 2022, with waste treatment expected to take 5 to 7 years to complete. At the Hanford Waste Treatment and Immobilization Plant, the Analytical Laboratory was transitioned from startup to commissioning in August 2020. An operational readiness assessment was successfully completed in December 2020, and the facility is ready to support commissioning of the Low-Activity Waste Facility. Additionally, the Department has completed construction on Hanford Waste Treatment and Immobilization Plant's Low-Activity Waste Facility, and testing and commissioning is scheduled to support commencement of radiological operations by the end of calendar year 2023.

Along with ensuring the completion and commissioning of the necessary tank waste treatment facilities, the Department has instituted new polices and approaches that have the potential to open new disposition pathways for tank waste. In 2019, the Department issued its interpretation of the statutory term, "high-level radioactive waste" as defined in the Atomic Energy Act of 1954, as amended, and the Nuclear Waste Policy Act of 1982, as amended. This interpretation represents a science-driven approach to managing tank waste via its radioactive characteristics, and not by how the waste was generated. The high-level waste interpretation could enable the Department to appropriately manage and disposition tank waste in a risk-based and more cost-effective manner that remains fully protective of human health and the environment. The first application of the high-level waste interpretation was completed with public participation in

September 2020 with 8 gallons of SRS DWPF recycle wastewater shipped to the Waste Control Specialists LLC low-level radioactive waste disposal facility in Andrews, Texas. Secretary Granholm committed to conduct an assessment of the high-level waste interpretation during her Congressional confirmation hearing in January 2021; this assessment is ongoing. The Department will not use the high-level waste interpretation without prior meaningful consultation with all affected stakeholders. Any decisions about whether and how the interpretation would apply to other wastes at any site would be the subject of subsequent actions using a robust public engagement process.

The safe and efficient management and disposition of tank waste will require the Department's sustained commitment and leadership. While progress has been made in establishing its capabilities to treat tank waste for final disposition, significant work remains. At Hanford, the Department will need to complete startup and commissioning of those facilities involved in the Direct Feed Low-Activity Waste approach. The Low-Activity Waste facility is estimated to treat approximately 50 percent of the low-activity inventory of tank waste. The Direct Feed Low-Activity Waste approach will treat approximately 1 million gallons yearly. The Department will need to identify and select additional treatment options to fully address Hanford's remaining inventory. Additionally, the Department needs to identify and develop technically achievable, cost-effective, and viable approaches for treating the high-activity inventory of tank waste at Hanford for disposition. The current program of record would use the Waste Treatment and Immobilization Plant's Pretreatment and High-Level Waste facilities to prepare and vitrify the high-level waste for eventual final disposition. However, work on those facilities was suspended to resolve technical issues. Analyses performed by the Department and the Army Corps of Engineers determined that it is unlikely the Department will complete the Pretreatment and High-Level Waste facilities and begin operation in time to meet current commitments. Currently, the Department is finalizing an Analysis of Alternatives on potential options for treating high-level tank waste as efficiently as possible.

At SRS, the Department will need to continue DWPF operations and demonstrate the SWPF's long-term reliability and availability. Implementation of Next Generation Solvent at the SWPF in 2023 will enable processing of up to 9 million gallons of waste per year. To complete the bulk of the tank waste mission at SRS in the next decade, the Department will need effective management of the spent nuclear fuel processing mission at the Savannah River H-Canyon facility, which contributes to the site's tank waste mission.

At INL, the Department is in the final stages of startup and commissioning of the IWTU, which will treat the remaining liquid tank waste. The Department completed facility modifications in July 2021 for the IWTU, and it is currently undergoing readiness assessments for startup testing and commissioning to prepare for radioactive operations, which are targeted for January 2022. Finally, the Department will need a pathway for the disposal of the calcined material currently stored at INL. In addition to the remaining efforts, the Department will also need to identify and develop final disposition pathways for all types of treated tank waste.

Office of Science/Artifical Intelligence and Technology Office – Estabilishing the Department as a Federal Enterprise Leader in Developing and Deploying Artificial Intelligence

"The progress in artificial intelligence is still in early stages, but I view it as the most profound technology humanity will ever work on and we need to make sure we harness it to societies benefit."
– Sundar Pichai, CEO of Alphabet Inc. and Google LLC

Photo courtesy of Shutterstock.com, 2021

In February 2019, the President directed the Department and other Federal agencies to pursue several strategic objectives to promote and protect American advancements in AI. These objectives include, among others, sustained investment in AI R&D in collaboration with industry; enhanced access to high-quality and fully traceable Federal data, models, and computing resources; and minimized vulnerability to AI-enabled attacks from malicious actors. The Executive Order states:

> *Maintaining American leadership in AI requires a concerted effort to promote advancements in technology and innovation, while protecting American technology, economic and national security, civil liberties, privacy, and American values and enhancing international and industry collaboration with foreign partners and allies.*

As an emerging strategic technology, AI has the potential to transform many aspects of discovery and applied technology science; manufacturing, infrastructure, finance, and commerce; Government operations; and national security. For example, the Department Summit supercomputer at the Oak Ridge National Laboratory, which has unsurpassed AI capabilities, has played an important role in Department urgent COVID-19 investigations of the virus and potential therapeutic responses. Maintaining American leadership in AI will require a "whole-of-government approach" that will include meaningful contributions from Department and other Federal agencies working in partnership with private and academic sector experts.

As the custodians of the most advanced high-performance supercomputers and massive multimodal data sets stemming from diverse research, the Department is well-situated, working in conjunction with its national laboratories, to take a leading role in developing and deploying AI. Moreover, because the Department is charged with wide-ranging and complex missions in environmental stewardship, energy infrastructure, and national security, the deployment of advanced AI technologies is vital to enhancing its operations and resisting threats from the adversarial use of AI. Meeting these goals will require a coherent, enterprise-wide strategy, excellent intradepartmental collaboration, and large-scale investments.

The Department investment in AI R&D and demonstration has been largely uncoordinated. Such efforts have been made by various Department elements drawing on their respective resources for research or operations, which are not dedicated exclusively to AI. This has meant that choices for AI investment have competed with other important initiatives sharing the same resource pools such as quantum information science and the Exascale Computing Initiative. While investments in those projects can further AI development, the benefits are often incidental to the primary purpose of the projects. Likewise, some of Department investments in cybersecurity R&D encompass elements of AI technology, but not exclusively so. Such a balkanized approach to AI investment poses the risk that the Department will miss opportunities to leverage all of its resources strategically.

Realizing the Department goal of AI leadership will require cross-cutting and enterprise-wide efforts with contributions from diverse elements such as: the Office of Science; the Office of Cybersecurity, Energy Security, and Emergency Response; the Office of the Chief Information Officer; Department national laboratories; and, among others, NNSA. Achieving success in such a collaborative effort is inherently challenging given the scope of the subject matter and the manner in which the Department conventionally operates.

As part of Department efforts, in September 2019, the Secretary of Energy established the Artificial Intelligence and Technology Office (AITO) as a new element reporting directly to the Under Secretary for Science. The secretarial order establishing the AITO specifies that this new office will foster the strategic coordination and development of AI activities across the Department enterprise by serving as a central point of coordination. In addition, the AITO is tasked with enhancing the Department sector-specific agency role and responsibility and providing support to its national security platforms. As its vision, the AITO intends to transform the Department into the U.S. Government lead agency in the civilian use of AI by accelerating its research, development, delivery, and application. The AITO's first Director was recruited from industry and joined the Department in February 2020.

To coordinate strategic research priorities and ensure investment decisions were effectively leveraged, the Deputy Secretary established the Research and Technology Investment Committee to convene the principal leaders of Department R&D activities on a regular basis. While currently this committee no longer exists, at the Research and Technology Investment Committee quarterly meeting in November 2019, the AITO demonstrated that the AI data

available to leaders responsible for coordination was incomplete. Specifically, the AITO presented data showing that the sum of Department-wide AI investments increased from $102.8 million in FY 2019 to an estimated $161.9 million in FY 2020. Notably, these amounts did not include investments at Department national laboratories funded either by laboratory-directed R&D or by third parties through collaborative R&D agreements and partnerships. Additionally, although the AITO identified almost 300 distinct AI projects, it estimated that these represented only about half of all AI projects by various Department elements that were planned, underway, or recently completed. As a result of these shortcomings, and in accordance with the Research and Technology Investment Committee guidance, the AITO established a comprehensive database, the AI Exchange, to gather a complete picture of Department AI projects and facilitate coordination for strategic advantage. The various Department elements and the national laboratories are in the process of currently validating and updating the information that was placed in the AI Exchange during 2019. Additionally, the AITO has assigned an AI Exchange coordinator to manage the comprehensive database.[5]

From July 2019 through October 2019, the Office of Science organized a series of "AI for Science" town hall meetings at three national laboratories and in Washington, DC, which were attended by over 1,300 scientists from the Department's 17 national laboratories, 39 private enterprises, and over 90 universities. The goal of these meetings was to discuss scientific opportunities and challenges in the coming decade in the areas of AI, big data, and high-performance computing. Scientific opportunities resulting from those discussions were captured in a report published in March 2020 that outlined the research and infrastructure needed to advance AI methods and techniques for science and energy applications.

Achieving the ambitious goal of establishing the Department as a leader among Federal agencies in developing and deploying AI technology will require well-coordinated initiatives, including focused cross-cutting investments. One such initiative is the Exascale Computing Project, which is a collaboration among Oak Ridge National Laboratory, Argonne National Laboratory, Lawrence Livermore National Laboratory, LANL, Lawrence Berkeley National Laboratory, and Sandia National Laboratories. These laboratories and the Department, including NNSA, are working to bring the next-generation of world-leading, AI-optimized supercomputers online along with mission critical applications that will effectively use these systems. One of these supercomputers, the Frontier, is scheduled to be commissioned in calendar year 2021, followed by Aurora in 2022, and El Capitan in 2023. The Exascale Computing Project has also been investing in a co-design project, ExaLearn, focused on development of Exascale machine learning technologies. ExaLearn is building a software tool set for the Exascale platforms that is being applied to multiple challenges such as understanding the impact of extreme climate events on the use of renewals in the electric power grid or developing new energy-efficient materials and others within the Department mission space.

---

[5] https://www.exascaleproject.org/

Additionally, in September 2020, the Advanced Scientific Computing Advisory Committee, with input from the other Office of Science Advisory Committees, industry and other Federal agencies recommended a major strategic initiative for AI research, which would be a 10-year "AI for Science" plan that emulates the Department Exascale Computing Initiative. The recommended initiative would be structured around four major R&D themes: AI-enabled applications, AI algorithms and foundational research, AI software infrastructure, and new hardware technologies for AI. It is anticipated that the recommended initiative would include a near-term incubation phase that would coincide with the expected commissioning of the Department's latest supercomputing resources (including Exascale machines), followed by pursuing AI R&D goals through the current decade.

Despite the recommended initiative for the AI for Science research, it represents only one arena for Department leadership in AI. The Department's full potential as a leader in AI will be realized only if it develops and deploys the technology in a wide range of its missions. For example, opportunities exist for the Department to deploy advanced AI technology to enhance the defense of the Agency and the security of the electric grid through the development of surrogate models, to improve operations of the national laboratory, to protect infrastructure against cyberthreats, to monitor financial records to detect potential waste or improper billings by Department contractors, and so forth.

The Department also needs to identify and consider making investments in cross-cutting AI opportunities that do not fall solely within the arena of a single program, yet have the potential to benefit several Department elements and stakeholders. While the Department plans to continue addressing and mitigating these challenges, doing so requires resources for AITO staff, on-going support to sustain AI software and tools developed in the Exascale project, and identification and coordination of cross-cutting AI R&D projects.

FEEDBACK

The Office of Inspector General has a continuing interest in improving the usefulness of its products. We aim to make our reports as responsive as possible and ask you to consider sharing your thoughts with us.

Please send your comments, suggestions, and feedback to OIG.Reports@hq.doe.gov and include your name, contact information, and the report number. You may also mail comments to us:

Office of Inspector General (IG-12)
Department of Energy
Washington, DC 20585

If you want to discuss this report or your comments with a member of the Office of Inspector General staff, please contact our office at 202–586–1818. For media-related inquiries, please call 202–586–7406.