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April 2018

# HANFORD WASTE TREATMENT PLANT

## DOE Needs to Take Further Actions to Address Weaknesses in Its Quality Assurance Program

Accessible Version

# GAO Highlights

Highlights of [GAO-18-241](#), a report to the Committee on Armed Services, U.S. Senate

## Why GAO Did This Study

DOE and its contractor are building the WTP—which consists of multiple facilities—to treat a large portion of nuclear waste at Hanford. The project has faced persistent challenges, including quality assurance problems that have delayed it by decades and more than tripled its costs, to nearly \$17 billion. DOE's quality assurance framework aims to ensure that all problems are identified and do not recur.

Senate Report 114-49 accompanying the National Defense Authorization Act for Fiscal Year 2016 included a provision for GAO to carry out an ongoing evaluation of the WTP. This first report examines (1) the actions DOE has taken to identify and address WTP quality assurance problems, (2) the extent to which DOE has ensured that quality assurance problems have been identified and do not recur, and (3) the extent to which DOE's organizational structure at ORP provides the Quality Assurance Division with independence to effectively oversee the contractor's quality assurance program. GAO reviewed DOE documents and obtained the insights of ORP's internal experts on WTP quality assurance efforts and outcomes.

## What GAO Recommends

GAO recommends that DOE direct the WTP contractor to determine the extent of problems in WTP structures, systems, and components and order work stops when problems recur, and DOE should direct ORP to revise its organizational structure to ensure the independence of the Quality Assurance Division. DOE generally agreed with GAO's recommendations.

View [GAO-18-241](#). For more information, contact David C. Trimble at (202) 512-3841 or [trimbled@gao.gov](mailto:trimbled@gao.gov).

April 2018

## HANFORD WASTE TREATMENT PLANT

### DOE Needs to Take Further Actions to Address Weaknesses in Its Quality Assurance Program

## What GAO Found

The Department of Energy (DOE) has taken several actions to identify and address quality assurance problems at the Waste Treatment and Immobilization Plant (WTP) at its Hanford site in Washington. Among the actions taken is the implementation of the Managed Improvement Plan by DOE's Office of River Protection (ORP) and the WTP contractor. The plan is intended to ensure that the WTP can operate in compliance with DOE-approved safety and quality requirements. The contractor has stated that the plan is fully implemented, but GAO found that a number of key activities may be incomplete and ORP officials will not be able to verify the extent of implementation until December 2018.

According to DOE documents that GAO reviewed and ORP quality assurance experts GAO spoke with, ORP has not ensured that all WTP quality assurance problems have been identified and some previously identified problems are recurring. For example, a 2016 DOE report found quality assurance problems, such as engineering errors and construction deficiencies, that neither ORP nor the contractor had identified when the work was conducted. ORP quality assurance experts GAO spoke with reiterated the issues identified in reports. In addition, DOE audits have found that previously identified quality assurance problems have recurred in key areas, such as the procurement of items that do not meet requirements or perform as specified. These problems were also raised by several of the ORP quality assurance experts GAO interviewed. According to these experts, such recurring problems may lead to significant rework at WTP facilities in the future if work is not stopped and the issues addressed. ORP's quality assurance framework requires the contractor to determine the extent to which quality assurance problems exist in all WTP structures, systems, and components when such problems are identified, and allows ORP to stop work at a facility if recurring issues arise. However, ORP has neither directed the contractor to make this determination nor stopped work when problems recur because it has confidence in the Managed Improvement Plan.

ORP's organizational structure may not provide its Quality Assurance Division with sufficient independence from the office's upper management to oversee the contractor's quality assurance program effectively. GAO has previously found that an oversight organization should be structurally distinct and separate from program offices responsible for cost and schedule performance to avoid conflict between mission objectives and safety. However, a 2017 DOE headquarters assessment found that ORP's Quality Assurance Division's effectiveness has been limited. This is because in some cases ORP upper management had mischaracterized its findings, and in other instances, ORP upper management had not used this division to evaluate the extent of potential quality assurance problems. ORP quality assurance experts GAO spoke to were also concerned that ORP's organizational structure does not always ensure the independence of the division. For example, two of these experts described instances when ORP upper management had downgraded the division's findings so that the contractor could take less stringent corrective measures. By providing the Quality Assurance Division adequate independence, DOE can better ensure that compliance with nuclear safety requirements will not be subordinated to other project management goals, such as meeting cost and schedule targets.

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<b>Abbreviations</b>		
	DFLAW	Direct Feed Low-Activity Waste
	DOE	Department of Energy
	MIP	Managed Improvement Plan
	ORP	Office of River Protection
	WTP	Waste Treatment and Immobilization Plant

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April 24, 2018

The Honorable John McCain  
Chairman  
The Honorable Jack Reed  
Ranking Member  
Committee on Armed Services  
United States Senate

The Department of Energy (DOE) is responsible for one of the world’s largest environmental cleanup programs: the treatment and disposal of millions of gallons of radioactive and hazardous waste at its 586-square-mile Hanford Site in southeastern Washington State. This waste was created as a by-product of producing plutonium and other special nuclear materials for nuclear weapons, starting during World War II and continuing until the late 1980s. The most hazardous and radioactive waste is stored in 177 large underground tanks.<sup>1</sup> However, as of January 2017, none of the tank waste had been treated for disposal because the facilities intended to treat a significant portion of this waste—known collectively as the Waste Treatment and Immobilization Plant (WTP)—have faced persistent technical and management challenges that have increased the project’s cost by billions of dollars and added decades to the waste treatment schedule. Among these challenges, DOE has had difficulty ensuring that WTP engineering, procurement, and construction work meets nuclear safety and quality requirements.

In 2000, DOE awarded a contract to Bechtel National, Incorporated, to design, construct, and commission the WTP. The WTP is a complex, first-of-a-kind project and is being constructed under a design-build contract. In the design-build approach, technology development activities, plant design, and construction occur simultaneously rather than sequentially.

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<sup>1</sup>The oldest 149 tanks, some of which date back to the 1940s, have single-layer walls, or shells; were built to last about 20 years; and will be almost 100 years old by the estimated end of waste treatment. DOE has reported that 67 of these tanks are assumed or are known to have leaked waste into the soil.

DOE no longer allows the use of the design-build approach for complex, first-of-a-kind facilities but has continued to use it for the WTP.<sup>2</sup>

In December 2012, the WTP Engineering Division of DOE's Office of River Protection (ORP) issued a memorandum that recommended that all activities affecting engineering design, construction, and installation of structures, systems, and components be stopped because the division had found that it could not verify that completed work met nuclear safety and quality requirements. According to the memorandum, stopping work would help the department avoid future nuclear safety and quality compromises and substantial rework.<sup>3</sup> Instead of stopping all work at the WTP, ORP management stopped work only on those facilities that faced the most significant technical challenges.<sup>4</sup> Around this time, ORP issued nine "Priority Level One" findings—findings reflecting problems that if uncorrected could have serious effects on safety, quality, and operability of a nuclear facility, as well as on the environment, according to ORP's quality assurance guidance.<sup>5</sup> Seven of the nine findings were issued by ORP's WTP Engineering Division in 2012 and focused on engineering and nuclear safety. The other two were issued by ORP's Quality

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<sup>2</sup>In 2004, we recommended that DOE avoid using the design-build approach for the Hanford tank waste treatment mission. See GAO, *Nuclear Waste: Absence of Key Management Reforms on Hanford's Cleanup Project Adds to Challenges of Achieving Cost and Schedule Goals*, [GAO-04-611](#) (Washington, D.C.: June 9, 2004). DOE concurred with the recommendation, and although it continues to use the design-build approach for the WTP, DOE has prohibited this contract structure for other large capital asset projects.

<sup>3</sup>Department of Energy, Office of River Protection, *WTP Engineering Division Memorandum: Stop Work Recommendation and Basis* (Dec. 19, 2012).

<sup>4</sup>Technical challenges vary widely, from the challenge of preventing hydrogen from building up in WTP facilities' piping and vessels and causing an explosion, to the challenge of preventing corrosive waste from eroding treatment equipment and causing a leak of radioactive materials.

<sup>5</sup>Department of Energy, Office of River Protection, *Quality Assurance Program Description*, MGT-PM-PL-04, rev. 4 (Aug. 20, 2014). In ORP's quality assurance program, project issues are identified using condition reports, which ORP quality assurance officials submit. Project issues are rated as Priority Level One, Two, or Three. A Priority Level One issue is the most serious and is defined as (1) a performance issue that directly or indirectly resulted in, or could result in, a major event or systemic breakdown in safety or quality or (2) an issue that could have a serious effect or impact on quality, worker health or safety, operability, the public, the environment, and facility operations. A Priority Level Two project issue is a serious issue that indicates an adverse condition, such as a noncompliance or breakdown of a management system.

Assurance Division in 2013 and focused on the contractor's quality assurance program.

Federal regulations require DOE contractors to establish DOE-approved quality assurance programs.<sup>6</sup> Under an approved quality assurance program, the contractor must establish and implement processes to detect and prevent quality problems; identify, control, and correct items, services, and processes that do not meet established requirements; identify the causes of problems and work to prevent recurrence as a part of correcting the problems; and plan and conduct independent assessments to measure the adequacy of work performance and to promote improvement. ORP's two Priority Level One findings related to quality assurance deficiencies found that the contractor's quality assurance program did not effectively ensure that work was being completed to meet these requirements. Significantly, one of the two findings concluded that the contractor's overall quality assurance program was not fully effective. The other finding concluded that the contractor's Corrective Action Program to address quality assurance problems was not fully effective. Overall, ORP determined that the deficiencies in the contractor's quality assurance program were the most serious type—those that could result in a systemic breakdown in safety or quality or that could have a serious effect on worker health and safety, the public and environment, and facility operations. In addition, the report stated that the deficiencies warranted immediate attention by the contractor and required corrective measures and a high degree of ORP oversight.<sup>7</sup>

We have reported on the need for effective oversight of nuclear safety—including quality assurance programs—across the DOE complex, finding in 2008 that a strong management and oversight program is needed to ensure that DOE's nuclear operations are carried out in a safe and environmentally acceptable manner.<sup>8</sup> Also in 2008, we identified key elements that any nuclear safety oversight organization should have in order for it to provide effective independent oversight. For example, we

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<sup>6</sup>10 C.F.R. part 830, subpart A, *Quality Assurance Requirements*.

<sup>7</sup>Systemic quality assurance problems described in the two Priority Level One findings included deficiencies in software quality assurance, document control, and control of purchased items and services.

<sup>8</sup>GAO, *Nuclear Safety: Department of Energy Needs to Strengthen Its Independent Oversight of Nuclear Facilities and Operations*, [GAO-09-61](#) (Washington, D.C.: Oct. 23, 2008).

found that the organization should be structurally distinct and separate from DOE program offices to avoid management interference or conflict between program office mission objectives, such as cost and schedule performance, and safety.

Senate Report 114-49 accompanying the Senate version of the National Defense Authorization Act for Fiscal Year 2016 includes a provision for GAO to carry out an ongoing evaluation of issues related to the WTP. This first report (1) describes the actions DOE has taken to identify and address quality assurance problems at the WTP, (2) examines the extent to which DOE has ensured that all quality assurance problems have been identified and will not recur, and (3) examines the extent to which DOE's organizational structure at ORP provides the independence to effectively oversee the WTP contractor's quality assurance program.

To describe the actions DOE has taken to identify and address quality assurance problems at the WTP, we obtained and reviewed DOE documents and reports that describe ORP and contractor actions, including the contractor's root cause analyses of quality assurance problems at the WTP. In addition, we reviewed DOE orders, ORP procedures, and documents that describe the requirements DOE is to follow to ensure that work meets quality assurance requirements and that the contractor has implemented corrective measures for identified quality assurance problems.

To examine the extent to which DOE has ensured that all quality assurance problems have been identified and will not recur, we reviewed internal and external assessments, audits, and reviews of ORP's and the contractor's quality assurance programs. In addition, we reviewed technical and management issues that were reported to the contractor's Corrective Action Management Program database from January 1, 2014, when the contractor started to implement corrective measures, to September 31, 2017, to identify significant quality assurance problems and issues.

To examine the extent to which DOE's organizational structure at ORP provides the independence to effectively oversee the WTP contractor's quality assurance program, we obtained and reviewed internal and external reports and assessments conducted by ORP, DOE's Office of Environmental Management's Office of Standards and Quality Assurance, DOE's Office of Enterprise Assessment, DOE's Office of Inspector General, and the Defense Nuclear Facilities Safety Board, on the portions of WTP engineering, procurement, and construction that have been

subject to review and examination for adherence to quality assurance requirements. In addition, we examined ORP's record of implementing DOE headquarters office's audit and assessment recommendations designed to improve the WTP quality assurance program dating back to January 2012.<sup>9</sup>

To address all of our objectives, we also conducted semi-structured interviews, which we used to obtain information from staff with ORP's Quality Assurance, WTP Construction Oversight and Assurance, and WTP Engineering Divisions who are involved in the oversight of the contractor's quality assurance program. The group consisted of all nine subject matter experts that ORP management identified as employees primarily responsible for WTP quality assurance oversight. In this report, we refer to this group as ORP quality assurance experts. During the semi-structured interviews, we asked a series of questions on DOE's and the contractor's compliance with quality assurance requirements, as well as questions on the resolution of problems with the contractor's quality assurance program and DOE's oversight of the program. In several cases, all nine ORP quality assurance experts were not able to answer our questions for various reasons, such as not having recent experience working in a particular quality assurance area. In addition to conducting semi-structured interviews, for all objectives we interviewed DOE officials with ORP; the Inspector General's Office at Hanford; and DOE headquarters offices, including the Office of Environmental Management's Office of Standards and Quality Assurance and the Office of Enterprise Assessments. We also interviewed WTP contractors, officials from the Washington State Department of Ecology, and officials from the Defense Nuclear Facilities Safety Board.

We conducted this performance audit from February 2016 to April 2018 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.

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<sup>9</sup>We examined ORP's implementation of audit and assessment recommendations issued by the DOE Inspector General, the Office of Enterprise Assessments, and Environmental Management's Office of Standards and Quality Assurance.

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## Background

This section describes DOE's tank waste treatment approach at Hanford and DOE's quality assurance framework and requirements.

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### DOE's Tank Waste Treatment Approach

Cleanup of the Hanford Site is governed by two main compliance agreements: (1) the 1989 Hanford Federal Facility Agreement and Consent Order, or Tri-Party Agreement, an agreement between DOE, the Washington State Department of Ecology, and the Environmental Protection Agency,<sup>10</sup> and (2) a 2010 consent decree.<sup>11</sup> The Tri-Party Agreement was signed in May 1989 and lays out a series of legally enforceable milestones for completing major activities in Hanford's waste treatment and cleanup process.<sup>12</sup> The Tri-Party Agreement has been amended a number of times to establish additional enforceable milestones for certain WTP construction and tank waste retrieval activities, among other things. Under the Tri-Party Agreement, DOE must complete waste treatment at the Hanford Site by 2047.

The overall mission of the WTP is to treat and immobilize a large part of 54 million gallons of radioactive and chemical waste stored in 177 underground storage tanks. The WTP is the most technically complex and largest construction project within DOE's Office of Environmental Management, occupying 65 acres of the Hanford Site. Some of DOE's tank waste is highly radioactive material—known as high-level waste—mixed with hazardous waste. Under current law, this waste must be vitrified—a process in which the waste is immobilized in glass—prior to

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<sup>10</sup>Hanford Federal Facility Agreement and Consent Order, Environmental Protection Agency Docket No. 1089-03-04-120, Ecology Docket No. 89-54, as amended through April 17, 2017. The agreement is available at <http://www.hanford.gov/page.cfm/TriParty/TheAgreement>.

<sup>11</sup>Washington v. Chu, Civ. No. 08-05085 (E.D. Wash), entered October 25, 2010, as amended through April 12, 2016.

<sup>12</sup>The purpose of the Tri-Party Agreement is to ensure that Hanford cleanup activities comply with the Comprehensive Environmental Response, Compensation, and Liability Act, Resource Conservation and Recovery Act, and Washington's Hazardous Waste Management Act. DOE entered into the Tri-Party Agreement pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act; the Resource Conservation and Recovery Act, Executive Order 12580; and the Atomic Energy Act of 1954.

disposal. Low-activity waste is DOE's term for the portion of the tank waste at Hanford with low levels of radioactivity. Low-activity waste is primarily the liquid portion of the tank waste that remains after as much radioactive material as technically and economically practical has been removed.<sup>13</sup>

The WTP consists of the following set of facilities that are designed to separate waste into low-activity and high-level waste streams and, once completed, treat these waste streams in separate facilities using vitrification.

- Pretreatment Facility. This facility is to receive the waste from the tanks and separate it into high-level and low-activity waste streams.
- Low-Activity Waste Facility. This facility is to receive the low-activity waste from the Pretreatment facility and immobilize it by vitrification. The canisters of vitrified waste will be permanently disposed of at another facility at Hanford.
- High-Level Waste Facility. This facility is to receive the high-level waste from the Pretreatment Facility and immobilize it by vitrification. The canisters of vitrified waste will be stored on-site until a final repository is established.
- Effluent Management Facility. The Effluent Management Facility is being built to evaporate much of the secondary waste produced during low-activity waste processing and vitrification at the Low-Activity Waste Facility.
- Analytical Laboratory. This facility will conduct analyses as needed, such as testing samples of the vitrified waste to ensure that it meets certain criteria and regulatory requirements for disposal.<sup>14</sup>

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<sup>13</sup>As designed, the WTP will only be capable of treating less than half of the expected quantity of Hanford's low-activity waste. DOE has indicated that a second plant, or alternative approach that is not part of the current project, will be necessary to treat the rest of the low-activity 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).

<sup>14</sup>Tank waste to be sent to the Pretreatment Facility for processing must meet specific physical and chemical characteristics, known as waste acceptance criteria, and the waste must be certified as having met these criteria before transfer from the tank farms to the Pretreatment Facility. The criteria may stipulate that waste meet certain requirements for chemical composition, particle size, and density.

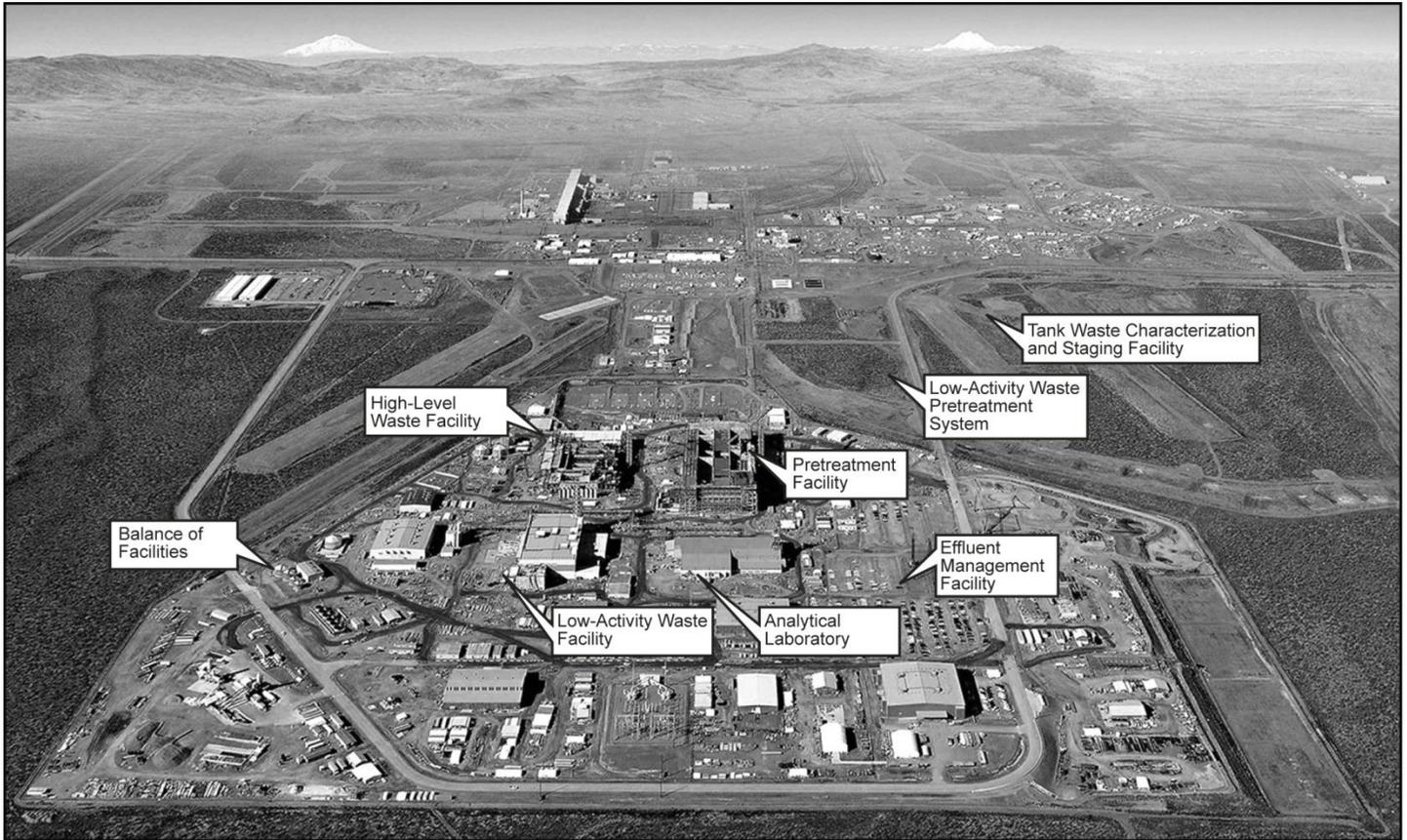
- **Balance of Facilities.** These facilities consist of the 22 support facilities that make up the plant infrastructure, such as cooling water systems and silos that hold vitrifying materials.

In part because of the 2012 work stoppage at the WTP's Pretreatment and High-Level Waste Facilities, in 2012 DOE adopted a phased waste treatment strategy through which the department aims to begin treating some of the low-activity waste before resolving all WTP technical issues.<sup>15</sup> During the first phase of this strategy, DOE plans to implement a Direct Feed Low-Activity Waste (DFLAW) approach to transfer some low-activity waste from the tanks to the WTP's Low-Activity Waste Facility for vitrification before the Pretreatment Facility is completed. The approach relies on construction of a new facility—the Low-Activity Waste Pretreatment System—designed to remove highly radioactive particles from liquid tank waste before sending the waste stream to the Low-Activity Waste Facility. During later phases, DOE intends to complete the WTP Pretreatment Facility and High-Level Waste Facilities. DOE also plans to construct a Tank Waste Characterization and Staging Facility under a different contract to stage, mix, sample, and characterize high-level waste from the tanks prior to delivery to the Pretreatment Facility. Figure 1 illustrates WTP and other facilities planned for Hanford tank waste treatment.

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<sup>15</sup>In December 2016, DOE and the contractor modified the WTP contract to account for the new phased strategy. According to DOE, under the revised contract it will cost approximately \$16.8 billion to complete the first phase. Through fiscal year 2017, DOE has spent \$11 billion on the construction of the WTP. The WTP facilities are in various stages of design and construction, and DOE and the contractor have not yet negotiated a cost for the remaining phases needed to complete the WTP.

**Figure 1: Waste Treatment and Immobilization Plant (WTP) and Other Facilities Planned for Hanford Tank Waste Treatment**



Source: Department of Energy. | GAO-18-241

Note: The Low Activity Waste Pretreatment System and the Tank Waste Characterization and Staging Facility are not part of the WTP, but these facilities may be needed to transport waste from the tanks to the WTP.

## DOE's Quality Assurance Framework and Requirements

A set of federal regulations, DOE orders, and ORP procedures collectively make up DOE's quality assurance framework that aims to ensure that all WTP quality assurance problems can be identified and that identified problems do not recur. DOE's quality assurance regulations require DOE contractors to establish DOE-approved quality assurance programs. The regulations specify that under an approved program, the contractor's quality assurance program must, among other things, (1) establish and implement processes to detect and prevent quality problems; (2) identify, control, and correct items, services, and processes

that do not meet established requirements; (3) procure items and services that meet established requirements and perform as specified; (4) plan and conduct independent assessments to measure item and service quality, to measure the adequacy of work performance, and to promote improvement; and (5) maintain items to prevent damage, loss, or deterioration.<sup>16</sup> In addition, DOE Order 226.1B requires that DOE's organizations and contractors implement oversight processes that ensure that relevant quality assurance problems are evaluated and corrected on a timely basis to prevent recurrence.<sup>17</sup>

The WTP contract requires compliance with these regulations and requirements. The WTP contract specifies that as the owner of the WTP project, DOE is responsible for providing quality assurance oversight of the WTP.<sup>18</sup> ORP's Quality Assurance Division provides such oversight, for example, by doing the following:

- Reviewing a sampling of the contractor's documentation on the WTP's engineering, procurement, and construction.
- Conducting audits and assessments to ensure that the contractor's work complies with applicable quality assurance requirements.
- Assessing the effectiveness of the contractor's Corrective Action Management Program, which involves identifying, documenting, planning, addressing, and tracking actions required to resolve or correct problems.<sup>19</sup>

Both the contractor's and ORP's quality assurance programs require that corrective actions to address significant problems with the quality of the work must include a determination of the extent to which the problematic conditions exist (known as an extent-of-condition review) as well as the underlying causes of those conditions. If corrective actions do not

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<sup>16</sup>10 C.F.R. § 830.122.

<sup>17</sup>Department of Energy, *Implementation of Department of Energy Oversight Policy*, DOE Order 226.1B (Washington, D.C.: Apr. 4, 2011).

<sup>18</sup>Waste Treatment and Immobilization Plant Contract Number: DE-AC27-01RV14136, Section C.3 (b), conformed through Modification No. 406.

<sup>19</sup>The Corrective Action Management Program provides a structured issues management system. Department of Energy, *Implementation of Department of Energy Oversight Policy Order 226.1B*, stipulates that contractors must implement oversight processes that ensure that relevant quality assurance problems are evaluated and corrected to prevent recurrence.

address the conditions, ORP's quality assurance policy allows the office to call for a suspension of work.<sup>20</sup> ORP's stop work procedure includes the process ORP is to follow when the Quality Assurance Division Director, in consultation with ORP management, determines that work needs to be suspended as a result of the occurrence or reoccurrence of significant quality assurance problems.<sup>21</sup> ORP updated this procedure in February 2016 to describe the type of quality assurance deficiencies that should trigger consideration of work stoppage. According to the updated procedure, characteristics of a deficiency that can trigger an order to stop work include, but are not limited to, problems that will result in \$25 million or more in loss of productivity, construction rework, or environmental damage or a significant quality problem that if left uncorrected can result in construction delays or create adverse safety conditions. Until February 2016, ORP did not have precise criteria describing the conditions under which it should evaluate work for possible stoppage, according to a DOE headquarters report.<sup>22</sup>

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## ORP Has Taken Several Actions to Identify and Address Quality Assurance Problems at the WTP, but All Planned Actions Have Not Been Completed

ORP has taken several actions to identify and address quality assurance problems at the WTP, but all planned actions have not been completed. In 2013 ORP conducted a comprehensive audit, which resulted in several actions, including when the office had the contractor begin implementing a Managed Improvement Plan (MIP) in 2014. The MIP is intended to ensure that the WTP could operate in compliance with DOE-approved safety and quality requirements. Implementation of the MIP was to be

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<sup>20</sup>Specifically, the policy states that "Work suspension is appropriate when continued work would be unsafe, would be likely to create rework, and when safety or quality is indeterminate." Department of Energy, Office of River Protection, *Quality Assurance Program Description*, MGT-PM-PL-04 Revision 4, August 20, 2014.

<sup>21</sup>Department of Energy, Office of River Protection, *ORP Stop Work Procedure*, TRS-QSH-IP-03, rev. 2 (Feb. 29, 2016).

<sup>22</sup>Department of Energy, Office of Environmental Management, *Quality Assurance Audit Report*, EM-PA-15-02, ORP, Technical and Regulatory Support, (Washington, D.C.: May 2015).

completed by April 2016. Although the contractor reported that the implementation was complete, some of the plan's corrective measures have not been fully implemented, according to contractor documents we reviewed and quality assurance experts we spoke to. In addition, ORP's effort to verify the extent to which the contractor has implemented MIP corrective measures is not scheduled to be complete until at least December 2018.

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### Actions Taken to Identify and Address Quality Assurance Problems at the WTP

ORP has taken several actions to identify and address quality assurance problems at the WTP. After the partial work stoppage in 2012, ORP conducted an audit in 2013 to evaluate the adequacy, implementation, and effectiveness of the contractor's quality assurance program. The audit found that the contractor's quality assurance program was generally adequate. However, it also found that the contractor's quality assurance program was not fully effective in several areas.<sup>23</sup> In response to the audit, ORP and the WTP contractor took the following actions:

- Developed compensatory measures. At ORP's request, in 2013, the contractor started implementing "compensatory measures" to ensure that ongoing WTP work during a 2-year performance improvement period would meet DOE quality and safety requirements. For example, in September 2013, the contractor implemented a measure requiring senior management review of all condition reports and their associated levels of significance. According to ORP officials, the compensatory measures were intended to be additional, temporary internal controls to ensure that work at the WTP did not result in new or recurring quality assurance problems.
- Initiated the MIP. To systematically integrate compensatory measures, the contractor developed the MIP to address all quality assurance problems identified in the two Priority Level One findings and the seven Priority Level One findings associated with engineering and nuclear safety. In August 2014, the contractor started implementing the MIP.<sup>24</sup> The MIP is a set of 52 corrective measures

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<sup>23</sup>In particular, the audit found unsatisfactory performance in the program's ability to ensure quality in design control, software design, procurement documentation, control of purchased items and services, and corrective actions.

<sup>24</sup>Department of Energy and Bechtel National, Incorporated, *Waste Treatment Plant Project Managed Improvement Plan*, 24590-WTP-PL-MGT-14-0006, Rev 1, August 2014.

intended to establish processes, procedures, and metrics to produce an overall quality program that ensures that the WTP can safely operate in compliance with DOE-approved nuclear safety requirements, according to the contractor.<sup>25</sup> The measures include the following:

- Actions to enhance external independent oversight. This measure calls for the contractor to conduct assessments using external subject matter experts to evaluate the ability of the contractor's quality assurance program to identify precursors to potential problems and their causes. This measure responds to the 2013 audit in which DOE concluded that the contractor's quality assurance program could not ensure compliance with requirements. Specifically, the audit found that the contractor's quality assurance program was not fully effective in several areas, including, but not limited to, design, software quality, procurement, and ensuring that identified problems are corrected.
- Actions to ensure that procured items and services meet requirements and perform as specified. This measure is intended to ensure that the contractor's processes and procedures to identify and ensure the quality of technical products meet requirements. The nuclear industry uses "commercial grade dedication" to refer to the process by which the contractor or subcontractor verifies that an item (e.g., an electric switch) or service (e.g., design of an electrical system) can meet commercial quality and safety requirements and be approved for use in a nuclear facility. It requires the contractor to perform source verification, perform inspections and tests, and assess the processes that control the quality of purchased items and services to help ensure that critical components of procured items and services are designed, fabricated, assembled, installed, and tested with appropriate documentation to support their compliance with WTP safety requirements. This measure also responds to DOE's 2013 audit, which found that the contractor had inadequate control over the quality of purchased items and services.
- Actions to control and correct items and processes that do not meet requirements. This measure is intended to allow the

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<sup>25</sup>In August 2014, the contractor estimated that it would cost more than \$1 billion to implement MIP corrective measures. ORP and contractor officials described the MIP implementation cost estimate as a rough order of magnitude cost estimate. According to these officials, a more accurate cost estimate was not developed for implementing the MIP and actual costs to implement MIP initiatives have not been tracked.

contractor to identify and ensure that materials and equipment that have been received, and that will be received in the future, meet requirements. The contractor is to conduct comprehensive reviews of previously received material and equipment, as well as all future deliveries, to help ensure the verification, accuracy, and completeness of documentation for materials and equipment received from suppliers. This measure also responds to DOE's 2013 audit, which found that the contractor had received components that did not comply with safety requirements.

- Performed targeted audits to test compensatory measures and the implementation of the MIP. To assess the effectiveness of the compensatory measures and the MIP, ORP performed targeted audits. For example, to assess the extent to which the contractor has addressed quality assurance program deficiencies, in early 2017 ORP's Quality Assurance Division conducted a "vertical slice audit." This audit reviewed engineering, procurement, and construction of a key system that will be needed for initial WTP operations.

Because of the long-standing quality assurance problems at the WTP, DOE required ORP to closely monitor the contractor's implementation of the MIP. Specifically, as a result of a DOE Office of Enforcement investigation into the contractor's quality assurance and corrective action management programs, DOE entered into a Consent Order with the contractor in 2015.<sup>26</sup> The Consent Order required the contractor to complete the actions identified in the MIP to the extent necessary to restore quality assurance program to full effectiveness by April 30, 2016.<sup>27</sup> The Consent Order does not preclude DOE from reopening the investigation or issuing an enforcement action if there is a recurrence of nuclear safety deficiencies similar to those identified in the Consent Order or the if contractor fails to complete actions required by the Consent Order in a timely and effective manner to prevent recurrence of the identified issues.

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<sup>26</sup>DOE has established procedures for (1) investigating the nature and extent of violations of DOE nuclear safety requirements, (2) determining whether a violation of these requirements has occurred, (3) imposing an appropriate remedy, and (4) adjudicating the assessment of a civil penalty at 10 C.F.R. part 820.

<sup>27</sup>Consent Order Incorporating Agreement Between U.S. Department of Energy and Bechtel National Incorporated, NCO-2015-02, June 8, 2015.

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## Corrective Measures to Address Quality Assurance Problems at the WTP Have Not Been Fully Implemented

The contractor has not fully implemented corrective measures for all identified quality assurance problems, according to contractor documents we reviewed. In August 2017, the contractor reported that it had finished its actions to implement the MIP.<sup>28</sup> However, according to the contractor's MIP status update accompanying the contractor's report, 13 of the 52 corrective measures specified in the MIP had not been fully implemented. Our review of these 13 MIP corrective measures we found that 9 were intended to exclusively or partially address weaknesses in the contractor's quality assurance program.<sup>29</sup> For example, the two corrective measures to ensure that WTP facilities' computer software meets requirements were not complete, according to the MIP status update. These corrective measures included improving the software procurement process and revising the quality assurance manual.

In addition, of the 39 measures that the contractor considers complete, some do not appear to be fully implemented, according to one ORP quality assurance expert that we spoke to. For example, one ORP quality assurance expert disagreed with the contractor's assessment that a corrective measure for documentation pertaining to radiographic film—which is needed for conducting quality assurance reviews of certain equipment—was fully implemented. This corrective measure calls for the contractor to review purchase orders for radiographic film and then store the radiographic film as documentation of compliance with nuclear quality standards. According to the expert, radiographic film reviews are still not consistently conducted, and radiographic film documentation is still not consistently stored. In cases where such documentation is incomplete or missing, the contractor is at times forced to re-create the documentation

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<sup>28</sup>Bechtel National, Incorporated, Letter to ORP Manager, Closure of the MIP (Aug. 24, 2017).

<sup>29</sup>Among the incomplete measures, one is related to the quality of procuring commercial items for use in a nuclear facility. ORP has previously identified weaknesses in quality assurance in this area on several occasions. For example, in 2008 ORP reported that the contractor had not met its due date to complete corrective actions to address weaknesses in its procedures for procuring commercial items for use in a nuclear facility. Later, in 2015 ORP found that the contractor's internal controls for this process were not consistently performed; did not consistently comply with procedural requirements; and, in many cases, did not establish reasonable assurance that procured systems, services, and components would perform their intended safety functions .

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at considerable cost to DOE. According to ORP's MIP oversight plan, it will take the office until at least December 2018 to verify the extent to which the contractor has implemented each of the 52 MIP corrective measures.

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## ORP Has Not Ensured That All Quality Assurance Problems Have Been Identified, and Some Previously Identified Problems Are Recurring

According to DOE documents we reviewed and ORP quality assurance experts we spoke with, ORP's actions have not ensured that all quality assurance problems have been identified at the WTP, and some previously identified problems are recurring. Specifically, according to DOE documents and the experts we spoke with, ORP's oversight has not ensured that the contractor has identified all quality assurance problems in structures, systems, and components that were completed and installed before the 2012 work stoppage or identified all such problems in newer structures, systems, and components needed for initial WTP operations. In addition, according to the documents we reviewed and experts we interviewed, previously identified quality assurance problems are recurring.

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## ORP Oversight Has Not Ensured That the Contractor Has Identified All Quality Assurance Problems

Recent DOE reviews have found that ORP has not ensured that all quality assurance problems have been identified at the WTP. First, a 2016 DOE Office of Enterprise Assessment report found quality assurance deficiencies that neither ORP nor the contractor had identified at the time the work was conducted.<sup>30</sup> The report identified numerous construction deficiencies, procurement and supplier deficiencies, engineering errors, maintenance issues, and materials with expired shelf lives. For example, the report identified welding deficiencies on tanks designed to hold nuclear waste that were identified in a WTP facility several years after the tanks were installed. The report concluded that the

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<sup>30</sup>Department of Energy, *Office of Enterprise Assessments Assessment of Construction Quality at the Hanford Site Waste Treatment and Immobilization Plant* (June 2016).

contractor is aware that significant quality assurance problems likely exist in older structures, systems, and components. This report noted that much of the equipment in older structures, systems, and components was manufactured and delivered to the project from 5 to 10 years ago—and some of this equipment was supplied by vendors or manufacturers that are no longer in business—which could lead to costly rework.

Second, a 2015 DOE Inspector General report found that the contractor had procured \$4 billion in parts and materials through fiscal year 2014, but ORP and the contractor had not always identified problems with the quality of procured items in a timely manner. For example, the report found that in about 45 percent of the nearly 1,400 procurement problems reviewed, the contractor did not identify the problems until at least 2 years after the items arrived on site. The report also found that in many cases the contractor canceled its efforts to recover the costs to resolve the problems because of the length of time that had passed. The report concluded that these problems were caused by weaknesses in the contractor's quality assurance program and that the contractor's procedures to prevent or identify problems with procured items were not always followed effectively.

The findings of these reports are consistent with the views of ORP quality assurance experts we spoke with who stated that ORP oversight has not ensured that the contractor has identified all quality assurance problems in structures, systems, and components—particularly those that were completed and installed before the 2012 work stoppage. These quality assurance experts said that because quality assurance problems have not been identified, they expect significant rework will be needed for work that was completed before 2012. Specifically, most of the ORP quality assurance experts (seven of the nine) told us that they expect rework will be needed for existing WTP facilities, such as the Pretreatment and High-Level Waste Facilities. One of these seven quality assurance experts noted that the contractor does not have a complete record of the documentation for key systems and equipment, which is required for demonstrating compliance with nuclear safety standards and eventual permitting of WTP facilities for operation. According to this expert, the extent of this shortcoming is not known, but fixing it—that is, creating a complete record of required documentation—may lead to years of delays.

ORP Quality Assurance Division officials told us that because ORP's focus is on ensuring that facilities needed for initial operations will be ready to operate by December 2023, they have not been directed by ORP management to focus on identifying all quality assurance problems for

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work completed before 2012 for facilities needed for later phases of WTP operations, such as structures, systems, and components of the Pretreatment and High-Level Waste Facilities. In addition, they stated that there may be significant changes to these facilities needed for the WTP's later phases, making it unnecessary for them to review the extent of quality assurance problems until it is known what parts of the facilities will remain and which parts will not.

However, similar problems appear to exist in WTP facilities needed for initial operations. ORP quality assurance experts that we interviewed also stated that ORP oversight has not always ensured that all quality assurance problems in facilities needed for the initial WTP operations, or DFLAW, have been identified. Five experts told us that issues such as identifying problematic items, services, and processes had not been fully resolved. Specifically, these ORP quality assurance experts told us that when quality assurance problems are identified in structures, systems, or components needed for DFLAW, ORP does not always ensure that the contractor identifies the extent to which such problems may exist in other areas affected by the same structures, systems, or components. For example, an ORP quality assurance expert cited an instance in which an ORP quality assurance team reviewed a sample of 25 procurement "packages" (out of thousands) for a DFLAW facility and identified 143 problems—significantly more problems than the team expected for such a small sample. Consistent with ORP quality assurance requirements, this ORP quality assurance expert recommended to ORP upper management that the contractor determine the extent to which such problems could affect other structures, systems, and components needed for DFLAW. However, according to an ORP memo, ORP upper management did not require the contractor to implement this recommendation, instead citing "extenuating circumstances" and requiring a lesser corrective action than what was recommended. Three ORP quality assurance experts told us that they believe that because problems have not been comprehensively assessed, there may be equipment and systems within DFLAW that will fail to meet their intended functions.

We also found that although ORP conducted its vertical slice audit in 2017 to test its compensatory measures and the MIP to improve quality assurance, the audit report notes that it was focused on only one system

within the Low-Activity Waste Facility.<sup>31</sup> According to ORP officials, there are numerous structures, systems, and components in facilities needed for DFLAW that have not been audited or reviewed in a manner similar to the vertical slice audit. Both the contractor's and ORP's quality assurance programs require that corrective actions to address significant problems with the quality of the work include a determination of the extent to which the problematic conditions exist as well as the underlying causes of those conditions. Until ORP requires the WTP contractor to determine the full extent to which problems exist in all WTP structures, systems, and components, DOE lacks a comprehensive understanding of all potential quality assurance problems at all WTP facilities.

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### Previously Identified Quality Assurance Problems Are Recurring

DOE requires its program offices, such as ORP, and contractors to have oversight processes to ensure that quality assurance problems are evaluated and corrected in a timely basis to prevent recurrence. However, several DOE documents we reviewed show that previously identified quality assurance problems have recurred in recent years, including the following:

- In 2015, an ORP audit report identified recurring weaknesses in quality assurance for the contractor's process for procuring commercial items for use in a nuclear facility.<sup>32</sup> For example, ORP found that the contractor's internal controls for this process were not consistently performed; did not consistently comply with procedural requirements; and, in many cases, did not establish reasonable assurance that procured systems, services, and components acquired from 2010 to 2014 would perform their intended safety functions.
- In a 2015 report on the design and operability of key systems and components for the Low-Activity Waste Facility, ORP found that the quality of computer systems software was not in full compliance with DOE requirements, leading to conditions where personnel and the

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<sup>31</sup>ORP Quality Assurance Division officials told us that they selected this system for audit because it was the only major system in which all engineering, procurement, and construction occurred after the contractor had started new internal controls.

<sup>32</sup>Department of Energy, *ORP of Bechtel National, Inc. Commercial Grade Dedication Program*, Audit Report U-14-QAD-RPPWTP-003 (Aug. 6, 2015).

environment may not be adequately protected.<sup>33</sup> ORP had identified a similar problem in 2008, when it found that the contractor's computer programs used in engineering calculations were not always verified to show that they produced correct solutions within defined limits for all parameters, as required by the contractor's quality assurance manual. ORP had also previously identified WTP computer software quality problems in 2010 when it issued a Priority Level Two finding on software procedures and another Priority Level Two finding on software testing.

- In 2017, ORP's Quality Assurance Division issued a report that examined the contractor's quality assurance program and found problems in quality assurance areas that had been previously identified.<sup>34</sup> The report noted that in 6 of 19 quality assurance program areas, the contractor's performance was marginal—and in need of improvement—or indeterminate. These 6 areas included identifying, controlling, and correcting items, services, and processes that do not meet established requirements; maintaining items to prevent damage, loss, or deterioration; and procuring items and services that meet established requirements and perform as specified.

ORP quality assurance experts that we spoke with also stated that previously identified quality assurance problems are recurring, including some in areas where the contractor had implemented corrective measures. These quality assurance experts told us that quality assurance problems are recurring in several key areas, including those areas identified in the documents described above: (1) procurement of items and services that do not meet established requirements or perform as specified; (2) software that does not meet established requirements; and (3) a maintenance program that does not prevent damage, loss, or deterioration of WTP structures, systems, and components. For example, see the following.

- Procurement of items and services that do not meet requirements or perform as specified. Four out of the five ORP quality assurance

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<sup>33</sup>Department of Energy, Office of River Protection, *Waste Treatment and Immobilization Plant Low-Activity Waste Facility Design and Operability Review and Recommendations* (Sept. 4, 2015).

<sup>34</sup>Department of Energy, *ORP Effectiveness Determination of Bechtel National, Inc. Project Office Corrective Actions Related to Audit Findings U-13-QAT-RPPWTP-001-F01 and U-13-QAT-RPPWTP-001-F02, and Overall Adequacy, Implementation, and Effectiveness of Bechtel National, Incorporated Quality Assurance Program* (February 2017).

experts we interviewed who had recent experience with the procurement of items and services told us that problems with procured items and services that do not meet established requirements or perform as specified are not fully resolved. One of these ORP quality assurance experts stated that an ORP team recently reviewed a random sample of 45 of the roughly 30,000 procurements the contractor had made for the WTP and identified a number of instances where materials did not meet requirements, which resulted in one Priority Level Two finding—which represents a serious issue that indicates an adverse condition, such as a noncompliance or breakdown of a management system—and five Priority Level Three findings. The expert noted that this was many more deficiencies than the team expected for such a small sample.<sup>35</sup>

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<sup>35</sup>According to one ORP quality assurance expert, the contractor's delay in inspecting items—and its interest in maintaining relationships with vendors—have prevented it from seeking reimbursement for items that do not meet requirements. In some cases, vendors are no longer in business when the contractor has discovered that a part does not meet requirements, and in other cases, the contractor has not sought reimbursement because it wants to maintain its ability to procure parts from the vendor in the future.

#### Settlement of Allegations of Contractors Knowingly Mischarging Costs at the Waste Treatment and Immobilization Plant (WTP)

In November 2016, the WTP contractor and certain subcontractors agreed to pay \$125 million to resolve allegations under the False Claims Act that they made false statements and claims to the Department of Energy (DOE) by charging DOE for deficient nuclear quality materials, services, and testing that were provided to the WTP at DOE's Hanford Site. The contract required materials, testing, and services to meet certain nuclear quality standards. The Department of Justice alleged that the defendants violated the False Claims Act by charging the government the cost of complying with these standards when they failed to do so. In particular, the Department of Justice alleged that the defendants improperly billed the government for materials and services from vendors that did not meet quality control requirements, for piping and waste vessels that did not meet quality standards, and for testing from vendors that did not have compliant quality programs. As part of the settlement, the contractors admitted no wrongdoing, and the United States did not concede that its claims were not well founded.

Source: Department of Justice. | GAO-18-241

- Software that does not meet requirements. ORP quality assurance experts told us that problems are recurring in certain areas where items and processes do not meet requirements, such as computer software quality assurance, despite the contractor developing two MIP corrective measures in this area. Two ORP quality assurance experts reported that problems with software quality are recurring. One ORP quality assurance expert added that the contractor often fails to develop software quality documentation that is needed to demonstrate compliance with quality requirements when permitting facilities for operation. As a result, the contractor will have to re-create this documentation at some cost.
- A maintenance program that does not prevent damage, loss, or deterioration. Each of the three ORP quality assurance experts with knowledge in this area told us that the contractor had not established a fully effective WTP maintenance program, particularly for the Pretreatment and High-Level Waste Facilities, and as a result, structures, systems, and components at these facilities have deteriorated and been damaged.<sup>36</sup> Such statements are consistent with findings of the Defense Nuclear Facilities Safety Board, which reported in April 2016 that systems and components stored in an outdoor storage yard were not properly covered and showed signs of being affected by water, sand, or animals. In March 2016, ORP reported significant water intrusion into several areas of the High-Level Waste Facility. As a result, some of the facility's structures, systems, and components had deteriorated and will require costly rework. The contractor notified DOE in April 2017 that because DOE's focus is on completing facilities needed for initial WTP operations, it would submit a proposal to change the WTP contract to account for the increased scope, cost, and schedule of long-term maintenance, storage, and management of procured and partially installed structures, systems, and components at those facilities not needed for initial WTP operations.

Consistent with its quality assurance procedures, ORP can use its authorities—such as those under the Consent Order and its quality assurance policy—to stop work if corrective measures do not prevent quality assurance problems from recurring. However, ORP has not used such authorities. ORP senior officials told us that they did not consider it necessary to stop work because of the recurrence of problems in certain

<sup>36</sup>The three ORP quality assurance experts who could discuss this area told us that this it is not yet fully resolved.

areas because they plan to evaluate the extent of the contractor's implementation of MIP corrective measures over the next year and have allowed work to continue because they believe that the contractor's quality assurance program is generally adequate. Without directing ORP to use its authorities to stop work in areas where quality assurance problems are recurring until it can verify that the problems are corrected and will not recur, DOE may face future rework that could increase costs and schedule delays for the WTP.

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## ORP's Organizational Structure May Not Provide Sufficient Independence for Effective Oversight of the WTP Contractor's Quality Assurance Program

A 2017 assessment from DOE headquarters and our interviews with nine ORP quality assurance experts suggest that ORP's organizational structure does not provide the quality assurance function with sufficient independence from upper management—which includes the ORP Manager and the WTP Federal Project Director—to effectively oversee the contractor's quality assurance program. Our prior work has found that to be independent, an oversight organization should be structurally distinct and separate from program offices responsible for achieving the program's mission to avoid management interference or conflict between program office mission objectives and safety.<sup>37</sup> At ORP, however, the Quality Assurance Division is not fully separate and independent from the upper management of the WTP project, which manages cost and schedule performance. We believe that such a structure has the potential to create a conflict of interest.

Specifically, we found that ORP's Quality Assurance Division performs assessments of the contractor's quality assurance program, among other things, and reports its findings to ORP upper management, including the ORP Manager, who has the discretion to determine whether and to what extent to require the contractor to take action in response to findings. When quality assurance issues are identified, ORP upper management must balance its mission of meeting cost and schedule targets with its responsibility to ensure that nuclear safety and quality standards are met.

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<sup>37</sup>[GAO-09-61](#).

However, these are two potentially conflicting responsibilities because meeting WTP cost and schedule targets may be threatened if serious quality assurance problems are identified.

A February 2017 external assessment from DOE headquarters noted that ORP's Quality Assurance Division's effectiveness has been limited because, in some instances, its findings have been mischaracterized by ORP upper management, and in others, ORP upper management has not used this division effectively to evaluate the extent of potential quality assurance problems.<sup>38</sup> This assessment found that ORP had not performed adequate oversight of the contractor's MIP and that some critical quality assurance areas were not receiving the necessary scrutiny from ORP. Further, the assessment found that ORP management sometimes mischaracterized the seriousness of the Quality Assurance Division's findings and, as a result, did not require the contractor to conduct extent-of-condition review for significant quality assurance problems. While this assessment stated that ORP had an effective quality assurance program, it concluded that three of the eight quality assurance areas the assessment team reviewed were not fully effective, including ORP's ability to conduct assessments of the contractor's quality assurance program.

The views of ORP quality assurance experts with whom we spoke are consistent with the findings of the 2017 DOE assessment. For example, see the following:

- Two ORP quality assurance experts told us that quality assurance findings are reviewed and approved by ORP upper management before being transmitted to the contractor, and in some instances ORP upper managements downgraded the Quality Assurance Division's findings. For example, a 2015 ORP quality assurance assessment found that many items procured from 2010 to July 2014 did not appear to meet nuclear safety requirements. One of these experts told us that the ORP Quality Assurance Division recommended that ORP management issue a Priority Level One finding, the most significant of three levels, based on this 2015 assessment. However, according to this expert, ORP upper management chose to issue it as a Priority Level Two finding, meaning that ORP considered the problem less severe and required

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<sup>38</sup>Department of Energy, *Quality Assurance Analysis Report on the Office of River Protection Quality Assurance Program* (February 2017).

**A Cautionary Tale: Quality Assurance Problems Doom Commercial Nuclear Power Plant**

In the commercial nuclear industry, there is a notable example of a construction project that faced significant quality assurance challenges. In the 1970s and early 1980s, Cincinnati Gas & Electric attempted to construct a commercial nuclear power plant, known as the Zimmer Plant, near Moscow, Ohio. After 10 years of construction and more than \$2 billion spent, the company abandoned its effort to construct the plant. An independent review mandated by the Nuclear Regulatory Commission in 1982 concluded that several issues impeded successful construction of the Zimmer Plant as a commercial nuclear power plant. These issues included (1) the company's failure to elevate its commitment to quality and quality assurance to an equal status with cost and schedule, (2) the regulator's failure to hold the company accountable for quality in design and construction, and (3) the company's inadequate quality assurance procedures. To recoup some of the \$2 billion spent in attempting to construct this commercial nuclear power plant, Cincinnati Gas & Electric later converted facilities built at the site for use in a coal-fired power plant.

Source: Nuclear Regulatory Commission. | GAO-18-241

the contractor to implement less stringent corrective measures to address the issue. The ORP quality assurance expert and an ORP upper manager told us that it was the WTP federal project director and the former ORP Manager who downgraded this Quality Assurance Division finding.

- Two other ORP quality assurance experts told us that ORP upper management and the contractor place cost and schedule performance above identifying and resolving quality assurance issues. One quality assurance expert specified that ORP's culture does not encourage staff to identify quality assurance problems or ineffective corrective measures. This expert said that people who discover problems are not rewarded; rather, their findings are met with resistance, which has created a culture where quality assurance staff are hesitant to identify quality assurance problems or problems with corrective measures. This expert added that quality assurance is subordinate to cost and schedule—that is, senior managers responsible for approving quality assurance findings are more concerned with whether WTP construction meets schedule milestones than identifying and resolving quality assurance issues. This expert compared the WTP to the Zimmer Power Plant—a power plant in Ohio that was designed to be a nuclear power plant but that was never licensed because of unresolved quality assurance problems and a focus on schedule over construction quality.

As stated earlier, in October 2008, we identified key elements that any nuclear safety oversight organization should have in order for it to provide effective independent oversight.<sup>39</sup> For example, we found that an organization should be structurally distinct and separate from DOE program offices to avoid management interference or conflict between program office mission objectives, such as cost and schedule performance and safety. We also found that the organization should have sufficient authority to require program offices to effectively address its findings and recommendations.

ORP's Assistant Manager for Technical and Regulatory Support and ORP senior quality assurance staff told us that ORP's organizational structure ensures that the quality assurance function is sufficiently independent of ORP management. These officials and the ORP Quality Assurance Program Description state that the Quality Assurance Division is structured to report directly to the ORP Assistant Manager for Technical

<sup>39</sup> [GAO-09-61](#).

and Regulatory Support and the ORP Manager. They also cited the ORP Quality Assurance Program policy, which states that the Quality Assurance Division has the authority and overall responsibility to independently audit the contractor's quality assurance program to verify the achievement of quality. According to these officials, this organizational structure ensures independence from cost and schedule considerations and ensures objectivity in quality assurance evaluations, and they added that the ORP Manager evaluates differing opinions without any hindrances or organizational bias.

Given that some previously identified problems are recurring at the WTP, including some in areas where the contractor had implemented corrective measures, and given the findings of the 2017 headquarters assessment and the statements of ORP's quality assurance experts outlined above, we are concerned that ORP's organizational structure may not entirely ensure that the Quality Assurance Division meets key elements for a nuclear safety oversight organization to provide effective independent oversight. According to ORP reports and officials, in ORP's current organizational structure, upper level management retains discretion in how to resolve quality assurance problems. As a result, the Quality Assurance Division does not have sufficient authority to ensure that its findings are addressed and its recommendations are implemented. By revising ORP's organizational structure so that the quality assurance function is independent of ORP upper-level management, DOE can have better assurance that compliance with nuclear safety requirements will not be subordinated to meeting cost and schedule targets.

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## Conclusions

For years DOE has faced quality assurance problems at the WTP. Upon learning in 2012 that it could not verify that engineering, procurement, and construction at the WTP met nuclear safety and quality requirements, ORP directed the contractor to implement quality assurance corrective measures to ensure that problems would be identified and prevented from recurring. However, 5 years later, the contractor has not fully implemented all planned corrective measures. Moreover, in some areas where the contractor has stated that corrective measures are now in place, ORP continues to encounter quality assurance problems similar to those it encountered in the past. When and where problems have recurred, ORP has not always required the contractor to determine the extent to which the problems may affect all parts of the WTP. By directing ORP to require the WTP contractor, where quality assurance problems

have been identified, to determine the full extent to which problems exist in all WTP structures, systems, and components, DOE will gain a comprehensive understanding of all quality assurance problems at all WTP facilities. In addition, ORP has not always used its authorities to stop work when problems are detected before they are fully corrected. Without directing ORP to use its authorities to stop work in areas where quality assurance problems are recurring until it can verify that the problems are corrected and will not recur, DOE may face future rework that could increase costs and schedule delays for the WTP.

Also of concern is the potential lack of sufficient independence of ORP's Quality Assurance Division from ORP's upper management. This has resulted in ORP upper management not always allowing its own experts to fully examine the contractor's work even when problems have recurred. At other times, this has resulted in the significance of identified problems—and strength of associated corrective measures—being reduced. DOE's ability to effectively self-regulate a high-hazard nuclear facility not only depends on vigorous oversight of the contractor by the program office but also on active oversight by an independent group. The WTP is the largest and most technically complex cleanup project managed by DOE, and we recognize that meeting its cost and schedule targets places immense pressure on ORP upper management. However, meeting those targets is further threatened when quality assurance problems are downgraded. By revising ORP's organizational structure so that the quality assurance function is independent of ORP upper management, DOE can have better assurance that compliance with nuclear safety requirements will not be subordinated to meeting cost and schedule targets.

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## Recommendations for Executive Action

We are making the following three recommendations to DOE:

The Secretary of Energy should direct ORP to require the WTP contractor to determine the full extent to which problems exist in all WTP structures, systems, and components.

The Secretary of Energy should direct ORP to use its authorities to stop work in areas where quality assurance problems are recurring until ORP's Quality Assurance Division can verify that the problems are corrected and will not recur.

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The Secretary of Energy should revise ORP's organizational structure so that the quality assurance function is independent of ORP upper management.

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## Agency Comments and Our Evaluation

We provided DOE with a draft of this report for its review and comment. In its written comments, reproduced in appendix I, DOE generally agreed with the findings in the report and its recommendations. DOE agreed with our first two recommendations and described actions it has under way and planned to address them. In addition, DOE agreed with our third recommendation—to revise ORP's organizational structure so that the quality assurance function is independent of ORP upper management—in principle. While DOE states that it believes that the current ORP quality assurance reporting relationship meets all established requirements, it also states that the report identifies instances that indicate that ORP could be strengthened to improve the effectiveness and independence of its quality assurance functions. In response to our recommendation, DOE plans to direct ORP to assess the quality assurance functional reporting lines, responsibilities, and processes to enhance the independence of the quality function from cost and schedule influences and to strengthen and clarify quality assurance reporting to the ORP Manager. This planned action is a positive first step toward implementing our recommendation.

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

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or [trimbled@gao.gov](mailto:trimbled@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff members who made major contributions to this report are listed in appendix II.



David C. Trimble  
Director, Natural Resources and Environment

## Appendix I: Comments from the Department of Energy



Department of Energy  
Washington, DC 20585

APR 11 2018

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

Dear Mr. Trimble:

The U.S. Department of Energy (DOE) has reviewed the Government Accountability Office (GAO) draft report GAO-18-241, *HANFORD WASTE TREATMENT PLANT: DOE Needs to Take Further Actions to Address Weaknesses in Its Quality Assurance Program (Job 100625)*. We appreciate the opportunity to respond to this report and its recommendations.

As the Secretary's Program Secretarial Officer for Environmental Management, I agree with Recommendations 1 and 2 in the report and agree in principle, with Recommendation 3. The DOE Office of River Protection (ORP) has an active, strong quality assurance organization staffed with well-qualified personnel operating according to approved procedures. With the identification of each significant condition adverse-to-quality, ORP quality assurance staff evaluate the significance of the condition and implement corresponding procedural requirements that require ORP contractors to determine causal factors, the extent-of-condition, and corrective actions to prevent recurrence of each significant deficiency. As a result, ORP had directed the Waste Treatment and Immobilization Plant (WTP) contractor to perform these actions for each of the significant quality assurance deficiencies cited in the GAO audit report.

Many of the quality assurance issues cited in the GAO report were complex and required a significant number of compensatory and corrective actions to fully resolve. In all cases, ORP staff has reviewed and evaluated the contractor's implemented compensatory actions and determined that a work stoppage was not warranted. The ORP staff has also reviewed the contractor's completed corrective actions for significant quality assurance issue which include actions documented within a Managed Improvement Plan (MIP). ORP staff have reviewed the identified MIP corrective actions for adequacy, monitored their implementation and completion, and performed an effectiveness review after a sufficient period of time had passed to allow demonstration of the effectiveness of the corrective action. However, the WTP contractor has not completed all MIP actions. ORP is scheduled to complete its effectiveness reviews of the remaining corrective actions after completion by the WTP contractor, and sufficient time has passed to demonstrate their effectiveness. This letter responds to each of the recommendations in the draft report and clarifies some information specifically relevant to the GAO recommendations.



***Recommendation 1: The Secretary of Energy should direct ORP to require the WTP contractor to determine the full extent to which problems exist in all WTP structures, systems, and components.***

***Management Response: Concur***

The WTP contractor has an implemented quality assurance program which requires conditions-adverse-to-quality be promptly identified, bounded, and corrected. However, the WTP contractor has not always effectively evaluated the extent of conditions as soon as practicable. This need for timely corrective actions has been identified by both the ORP and the WTP contractor, but opportunities to improve remain. While ORP previously directed the WTP contractor to perform extent-of-condition evaluations for a number of weaknesses identified in the WTP contractor quality assurance program, including the Software Quality Program, the completeness and accuracy of quality verification records, the commercial grade dedication program, and the specification of quality requirements in procurement technical specifications, the WTP contractor's extent of condition reviews, causal analyses, and identification of corrective actions have taken longer than expected. Therefore, on the Secretary's behalf and, in my role as the Assistant Secretary for Environmental Management, I will work with ORP to direct the WTP contractor to determine the full extent to which quality problems exist in all WTP structures, systems, and components and also ensure the contractor conducts an independent assessment of its corrective action program deficiencies to identify programmatic weaknesses and address those issues.

***Recommendation 2: The Secretary of Energy should direct ORP to use its authorities to stop work in areas where quality assurance problems are recurring until ORP's Quality Assurance Division can verify that the problems are corrected and will not recur.***

***Management Response: Concur***

The Secretary of Energy and the Department's senior leaders have repeatedly articulated their commitment to fostering a work environment that encourages open communication, a questioning attitude, and an organizational culture that promotes stopping work when there is concern that a situation exists that places anyone at risk or in danger. This commitment to safety and quality is implemented in ORP procedure TRS-QSH-IP-03, *Stop Work*. It gives all ORP employees the responsibility and authority to recommend stop work when they believe a potentially unrecoverable quality problem exists.

In accordance with this procedure, ORP evaluates each significant condition adverse-to-quality to determine whether stopping work is warranted. Past examples include the 2013 quality assurance effectiveness audit that identified two significant conditions adverse-to-quality and the 2015 quality assurance audit of the WTP contractor's commercial grade dedication program that also identified one significant condition adverse-to-quality. In these instances, the WTP contractor expeditiously implemented compensatory measures and identified corrective actions that were determined by ORP to

be sufficient to allow work to proceed. Therefore, ORP determined a stop work order was not necessary.

Another more recent example that occurred subsequent to the GAO performing its audit field work, ORP became aware of missing material test reports for important-to-safety structural steel. Quality assurance staff evaluated the potential significance of the condition and briefed ORP management. In accordance with TRS-QSH-IP-03, a Request for Investigation letter was issued to the WTP contractor that directed the contractor to determine the extent-of-condition, to provide a technical basis for continuation of work activities, and to identify the controls for the continued receipt, acceptance, and installation of important-to-safety items in all WTP facilities.

ORP will continue to apply effective oversight processes to ensure significant conditions adverse-to-quality are identified, the necessity for stopping work is evaluated, and the appropriate corrective actions to prevent recurrence are developed. On the Secretary's behalf, and in my role as the Assistant Secretary for Environmental Management, I will direct ORP to evaluate strengthening the existing ORP Stop Work process to ensure it is sufficiently rigorous.

***Recommendation 3: The Secretary of Energy should revise ORP's organizational structure so that the quality assurance function is independent of ORP upper management.***

***Management Response: Concur In Principle***

The Department believes that the current ORP quality assurance reporting relationship meets all established requirements. However, the GAO report does identify some instances that indicate the independence of the organization could be strengthened to improve the effectiveness and independence of ORP quality assurance functions. Based on the recommendations in the GAO report, I, in my role as the Assistant Secretary on the Secretary's behalf, will direct ORP to complete an assessment of the quality assurance functional reporting lines, responsibilities, and processes to enhance the independence of the quality function from cost and schedule influences along with strengthening and clarifying quality assurance reporting to the ORP Manager.

Thank you for the opportunity to provide the DOE perspective on draft GAO-18-0241 report regarding DOE management of quality assurance at the WTP. If you have any further questions, please contact Mr. Dae Chung, Acting Associate Principal Deputy Assistant Secretary for Field Operations, at (202) 586-1426.

Sincerely,



Anne M. White  
Assistant Secretary  
for Environmental Management

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## Appendix II: GAO Contact and Staff Acknowledgments

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### GAO Contact

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

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### Staff Acknowledgments

In addition to the contact named above, Nathan Anderson (Assistant Director), Mark Braza, Scott Fletcher, Ellen Fried, Richard Johnson, Paul Kazemersky, and Peter Ruedel made key contributions to this report.

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## Appendix III: Accessible Data

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### Agency Comment Letter

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Text of Appendix I: Comments from the Department of Energy

Page 1

David Trimble Director

Natural Resources and Environment Government Accountability Office  
441 G Street, N.W.

Washington, D.C. 20548

Dear Mr. Trimble:

The U.S. Department of Energy (DOE) has reviewed the Government Accountability Office (GAO) draft report GAO-18-241, HANFORD WASTE TREATMENT PLANT : DOE Needs to Take Further Actions to Address Weaknesses in Its Quality Assurance Program (Job 100625). We appreciate the opportunity to respond to this report and its recommendations.

As the Secretary's Program Secretarial Officer for Environmental Management, I agree with Recommendations 1 and 2 in the report and agree in principle, with Recommendation 3. The DOE Office of River Protection (ORP) has an active, strong quality assurance organization staffed with well-qualified personnel operating according to approved procedures. With the identification of each significant condition adverse-to- quality, ORP quality assurance staff evaluate the significance of the condition and implement corresponding procedural requirements that require ORP contractors to determine causal factors, the extent-of-condition, and corrective actions to prevent recurrence of each significant deficiency. As a result, ORP had directed the Waste Treatment and Immobilization Plant (WTP) contractor to perform these actions for each of the significant quality assurance deficiencies cited in the GAO audit report.

Many of the quality assurance issues cited in the GAO report were complex and required a significant number of compensatory and corrective actions to fully resolve. In all cases, ORP staff has reviewed and evaluated the contractor's implemented compensatory actions and determined that a work stoppage was not warranted. The ORP staff has also reviewed the contractor's completed corrective actions for significant quality assurance issue which include actions documented within a Managed Improvement Plan (MIP).

ORP staff have reviewed the identified MIP corrective actions for adequacy, monitored their implementation and completion, and performed an effectiveness review after a sufficient period of time had passed to allow demonstration of the effectiveness of the corrective action. However, the WTP contractor has not completed all MIP actions.

ORP is scheduled to complete its effectiveness reviews of the remaining corrective actions after completion by the WTP contractor, and sufficient time has passed to demonstrate their effectiveness. This letter responds to each of the recommendations in the draft report and clarifies some information specifically relevant to the GAO recommendations.

## Page 2

**Recommendation 1: The Secretary of Energy should direct ORP to require the WTP contractor to determine the full extent to which problems exist in all WTP structures, systems, and components.**

### **Management Response: Concur**

The WTP contractor has an implemented quality assurance program which requires conditions-adverse-to-quality be promptly identified, bounded, and corrected. However, the WTP contractor has not always effectively evaluated the extent of conditions as soon as practicable. This need for timely corrective actions has been identified by both the ORP and the WTP contractor, but opportunities to improve remain. While ORP previously directed the WTP contractor to perform extent-of-condition evaluations for a number of weaknesses identified in the WTP contractor quality assurance program, including the Software Quality Program, the completeness and accuracy of quality verification records, the commercial grade dedication program, and the specification of quality requirements in procurement technical specifications, the WTP contractor's extent of condition reviews, causal analyses, and identification of corrective actions have taken longer than expected. Therefore, on the Secretary's behalf

and, in my role as the Assistant Secretary for Environmental Management, I will work with ORP to direct the WTP contractor to determine the full extent to which quality problems exist in all WTP structures, systems, and components and also ensure the contractor conducts an independent assessment of its corrective action program deficiencies to identify programmatic weaknesses and address those issues.

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**Management Response: Concur**

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Page 3

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**Recommendation 3: The Secretary of Energy should revise ORP's organizational structure so that the quality assurance function is independent of ORP upper management.**

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The Department believes that the current ORP quality assurance reporting relationship meets all established requirements. However, the GAO report does identify some instances that indicate the independence of the organization could be strengthened to improve the effectiveness and independence of ORP quality assurance functions. Based on the recommendations in the GAO report, I, in my role as the Assistant Secretary on the Secretary's behalf, will direct ORP to complete an assessment of the quality assurance functional reporting lines, responsibilities, and processes to enhance the independence of the quality function from cost and schedule influences along with strengthening and clarifying quality assurance reporting to the ORP Manager.

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Sincerely,

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Anne M. White Assistant Secretary  
for Environmental Management

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