



OFFICE OF INSPECTOR GENERAL

U.S. Department of Energy

# AUDIT REPORT

DOE-OIG-20-44

June 2020

**THE DEPARTMENT OF ENERGY'S  
MANAGEMENT OF CLEANUP AT THE  
PADUCAH SITE'S C-400 COMPLEX**



**Department of Energy**  
Washington, DC 20585

June 8, 2020

MEMORANDUM FOR THE MANAGER, PORTSMOUTH/PADUCAH PROJECT OFFICE

A handwritten signature in black ink, appearing to read "Jennifer L. Quinones".

FROM: Jennifer L. Quinones  
Assistant Inspector General  
for Audits  
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on "The Department of Energy's  
Management of Cleanup at the Paducah Site's C-400 Complex"

BACKGROUND

The C-400 complex at the Paducah Site in Paducah, Kentucky includes the 134,000 square-foot C-400 building and surrounding areas. The C-400 building had been used in a variety of functions to support operations at the plant but was primarily used to clean parts and equipment from the uranium enrichment process buildings using a hazardous solvent containing trichloroethylene. The Paducah Site contains the largest offsite trichloroethylene groundwater plumes in the Department of Energy's complex, and releases beneath the C-400 building are the primary ongoing source to the plumes. In 2016, the Department proposed to accelerate the investigation and cleanup of the C-400 complex for all sources of contamination associated with the C-400 building and associated structures.

In August 2017, the Department entered into a Memorandum of Agreement with the environmental regulators who oversee the Paducah cleanup through a Federal Facilities Agreement (FFA). Paducah's FFA, a tri-party agreement between the Department, the U.S. Environmental Protection Agency (EPA), and the Kentucky Department of Environmental Protection, governs the site's corrective and response actions, from site investigation through site remediation, as agreed upon by the three parties. The Memorandum of Agreement outlined the tri-party agreement to accelerate the investigation of all remaining contaminants under and around the C-400 building and set forth a timeline for C-400 cleanup activities to be completed and/or started between 2019 and 2024. Near-term activities, which are those with completion dates or milestones in 2019 and 2020, included the deactivation, building demolition, and commencement of remedial investigations of the C-400 building. We initiated this audit to determine if the Department was on track with cleanup activities at the Paducah Site's C-400 building and surrounding areas.

## RESULTS OF AUDIT

We determined that the Department was not on track with cleanup activities at the C-400 complex. Specifically, the Department had not yet completed the C-400 building deactivation, had postponed the building demolition, and had re-aligned the start of remedial investigation to begin prior to the building demolition. While the project encountered some minor delays, we noted two events that impacted the schedule more significantly. In one particular event, a contractor error resulted in a 15-week work pause in the C-400 work. The second delay resulted from one of the disputes the Department and a regulator had on policy issues related to the cleanup. In this case, one area of dispute delayed deactivation activities and demolition plans for 1 year.

### **Status of C-400 Near-Term Cleanup Activities**

The Department had experienced delays with the first of the near-term activities described in the 2017 Memorandum of Agreement. Deactivation, the process necessary to place the building in a safe, stable condition and prepare it for demolition, was about 18 months behind schedule as of November 2019, and was planned to be completed in April 2020.<sup>1</sup> Impacts to the deactivation schedule included a 15-week work pause due to a January 2018 pipe cutting incident that released the corrosive gas hydrogen fluoride. The Department halted deactivation activities and required the contractor to prepare a corrective action plan. After the Department agreed with the contractor's corrective actions, the contractor resumed deactivation work in April 2018. Portions of project deactivation activities and demolition plans were again delayed, this time by more than 1 year, when the Department initiated disputes with its regulators over cleanup decisions at the C-400 building. After months of discussions, the Department rescoped the deactivation activities in October 2019.

The remaining near-term project schedules were also impacted. In the 2017 Memorandum of Agreement, the Department set forth its plan to demolish the C-400 building in fiscal year 2019 after deactivation was completed. However, due to the 2018 disagreements with its regulators, the Department now plans to start demolition activities in 2025, and to perform the remedial investigation after deactivation, though prior to the demolition of the building.

### **Contractor Processes and Consensus with Regulators**

The delays in the C-400 near-term cleanup actions were caused, in part, by deficiencies in the contractor's work processes, and the inability of the Department and its regulators to reach a consensus on some of the C-400 activities.

#### **Contractor Processes**

The C-400 cleanup work was delayed initially because of the contractor's inexperience at the site and deficiencies in its work processes. Specifically, the root cause analysis conducted by the contractor concluded that the hydrogen fluoride release occurred as a result of knowledge-based

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<sup>1</sup> Due to these delays and those caused by COVID-19, the C-400 deactivation is now expected to be completed in September 2020.

human error in the management, work organization, planning, and execution of the removal activities at the site. The error was attributed to the contractor's work planning and control processes not being robust enough to ensure instructions and supporting documents were developed adequately for use during the removal of process system items from the C-400 building. Subsequent to the incident, the contractor implemented its corrective action plan and initiated a "projectized" approach to the cleanup, which is a method used in the Department to institute more accountability and control.

### **Consensus with Regulators**

In addition to contractor issues, further delays were caused, in part, by the arrangement governing the C-400 building cleanup and the requirement to obtain its regulators' consensus on some of the activities. In accordance with the tri-party FFA, the Department, State, and Federal regulators all must agree on certain cleanup actions at the site. However, not all the C-400 actions were governed by the FFA. Specifically, the C-400 deactivation was not covered under the FFA, but demolition and remedial investigation activities were covered. Accordingly, the Department independently established and implemented a deactivation strategy. As deactivation progressed, the Department submitted its demolition plan and other required demolition documents to the regulators. While the Kentucky Department of Environmental Protection approved the demolition plan, the EPA did not agree to it and expressed concerns about the deactivation end-state, or demolition-ready condition of the building. In particular, the EPA did not agree with the Department's plan of filling the building's basement and subgrade areas with a cementitious mixture called "flowable fill" during deactivation and then demolishing the building down to the above-grade slab. The Department disagreed with the EPA's position and halted deactivation work activities associated with the dispute while seeking a resolution. The inability to reach agreement on this dispute also impacted progress on resolving issues contained in the other required demolition documents.

While the Department was not required to obtain the regulators' concurrence on deactivation activities, we believe that it was in the Department's best interest to mitigate potential disagreements that could impact the project. The Department's deactivation guide recommends that when third parties, such as the State and Federal regulators overseeing C-400 work, have a stake in the condition of the facility after deactivation, then a consensus on the end points helps reduce scope, cost, and schedule changes, and ensures an improved level of satisfaction by stakeholders. Yet, in this case, the Department did not seek assurance that the regulators agreed with the deactivation end point of the C-400 building. Instead, the Department contends that it submitted plans as agreed upon in the August 2017 Memorandum of Agreement, which included agreement to demolish to the above-grade slab. The Department also specified that the use of flowable fill was a standard practice at the site, and that the regulators had known of and agreed to the use of flowable fill in previous building demolition activities at the site.

### **Historical Disputes at Paducah Site**

This regulator disagreement was not an isolated incident, but rather another example of historic disputes between the Department and the regulators at Paducah. In fact, these disputes, and the detrimental effect they have had on cleanup work, had been reported as far back as 2000. For example, the Government Accountability Office reported in 2000 that the regulators had disagreed with the Department's approaches on several issues and that assumptions of agreement

on other cleanup strategies were optimistic. In 2004, the Government Accountability Office again reported that the Department and the regulators had difficulty agreeing on an overall cleanup approach, concluding that unless the Department and the regulators could reach agreement and quickly resolve technical differences, progress at Paducah would continue to be delayed. Although the Government Accountability Office had made recommendations to address this, we found in 2015 that the same issues were still occurring. Specifically, we reported on the Department's lack of progress on cleaning up some of the facility's key environmental hazards and determined that the lack of progress was due, in part, to the inability of the Department and its regulators to reach timely agreement on cleanup decisions for the Paducah Site.

## **Impact**

It is too early to determine the full impact that the dispute between the Department and the EPA will have on this high priority project and the schedule for its out-year activities. Nonetheless, continued indecision on the C-400 cleanup may delay the Department's ability to remedy the most significant contributor to groundwater contamination at the Paducah Site. The dispute over the use of flowable fill during deactivation was not the only dispute over demolition activities at the site. Those issues will also have to be resolved prior to beginning eventual demolition of the building. The Department justified reprioritizing the site's milestones because it wanted to better understand the sources of contamination beneath the C-400 building and their associated risks. According to the Department's plume projections, the highest groundwater concentration levels of trichloroethylene are now mostly contained within the site boundary. We noted that concentration levels of trichloroethylene are still highest under and around the C-400 building, despite the Department's groundwater cleanup remedies used during the C-400 Interim Remedial Action to address this contamination in the past.

In addition, the risks associated with deferring the building's demolition until 2025 may unnecessarily increase risks to workers and the environment. In its 2018 demolition plan, the Department detailed the structural instability of the building's deteriorating condition and stated that demolition would reduce the risk of exposure to workers located near this facility. Further, the Department conveyed that building degradation over time and possible damage from a weather-related event would make repairs more difficult, thereby increasing the probability of a contaminant release. The Department concluded that the controlled demolition of this facility would ensure that risks to human health and the environment from actual or potential exposure to hazardous substances, including radiological contamination, are reduced or eliminated. Due to the new schedule, these risks will be ongoing until the building is demolished.

## **RECOMMENDATIONS**

We recommend that the Manager, Portsmouth/Paducah Project Office:

1. Ensure that the contractor has robust work planning and control processes in place for the remaining C-400 cleanup activities; and

2. Obtain regulators' insight and understanding, where appropriate, on the end-state of deactivation projects when the regulators have a stake in the condition of the facility after deactivation.

### MANAGEMENT RESPONSE

Management concurred with the report's recommendations and provided its planned corrective actions. In the response, the Manager, Portsmouth/Paducah Project Office, recognized that the cleanup of trichloroethylene in the C-400 Complex had experienced delays over the years; however, he noted that significant reductions in the concentration levels, around 96 to 97 percent, have occurred over the last 20 years.

### AUDITOR COMMENTS

Management's comments and planned corrective actions are responsive to our recommendations.

Management's comments are included in Attachment 3.

### Attachments

cc: Chief of Staff  
Senior Advisor for Environmental Management to the Under Secretary for Science

## **OBJECTIVE, SCOPE, AND METHODOLOGY**

### OBJECTIVE

We initiated this audit to determine if the Department of Energy was on track with cleanup activities at the Paducah Site's C-400 building and surrounding areas.

### SCOPE

We conducted this audit between April 2019 and March 2020. We performed fieldwork at the Paducah Site in Paducah, Kentucky. We focused our work on the Department's cleanup activities at the C-400 complex over the last 4 years. This audit was conducted under Office of Inspector General project number A19OR012.

### METHODOLOGY

To accomplish the audit objective, we:

- Reviewed regulations, directives, contract requirements, and performance measures related to the cleanup of the C-400 complex;
- Analyzed prior audits and reviews related to cleanup at the Paducah Site;
- Reviewed regulatory documents;
- Discussed cleanup activities with Department and contractor personnel;
- Reviewed the projected schedule for completion of cleanup activities at the C-400 building under the August 2017 Memorandum of Agreement; and
- Identified the status of cleanup milestones for the C-400 complex.

We conducted this performance audit 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 objective. Accordingly, we assessed internal controls and compliance with laws and regulations to the extent necessary to satisfy the audit objective. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our audit. Finally, computer-processed data did not materially support the findings, conclusions, or recommendations of the audit objective, and therefore, we did not perform a reliability assessment.

Management waived the exit conference on May 15, 2020.

## RELATED REPORTS

### Office of Inspector General

- Audit Report on [\*The Status of Cleanup at the Department of Energy's Paducah Site\*](#) (DOE/IG-0937, June 2015). The audit disclosed that while the Department of Energy had achieved some of its cleanup goals at the Paducah Site, progress had been delayed on cleaning up some of the facility's key environmental hazards. Notably, work on two of the Paducah Site's most significant hazards remained to be completed: a remedy for the final phase of the C-400 groundwater cleanup project and remediation plans for the Burial Grounds Operable Unit. The impact of technical challenges and budget constraints was clear; however, the lack of progress on these two projects was also due, in part, to the inability of the Department to reach a timely agreement with the regulators on cleanup decisions at the Paducah Site.

### Government Accountability Office

- Audit Report on [\*NUCLEAR WASTE CLEANUP: DOE Has Made Some Progress in Cleaning Up the Paducah Site, but Challenges Remain\*](#) (GAO-04-457, April 2004). The Government Accountability Office (GAO) reported that the Department and its regulators had difficulty agreeing on an overall cleanup approach, as well as on the details of specific projects. GAO observed that, over time, those disagreements had undermined trust and damaged the parties' working relationship. To help improve the likelihood that the Department and its regulators would reach timely agreement on the cleanup approach, GAO recommended that the Department involve the Environmental Protection Agency and the Commonwealth of Kentucky early in the development of both overall cleanup plans and specific projects to resolve concerns. GAO also recommended that the Department, in conjunction with the Environmental Protection Agency and the Commonwealth of Kentucky, identify external technical peer review groups with environmental cleanup expertise to facilitate timely resolution of future differences.
- Audit Report on [\*NUCLEAR WASTE CLEANUP: DOE's Paducah Plan Faces Uncertainties and Excludes Costly Cleanup Activities\*](#) (GAO/RCED-00-96, April 2000). GAO found that a number of technical, financial, and regulatory factors associated with the implementation of the cleanup plan made it uncertain whether the Department could complete the cleanup in accordance with its plan. Uncertainties existed about the nature and extent of contamination and the feasibility of available cleanup technologies. In addition, assumptions about the availability of Federal funding and the timeliness of stakeholders' agreement with cleanup levels and strategies could affect the Department's ability to meet the plan's milestones. The plan contained optimistic assumptions about reaching timely agreement with regulators on issues such as cleanup levels, strategies, and priorities. Collectively, the number and nature of the uncertainties and assumptions made it doubtful that Paducah's cleanup would be completed within its planned time frame and estimated cost.



## MANAGEMENT COMMENTS

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(3/02)

United States Government

Department of Energy  
Portsmouth/Paducah Project Office

## memorandum

DATE: MAY 08 2020

REPLY TO  
ATTN OF: PPPO: Edwards

PPPO-01-10004728-20

SUBJECT: **MANAGEMENT RESPONSE TO THE OFFICE OF INSPECTOR GENERAL DRAFT  
AUDIT REPORT ON THE DEPARTMENT OF ENERGY'S MANAGEMENT OF  
CLEANUP AT THE PADUCAH SITE'S C-400 COMPLEX**

TO: Jennifer L. Quinones, Assistant Inspector General for Audits, Office of Inspector General, IG-30

Reference: Letter from J. Quinones to R. Edwards, "Draft Audit Report on 'The Department of Energy's Management of Cleanup at the Paducah Site's C-400 Complex,'" dated March 25, 2020

The Department of Energy Portsmouth/Paducah Project Office (PPPO) has reviewed the subject 2020 draft report and appreciates the recognition that PPPO is focused on the comprehensive cleanup of the source (C-400 Complex) of the offsite groundwater plume at Paducah. PPPO appreciates the opportunity to provide additional information and considers the report more complete as a result.

PPPO recognizes that the cleanup of trichloroethylene (TCE) in the C-400 Complex has experienced delays over the years; however, significant reductions in the concentration levels have occurred over the last twenty years. Between 2000 and 2003, the TCE concentrations ranged from 1,000 – 230,000 parts per billion (ppb). As compared to the 2015 to 2019 timeframe, the TCE concentrations in the same area ranged from 30 – 10,250 ppb. This change represents a 96% - 97% reduction in concentration levels. During this time, PPPO has also removed approximately 3,500 gallons of TCE from the same areas.

Response to Recommendations: PPPO concurs with the recommendations in the report and intends on taking the following actions:

1. PPPO agrees that the contractor must have robust work planning and control processes. PPPO has been monitoring the contractor's processes, attending the planning meetings, and providing feedback to the contractor. Additionally, EM Headquarters is currently performing an assessment of the contractor's work planning and control processes.
2. PPPO intends to continue ongoing discussions with stakeholders related to the project progress along with providing updates to the stakeholders, which includes the regulators. These interactions provide the stakeholders with the opportunities to ask questions and provide input.

PPPO appreciates the opportunity to submit this response for inclusion in the final audit report.



Robert E. Edwards, III  
Manager  
Portsmouth/Paducah Project Office

## **FEEDBACK**

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