



Independent Assessment of the Transuranic Waste All-Hazards Planning Basis at the Hanford Site

December 2023

Office of Enterprise Assessments
U.S. Department of Energy

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Acronyms

AHS	All-Hazards Survey
CPCCo	Central Plateau Cleanup Company
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
EAL	Emergency Action Level
EPHA	Emergency Planning Hazards Assessment
EPZ	Emergency Planning Zone
FHA	Fire Hazards Analysis
Hanford	Hanford Site
OFI	Opportunity for Improvement
PA	Protective Action
PAC	Protective Action Criteria
PE-Ci	Plutonium Equivalent Curie
RL	DOE Richland Operations Office
RLEP	RL Emergency Plan Implementing Procedure
TRU	Transuranic

INDEPENDENT ASSESSMENT OF THE TRANSURANIC WASTE ALL-HAZARDS PLANNING BASIS AT THE HANFORD SITE

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the all-hazards planning basis for transuranic (TRU) waste operations at the Hanford Site during August 2023. This assessment evaluated the effectiveness of both the DOE Richland Operations Office (RL) and its management and operating contractor, Central Plateau Cleanup Company (CPCCo), in developing and maintaining the all-hazards planning basis for TRU waste operations.

The all-hazards planning basis includes development and maintenance of all-hazards surveys (AHSs) and emergency planning hazards assessments (EPHAs). DOE Order 151.1D, *Comprehensive Emergency Management System*, identifies requirements for the all-hazards planning basis, and the associated emergency management guide provides guidance for implementing the requirements. CPCCo and RL procedures governing all-hazards planning and the associated AHS have been updated to incorporate current requirements; however, the EPHA is still based on DOE Order 151.1C requirements. CPCCo is expected to fully implement DOE Order 151.1D during 2024. As a result, procedures and the AHS were evaluated against DOE Order 151.1D, while the EPHA was evaluated against DOE Order 151.1C.

EA focused primarily on hazards identification and screening and the documented analysis for supporting the development of response plans, emergency action levels, predetermined protective actions, and sizing of the emergency planning zone. EA also evaluated the utility of the EPHA as a reference for a consequence assessment team when conducting dispersion modeling of analyzed release scenarios.

EA identified the following strengths:

- CPCCo and RL have developed procedures that are accurate, complete, and compliant. The procedures define adequate processes for effectively implementing the all-hazards planning basis requirements of DOE Order 151.1D.
- CPCCo has prepared formal training qualification cards for emergency preparedness analysts and hazardous chemical screeners.
- CPCCo has prepared, and RL has approved, an EPHA for facilities where TRU waste is generated, stored, and packaged for shipping that effectively implements the applicable requirements of DOE Order 151.1C. With the exception of four fire scenarios, the EPHA is technically accurate and provides information to support the development of response plans, emergency action levels, predetermined protective actions, protective action recommendations, and sizing of the emergency planning zone. In addition, the EPHA provides the data, methods, and assumptions needed for a consequence assessment team to replicate the analysis in response to an incident.

EA also identified the following finding involving the CPCCo EPHA:

- The CPCCo EPHA does not accurately identify the potential consequences of unplanned releases of hazardous materials for some fire scenarios due to the use of non-conservative heat release values. (Finding)

In summary, aside from the identified finding, RL and CPCCo have developed an all-hazards planning basis for TRU waste operations that meets DOE requirements to support the development of response plans, emergency action levels, predetermined protective actions, and sizing of the emergency planning zone. Additionally, the CPCCo EPHA provides pertinent information to support incident analysis by a

consequence assessment team. Until the concern identified in this report is addressed, potential inadequacies may exist in key facets of the Hanford TRU waste operations emergency preparedness program, such as incident classification, predetermined onsite protective actions (PAs), and offsite PA recommendations for some fire incidents.

INDEPENDENT ASSESSMENT OF THE TRANSURANIC WASTE ALL-HAZARDS PLANNING BASIS AT THE HANFORD SITE

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Emergency Management Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the all-hazards planning basis for transuranic (TRU) waste operations at the Hanford Site (Hanford). The all-hazards planning basis includes the development and maintenance of all-hazards surveys (AHSs) and emergency planning hazards assessments (EPHAs). EA conducted this assessment as part of a series of assessments of the TRU waste all-hazards planning basis for sites that make shipments to DOE's Waste Isolation Pilot Plant. Onsite assessment activities were conducted August 15, 2023.

The DOE Richland Operations Office (RL) and its management and operating contractor, Central Plateau Cleanup Company (CPCCo) are responsible for the development of the all-hazards planning basis for TRU waste operations. The all-hazards planning basis is used to develop response plans, emergency action levels (EALs), predetermined onsite protective actions (PAs), offsite PA recommendations, and the Hanford emergency planning zone (EPZ). The assessment evaluated the effectiveness of both RL and CPCCo in developing and maintaining the all-hazards planning basis and its utility for use by a consequence assessment team for TRU waste operations at the Hanford Central Waste Complex/Low-Level Burial Ground.

This assessment was conducted in accordance with the *Plan for the Independent Assessment of the Transuranic Waste All-Hazards Planning Basis at the Hanford Site, July 2023-November 2023*. A deviation from the assessment plan occurred once EA identified that CPCCo's EPHA was written to DOE Order 151.1C, not to DOE Order 151.1D, *Comprehensive Emergency Management System*, requirements.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which EA implements through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms "best practices, deficiencies, findings, and opportunities for improvement (OFIs)" as defined in the order.

As identified in the assessment plan, this assessment considered requirements related to DOE Order 151.1D, *Comprehensive Emergency Management System*. EA also used section 4.2, *All Hazards Planning Basis*, of Criteria and Review Approach Document 33-09, Revision 0, DOE Order 151.1D *Emergency Management Program*, and considered the guidance provided in DOE Guide 151.1-1B, *Comprehensive Emergency Management System Guide*. During the assessment, EA learned that Hanford is in a transition stage regarding implementation of DOE Order 151.1D. CPCCo procedure CPCC-STD-EM-54759, *Hazards Surveys and Emergency Planning Hazards Assessments*, and RL Emergency Plan Implementing Procedure (RLEP) procedures RLEP 3.27, *Hazard Surveys*, and RLEP 3.22, *Emergency Planning Hazard Assessments*, have been updated to incorporate DOE Order 151.1D requirements. The AHS for facilities operated by CPCCo at Hanford has been updated to incorporate the requirements of DOE Order 151.1D; however, the CPCCo EPHA is still based on DOE Order 151.1C requirements. The RL contracting officer issued a letter to CPCCo in January 2023 directing implementation of DOE Order 151.1D. A *Hanford Site Implementation Plan for Implementation of DOE Order 151.1D* indicates that

CPCCo will incorporate DOE Order 151.1D criteria as current EPHAs are revised. The RL Emergency Preparedness Program Manager indicated that the CPCCo EPHA is due to be revised during 2024 with the DOE Order 151.1D requirements implemented. As a result, the EPHA was assessed to the requirements in DOE Order 151.1C.

EA examined key documents, such as CPCCo's procedures for developing and maintaining AHSs and EPHAs; the AHS and EPHA for facilities where TRU waste is generated or stored; the documented safety analysis (DSA) for the reviewed facilities; and other relevant programmatic documentation supporting the preparation of the all-hazards planning basis. EA visited Hanford waste facilities and interviewed key personnel responsible for TRU waste operations and the development of all-hazards planning basis documents, including Central Waste Complex operations personnel. The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

There were no previous findings for follow-up addressed during this assessment.

3.0 RESULTS

3.1 Procedures

This portion of the assessment determined whether RL and CPCCo procedures provide clear and appropriate guidance for developing, documenting, and maintaining the AHSs and EPHAs, including identifying roles and responsibilities for review and approval. The AHS and EPHA procedures are applicable to all hazards at the site, including TRU waste.

The AHSs and EPHAs for CPCCo-managed Hanford facilities are prepared or reviewed by a CPCCo emergency preparedness analyst who has completed the *Emergency Preparedness Analyst Qualification Card* training program. RL and CPCCo have developed and implemented an adequate set of program documents for developing and maintaining a technically based emergency management program that meets DOE Order 151.1D requirements. Together, CPCCo procedure CPCC-STD-EM-54759, RLEP 3.27, RLEP 3.22, and RLEP 3.21, *Emergency Action Levels*, implement the technical and administrative requirements for the development of AHSs, EPHAs, EALs, EPZs, and predetermined PAs. The procedures are compliant with DOE Order 151.1D and provide guidance for developing, documenting, and maintaining AHSs and EPHAs, including identifying roles and responsibilities for review and approval.

The RL and CPCCo AHS development and maintenance procedures, RLEP 3.27 and CPCC-STD-EM-54759, provide a systematic process to identify, record, and screen facility hazards. The procedures provide adequate guidance on identifying and estimating hazardous material release scenarios, both man-made and those associated with natural phenomena, in terms of type, quantity, and form of radioactive and other hazardous materials. The procedures provide a clear description of the hazardous materials screening process and their application to the hazardous materials in a facility for AHS and EPHA development, and the CPCCo procedure also requires personnel assigned to screen hazardous materials to complete the *Hazardous Chemical Material Screener Qualification Card* training program. The hazardous materials screening process requires the identification of all hazardous materials (i.e., radiological, chemical, explosives, and hazardous biological agents and toxins) in a facility for a qualitative assessment based on the DOE screening criteria. Although it is not mentioned in the CPCCo hazard survey procedure, RLEP 3.27 includes language that requires active hazard surveys to be updated from DOE Order 151.1C to DOE Order 151.1D requirements when they are revised.

The RL and CPCCo EPHA development and maintenance procedures, RLEP 3.22 and CPCC-STD-EM-54759, provide accurate and complete guidance for preparing an EPHA that defines the provisions of the emergency management hazardous materials program, as required by DOE Order 151.1D. The procedures require a quantitative analysis of all hazardous materials identified for further analysis in the AHS; provides correct criteria for excluding hazardous materials from further analysis in the EPHA; identifies receptors of interest for consequence projections; and provides source term determination instructions that effectively establish conservative material-at-risk quantities. In addition, the procedure appropriately defines conservative and average meteorological conditions and includes PA guides for both radioactive and chemical hazardous materials. Finally, the procedure effectively describes the establishment of a spectrum of potential emergency incident scenarios for analysis in the EPHA.

Both the AHS and EPHA development and maintenance procedures appropriately require facility management and suitable technical expert involvement in developing, reviewing, and approving AHSs and EPHAs. Following the contractor's approval, the EPHA is formally submitted to RL for DOE review and approval. Furthermore, the procedures have adequate maintenance provisions that require AHSs and EPHAs to be reviewed after any update to the facility's safety basis documents and updated prior to significant changes to the facility/site operations or to hazardous material inventories, but not less than every three years, as required by DOE Order 151.1D.

Procedures Conclusions

RL and CPCCo have prepared procedures that are compliant with DOE Order 151.1D and provide accurate guidance for developing, documenting, and maintaining the all-hazards planning basis.

3.2 All-Hazards Survey

This portion of the assessment determined whether the AHS prepared by CPCCo and approved by RL identifies all the hazards applicable to TRU waste operations and establishes the appropriate input for the all-hazards planning basis of the emergency management program.

CPCCo prepared, and RL approved, AHS CPCC-EM-67489, *Hazards Survey for the Central Plateau Cleanup Company*, which covers all facilities managed by CPCCo at Hanford. The CPCCo AHS is consistent with DOE Order 151.1D and Hanford procedural requirements.

The results of the AHS are informative and technically sound, consistent with DOE guidance, and were prepared in accordance with the RL and CPCCo AHS development and maintenance procedures, RLEP 3.27 and CPCC-STD-EM-54759. The AHS accurately describes the chemical and radiological hazards applicable to TRU waste operations. In addition, the AHS identifies and documents the generic types of potential emergency conditions and the impacts to which TRU operations facilities may be exposed (i.e., fire, explosion, loss of confinement, natural phenomena, malevolent act, and external hazards). The hazardous materials and emergency conditions identified in the AHS are consistent with those identified in the facility DSA.

All-Hazards Survey Conclusions

CPCCo has effectively prepared, and RL has approved, a complete and accurate AHS for TRU waste operations at Hanford facilities where TRU waste is generated, stored, and packaged for shipping. The AHS identifies all applicable hazards, establishes the planning basis for the emergency management program, and complies with DOE Order 151.1D requirements.

3.3 Emergency Planning Hazards Assessment

This portion of the assessment determined whether the CPCCo EPHA defines the provisions of the emergency management hazardous materials program and provides the basis for establishing a graded approach that meets the hazardous material program requirements in DOE Order 151.1C.

CPCCo prepared, and RL approved, CPCC-EM-65991, *Emergency Planning Hazards Assessment for the Central Waste Complex/Low-Level Burial Grounds*, which is consistent with DOE Order 151.1C and procedural requirements for Hanford facilities where TRU waste is generated, stored, and packaged for shipping. The EPHA includes an analysis of a comprehensive set of accident scenarios that are consistent with facility operational activities and the facility DSA. The EPHA contains a current and accurate compilation of hazardous material maximum quantities associated with TRU waste operations and the analyses of scenarios ranging from low consequence and high probability to high consequence and low probability. The EPHA includes an appendix outlining the EAL changes that will be required when DOE Order 151.1D requirements are implemented.

The release of or loss of control of hazardous materials is quantitatively analyzed in the EPHA as required by DOE Order 151.1C; however, contrary to DOE Order 151.1C, attachment 2, paragraph 3.b.(1), the EPHA does not accurately identify the potential consequences from some unplanned releases of hazardous materials due to the use of non-conservative heat release rates for four of six fire scenarios. (See **Finding F-CPCCo-1**.) The fuel pool fires modeled in the EPHA use heat release rates calculated in HNF-21239, *Solid Waste Operations Complex Fire Hazards Analysis (FHA)*. The FHA describes a fuel pool fire as involving an initial heat output that is very high and short (i.e., about 115 seconds), followed by the burning of the drum contents with a much lower heat release rate, similar to a trash fire. The EPHA modeling does not account for the lower heat release rates that would be encountered during the progression of the fire, which makes the dose calculations at ground level non-conservative due to a higher-than-expected effective release height and increased atmospheric dispersion. Although different models were used with different assumptions and parameters, the doses calculated using the non-conservative heat release rates are five to eight orders of magnitude lower than doses calculated for fires involving similar source terms in the facility DSA. Consequently, the EPHA does not accurately identify potential consequences for some fire events, which may result in potential inadequacies in key facets of CPCCo's emergency preparedness program, such as incident classification, predetermined onsite PAs, and offsite PA recommendations for some emergency incidents.

The source term for each scenario involving TRU waste was appropriately converted to an equivalent isotope to facilitate dispersion modeling calculations; for all scenarios, the source terms were converted into plutonium-240 equivalent. For fire scenarios, the source term quantities decrease as the number of drums in each scenario increases, resulting in lower consequences for a multiple container scenario than for a comparable scenario involving a single container. (See **OFI-CPCCo-1**.) For example, an outside fire involving a single TRU drum has a source term of 1.57 plutonium equivalent curies (PE-Ci), while a medium outside fire involving 60 TRU drums has a source term of 0.526 PE-Ci, and a large outside fire involving 974 TRU drums has a source term of 0.347 PE-Ci. Decreasing source terms and consequences as the number of drums increases produces counterintuitive results, which can pose problems for emergency planning and response.

EPHA calculations use the appropriate protective action criteria (PAC) and threshold for early lethality (TEL) of 1 rem and 100 rem for radioactive material, as stated in the EPHA development procedure, RLEP 3.22. Consequences were calculated for receptors of interest using the HotSpot dispersion-modeling program using modeling parameters outlined in RLEP 3.22; however, the procedure does not contain guidance on development of heat release values when using the HotSpot general fire model. (See **OFI-CPCCo-1**.) The EPHA uses the results of dispersion modeling calculations, including the distance

at which the PAC is projected to be exceeded and the consequences for receptors of interest under both conservative and average meteorological conditions, to determine incident classification and predetermined PAs. Calculations are made for the distances to the PAC, as well as the consequences for receptors of interest under both severe and average meteorological conditions. Modeling parameters used in EPHA calculations are documented in the EPHAs and are consistent with guidance in RLEP 3.22.

Emergency Planning Hazards Assessment Conclusions

The CPCCo EPHA results are consistent with DOE guidance and are accurate and technically sound. The EPHA clearly identifies the hazardous materials that were analyzed, how the results were formulated, and how the results relate to facility operations and configurations in a way that can be replicated and effectively used by Hanford consequence assessment personnel during an Operational Emergency response. However, the EPHA does not accurately identify the potential consequences of unplanned releases of hazardous materials for some fire scenarios Hanford Mission Integration Solutions, LLC has used the results of the EPHA in developing response plans, EALs, PAs, and EPZ sizing for Hanford EPHA facilities.

4.0 BEST PRACTICES

No best practices were identified during this assessment.

5.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*, to manage the corrective actions and track them to completion.

Central Plateau Cleanup Company

Finding F-CPCCo-1: The CPCCo EPHA does not accurately identify the potential consequences from some unplanned fire dispersion scenarios of hazardous materials for development of EALs, predetermined PAs, and sizing of the EPZ. (DOE Order 151.1C, att. 2, par. 3.b.(1))

6.0 DEFICIENCIES

No deficiencies were identified during this assessment.

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified the OFI shown below to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may also address other conditions observed during the assessment process. This OFI is offered only as a recommendation for line management consideration; it does not require formal resolution by

management through a corrective action process and is not intended to be prescriptive or mandatory. Rather, it is a suggestion that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

Central Plateau Cleanup Company

OFI-CPCCo-1: To improve the technical planning basis, consider:

- Revising source term calculations in CPCC-EM-65991 to provide an increase in the material at risk as the number of containers involved in the scenario increases.
- Providing guidance to EPHA analysts on the development of heat release rates for fire events that are consistent with the FHA.

Appendix A Supplemental Information

Date of Assessment

Onsite Assessment: August 15, 2023

Office of Enterprise Assessments (EA) Management

John E. Dupuy, Director, Office of Enterprise Assessments
William F. West, Deputy Director, Office of Enterprise Assessments
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments
David A. Young, Deputy Director, Office of Environment, Safety and Health Assessments
Thomas E. Sowinski, Director, Office of Nuclear Safety and Environmental Assessments
Kimberly G. Nelson, Director, Office of Worker Safety and Health Assessments
Jack E. Winston, Director, Office of Emergency Management Assessments
Brent L. Jones, Director, Office of Nuclear Engineering and Safety Basis Assessments

Quality Review Board

William F. West, Advisor
Kevin G. Kilp, Chair
Thomas C. Messer
Brent L. Jones
Michael A. Kilpatrick

EA Assessment Team

Dr. Wade W. Gough, Lead
Robert F. Gee
Jonathan L. Pack