Independent Assessment of Interim Storage of Spent Nuclear Fuel at the Idaho Cleanup Project

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Office of Enterprise Assessments
U.S. Department of Energy

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Acronyms

CM	Corrective Maintenance
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
DOE-ID	DOE Idaho Operations Office
EA	Office of Enterprise Assessments
FR	Facility Representative
ICP	Idaho Cleanup Project
IEC	Idaho Environmental Coalition, LLC
IFSF	Irradiated Fuel Storage Facility
INTEC	Idaho Nuclear Technology and Engineering Center
ISI	In-service Inspection
LCO	Limiting Condition for Operation
M&TE	Measuring and Test Equipment
NMMP	Nuclear Maintenance Management Program
PM	Preventive Maintenance
SAC	Specific Administrative Control
SE	System Engineer
SNF	Spent Nuclear Fuel
SR	Surveillance Requirement
SSCs	Structures, Systems, and Components
TSR	Technical Safety Requirement
WO	Work Order

INDEPENDENT ASSESSMENT OF INTERIM STORAGE OF SPENT NUCLEAR FUEL AT THE IDAHO CLEANUP PROJECT

Executive Summary

The U.S. Department of Energy Office of Enterprise Assessments (EA) conducted an independent assessment to evaluate the effectiveness of nuclear safety programs and controls implemented to ensure the safe interim storage of spent nuclear fuel (SNF) at the Idaho Cleanup Project (ICP). The assessment, conducted in October 2022, focused on the SNF that is in a dry storage configuration at three Idaho Nuclear Technology and Engineering Center (INTEC) facilities at ICP: CPP-603 Irradiated Fuel Storage Facility, CPP-749 Underground Fuel Storage Facility, and CPP-2707 Outdoor Fuel Storage Facility. The INTEC facilities are managed and operated by Idaho Environmental Coalition, LLC (IEC) for the Office of Environmental Management and overseen by the DOE Idaho Operations Office (DOE-ID). EA also reviewed the effectiveness of DOE-ID oversight of the SNF activities at INTEC.

EA identified the following strengths:

- Operators implementing technical safety requirement controls were knowledgeable of each control's purpose and importance.
- In-service inspection program requirements for SNF storage-related safety significant structures, systems, and components are well defined.
- Periodic assessments of completed in-service inspection data continue to confirm that SNF storage-related safety significant components meet their respective design requirements.
- IEC has implemented a corrosion monitoring and trending program that effectively evaluates SNF storage materials, canisters, and casks for aging degradation.
- DOE-ID oversight of INTEC SNF activities is robust and well documented.

No areas of concern for either IEC or DOE-ID were identified by EA during this assessment.

In summary, DOE-ID and IEC are safely and effectively managing the interim storage of SNF at INTEC.

INDEPENDENT ASSESSMENT OF INTERIM STORAGE OF SPENT NUCLEAR FUEL AT THE IDAHO CLEANUP PROJECT

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), assessed the interim storage of spent nuclear fuel (SNF) at the Idaho Cleanup Project (ICP). Assessment planning and document collection began in September 2022, with onsite activities conducted October 24-27, 2022.

Consistent with the *Plan for the Independent Assessment of Safe Interim Storage of Spent Nuclear Fuel at the Idaho National Laboratory, October 2022*, this assessment evaluated the effectiveness of nuclear safety programs and controls implemented to ensure the safe interim storage of SNF. This assessment focused on the SNF that is in a dry storage configuration at three Idaho Nuclear Technology and Engineering Center (INTEC) facilities: CPP-603 Irradiated Fuel Storage Facility (IFSF), CPP-749 Underground Fuel Storage Facility, and CPP-2707 Outdoor Fuel Storage Facility. The INTEC facilities are managed and operated by Idaho Environmental Coalition, LLC (IEC) for the Office of Environmental Management and overseen by the DOE Idaho Operations Office (DOE-ID). EA also reviewed the effectiveness of DOE-ID oversight of the SNF activities at INTEC.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which is implemented 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" as defined in the order.

As identified in the assessment plan, this assessment considered requirements related to the storage and handling of SNF. Criteria to guide this assessment were based on selected criteria from within objectives SNF.1 and SNF.3 of EA Criteria and Review Approach Document (CRAD) 31-37, Rev. 0, *Safe Interim Storage of Spent Nuclear Fuel*. In addition, EA used elements of CRAD 30-07, Rev. 0, *Federal Line Management Oversight Processes*, to collect and analyze data on DOE-ID oversight activities.

EA examined key documents, such as safety basis documents, system design descriptions, work packages, procedures, manuals, engineering analyses, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs, observed SNF handling activities, and walked down significant portions of the INTEC SNF storage facilities.

The members of the assessment team, the Quality Review Board, and 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 Technical Safety Requirements Implementation

This portion of the assessment evaluated IEC's effectiveness in implementing technical safety requirement (TSR) controls for the safe interim storage of SNF using appropriately controlled measuring and test equipment (M&TE).

Implementation

IEC adequately implemented evaluated TSR controls that ensure that the SNF is maintained in a safe configuration in accordance with the requirements of 10 CFR 830 subpart B, app. A, par. G. Limiting conditions for operation (LCOs), surveillance requirements (SRs), and specific administrative controls (SACs) are adequately described in the applicable safety analysis reports and TSR documents (SAR-112, *Safety Analysis Report for the Outdoor Fuel Storage Facility*, and TSR-112, *Technical Safety Requirements for the Outdoor Fuel Storage Facility*, which address CPP-749 and CPP-2707; and SAR-114, *Safety Analysis Report for the Irradiated Fuel Storage Facility*, and TSR-114, *Technical Safety Requirements for the Irradiated Fuel Storage Facility*, which address CPP-603). TSR controls were appropriately flowed down into reviewed procedures, were clearly written, and can be effectively performed by operators.

Further, IEC personnel use an effective scheduling and tracking system to ensure that TSRs are met, required actions are taken within completion times, and SRs are performed within the required frequencies, resulting in no TSR-related occurrence reports (LCO or SAC violations or missed SRs) in the last year. Reviewed correspondence demonstrates that IEC has appropriately documented the "annual list compliance performance summary" required by SRs 4.112.1.4 (TSR-112) and 4.114.1.1 (TSR-114). The purpose of this summary is to allow IEC senior management to assess compliance with LCO limits and controls identified in the applicable contractor-approved fuel lists, cask lists, and criticality safety controls lists for each facility. The readiness assessment (IAS 2164, *Contractor Readiness Assessment for Inspection of Peach Bottom Packages in CPP-749, First Generation Vaults*) adequately evaluated implementation of new or revised requirements in safety basis documents as required by MCP-1519, *Project Requirement Change Implementation*.

IEC operations personnel effectively implemented TSR controls during three observed activities performed using procedures that implemented TSR SACs (TPR-7022, *Retrieve Peach Bottom Fuel Baskets From 1st Generation Storage Vaults*; TPR-7026, *Perform Peach Bottom Vault Configuration Inspections*; and TPR-7992, *Unload Fuel-Loaded Charger in IFSF*). The procedures appropriately cited applicable safety requirements, identified precautions, and included clear performance steps that used appropriate tools, such as mechanical gauges, to verify satisfactory compliance. These procedures also included provisions for the listing of discrepancies and timely notification of facility management about any failure or abnormality in entering the appropriate LCO condition and taking necessary actions to place the plant in a safe condition. The operators who implemented the TSR controls in these procedures complied with the identified SACs, were knowledgeable of each control's purpose and importance, and were qualified, having satisfactorily completed the required training in accordance with PDD-238, *INTEC Nuclear Facility Training Program*. The Facility Manager's signature appropriately documented review and acceptance of the procedure results.

Measuring and Test Equipment

IEC personnel adequately control M&TE used in performing SRs in accordance with the requirements of 10 CFR 830.122, criterion 8. Three observed operations activities performed in accordance with the

procedures referenced above confirmed that the M&TE was appropriately calibrated and maintained at prescribed intervals (or before use) and included the information necessary for ensuring traceability. The calibration documentation appropriately included all required information (i.e., identification, traceability to the calibration standard, calibration data, recalibration due date or interval, and identification of the individual performing the calibration). Calibrated M&TE identified in the completed procedures was properly labeled, tagged, or suitably marked or documented to indicate a due date or interval of the next calibration and uniquely identified to provide traceability to its calibration data. Further, interviews with the M&TE Coordinator, reviews of completed M&TE documentation, and observations of M&TE use in the field confirmed that calibrated M&TE is properly handled and stored to maintain instrument accuracy. Out-of-calibration M&TE is properly tagged and segregated, as required by MCP-2391, *Control of Measuring and Test Equipment*. M&TE users and system engineers (SEs) are properly notified by the out-of-tolerance notification and evaluation system when instruments are out-of-calibration.

Technical Safety Requirements Implementation Conclusions

IEC personnel effectively performed TSR implementation activities. LCOs, SRs, and SACs are adequately described in the applicable SARs and TSRs and implementing documents. TSR requirements are effectively scheduled and tracked, and M&TE is appropriately calibrated and controlled.

3.2 In-Service Inspection Program

This portion of the assessment evaluated the in-service inspection (ISI) program requirements, system performance assessments, and cognizant system engineer (CSE) qualifications.

In-Service Inspection Requirements

IEC effectively implements ISI requirements through seven reviewed planning "PLN" documents that appropriately include the TSR inspection requirements and design assumptions necessary to ensure that the hazards from stored SNF are adequately controlled. Reviewed calculations and analyses demonstrate that IEC has established an adequate technical basis for criteria specified in the PLN documents. PLN document requirements have also been adequately incorporated into reviewed implementing inspection procedures and/or work orders (WOs). The limits in the PLN documents adequately ensure that SNF continues to be stored in accordance with the design of each respective storage device. For example, PLN-1611, *CPP-749 Vault Monitoring Plan*, contains criteria for maintaining required vault configuration, detecting and controlling potentially hazardous conditions that may develop, and generating corrosion rate data used to monitor fuel storage devices and vault conditions.

System Performance Assessments

IEC personnel have performed adequate periodic assessments evaluating system reliability, material condition, and ISI data trending. Seven reviewed assessments from 2006 to 2022 confirm that the IFSF and Outdoor Fuel Storage Facility safety significant structures, systems, and components (SSCs) continue to meet their safety functions, in accordance with the facility design requirements and performance criteria specified in SAR-112 and SAR-114. The physical configuration of the safety significant SSCs is being adequately maintained in accordance with the system design documentation, as confirmed by the following three reviewed evaluations:

- Engineering design file EDF-6498, *Corrosion Evaluation of IFSF CS Canisters*, evaluated corrosion data from previous CPP-749 vault ISIs, concluding that CPP-749 carbon steel canisters, considering worst case corrosion rates, will continue to perform as designed for over 1,000 years.

- CCN 328164, *CY-2021 IFSF (CPP-603) Corrosion Coupon Evaluation*, evaluated the corrosion rates of metal coupons (a small sample used to detect corrosion of materials with similar composition of canisters and casks located in the vaults) of the storage rack materials after 10 years of exposure, concluding that the corrosion rates in the IFSF are within acceptable limits and continue to remain low.
- RPT-1006, *Evaluation of ANSI/ANS-8.21 Compliance for the INTEC SNF Dry Storage Casks*, concludes that the six casks stored outdoors on the CPP-2707 concrete pad are currently qualified for use to the year 2035.

Cognizant System Engineer Qualifications

IEC maintains an adequately trained and qualified CSE staff. IEC procedure PDD-238 establishes training and qualification requirements for CSEs in accordance with DOE Order 420.1C, *Facility Safety*, which requires that CSEs be qualified as described in attachment 1 of DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*. PDD-238 appropriately requires system-specific training, oral qualification board examination, and biennial requalification. Qualification standard PLN-964, *System Engineer Qualification*, adequately implements PDD-238 and DOE requirements for CSE training and qualification. Reviewed training records for the CSEs confirmed that they were appropriately selected, trained, and fully qualified. These training records complied with the qualification standard and reflected IEC's overall commitment to training and qualification of engineers, which is comprehensive, well-documented, and timely.

In-Service Inspection Program Conclusions

IEC is adequately managing the ISI program through an appropriate set of requirements. IEC personnel perform adequate system performance assessments, and CSEs are adequately trained and qualified.

3.3 Nuclear Maintenance

This portion of the assessment evaluated IEC's nuclear maintenance management program (NMMP), maintenance resources, and inspection and maintenance performance supporting aging management processes for interim storage of SNF.

Nuclear Maintenance Management Program Description

IEC appropriately established PDD-600, *Idaho Cleanup Project (ICP) NMMP*, to conduct inspection and maintenance activities. PDD-600 adequately addresses DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, att. 2, sec. 2.m. The NMMP was submitted to DOE-ID on March 1, 2022, satisfying the requirement for submittal to DOE for review and approval at least every three years. DOE-ID subsequently approved the NMMP. The NMMP is appropriately identified in the applicable safety analysis report (SAR-100, *ICP Standardized Safety Analysis Report*) in accordance with DOE Order 433.1B, att. 2, sec. 1.h. The NMMP appropriately requires a process for implementing, managing, and maintaining the master equipment list to identify the specific safety significant SSCs and parameters subject to aging degradation monitoring and inspection. Two reviewed IEC assessments from November 2021 to July 2022 confirmed that the DOE Order 433.1B requirements are satisfied. For example, a management assessment of IEC's NMMP implementation and compliance with contract requirements was conducted in November 2021. This reviewed management assessment was appropriately performed to satisfy the triennial assessment as required by DOE Order 433.1B, sec. 4.d. The 17 NMMP elements required by DOE Order 433.1B were properly verified to be implemented by the

ICP program description documents, program requirements documents, and management control procedures.

Maintenance Resources

IEC provides adequate resources (personnel, a maintenance tracking database, work instructions, and facilities) for scheduling and performing aging management maintenance activities. Annually, maintenance personnel staffing levels are appropriately determined through a formal staffing plan, which is updated throughout the year. The current staffing plan identifies personnel who are adequately qualified to perform scheduled inspection and maintenance activities. Maintenance personnel observed during plan-of-the-day and plan-of-the week meetings adequately coordinated task priorities with facility operations personnel and engineering management, demonstrated effective use of the graded approach, and prioritized attention on safety significant SSCs.

Programmatic and staff resources support implementation of the NMMP sufficiently. Ten reviewed maintenance WOs were adequately developed and used in accordance with the requirements of MCP-101, *ICP Integrated Work Control Process*. Work planners appropriately developed these WOs using the Maximo® software application, and each included a pre-job briefing checklist, an operations management work release, a list of trained and qualified maintenance personnel, a WO status log, a drawing list, and a hazard analysis. Template TEM-62, *Planned Work Order*, is appropriately used to develop detailed work instructions, post-maintenance testing, return to work management reviews, and closeout sections of the WOs. Work planners appropriately conduct pre-planning walkdowns in conjunction with CSEs and maintenance and operations personnel. The work broker group adequately prepared a three-week work schedule that was used to present the status of work tasks and update the scheduled activities; this schedule was effectively shared during the observed plan-of-the-week meeting. The work broker group is responsible for integrating all resources needed for the WOs, including operations, engineering, maintenance, lockout/tagout, and radiological control groups. Group managers appropriately assigned personnel resources for the tasks on the provided schedule.

Inspection and Maintenance Performance

IEC has established adequate processes for performing periodic inspections and corrosion monitoring to evaluate degradation of safety significant SSCs that may impact their safety functions. Periodicity of aging inspections is appropriately established based on two corrosion monitoring plans: PLN-1625, *Corrosion Monitoring Plan for the CPP-603 Irradiated Fuel Storage Facility (IFSF)*, and PLN-1611, *CPP-749, Vault Monitoring Program*. For example, PLN-1625 requires visual inspections of the storage racks and canister surfaces every four years. Additionally, PLN-1611 requires annual exterior inspections by the SE of all in-service vaults and those containing corrosion coupons. CPP-749 vault interior inspections are adequately conducted periodically by SEs and prior to loading fuel into the vaults.

Further, two reviewed aging inspection reports adequately demonstrated the CSE evaluations of corrosion coupons and visual inspections used to determine the severity of corrosion, pitting, and trends that would indicate problems with SSCs stored in the CPP-749 vaults and CPP-603 storage facility. For example, coupon sets of various materials (reflective of canister composition) were placed in an underground storage Peach Bottom vault (PB-22) within CPP-749 in November 2005 by a previous contractor. IEC personnel appropriately sampled and evaluated corrosion rates of the coupons in accordance with PLN-1611. Additionally, IEC personnel adequately conducted visual inspections of the vaults and compared the results with photographs of the corrosion coupons. IEC concluded that the PB-22 vault coupon corrosion rates were not representative of the current corrosion rates in the other vaults; the observed differences were attributed to moisture content differences between the PB-22 vault and the other vaults. IEC used this monitoring data to appropriately upgrade the storage vaults by including a vent with a high

efficiency particulate air filter to control ambient moisture, reducing the impact of corrosion. EDF-11059, *CPP-749 1st-Generation Vaults: Corrosion Evaluation in Support of CPP-749 Aging Management Review of Peach Bottom Vault Contents*, noted that evidence indicates that moving the fuel to second-generation vaults, installing high efficiency particulate air (HEPA) filtered vents on the first-generation vaults, or purging vaults with nitrogen to remove hydrogen and moisture from the vaults will slow down the deterioration of the fuel package.

Six reviewed preventive maintenance (PM) WOs and four corrective maintenance (CM) WOs demonstrated adequate maintenance performance and timely resolution of issues in accordance with MCP-6201, *Preventive/Predictive Maintenance Program*. These WOs adequately addressed pre-job briefs, sequenced work steps, use of hold points for quality inspections, completion of post-maintenance testing, and effective post-job debriefings. For example, CPP-603 roof inspections (PM WO# 582246) appropriately identified cracks and voids around equipment pedestals on the roof. Subsequently, CM WO# 578292 was initiated to patch the cracks in the roof; however, the replacement materials were no longer available, and this WO was subsequently cancelled. Instead, CM WO# 594968 was developed to recoat the entire roof, and this WO is currently in the final closeout review phase of work, demonstrating proper follow-up to facility roof degradation issues.

IEC PM completion metrics for October 2021 through September 2022 adequately demonstrate prioritized attention to safety significant SSCs and timely completion. These metrics also reflect a well-managed CM backlog rolling average for the last 12 months and that no delinquent critical PM WOs were reported during this period.

Nuclear Maintenance Conclusions

IEC has an effective NMMP to support the aging management program. The NMMP appropriately covers required inspection and maintenance activities that are properly scheduled, planned, and performed by qualified inspection and maintenance personnel. Adequate corrosion monitoring and inspection programs are established. PM and CM were appropriately planned, scheduled, and performed as demonstrated by reviewed WOs.

3.4 Federal Oversight

This portion of the assessment evaluated the DOE-ID oversight of activities at INTEC, with a specific focus on those oversight activities relating to the storage and handling of SNF.

The DOE-ID oversight program and responsibilities are appropriately defined in approved Idaho Operations Office documents 03.PD.04, *Contract Oversight*, 03.WI.04.01, *Oversight Planning and Scheduling*, and 03.WI.0.02, *Conduct of Oversight Activities*. As required by DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*, DOE-ID maintains sufficient staffing with the necessary expertise to make informed decisions about the hazards, risks, and needed resource allocation for INTEC SNF activities. DOE-ID is effectively implementing its oversight program to evaluate the adequacy of IEC programs, management systems, and site assurance systems necessary to safely store SNF at INTEC. DOE-ID performance evaluations of IEC are appropriately based on the results of operational awareness activities and assessments of facilities, operations, programs, and the IEC contractor assurance system. DOE-ID has adequately implemented issues management processes capable of categorizing identified issues based on risk and priority and communicating those issues to IEC.

DOE-ID oversight processes are appropriately tailored according to the effectiveness of contractor assurance systems and hazards of the SNF activities. The DOE-ID oversight program includes written plans and schedules for assessments, focus areas for operational oversight, and reviews of the contractor's

self-assessment of processes and systems. The DOE-ID assessment planning process includes an analysis of the program performance and perceived risks based upon data from the IEC contractor assurance system and DOE-ID oversight. Both DOE-ID operational awareness activities and assessment results are documented electronically in a system called Zeus, allowing easy sharing, searching, and retrieval of the data. DOE-ID has effective processes for communicating oversight results and other issues in a timely manner up the line management chain and to the contractor as appropriate, allowing senior managers sufficient time to make informed decisions.

DOE-ID has a well-established and fully implemented technical qualification program for nuclear safety specialists, safety system oversight engineers, Facility Representatives (FRs), and subject matter experts (e.g., fire protection, radiation protection, quality assurance).

FRs, with their day-to-day presence, provide the bulk of DOE-ID's oversight at INTEC. The FR oversight is supplemented by the routine oversight provided by the various DOE-ID subject matter experts. DOE-ID has a staffing analysis that shows that four FRs are required to adequately oversee operations at INTEC. At the time of the assessment, three qualified INTEC FRs were assigned, with the remaining FR position in the process of being filled. DOE-ID has a mature FR program with a specific qualification card for INTEC that encompasses the SNF facilities and activities.

Federal Oversight Conclusions

DOE-ID oversight of INTEC SNF activities is robust and well documented. DOE-ID has a mature oversight program that is effectively implemented.

4.0 BEST PRACTICES

No best practices were identified during this assessment.

5.0 FINDINGS

No findings were identified during this assessment.

6.0 DEFICIENCIES

No deficiencies were identified during this assessment.

7.0 OPPORTUNITIES FOR IMPROVEMENT

No opportunities for improvement were identified during this assessment.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: October 24-27, 2022

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
Kevin M. Witt, 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

Quality Review Board

William F. West, Advisor
Kevin G. Kilp, Chair
Christopher E. McFearin
Aleem E. Boatright
Michael A. Kilpatrick

EA Site Lead for Idaho National Laboratory (Idaho Cleanup Project)

Ronald G. Bostic

EA Assessment Team

Ronald G. Bostic, Lead
John J. Golyski
Kenneth L. Johnson
James D. Kekacs