



Independent Assessment of the Emergency Management Program at the Pacific Northwest National Laboratory

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Acronyms

325RPL	Radiochemical Processing Laboratory
BED	Building Emergency Director
BERO	Building Emergency Response Organization
BMI	Battelle Memorial Institute
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
DNF	Defense Nuclear Facility
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
EAL	Emergency Action Level
EEG	Exercise Evaluation Guide
EPHA	Emergency Planning Hazards Assessment
ERAPs	Emergency Readiness Assurance Plans
ERO	Emergency Response Organization
FY	Fiscal Year
HMIS	Hanford Mission Integration Solutions, LLC
ITS	Issue Tracking System
MGT	Manage Group Training
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
OTS	Optional Tracking System
PNNL	Pacific Northwest National Laboratory
PNSO	Pacific Northwest Site Office
RL	Richland Operations Office
RLEP	Richland Operations Office Emergency Plan Implementing Procedure
WBT	Web-based Training

INDEPENDENT ASSESSMENT OF THE EMERGENCY MANAGEMENT PROGRAM AT THE PACIFIC NORTHWEST NATIONAL LABORATORY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the emergency management program at the Pacific Northwest National Laboratory (PNNL) assessing whether the Pacific Northwest Site Office (PNSO) and operating contractor, Battelle Memorial Institute (BMI), managed and maintained the PNNL emergency management program as required by DOE Order 151.1D, *Comprehensive Emergency Management System*. The assessment was conducted June – August 2023.

EA identified the following strengths:

- BMI’s chemical management system provides real-time inventory management and automatic alerts if a chemical order potentially exceeds allowable inventories in facility-specific Facility Use Agreements.
- BMI’s web-based refresher training, “*Emergency Preparedness Drill*,” effectively guides trainees through a realistic scenario and requires them to make decisions based on their duties, similar to an interactive movie.

EA also identified several weaknesses with the BMI emergency management program, including three deficiencies and the following two findings that warrant a high level of attention from BMI management:

- BMI does not demonstrate and evaluate the integrated emergency response capability of all site-level emergency response elements and resources. (Finding)
- BMI does not annually assess both readiness and effectiveness for portions of all program elements, as required by DOE Order 151.1D. (Finding)

In summary, PNSO and BMI generally maintain an effective emergency management program at PNNL. However, EA identified weaknesses in the BMI readiness assurance program. Weaknesses associated with the lack of the validation of readiness assurance program components could impact BMI’s ability to ensure an effective and efficient response to emergency incidents. Resolution of the concerns identified in this report would further enhance the PNNL emergency management program. EA will monitor corrective actions implementation, as appropriate, and seek opportunities to evaluate future exercises and performance tests.

INDEPENDENT ASSESSMENT OF THE EMERGENCY MANAGEMENT PROGRAM AT THE PACIFIC NORTHWEST NATIONAL LABORATORY

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Emergency Management Assessments, within the independent Office of Enterprise Assessments (EA), assessed the effectiveness of the Pacific Northwest National Laboratory (PNNL) emergency management program. This assessment evaluated the effectiveness of both the PNNL operating contractor, Battelle Memorial Institute (BMI), and the DOE Pacific Northwest Site Office (PNSO) in managing and maintaining the PNNL emergency management program. Selected elements of the emergency management program were evaluated, including technical planning basis, readiness assurance, and training and drills. The scope and scheduling of this assessment were coordinated with PNSO and the DOE Richland Operations Office (RL). This assessment was conducted in accordance with the *Plan for Independent Assessment of the Emergency Management Program at the Pacific Northwest National Laboratory, June-September 2023*. Onsite assessment activities were conducted in June – August 2023.

PNSO provides Federal oversight of the PNNL emergency management program. BMI manages and operates the PNNL site-level emergency preparedness program. BMI has a fixed-price subcontract with Hanford Mission Integration Solutions, LLC (HMIS), which is the Hanford Site integrating contractor for emergency management. Per this subcontract, HMIS agrees to provide fire department emergency services, an emergency operations center, joint information center, consequence assessment, and some security support at PNNL. In addition to implementing the emergency management core program requirements in DOE Order 151.1D, *Comprehensive Emergency Management System*, BMI coordinates with HMIS for the maintenance of the Hanford site emergency management materials program due to Building 325 Radiochemical Processing Laboratory (325RPL), a defense nuclear facility (DNF) that is managed by PNNL, but is located in the 300 Area of the Hanford Site. Building 325 RPL is the only PNNL facility where inventories of hazardous materials could result in a classified operational emergency, as defined by DOE Order 151.1D.

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, criteria to guide this assessment were based on selected objectives and criteria from within the following sections of EA criteria and review approach document (CRAD) 33-09, Revision 0, *DOE Order 151.1D Emergency Management Program CRAD: All Hazards Planning*, 4.2, *Training and Drills*, 4.5, *Readiness Assurance*, 4.14, and *Exercises*, 4.15.

EA examined key documents, such as procedures, manuals, analyses, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs and walked down significant portions of selected PNNL facilities, focusing on emergency preparedness. 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 Technical Planning Basis

This portion of the assessment determined whether: (1) BMI has established a technical planning basis for the emergency management hazardous materials program, (2) the all-hazards survey identifies all applicable hazards and contains a hazardous material screening process that identifies specific hazardous materials that, if released, could produce impacts consistent with an operational emergency, and whether it establishes the planning basis for the emergency management program, and (3) BMI has developed an emergency planning hazards assessment (EPHA) that identifies the potential consequences from unplanned releases of (or loss of control over) hazardous materials identified in the all-hazards survey and has developed facility-specific emergency action levels (EALs) for the spectrum of potential operational emergencies identified in the EPHA, including corresponding protective actions.

The all-hazards survey and EPHA serve as the foundation of an emergency management program; consequently, the accuracy of these documents is key in developing effective emergency response procedures and other elements of the program. The degree to which the EPHA effectively serves this function depends primarily on the effectiveness of the initial screening process for hazardous materials, the completeness and accuracy of the processes for developing the all-hazards survey and EPHA, and the accuracy of the analyses in the EPHA. BMI uses Richland Operations Office Emergency Plan Implementing Procedure (RLEP) 3.27, *Hazard Surveys*, and RLEP 3.22, *Emergency Planning Hazards Assessments*, which outline the processes for developing and maintaining all-hazards surveys and EPHAs and incorporates the requirements of DOE Order 151.1D and recommendations of DOE Guide 151.1-1B, *Comprehensive Emergency Management System Guide*. These procedures effectively establish the administrative and management requirements for developing, reviewing, approving, and maintaining all-hazards surveys and EPHAs.

BMI has appropriately developed all-hazards surveys that incorporate the requirements of DOE Order 151.1D, the guidance of DOE Guide 151.1-1B, and the provisions of RLEP 3.27. The following all-hazards surveys cover all PNNL facilities/operations:

- *2021 Emergency Planning Hazards Survey Pacific Northwest National Laboratory – Richland Campus*, September 2021
- *2021 Emergency Planning Hazards Survey Pacific Northwest National Laboratory – Sequim Campus*, September 2021
- *Pacific Northwest National Laboratory 2022 Emergency Planning Hazards Survey: Hanford Site Facilities*, August 2022.

These all-hazards surveys provide accurate technical descriptions of the PNNL facilities and areas; describe emergency events and conditions; identify all the hazards applicable to the operation of PNNL facilities, including chemical, radiological, explosives, and biological agents and toxins; and implement the screening requirements of DOE Order 151.1D. The BMI hazardous material screening process identifies specific hazardous materials and quantities that, if released, could produce impacts consistent with the definition of an operational emergency. Hazardous materials are appropriately screened against the exclusion thresholds described in DOE Order 151.1D, attachment 3, paragraph 2.e.

BMI developed and maintains a robust chemical management system that provides an accurate and timely method for tracking changes that involve hazardous materials (e.g., introduction of new materials, significant changes in inventories, modification of material location). BMI's Chemical Management System provides real-time inventory management of chemicals based on specific Facility Use Agreements and provides automatic alerts for three conditions: (1) if chemical inventory quantity limits may be exceeded, (2) if chemicals do not have an assigned National Fire Protection Association health hazard rating, or (3) if containers of hazardous chemicals are being ordered in container sizes that do not meet the criterion of being "easily and safely manipulated by one person" or "laboratory-scale quantities" per 29 CFR 1910.1450(b), *Definitions*. The alerts allow for preventive actions to ensure that facility-specific limits are not exceeded. The system also includes real-time location tracking of individual chemical containers through radio frequency identification tags.

Based on the results of the all-hazards surveys, BMI prepared, and PNSO approved, PNNL-EPHA-325RPL, *Emergency Planning Hazards Assessment for the Radiochemical Processing Laboratory (325RPL) Complex*. The EPHA provides the basis for defining the provisions of the Emergency Management Hazardous Materials Program, ensuring that the program is commensurate with the hazards identified, and establishing a graded approach that meets the program requirements outlined in DOE Order 151.1D.

The EPHA analyzes a range of scenarios from low-consequence and high-probability to high-consequence and low-probability and clearly outlines release and atmospheric transport assumptions used in calculating consequences. The EPHA presents consequences calculated for a suitable set of receptors and the calculations use the appropriate radiological protective action guide (1 rem) and threshold for early lethality (100 rem) values for analyzed releases. The HotSpot dispersion modeling code was used for all dose calculations in the EPHA. The EPHA presented calculations of consequences for receptors important to incident classification using two sets of meteorological conditions: severe (95th percentile) and average (50th percentile). The severe and average conditions were calculated using meteorological data supplied to the HotSpot code as hourly measurements of atmospheric stability, wind speed, and wind direction over five years (calendar years 2008 through 2012) based on data collected at the site's 300 Area meteorology station.

The HotSpot code does not have an explicit building wake model, but BMI used the general plume complex geometry feature to emulate building wake effects for releases from 325RPL and the East Storage Yard/3714. Although modeling results in the EPHA are correct, the EPHA incorrectly describes Hotspot general plume complex geometry and general fire modeling concepts in 7 of 15 fire scenario descriptions. (See **OFI-BMI-1**.) For example:

- The EPHA incorrectly reported that the 325RPL with dimensions of 82 meters wide by 12 meters tall resulted in an effective circular area with a 53 meters radius instead of the correct radius of 18 meters. The effective release radius of 53 meters applies to the footprint of 325RPL, which has dimensions of 82 meters by 102 meters. The effective release radius is only used in the Hotspot general fire model.
- The EPHA incorrectly reported that an effective release radius of 53 meters was applied in the HotSpot general plume model to implement building wake dispersion of 325RPL emissions. The Hotspot general plume model does not permit the use of an effective release radius. Instead, the building width and height are entered to represent a source with complex geometry.
- The EPHA incorrectly reported that since the East Storage Yard is adjacent to the 325RPL, the effective release radius of the 325RPL (53 meters) is applied to emulate building wake effects. Building wake effects are emulated by the Hotspot general plume model that uses the building width and height instead of the effective release radius.

BMI developed facility-specific EALs for the 325RPL that incorporate the provisions of RLEP 3.21, *Emergency Action Levels*, and cover the spectrum of potential operational emergencies identified in the EPHA. EALs are developed for applicable incident scenarios contained in the EPHA and provide the information that decision makers need for implementing actions to protect onsite personnel and making offsite protective action recommendations based on the calculated material at risk quantity required to produce a dose of 1 rem at 30 meters, 100 meters, or the site boundary.

Technical Planning Basis Conclusions

Overall, BMI has appropriately developed all-hazards surveys and an EPHA that incorporate the relevant requirements of DOE Order 151.1D, the guidance in DOE Guide 151.1-1B, and the provisions identified in RLEP. BMI has also developed a robust chemical management system that provides an accurate and timely method for tracking changes that involve hazardous materials present in PNNL facilities. The EPHA for the 325RPL provides the basis for defining the provisions of the emergency management hazardous material program; however, the EPHA incorrectly describes Hotspot modeling concepts in several analyzed scenarios. Additionally, BMI has developed facility-specific EALs for each applicable incident scenario contained in the EPHA, providing the information that decision makers need for implementing protective actions.

3.2 Readiness Assurance

This portion of the assessment determined whether BMI and PNSO have established a framework and associated mechanisms for ensuring that emergency management is effective on a programmatic and performance level while promoting a culture of continuous improvement.

3.2.1 Evaluations

This portion of the assessment determined whether PNNL's emergency management program includes evaluations consisting of exercises, assessments, and performance indicators, as required by DOE Order 151.1D, that validate site plans and procedures and promote program improvement.

Exercises

Exercises are a key component of the framework required to ensure the readiness and effectiveness of an emergency management program on both programmatic and performance levels while promoting a culture of continuous improvement. DOE Order 151.1D requires DOE sites to conduct an annual site-level exercise to test and validate emergency plans and procedures. The exercise program must establish a five-year exercise schedule that rotates scenarios among the hazards and risks identified in the EPHA so that associated emergency response capabilities are tested. The field element manager must approve the annual exercise plan, and after-action reports must include the results of the evaluation to include findings, issues, and improvement items. Annual exercise after-action reports must be submitted to the field element manager or appropriate Federal manager.

RL defines exercise requirements for PNNL in DOE/RL-94-02, *Hanford Emergency Management Plan*. BMI further defines requirements in PNNL-MA-110, *Pacific Northwest National Laboratory Emergency Management Plan*, and implements the requirements in accordance with EPIP-14.0, *Drill and Exercise Program*, and PNNL's five-year exercise schedule (five-year projection). Reviewed BMI plans and procedures for exercises are adequate, with two weaknesses noted below:

- BMI emergency plans and implementing procedures do not specifically identify DNF requirements pertaining to exercises at 325RPL. DNF requirements include developing compensatory measures

and formal corrective action plans for findings, conducting causal analyses for life-safety findings, and evaluating the effectiveness of corrective actions through verification and validations conducted by an independent reviewer. (See **OFI-BMI-2.**)

- Contrary to DOE Order 151.1D, attachment 4, paragraph 15, BMI did not test the entire spectrum of response elements and capabilities over the past five years. (See **Deficiency D-BMI-1.**) Furthermore, the BMI five-year exercise schedule for future exercises does not identify and ensure all PNNL specific emergency response elements and capabilities for EPHA hazards will be validated, as required by DOE Order 151.1D. (See **OFI-BMI-2.**) When the EA team brought the issue to BMI's attention, the emergency management staff immediately initiated an effort to define PNNL specific emergency response elements and capabilities and determine validation frequencies.

BMI conducts a sufficient number of annual drills at EPHA facilities, ensuring that the proficiency of all building emergency directors (BEDs) is validated annually. In addition, BMI conducts annual evacuation, criticality, and protective action drills and exercises to validate the proficiency of building occupants and Building Emergency Response Organization (BERO) members with checklists that describe response actions, as well as validate the adequacy of emergency facilities and systems. However, BMI does not include objectives for some emergency response elements in annual exercise packages and has not formally evaluated the effectiveness of offsite interactions, consequence assessment, emergency public information, emergency medical services, or termination and recovery. Furthermore, with the exception of the BED's performance and facility support provided to the Incident Commander, BMI does not assess the effectiveness of Hanford's emergency operating system during PNNL exercises, to include emergency response subcontracted actions received by HMIS Hanford Fire and Hanford Patrol. Consequently, contrary to DOE Order 151.1D, attachment 4, paragraph 15, BMI does not demonstrate and evaluate the integrated emergency response capability of site-level emergency response elements and resources. (See **Finding F-BMI-1.**) Not evaluating the integrated emergency response capability of all site-level emergency response elements and resources results in the inability to ensure the readiness and effectiveness of an emergency management program on both programmatic and performance levels. Although an HMIS evaluation form exists for the purpose of communicating HMIS performance issues identified during PNNL exercises, BMI has not developed a formal process for communicating HMIS exercise performance issues to HMIS, and HMIS currently is not required to act on issues identified by BMI. (See **OFI-BMI-2.**)

After-action reports developed over the past five years present some validated aspects of PNNL's emergency management program. With some exceptions, which are discussed in section 3.2.2, most identified issues were appropriate and well-written, and exercise evaluation was rigorously documented for some response elements. However, PNNL exercise evaluation guides (EEGs) do not contain sufficient details to ensure a thorough evaluation of exercise performance. For example, the EEGs do not examine time-critical requirements for EAL declaration, offsite notifications, or protective action implementation. BMI acknowledged this weakness and is in the process of developing EEGs based on local emergency plan implementing procedures, the DOE/National Nuclear Security Administration (NNSA) Emergency Management electronic-CRAD, and emergency management CRADs. (See **OFI-BMI-2.**)

PNSO participates on exercise planning committees and ensures that actions for findings and deficiencies are tested in drills and exercises.

Assessments

Assessments are necessary to ensure that emergency plans, procedures, emergency response activities, and resources are adequately implemented and sufficiently maintained. DOE Order 151.1D requires

management and operations (M&O) contractors responsible for hazardous material emergency management programs to conduct self-assessments that address some portion of all 15 emergency management program elements annually, and all portions of all elements over five years. Self-assessment requirements must be met through a combination of both programmatic self-assessments and performance-based validation through exercises for all program elements. For the Federal field elements, an annual self-assessment of the emergency management program is required, and results of the assessment must be documented in the emergency readiness assurance plan (ERAP). In addition, field elements are responsible for assessing the emergency management programs under their purview, reviewing the M&O contractor's annual self-assessment, and ensuring external assessments are supported.

Assessment requirements for PNSO and BMI are defined in DOE/RL-94-02 and implemented in accordance with RLEP 3.29, *Emergency Management Assessment Program*. BMI assessment requirements are described in PNNL-MA-110 and conducted in accordance with EPRP-ADMIN-001, *Preparing and Conducting Assessments*. Reviewed PNNL plans and procedures for assessments are adequate, with two exceptions noted below:

- PNNL's emergency plan states that all applicable program elements will be assessed over a five-year period, but does not state that some portion of all 15 program elements will be assessed annually and that self-assessment requirements must be met through a combination of both programmatic self-assessments and performance-based validation through exercises. (See **Finding F-BMI-2.**) DOE Order 151.1D requires annual assessment of some portion of all 15 program elements, and evaluation of all aspects of each program element within five years. In addition, a DOE Order 151.1D policy clarification issued by the DOE Office of Plans and Policy in 2018 states that self-assessment requirements must be met through a combination of both programmatic self-assessments and performance-based validation through exercises for all program elements. Comprehensive assessments of emergency programs are necessary to ensure that emergency plans, procedures, emergency response activities, and resources are adequately implemented, periodically validated, and sufficiently maintained.
- RLEP 3.29 contains an inaccurate table indicating that only RL and the Office of River Protection are responsible for assessing all 15 program elements annually. The matrix further indicates that PNNL and all other contractors at Hanford are only responsible for assessing nine program elements. PNSO is only responsible for assessing two program elements: program administration and readiness assurance. Contrary to RLEP 3.29, DOE Order 151.1D requires sites/facilities/activities to conduct annual self-assessments that address all program elements. (See **OFI-BMI-3.**)

BMI's self-assessment reports from 2018 through 2023 collectively contain 1 finding and 26 OFIs. For the finding, a rigorous review of the BED training program determined that the training materials were inaccurate. The issues identified by BMI were appropriate and indicate that assessors reviewed procedures thoroughly during the assessment process. However, while significant issues were discovered and corrected through self-assessments, some BMI self-assessment reports are not comprehensive. BMI does not use a CRAD with PNNL-specific programmatic and performance-based assessment criteria to help ensure a rigorous annual self-assessment of both readiness and effectiveness for each program element. (See **OFI-BMI-2.**) As a result, BMI self-assessment reports do not discuss program effectiveness through performance-based validation of elements during evaluated drills and exercises, nor do they use many of the other typical methods for assessing both programmatic readiness and effectiveness, to include:

- Interviewing emergency response organization (ERO) members responsible for programmatic elements conducted in the emergency operations center to help gauge program effectiveness.
- Checking dispersion modeling software programs and procedures used in the Unified Dose Assessment Center to verify that the latest versions are available.

- Reviewing HMIS emergency management records to verify that offsite agency phone numbers are correct and that regular communication checks with offsite agencies are occurring.
- Observing ERO evaluated drills to gauge the effectiveness of program elements managed by HMIS, such as emergency public information and consequence assessment.
- Reviewing drill and exercise after-action reports and corrective action plans from HMIS and other contractors for potential issue trends that may apply to PNNL.
- Reviewing all ERO training programs for PNNL members of the ERO to verify effectiveness.

While BMI assessed some portion of all 15 elements over 5 years, it did not assess some portion of all elements annually during from 2018 through 2023, as summarized below:

- In 2018, BMI did not produce a self-assessment report and instead used its annual exercise after-action report, which was written by HMIS, to satisfy the self-assessment requirement.
- In 2019, BMI assessed only 2 of the 15 program elements: program administration and management and ERO.
- In 2020, BMI's self-assessment report was a crosswalk showing how DOE Order 151.1D requirements had been incorporated into the PNNL emergency plan for all 15 program elements.
- In 2021, BMI's self-assessment report addressed only 14 of the 15 program elements, stating that the consequence assessment program element did not apply to BMI and therefore omitted it from consideration.

Furthermore, none of the self-assessment reports produced by BMI since 2018 considered whether plans and procedures were effectively implemented, nor did they include annual validation of any of the program elements through exercises. As explained in the exercises section above, BMI omits objectives for program elements managed by HMIS from its annual exercise packages. As a result, some program elements are not validated during annual exercises. (See **Finding F-BMI-1.**) Because BMI's self-assessment reports are not comprehensive, assessing both readiness and effectiveness for some portion of all program elements annually, BMI has not established a readiness assurance program that serves to ensure the readiness and effectiveness of its emergency management program on both programmatic and performance levels, contrary to DOE Order 151.1D, attachment 3, paragraph 14. (See **Finding F-BMI-2.**) Establishing a robust readiness assurance program is necessary to ensure that plans and procedures are validated, and program improvement is promoted. Interviewed BMI emergency management staff stated that they are beginning to develop and intend to implement a comprehensive BMI-specific CRAD for use by assessors to ensure self-assessments are more comprehensive.

PNSO observes drills; approves emergency plans, all-hazard surveys, EPHAs, exercise plans, after-action reports, corrective action plans for external findings, and ERAPs as required by DOE Order 151.1D; and participates in BMI self-assessment activities in a shadow role. However, the assessment of BMI by PNSO is not rigorous. RLEP 3.29 requires PNSO to conduct an assessment of the contractor no less than once every five years. Although shadow assessments are sufficient to meet DOE requirements, PNSO does not conduct independent assessments of the contractor, and PNSO does not provide written feedback to the contractor following drills and exercises. (See **OFI-PNSO-1.**) In addition, contrary to DOE Order 151.1D, appendix A, paragraph 10.f.(1), PNSO does not conduct annual self-assessments of the field element emergency management program and document the results in the annual ERAP, as required by DOE Order 151.1D. (See **Deficiency D-PNSO-1.**) Assessments of the field element program are necessary to ensure that emergency plans, procedures, emergency response activities, and resources are adequately implemented and sufficiently maintained.

Performance Indicators

DOE Order 151.1D requires DOE sites and facilities to participate in a performance indicator program. BMI regularly participates in a triannual performance indicators program that gauges the overall health of the emergency management program and formally reports its assessment to senior management. The contractor's performance metric system is used to evaluate emergency management program assessments, building emergency management surveys, emergency drills and exercises, emergency event critiques, reportable occurrences or emergency calls involving emergency management training, and other emergency management program issues. PNNL's Office of Performance Management issued a document titled *Assessing Risk at PNNL* that provides guidance for the contractor in categorizing the risks identified for performance metrics. Emergency management program metrics produced during the review period were adequately graded, and areas of concern were appropriately noted, such as the potential for reduced ERO proficiency during the pandemic.

Evaluations Conclusions

BMI's performance indicator program is adequate, but significant concerns were identified in its exercise and self-assessment programs. Key program elements are validated only once every five years in exercises conducted by HMIS. Issues pertaining to the effectiveness of Hanford's emergency operating system during PNNL exercises, including emergency response subcontracted actions received by HMIS, Hanford Fire, Hanford Patrol, and the site ERO are not captured in PNNL after-action reports. In addition, self-assessments conducted by BMI do not evaluate some portion of all program elements annually, nor do they evaluate program effectiveness. PNSO participates in PNNL self-assessments in a shadow role and approves required documents. However, PNSO does not currently conduct an annual self-assessment as required. Both BMI and PNSO acknowledged weaknesses in their evaluation programs and indicated that improvements will be made, to include creating a CRAD for use during self-assessments, improving EEGs used by exercise evaluators, revising BMI's five-year exercise scheduling matrix to ensure that all capabilities are validated over time, and increasing PNSO's oversight role.

3.2.2 Program Improvements

This portion of the assessment determined whether BMI makes appropriate and timely improvements, consisting of corrective actions and lessons learned, when issues are identified, as required by DOE Order 151.1D.

Corrective Actions

DOE Order 151.1D requires that corrective actions be developed for findings identified during evaluations, assessments, drills, exercises, and actual emergencies. Corrective actions for external assessments must be submitted to the field element manager for approval within 45 days of an assessment or after-action report, and as requested for contractor-initiated assessments. A formal tracking system must be used to track completion of corrective actions.

In program assessments and annual exercise reports in emergency management since 2018, PNNL issues management processed and tracked 7 findings and 37 OFIs using PNNL procedure IM-09, *Issues Management Life Cycle*, which requires all issues identified at PNNL to be categorized as either a finding or an OFI. Overall, PNNL effectively manages and tracks issues identified as findings to closure in the site Issue Tracking System (ITS), an effective software tool used to manage issues and their associated actions per procedure IM-09. Issues identified as OFIs are addressed as required by the site procedure and are entered and tracked in the site Optional Tracking System (OTS) software tool. OTS is functionally similar to ITS but is used to track OFIs and other items not required to be tracked in ITS due

to the lack of formal actions required, such as determining the need for compensatory measures, causal analysis, and verification of closure evidence. However, DOE Order 151.1D requirements for the disposition of findings pertaining to DNF facilities are not specifically identified in the site procedure or emergency management plans. (See **OFI-BMI-2**.) Contrary to DOE Order 151.1D, attachment 2, and procedure IM-09 definitions of findings, BMI incorrectly classified the following three issues identified during programmatic assessments and exercise evaluations (see **Deficiency D-BMI-2**):

- BMI evaluators for the fiscal year (FY) 2020 Emergency Management Program Assessment identified an issue involving EPHAs and said that “the emergency management program should develop a process to ensure work activities requiring updates to the EPHA were identified and implemented prior to the 3-year review cycle.” BMI categorized this issue as an OFI in the report rather than as a finding even though it identified a violation to a DOE Order 151.1D requirement for EPHA revisions (att. 4, par. 2.k).
- The FY 2021 Emergency Management Annual Exercise after-action report identified an issue involving protective action recommendations for PNNL site workers as follows: “The PNNL program should collaborate with the appropriate personnel to develop a process for receiving and relaying protective actions directed by Benton County Emergency Management.” The issue was categorized as an OFI in the report rather than as a finding even though it identified a violation to a DOE Order 151.1D requirement to provide immediate notification and protective actions to affected employees no later than 10 minutes after the protective actions have been identified (att. 3, par. 11.a.(3)).
- The FY 2022 Emergency Management Annual Exercise after-action report identified an issue with 325RPL EALs as follows: “Revise facility Emergency Action Levels to categorize in accordance with DOE Order 151.1D.” The issue was categorized an OFI in the report rather than as a finding even though it identified that the EALs were not in compliance with DOE Order 151.1D (att. 4, par. 2.t.).

Categorizing these problems as improvement items instead of findings allowed BMI to use the less formal OTS to track closure, which did not implement the DOE Order 151.1D requirements for disposition of findings, particularly if involving a DNF, such as a formal review of the issue, causal analysis, evaluating for possible compensatory measures, and closure actions and validations.

Lessons Learned

DOE Order 151.1D requires sites and facilities to use a system for incorporating and tracking lessons learned from training, drills, actual responses, and site lessons-learned programs. Sites are required review lessons learned from emergency management program activities under DOE Order 210.2A, *DOE Corporate Operating Experience Program*, as well as lessons learned and best practices from EA’s annual lessons-learned reports, which provide opportunities for improving DOE emergency management programs.

BMI implements the lessons learned program in accordance with DOE/RL-94-01, which appropriately requires PNSO and site contractors to:

- Implement a system for incorporating, tracking, and trending lessons learned.
- Participate in the DOE corporate lessons learned program.
- Use lessons learned to help determine the scope, objectives, and frequency of future drills and exercises.

BMI began implementing a lessons learned program for the BERO in 2022 when it provided separate lessons learned bulletins to the 325RPL BERO and to the administrative and low hazards BERO. BMI provides annual lessons learned to BEDs, and the reviewed lessons learned provided in the current annual refresher training for 325RPL BEDs were thorough and appropriate. BERO members receive an annual newsletter that includes lessons learned, and members are required to acknowledge that they read and

understood the lessons. In 2023 BMI recently began participating in the DOE corporate lessons learned program, issuing bulletins with lessons learned from other DOE sites that it determined were applicable to PNNL employees. PNNL staff who are members of the Hanford Site ERO are provided lessons learned bulletins by HMIS. However, refresher training for PNNL BERO members is not consistently updated annually to include lessons learned, and lessons learned are not discussed with ERO members routinely in conjunction with training and drills. In addition, BMI does not routinely examine after-action reports and corrective action plans from other Hanford Site contractors to look for response issue trends applicable to PNNL and develop lessons learned accordingly. (See **OFI-BMI-4**.)

Program Improvements Conclusions

Overall, BMI has implemented a compliant emergency management improvement program that includes corrective actions and lessons learned. Reviewed BMI issues identified as findings were effectively managed and tracked to closure per DOE Order 151.1D requirements. However, three findings identified in the last five years were incorrectly categorized as OFIs; consequently, the disposition of these issues did not meet DOE Order 151.1D requirements for closure to prevent reoccurrence. BMI has a lessons learned program for its ERO; however, lessons learned are not consistently incorporated into refresher training or routinely discussed with ERO members in conjunction with training and drills, and after-action reports and corrective action plans from other contractors at Hanford are not routinely reviewed for potential trends or lessons learned that could apply to PNNL.

3.2.3 Emergency Readiness Assurance Plans

This portion of the assessment determined whether BMI and PNSO issue adequate ERAPs using the format and content guidelines provided by the Program Secretarial Officer.

DOE Order 151.1D requires that ERAPs be submitted to the field element manager for approval and must:

- Highlight program status, including significant changes in the emergency management program.
- Include a summary of the threat and hazard identification and risk assessment.
- Document evaluation results and the status (e.g., open/unresolved or closed) of associated corrective actions.
- Identify what the goals were for the FY that ended and the degree to which those goals were accomplished.
- Identify the goals for the next FY.

In addition, the field element manager is required to prepare and submit a consolidated ERAP covering the sites/facilities/activities under their supervision to the Program Secretarial Officer and Associate Administrator, and Office of Emergency Operations, by November 30 of each year.

ERAPs from FY 2018 through FY 2022 were submitted to PNSO and approved in a timely manner following the approved format designed to help PNSO verify that emergency plans, implementing procedures, and resources are adequate, sufficiently maintained, and exercised. In addition, each ERAP documented progress made during the FY, including assessments conducted and corrective actions closed, and presented proposed program enhancements for the upcoming FY. However, PNSO did not conduct self-assessments of the field element between 2018 and 2022, as noted in the assessments section above. Consequently, field element self-assessment results are not included in the reports as required by DOE Order 151.1D. (See **Deficiency D-PNSO-1**.)

Emergency Readiness Assurance Plans Conclusions

PNNL ERAPs are submitted and approved on time and, except for the omission of field element self-assessment results, include the appropriate information.

3.3 Training and Drills

This portion of the assessment determined whether BMI has established a comprehensive, coordinated, and documented program of training and drills as an integral part of the emergency management program to ensure that program-specific emergency response capabilities are accomplished and maintained.

DOE Order 151.1D requires the development of a training and qualification program that establishes and maintains specific emergency response capabilities as determined by the all-hazards planning basis. ERO training must be provided initially and when there are significant changes. Refresher training that includes lessons learned, best practices, and deficiencies on individual training must be provided annually. Programs must also offer orientation on an annual basis to offsite emergency responders and formally invite applicable offsite first responders to participate in relevant drills or exercises at least annually.

BMI documents the BERO training and drill program in section 6.0 of PNNL-MA-110 and section 3.0 of the *Training Requirements Document for the Emergency Management, Environmental Management, Property Management, and Transportation Management and Operations Programs (M&OPs)*, February 2023. Also, BMI appropriately executes the ERO training program using an electronic learning management system using the Manage Group Training (MGT) interface. Within MGT, BMI assigns BERO training requirements such as classroom and web-based training (WBT), records drill and exercise participation, and tracks qualification completion.

BMI maintains a thorough and comprehensive BERO training and drill program with some needed improvements noted below. A strength of the program is the web-based annual refresher training, “*Emergency Preparedness Drill*,” lesson plan 2611, for low-hazards facility BEDs, building support emergency coordinators, and all zone wardens. The training is a scenario-driven WBT that presents trainees with realistic scenarios they may encounter based on their duties. Knowledge evaluation questions are embedded throughout the training and immediate feedback is provided based on the selected answer. Trainees must score at least 80%, and if they do not successfully pass the training in two attempts, they must undergo in-person remedial training. Other noteworthy aspects of the training and drill program include:

- Detailed and thorough initial qualification cards for both the 325RPL and the low-hazards facility BEDs.
- Robust quarterly drill program to assess the proficiency of the 325RPL BED and BERO members.
- Incorporation of recent lessons learned in annual refresher training for some BERO positions, such as the 325RPL BED.

Despite these positive aspects, the following issues associated with the training and drill program were identified:

- BMI does not consistently perform an internal assessment of BERO training development and implementation annually as recommended by section 3.2.3.3 of DOE Guide 151.1-1B. (See **OFI-BMI-3**.)
- Five of the six annual refresher training lesson plans for BERO members either do not contain lessons learned or they are outdated. To provide updated annual lessons learned to BERO members, BMI

provides a required reading newsletter but does not discuss lessons learned with BERO members to ensure that issues are understood. (See **OFI-BMI-4**.)

- BMI has no comprehensive and systematic training program plan document with all of the elements described in section 3.2.3 of DOE Guide 151.1-1B. The *Training Requirements Document* and PNNL-MA-110 contain some elements of the BERO training program, but are missing many elements described in the guide, such as identifying training resources, describing the process for identifying and documenting training needs, and identifying training program approval and signature authority. (See **OFI-BMI-5**.)
- Although Hanford Fire Department personnel attend orientation and building walkdown training annually, other emergency service organizations that provide support to PNNL, such as the cities of Richland and Pasco and the counties of Benton and Franklin, do not. (See **OFI-BMI-5**.)
- Although qualified incident managers are required to conduct annual refresher training, their proficiency is not evaluated annually. The incident manager position plays a key role in a complex emergency management incident with multiple BEDs and are required to be activated during active shooter events. (See **OFI-BMI-5**.)
- Visitor training requirements in PNNL-MA-110 are unclear. Section 6.3 states that “PNNL visitors (both escorted and unescorted) are issued visitor emergency preparedness information cards when they receive their badges and take a computer-based training that provides emergency protective action information.” BMI clarified during interviews that some visitors do not require computer-based training, depending on the area that they visit. (See **OFI-BMI-5**.)
- Lesson plans do not contain instructor notes and directions to ensure that training is presented consistently. Instructor notes help ensure that important information is emphasized, offer examples, and provide reference or source information to the instructor. (See **OFI-BMI-5**.)

Training and Drills Conclusions

BMI maintains a thorough and comprehensive training and drill program. The in-person and WBT drill program annually assesses the proficiency of key BERO members (with the exception of the incident manager), and BMI’s WBT lesson plan 2611, “*Emergency Preparedness Drill*,” is considered a strength. Although BMI’s BERO training and drill program is effective, EA identified several issues associated with developing a comprehensive and systematic training plan, conducting an annual assessment of the training program, improving the method for delivering lessons learned during refresher training, formalizing the invitation of offsite agencies to participate in orientation training, and assessing the proficiency of the incident manager.

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.

Battelle Memorial Institute

Finding F-BMI-1: BMI does not demonstrate and evaluate the integrated emergency response capability of all site-level emergency response elements and resources. (DOE Order 151.1D, att. 4, par. 15)

Finding F-BMI-2: BMI does not annually assess both readiness and effectiveness for some portion of all program elements. (DOE Order 151.1D, att. 4, par. 14)

6.0 DEFICIENCIES

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

Battelle Memorial Institute

Deficiency D-BMI-1: BMI's five-year exercise schedule does not identify and ensure that all PNNL-specific emergency response elements and capabilities for EPHA hazards are validated over a five-year period. (DOE Order 151.1D, att. 4, par. 15)

Deficiency D-BMI-2: BMI did not correctly categorize some identified issues as findings per the definition of a finding/deficiency. (DOE Order 151.1D, att. 2, and IM-09)

Pacific Northwest Site Office

Deficiency D-PNSO-1: PNSO does not conduct annual self-assessments of the field element emergency management program and document the results in the annual ERAP. (DOE Order 151.1D, app. A, par. 10.f.(1))

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified the OFIs 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. These OFIs are offered only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

Battelle Memorial Institute

OFI-BMI-1: To improve the PNNL technical planning basis program, consider revising PNNL-EPHA-325RPL to accurately describe the Hotspot general plume complex geometry and general fire modeling concepts in fire scenario descriptions.

OFI-BMI-2: To improve the PNNL exercise program, consider:

- Incorporating DOE Order 151.1D DNF requirements pertaining to exercises at the 325RPL into plans and procedures including:
 - Developing compensatory measures and formal corrective action plans for findings
 - Conducting causal analysis for life-safety findings
 - Evaluating the effectiveness of corrective actions through verification and validation conducted by an independent reviewer.
- Identifying and ensuring that all PNNL-specific emergency response elements and capabilities for EPHA hazards are validated over a five-year period, as required by DOE Order 151.1D.
- Developing EEGs based on local emergency plan implementing procedures, the DOE/NNSA Emergency Management electronic-CRAD, and emergency management CRADs, that include time-critical requirements for EAL declaration, offsite notifications, and protective action implementation.
- Develop a formal process to communicate exercise performance issues to HMIS and ensure HMIS formally tracks BMI-identified issues to closure.

OFI-BMI-3: To improve the PNNL assessment program, consider:

- Working with PNSO and the RL to update the matrix in RLEP 3.29 to indicate that BMI is responsible for assessing all 15 program elements at PNNL facilities.
- Updating the PNNL emergency plan to state that some portion of all 15 elements will be assessed annually, that a full assessment of all 15 elements will be completed over a 5-year period, and that self-assessment reports will evaluate both program readiness and program effectiveness (via performance evaluations).
- Developing a PNNL-specific criteria review and approach document for assessors to use when conducting self-assessments to help ensure that some portion of each program element is evaluated annually for both program readiness (e.g., via plan, procedure, facility, and equipment reviews) and effectiveness (i.e., via performance-based validation), and that all aspects of the emergency management program are evaluated over five years.
- Interviewing ERO members responsible for programmatic elements conducted in the emergency operations center to help gauge program effectiveness.
- Checking dispersion modeling software programs and procedures used in the Unified Dose Assessment Center to verify that the latest versions are available.
- Reviewing HMIS emergency management records to verify that offsite agency phone numbers are correct and that regular communication checks with offsite agencies are occurring.
- Observing ERO evaluated drills to gauge the effectiveness of program elements managed by HMIS, such as emergency public information and consequence assessment.
- Reviewing drill and exercise after-action reports and corrective action plans from HMIS and other contractors for potential issue trends that may apply to PNNL.
- Conducting an annual assessment of the training program as recommended by DOE Guide 151.1-1B.

OFI-BMI-4: To improve the PNNL lessons-learned program, consider:

- Reviewing after-action reports and corrective action plans from HMIS and other site contractors to look for issue trends that could affect PNNL emergency responders and issue lessons learned as needed.

- Implementing a program of presenting annual lessons learned in-person to BERO members.

OFI-BMI-5: To improve the overall quality of BERO training and drill program, consider:

- Developing a single comprehensive and systematic training program document containing all elements recommended by the DOE Guide 151.1-1B.
- Investigating different ways to increase offsite agencies' participation in orientation training such as formalizing the invitation process.
- Conducting annual evaluations of incident managers.
- Clarifying the requirement for visitors training contained in section 6.3 of PNNL-MA-110.
- Developing and including instructor notes in all BERO lesson plans.

Pacific Northwest Site Office

OFI-PNSO-1: To improve the PNNL emergency management program, consider periodically conducting independent assessments of the contractor (versus shadow assessments), including programmatic assessments as well as written performance feedback to the contractor following drills, exercises, and actual events.

Appendix A Supplemental Information

Dates of Assessment

Onsite Assessment: June to August 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

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