# Independent Assessment of Fire System Maintenance at the Hanford Site

**July 2024**

Office of Enterprise Assessments
U.S. Department of Energy

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## Acronyms

| | |
|---|---|
| AWWA | American Water Works Association |
| CAP | Corrective Action Plan |
| CFR | Code of Federal Regulations |
| CHPRC | CH2M HILL Plateau Remediation Company |
| CPCCo | Central Plateau Cleanup Company, LLC |
| CRAD | Criteria and Review Approach Document |
| CWC | Central Waste Complex |
| DFM | Deputy Fire Marshal |
| DOE | U.S. Department of Energy |
| DSA | Documented Safety Analysis |
| EA | Office of Enterprise Assessments |
| FACU | Fire Alarm Control Unit |
| FHA | Fire Hazards Analysis |
| FPE | Fire Protection Engineer |
| FPP | Fire Protection Program |
| FR | Facility Representative |
| FSS | Fire Suppression System |
| FY | Fiscal Year |
| GSSC | Government Support Service Contractor |
| HFD | Hanford Fire Department |
| HFM | Hanford Fire Marshal |
| HLMI | Hanford Laboratory Management and Integration, LLC |
| HMIS | Hanford Mission Integration Solutions, LLC |
| HMIS FSM | HMIS Fire System Maintenance |
| HVAC | Heating, Ventilation, and Air Conditioning |
| iCAS | Integrated Contractor Assurance System |
| ICD | Interface Control Document |
| INFRA | Hanford Site Infrastructure |
| INFRA-EW | Hanford Site Infrastructure Export Water System |
| INFRA-RW | Hanford Site Infrastructure Raw Water System |
| INFRA-SW | Hanford Site Infrastructure Sanitary Water System |
| ITM | Inspection, Testing, and Maintenance |
| LWSS | Limited Water Volume Wet-pipe Sprinkler System |
| MSA | Mission Support Alliance, LLC |
| NFPA | National Fire Protection Association |
| NICET | National Institute for Certification in Engineering Technologies |
| NMMP | Nuclear Maintenance Management Program |
| OFI | Opportunity for Improvement |
| OHC | Other Hanford Contractor |
| OOD | Operations Oversight Division |
| ORP | Office of River Protection |
| ORPS | Occurrence Reporting and Processing System |
| PM | Preventive Maintenance |
| POD | Plan of the Day |
| RFAR | Radio Fire Alarm Reporter |
| RL | Richland Operations Office |
| SHR | System Health Report |
| SR | Surveillance Requirement |

## Acronyms (cont'd)

| | |
|---|---|
| SS | Safety Significant |
| SSCs | Structures, Systems, and Components |
| SSO | Safety System Oversight |
| SWOC | Solid Waste Operations Complex |
| TSR | Technical Safety Requirement |
| WRPS | Washington River Protection Solutions, LLC |
| W&SU | Water and Sewer Utilities |

# INDEPENDENT ASSESSMENT OF FIRE SYSTEM MAINTENANCE AT THE HANFORD SITE

## Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of fire system maintenance performed by Hanford Mission Integration Solutions, LLC (HMIS) and facility-operating contractors at the Hanford Site from April to May 2024. The assessment also evaluated the effectiveness of the Office of River Protection and Richland Operations Office (together "DOE Hanford") oversight of fire system maintenance. Additionally, the assessment reviewed corrective actions for fire system maintenance-related items identified during previous EA oversight activities.

EA identified the following strengths, including one best practice:

- DOE Hanford provides a master oversight plan to Richland Operations Office Facility Representatives with all the information necessary to conduct high-quality, risk-informed oversight across multiple functional areas and Hanford Site contractors. (Best Practice)
- After identifying inoperable safety significant fire suppression systems (FSSs), dry-pipe sprinkler systems in Central Waste Complex 2402W-series waste storage buildings are in the process of being replaced with upgraded systems that improve margin of safety and correct the identified issues.
- Water supply upgrades are ongoing to address previously identified water supply adequacy and reliability vulnerabilities, including upgrading existing pumps to provide a dual-source capability, ensuring each pump can individually supply the combined fire protection demands.
- Site Fire Marshal responsibility is established with the site integration contractor, but centrally vetted Deputy Fire Marshals embedded in building-operating contractors' staffs enhance local decision-making capabilities.

EA also identified several areas of concern, including one finding, as summarized below:

- HMIS does not have an approved nuclear maintenance management program, and work performed at nuclear facilities is not subject to the facilities' nuclear maintenance management programs. (Finding)
- Technical safety requirement surveillance requirements are not adequate to ensure that safety-significant FSSs at the Central Waste Complex can still perform their safety functions; this issue has been known for at least five years and has not been corrected.
- Emergency impairments of multiple fire systems at the 222-S Laboratory have not been resolved in a timely manner.
- Seasonal cold-weather preparations have not been adequate to prevent freeze damage to FSS piping at one or more Hanford Site nuclear facilities each of the past three winters.
- Training and qualification of some technicians performing fire system inspection, testing, and maintenance does not meet DOE standards or are not well documented; the Hanford Fire Department is not trained on the operation of all FSSs at the 222-S Laboratory.
- While DOE Hanford programmatic oversight of contractor fire protection programs is comprehensive and substantive, no coordinated strategy has been established to review the overall operational performance of fire system maintenance by HMIS on facilities having operational oversight from multiple DOE Hanford groups.

In summary, fire system maintenance programs on the Hanford Site are generally adequately established, but FSS ITM weaknesses continue to impact multiple Hanford Site nuclear facilities. Additionally, the coordination between the site integration contractor's fire system maintenance group and the nuclear facility-operating contractors it supports is not always adequate to ensure that preventive maintenance is performed as scheduled and corrective maintenance is appropriately prioritized and timely performed. Further, aging infrastructure may impact the reliability and adequacy of the water supply for nuclear facility FSSs. Until the concerns identified in this report are addressed or effective mitigations are put in place, elevated risk associated with maintenance and reliability of fire systems remains.

# INDEPENDENT ASSESSMENT OF FIRE SYSTEM MAINTENANCE AT THE HANFORD SITE

## 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), conducted an assessment of the effectiveness of fire system maintenance at the Hanford Site. The assessment was conducted from April to May 2024.

Hanford Mission Integration Solutions, LLC (HMIS) supports DOE and other Hanford Site management and operations contractors under the Hanford Mission Essential Services Contract, providing infrastructure and site services that are integral and necessary to accomplish the environmental cleanup mission. Among the site services provided by HMIS are fire and emergency response services, which include inspection, testing, and maintenance (ITM) of existing and new fire protection systems for the Hanford Site.

Per contract requirements, ITM is provided by the HMIS Fire System Maintenance (FSM) organization at facilities operated by other Hanford contractors (OHCs), including Central Plateau Cleanup Company, LLC (CPCCo), Hanford Laboratory Management and Integration, LLC (HLMI), and Washington River Protection Solutions, LLC (WRPS). HMIS FSM performs the following distinct scope of inspection, testing, and preventive, predictive, and routine corrective maintenance at OHC facilities:

- Fire suppression systems (FSSs) (quarterly, semi-annual, annual, 3-year, and 5-year as per National Fire Protection Association (NFPA) 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*)
- Fire detection and alarm systems (semi-annual, annual, and biennial as per NFPA 72, *National Fire Alarm and Signaling Code*)
- Backflow preventer ITM per NFPA 25 and American Water Works Association (AWWA) requirements and State of Washington regulations
- Dry chemical fire extinguishing systems (semi-annual and annual as per NFPA 17, *Standard for Dry Chemical Extinguishing Systems*).

The Hanford Fire Department (HFD), which is also an HMIS organization, performs annual ITM of portable fire extinguishers as per NFPA 10, *Standard for Portable Fire Extinguishers*. As a sitewide practice, these devices are replaced with new units on 6- or 12-year frequencies instead of completing additional ITM requirements.

Facility-operating contractors are responsible for the balance of ITM of facility FSSs, fire detection and alarm systems, dry chemical fire extinguishing systems, and portable fire extinguishers within their facilities. Facility-operating contractors also perform ITM of passive fire barriers and associated opening protectives, emergency lighting and exit signage, and lightning protection systems, and implement cold weather preparation and surveillance activities.

In June 2021, CPCCo identified a lack of internal inspections of the Central Waste Complex (CWC) safety significant (SS) FSSs and received DOE Hanford authorization to self-perform this work. In November 2022, CPCCo discovered that two branch lines of an SS fire sprinkler system in one building at the CWC were completely occluded. For the CWC, adherence to NFPA 25 is credited as part of the technical safety requirement (TSR)-required fire protection safety management program.

Since the discovery of the degraded FSS at the CWC, several additional adverse events affecting fire systems have occurred at Hanford Site high-hazard nuclear facilities, including a FSS pipe-freeze event affecting multiple locations at the Building 242-A Evaporator (operated by WRPS), and a pipe-freeze event and valve misalignment at the 222-S Laboratory (operated by HLMI) that would have prevented systems from performing their fire suppression and life-safety functions. Following these events, the Office of River Protection (ORP) and Richland Operations Office (RL)[1] (together "DOE Hanford") and the affected contractors have begun implementing programmatic corrective actions to ensure that fire systems are able to perform their required nuclear-safety and life-safety functions.

This assessment evaluated the effectiveness of contractor programs in managing and performing maintenance on fire systems. The assessment also evaluated the effectiveness of DOE Hanford oversight of contractor fire system maintenance. Additionally, the assessment reviewed corrective actions for fire system maintenance-related items identified during previous EA oversight activities.

## 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 contractor programs managing and performing maintenance on fire systems. Criteria to guide this assessment were based on objectives 4.4 and 4.6 of EA Criteria Review and Approach Document (CRAD) 31-12, Revision 2, *Fire Protection Program*, and objectives MT.2, MT.5, MT.7, MT.14, and MT.17 of EA CRAD 30-06, Revision 0, *Conduct of Maintenance*.

EA examined key documents, such as system descriptions, work packages, procedures, manuals, analyses, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs; observed fire system maintenance activities; and walked down significant portions of selected fire systems, focusing on maintenance and corrective actions from previous events. The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

This assessment also reviewed the completion and effectiveness of corrective actions from findings described in previous EA assessments of fire protection program (FPP) implementation at the Hanford Site Solid Waste Operations Complex (SWOC), which includes CWC, conducted in September and October 2018,[2] and of commissioning test procedures at the Hanford Site Waste Treatment and Immobilization Plant conducted August through October 2021.[3] The results of the corrective action assessments are included in section 3.7 of this report. Further, this assessment completed an item for follow-up described in a December 2021 report documenting an EA assessment of the WRPS issues management program.[4]

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[1] Some oversight functions are consolidated between ORP and RL; both provide programmatic oversight for projects managed by both offices.
[2] See EA report *Fire Protection Program Implementation Assessment at the Hanford Site Central Waste Complex and T Plant – May 2019*
[3] See EA report *Independent Assessment of Direct-Feed Low-Activity Waste Commissioning Test Procedures at Hanford Site Waste Treatment and Immobilization Plant – May 2022*
[4] See EA report *Independent Assessment of the Washington River Protection Solutions, LLC Management of Safety Issues at the Hanford Site – December 2021*

## 3.0 RESULTS

### 3.1 Fire Protection Maintenance Programs

This portion of the assessment evaluated the effectiveness of the CPCCo, HLMI, WRPS, and HMIS FPPs, fire hazards analyses (FHAs), delegated FPP responsibilities, and approved equivalencies and exemptions in defining respective ITM programs for fire protection and life safety structures, systems, and components (SSCs) and features at the Hanford Site.

#### 3.1.1 Administration of Fire Protection Programs

**Fire Protection Programs**

The CPCCo, HLMI, WRPS, and HMIS FPPs are generally adequately documented and appropriately based on the respective contracts, in accordance with DOE Order 420.1C, *Facility Safety*; DOE-STD-1066-2016; *Fire Protection*; and NFPA codes and standards. Specifically:

- CPCCo has established an adequate FPP (CPCC-STD-FP-40404, *Fire Protection Program*) for CPCCo facilities, which has been approved by DOE Hanford. The CPCCo FPP adequately defines the ITM program for SWOC CWC facility fire protection and life safety SSCs and features that is verified through periodic self-assessments. Recent self-assessments, CPCC-CR-2023-0674, *Fire Protection Exemption Review*, and CR-ASMT-ENG-2023-MA-00294, *Comprehensive fire protection self assessments (SMP LOIs 11-3-1, 11-4-1, 11-4-2, 11-4-3, 11-5-1, 11-6-1, 11-7-1, 11-7-2)*, appropriately included elements evaluating fire protection ITM performance.
- HLMI has established a generally adequate FPP (HLMI-PLN-FP-51082, *Fire Protection Program*) for HLMI facilities that defines the ITM program for the 222-S Laboratory fire protection and life safety SSCs and features. However, contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.b.(1), HLMI has not submitted this FPP to DOE Hanford for review and approval. (See **Deficiency D-HLMI-1**.) DOE approval ensures that applicable contractor FPP objectives, requirements, and performance expectations are appropriately identified and understood by DOE line management. DOE Hanford previously approved a "blue-sheeted" version of the WRPS FPP (TFC-PLN-13, *Fire Protection Program*) in April 2022 in support of the contract transition to HLMI. Additionally, HLMI-PLN-FP-51082 does not instruct HLMI fire protection engineering to assess fire protection ITM as part of the annual fire protection assessment of the 222-S Laboratory in accordance with DOE-STD-1066-2016, section 7.2.3. (See **OFI-HLMI-1**.)
- WRPS has established a generally adequate FPP (TFC-PLN-13) for WRPS facilities, which has been approved by DOE Hanford. The WRPS FPP adequately defines the ITM program for Building 242-A Evaporator facility fire protection and life safety SSCs and features. However, TFC-PLN-13 does not instruct WRPS fire protection engineering to assess fire protection ITM as part of the enduring annual fire protection assessment of Building 242-A in accordance with DOE-STD-1066-2016, section 7.2.3. (See **OFI-WRPS-1**.) Nevertheless, the scope and effectiveness of the Building 242-A fire protection ITM program has been appropriately assessed as part of ongoing readiness activities.
- HMIS has established an adequate FPP (HMIS-PLN-FP-58194, *Hanford Fire Department Program Plan*) for HMIS facilities, which has been approved by DOE Hanford. The HMIS FPP adequately defines the sitewide ITM program for facility fire protection and life safety SSCs and features that is verified through periodic sampling self-assessments. In accordance with HNF-52336, *Authorities, Responsibilities, and Duties of the Hanford Fire Marshal (Fire Marshal's Charter)*, and HMIS-RD-FP-7889, *Fire Protection System Testing/Inspection/Maintenance/Discrepancies*, the Hanford Fire Marshal (HFM) performs periodic assessments of the fire protection ITM. The last two ITM program self-assessments demonstrated adequate evaluations and appropriate reviews of program maturity

with improvement actions identified and entered into the integrated Contractor Assurance System (iCAS) for issues management disposition.

**Fire Hazards Analyses**

Overall, the FHAs for CPCCo (SWOC), HLMI (222-S Laboratory) and WRPS (Building 242-A Evaporator) adequately assess the hazards of and potential damage from fire to ensure that analyzed fire hazards are prevented or sufficiently mitigated. In general, the FHAs adequately identify applicable fire system design criteria to demonstrate that fire safety objectives will be met. Concise descriptions of building construction are provided, fire-rated separations are identified, and building fire areas are adequately defined as required by DOE-STD-1066-2016. The Building 242-A Evaporator FHA is within the 3-year review and update cycle and meets the requirements of DOE Order 420.1C and TFC-ESHQ-FP-STD-06, *Fire Hazard Analysis and Fire Protection Assessment Requirements*. However, the following weaknesses were identified:

- Contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.f.(1)(d), CPCCo has not maintained the SWOC FHA within the 3-year review and update cycle. (See **Deficiency D-CPCCo-1**.) An FHA that is not maintained up to date may result in an incomplete hazards analysis and missing controls necessary to mitigate the risk of fire.
- Contrary to DOE-STD-1066-2016, section 4.4.2.3; AGS-G010, *Standard of Practice for Glovebox Fire Protection*, section 6.2; and NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*, section 4.3.2.2, the fire analyses for the 222-S Laboratory hot cells and gloveboxes are incomplete and do not adequately analyze the hazards or potential damage of fire and/or energetic events. (See **Deficiency D-HLMI-2**.) An incomplete FHA may result in selected fire controls that are insufficient to mitigate the risk of fire.

**Delegation of Authority Having Jurisdiction Responsibilities**

DOE Hanford has adequately delegated specific FPP authority having jurisdiction responsibilities and authorities to the HMIS HFM through approval of HMIS-PLN-FP-58194. CPCCo, HLMI, and WRPS appropriately designate one or more deputy fire marshals (DFMs) through implementation of HNF-52336; HNF-58158, *Fire Protection Flow-Down of Roles, Responsibilities, Authorities, and Enforcement*; HNF-51041, *AIA for Fire Protection Flow-Down Roles, Responsibilities, and Enforcement*; and each contractor's FPP. DFMs are empowered with responsibilities and authorities delegated by the HFM, which include approving some fire protection ITM procedures, overseeing facility fire protection water supplies, and specifying compensatory actions in response to fire protection system impairments for the respective contractor.

**Inspection, Testing, and Maintenance Equivalencies and Exemptions**

DOE Hanford has appropriately approved equivalencies and exemptions from several historical editions of NFPA 25 and NFPA 72 since the early 1990s. Reviewed ITM procedures adequately demonstrate that approved equivalencies/exemptions are selectively applied to fire suppression, water supply, and fire detection and alarm systems except those designated as safety class SSCs. A previous HFM assessment (HMIS-ASMT-2020-0141, *FYPLAN-FY2021 ME000000 - Fire System Inspection, Testing, & Maintenance at a select OHC Facility*) appropriately concluded that a comprehensive mapping of implemented ITM equivalency and exemption elements is lacking within contractor and HMIS ITM procedures; corrective actions remain outstanding.

### 3.1.2 Infrastructure Fire Protection Inspection, Testing, and Maintenance Program

Hanford Site water-based FSSs depend on a reliable water source that is supplied by the Hanford Site infrastructure (INFRA). HMIS responsibilities to operate and manage the INFRA (e.g., tanks, pumps, valves, piping) water system are sufficiently documented (reference Contract 89303320DEM000031). INFRA consists of three separate water systems: export water system (INFRA-EW), raw water system (INFRA-RW), and sanitary water system (INFRA-SW). The Water and Sewer Utilities (W&SU) organization appropriately implements the HMIS Maintenance Management Program strategy as outlined in HMESC-PLN-MN-56352, *Maintenance Management Plan*, and HMESC-PLN-MN-61087, *Maintenance Five-Year Plan*. W&SU relies on the HMIS Maintenance Services organization to perform all ITM on W&SU assets, primarily in three categories: predictive, preventive, and corrective maintenance.

Routine monitoring of each water system (INFRA-EW, -RW, and -SW) is adequately documented through system health reports (SHRs) completed by HMIS W&SU engineers as required by HMIS-PRO-ENG-61164, *Infrastructure System Health and Status Reports*. Four reviewed SHRs sufficiently depict the overall system health in terms of a defined rating system and include factors such as preventive and corrective maintenance, status of system configuration, system availability, and age. System supply piping vulnerabilities appropriately include critical systems that contain a single point of failure, aging or obsolete infrastructure, and equipment with a risk of impacting safety, compliance, and/or environmental regulations on failure. However, SHRs do not address the identification, monitoring, and leakage rate of the aged underground water supply distribution system, constructed of numerous different types of piping material (e.g., polyvinyl chloride, cement-lined cast/ductile iron, asbestos cement, reinforced cement lined carbon steel, unlined cast/ductile iron). (See **OFI-HMIS-1**.)

HMIS is appropriately performing water supply upgrades to address previously identified water supply adequacy and reliability vulnerabilities. Project L-895 will appropriately upgrade existing pumps to ensure that each pump can individually supply the combined fire protection demands and provide a dual-source capability by using the cross-site tie on the INFRA-RW system line (see HNF-67940, *Hanford Site Water System Master Plan*). Project L-850 includes a 1,500,000-gallon tank for the INFRA-SW system that will replace the system's current tank. The new tank appropriately includes freeze protection to satisfy NFPA requirements. Project L-850 will also install four pumps to pressurize the INFRA-SW grid. Applicable NFPA codes and standards are appropriately identified through the respective functional requirements and design criteria documents (see HNF-FRDC-63979, *Project L-895, Fire Protection Infrastructure for Plateau Raw Water Functional Requirements and Design Criteria*, and HNF-FRDC-62005, *Projects L-849 and L850, Replacement of the 200E and 200W Potable Water Tanks Functional Requirements and Design Criteria*). These upgrades are scheduled for completion in fiscal year (FY) 2025.

### 3.1.3 Facility Fire Protection Inspection, Testing, and Maintenance Programs

Each Hanford contractor's documents[5] adequately define the roles, scope of responsibilities, and reporting authorities for the performance of ITM of fire protection and life safety SSCs and features within Hanford Site facilities consistent with contract requirements. Reviewed HMIS ITM documents demonstrate the use of detailed procedures that include facility and system specific data sheets with appropriate acceptance criteria and necessary response actions should the acceptance criteria not be met. This data collection sufficiently supports trending and monitoring used in SHRs. Similarly, reviewed facility-performed ITM local procedures commonly contain detailed instructions, acceptance criteria, and

[5] CPCC-PRO-FP-40425, *Fire Protection System Inspection, Testing, and Maintenance*, and CPCC-PRO-FP-40426, *Fire Protection System Discrepancies*, for CPCCo; HLMI-STD-FP-50567, *Fire Protection System Inspection, Testing, Maintenance, and Discrepancy Management*, for HLMI; TFC-ESHQ-FP-STD-04, *Fire Protection System Inspection, Testing, Maintenance, and Discrepancy Management*, for WRPS; and HMIS-RD-FP-7899, *Fire Protection System Testing/Inspection/Maintenance/Discrepancies*, for HMIS

necessary response actions should the acceptance criteria not be met, providing data for trending and monitoring.

HMIS FSM execution of ITM within Hanford Site facilities appropriately requires collaboration and coordination with facility operations for successful completion of scheduled activities. The observed annual fire alarm system device testing at the HLMI 222-S Laboratory included complex coordination with facility stationary operating engineers to observe and verify proper exhaust fan controls and response during duct smoke detector testing that demonstrated effective coordination.

In response to delinquent ITM performance, CPCCo appropriately initiated and completed internal piping inspections of 2402W-series and 2403W-series dry-pipe sprinkler systems using an outside contractor and is implementing corrective and recommended improvement actions. For example, the dry-pipe sprinkler riser assemblies in these buildings are being systematically replaced as responsive corrective maintenance. The 2402WC dry-pipe sprinkler system was completely replaced with an upgraded system capable of protecting an Ordinary Hazard Group 2 occupancy (quantity and combustibility of contents is moderate to high) in contrast to the former system only capable of protecting an Ordinary Hazard Group 1 occupancy where combustibility is low and quantities are moderate (see NFPA 13, *Standard for the Installation of Sprinkler Systems*). This upgrade provides a higher level of protection (or greater margin of safety) and is a repeatable design suitable for other 2402W-series buildings.

**Fire Protection Maintenance Programs Conclusions**

DOE Hanford-approved contractor FPPs adequately define fire protection ITM programs for facility fire protection and life safety SSCs and features, including consistent roles and scope of responsibilities, and define delegated roles, responsibilities, and authorities for the HFM and DFMs. Approved equivalencies and exemptions for some ITM requirements are selectively included in current contractor ITM procedures. However, identified weaknesses include the lack of DOE Hanford approval for the HLMI FPP, delinquent FHA update for SWOC (CPCCo) and incomplete fire analyses for the 222-S Laboratory hot cells and gloveboxes.

## 3.2 Implementation of National Fire Protection Association Codes and Standards

This portion of the assessment evaluated whether CPCCo, HLMI, WRPS, and HMIS have implemented comprehensive and adequate ITM and impairment control programs for fire protection and life safety SSCs, features, and equipment that align with NFPA codes and standards requirements.

As previously identified by the four contractors, not all NFPA 25- and NFPA 72-required ITM is being performed at the Hanford Site. ITM requirements and gaps in performance within CPCCo, HLMI, and WRPS facilities have been adequately and comprehensively identified within HNF-63654, *Review of MSA* [Mission Support Alliance, LLC] *Fire Systems Maintenance ITM Procedures Against NFPA Requirements* (revised by HMIS in March 2022), and by other individual self-assessments, for NFPA 17, NFPA 25, and NFPA 72. Multiple corrective action plans have been developed by the individual contractors and HMIS with progress discussed as appropriate in sections 3.2.1 and 3.2.2 below.

### 3.2.1 Infrastructure Implementation of NFPA Codes and Standards for ITM

In general, HMIS has established and implemented an adequate ITM program for fire protection systems. DOE Hanford assessment DOE-ASMT-2023-2588, *RL/ORP Management Assessment of the Hanford Site Water Utilities Availability and Reliability for Fire Water*, recently identified vulnerabilities with the operation and maintenance of the Hanford Site water supply, appropriately citing that "HMIS W&SU does not have a well-defined process for implementation and verification for meeting the requirements for

operation and maintenance of the water supply system such as that of AWWA G200." This DOE Hanford assessment and subsequent letter of concurrence (HMIS-2200321, *Request for Concurrence with Proposed Approach to Determine the Applicability of NFPA 24 to Hanford's Water Piping*) appropriately resulted in HMIS identifying numerous corrective actions (HMIS-CR-2022-0450, *Implementation of DOE Approved NFPA 24 Determination Methodology*) including identifying applicable NFPA and AWWA ITM requirements for the Hanford Site INFRA water systems (e.g., tanks, pumps, valves, piping).

In general, the ITM requirements for the fire protection water supply to the SWOC CWC and 222-S Laboratory have been identified and implemented to satisfy applicable NFPA codes and standards. The water supply for the Hanford Site consists of both the raw and sanitary water systems, while the Building 242-A Evaporator is limited to the raw water supply. The fire protection water supply demarcation point is associated with the first off-valve/post indicator valve for the respective facility (see HNF-46148, *Interface Control Document*). The underground distribution system control valves and backflow prevention devices, and fire hydrants are appropriately subject to routine ITM consistent with NFPA 25. ITM records demonstrate that annual tests for backflow preventers on the fire protection water supplies to SWOC CWC, 222-S Laboratory, and Building 242-A were completed, with the exception of forward-flow testing (HMIS FSM effectively uses "Get-to-Green" stoplight charts to track the status of individual building sprinkler systems for forward-flow testing status of completion). Completed five-year fire inspection flush and flow tests sufficiently affirm the required facility sprinkler system (SWOC, 222-S Laboratory, and Building 242-A Evaporator) demands are being met and aligns with the available maximum INFRA water supply system (see HNF-61874, *Evaluation and Determination of Maximum Central Plateau Fire Flow*). Underground distribution system control and sectional valves are appropriately exercised annually and are currently being evaluated to determine applicable ITM requirements (see HMIS-CR-2022-0450, *Implementation of DOE Approved NFPA 24 Determination Methodology*). Water was observed to be leaking from the fire protection water supply yard backflow preventer enclosure 280W5 east of the 222-S Laboratory, and temporary electrical cords were routed to enclosures 280W4 and 280W5 (indicating loss of normal power for heating). (See **OFI-HMIS-2**.)

### 3.2.2 Facility Implementation of NFPA Codes and Standards for ITM

**CPCCo SWOC CWC Facilities ITM**

CPCCo has established and implemented a generally adequate ITM program for fire protection and life safety SSCs and features for CWC facilities with performance gaps as identified in HNF-63654 based on the Building 2402WB, 2402WC, 2402WE, 2402WF, and 2403WB sample set.

*Dry-pipe Sprinkler Systems*

Building 2402WB, 2402WC, 2402WE, 2402WF, and 2403WB dry-pipe sprinkler systems are generally adequately subject to routine ITM consistent with NFPA 25 requirements. SWSD-PRO-OP-51716, *Cold Weather Protection Plan*, specifies appropriate daily/as-needed CWC sprinkler riser room temperature checks. Reviewed records demonstrate that monthly visual inspection of sprinkler system control valves and riser room temperatures (per approved equivalency), and weekly/monthly riser pressure gauge readings, are appropriately performed by CPCCo using SWSD-PRO-OP-51714, *Inspect CWC & Miscellaneous Buildings*. CPCCo demonstrated adequate performance of an observed post-ITM system operability verification for the Building 2402WB SS sprinkler system using CPCC-PRO-OP-54359, *CWC & WRAP Fire Suppression Operability Verification*.

Quarterly and less frequent ITM of the Building 2402WB, 2402WC, 2402WE, 2402WF, and 2403WB dry-pipe sprinkler systems is generally adequately performed by HMIS using FMS-PRO-ITM-61678, *Maintenance on Dry Pipe Sprinkler Systems*, and FMS-PRO-ITM-61682, *Inspecting and Testing Dry*

*Riser Fire Sprinkler Systems*. Eleven reviewed ITM work packages for Buildings 2402WB, 2402WC, 2402WE, 2402WF, and 2403WB, demonstrated generally adequate quarterly, annual, and 3-year ITM performance. Observation of the annual ITM of the Building 2402WB and 2402WC sprinkler systems demonstrated effective performance in accordance with HMIS procedures, and the interior condition of the dry-pipe valves was excellent. Sprinkler riser and full system replacements within the last two years for several CWC buildings have appropriately re-started the 3-year and 5-year ITM cycles for those systems and are therefore current.

However, contrary to the NFPA 13 section 8.2.3.2 design objective of 60 seconds for the water transit delivery time to the remote test outlet, the April 2024 3-year ITM activity for the Building 2403WB riser #2 (work document FP-24-00455) documented a water transit delivery time of 80 seconds. While NFPA 25 does not specify 60 seconds as a pass/fail criterion, the observed water transit delivery time is to be used for comparison with acceptance test results and previous trending for determination of a system problem. The April 2024 ITM activity also documented a 57 second water transit delivery time to the remote test outlet for Building 2403WB riser #1 which is of similar configuration and size. (See **Deficiency D-CPCCo-2**.) Exceeding the design objective for water delivery time may contribute to a larger fire for which the dry-pipe sprinkler system may not be designed to control. Furthermore, FMS-PRO-ITM-61682 lacks acceptance criteria for the dry-pipe valve trip time and water transit delivery time to the inspector's test connection (e.g., 60 seconds or less) during full flow trip tests, which inhibits the prompt investigation into the cause of delayed time results. (See **OFI-HMIS-3**.)

CPCC-STD-FP-40404, section 1.3.8, and CPCC-PRO-FP-40425 appropriately state that fire protection engineering staff provide oversight and support of fire protection ITM within SWOC facilities. Reviewed SHRs demonstrate that ITM results are adequately evaluated as part of the cognizant system engineering program for the CWC SS sprinkler systems in accordance with CPCC-STD-EN-40330, *System Health Reports*.

*Fire Detection and Alarm Systems*

The Building 2402WB, 2402WC, 2402WE, 2402WF, and 2403WB fire alarm system(s), consisting of Radio Fire Alarm Reporter (RFAR) panels, monitoring sprinkler system devices, and manual pull stations, are generally adequately subject to routine ITM consistent with NFPA 72 requirements using FSM-PRO-ITM-61674, *Testing and Maintenance of Conventional Fire Alarm Control Unit (FACU)*. Three reviewed annual ITM work packages for the RFAR at Building 2402W demonstrated adequate performance in accordance with procedures, including appropriate verification of riser room temperature monitoring devices that support an approved NFPA 25 equivalency. The most recent annual ITM work package reviewed for Building 2403WB (work document FP-24-25077) demonstrated generally adequate performance, including confirmation of the building exhaust fan shutdown (four fans) auxiliary control function initiated by the RFAR zone #1 sprinkler riser #1 flow alarm switch. However, the FMS-PRO-ITM-61674 system-specific data sheet does not annually confirm the building exhaust fan shutdown auxiliary control function upon initiation of RFAR zone #2 (sprinkler riser #2 flow alarm switch) or zone #3 (manual pull stations) as specified by NFPA 72, table 14.4.3.2, item 24. (see **Deficiency D-CPCCo-3**). Fire alarm system auxiliary control functions not subject to routine testing verification may not reliably operate as intended, including interfaced systems. Reviewed FMS-PRO-ITM-61682 data sheets for Building 2403WB sprinkler system testing (work documents FP-23-07076, FP-24-00455, and FP-24-00475) document adequate flow alarm testing but did not confirm the building exhaust fan shutdown auxiliary control function for either sprinkler riser.

*Portable Fire Extinguishers and Life Safety Equipment*

CWC building portable fire extinguishers are adequately subject to routine ITM consistent with NFPA 10 requirements. CPCCo procedures SWSD-PRO-OP-51714, appendix L; CPCC-PRO-FP-54129, *Portable Fire Extinguishers*; and CPCC-GD-FP-5413, *Fire Protection Self-Inspections*, appropriately specify required monthly visual inspections of building portable fire extinguishers. CWC building life safety systems and equipment (emergency lighting and exit signage) are appropriately subject to routine ITM consistent with NFPA 101, *Life Safety Code*, requirements through implementation of CPCC-PRO-FP-54130, *Life Safety Features and Emergency Lighting*, and CPCC-PRO-MN-40508, *Emergency Lighting and Exit Sign Inspection/Testing/Repair*. No adverse conditions were observed with portable fire extinguishers, battery-operated emergency lighting fixtures, or self-luminous exit signage within Buildings 2402WB and 2402WC.

**HLMI 222-S Laboratory ITM**

HLMI has established and implemented a generally adequate ITM program for fire protection and life safety SSCs and features at the 222-S Laboratory with performance gaps as identified in HNF-63654. The 222-S Laboratory is protected by four wet-pipe and two dry-pipe automatic sprinkler systems, except in specific areas described within HNF-SD-CP-FHA-003, *222-S Laboratory Fire Hazard Analysis*, that are generally adequately subject to routine ITM consistent with NFPA 25 requirements.

*Wet- and Dry-pipe Sprinkler Systems*

HLMI adequately performs monthly visual inspections of sprinkler system control valves using HLMI-PRO-FP-50176, *222-S Lab Monthly Check of Fire Protection and Emergency Equipment*. The reviewed last three completed monthly inspections demonstrated satisfactory performance. Further, HLMI has performed appropriate testing and inspections resulting in further actions as follows:

- The 5-year internal pipe inspection of the 222-S Laboratory riser #2 wet-pipe and riser #2 auxiliary dry-pipe sprinkler systems was appropriately performed by HMIS in December 2023 in accordance with NFPA 25, section 14.2.1.1. The riser #2 auxiliary system is supplied from the 222-S Laboratory riser #2. This inspection found excessive debris, rust, and sludge throughout the piping of both systems and appropriately led to declaration of an emergency impairment and implementation of compensatory actions defined by the HLMI DFM in HFM permit 2023-0472. The systems remain in-service but provide indeterminate protection capability pending planned corrective actions (see section 3.2.3 of this report).
- A sample of 4 50-year-old sprinklers from the 222-S Laboratory riser #2 wet-pipe system protecting the first-floor laboratory areas was appropriately subject to Nationally Recognized Testing Laboratory (NRTL) testing in 2023 per NFPA 25, section 5.3.1, with 1 of the 4 sprinklers exhibiting "abnormal" performance, requiring full replacement of this population due to this failure rate (iCAS condition report HLMI-CR-2022-0196 and HFD Discrepancy Notification No. 23-00801).
- A sample set of 50-year-old sprinklers from the 222-S Laboratory riser #1 wet-pipe system protecting the second-floor heating, ventilation, and air conditioning (HVAC) equipment room was appropriately subject to NRTL testing in 2015 per NFPA 25, section 5.3.1 and the sprinklers were determined to operate "normally," allowing continued use for another 10 years.

While most 222-S Laboratory sprinkler system ITM is generally adequate, the following weaknesses were identified:

- Contrary to NFPA 25, section 4.1.2.5, daily cold weather protection rounds performed per HLMI-OR-OPS-51339, *222-S Complex Cold Weather Protection Checklist for Chemical Technologists*, do

not include a temperature check of the 222-S Laboratory dry-pipe sprinkler system riser #4 room. (See **Deficiency D-HLMI-3**.) Missing daily temperature checks during cold weather of dry-pipe sprinkler system riser rooms could result in freeze damage to system piping and the impairment of required fire protection.

- Neither HLMI-OR-OPS-51339 nor HLMI-OR-OPS-51325, *222-S Complex Cold Weather Protection Checklist for Stationary Operating Engineers*, include a check for temperature and/or exterior alarm lights for all of the heated yard backflow preventer enclosures for the 222-S Laboratory fire suppression systems. (See **OFI-HLMI-2**.)

HMIS generally performs adequate quarterly and less frequent ITM of the 222-S Laboratory sprinkler systems through FSM-PRO-ITM-61683, *Maintenance on Wet Pipe Sprinkler Systems*; FSM-PRO-ITM-61681, *Inspection and Testing Wet Risers Fire Sprinkler Systems*; FMS-PRO-ITM-61678; and FMS-PRO-ITM-61682. Seven reviewed ITM work packages for the 222-S Laboratory sprinkler systems demonstrated generally adequate quarterly, annual, and 3-year ITM performance. However, contrary to NFPA 25, section 5.2.6, no evidence of routine ITM of the heat tracing system protecting the wet supply line to the Building 222-SH dry-pipe riser #2 auxiliary was provided. (See **Deficiency D-HLMI-4**.) Missing ITM of this heat tracing system could result in freeze damage to system supply piping and impairment of required fire protection for Building 222-SH. Additionally, the March 2024 HMIS FSM "Get-to-Green" stoplight chart shows that internal pipe inspections, flushing (where needed), fire department connection hydrostatic testing, and backflow preventer forward flow testing were incomplete for 222-S Laboratory sprinkler systems.

*Limited Water Volume Wet-pipe Sprinkler Systems*

HLMI performs generally adequate monthly ITM (reference HLMI-PRO-FP-50176) of the special limited water volume wet-pipe sprinkler systems (LWSSs) protecting selected hot cells, gloveboxes, and a hood, consisting of compressed air pressurized water storage tanks/containers, distribution piping, sprinklers, and alarm supervision devices. However, the eight pressurized water storage canisters (fire extinguisher cylinders) for two LWSSs are inspected as typical portable fire extinguishers in HLMI-PRO-FP-50176 but are uniquely configured for LWSS applications that do not align with NFPA 10 inspection criteria. (See **OFI-HLMI-3**.)

HMIS performs generally adequate quarterly, annual, and 5-year ITM of the LWSSs through FSM-PRO-ITM-61671, *222-S Hot Cell Limited Water Sprinkler System Functional Test*; FSM-PRO-ITM-61704, *Inspect and Test Pressurized Limited H2O Canisters*; and FSM-PRO-ITM-62186, *Maintenance on Wet Riser Check Valves and Associated Equipment 222-S Hot Cell Limited Water Sprinkler System*, responsive to applicable NFPA 25 requirements. Five reviewed ITM packages for these systems demonstrated generally adequate performance with procedure steps and scope. However, the following weaknesses were identified:

- Contrary to DOE Order 422.1, *Conduct of Operations*, attachment 2, requirement 2.h.(5), the last annual FSM-PRO-ITM-61671 inspection record (work document FP-23-05260) documents a completed inspection of hot cell sprinklers and associated piping (step 6.2.1 responsive to NFPA 25, sections 5.2.1.1 and 5.2.2) that could not be fully performed due to inaccessibility of the space and limited ability to inspect the sprinkler heads through the hot cell windows. (See **Deficiency D-HMIS-1**.) Recording procedure steps that cannot be performed as having been satisfactorily completed could result in inaccurately documented system conditions and does not ensure system operation with the known, proper configuration as designed.
- Contrary to NFPA 25, section 13.5.1, FSM-PRO-ITM-61671, section 6.7, does not address routine ITM for the hot cell LWSS pressure tank relief valve. (See **Deficiency D-HMIS-2**.) A pressure

relief device not subject to routine ITM may not reliably operate as intended. FSM-PRO-ITM-61671, step 6.7.3, only requires dislodging of accumulated debris and verification that the devices properly reset and does not require confirmation of proper operation at the required pressure for the protection of the tank, piping, and devices.

- Contrary to DOE-STD-1066-2016, sections 6.3.1 and 6.4.1, and NFPA 1620, *Standard for Pre-Incident Planning*, section 7.3.1, which requires documenting the means for manual fire department activation of FSSs in pre-incident plans, the HFD pre-incident plan for the 222-S Laboratory lacks operating instructions for the hot cell LWSS. (See **Deficiency D-HMIS-3**.) Lack of familiarity and operating instructions for establishing the alternative water supply for the hot cell fire extinguishing system within the fire department pre-incident planning documents may preclude effective emergency response to a fire event. The HLMI FPP Manager explained that the HFD is not trained on the means to manually align the hot cell LWSS for the alternative water supply configuration.

*Dry Chemical Fire Extinguishing Systems*

Three dry chemical fire extinguishing systems protecting the 222-S Laboratory yard area hazardous material storage buildings HS00065, HS00082, and HS00083 are adequately subject to routine ITM consistent with NFPA 17, NFPA 72, and manufacturer requirements. HLMI adequately performs monthly visual inspections of the systems during HLMI-PRO-FP-50176. A review of three previously completed monthly visual inspections demonstrated satisfactory performance. Quarterly, semi-annual, and annual ITM is adequately performed by HMIS through FSM-PRO-ITM-61718, *Inspection and Testing of Hazardous Storage Pyro-Chem Model PCI Dry Chemical Extinguishing Systems*. Review of the last two ITM records demonstrated satisfactory performance by HMIS. According to HNF-63654, dry chemical agent storage containers are appropriately replaced upon reaching the 12-year hydrostatic due date.

*Fire Detection and Alarm System*

The 222-S Laboratory fire detection and alarm system is adequately subject to routine ITM consistent with NFPA 72 requirements as modified by approved equivalencies. The annual ITM completed by HMIS is adequately performed through FSM-PRO-ITM-61993, *Fire Alarm Control Unit (FACU) Inspection, Testing, and Maintenance*, and FSM-PRO-ITM-61719, *Function Test and Inspect Initiation and Notification Devices*. Two reviewed completed work packages and an observation of a portion of the annual FACU and device testing demonstrated satisfactory performance.

*Portable Fire Extinguishers and Life Safety Equipment*

The 222-S Laboratory portable fire extinguishers are subject to adequate routine ITM consistent with NFPA 10 requirements. HLMI adequately performs monthly visual inspection of the systems in accordance with HLMI-PRO-FP-50176. Three reviewed records for monthly visual inspections demonstrated satisfactory performance. Sample observation of portable fire extinguishers within the 222-S Laboratory noted no adverse conditions. 222-S Laboratory life safety systems and equipment are subject to routine ITM by HLMI consistent with NFPA 101 requirements through adequate implementation of HLMI-PRO-MAINT-50254, *Emergency Lighting Inspection and Testing*, and linked data sheets (instructions and equipment inventories). Portions of the 222-S Laboratory that are lacking complete emergency lighting coverage have appropriate compensatory actions implemented pending planned improvement actions.

*Fire Barriers*

The 222-S Laboratory designated fire barriers enclosing stair and elevator shafts are adequately subject to biennial inspection consistent with applicable NFPA and building code requirements. A review of the last two inspection records demonstrated adequate performance. HLMI has self-identified (iCAS action request HLMI-AR-2023-0572) that fire doors within the designated fire barriers are not being inspected annually as required by NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, and is in the process of implementing corrective actions.

**WRPS Building 242-A Evaporator ITM**

WRPS has established and implemented a generally adequate ITM program for fire protection and life safety SSCs and features at Building 242-A with performance gaps as identified in HNF-63654.

*Wet-pipe Sprinkler System*

The Building 242-A wet-pipe automatic sprinkler system is generally adequately subject to routine ITM consistent with NFPA 25 requirements. Visual inspection of sprinkler system control valves and pressure gauge readings are appropriately completed by WRPS during weekly and monthly Operations rounds/tours. The reviewed tour record for May 2, 2024, demonstrated satisfactory performance. Four reviewed ITM work packages for the Building 242-A wet-pipe sprinkler system demonstrated generally adequate quarterly and annual ITM procedure performance by HMIS using FSM-PRO-ITM-61683 and FSM-PRO-ITM-61681. WRPS nonconformance report TO-NCR-2023-0083, *242A Fire Protection System* (March 2023), appropriately addresses lacking or incomplete internal pipe inspections and flushing (if needed), lead-in strainer ITM, fire department connection hydrostatic testing, and backflow preventer forward flow testing (iCAS action request WRPS-AR-2023-0996, *242A Fire Protection System*). The March 2024 HMIS FSM "Get-to-Green" stoplight chart showed that the last three of these ITM activities remained outstanding.

*Fire Detection and Alarm System*

The Building 242-A fire detection and alarm system is adequately subject to routine ITM consistent with NFPA 72 requirements. Four reviewed ITM work packages implementing FSM-PRO-ITM-61719; FSM-PRO-ITM-62005, *MAAP+ Fire Alarm Control Unit (FACU) Testing/Maintenance*; and FSM-PRO-ITM-62147, *Monaco Model MAAP+ Fire Alarm Reporter (RFAR) Testing & Maintenance*, demonstrated adequate annual ITM procedure performance including auxiliary control functions.

*Portable Fire Extinguishers and Life Safety Equipment*

Building 242-A portable fire extinguishers, emergency lighting units, and exit signs are generally adequately subject to routine ITM consistent with applicable NFPA requirements. WRPS adequately performs monthly visual inspections of these devices in accordance with 242-85B-005, *Safety Equipment Inspection and Operational Checks*, except for verifying portable fire extinguisher fullness (weighing or hefting). Review of a sample set of records from the last two completed monthly visual inspections of portable fire extinguishers and exit signage demonstrated generally satisfactory performance with checklist requirements. Review of the last two annual ITM records for the emergency lights demonstrated satisfactory performance per NFPA 101 requirements.

*Lightning Protection*

WRPS report RPP-TE-58996, *242-A Evaporator Lightning Protection System Evaluation*, appropriately concludes that Building 242-A should be provided with a lightning protection system per NFPA 780,

*Standard for the Installation of Lightning Protection Systems*. WRPS has self-identified this as a future facility upgrade (iCAS action request WRPS-AR-2024-0684). HNF-SD-WM-FHA-024, *Fire Hazard Analysis for the Evaporator Facility (242-A)*, describes the low impedance ground for the Building 242-A vessel vent stack as providing protection from lightning strikes, but RPP-TE-58996 establishes the technical basis that the low impedance ground is not an NFPA 780 lightning protection system and therefore not subject to this standard's ITM requirements.

### 3.2.3 Fire Protection System Impairment Control Programs

CPCCo, HLMI, WRPS, and HMIS have established generally adequate impairment control programs for fire protection SSCs in HMIS-RD-FP-7899, CPCC-PRO-FP-40426, HLMI-STD-FP-50567, and TFC-ESHQ-FP-STD-04, respectively, which are appropriately based on DOE Order 420.1C, DOE-STD-1066-2016, and applicable NFPA codes and standards. Instructions for notifications, tagging, tracking, establishing compensatory actions by the HFM or DFMs, fire surveillance/watch instructions, and restoration are adequately described within these procedures. No active fire protection system impairments were in place at the Building 242-A Evaporator or 2402W-series CWC facilities during this assessment. The 222-S Laboratory had the following active sprinkler system impairments in place during this assessment:

- Isolation of riser #1 (protecting second floor level) due to leaking backflow preventer (open since November 2, 2023)
- Riser #2 (protecting first floor) due to obstructed piping observed during internal piping inspections (IPIs) (open since December 7, 2023, see section 3.2.2 of this report)
- Riser #2 auxiliary (protecting adjacent Building 222-SH) due to obstructed piping observed during IPIs (open since December 12, 2023, see section 3.2.2 of this report)
- Isolation of riser #3 (protecting the maintenance annex) due to freeze damage (open since January 15, 2024).

These 222-S Laboratory sprinkler system impairments are collectively addressed, including comprehensive compensatory actions, within HFM permit 2023-0472, and appropriately prepared and managed by the HLMI DFM. However, the following weaknesses were identified:

- Contrary to DOE Order 420.1C, attachment 2, chapter II, sections 1.b, 1.c, and 3.c.(2)(b), HLMI has not maintained automatic sprinkler systems capable of performing their intended design function in the 222-S Laboratory. (See **Deficiency D-HLMI-5**.) Without reliable automatic sprinkler system protection, the 222-S Laboratory is vulnerable to damage or loss. HNF-SD-CP-FHA-003 states that the calendar year (CY) 2020 maximum possible fire loss estimate is $130 million for the 222-S Laboratory and well in-excess of DOE Order 420.1C, attachment 2, chapter II, section 3.c.(2), property protection thresholds for automatic sprinkler systems throughout the facility. Furthermore, this FHA describes a vulnerability with unprotected vertical ductwork penetration openings that credits the sprinkler systems for mitigation. All four 222-S Laboratory risers (#1, #2, #2 Auxiliary, and #3) have been impaired for over four months.
- The HLMI task plan for resolution of the riser #2 and riser #2 auxiliary sprinkler system impairments includes securing a subcontractor to appropriately perform NFPA 25-specified flushing of the piping and nondestructive examination of piping conditions, with conditional follow-on tasks based on the results of these activities. The planned replacement of the "abnormal" population of riser #2 50-year-old sprinklers is appropriately incorporated into the task planning. These systems remain in service but provide indeterminate protection capability, with reliance on operational limitations and nearly complete remotely monitored automatic fire detection in the areas of coverage (instead of fire surveillances) established in HFM permit 2023-0472 as appropriate compensatory actions. However,

the HLMI task plan has a preliminary completion date no earlier than mid-CY 2025, leaving key portions of the facility without reliable DOE Order 420.1C-required protection for an undesirable extended period. (See **OFI-HLMI-4**.)

In addition, inconsistencies exist among the CPCCo, HLMI, WRPS, and HMIS ITM program procedures on the expectations for response and restoration of emergency impairments. CPCC-PRO-FP-40426 emphasizes expediency for impairment resolution. HLMI-STD-FP-50567 and TFC-ESHQ-FP-STD-04 retain what was explained as an older "priority" response scheme that includes target resolution timeframes for return to service (i.e., Priority 1 within 24-hours; Priority 2 within 21-days). HMIS-RD-FP-7899 describes a qualitative scheme with impairments of safety systems and those within nuclear facilities as having the highest priority without restoration timeframes. Additionally, a focus on maintaining routine ITM schedules diminishes the priority attention on facility prioritized resolution of emergency impairments. (See **OFI-HMIS-4**.)

**Implementation of National Fire Protection Association Standards Conclusions**

Acknowledging the previously identified NFPA 25 and NFPA 72 ITM program gaps, CPCCo, HLMI, WRPS, and HMIS have implemented generally adequate ITM and impairment control programs for fire protection and life safety SSCs and features for the sample set of facilities assessed. Weaknesses were identified for CPCCo associated with recent testing results for Building 2403WB. HLMI weaknesses include inadequate ITM for a sprinkler system riser room and a heat trace system, and appropriate ITM criteria for the LWSSs in the 222-S Laboratory. Finally, the lack of timely resolution of sprinkler system impairments at the 222-S Laboratory is a significant weakness.

### 3.3 Fire System Surveillances at SWOC

CPCCo appropriately plans, schedules, and performs TSR surveillances to ensure that documented safety analysis (DSA)-credited sprinkler systems in SWOC facilities provide adequate fire protection for other SS SSCs, critical process equipment, and high-value property, and can prevent fires from impacting the remainder of the facility. The CPCCo detailed operating procedures for the fire systems appropriately contain "use every time" attachments for performing and documenting surveillance requirements (SRs) to verify system operability. Acceptance criteria are well-defined and serve as baseline requirements. Observed surveillances of *Verify Static Pressure at 286W-WATER-SW-GAGE-1 or 286W-WATER-SW-GAGE-2 is >70 psi (SR 4.2.1.1*) and *VERIFY water supply isolation valves "SWOC Post Indicating Valves/Control Valves" are open and either locked open or visual tamper device intact (SR 4.2.1.2)* demonstrated that CPCCo operations personnel have adequate knowledge of system operability limits and equipment control settings as described in the TSR bases. However, the following weaknesses were identified:

- Contrary to 10 CFR 830, *Nuclear Safety Management*, subpart B, section 830.204(b)(4), and appendix A, section G.3; and DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, section 4.4.X.4, CPCCo has not evaluated and specified the minimum performance criteria for the SWOC FSSs in the SWOC DSA. (See **Deficiency D-CPCCo-4**; see also previous 2019 EA Finding F-CHPRC-1,[6] which is further discussed in section 3.7 of this report.) Incomplete TSRs for the SS FSSs may result in the safety function not being satisfied and operability requirements not being met.
- Contrary to 10 CFR 830, subpart B, appendix A, section G.4.(iii); SR 4.2.1.1 and SR 4.2.1.2; and CPCC-ICD-HMESC-00003, *Interface Control Document between CPCCo and HMIS for Water and*

[6] See EA report *Fire Protection Program Implementation Assessment at the Hanford Site Central Waste Complex and T Plant – May 2019*

*Sewer Services*, CPCCo has not updated the interface control document (ICD) to include the minimum water supply criteria for SWOC FSSs necessary to ensure that the SWOC TSRs are met. (See **Deficiency D-CPCCo-5**). An insufficient water supply for SWOC FSSs may result in the system operability requirements not being met.

**Fire System Surveillances at SWOC Conclusions**

In general, CPCCo adequately performs SWOC TSR surveillances in accordance with safety basis documents and applicable codes and standards. However, CPCCo has not evaluated and specified the minimum performance criteria for the SWOC FSSs in the SWOC DSA, which was previously identified by EA in a 2019 assessment. Additionally, HMIS has not updated the ICD to ensure that the minimum water supply criteria are identified to ensure that the SWOC FSS TSRs are satisfied.

## 3.4 Conduct of Maintenance for Fire Systems

This portion of the assessment evaluated whether the contractors have approved nuclear maintenance management programs (NMMPs) that address resources, work planning and control, types of maintenance and post-maintenance testing, maintenance personnel training and qualification, configuration management, and seasonal facility preservation.

**Maintenance Management Program Resources**

CPCCo (CWC facilities), HLMI (222-S Laboratory), and WRPS (242-A) have each established adequate maintenance staffing levels through formal staffing analyses governed by approved NMMPs (CPCC-MP-MN-40443, *Nuclear Maintenance Management Program (NMMP) Description Document*, HLMI-PLN-OPS-51112, *NMMP,* and TFC-PLN-29, *NMMP*). HMIS provides FSS maintenance support to all three contractors and has adequate staffing levels based on a low maintenance backlog; however, HMIS does not have an approved NMMP and no formal staffing analysis has been conducted. Contrary to DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, attachment 2, section 1.b, HMIS has not developed an NMMP. (See **Finding F-HMIS-1**.) Lack of an NMMP could lead to maintenance being inappropriately conducted. Further, because an NMMP has not been developed, staffing levels have not been appropriately evaluated through a formal staffing plan.

**Work Planning and Control**

The NMMPs for CPCCo, HLMI, and WRPS appropriately require proper planning, scheduling, coordination, and control of maintenance work activities. Plan-of-the-day (POD) and plan-of-the-week meetings are appropriately used to control and schedule work activities performed by each contractor. Each contractor uses appropriate tracking and scheduling tools to ensure that periodic maintenance is completed on schedule. Preventive maintenance (PM) activities that are not completed on time are appropriately tracked by each contractor's scheduling and tracking system. HMIS is appropriately tracking overdue FSS maintenance activities in its maintenance backlog. HMIS conducts pre-shift, mid-shift, and end-of-shift POD meetings. Work planners effectively assemble and plan work packages. HMIS appropriately includes the system engineer in the review of completed work and the evaluation of system conditions when they are not as expected; however, HMIS-PRO-WC-12115, *Work Management*, does not address the role of the system engineer in the work planning process.

HMIS coordinates with each facility; however, HMIS personnel do not participate in the operating facilities' POD meetings. Interviewed CPCCo, HLMI, and WRPS facility management stated that they do not have control over the work performed by HMIS and don't always know whether HMIS will conduct the work that they are expecting. Contrary to DOE Order 433.1B, attachment 2, section 2.d,

work planning is not adequately integrated between HMIS and the other contractors. (See **Deficiency D-HMIS-4**.) A lack of thorough integration of HMIS activities into the operating facilities' POD processes could lead to loss of control of the operability of facility safety systems and could result in hazards associated with co-located work not being adequately addressed.

**Types of Maintenance and Post-maintenance Testing**

The NMMPs for CPCCo, HLMI, and WRPS, and HMIS-PRO-WC-19304, *Periodic Maintenance Process*, adequately address different maintenance types. The NMMPs appropriately require a balance of preventive and corrective maintenance, and evaluative techniques are applied to ensure a balance between maintenance types.

All four contractors appropriately perform corrective maintenance to ensure the safe, efficient, and reliable operation of safety SSCs. Three reviewed completed work packages performed by each contractor appropriately documented the completion of corrective maintenance activities demonstrating an adequate process for performing corrective maintenance. These completed corrective maintenance work packages were documented as required by the maintenance work control processes. Corrective maintenance currently accounts for approximately 25% of the maintenance (by total maintenance activities) for HMIS. These completed work packages demonstrated appropriate and timely review, ensuring proper completion of maintenance work and verification that the corrective action resolved the problem.

Review of five completed PM work packages demonstrated that the work was properly performed. Work step performance was documented as required in all five completed PM work packages.

The NMMPs and HMIS-PRO-WC-12115 provide adequate direction for the performance of post-maintenance testing. Steps for performing post-maintenance testing and associated acceptance criteria were appropriately included in the three reviewed corrective maintenance work packages. During the observation of a corrective maintenance activity to troubleshoot and repair a Harlow and Monaco RFAR Panel, the associated corrective maintenance work package also contained the appropriate steps to perform the system restoration testing and return the system to service. HMIS properly performed the steps, applied the acceptance criteria, and documented the results.

Six observed PM pre-job briefings adequately covered the work to be performed and the potential hazards. These six PM/testing activities demonstrated adequate conduct of maintenance. Maintenance steps were appropriately read, performed, and checked as completed. Recording of calibrated test equipment was accurately recorded in the work record as required.

**Maintenance Personnel Training and Qualification**

HMIS FSM personnel are trained and qualified in accordance with HMIS-PS-10663, *FSM Group Training Requirements*, and FSM-PRO-TRN-62363, *Fire System Maintenance Training Program*. These procedures adequately specify the requirements, competencies, and qualification cards for electricians and pipe fitters who perform fire system maintenance in support of CPCCo, HLMI, and WRPS. The qualification requirements for fire system maintenance personnel supervisors are also appropriately specified. The training and qualification program allows for qualification based on previous experience and accurately specifies requalification requirements. Completed qualification cards for 7 electricians, 10 pipe fitters, and 2 supervisors properly specified that they were fully qualified. However, contrary to FSM-PRO-TRN-62363, section 3.2, HMIS did not include evidence of previous experience with the qualification records for personnel (four pipe fitters) qualified based on prior experience. (See **Deficiency**

**D-HMIS-5**). Incomplete qualification records could result in unqualified personnel performing maintenance on fire systems.

**Configuration Management**

CPCCo, HLMI, and WRPS have established adequate configuration management programs that flow down requirements from their respective NMMPs to configuration management program documents (CPCC-PRO-EN-20050, *Engineering Configuration Management*; HLMI-PLN-ENG-51110, *Configuration Management Plan*; and TFC-PLN-23, *Configuration Management Plan*). HMIS has established an adequate configuration management program through HMIS-PRO-ENG-20050, *Engineering Configuration Management*. These programs appropriately address the requirements of DOE-STD-1073-2016, *Configuration Management*. Five completed change packages contained adequate detail to document the change, were approved by management, and were appropriately reviewed through the unreviewed safety question (USQ) process. Interviewed work planners were properly familiar with the requirements to have changes reviewed by the appropriate engineer and the USQ process. System walkdown evidence was adequately included in SHRs.

During an observed corrective maintenance activity performed by HMIS FSM at a CPCCo nuclear facility (FP-24-02737/Y, *HFD – Standing – 2706T Troubleshoot Harlow and Monaco RFAR Panels*), a transformer was incorrectly replaced with one that had similar but not identical specifications. The work package required any change of components to be like-for-like. After discussion between the electricians and their supervisor, a decision was made to install the non-like-for-like transformer; however, engineering was not contacted. Contrary to DOE Order 433.1B, attachment 2, section 2.h, and HMIS-PRO-ENG-20050, which requires an engineering evaluation to determine whether a non-identical substitute part constitutes a modification, an engineering evaluation did not occur. (See **Deficiency D-HMIS-6**.) Replacing components in a fire alarm panel with non-identical components and no engineering evaluation to determine acceptability could result in degraded performance or a lack of configuration control for the system.

**Seasonal Facility Preservation**

Each contractor has appropriately established a seasonal facility preservation program. CPCCo, HLMI, and WRPS appropriately flow down seasonal facility preservation requirements identified in their NMMPs to implementing documents (CPCC-PRO-MN-472, *Cold Weather Protection*, for CPCCo; HLMI-STD-ENG-50492, *Seasonal Requirements for HLMI SSCs*, for HLMI; and SWSD-PRO-OP-51716 for WRPS). HMIS has established seasonal facility preservation measures through HMIS-PRO-WC-472, *Cold Weather Protection*, for facilities in which it is an occupant. All four programs establish requirements for periodic surveillance of facility systems during cold weather. A review of completed seasonal facility preservation checklists for all four contractors (two for each contractor from March/April 2024) demonstrated that the checks are being adequately performed as required. However, some freeze damage to safety systems has occurred over three consecutive winters. (See **OFI-CPCCo-1**, **OFI-HLMI-5**, and **OFI-WRPS-2**.)

**Conduct of Maintenance for Fire Systems Conclusions**

CPCCo, HLMI, and WRPS have each established adequate maintenance staffing levels through formal staffing analyses governed by approved NMMPs. Work planning and control is generally adequate, and different types of maintenance are adequately addressed. Training and qualification of maintenance personnel is generally adequate, and configuration management programs are generally well established. However, HMIS does not have an approved NMMP as required. Other identified weaknesses include a lack of integration of HMIS activities into the operating facilities' POD processes, some incomplete

qualification records, and a lack of engineering evaluation for a component replacement. Finally, although existing seasonal facility preservation programs have been implemented, freeze damage to systems has occurred over three consecutive winters.

## 3.5 Contractor Interface

This portion of the assessment evaluated contract interface processes for the timely communication and resolution of ITM-related issues. *Hanford Site Services and Interface Requirements Matrix* (J-3 Matrix), section J, attachment J.3, of each contract identifies the mandatory and optional services provided by the Hanford Mission Essential Services Contract (i.e., HMIS) to OHCs.

**Interface Management between Contractors**

CPCCo, HLMI, WRPS, and HMIS have implemented generally adequate processes to communicate and resolve ITM-related issues. The J-3 Matrix, interface number 2, establishes interface management expectations between the Hanford Site contractors and requires that they work collaboratively to resolve issues at the lowest possible level of operations. Interviewed contract interface managers for each of the four contractors described good working relationships with their counterparts. They explained that issues that cannot be resolved at the working level can be elevated to them to attempt to find an acceptable resolution. Additional mechanisms (e.g., Contractor Interface Board, Hanford Leadership Council) are appropriately formalized and in place for issues that cannot be resolved by the interface managers, although each noted that escalation to those levels is not desirable and rarely occurs.

While the communication processes are generally adequate, four of the seven reviewed FSS-related Occurrence Reporting and Processing System (ORPS) reports submitted during the previous two years and three additional issues reviewed by EA demonstrated that Hanford contractors' issues resolution processes are ineffective for managing issues with potentially wider ranging impacts. Actions taken to resolve these specific issues had limited transparency beyond the parties directly working to resolve them, although similar conditions could reasonably impact other site contractors and operations. (See **OFI-DOE Hanford-1**). Specifically:

- Two contractors experienced ORPS-reportable events related to FSS freeze damage approximately 13 months apart. Both events were preceded by HVAC malfunctions, with the full implications of those malfunctions unrecognized at the time. After the events, both affected contractors identified limitations in their existing controls and surveillances related to low temperature environmental conditions. Inter-contractor communications were not adequate for preventing the second similar event.
- In September 2022, HMIS secured a damaged raw water line, with repair activities planned for the following week. HMIS provided a "courtesy notification" to some downstream facilities and communicated that it would have no impact on their operations due to the water loop configuration providing an alternate flow path. Three days later, a downstream operation reported a lack of water flow or pressure. The lack of flow also impacted FSS functionality at the 222-S Laboratory and supporting facilities. HMIS personnel investigated and determined that their decision to reconfigure valves to isolate the leak did not consider an existing configuration change implemented in early 2020 that limited water flow to the 222-S Laboratory and supporting facilities to a single line. Corrective actions by HMIS focused on its internal work planning processes. HMIS also did not address additional actions, such as improving inter-contractor communications prior to activities that may impair adequate water for FSSs and coordinating efforts with downstream users to verify the continued availability of adequate flow and pressure.
- In March 2024, an ORPS-reportable fire occurred in a laboratory hood while HMIS FSM was actively engaged in repairing a damaged sprinkler riser and fire alarm functionality was in bypass mode, with adequate compensatory measure in place. A post-event review of the scenario revealed

that building occupants experienced a loss of confidence in the fire alarm system due to the event, as documented in *Hanford Laboratory Mission Integration (HLMI) Fire Protection Engineering – Post Incident Fire Investigation*. As a result, the HLMI FPP Manager requested HMIS FSM management to revise its work packages for the 222-S Laboratory to minimize the amount of time that alarm functionality is bypassed during fire protection system work. Broader applicability of the proposed changes is not part of the focus of these communications.

- A WRPS fire system specialist identified that an alarm control valve was in the closed position, which does not allow the local alarms to operate or send a signal to fire dispatch. HMIS FSM confirmed and corrected the as-found condition. WRPS appropriately initiated an extent-of-condition review of its facilities and is considering performing a cause analysis, as documented in the iCAS action request identifier WRPS-AR-2024-1563, *241-AZ-702 Alarm control valve improper orientation*. Because iCAS does not provide an interface between site contractors and inter-contractor issues, this issue has been assigned to the contract interface manager for additional coordination with HMIS external to iCAS. This issue may also affect other contractors' facilities; however, the existing communication processes do not ensure inter-contractor awareness.
- WRPS conducted a work observation during an FSS flush of a dry riser system in early April 2024. Management observation program (MOP) WRPS-MOP-2024-2110, *Job Oversight, 702AZ Fire Suppression System Flush*, identified several issues with the conduct of those work activities. The MOP notes that after multiple walkdowns and attempts to flush the system, the HMIS FSM crew did not arrive with all the necessary equipment and had to return to the shop for additional supplies before the system could be drained, causing some delays. The observing WRPS fire system specialist raised concerns to the crew that their intended flush sequence did not align with the flush plan in their work package and code requirements. Following the flush, the MOP notes that the crew inspected the pipe and determined that the flush did not remove all debris and, because they did not record the flow rate as required by code and their procedure, it resulted in a situation that will most likely require an additional line flush. WRPS communicated its observations to HMIS FSM management; however, similar conduct of work issues may also impact other contractors' facilities. WRPS also shared its concerns with HMIS FSM management that technicians not following procedure may indicate a potential lack of training, attention to detail, and understanding of the job requirements by the entire crew.

**Interface Management for Delivery of Fire Protection System Services**

HMIS has implemented generally adequate processes for the delivery of fire protection system services. The J-3 Matrix, interface number 20, establishes service expectations related to fire and emergency response services and covers fire protection system ITM, including backflow prevention devices. HMIS has established adequate processes to capture and communicate fire protection system deficiencies across the Hanford Site. The HFM's roles, responsibilities, and authorities are adequately defined, and clarity on how the roles of the HFM, DFMs, and fire protection engineers (FPEs) are interrelated is provided in supporting documents. However, the following weaknesses related to the delivery of ITM services were identified:

- HMIS is direct-funded by DOE to perform fire protection system ITM for each Hanford Site contractor during normal business hours at the site, and use of these services is mandatory. Hanford Site contractors can request additional work and/or work outside of this schedule by providing a statement of work and requesting that scope as a usage-based service. In early 2024, HLMI requested fire protection system testing activities during off-hours in order to minimize operational impacts, and funded an inter-contract work order (ICWO) for this effort. HMIS declined to accept the funding or perform this work outside of normal working hours. Because the use of HMIS for these services is mandatory under the terms of the J-3 Matrix but ICWO-funded activities are discretionary, the situation has not yet been resolved in a mutually acceptable manner.

- Although the current HMIS program FSM-PRO-TRN-62363, *FSM IT&M Training Procedure*, does not require certification, service delivery document J-3 ID #20, *Fire and Emergency Response Services (Fire Protection System Inspection, Testing, and Maintenance)*, July 2022, between HMIS and CPCCo/WRPS states in part that "[i]ndividuals performing IT&M [ITM] on fire suppression and fire alarm systems shall have a minimum Level II certification from the National Institute for Certification in Engineering Technologies (NICET)." Interviewed fire protection staff and contract interface managers expressed concerns over a lack of documentation on technician certifications or documented equivalencies. See further discussion in section 3.6 of this report.

**Contractor Interface Conclusions**

CPCCo, HLMI, WRPS, and HMIS have implemented generally adequate processes to communicate and resolve ITM-related issues. In addition, HMIS has implemented generally adequate processes for delivery of fire protection system services. However, some barriers to managing issues within the existing framework of iCAS limit inter-contractor visibility of issues and actions that may have broader applicability. Similarly, the routine practice of working to resolve issues directly between managers with different contractors can also limit the visibility of issues that may have broader applicability.

### 3.6 Federal Oversight

This portion of the assessment evaluated the adequacy of DOE Hanford's oversight of Hanford Site contractor fire system maintenance.

DOE Hanford's sitewide oversight process is directed by the field office manager in DOE-PRO-PAI-50085, *Integrated Oversight*. This procedure requires implementation using iCAS, which provides an electronic records and processing system for all Hanford contractors, as well as DOE Hanford. Each organization is provided a separate module in iCAS, with defined operability between modules. Assessment records (including "unscheduled" operations awareness activities) are generated, routed for approval, and stored using iCAS. All interviewed DOE Hanford managers and staff indicated familiarity with the routine use of iCAS to record the results of oversight activities. In addition, DOE Hanford Performance Assurance Group staff demonstrated the ability to produce oversight records aggregated by FY from iCAS.

DOE-PRO-PAI-50086, *Integrated Issues Management*, provides direction for processing issues identified during DOE Hanford oversight activities using iCAS. Any issues identified during assessments reside within iCAS, which has the ability to send issues generated in the Federal module to OHC modules. Furthermore, DOE Hanford can access issues managed by each of the contractors within iCAS. However, as noted in section 3.5, contractors do not have inter-contractor capabilities within iCAS and must communicate and coordinate actions on issues of broader impact outside of iCAS. (See **OFI-DOE Hanford-1**.) This capability gap limits the visibility of actions and status to resolve inter-contractor issues and reduces the likelihood that issues with broader, sitewide applicability will be readily identified.

DOE-PPD-NSE-50618, *Fire Protection Program*, delineates DOE Hanford's objectives, as well as specific roles and responsibilities for its FPP. DOE Hanford staffs two FPE positions to provide programmatic oversight of Hanford Site contractor FPPs. The incumbents in these positions are qualified to DOE-STD-1137-2014, *Fire Protection Engineering Functional Area Qualification Standard*. The FPEs complete annual continuing training, such as specific NFPA code training and Energy Facility Contractors Group annual meeting attendance. In addition, one FPE is currently completing the DOE-STD-8000-2021, *Safety System Oversight* [SSO] *Functional Area Qualification Standard*, technical qualification program, including an organization-specific qualification standard focusing on the SWOC

SS FSSs. However, DOE Hanford does not currently assign a designated qualified SSO for this system. (See **OFI-DOE Hanford-2**).

Additional expertise and communication efforts enhance the FPE oversight strategy. A government support service contractor (GSSC) is retained by DOE Hanford to provide supplemental technical expertise in fire protection. In addition, DOE Hanford plans to bring on one additional GSSC employee, as funding allows, to provide more in-field FPE presence. Finally, interviewed DOE Hanford FPEs described open communication with the DOE Hanford Facility Representatives (FRs) as a key component of their overall oversight strategy.

A review of 47 FPE programmatic oversight products – both formal, planned assessments and operational awareness activities – demonstrated comprehensive and substantive programmatic oversight of fire protection for multiple Hanford Site contractors. In addition, an interview with the FPEs revealed an oversight strategy that is responsive to emergent information and events at the six major Hanford contractors using a graded approach. The FPEs also demonstrated a commitment to two-way communication with Hanford Site contractors, both through informal discussions and formal, periodic fire protection status meetings with the contractors.

Some operational oversight of facility FPP implementation is provided by DOE Hanford FRs. These FRs are organizationally located within two separate Operations Oversight Divisions (OODs), one in RL and one in ORP. Three interviewed FRs assigned to each of the targeted facilities (Building 242-A, 222-S Laboratory, and the CWC) demonstrated an awareness of major fire protection activities, events, and concerns in their facilities, as well as DSA-credited fire protection controls. The qualification card for the CWC FR position includes a fire protection-related competency that reflects the SS FSS at the CWC. All interviewed FRs mirrored the DOE Hanford FPEs' descriptions of an open communication interface with the FPEs for the sharing of oversight data and concerns. For example, one FR provided documentation of a field-identified fire protection issue that was subsequently shared with the cognizant DOE Hanford FPE.

DOE Hanford provides its FRs with periodic focus areas for operational oversight on a monthly (conduct of operations for ORP) or quarterly (conduct of operations and work planning and control for RL) basis. In addition to basic focus areas, RL provides an annual master oversight plan to its FRs, which is considered a **Best Practice** because the master oversight plan provides each RL FR with all the information necessary to conduct high-quality, risk-informed oversight across multiple functional areas and Hanford Site contractors in one convenient document. RL solicits input from each FR, performs analysis, and aggregates information in the master oversight plan. The FY 2024 master oversight plan contains core performance areas (CPAs) and cross-cutting performance areas (CCPAs), along with specific examples of field oversight activities that could be performed by an FR to strongly assess each CPA and CCPA. A baseline oversight schedule is provided with the RL quarterly focus areas, as well as provisions for supplemental and reactive oversight. Significant performance issues are summarized by contractor and project, and areas warranting additional oversight emphasis are also described in the master oversight plan. Finally, throughout the master oversight plan, salient and diverse information from a variety of sources (including ORPS, DSAs, DOE Hanford issues documented in iCAS, and Hanford Site contractor adverse trends) is integrated into the document and applied contextually in a risk-adjusted fashion to enhance the overall oversight perspective for the FR.

Despite an overall strong FPE program as well as good communications between the FPEs and DOE Hanford FRs, operational oversight (both work planning and control and conduct of operations) of facility safety management performed by HMIS is not well coordinated between the ORP and RL projects. Interviews demonstrated differing expectations for which office is tasked with primary responsibility for conducting and documenting oversight of HMIS FSM. The absence of a coordinated DOE Hanford oversight strategy that tracks and compares HMIS FSM performance across multiple facilities limits the

ability to identify cross-cutting HMIS FSM issues. (See **OFI-DOE Hanford-3**.) An RL plan shared during interviews to hire an OOD GSSC to focus on HMIS operational oversight at multiple facilities could mitigate this concern.

On two occasions, DOE Hanford provided direction to Hanford Site contractors regarding ITM technical qualification in accordance with DOE-STD-1066, which in both cases impacted the associated HMIS contract requirement. In 2020, DOE Hanford provided direction to MSA on ITM technician qualifications in letter 20-NSD-0018_RL, *Response – RL Clarification – Application of the Requirement for Fire Protection Technicians to Meet the Standards of the National Institute for Certification in Engineering Technologies*. This direction was consistent with the 2012 edition of DOE-STD-1066, which considered NICET certification to be a recommendation, although that letter introduced a level of ambiguity by stating that NICET certification is not required for "routine" ITM, without defining the term.

In 2021, DOE Hanford reaffirmed its direction to HMIS in letter 20-NSD-0018_RL. However, the contract with HMIS incorporates a later edition of DOE-STD-1066, which establishes NICET certification as a technical expectation, with allowances for establishing alternate qualifications instead of NICET certification. As a result, although HMIS's training and qualification program, FSM-PRO-TRN-62363, is consistent with DOE Hanford direction, it is not fully aligned with the contract-incorporated standard. (See **OFI-DOE Hanford-4**.)

**Federal Oversight Conclusions**

In general, DOE Hanford oversight is well-established and tailored to provide appropriate levels of programmatic oversight of fire protection maintenance. Review of FPE oversight products demonstrates comprehensive and substantive programmatic oversight of the Hanford Site contractor FPPs. In addition, RL's annual master oversight plan provides high-quality information and oversight guidance to its FRs to enable an informed graded approach to field oversight, which is considered a best practice. However, the absence of a coordinated HMIS FSM operational oversight strategy challenges the ability to identify cross-cutting issues that affect multiple Hanford Site facilities and contractors. In addition, the SWOC SS FSSs are not assigned a qualified SSO.

## 3.7 Follow-up on Previous EA Findings

This portion of the assessment examined the status and corrective actions for the two findings documented in EA report *Fire Protection Program Implementation Assessment at the Hanford Site Central Waste Complex and T Plant – May 2019*. At the time of that assessment:

- CH2M HILL Plateau Remediation Company (CHPRC), the predecessor to CPCCo, managed and operated the Hanford Site CWC and T Plant.
- MSA, the predecessor to HMIS, managed the HFD, maintained infrastructure systems (e.g., water treatment and distribution systems), and provided FSS ITM services.

In addition, this assessment examined the status and corrective actions for the one finding documented in EA report *Independent Assessment of Direct-Feed Low-Activity Waste Commissioning Test Procedures at Hanford Site Waste Treatment and Immobilization Plant – May 2022*.

The three EA findings and their status are described below:

**Finding F-CHPRC-1** of the 2019 EA report stated that CHPRC had not specified and evaluated the minimum performance criteria for the SWOC FSSs in the SWOC DSA. This resulted in a set of TSRs for the FSSs that did not fully define the operability requirements and ensure that operable FSSs are available.

**Status**: In response to this finding, CHPRC initially concluded that an analysis supported downgrading the FSS from SS to general services and did not require a TSR to ensure operability. The CHPRC corrective action plan (CAP) identified that the finding would be closed following approval of an update to the SWOC DSA. DOE Hanford rejected this conclusion and determined that the FSS was credited and remains an SS SSC.

In March 2021, CPCCo retracted the CHPRC CAP and provided a new CAP for closure of the finding, which requires development of minimum performance requirements for the FSS to be incorporated into the SWOC DSA and TSRs. Actions to fully address this finding are not anticipated to be completed until mid-2025. In the interim, the current operability requirements in place are that the static pressure exceeds 70 pounds per square inch (psi) and that the facility water supply isolation valves are open, with the valves either locked open or have an intact visual tamper device. These operability requirements do not fully define the operability requirements and ensure that operable FSSs are available. (See section 3.3 of this report for additional details.) This finding remains open.

**Finding F-MSA-1** of the 2019 EA report stated that MSA had not established the required formal training program to ensure that technicians are qualified and trained to implement the required ITM on fire safety systems.

**Status**: Procedure FSM-PRO-TRN-62363 incorporates the mandatory requirements referenced in the finding. The program does not incorporate the recommendation in DOE-STD-1066-2012 that technicians be NICET certified. This is permitted under that edition of the standard and DOE Hanford direction provided to MSA in letter 20-NSD-0018_RL, which it reaffirmed to HMIS in letter 21-NSD-0018, *Response – National Institute for Certification in Engineering Technologies Clarification*. This finding has been adequately addressed.

Although the training program was developed and implemented to address the 2019 finding, several weaknesses with respect to NICET certification were identified during this review. HMIS has communicated technician certification expectations to supported contractors that are inconsistent with its current program. (See section 3.5 of this report for additional details.) In addition, although the 2012 edition of DOE-STD-1066 applicable to MSA considered NICET certification of technicians a recommendation only, the current contract with HMIS incorporates the 2016 edition of the standard, which considers NICET certification to be a technical expectation, with allowances for establishing alternate qualifications instead of NICET certification. However, HMIS cannot independently address this issue due to alternate direction contained in letter 21-NSD-0018. (See section 3.6 of this report for further discussion.)

**Finding F-ORP-1** of the 2022 EA report stated that ORP's issues management process does not provide a mechanism for ensuring that contractor problems identified during DOE oversight activities are evaluated and corrected on a timely basis, or to ensure that the contractor has implemented corrective actions that address the causes and prevent recurrence of high-significance issues and has verified the effectiveness of those actions.

**Status**: DOE Hanford recently updated its procedures to establish the responsibilities and implementing processes for the integrated RL and ORP issues management process. Procedure DOE-PRO-PAI-50085

was modified since the 2022 finding was issued to provide a note describing the follow-up requirements of DOE Order 221.B, section 4.b(4): "It is expected that follow-up review of significant DOE-identified contractor problems identified during DOE oversight activities is performed to ensure that the contractor has implemented corrective actions that address the causes and prevent recurrence of high-significance issues and has verified the effectiveness of those actions, as appropriate." Procedure DOE-PRO-PAI-50086 provides direction, through DOE-PRO-PAI-50086 and other referenced procedures, on actions to be taken for issues identified through assessments conducted by the U.S. Government Accountability Office, the DOE Office of Inspector General, the Defense Nuclear Facilities Safety Board, and DOE Headquarters organizations such as EA. This finding has been adequately addressed.

**Follow-up on Previous EA Finding Conclusions**

DOE Hanford has adequately revised its process to close the EA finding related to its issues management process. HMIS has adequately addressed the EA finding related to its training and qualification program. However, additional actions by CPCCo to address the EA finding related to FSS operability requirements have not yet been completed, and this finding remains open.

## 4.0 BEST PRACTICES

Best practices are safety-related practices, techniques, processes, or program attributes observed during an assessment that may merit consideration by other DOE and contractor organizations for implementation. The following best practice was identified as part of this assessment:

- RL provides an annual master oversight plan to its FRs that contains aggregated oversight information from many functional areas to enable an informed graded approach to field oversight.

## 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.

**Hanford Mission Integration Solutions, LLC**

**Finding F-HMIS-1**: HMIS does not have an approved NMMP as required. (DOE Order 433.1B, att. 2, sec. 1.b)

## 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.

**Central Plateau Cleanup Company, LLC**

**Deficiency D-CPCCo-1**: CPCCo has not maintained the SWOC FHA within the 3-year review and update cycle. (DOE Order 420.1C, att. 2, chap. II, sec. 3.f.(1)(d))

**Deficiency D-CPCCo-2**: CPCCo's 3-year ITM activity (in April 2024) for the Building 2403WB riser #2 dry-pipe valve documented a water transit delivery time to the inspector's test connection of 80 seconds, which is approximately 20 seconds greater than the design objective. (NFPA 13, sec. 8.2.3.2)

**Deficiency D-CPCCo-3**: CPCCo's last annual ITM activity for the Building 2403WB fire alarm system and sprinkler systems did not confirm the auxiliary control function of building exhaust system shutdown for alarm initiating zones. (NFPA 72, table 14.4.3.2, item 24)

**Deficiency D-CPCCo-4**: CPCCo has not evaluated and specified the minimum performance criteria for the SWOC FSSs in the SWOC DSA. (10 CFR 830, subpart B, sec. 830.204(b)(4) and app. A, sec. G.3; and DOE-STD-3009-94, sec. 4.4.X.4)

**Deficiency D-CPCCo-5**: CPCCo has not updated the ICD to ensure that the minimum water supply criteria for the SWOC FSSs TSRs are met. (10 CFR 830, subpart B, app. A, sec. G.4.(iii); SR 4.2.1.1 and SR 4.2.1.2; and CPCC-ICD-HMESC-00003)

**Hanford Laboratory Management and Integration, LLC**

**Deficiency D-HLMI-1**: HLMI has not submitted its current FPP (HLMI-PLN-FP-51082) to DOE Hanford for review and approval. (DOE Order 420.1C, att. 2, chap. II, sec. 3.b.(1))

**Deficiency D-HLMI-2**: HLMI has not documented a complete and adequate fire analysis for the hot cells and gloveboxes within the 222-S Laboratory. (DOE-STD-1066-2016, sec. 4.4.2.3; AGS-G010, sec. 6.2; and NFPA 801, sec. 4.3.2.2)

**Deficiency D-HLMI-3**: HLMI's 222-S Laboratory dry-pipe sprinkler system riser #4 room is not subject to daily temperature checks during cold weather. (NFPA 25, sec. 4.1.2.5, and HLMI-OR-OPS-51339)

**Deficiency D-HLMI-4**: HLMI does not include the heat tracing system for freeze protection of the wet supply piping to the Building 222-SH dry-pipe sprinkler system riser #2 auxiliary in its routine ITM program. (NFPA 25, sec. 5.2.6).

**Deficiency D-HLMI-5**: HLMI has not maintained in-service 222-S Laboratory automatic sprinkler systems capable of performing their intended design function by not timely addressing resolution/restoration emergency impairments. (DOE Order 420.1C, att. 2, chap. II, secs. 1.b, 1.c, and 3.c.(2)(b))

**Hanford Mission Integration Solutions, LLC**

**Deficiency D-HMIS-1**: An HMIS ITM inspection record for the 222-S Laboratory hot cell LWSS (Riser #7) documented the completion of inspection steps for sprinklers and piping that could not have physically been performed. (DOE Order 422.1, att. 2, requirement 2.h.(5); and NFPA 25, secs. 5.2.1.1 and 5.2.2)

**Deficiency D-HMIS-2**: HMIS ITM procedures for the 222-S Laboratory hot cell LWSS (Riser #7) lack routine ITM requirements for the pressure tank relief valve. (NFPA 25, sec. 13.5.1)

**Deficiency D-HMIS-3**: The HFD has not been provided with training and instructions on the means to manually-align the 222-S Laboratory hot cell LWSS for the alternative water supply configuration and this information is not included within HFD pre-incident planning documents. (DOE-STD-1066-2016, secs. 6.3.1 and 6.4.1, and NFPA 1620, sec. 7.3.1)

**Deficiency D-HMIS-4**: HMIS's work planning process is not adequately integrated into the operating facilities' POD processes. (DOE Order 433.1B, att. 2, sec. 2.d)

**Deficiency D-HMIS-5**: HMIS did not include evidence of previous experience with the qualification records for personnel qualified based on prior experience. (FSM-PRO-TRN-62363, sec. 3.2)

**Deficiency D-HMIS-6**: HMIS did not perform an engineering evaluation for the change out of a component in a fire alarm panel that was not like-for-like. (DOE Order 433.1B, att. 2, sec. 2.h, and HMIS-PRO-ENG-20050)

## 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.

**Central Plateau Cleanup Company, LLC**

**OFI-CPCCo-1**: Consider reassessing whether the scope of the seasonal facility preservation program is adequate, in light of recent freeze damage events.

**Hanford Laboratory Management and Integration, LLC**

**OFI-HLMI-1**: Consider including instructions within the HLMI FPP for fire protection engineering to evaluate fire protection ITM as an element of the 222-S Laboratory annual fire protection assessment consistent with DOE-STD-1066-2016, section 7.2.3.

**OFI-HLMI-2**: Consider including daily temperature checks and/or inspection of exterior alarm lights on all of the 222-S Laboratory yard area heated backflow preventer enclosures on fire protection supplies within HLMI-OR-OPS-51339 or HLMI-OR-OPS-51325 for proactive monitoring of fire protection system readiness.

**OFI-HLMI-3**: Consider incorporating specific inspection criteria for the 222-S Laboratory glovebox and hood LWSSs within HLMI-PRO-FP-50176 reflecting the unique configuration of the portable fire extinguisher cylinders that differ from typical NFPA 10 inspection criteria.

**OFI-HLMI-4**: Consider initiatives to accelerate the resolution/restoration of the 222-S Laboratory riser #2 and riser #2 auxiliary sprinkler system impairments, including replacement of "abnormal" 50-year-old sprinklers, and shorten the duration of the substandard level of protection.

**OFI-HLMI-5**: Consider reassessing whether the scope of the seasonal facility preservation program is adequate, in light of recent freeze damage events.

**Washington River Protection Solutions, LLC**

**OFI-WRPS-1**: Consider including instructions within the WRPS FPP for fire protection engineering to evaluate fire protection ITM as an element of the enduring Building 242-A annual fire protection assessment consistent with DOE-STD-1066-2016, section 7.2.3.

**OFI-WRPS-2**: Consider reassessing whether the scope of the seasonal facility preservation program is adequate, in light of recent freeze damage events.

**Hanford Mission Integration Solutions, LLC**

**OFI-HMIS-1**: Consider validating underground pipe leaks and developing a leakage rate for the underground water supply distribution system to ensure that an acceptable hydraulic margin exists for facilities with minimum water supply requirements and demonstrate adherence to American National Standard Institutes/AWWA G200, *Distribution Systems Operation and Management*.

**OFI-HMIS-2**: Consider elevating the priority for corrective maintenance at the 280W4 and 280W5 backflow preventers adjacent to the 222-S Laboratory to repair leaking devices and restore permanent electrical power.

**OFI-HMIS-3**: Consider incorporating acceptance criteria for the dry-pipe valve trip time and water transit delivery time to the inspector's test connection (e.g., 60 seconds or less) during full flow trip tests within FMS-PRO-ITM-61682 so that delayed time results initiate prompt investigation into the cause.

**OFI-HMIS-4**: Consider consensus development and promulgation of consistent fire protection system emergency impairment restoration priorities and associated timeline objectives.

**DOE Hanford**

**OFI-DOE Hanford-1**: Consider adding additional functionality to iCAS to enable contractors to share documented issues (that either require action by multiple contractors to resolve or have the potential to impact the operations of other contractors), providing visibility on planned actions, points of contact, and action status.

**OFI-DOE Hanford-2**: Consider expediting SSO qualification for the SWOC FSSs to ensure adequate oversight of this SS SSC.

**OFI-DOE Hanford-3**: Consider implementing a coordinated oversight strategy focused on operational oversight of HMIS FSM.

**OFI-DOE Hanford-4**: Consider updating the direction provided to HMIS related to training and qualification of personnel who conduct ITM to be consistent with DOE-STD-1066-2016.

# Appendix A
# Supplemental Information

**Dates of Assessment**

April 8 to May 8, 2024

**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
Christopher E. McFearin
Thomas C. Messer
William A. Eckroade

**EA Site Lead for the Hanford Site**

Eric A. Ruesch

**EA Assessment Team**

Eric A. Ruesch, Lead
Eric M. Moore
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James R. Streit