Independent Assessment of the Fire Protection Program at the Argonne National Laboratory

June 2025

U.S. DEPARTMENT of ENERGY | Office of Enterprise Assessments

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Acronyms

ACTS	ASO Commitment Tracking System
AFD	Argonne Fire Department
AGHCF	Alpha Gamma Hot Cell Facility
ANL	Argonne National Laboratory
Argonne	UChicago Argonne, LLC
ASO	Argonne Site Office
BIO	Basis for Interim Operations
BNA	Baseline Needs Assessment
CAHJ	Contractor Authority Having Jurisdiction
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
ESH	Environment, Safety, and Health
FACP	Fire Alarm Control Panel
FAO	Fire Alarm Office
FD&AS	Fire Detection and Alarm System
FDC	Fire Department Connection
FHA	Fire Hazards Analysis
FPA	Fire Protection Assessment
FP-AHJ	Fire Protection Authority Having Jurisdiction
FPE	Fire Protection Engineer
FPP	Fire Protection Program
FR	Facility Representative
FSS	Fire Suppression System
HSSD	High-sensitivity Smoke Detection
IBC	International Building Code
ITM	Inspection, Testing, and Maintenance
Li-ion	Lithium-ion
NFPA	National Fire Protection Association
OFI	Opportunity for Improvement
OSS	Office of Safety and Security
PAI	Permit Authorizing Individual
PIP	Pre-incident Plan
PM	Preventive Maintenance
RWSF	Radioactive Waste Storage Facility
SCMS	Office of Science Management System
SME	Subject Matter Expert
SMP	Safety Management Program
SOG	Standard Operating Guideline
SR	Surveillance Requirement
SS	Safety Significant
SSCs	Structures, Systems, and Components
TSR	Technical Safety Requirement
VSS	Vital Safety System
WCD	Work Control Document

INDEPENDENT ASSESSMENT OF THE FIRE PROTECTION PROGRAM AT THE ARGONNE NATIONAL LABORATORY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the fire protection program (FPP) at the Argonne National Laboratory (ANL) in November and December 2024. This assessment focused on Building 331 – Radioactive Waste Storage Facility (RWSF) and Building 212 – Alpha Gamma Hot Cell Facility (AGHCF), which are hazard category 2 and 3 nuclear facilities, respectively. UChicago Argonne, LLC (Argonne) is the prime contractor at ANL for the DOE Office of Science and is overseen by the Argonne Site Office (ASO). This assessment evaluated the effectiveness of Argonne's FPP, including policies, procedures, and fire and related safety hazards analyses; fire hazards analysis and safety design basis documentation integration; fire prevention and protection design requirements; surveillances and inspection, testing, and maintenance (ITM); and contractor self-assessment. Federal oversight by ASO relating to fire protection was also evaluated.

EA identified the following strengths, including one best practice:

- The Argonne Fire Department (AFD) has developed and implemented a standard operating guideline for identifying the hazards of and tactics for responses to lithium-ion battery incidents. The guide is directly responsive to the emergent concerns for emergency response to this increasingly prevalent hazard and is available for use by adjacent mutual aid fire departments. (Best Practice)
- Argonne has a strong central FPP organization, staffed with capable and qualified FPP personnel (fire protection engineers, cognizant system engineers, ITM technicians, and AFD personnel).
- The AFD made significant progress in addressing Argonne's 2021 baseline needs assessment recommendations, including staffing, training, and equipment.
- Argonne has shown a positive trend in FPP improvements since EA's previous assessment in 2015.
- Argonne initiated replacement of the high-sensitivity smoke detection system for the RWSF and repairs to the elevated water storage tank.
- ASO's nuclear safety and fire protection Facility Representatives have extensive knowledge of facility fire protection structures, systems, and components (SSCs) requirements and maintain a strong field presence.

EA also identified several weaknesses including but not limited to the following:

- Argonne did not include a required dust hazard analysis in the AGHCF fire hazards analysis.
- Argonne did not complete annual building fire protection assessments for the AGHCF and RWSF in calendar years 2023 and 2024.
- Argonne did not document obstructed sprinklers in the RWSF during the last performance of surveillance requirement (SR) 4.3.3 annual visual inspection.
- Argonne did not adequately document technical safety requirement (TSR) derivations for SR 4.3.1 and SR 4.3.4 for the RWSF.
- Argonne does not hydrostatically test the piping from the sprinkler system fire department connection to the fire department check valve every five years for the AGHCF and RWSF sprinkler systems.
- Argonne does not complete monthly and annual testing of RWSF battery-operated exit signs.

- ASO has not established a formal process for, nor documented, its required annual review of all contractor authority having jurisdiction (CAHJ) determinations to ensure that delegated fire protection authority having jurisdiction authorities are being appropriately employed.

In summary, Argonne has established a generally effective FPP, and ASO is adequately performing Federal oversight relating to fire protection. Several significant strengths were identified, including one best practice. However, this assessment identified weaknesses related to documentation, assessments, and ITM performance. Resolution of the weaknesses identified in this report will enhance the effectiveness of Argonne's FPP at ANL.

INDEPENDENT ASSESSMENT OF THE FIRE PROTECTION PROGRAM AT THE ARGONNE NATIONAL LABORATORY

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 fire protection program (FPP) at the Argonne National Laboratory (ANL). UChicago Argonne, LLC (Argonne) is the prime contractor at ANL for the DOE Office of Science and is overseen by the Argonne Site Office (ASO). Assessment activities were conducted in November and December 2024. This assessment was part of an ongoing review of FPPs at hazard category 1, 2, and 3 nuclear facilities across the DOE complex.

In accordance with the *Plan for the Independent Assessment of the Fire Protection Program at the Argonne National Laboratory, October 2024*, this assessment evaluated the FPP, including policies, procedures, and fire and related safety hazards analyses; fire hazards analysis (FHA) and documented safety analysis (DSA) integration; fire prevention and protection design requirements; surveillances and inspection, testing, and maintenance (ITM); contractor self-assessment; and Federal oversight relating to fire protection.

At ANL, research and development are conducted on a broad spectrum of engineering and physics topics. Currently, the nuclear and radiological operations at ANL consist mainly of radioactive waste handling and storage. In addition, several hot cell facilities are in the process of decontamination and decommissioning as the ANL nuclear footprint is reduced. Most ANL nuclear facility DSA-postulated accident scenarios presenting the highest risks are fire events. This assessment focused on Building 331 – Radioactive Waste Storage Facility (RWSF) and Building 212 – Alpha Gamma Hot Cell Facility (AGHCF), which are hazard category 2 and 3 nuclear facilities, respectively.

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 10 CFR 830, *Nuclear Safety Management*; DOE Order 420.1C, Change 3, *Facility Safety*; and DOE-STD-1066-2023, *Fire Protection*. EA used objectives 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6 of EA CRAD 31-12, Revision 2, *Fire Protection Program*.

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 protection-related activities; and walked down significant portions of the RWSF and AGHCF, focusing on aspects of the FPP. The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

EA conducted a previous assessment at ANL in 2015, which was documented in EA report *Office of Enterprise Assessments Review of the Argonne National Laboratory Fire Protection Program, August 2015*. The current EA assessment examined the completion and effectiveness of corrective actions for

one of the previously identified assessment findings related to fire suppression system (FSS) water supply reliability. Results of the corrective action review are included in section 3.7 of this report.

3.0 RESULTS

3.1 Fire Protection Program

This portion of the assessment evaluated the effectiveness of Argonne's FPP policy and administration, staffing and qualification, implementing elements and procedures, equivalencies and exemptions, FHA program, building fire protection assessment (FPA) program, emergency services baseline needs assessment (BNA), fire department pre-incident plans (PIPs), and wildland fire management program.

Fire Protection Program Policy and Administration

Argonne has established and implemented a comprehensive sitewide fire protection policy and FPP. FP-009, *Fire Protection Program Description*, and LMS-POL-1, *Safety and Health*, document the Argonne FPP and policy, which are appropriately based on the Argonne prime contract requirements. The FPP appropriately identifies applicable directives, codes, and standards, including DOE Order 420.1C, DOE-STD-1066-2023, National Fire Protection Association (NFPA) codes and standards, and the International Building Code (IBC). The FPP is implemented site wide through a collection of generally adequate procedures. The fire protection authority having jurisdiction (FP-AHJ) and IBC building code official roles and responsibilities delegated to Argonne by ASO are adequately documented in FP-009.

Staffing and Qualification

The Argonne Fire Protection organization detailed in FP-009 has appropriately qualified fire protection engineers (FPEs) and technical staff to support and monitor implementation of the FPP at ANL facilities. FP-PROC-1, *Fire Protection Engineer Qualification Program (FPEQ)*, adequately establishes the qualification program for FPEs in accordance with DOE Order 420.1C, attachment 2, chapter II, section 3.d.(2)(a) requirements and DOE-STD-1066-2023 criteria. FP-009 appropriately defines training and qualification requirements for fire protection system technicians and supervisors performing ITM activities that are consistent with applicable NFPA codes and standards. The reviewed records for four Argonne FPEs demonstrated adequate qualification program implementation.

NWM-428, *NWM Training Implementation Matrix* (approved by ASO); NWM-PP-520, *Cognizant System Engineer Program*; and FP-009 adequately document the cognizant system engineer (CSE) training and qualification program for ANL nuclear facilities in accordance with DOE Order 426.2A, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*. The Nuclear, Waste, and Site Services fire protection CSE, a deployed FPE from the Fire Protection organization, appropriately performs systems engineering, FHA maintenance, and FPP implementation support roles and responsibilities at ANL nuclear facilities. Interviewed FPEs, the FP-AHJ, CSEs, and CSE organization personnel demonstrated an adequate understanding of the roles and responsibilities of FPEs and CSEs consistent with the qualification standards and job assignments.

Implementing Elements and Procedures

Argonne has established and implemented a generally adequate FPP that includes requirements for facility operations and fire prevention. In support of facility operations, Argonne has established and implemented an adequate set of sitewide FPP implementing procedures for using, handling, and storing

combustible, flammable, and hazardous materials as specified by DOE Order 420.1C, DOE-STD-1066-2023, and the requirements of applicable NFPA codes and standards, including:

- Environment, Safety, and Health (ESH) Manual, chapter 11, procedure 11.2 (ESH-11.2), *General Fire Safety*, appropriately addresses multiple fire safety topics, including housekeeping, combustible material controls, compressed gas cylinders, chemical management, pyrophoric materials, means of egress maintenance, and fire drills.
- ESH-11.3, *Flammable and Combustible Liquids*, for the management and control of combustible and flammable liquids, is consistent with the requirements of NFPA 30, *Flammable and Combustible Liquids Code*, and NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*.
- ESH-19.1, *Exit Systems and Life Safety*, and LMS-PROC-159, *Emergency Egress Inspections*, appropriately address general housekeeping, combustible materials control, and means of egress inspection.

The Argonne hot work control program is, in general, adequately defined at the site-level by ESH-11.4, *Open Flame and Portable Spark-Producing Operations*, and is appropriately based on DOE Order 420.1C, DOE-STD-1066-2016, and NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*. ESH-11.4 adequately incorporates the use of a hot work "permit" with appropriate site condition reviews, role assignments (e.g., welder, fire watch, safety watch), and work release approvals delineated within NFPA 51B. The Argonne hot work program and permits are adequately administered by the Argonne Fire Department (AFD), including permit approvals, personnel training, and periodic oversight. Requests for permits are efficiently and consistently facilitated by an on-line fillable form process with electronic routing of approvals and verification of current training.

Observation of the daily review and approval of a hot work permit in Building 450 demonstrated adequate review of the work area, including the applicability of specified compensatory actions such as a fire watch and planned impairment of fire detection devices. However, an inconsistency between the current program implementing practice and the ESH-11.4 requirements was identified. ESH-11.4, section 11.4.2, states that a second permit authorizing individual (PAI) must review and approve a permit when a fire watch is specified. The observed Building 450 permit re-approval and interviews with the Argonne Fire Chief and Deputy Chief/Fire Prevention Officer confirmed that the required second PAI approval is not being implemented. (See **OFI-Argonne-1**.) Two PAI approvals on a hot work permit when a fire watch is specified is not an NFPA 51B requirement. There were no active hot work activities or designated hot work areas in the AGHCF or RWSF at the time of this assessment.

Argonne has also appropriately implemented further controls for ignition sources, including smoking (LMS-POL-12, *No Smoking Policy*) and temporary space heaters (ESH-11.2, section 11.2.11) in accordance with DOE-STD-1066-2023 and associated NFPA codes and standards. Laboratory operations using furnaces, ovens, and other appliances posing a fire hazard are effectively managed by implementing ESH-11.2 and the work control review and release process in accordance with NFPA 45.

NWS-AGHCF-NSB-201, *Basis for Interim Operations* [BIO] *for the Alpha Gamma Hot Cell Facility*, section 7.7, *Fire Protection Safety Management Program (SMP)*, adequately establishes the facility-level FPP implemented at the AGHCF, as required by DOE-STD-1066-2023 and NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*. The BIO appropriately prioritizes important AGHCF FPP aspects, identifying them as "key features," such as the Building 212 fire detection and alarm system (FD&AS), FSS, hot cell nitrogen inerting system, and hot work and combustible loading controls. The FPP implemented at the AGHCF appropriately invokes sitewide FPP policies, programs, and procedures for implementation at the facility level, including procedures for the control of flammable and combustible liquids, gases, and other hazardous materials; control of ignition sources; ITM and

impairment control of fire protection systems; emergency response and PIP programs; and building fire protection inspections.

The AGHCF FPP appropriately implements facility-specific requirements for general employee training, access, evacuation, emergency alarm initiation and response (e.g., AGHCF-EMER-101, *Initial Response to AGHCF Alarms*, and AGHCF-EMER-200, *Emergency Response to an In-cell Fire*), and fire reporting in accordance with NFPA 801. NWS-PROC-015, *Fire Patrol and Fire Watch*, adequately implements ESH-11.4 fire watch requirements for hot work operations in ANL nuclear facilities. AGHCF-OPS-403, *Nitrogen De-Inerting and Inerting Process*, appropriately implements facility-specific requirements for the use of the hot cell nitrogen inerting system as a fire prevention system instead of sprinkler protection in this facility area. While the hot cell nitrogen inerting system oxygen concentration monitoring alarm set-points of 4% are consistent with the DOE-HDBK-1081-2020, *Primer on Spontaneous Heating and Pyrophoricity*, for the upper value in fire extinguishment of actinide metal fires, this concentration does not include a safety factor as recommended by DOE-STD-1066-2023, section 4.4.2.4.1.

The RWSF DSA (NWM-RWSF-NSB-101, *Documented Safety Analysis for the RWSF*), chapter 12, adequately establishes the facility-level FPP implemented at the RWSF, as required by DOE-STD-1066-2023 and NFPA 801. In addition to the designated safety-related FSS, wet-pipe sprinkler system, and FD&AS, the DSA appropriately prioritizes important RWSF FPP aspects, identifying them as "key features," such as local fire response capability, lightning protection system, east stairwell (enclosed and pressurized) egress, combustible loading and hot work controls, flammable gas and refueling restrictions (prohibitions), and code-compliant electrical equipment. The FPP implemented at the RWSF appropriately invokes sitewide FPP policies, programs, and procedures for implementation at the facility level. The RWSF FPP appropriately implements facility-specific requirements for general employee training, access, emergency alarm initiation and response, evacuation (WMO-DOC-12, *Waste Management Facility Orientation*), and fire reporting consistent with the requirements of NFPA 801. WMO-PRO-058, *Review and Approval of Radioactive Waste Requirements*, appropriately limits and verifies the quantity of oxidizers allowed within the RWSF, consistent with the maximum allowable quantities of the IBC to effectively limit these materials.

NWS-PROC-016, *Combustible Loading Control and Inspection*, in general, adequately implements Argonne nuclear facility-specific requirements for the use, control, and monthly inspection of transient combustible and flammable materials in the AGHCF and RWSF in accordance with their respective safety basis documents and NFPA 801. AGHCF-specific criteria for the minimization and limitations of combustibles in areas lacking sprinkler protection (as approved in an equivalency) are appropriately incorporated into the procedure. AGHCF-DS-236-06, *AGHCF Combustible Material Control and Inspection Checklist* (work order SS24-000962), demonstrated effective performance of the procedure for the AGHCF. Review of the completed RWSF-DS-024-02, *RWSF Combustible Control Visual Inspection Checklist* (work order SS24-000976), record review for September 2024 and observation review of the December 2024 inspection, demonstrated generally effective performance of the procedure for the RWSF. However, transient combustible materials were observed in the RWSF Level 4 (grade-level) roll-up door alcove that may lack complete sprinkler coverage from the dome high-ceiling-level sprinklers. (See **OFI-Argonne-2**.) Six reviewed, recently completed monthly LMS-PROC-159 inspection records for the AGHCF and RWSF (three each), and the observed December 2024 RWSF inspection demonstrated effective procedure implementation.

Equivalencies and Exemptions

FP-PROC-27, *Fire Protection Equivalencies and Exemptions*, and LMS-PROC-119, *Exceptions to Internal and External Requirements*, define adequate processes for developing, submitting, and

maintaining FPP-related equivalencies and exemptions that are appropriately based on DOE Order 420.1C requirements. The following reviewed approved equivalencies were adequate:

- NWM-553, *Sprinkler System Equivalency for Building 212 AGHCF Non-Sprinklered Areas*, adequately documents an ASO-approved equivalency approach for specific rooms lacking sprinkler protection. The bases for the equivalency included: existing smoke detection in some of the rooms or in adjacent spaces, existing facility and operational conditions, combustible loading controls, and manual fire extinguishing response capabilities.
- FMS-FTS-002-00, *Equivalency Determination: Building 331 Life Safety Code Equivalency for the Proposed TRU Waste Storage Facility*, adequately documents an ASO-approved equivalency package for life safety code deficiencies identified for the building during transition from an experimental nuclear reactor facility to a waste storage facility. The bases for the equivalency included: installation of sprinkler, standpipe, and early-warning FD&ASs; construction of a smoke-proof egress stairwell enclosure; and the addition of two new exit doors at ground level.

Fire Hazards Analysis Program

NWM-PROC-023, *Fire Hazards Analysis Development*, documents an adequate FHA program for ANL nuclear facilities that is appropriately based on NFPA 801 using the graded approach as allowed by DOE Order 420.1C and DOE-STD-1066-2023. The RWSF FHA (NWM-059, *Fire Hazard Analysis for the Radioactive Waste Storage Facility*) is current (reviewed and approved within the past three years or less) and adequately describes the design bases of fire protection and life safety structures, systems, and components (SSCs), consistent with the recommendations and requirements of DOE-STD-1066-2016, section 7.1.1 and appendix B, and NFPA 801, section 4.3. The AGHCF FHA (NWM-056, *Fire Hazard Analysis for the Alpha Gamma Hot Cell Facility*) is current and adequately describes the design bases of fire protection SSCs consistent with expectations of the cited standards. The two FHAs adequately describe the supporting fire protection water supply and provide conclusions of the adequacy of protection based on the fire hazards protected. The two FHAs also adequately describe applicable approved equivalencies, including the bases and revalidation of approval conditions associated with the AGHCF and RWSF. Issues, deficiencies, and recommendations resulting from previous and current FHAs were appropriately entered into the Argonne issues management system (PRISM®) for tracking to closure in accordance with LMS-MNL5, *Performance Improvement*.

The AGHCF and RWSF FHAs analyze most facility fire hazards in accordance with the recommendations and requirements of the previously identified standards and are adequately integrated into the AGHCF BIO and the RWSF DSA, respectively. During walkdowns of both facilities, observed conditions were generally consistent with the FHA descriptions, hazards evaluations, discussions, and justifications for adequacy. However, the following weaknesses were identified:

- Contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.f.(1)(b); DOE-STD-1066-2023, section B.2.11; and NFPA 801, section 4.3.2.2(3), Argonne did not evaluate the existing dust hazard conditions to determine if a dust hazard analysis was required for the hot cell, as required by NFPA 484, *Standard for Combustible Metals*, and NFPA 652, *Standard on the Fundamentals of Combustible Dust*. (See **Deficiency D-Argonne-1**.) The omission of a dust hazard analysis for the AGHCF hot cell could inhibit the identification and mitigation of possible conditions associated with a fire or explosion due to accumulated, non-controlled metal dust.
- The *System Description: Nitrogen Supply System for Building 212 Alpha-Gamma Hot Cell Facility* document erroneously states that the AGHCF FHA concludes that an in-cell fire is not a credible event based on a low probability of a loss of nitrogen inerting, minimal combustible materials, and minimal ignition sources. (See **OFI-Argonne-3**.) The system description statement is inconsistent

with the respective FHA conclusions and includes a non-conservative assertion that a fire in the cell is not a credible event.

- The RWSF FHA, section 3.5, does not evaluate the fire exposure hazard posed by the exterior oil-insulated transformer (substation 331A) located south of the RWSF exterior roll-up door and the lack of spill containment features, contrary to the recommendations of Factory Mutual Global Property Loss Prevention Data Sheet 5-4, *Transformers*; NFPA 70, *National Electrical Code*; and/or NFPA 850, *Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations*. (See **OFI-Argonne-4**.)

Building Fire Protection Assessment Program

FP-PROC-15, *Facility Fire Protection Assessments*, documents a generally adequate ANL building FPA program that is appropriately based on DOE Order 420.1C and DOE-STD-1066-2023, section 7.2. FP-PROC-15 implements a detailed and comprehensive assessment checklist, and attachment A appropriately requires annual FPAs of ANL nuclear facilities, including the AGHCF and RWSF. However, contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.f.(2)(e); DOE-STD-1066-2023, section 7.2.1; and FP-PROC-15, attachment A, Argonne did not complete annual building FPAs for the AGHCF and RWSF in calendar years 2023 and 2024. (See **Deficiency D-Argonne-2**.) A lack of annual building FPAs could result in missed opportunities to strengthen the facility FPPs through timely identification and correction of deficiencies and other improvement initiatives. The Argonne FPP Manager explained that the practice of combining triennial FHAs/FPAs has been the long-standing approach for assessing FPP implementation in nuclear facilities. However, the last building FHAs/FPAs performed in 2022 did not adequately address fire protection and life safety SSCs; ITM record reviews in accordance with procedure requirements; validation and accuracy of the PIPs; and the implementation effectiveness of sitewide and facility FPP procedures.

Emergency Services Baseline Needs Assessment

The BNA (*Argonne National Laboratory Fire Department Baseline Needs Assessment*) is current (December 2021) and appropriately based on DOE Order 420.1C, DOE-STD-1066-2016, and the applicable requirements of NFPA codes and standards, such as NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. Argonne appropriately obtained DOE approval of the calendar year 2021 BNA in April 2022, following resolution of ASO comments and questions documented in Argonne letter *Argonne Response to Site Office Comments and Questions reference the Argonne Fire Department 2021 Baseline Needs Assessment submittal* subject to three conditions of approval. The BNA improvement actions are being actively managed by the AFD.

The BNA-described minimum fire department staffing, apparatus and equipment requirements, and tactics and procedures are appropriately based on credible fire response scenarios as described within DOE-STD-1066-2016, section 6.1, and NFPA 1710. A walkdown of the Building 333 fire station confirmed that on-shift station staffing, apparatus inventory, and equipment were consistent with the BNA descriptions, with exceptions for recent apparatus and equipment purchases. According to the October 3, 2024, *Argonne National Laboratory Fire Department Operational Dashboard*, and in response to a calendar year 2021 BNA recommendation, the AFD has appropriately increased on-shift response staff. AFD's routine daytime on-shift staffing currently consists of eight response personnel (one battalion chief, one lieutenant, and six firefighter/emergency medical technicians, two of whom are qualified at the paramedic level). Routine off-hour and weekend staffing consists of seven response personnel with one firefighter staffing the Fire Alarm Office (FAO).

Even with the current AFD on-shift staffing levels, the BNA places extensive reliance on ANL non-combustible building construction, building sprinkler protection, and mutual aid response from adjacent fire departments to effectively mitigate escalating fire suppression operations, significant hazardous material releases, and/or a concurrent unrelated medical response event (per DOE-STD-1066-2016, section 6.1.8). As compared to other DOE sites, ANL is sited in close proximity to multiple municipalities whose mutual aid cooperation enable this BNA approach. The BNA clearly defined and affirmed emergency response mutual aid agreements in support of the ANL emergency management program and the AFD and described the mechanism(s) to request and activate mutual aid agency response. The BNA appropriately identifies vulnerabilities with AFD response capabilities and timeliness of mutual aid response agencies, and states that these risks have been historically acknowledged and deemed acceptable through Argonne management and ASO's approval of previous revisions, as well as the current revision of the BNA.

At the time of the assessment, an updated AFD BNA, appropriately developed within the three-year cycle specified by DOE Order 420.1C, had been prepared and was undergoing internal Argonne and informal ASO review prior to final submittal to ASO for approval. In support of the updated BNA, an independent review of the draft document that appropriately included DOE participation was performed and documented in the *Independent Validation of the Argonne National Lab Baseline Needs Assessment – Team Report*.

Fire Department Pre-incident Plans

The AFD appropriately uses a software-based PIP tool that is augmented by standard operating guidelines (SOGs) for unique facility hazards, features, or response tactics that are appropriately based on recommendations from DOE-STD-1066-2023, section 6.3; NFPA 1620, *Standard for Pre-Incident Planning*; and/or NFPA 1660, *Standard for Emergency, Continuity, and Crisis Management: Preparedness, Response, and Recovery*. Use of this tool enhances the effectiveness and safety of emergency response activities. Physical access and appropriate apparatus and equipment for manual firefighting were generally consistent with descriptions in the AGHCF and RWSF PIPs and verified during facility walkdowns. There are no moderator-controlled areas in the AGHCF or RWSF that limit the use of firefighting water within these facilities.

The AFD has proactively developed and implemented an SOG for identifying the hazards of and practices/tactics for responses to lithium-ion (Li-ion) battery incidents associated with small-scale devices (e.g., computers and mobility devices), vehicles, and battery storage systems. *MABAS Division 16 Standard Operating Guidelines – Response to Incidents Involving Lithium-ION Batteries* is considered a **Best Practice** because it is directly responsive to the emergent concerns for emergency response to this increasingly prevalent hazard and is available for use by adjacent mutual aid fire departments.

In general, the AGHCF PIP adequately describes the DOE-STD-1066-2023, section 6.3.4 critical factors in coordination with AFD SOGs for effective AFD response to the AGHCF. Basic information on building construction, access, and most fire protection features are adequately described in the PIP. The AFD Fire Chief explained that recurring firefighter training is relied upon for the proper use of Class D portable fire extinguishers, which are fitted with glove-piercing bayonets for manual fire suppression efforts within the glovebox and hot cell. AGHCF-EMER-200 appropriately assigns response actions to AGHCF technicians for applying Class D manual fire extinguishing agents deployed in the hot cell with the manipulators and operating the nitrogen inerting system to facilitate fire extinguishment in the hot cell during a fire response. The use of water for fire suppression operations in the hot cell following execution of other preferred actions is adequately described in AGHCF-EMER-200 and AFD SOG SOP 600.09, *In Cell Fire 212 AGHCF*. AFD response actions to the AGHCF high-gamma alarm signal connected to the fire alarm system are appropriately described in AFD SOG SOP 600.10, *High Gamma*

alarm 212 AGHCF, and AFD response actions to other AGHCF alarms are appropriately described in AFD SOG SOP 600.11, *Non Gamma alarms 212 AGHCF*.

In general, the RWSF PIP adequately describes the DOE-STD-1066-2023, section 6.3.4, critical factors for effective AFD response to the RWSF. Basic information on building construction, access, and most fire protection and life safety features are adequately described. Due to its relative simplicity, no AFD SOGs have been developed for the RWSF. However, contrary to NFPA 1620, section 7.2.2.1, and NFPA 1660, section 20.2.2.1, Argonne did not include available fire flow information for fire hydrants adjacent to the AGHCF and RWSF in the respective PIPs (fire hydrants are listed but fire flow information is stated as "unknown"). (See **Deficiency D-Argonne-3**.) The absence of information on the available fire flow from fire hydrants in the vicinity of a facility could delay incident commander decision-making at the scene during a fire response. Furthermore, the following inconsistencies between the RWSF DSA, FHA, and PIP were observed (see **OFI-Argonne-5**):

- The RWSF DSA, section 2.7.2.4, and RWSF FHA, section 6.4, state that the "PIP includes information that the standpipe system requires flow and pressure augmentation to meet design requirements," but the PIP lacks this information. The AFD Fire Chief explained that it is standard operating practice to establish hose line connections and augment any ANL sprinkler or standpipe system upon arrival to the scene, and the RWSF PIP does not need to contain this information as a unique operational feature.
- The RWSF FHA, section 6.2, states that the PIP references the "RCRA Contingency Plan" as a response tactic to addressing potentially contaminated firefighting water run-off from the facility; however, the PIP lacks this information.

Wildland Fire Management Program

The Argonne wildland fire management plan (FP-005, *Wildland Fire Management Plan*) is current (calendar year 2024); appropriately based on the *Federal Wildland Fire Management Policy* as delineated in DOE-STD-1066-2023, section 8.0; approved by ASO; and adequately implemented in accordance with the applicable portions of NFPA 1140, *Standard for Wildland Fire Protection* (FP-009 cites NFPA 1143, *Standard for Wildland Fire Management*, as applicable). No new recommendations or improvement actions were identified within the current plan. The calendar year 2021 BNA recommendation for lacking wildland fire safety training has been adequately addressed by the AFD for readiness to respond to onsite brush fire events. The wildland fire exposure risks to the AGHCF and RWSF are adequately described and evaluated within the respective facility FHAs. Walkdowns of both facilities confirmed that there are no adverse wildland fire exposure concerns due to effective vegetation management in the vicinity of the buildings, consistent with the FHA exposure risk assessment conclusions.

Fire Protection Program Conclusions

Argonne has implemented a sitewide fire protection policy and comprehensive FPP, assigned appropriate individuals as the FP-AHJ and deployed fire protection CSEs to nuclear facilities, and identified a generally appropriate set of sitewide and facility-specific procedures. Argonne has developed and implemented adequate FPP-related equivalencies for the AGHCF and RWSF, implemented a generally adequate FHA program for nuclear facilities, maintains a BNA, implements a PIP program, and maintains an integrated sitewide wildland fire management plan. DOE Order 420.1C-required FPP documents subject to DOE approval have been reviewed and approved by ASO. The AFD's SOG for identifying the hazards of and practices/tactics for responses to Li-ion battery incidents is considered a best practice. However, weaknesses were identified in the areas of dust hazard analysis for the AGHCF hot cell, performance of annual building FPAs, and PIP fire hydrant flow information.

3.2 Fire Hazards Analysis and Documented Safety Analysis Integration

This portion of the assessment evaluated the integration of the RWSF and AGHCF FHAs into associated safety design basis documentation and the adequacy of fire protection controls for implementation of the facility safety bases.

Argonne has appropriately integrated the RWSF and AGHCF FHAs into the RWSF DSA and AGHCF BIO to ensure that analyzed fire hazards are prevented or sufficiently mitigated through controls for normal, abnormal, and accident conditions. In general, the FHAs and DSA/BIO appropriately evaluate credited fire systems and associated fire scenarios, their possible locations, and the consequences of those fires. The evaluated fire scenarios and supporting conclusions in the FHAs are appropriately included in the DSA/BIO hazard evaluations and accident analyses sections in accordance with NWM-NSB-607, *Development of Safety Basis Documents, Amendments and Annual Updates*. The RWSF-credited FSS, FD&AS, fire barriers, and the AGHCF fire barriers are adequately based on fire hazard identification and the supporting accident analyses to ensure the protection of workers, the public, and the environment in accordance with DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, and 10 CFR 830.

Fire Hazards Analysis and Documented Safety Analysis Integration Conclusions

Argonne has appropriately integrated the two FHAs into the respective DSA and BIO. The DSA and BIO evaluate and analyze accidents to adequately support the development of required controls for the prevention or mitigation of hazard events for the implementation of the facility safety bases.

3.3 Fire Prevention and Protection SSCs and Design Requirements

This portion of the assessment evaluated design requirements, engineering, and design verification for fire prevention and protection SSCs.

Design Requirements

Argonne's fire protection design requirements are adequate. Reviewed procedures used to operate, test, and inspect the fire protection SSCs contained design requirements that were aligned with corresponding calculations. During interviews, Argonne FPEs and CSEs demonstrated that they are familiar with the design requirements of these procedures.

Engineering

Argonne's conduct of engineering program establishes an appropriate design change process to implement design changes for fire protection SSCs. Requirements for fire protection design, design control, review, approval, acceptance, and configuration management are adequately defined in NWM-QA-901, *Design Process*, and implemented in accordance with NWM-DS-165, *Design Process Checklist*, and NWM-PROC-003, *Work Planning and Control Implementation*. Applicable component-level changes are controlled through NWM-CM-103, *Approved Equivalent Part Procedure*, which adequately implements applicable engineering program and design criteria for implementing regulatory requirements as they apply to initiating, screening, processing, and executing requests.

Two reviewed work control documents (WCDs) (WCD 71076.0, *Install Sprinklers in Waste Storage Cells*, and WCD 77436.1, *Installation of Keltron Wireless Fire Alarm Communication System Transceiver*) appropriately included unreviewed safety question determinations, identification of affected documents, engineering instructions detailing the scopes of work, SSC grade levels, materials for installation, and

design requirements with NFPA code references. The unreviewed safety questions supporting the two WCDs included adequate descriptions of the proposed activities, justifications, and screening, as required by NWS-CM-102, *Unreviewed Safety Question Procedure*.

WCD 71076.0 provided appropriate instructions for installing fire suppression sprinklers in waste storage cells D-002, D-010, and D-014. The scope of work extended sprinkler system coverage to include waste storage cells D-002, D-010, and D-014, improve the fire suppression capability, and ensure that the sprinkler system coverage is code compliant. Upon completion of the work, the FSS was appropriately inspected and tested per NFPA 13, *Standard for the Installation of Sprinkler Systems*, and WMOF-MAINT-209, *WMOF Main Drain-in Test*, to ensure that the sprinkler system operated properly prior to being returned to service.

WCD 77436.1 provided appropriate instructions for installing the Keltron® transceiver in Building 331 and connecting alternating current power to the transceiver, allowing the system to communicate trouble, supervisory, and alarm signals to the AFD FAO and interface with the RWSF FD&AS. Review of RWSF-SR-502, *RWSF Fire Detection and Alarm System Test and Visual Inspection*, and in accordance with JMLT-268-W-T002, *Keltron System Acceptance Testing*, verified the acceptance of transmission of alarm signals to the AFD and met applicable NFPA 72, *National Fire Alarm and Signaling Code*, design requirements.

Vital safety systems (VSSs) are appropriately identified, and CSEs perform annual walkdowns and assessment reports every four years as required by NWM-PP-520 and NWM-QA-906, *Vital Safety Systems Management*. Three reviewed VSS assessment reports for the RWSF (FSS, FD&AS and fire barriers) and AGHCF (fire barriers) fire systems appropriately included system status, system reliability metrics, trending of key parameters, maintenance history, corrective action commitments, and most ongoing performance and reliability issues.

NWS-355, *Building 331 Shell Fire Suppression System*, and NWM-354, *Radioactive Waste Storage Facility, Fire Detection and Alarm System*, were adequately documented in accordance with NWM-CM-203, *System Design Description.* Interviewed CSEs for the RWSF and AGHCF VSSs were qualified and knowledgeable of their systems, including the status of current maintenance activities, elevated fire water storage tank (Building 568), RWSF FD&AS upgrades, and ongoing challenges to system operability and reliability. NWM-428, NWM-PP-520, and FP-009 adequately establish appropriate CSE training and qualification requirements in accordance with DOE Orders 420.1C and 426.2A.

Design Verification and Configuration Management

Argonne has established and implemented effective design verification and configuration management processes. NWS-PP-525, *Configuration Management Program*, appropriately requires CSEs to be involved in design development and design changes. Due to the age of the ANL facilities, a graded approach is appropriately applied regarding reconstitution of non-conforming legacy documentation and design requirements. The grading of configuration management activities is generally applied consistently with the quality level grading used in NWM-CM-305, *Master Equipment List Maintenance*, and LMS-MNL-7, *Quality Manual*. Argonne engineering personnel adequately verified the fire protection design of the two reviewed WCDs discussed above. These two WCDs appropriately documented the adequacy of the fire protection designs and their verification by individuals and groups other than those who performed the work.

Observed labeling of the RWSF and AGHCF SSCs were consistent with design drawings and implemented as required by NWM-PP-418, *Equipment and Pipe Labeling*. Observed tagging and

labeling of FSS components, fire barriers, fire alarm panels, fire sprinkler system risers, and other fire protection components were appropriate.

Fire Prevention and Protection SSCs and Design Requirements Conclusions

Argonne's fire protection design requirements are adequate. Further, Argonne has an adequate conduct of engineering program, as well as effective design verification and configuration management processes.

3.4 Surveillances and Inspection, Testing, and Maintenance

This portion of the assessment evaluated the effectiveness of the Argonne surveillance, ITM, and impairment control programs for fire protection and life safety SSCs and equipment.

Surveillances

Argonne has established and implemented a generally adequate surveillance program for the AGHCF and RWSF safety significant (SS) fire protection SSCs. Argonne appropriately plans, schedules, and performs technical safety requirement (TSR) surveillances to ensure that DSA-credited FSS, FD&AS, and fire barrier systems in the RWSF and AGHCF provide adequate fire protection for other SS SSCs, critical process equipment, and high-value property; and can prevent a major fire from impacting the remainder of the facility. The Argonne detailed operating procedures for these fire systems appropriately use maintenance instructions with checklists for performing and documenting surveillance requirements (SRs) to verify system operability. Acceptance criteria are sufficiently documented and well defined within these checklists and serve as baseline requirements. The reviewed surveillance procedures demonstrated, and interviews confirmed, that surveillances are performed by knowledgeable personnel and supported by qualified design authority engineers to satisfy NFPA requirements.

Observed surveillances of RWSF-SR-200, *RWSF Main Drain Test* (TSR SR 4.3.1); NWM-SR-101, *NWM Fire Suppression System Water Supply Valve Inspections* (TSR SR 4.3.2); and simulated performance of surveillances of NWM-SR-102, *Fire Suppression System Visual Inspections* (TSR SR 4.3.3) demonstrated that personnel have adequate knowledge of system operability limits and equipment control settings as described in the TSR bases. The reviewed Argonne surveillances for the FSS, FD&AS and fire barriers over the past three years (FSS and FD&AS) and past four years (fire barriers/dampers) confirmed that the systems have met their respective TSR acceptance criteria as currently defined. However, the following weaknesses were identified:

- Contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.d.(1)(c), and NWM-RWSF-NSB-201, *Technical Safety Requirements for the Radioactive Storage Facility,* SR 4.3.3*, RWSF Inspector's Test/Waterflow Alarm Test*, Argonne did not document obstructed sprinklers in the RWSF during the last two performances of NWM-RWSF-NSB-201 SR 4.3.3 (annual visual inspection). (See **Deficiency D-Argonne-4**.) Lack of identification and subsequent documentation reduces assurance that obstructed sprinkler heads are being appropriately inspected to ensure they can achieve their required design coverage and therefore may not satisfy the FSS safety function.
- Contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.d.(1)(c), and DOE-STD-3009-94, CN3, section 5.5.X.2, the NWM-RWSF-NSB-201 TSR derivations were inadequate for the RWSF. (See **Deficiency D-Argonne-5**.) Inadequate TSR derivations could lead to incomplete safety controls and result in not fully satisfying the FSS safety function. Specifically, SR 4.3.1 did not identify the required 2-hour fire water volume necessary to satisfy the FSS safety function.

Fire Protection and Life Safety Inspection, Testing, and Maintenance Program

In general, the Argonne fire protection and life safety SSC ITM program is adequately documented in FP-009, sections 7 and 8; ESH-11.6, *Fire Barriers*; ESH-7, *Portable Fire Extinguishers*; ESH-8, *Fire Sprinkler System Inspection, Testing, and Maintenance*; FTS-PROC-2, *Fire Protection Inspection, Testing, and Maintenance*; and subordinate procedures and instructions that are in accordance with DOE Order 420.1C, DOE-STD-1066-2023, applicable NFPA codes and standards, and identified requirements for unique SSCs. ITM procedures generally have appropriate acceptance criteria, and actions are defined should acceptance criteria not be met.

Fire Protection Water Supply and Infrastructure

The ANL site fire protection water supply is adequately subject to routine ITM in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*. The elevated water storage tanks are automatically filled through altitude valves connected to the underground distribution network. The altitude valves appropriately maintain the tank water capacity between an upper and lower operating limit. The underground water distribution network is adequately looped, and the gridded system has multiple isolation valves and fire hydrants, with the elevated tanks serving as multiple individual sources of fire protection water for protected facilities. Water storage tanks are subject to periodic inspection, maintenance, and refurbishment.

Fire protection distribution system fire hydrants are appropriately subject to routine preventive maintenance (PM) activities, flushing, and flow testing per FMS-PROC-5, *Site Fire Hydrant Testing and Maintenance*, and NFPA 25. Review of nine fire hydrant PM records for calendar year 2024 and onsite visual inspection of the RWSF hydrants demonstrated adequate routine ITM and labeling for these devices. The most recent (within the last six years) fire hydrant flow tests affirm that the available water supply adequately supports the AGHCF and RWSF FSSs.

Underground distribution system control and sectional valves are periodically inspected and operated per NWM-SR-101; American Water Works Association Manual M44, *Distribution Valves: Selection, Installation, Field Testing, and Maintenance*; and/or NFPA 25 to support operability. Eight reviewed valve PM records for calendar year 2024 documented adequate routine ITM for these devices.

The underground distribution network piping consists of either cement lined cast iron, ductile iron, polyvinyl chloride, or high-density polyethylene of various ages. The *Site Domestic Water Supply Analysis* postulates multiple pipe failures can occur and the ANL water supply will continue to meet its hydraulic design requirements with sectional valves and redundant supplies, demonstrating appropriate analysis of the robustness of the supply and ability to satisfy single point of failure criteria as recommended in DOE-STD-1066-2023. Argonne is currently upgrading the aged water supply equipment, including the recent refurbishment of domestic water storage Tank 568 to address water supply adequacy and reliability concerns (see section 3.7 of this report for further discussion).

AGHCF

The AGHCF automatic wet-pipe FSS (AGHCF BIO, section 7.7, FP SMP key feature) is, in general, adequately subject to routine ITM in accordance with NFPA 25 requirements through the combination of surveillance procedures, facility-specific procedures based on FTS-PROC-2, AFD inspections, and routine PMs. Reviewed routine ITM documents that adequately addressed requirements include:

- Periodic visual inspections through implementation of NWM-SR-101, NWM-SR-102, and other routinely scheduled PM activities.

- AFD quarterly (minimum) inspections of the Building 212 FSS fire department connections (FDCs) in accordance with NFPA 25.
- Periodic testing through implementation of AGHCF-MAINT-217, *AGHCF Main Drain Test*; AGHCF-MAINT-218, *AGHCF Inspector's Test and Waterflow Alarm Test*; and NWM-MAINT-209, *Testing Backflow Prevention Devices*, annual pressure gauge calibrations, and other routinely scheduled PM activities.
- Periodic inspection and testing of the water supply low pressure monitoring system per NWM-PROC-042, *Pressure Monitoring System Inspection and Testing*, and AGHCF-MAINT-213, *Fire Detection and Alarm System Test and Visual Inspection*.

The AGHCF FD&AS (AGHCF BIO, section 7.7, FP SMP key feature) is adequately subject to routine ITM in accordance with NFPA 72 and FTS-PROC-2 requirements. Reviewed routine ITM documents that adequately addressed requirements include:

- Periodic visual inspections through implementation of AGHCF-MAINT-213.
- Periodic tests of initiating devices, auxiliary functions, notification appliances, and remote alarm transmission per AGHCF-MAINT-213.
- Smoke detectors are self-monitoring by the AGHCF fire alarm control panel (FACP) and thus do not require periodic sensitivity testing per NFPA 72, section 14.4.4.3 and table 14.4.3.2, item 17(8).
- Periodic testing of the hot cell high-gamma detectors and alarm functions per AGHCF-MAINT-207, *Testing of the AGHCF Peripheral High-Gamma Alarm System*, as an FD&AS initiating device providing an emergency control function per NFPA 72, table 14.4.3.2, item 24 and section 17.17.2.2.4.

The AGHCF hot cell nitrogen inerting and oxygen concentration monitoring systems (AGHCF BIO, section 7.7, FP SMP key feature) are appropriately subject to routine ITM and calibration through implementation of AGHCF-MAINT-219, *Testing of the Servomax MoneExact Oxygen Analyzers for Areas 1, 3, and 6*. The manual extinguishing agent (e.g., Met-L-X Class D powder) deployed in the hot cell are adequately inspected weekly for proper placement by AGHCF technicians per AGHCF-MAINT-701, *AGHCF Routine Weekly Maintenance*.

Review of 12 ITM records for the FSS, the last semi-annual and annual ITM records for the FD&AS, the last high-gamma alarm test record, and procedures for the hot cell oxygen analyzers demonstrated adequate ITM program performance for these SSCs and features.

RWSF

The RWSF combination automatic SS FSS and manual Class I standpipe system is, in general, adequately subject to routine ITM in accordance with NFPA 25 and FTS-PROC-2 requirements through the combination of DSA/TSR surveillance procedures, facility-specific procedures, AFD inspections, and routine PM activities. Reviewed routine ITM documents that adequately addressed requirements include:

- Periodic visual inspections through implementation of NWM-SR-101, NWM-SR-102, and other scheduled PM activities.
- AFD quarterly (minimum) inspections of the Building 331 sprinkler/standpipe system FDC per NFPA 25.

- Periodic testing through implementation of RWSF-SR-200; RWSF-SR-201, *RWSF Inspector's Test/Waterflow Alarm Test*; and NWM-MAINT-209 annual pressure gauge calibrations, and other routinely scheduled PM activities.
- Periodic inspection and testing of the water supply low pressure monitoring system per NWM-PROC-042.

The RWSF manual dry-pipe FSS protecting the remote handling waste storage vault is, in general, adequately subject to routine ITM in accordance with NFPA 25 requirements, consisting of minimum quarterly FDC visual inspections by the AFD and annual visual inspections of accessible piping and supports through implementation of NWM-SR-102. Delinquent 5-year internal inspections of standpipe and sprinkler systems piping and interior inspections and maintenance of system check valves per NFPA 25 (last completed in 2016) was self-identified by the CSE in ANL-764A-3464, *Vital Safety System, Annual VSS Walkdown Report, Building 331 - Fire Suppression System* (issue SSFMax #SS20-001163).

The RWSF SS FD&AS, including the high-sensitivity smoke detection (HSSD) sub-system, is, in general, adequately subject to routine ITM in accordance with NFPA 72 and FTS-PROC-2 requirements. Reviewed routine ITM documents that adequately addressed requirements include:

- Periodic visual inspections through implementation of RWSF-SR-200.
- Periodic tests of initiating devices, auxiliary functions, notification appliances, and remote alarm transmission per RWSF-SR-502. FD&AS auxiliary functions (i.e., HVAC supply fan shutdown and egress stair pressurization system activation on manual pull station or HSSD actuation) are appropriately verified through RWSF-SR-502. Sprinkler system waterflow actuation activation of the egress stair pressurization is verified through RWSF-SR-201.
- Spot (non-HSSD) smoke detectors are self-monitoring by the RWSF FACP and thus do not require periodic sensitivity testing per NFPA 72.

The RWSF east egress stair protected enclosure and pressurization system (RWSF DSA, chapter 12, FP SMP key feature and FMS-FTS-002-00 equivalency compensatory measure) are adequately subject to routine ITM in accordance with applicable NFPA requirements. Reviewed routine ITM documents that adequately addressed requirements include:

- Stair enclosure fire door ITM per NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, and periodic enclosure barrier and penetration inspections through implementation of RWSF-MAINT-201, *RWSF Fire and Smoke Barrier Inspections*.
- RWSF-MAINT-200, *RWSF Stairwell Pressurization System Inspection and Test*, completes periodic inspection of supply and exhaust ductwork fire wrap, fans, dampers, and control panel, and testing of system components per NFPA 92A, *Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences*, and NFPA 101, *Life Safety Code*. Pressure differential and door opening force acceptance criteria are appropriately based on existing buildings.
- Automatic activation of the pressurization system is periodically verified during performance of RWSF-SR-201 and RWSF-SR-502 tests.

Review of 14 ITM records for the FSSs, the last semi-annual and annual ITM records for the FD&AS, and the last completed inspection records and procedures for the egress stair enclosure barriers and pressurization system demonstrated adequate ITM program performance for these SSCs and features.

The RWSF shell lightning protection system (RWSF DSA, chapter 12, FP SMP key feature) is adequately subject to routine inspection in accordance with NFPA 780, *Standard for the Installation of Lightning*

Protection Systems, requirements. The reviewed inspection report for September 2024 documented no adverse operability issues or degraded conditions with this feature.

Common Fire Protection Equipment

AGHCF and RWSF portable fire extinguishers are, in general, adequately subject to routine ITM in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*, requirements through implementation of ESH-11.7, *Portable Fire Extinguishers*, and AFD SOG 800.5, *Fire Extinguisher Inspections*. The AFD is responsible for the ITM program for portable fire extinguishers, which appropriately includes monthly visual inspections including glove-piercing bayonets in the AGHCF, annual inspections and maintenance (by a third-party subcontractor), and 6-year maintenance and 12-year hydrostatic testing of agent storage containers (by a third-party subcontractor). Review of the last three monthly, last annual, and last 6-year maintenance and 12-year hydrostatic test inspection database records for the AGHCF and RWSF demonstrated adequate ITM program performance.

AGHCF and RWSF life safety systems and equipment (i.e., battery-operated emergency lighting) is adequately subject to routine ITM in accordance with NFPA 101 requirements through implementation of ESH-19.3, *Emergency Lighting Systems*, and completion of recurring work orders. Routine ITM includes monthly visual inspections and annual inspections and testing. Ten reviewed work order records for recent monthly and the last annual ITM for these devices in the AGHCF and RWSF documented adequate ITM program performance.

While most ITM performance was adequate, the following weaknesses were identified:

- Contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.d.(1)(c); DOE-STD-1066-2023, section 5.1.3.1; and NFPA 25, section 13.8.5, Argonne does not hydrostatically test the piping from the sprinkler system FDC to the fire department check valve every five years for the AGHCF (wet-pipe) and RWSF (wet-pipe and dry-pipe) sprinkler systems. (See **Deficiency D-Argonne-6**.) Periodic hydrostatic testing of this FDC pipe segment provides assurance of piping integrity when the AFD connects and pressurizes the FSS during a fire response. FTS-PROC-2 does not contain ITM criteria for the NFPA 25-specified 5-year hydrostatic testing of FDC piping.
- Contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.d.(1)(c); DOE-STD-1066-2023, section 5.1.3.1; and NFPA 72, table 14.3.1, item 17(2), and section 17.7.5.5, Argonne does not periodically inspect the RWSF FD&AS duct smoke detector sampling tubes for mounting and orientation. (See **Deficiency D-Argonne-7**.) Periodic inspection of sampling tube orientation verifies that smoke traveling in the ductwork will be directed to the smoke detector for initiating the intended alarm signal. FTS-PROC-2 and RWSF-SR-502 do not contain inspection criteria for duct smoke detector sampling tube inspection.
- Contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.d.(1)(c); DOE-STD-1066-2023, section 5.1.3.1; NFPA 101, sections 7.9.3.1 and 7.10.9; and ESH-19.1, sections 19.1.3 and 19.1.12, Argonne does not complete monthly and annual testing of RWSF battery-operated exit signs. (See **Deficiency D-Argonne-8**.) Monthly and annual testing of battery-operated exit signage provides assurance of reliable operation and illumination of means of egress routes to exits during loss of normal power events. While LMS-PROC-159 includes monthly visual inspections, and ESH-19.1 details ITM requirements for these devices, ESH-19.3 does not identify monthly and annual testing requirements for battery-operated exit signs.
- Contrary to DOE Order 420.1C, attachment 2, chapter II, section 3.d.(1)(c); DOE-STD-1066-2023, section 5.1.3.1; and NFPA 25, sections 8.3.2.2 and 8.3.2.3, Argonne does not automatically start or run the electric fire booster pump for at least 10 minutes in Building 401 during the weekly test and

inspection activity. (See **Deficiency D-Argonne-9**.) Incomplete performance of required fire pump testing could result in adverse conditions related to design and operability criteria not being identified.

- Argonne has not formalized a process to annually inspect AGHCF and RWSF spare sprinklers and associated installation wrenches in accordance with NFPA 25, section 5.2.1. (See **OFI-Argonne-6**.) Spare sprinklers for both buildings are staged in spare parts storage cabinets designated for enhanced quality assurance requirements; however, the periodicity of inspection is not identified and there were no wrenches available for the AGHCF sprinklers.
- NWM-SR-102 and specifically form RWSF-DS-003-04, *RWSF Fire Suppression System Visual Inspection Checklist*, do not clearly document the NFPA 25-required annual visual inspection of the RWSF manual dry-pipe FSS protecting the remote handling waste storage vault, as is the stated practice during interviews with the Facility Manager and CSE. (See **OFI-Argonne-7**.)
- While the RWSF shell wet-pipe combination sprinkler/standpipe and dry-pipe sprinkler systems are provided with NFPA 13-compliant FDCs exterior to the northeast stair enclosure, current signage is nearly illegible and the responding AFD may have difficulty distinguishing between them for prompt connection of apparatus during low lighting, nighttime, or adverse weather conditions. (See **OFI-Argonne-8**.)
- During walkdowns of the Building 331 RWSF office building, missing suspended ceiling tiles on the first floor and basement corridors and Room A-018 were observed. (See **OFI-Argonne-9**.) Missing suspended ceiling tiles could delay activation of sprinklers by preventing heat released by a fire collecting at the ceiling. The office building sprinkler system is not part of the SS FSS protecting the RWSF shell.
- AFD SOG 800.5, section 2.A.iii, does not specifically identify that all hand-held portable fire extinguishers are to be weighed or hefted to verify agent quantity during the monthly inspection in accordance with NFPA 10, section 7.2.2(5). (See **OFI-Argonne-10**.) This inspection criterion is identified only for carbon dioxide portable fire extinguishers.

Fire Protection Impairment Control Program

ESH-11.5, *Fire Protection System Impairment*, adequately documents the Argonne FP impairment control program that is in accordance with DOE Order 420.1C, DOE-STD-1066-2023, and applicable NFPA codes and standards. The fire protection impairment control program is appropriately applied to ANL fire protection water supplies, fire hydrants, sprinklers, standpipe, special fire extinguishing, and FD&ASs. ESH-11.5 adequately describes coordination, communication, approval, and tagging requirements for planned and emergency outages and impairments, including the determination and assignment of compensatory actions (e.g., implementation of fire patrols). Fire protection impairments, including compensatory actions, are adequately tracked (e.g., impairment logs and status board in the AFD FAO) until the return to service. In addition, the Argonne Fire Protection organization routinely monitors the status of impairments through its routine plan of day process.

NWS-PROC-015 adequately implements ESH-11.5 compensatory fire patrol requirements for impairments to ANL nuclear facility fire protection systems in accordance with facility safety basis requirements. During a walkdown of the active FACP impairment (ground fault) in Building 212, adequate implementation of the impairment control program was observed. No compensatory actions were identified or implemented at Building 212, as FD&AS functionality is not adversely affected with the current impairment pending resolution. AGHCF-OPS-403 appropriately implements impairment protocols including notifications, fire patrols, and oxygen concentration monitoring actions for planned de-inerting of the AGHCF hot cell.

Reviewed fire protection impairment logs in the AFD FAO showed inconsistencies in tracking changes in anticipated due dates for closing impairments, the use of correction fluid for changes or corrections, and inconsistent practices for tracking long-term impairments on the status board. (See **OFI-Argonne-11**.) FAO staff rely on knowledge of daily situations and manually track the status of impairments through multiple means, with required turnovers at coverage shift changes, where the potential to misinterpret important information is the greatest.

Surveillances and Inspection, Testing, and Maintenance Conclusions

Argonne has implemented generally adequate surveillance, ITM, and impairment control programs for fire protection SSCs and equipment. Procedures for implementation of AGHCF and RWSF TSR SRs were appropriately developed and observations demonstrated adequate performance at the RWSF. Fire protection, life safety, and unique SSCs and equipment are adequately defined and generally performed in accordance with applicable and identified requirements. Fire protection impairments are adequately controlled and managed. However, weaknesses were identified in the areas of RWSF FSS SR performance, RWSF FSS and FD&AS TSR derivations, testing of FSS FDC piping at the AGHCF and RWSF, inspection of FD&AS duct smoke detector sampling tubes at the RWSF, inspection and testing of battery-operated RWSF exit signs, and Building 401 fire booster pump testing.

3.5 Contractor Fire Protection Program Self-assessment

This portion of the assessment evaluated whether Argonne has completed an adequate FPP self-assessment to continuously strengthen implementation through critical review, identification and correction of weaknesses and vulnerabilities, and incorporation of OFIs and lessons learned.

PA-FY21-IA-02, *Independent Assessment Report - Fire Protection Program Assessment*, and PA-FY24-IA-03, *Independent Assessment Report - 2024 Fire Protection Triennial Assessment*, document the completion of adequate triennial FPP self-assessments for calendar years 2021 and 2024, respectively, as required by DOE Order 420.1C and DOE-STD-1066-2016/-2023, section 3.2. The assessments, performed in accordance with LMS-MNL-14, *Assessments*, were appropriately performed and reviewed by qualified FPEs as specified by DOE-STD-1066-2016/-2023, section 3.2.1. The calendar year 2021 assessment consisted primarily of a crosswalk review of documents and procedures against DOE Order 420.1C requirements and resulted in no issues or recommendations. The calendar year 2024 assessment, with specified scope to include verification of FPP implementation in the three ANL nuclear facilities, consisted of FPP policy and program document reviews, a sampling review of fire protection system ITM procedures and records for non-nuclear buildings, staffing qualifications and fire department apparatus, non-nuclear facility walkdowns, and interviews. Among the conclusions identified in the current assessment was an issue associated with insufficient staffing of the AFD FAO and an OFI for obtaining an aerial apparatus; both were appropriately entered in PRISM. The AFD SOG for response to Li-ion battery incidents was identified as an FPP strength in the calendar year 2024 self-assessment.

FAC-FPP-FY23-MA-001, *Open Flame and Portable Spark-Producing Operations Assessment*, documents an adequate fiscal year 2023 FPP topical self-assessment of the hot work program. FAC-F24-MA-001, *Risk Assessment of Sprinklers and other Wet Systems in Electrical Rooms and Similar that Impact Multiple Buildings*, documents an adequate fiscal year 2024 FPP topical self-assessment of sprinkler protection for electrical equipment and other rooms housing sensitive infrastructure. An identified concern from FAC-F24-MA-001 was appropriately entered into PRISM for tracking to closure and appropriately incorporated by reference into the calendar year 2024 triennial FPP self-assessment.

Contractor Fire Protection Program Self-assessment Conclusions

Argonne has appropriately completed an FPP self-assessment within the last three years and entered the identified needed improvement actions into its issues management system.

3.6 Federal Oversight

This portion of the assessment evaluated the effectiveness of ASO's oversight of Argonne's fire protection activities, including field oversight, FPP assessments and reviews, and management of ASO-identified issues.

Field Oversight

ASO has performed effective field oversight of Argonne fire protection activities through the use of knowledgeable personnel, recurring facility walkthroughs and surveillances, and close engagement with Argonne counterparts. ASO assigns Facility Representatives (FRs) to specific functional areas across multiple facilities. The FRs assigned to fire protection and nuclear safety are appropriately qualified in accordance with ASO-approved elements of DOE-STD-1151, *Facility Representative Functional Area Qualification Standard*, and ASO-specific requirements. The fire protection FR is a certified safety professional and has multiple years of experience conducting oversight of occupational health and safety areas, including life safety fire code implementation. During interviews, the fire protection FR demonstrated strong knowledge of Argonne FPP elements, recent challenges, and associated improvement initiatives. The nuclear safety FR has over 30 years of experience conducting oversight of ANL facilities, with documented advanced training in multiple nuclear safety basis technical areas.

ASO also has access to fire protection engineering expertise from the Office of Science's Office of Safety and Security (OSS). The OSS FPE has significant government and private sector fire protection experience, is a licensed professional FPE, and is qualified in accordance with DOE-STD-1137-2014, *Fire Protection Engineering Functional Area Qualification Standard*. During interviews, the OSS FPE demonstrated a thorough knowledge of FPP oversight and review methodologies based on required DOE-STD-1066 elements. The OSS FPE also described increased engagement with ASO and Argonne fire protection subject matter experts (SMEs) over the past year to better understand Argonne-specific FPP strengths and emerging challenges.

The *ASO Oversight Plan*, Revision 8, provides ASO personnel with adequate guidance on conducting and documenting field oversight activities. ASO management has also formally established specific walkthrough, surveillance, and contractor assessment observation periodicity requirements in the FRs' annual performance plans. Reviewed nuclear safety and fire protection FR walkthrough and surveillance reports from calendar year 2024 documented a strong field presence (e.g., multiple field oversight activities per month) and effective communication of field observations to Argonne.

Interviews with Argonne fire protection SMEs and nuclear facility managers confirmed that the fire protection and nuclear safety FRs routinely engage with them, attend daily and weekly facility work planning meetings, and provide value-added, real-time feedback during oversight activities. During observed walkthroughs of the RWSF and AGHCF, the nuclear safety FR demonstrated extensive knowledge of facility SS and defense-in-depth SSCs, associated safety basis SRs, status of SS fire protection system upgrades, and effective oversight strategies for monitoring SS fire protection SSC performance.

Additionally, ASO, in close coordination with the nuclear safety FR, is establishing detailed desktop guides to support knowledge transfer of Federal field oversight performance considerations to new FRs. The guides document primary facility missions and operating regimes, as well as SS SSCs, specific

administrative controls and design features, SRs, historical performance trends and planned facility updates, and useful practices employed by experienced ASO FRs to effectively conduct day-to-day oversight of ANL nuclear facilities.

FPP Assessments and Reviews

In general, ASO has adequately performed required periodic assessments and reviews of Argonne FPP elements. Office of Science Management System (SCMS) Procedure 13, *Oversight of Facility Safety*, provides Office of Science Program Office-level requirements for site office reviews and approvals of contractor FPP elements (e.g., FPP, BNA, FP-AHJ delegation) required by DOE Order 420.1C. As allowed per SCMS Procedure 13, step 18, ASO elected to have the fire protection FR directly serve as a participant and observer on Argonne's 2021 and 2024 FPP triennial assessments, respectively, to fulfill ASO's periodic FPP oversight requirement. ASO SOP 15, *Assessments*, defines ASO-specific requirements for planning, conducting, and tracking the results of its assessment activities. Reviews of both triennial assessment reports and associated correspondence between ASO and Argonne fire protection SMEs demonstrated appropriate ASO involvement during the assessment and communication of results in accordance with ASO SOP 15 requirements.

For the 2021 BNA, the fire protection FR served as the primary ASO reviewer. Reviewed correspondence between the fire protection FR and Argonne counterpart confirmed that ASO-identified concerns were appropriately addressed and resolved prior to site office approval of the BNA. For the 2024 BNA (still under ASO review at time of this assessment), ASO elected to have the OSS FPE serve as an independent reviewer.

Reviewed ASO integrated assessment schedules for fiscal years 2023 and 2024 were appropriately developed in accordance with ASO SOP 15 requirements and identified ASO reviews/assessments of Argonne fire protection activities.

While ASO is generally meeting its periodic Argonne FPP assessment and review requirements, the following weaknesses were identified:

- Contrary to SCMS Procedure 13, step 12, ASO has not established a formal process for, nor documented, its required annual review of all contractor authority having jurisdiction (CAHJ) determinations to ensure that delegated FP-AHJ authorities are appropriately employed. (See **Deficiency D-ASO-1**.) A lack of formal review processes and associated documentation could reduce assurance that the CAHJ is appropriately making all determinations within their ASO-delegated authorities.
- ASO has taken inconsistent approaches and has not established clearly defined roles, responsibilities, and expectations for conducting its required periodic reviews of Argonne FPP elements. (See **OFI-ASO-1**.) For example, ASO has used different oversight strategies and levels of review for the previous two Argonne FPP triennial assessments, 2021 BNA, and 2024 BNA without a clear basis. Additionally, ASO management and oversight personnel stated during interviews that no formal direction currently exists to determine when or if OSS FPE review is required for ASO approval of Argonne FPP elements.

Federal Issues Management

ASO has appropriately communicated, documented, and tracked resolution of issues identified during its oversight of recent Argonne fire protection activities. ASO SOP 12, *Issues Management*, adequately defines roles, responsibilities, and requirements for the management of ASO-identified issues, including criteria for documenting and tracking oversight results in the ASO Commitment Tracking System

(ACTS). Reviewed ACTS entries for calendar year 2024 ANL nuclear facility fire protection oversight activities appropriately documented activity results, ASO-identified issues, corresponding Argonne PRISM reports, and the status of associated corrective actions in accordance with SOP 12 requirements. However, interviewed ASO oversight personnel acknowledged that ACTS currently has limited built-in trending capabilities, categories for oversight activity type and functional area, ability to directly link ASO-identified issues to corresponding PRISM entries, and templates supporting consistent documentation of oversight activity results. (See **OFI-ASO-2**.)

ASO has effectively monitored Argonne efforts to resolve recent high priority fire protection issues. During the 2021 BNA review, Argonne fire protection SMEs and the ASO fire protection FR identified significant challenges with AFD culture, staffing, training, and response capabilities. Reviewed corrective action plans, associated status documents, and interviews with AFD leadership and ASO fire protection SMEs demonstrated close engagement between ASO and Argonne on resolving these challenges. Additionally, the ASO fire protection FR has engaged quarterly with AFD leadership to review strategic performance metrics (e.g., response times, unit availability, inspections performed, training hours) to monitor the effectiveness of AFD improvement initiatives in response to the 2021 BNA. ASO also annually appraises Argonne's overall fire protection/prevention performance through the Office of Science's formal laboratory performance evaluation and measurement plan (PEMP) process. Per reviewed fiscal years 2022 and 2023, Argonne PEMPs appropriately incorporated ASO feedback on recent Argonne FPP improvement initiatives, including those associated with the AFD.

Federal Oversight Conclusions

Overall, ASO has performed effective field oversight and generally adequate periodic assessments and reviews of Argonne FPP elements. ASO has appropriately managed issues identified during fire protection oversight activities and has effectively monitored Argonne efforts to resolve recent high priority fire protection issues. However, a weakness was identified related to a lack of formal processes or documentation for required ASO annual reviews of CAHJ determinations.

3.7 Follow-up on Previous EA Finding

This portion of the assessment examined the status of corrective actions for an Argonne finding that was documented in EA report *Office of Enterprise Assessments Review of the Argonne National Laboratory Fire Protection Program, August 2015*. Four ANL-related findings are listed in this report, and EA performed a review of completed corrective actions during a follow-up activity in 2021 (documented in EA field note FN-EA-31-ANL-2021-01-11). EA concluded from this review that **Findings F-ANL-1**, **F-ANL-2**, and **F-ANL-3** were satisfactorily resolved, indicating an overall positive trend. However, the 2021 review determined that **Finding F-ANL-4** was not yet resolved as described below.

Finding F-ANL-4 of the August 2015 report stated that Argonne had not demonstrated the reliability of the site water supply and distribution system for credited fire water systems, as required by NFPA 25. The subsequent EA follow-up review in 2021 evaluated Argonne's actions, which included performing a detailed condition and code requirements analysis report of the water supply tanks, pumping stations, and piping systems in 2016 as documented in the *Domestic Water Supply Analysis* report. The report detailed the condition of the ANL water supply and identified 12 deficiencies (with supporting recommendations) that affected the reliability of the system, including: "Approximately 80% of the site's domestic water piping is identified as in substandard condition. The remaining 20% of the site piping is divided between 10% being identified as adequate and 10% identified as inadequate, the worst of the three condition categories. Many building water service lines (lead-ins) are original and anticipated to be in poor condition. The lead-in piping has exceeded its expected life and should be proactively replaced prior to failure."

In response, Argonne developed a business case for a multi-year phased project plan to address the deficiencies and recommendations presented in the *Domestic Water Supply Analysis* report. These upgrades were planned to be completed in multiple project phases as part of the *Argonne Utilities Upgrade Project* with a full project completion anticipated in 2028. However, during the 2021 EA follow-up review, Argonne provided no evidence of an effort to reconcile the identified water supply system deficiencies with regard to system reliability, or a documented analysis of the system's reliability to ensure compliance with DOE Order 420.1C, attachment 2, chapter II, section 3.c.(3)(e). EA concluded in 2021 that, although progress in addressing this finding was ongoing with a scheduled completion date of 2028, the condition of the site water supply and supporting infrastructure remained largely unchanged and did not demonstrate that the site water supply was reliable.

At the time of this assessment, upgrades to the ANL water supply infrastructure were partially in progress with the refurbishment of domestic water storage Tank 568. A new water supply evaluation (*Site Domestic Water Supply Analysis*) was performed by Argonne in 2021. Although this report evaluated ANL's water supply, including the adequacy and single point failure criteria, it did not address the 12 deficiencies documented in the 2016 report, nor was the 2016 report cited as a reference. EA concludes that the August 2015 EA finding is not yet resolved, given that the previously identified piping deficiencies have not been repaired. The piping deficiencies continue to affect the reliability of the ANL water supply, most notably the 2016 deficiency that "the lead-in piping has exceeded its expected life and should be proactively replaced prior to failure."

Follow-up on Previous EA Finding Conclusions

The August 2015 EA finding is not yet resolved pending identified piping deficiency repairs and resolution of reliability concerns of the ANL water supply infrastructure.

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:

- The AFD has proactively developed and implemented an SOG for identifying the hazards of and practices/tactics for responses to Li-ion battery incidents associated with small-scale devices, vehicles, and battery storage systems. The SOG is directly responsive to the emergent concerns for emergency response to this increasingly prevalent hazard and is available for use by adjacent mutual aid fire departments.

5.0 FINDINGS

No findings were identified during this assessment.

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.

UChicago Argonne, LLC

Deficiency D-Argonne-1: Argonne did not include a dust hazard analysis for hot cell dust hazards in the AGHCF FHA, as required by NFPA 484 and NFPA 652. (DOE Order 420.1C, att. 2, chap. II, sec. 3.f.(1)(b); DOE-STD-1066-2023, sec. B.2.11; and NFPA 801, sec. 4.3.2.2(3))

Deficiency D-Argonne-2: Argonne did not complete annual building FPAs for the AGHCF and RWSF in calendar years 2023 and 2024. (DOE Order 420.1C, att. 2, chap. II, sec. 3.f.(2)(e); DOE-STD-1066-2023, sec. 7.2.1; FP-PROC-15, att. A)

Deficiency D-Argonne-3: Argonne did not include available fire flow information for fire hydrants adjacent to the AGHCF and RWSF in the respective PIPs (fire hydrants are listed but fire flow information is stated as "unknown"). (NFPA 1620, sec. 7.2.2.1; and NFPA 1660, sec. 20.2.2.1)

Deficiency D-Argonne-4: Argonne did not document obstructed sprinklers in the RWSF during the last performance of NWM-RWSF-NSB-201 SR 4.3.3 (annual visual inspection). (DOE Order 420.1C, att. 2, chap. II, sec. 3.d.(1)(c), and NWM-RWSF-NSB-201 SR 4.3.3)

Deficiency D-Argonne-5: Argonne did not adequately document TSR derivations for SR 4.3.1 and SR 4.3.4 for the RWSF. (DOE Order 420.1C, att. 2, chap. II, sec. 3.d.(1)(c), and DOE-STD-3009-94, CN3, sec. 5.5.X.2)

Deficiency D-Argonne-6: Argonne does not hydrostatically test the piping from the sprinkler system FDC to the fire department check valve every five years for the AGHCF and RWSF sprinkler systems. (DOE Order 420.1C, att. 2, chap. II, sec. 3.d.(1)(c); DOE-STD-1066-2023, sec. 5.1.3.1; and NFPA 25, sec. 13.8.5)

Deficiency D-Argonne-7: Argonne does not periodically inspect the RWSF FD&AS duct smoke detector sampling tubes for mounting and orientation. (DOE Order 420.1C, att. 2, chap. II, sec. 3.d.(1)(c); DOE-STD-1066-2023, sec. 5.1.3.1; and NFPA 72, table 14.3.1, item 17(2), and sec. 17.7.5.5)

Deficiency D-Argonne-8: Argonne does not complete monthly and annual testing of RWSF battery-operated exit signs. (DOE Order 420.1C, att. 2, chap. II, sec. 3.d.(1)(c); DOE-STD-1066-2023, sec. 5.1.3.1; NFPA 101, secs. 7.9.3.1 and 7.10.9; and ESH-19.1, secs. 19.1.3 and 19.1.12)

Deficiency D-Argonne-9: Argonne does not automatically start or run the electric fire booster pump for at least 10 minutes in Building 401 during the weekly test and inspection activity. (DOE Order 420.1C, att. 2, chap. II, sec. 3.d.(1)(c); DOE-STD-1066-2023, sec. 5.1.3.1; and NFPA 25, secs. 8.3.2.2 and 8.3.2.3)

Argonne Site Office

Deficiency D-ASO-1: ASO has not established a formal process for, nor documented, its required annual review of all CAHJ determinations to ensure that delegated FP-AHJ authorities are being appropriately employed. (SCMS Procedure 13, step 12)

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.

UChicago Argonne, LLC

OFI-Argonne-1: Consider revising ESH-11.4 to remove the inconsistency between the procedure requirement and current practices for PAI approvals of hot work permits when a fire watch is specified.

OFI-Argonne-2: Consider establishing the RWSF Level 4 roll-up door alcove as a transient combustible exclusion area within NWS-PROC-016 and RWSF-DS-024-02.

OFI-Argonne-3: During the next planned update to the AGHCF nitrogen supply system description document, consider removing the erroneous conclusion that an in-cell fire is not a credible event, which conflicts with the AGHCF FHA.

OFI-Argonne-4: Consider incorporating a fire exposure hazard evaluation of the exterior oil-insulated transformer located south of the RWSF roll-up door and the lack of spill containment features in the RWSF FHA.

OFI-Argonne-5: Consider resolving the inconsistencies between the RWSF DSA, FHA, and PIP on the content requirements in the PIP for standpipe operation and potentially contaminated firefighting water run-off actions.

OFI-Argonne-6: Consider incorporating the NFPA 25, sec. 5.2.1, requirement for the annual inspection of spare sprinklers and associated wrenches into NWM-SR-102 to formally ensure the fire protection SMP requirement is satisfied.

OFI-Argonne-7: Consider including a specific checklist entry for the "Shell Level 4 dry-pipe FSS (fire protection SMP)" to form RWSF-DS-003-04 to clearly document the completion of the annual inspection of the RWSF dry-pipe FSS protecting the vault to reflect current practice when implementing NWM-SR-102.

OFI-Argonne-8: Consider installing improved signage designating each system, type, protected areas, and operational requirements (e.g., pressure augmentation for standpipe design requirements) for the RWSF shell sprinkler/standpipe and dry-pipe sprinkler system FDCs located exterior to the northeast stair enclosure to allow for prompt decision-making by emergency responders.

OFI-Argonne-9: Consider timely replacement of missing suspended ceiling tiles in the Building 331 RWSF office building to ensure reliable operation of sprinklers in response to a fire event.

OFI-Argonne-10: Consider incorporating the NFPA 10, section 7.2.2(5) requirement for weighing or hefting all types of hand-held portable fire extinguishers in AFD SOG 800.5.

OFI-Argonne-11: Consider incorporating applicable elements of DOE-HDBK-1226-2019, *Conduct of Operations Implementation*, section 12.0, *Logkeeping,* recommendations for the formatting, entry, change control, and corrections of AFD fire protection impairment logs and status board to standardize formality and eliminate inconsistencies in tracking this important information.

Argonne Site Office

OFI-ASO-1: Consider establishing ASO-specific guidance defining the roles, responsibilities, and expectations of ASO management, ASO fire protection oversight personnel, and OSS FPEs for conducting required periodic site office reviews and approvals of Argonne FPP documents.

OFI-ASO-2: Consider updating ACTS to enhance built-in trending and data analysis capabilities, more closely align oversight activity/functional area categories with those routinely used by ASO oversight personnel, more directly link ASO-identified issues to associated PRISM entries, and provide consistent templates for documenting oversight activity results.

8.0 ITEMS FOR FOLLOW-UP

EA will continue to follow up on the status of corrective actions for the finding documented in the August 2015 EA report related to the reliability of the site water supply and distribution system.

Appendix A
Supplemental Information

Dates of Assessment

November 18 to December 10, 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
Brent L. Jones, Acting Director, Office of Nuclear Safety and Environmental Assessments
David Olah, 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
Kimberly G. Nelson
Christopher E. McFearin
William A. Eckroade

EA Site Lead for Argonne National Laboratory

Samina A. Shaikh

EA Assessment Team

Keith E. Boring, Lead
Eric M. Moore, Co-lead
Thomas E. Sowinski
Jeffrey L. Robinson
Barry L. Snook
James R. Streit