Independent Assessment of Fire Protection Program Implementation at the Pantex Plant

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Office of Enterprise Assessments
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Acronyms

BNA	Baseline Needs Assessment
CFR	Code of Federal Regulations
CNS	Consolidated Nuclear Security, LLC
CRAD	Criteria and Review Approach Document
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
FARS	Fire Alarm Receiving Station
FD	Fire Department
FHA	Fire Hazard Analysis
FPP	Fire Protection Program
HPFL	High Pressure Fire Loop
ITM	Inspection, Testing, and Maintenance
LCO	Limiting Condition for Operation
LON	Local Operating Network
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NPO	NNSA Production Office
OFI	Opportunity for Improvement
Pantex	Pantex Plant
SAC	Specific Administrative Control
SAR	Safety Analysis Report
SC	Safety Class
SME	Subject Matter Expert
SR	Surveillance Requirement
SSCs	Structures, Systems, and Components
SSO	Safety System Oversight
TSR	Technical Safety Requirement

INDEPENDENT ASSESSMENT OF FIRE PROTECTION PROGRAM IMPLEMENTATION AT THE PANTEX PLANT

Executive Summary

The U.S. Department of Energy Office of Enterprise Assessments (EA) conducted an independent assessment of the fire protection program at the Pantex Plant from July to August 2021. Specifically, this assessment evaluated the Consolidated Nuclear Security, LLC (CNS) implementation of the fire protection program for Pantex Plant nuclear facilities. This assessment also evaluated the oversight provided by the National Nuclear Security Administration Production Office (NPO).

EA identified the following strengths, including one best practice:

- The combustible control program for the nuclear facilities is well implemented. Minimal combustibles are present, and the material present was logged and thoroughly evaluated. A rigorous combustible control program limits the ability of an incipient fire to spread to an explosives package. (Best Practice)
- CNS and NPO are proactively engaged in managing the challenging issues presented by some fire protection equipment.
- All outstanding EA findings in the area of fire protection were adequately closed.

EA also identified several weaknesses and one finding as summarized below. The finding warrants a high level of attention from CNS management.

- CNS has not properly implemented all inspection, test, and maintenance requirements for the safety class fire systems. Inadequate maintenance can lead to fire protection systems that may not perform their safety functions when required. (Finding)
- CNS has not completed the required system evaluation of the Building 12-066 heat detectors as a safety support system to the safety class fire door interlock.
- CNS has not implemented a short-term plan to address the immediate risk associated with degraded zone 11 high pressure fire loop ductile iron pipe and with the aging cathodic protection.
- Although progress has been made in identifying the causes of the faults on the new Det-Tronics fire detection system, CNS has not shown that the system can perform its safety function with a single active local operating network fault.

In summary, CNS is adequately implementing the fire protection program for the facilities and controls reviewed, and NPO is providing adequate oversight. However, until the concerns identified in this report are addressed or effective mitigations are put in place, increased risk associated with the specific fire protection program weaknesses will remain. EA will follow up to assess the causes and corrective actions to address the Det-Tronics fire detection system faults when the causes are fully identified and will review NPO's completed assessment of the situation when available.

INDEPENDENT ASSESSMENT OF FIRE PROTECTION PROGRAM IMPLEMENTATION AT THE PANTEX PLANT

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the effectiveness of fire protection program (FPP) implementation at the Pantex Plant (Pantex). This assessment, conducted in July and August 2021, reviewed aspects of the FPP; fire hazard analysis (FHA) and sitewide safety analysis report (SAR) integration; technical safety requirement (TSR) surveillances; and structure, system, and component (SSC) design requirements. Additionally, the assessment reviewed the resolution of fire protection findings previously identified by EA, and the status of several ongoing equipment challenges to the FPP, including issues with the new infrared fire detection system.

This assessment was conducted in accordance with the *Plan for the Fire Protection Program Assessment at the Pantex Plant, July 2021*. The scope focused on FPP implementation in nuclear facilities, specifically Building 12-096, Building 12-084, and Building 12-104. Consolidated Nuclear Security, LLC (CNS) operates Pantex, in support of the National Nuclear Security Administration (NNSA). The NNSA Production Office (NPO) provides oversight for Pantex. This assessment evaluated the effectiveness of CNS and NPO in managing and maintaining FPP performance.

Pantex is the nation's primary assembly, disassembly, retrofit, and life-extension center for nuclear explosives and includes facilities for the assembly and disassembly of these explosives. These facilities have safety class (SC) fire detection and suppression systems, as well as specific administrative controls for preventing and mitigating fires.

2.0 METHODOLOGY

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

As identified in the assessment plan, this assessment considered requirements included in Criteria and Review Approach Document (CRAD) EA CRAD 31-12, Revision 2, *Fire Protection Program,* associated with the following program elements:

- 4.1 Fire Protection Program
- 4.2 Fire Hazard Analysis and Documented Safety Analysis Integration
- 4.3 Fire Prevention and Protection SSCs and Design Requirements
- 4.4 TSR Surveillance Requirements, Inspection, Testing and Maintenance
- 4.6 DOE Field Element Oversight.

EA also used elements of EA CRAD 30-07, Revision 0, *Federal Line Management Oversight*, particularly objectives FO.2 and FO.4, as needed to collect and analyze data on NPO oversight activities related to fire protection.

EA examined key documents, such as pre-incident plans, work packages, procedures, manuals, analyses, impairment lists, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs; observed fire protection system surveillance activities; toured the fire station; and walked down significant portions of Building 12-096 and the selected bays, focusing on SC fire systems. This assessment was conducted with a hybrid remote/onsite team. The team followed standing order SO-PX-20-001, *COVID-19 Workplace Safety Plan – Guidelines for Minimizing Risk during the COVID-19 Pandemic*, while on site. The members of the assessment team, the Quality Review Board, and management responsible for this assessment are listed in appendix A.

EA conducted a previous assessment of the FPP at Pantex in October 2015 that identified four findings. During a follow-up review in 2017, EA identified that corrective actions for three of the four findings were incomplete, or not adequately resolved. This 2021 assessment reviewed the completion and effectiveness of corrective actions for the remaining incomplete or unresolved findings identified in the previous assessment. Results of this review are included in the most relevant sections of this report.

3.0 RESULTS

3.1 Fire Protection Program

The objective of this portion of the assessment was to verify the adequacy of the FPP's FHA, combustible control program, building fire protection assessments, baseline needs assessment (BNA), and pre-incident plans per DOE Order 420.1C, *Facility Safety*, attachment 2, chapter II. Building 12-096, a building that was in operation mode at the time of the onsite portion of the assessment, was selected as a representative example of how the FPP is implemented during the most hazardous work activities.

Fire Hazard Analysis

FHA-12096, *Fire Hazard Analysis for Building 12-096 Nuclear Explosive Cell*, Issue No. 008, comprehensively and qualitatively identifies the FPP elements and assesses the risk from fire within individual fire areas in the facility. A concise description of building construction is provided, and fire-rated separations are identified as required by DOE-STD-1066-2016, *Fire Protection*. Building fire areas are defined and bounded by fire-rated construction with openings protected by equivalently rated fire doors and penetration seals.

The FHA adequately analyzes fire hazards but does not include detailed information for SC SSCs as recommended by Pantex DESKAID-0110, *Guide for the Preparation of Fire Hazard Analysis*. (See **OFI-CNS-1**.) DESKAID-0110 recommends that FHAs include a list identifying active and passive SC equipment, components, systems, and support equipment located within the facility, as well as summary descriptions of the equipment that identify the safety function, location, power supply location, mission impact and data for determining fire loss consequences, and recovery potential. In contrast, the FHA only refers to the fire systems as SC in a parenthetical statement, which can be confusing because some fire systems have safety functions that are not intended to address fire hazards. For example, the fire extinguishers are SC equipment, not for their fire-fighting capability but for their design that prevents them from becoming a missile hazard.

Combustible Control Program

RPT-SAR-199801, *Technical Safety Requirements for Pantex Facilities*, defines the elements of the combustible control program that are required to be implemented using specified combustible disposition loading documents. Due to the nature of the work at Pantex, where the fire hazard is very different depending on what material is present and what work is occurring, CNS fire protection engineers successfully implement separate fire prevention requirements documents for the work activity, location, and material present to manage the combustible loading fire risk, including work instructions and combustible disposition loading documents. To determine the limits assigned to a fuel package, i.e., something that can burn, and identify the peak heat release rate and subsequent required minimum separation distances between fuel packages, CNS uses ESD-005, *Consolidated Report on Fire Modeling of Multiple Fuel Packages*. Distances are marked accordingly when the fuel package is in place for work. During a walkdown of the facility, EA observed that the minimum necessary amount of combustible material was present. Review of a completed combustible loading disposition form for Building 12-096 confirmed that combustible materials introduced into the facility were logged and thoroughly evaluated by fire protection engineers.

EA considers the CNS combustible control program, as implemented in Building 12-096, Building 12-084, and Building 12-104, as a **Best Practice**. A rigorous combustible control program limits the ability of an incipient fire to spread to an explosives package.

Building Fire Protection Assessments

Building fire protection assessments for Building 12-096, conducted in accordance with WI 02.01.05.01.26, *Conduct Facility Fire Assessments and Fire Hazard Analyses*, were sufficiently comprehensive and performed at the appropriate frequency. EA verified that housekeeping and chemical storage were adequate during the walkdown of Building 12-096, and that fire protection equipment was accessible and in good condition.

In addition to conducting annual building fire protection assessments, the Pantex fire prevention officer performs monthly building inspections using procedure PX-AG-014, *Fire Prevention Inspection*, to assess the condition of electrical equipment, adequacy of housekeeping, chemical storage areas, fire protection equipment, and means of egress. EA reviewed inspection forms dated May 5, 2021, through July 7, 2021, and determined that the building areas being assessed were adequately evaluated and documented, and identified issues were appropriately captured and addressed.

Baseline Needs Assessment

RPT-FD-0001, *Baseline Needs Assessment Report*, adequately defines and documents roles and responsibilities, command and control, communications protocols, available apparatus and equipment, emergency medical response, and training for site emergency services and the fire department (FD). The mutual aid agreement between the Pantex FD and the surrounding communities clearly defines communications protocols. The Pantex FD frequently provides mutual aid to the smaller FDs, successfully exercising these communications protocols. EA also determined that the mobile emergency apparatus inventory is sufficient and adequately maintained for response operations during site emergencies, based on walkdowns and inspection of the mobile emergency apparatus and interviews with FD personnel.

EA interviewed production technicians working in Building 12-084, who demonstrated an appropriate understanding of the fire protection systems in the bays and cells, as well as their roles and

responsibilities. The production technicians adequately demonstrated their knowledge through miming the procedures for the flammable vapor controls, and manual actuation of the deluge fire suppression system. Additionally, they understood the limitations of their training, when to stop work, and when to contact fire protection engineering for additional information during complex situations.

The BNA appropriately specifies minimum FD staffing. The minimum staffing represents a decrease from the personnel required by National Fire Protection Association (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*, for a facility with comparable square footage. Adequate justification for this decrease is sufficiently discussed in the BNA, which includes the presence of automatic fire suppression systems in the buildings, the successful exercises by the FD, and the training for plant personnel on emergency evacuation. CNS has not yet formally requested an equivalency for the change from the staffing levels required by NFPA 1710 from the Authority Having Jurisdiction. However, the NPO document approval report for the BNA, which is signed by the NPO Authority Having Jurisdiction, specifically agrees with CNS's justification for the reduced staffing level.

CNS's FD training program and exercises are adequate to appropriately train FD personnel to meet the safety basis requirements with one exception. The current approach to training Pantex firefighters on a flammable liquid pool fire is to use a designated training facility, which EA toured and found to be adequate for the training needs. However, CNS has not defined the requirements and recurrence frequency for flammable liquid pool fire response training, and training has correspondingly occurred inconsistently. (See **OFI-CNS-2**.) TSR specific administrative control (SAC) 5.7.33.2 requires the FD to respond to such events. The SAR relies on the CNS FD providing escort duties for fuel trucks that enter the zone 12 material access area and fighting fires that might occur, including flammable liquid pool fires.

Pre-Incident Plan

CNS has adequately established the pre-incident plan for Building 12-096 to ensure the effectiveness of emergency response activities; the plan was reviewed and approved by fire protection engineering staff, facility subject matter experts (SMEs), and emergency responders. The plan adequately identifies impacts to the inside of the building from external fire exposures, evaluates potential fire and smoke spread from one fire area to another within the building, and is consistent with the requirements of DOE Order 420.1C and the guidance provided in NFPA 1620, *Standard for Pre-Incident Planning*. The plan also addresses physical access and appropriate equipment for manual firefighting. However, EA identified the following omissions that could impact the FD response:

- Not all SC fire equipment was identified (e.g., manual pull station, flammable liquid storage cabinet).
- The plan does not include the locations of the SC flammable liquid cabinet or fire-rated barriers/walls.
- Not all hydrants are referenced in the plan.
- The plan has not yet been updated to reflect the upgraded infrared fire detection system.

When asked why the pre-incident plan had not yet been updated, interviewees explained that updates are based on a schedule for updating all pre-incident plans affected by the upgrades. EA reviewed the schedule and confirmed that Building 12-096 was on the schedule. According to the interviewees, the pre-incident plan revisions are not able to be completed as quickly as the upgrades occur.

Finding Follow-Up

2015 Finding F-CNS-PX-03: *CNS has not demonstrated compliance with SAC 5.7.33.1*

EA concludes that CNS has appropriately addressed this finding. At the time of the 2017 follow-up review, CNS had not demonstrated compliance with RPT-SAR-199801, SAC 5.7.33.1. SAC 5.7.33.1 requires the FD to respond to bay and cell facilities within a maximum of 60 minutes and establish water flow or attempt to suppress the fire if the fire suppression system is not flowing water. Corrective actions taken in response to this finding are documented in issue number PER-2016-0096. CNS's revised procedure PX-OF-017, *Emergency Response to Unique/Special Facilities*, adequately addresses the SAC requirement. Based on discussion with the FD, the FD has implemented a drill performed annually to test this capability with all three shifts; this drill is included in Emergency Management Drill Schedules PX19-FD-8A-001 and PX20-FD-8A-001. During the drills, the FD successfully demonstrates that they can respond to the bay and cell facilities and establish water flow within eight minutes.

Fire Protection Program Conclusions

Overall, CNS adequately implements the FPP in Building 12-096. The FHA, BNA, and pre-incident plan were generally comprehensive and accurate with some exceptions. The building fire protection assessments covered sufficient scope and were performed at the appropriate frequency. Further, the combustible control program implemented in Building 12-096 and other nuclear explosive facilities is comprehensive and a DOE best practice. However, the FHA includes limited information for SC SSCs, and the CNS FD is not conducting live training for fighting fuel pool fires on a specified frequency.

3.2 Fire Hazard Analysis and Sitewide Safety Analysis Report Integration

The objective of this portion of the assessment was to verify that CNS has appropriately integrated the FHA and the sitewide SAR.

With some exceptions, CNS has appropriately integrated the FHA and the sitewide SAR. The sitewide SAR adequately defines the scope of work that is performed in the facility, identifies and analyzes the hazards associated with fires and establishes the hazard controls to ensure adequate protection of workers, the public, and the environment in accordance with DOE-STD-3009-94, Change Notice 3, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*; this content is consistent with the FHA. Additionally, the safety basis accident analysis in the sitewide SAR clearly identifies and describes the credited functional requirements of the fire protection SSCs, and those requirements are consistent with the FHA.

RPT-SAR-199801 adequately addresses the requirements to maintain important operating parameters within acceptable limits, as well as the safety SSCs and administrative controls necessary to ensure that credited fire systems are available and able to perform their intended safety functions under normal, abnormal, and accident conditions. CNS is working to simplify and standardize the fire protection limiting conditions for operation (LCOs). Three tasks are being implemented through the Pantex TSR improvement plan that will address fire protection related LCOs, design features, and SACs. The plan identified these three tasks as a high priority with a completion date of December 31, 2021.

The sitewide SAR, which cites specific reliability rates for SC fire water systems, may not be conservative. (See **OFI-CNS-3**.) The SC fire water system reliability rates were derived from ESD-031, *Fire Protection Engineering Justification for Fire Protection System Success Probabilities and Performance Reliabilities for the Pantex Plant*, and were documented in the SAR analysis to evaluate the adequacy of fire protection systems to mitigate fires. However, recent underground piping failures of the

high-pressure fire loop (HPFL) system and the known vulnerability of the existing lead-in mains to corrosion are not considered in ESD-031. This was identified by NPO in 2017, and an action plan was documented in PER-2017-0121. However, the last action to replace the outdated quantitative reliability analysis with a qualitative analysis is not yet complete, with a due date in 2025. (For more information on the need for near-term action to address the current HPFL challenges, see section 3.3)

EA also identified inconsistencies between TSRs and supporting documentation. For example, ESD-168, *Building 15-033A and Building 15-034A Diesel Fire Pump and Co-located Water Storage Tank Failure Modes and Effects Analysis*, was last updated in 2018 to reflect the design change that added the pump house temperature sensors. However, ESD-168 still refers to surveillance requirement (SR) 4.4.4.2, which requires a weekly pump house temperature check, even though the SR was deleted from the TSR due to the addition of the temperature sensors. Five other SRs (i.e., SR 4.4.4.4 and SR 4.4.4.6 through SR 4.4.4.9) are also referenced in ESD-168 but have been deleted in the TSR.

Fire Hazard Analysis and Sitewide Safety Analysis Report Integration Conclusions

Overall, CNS has appropriately integrated the FHA and the sitewide SAR, with some exceptions. The FHA and sitewide SAR accurately identify the safety-related fire protection systems and controls. However, the sitewide SAR cites reliability rates from an engineering justification document (ESD-031) that may be non-conservative, and inconsistencies exist between the TSRs and ESD-168.

3.3 Fire Prevention and Protection SSCs and Design Requirements

The objective of this portion of the assessment was to verify the technical adequacy of the fire protection engineered design features and analyses per DOE Order 420.1C regarding the fire protection design requirements, the HPFL, and the Det-Tronics fire detection system.

Fire Protection SSCs Design Requirements

In general, the design requirements for the reviewed fire prevention and protection SSCs were appropriately identified, except for two instances where the design requirements of components were not properly characterized. First, the vent/purge pipe intended to remove exhaust from the lead acid battery cabinet, located in the interlock of the bays and installed as part of the Det-Tronics Eagle Quantum Premier fire protection system upgrade, has not been appropriately identified in accordance with NFPA 70, *National Electric Code*, as a Class I, Division 2 component. Also, hazardous classifications drawings, conveying where potential flammable vapors exist within the system during normal operations, were not developed. (See **OFI-CNS-4**.) Without the hazardous classifications' drawings, the potential exists for the flammable vapor hazard to go unrecognized.

Second, the Building 12-066 heat detectors were not evaluated in the sitewide SAR for their performance capabilities as a credited component. The Building 12-066 heat detectors support an SC fire door interlock credited to mitigate design basis accident fires in the SAR. DOE-STD-3009-94, section 4.3, requires performing a system evaluation of any SSCs needed to ensure the availability of a preventive or mitigative SC or safety significant SSC. An engineering evaluation, EE-10-010, *12066 Center Fire Doors Operation During a Fire*, was performed in 2010 to document the fail-safe features of the fire doors. It identifies the heat detectors as having a safety class function, but this information is not captured in the sitewide SAR. (See **Deficiency D-CNS-1**.)

High Pressure Fire Loop

Overall, the reliability of the SC HPFL system has improved since EA's fire protection assessment in 2015. CNS has implemented an HPFL flow assurance process, which routinely analyzes the system configuration and ensures that hydraulic requirements are met. EA observed that ultrasonic flow meters have been installed to improve monitoring of HPFL system leakage. Also, CNS has continued to replace underground piping in the HPFL. Although these pipe replacements have been beneficial, the system vulnerabilities discussed below continue to exist for the underground pipe supplying zone 11 (non-nuclear) and zone 12 south (nuclear).

CNS has not addressed the immediate risk associated with current challenges to the reliability of the HPFL. ESD-168 and ESD-187, *Failure Modes and Effects Analysis*, provide a component-level analysis of the HPFL. These analyses consider a breach of the HPFL underground supply piping as an acceptable significant single failure vulnerability. This vulnerability exists because the underground ductile iron HPFL pipe experiences external corrosion due to contact with the soil, resulting in leaks. The vulnerability is heightened by the degraded cathodic protection that provides corrosion protection of the ductile iron pipe, as reported in NPO HPFL Assessment dated February 13, 2017, and documented in the current FHA. As demonstrated during the July 16, 2021, zone 11 (non-nuclear) pipe break, described in Occurrence Reporting and Processing System report NA--NPO-CNS-PANTEX-2021-0094, a break in the non-nuclear zone compromised the zone 12 south (nuclear) two-hour water supply, requiring entrance into an LCO. This recent incident highlights the known issue that failures can occur that render the HPFL system inoperable. While CNS has developed a long-term corrective action as documented in PLN-0095, *Life Sustainment Program Fire Protection*, CNS has not addressed the immediate risk associated with the degraded zone 11 HPFL ductile iron pipe or the degraded cathodic protection. Both challenge the reliability of the water supply and distribution system, contrary to DOE Order 420.1C, attachment 2, chapter II, paragraph 3.c(3)(e). (See **Deficiency D-CNS-2**.) If the immediate risk is not addressed, pipe breaks may continue to occur that challenge the operability of the HPFL before the long-term strategy addresses the problem.

Det-Tronics Fire Detection System

CNS is in a multi-year process of replacing the existing SC ultraviolet/infrared fire detection systems that operate the deluge systems for the bays and cells with new SC multispectral infrared fire detection systems. In October 2019, the most recent installations began experiencing faults. A total of 67 faults have been recorded on 14 systems through July 2021, with faults continuing to occur through the duration of this assessment. Pantex FD responds promptly to each fault, the affected system is taken out of service, and the appropriate LCO conditions are entered when the faults occur.

In April 2020, EA began following the CNS activities related to determining the cause of these faults and actions to resolve the issue. Based on Occurrence Reporting and Processing System reporting and conversations with both CNS and NPO representatives, appropriate actions are being taken to meet the safety basis requirements upon discovery of a fault. Corrective actions are taken to return the systems to service. Given the ongoing nature of the faults, EA will follow up on this issue as more information becomes available.

CNS is currently working with the equipment manufacturer, Det-Tronics, and has taken numerous actions to better understand the cause of the faults and work toward a solution. These actions include:

- Conducting surveys and data reviews to eliminate external causes such as faulty installation, weather, activities in the facilities, and electrical interference.

- Det-Tronics developing a diagnostic tool that CNS has installed on several systems to help identify the cause(s) of the faults. An upgraded version of this tool has been developed to gather more information and will be installed on several additional systems.
- Reviewing the potential for incompatibilities between device firmware and system software that is currently ongoing.

The information developed as of this assessment indicates that two general types of faults were caused by errors in communication between individual detection devices and the system control hardware (i.e., local operating network (LON) diagnostic fault, and LON CPU fault). Of the 67 faults recorded through July 2021, 33 were LON diagnostic faults and 34 were LON CPU faults. The LON diagnostic fault does not interfere with the ability of a detector to detect a fire and there has been one instance where two faults were received at the same time. A LON CPU fault renders the detector in a fault condition unable to detect a fire. In all instances of the LON CPU fault so far, it has only affected one detector at a time.

The fire detection system is designed to allow the suppression system to perform its safety-related function even with the loss of a single detector, as each protected room requires two detectors to alarm in response to a fire to activate the deluge system and all protected areas are covered by at least three detectors. However, since the cause of the faults has not yet been determined and the manufacturer has not been able to simulate the faults, CNS has not been able to verify that the detection system can perform its safety function while in a LON CPU fault condition. As a result, CNS cannot confirm that the SC fire detection system meets single failure criterion in accordance with DOE Order 420.1C, attachment 2, chapter I, paragraph 3.b (7). (See **Deficiency D-CNS-3**.)

Finding Follow-Up

2015 Finding F-CNS-PX-04: *Chapter 4 of the sitewide SAR did not include a system evaluation to determine the proper safety designation of the fire alarm receiving station (FARS), even though the system supports the electronic processing and annunciation of the safety class tank level signal credited in the sitewide SAR.*

EA concludes that CNS has appropriately addressed this finding. At the time of the 2017 follow-up review, the sitewide SAR and design information summary did not properly document the contribution of the FARS signal to credited controls. Equipment that provides a required support function to credited SC equipment must be evaluated to determine whether it also meets the criteria for SC systems. The actions taken in response to this finding are documented in issue number PER-2016-0096. The sitewide SAR has been updated to classify the FARS as SC and now identifies the FARS as being credited to provide real-time communication as specified in TSR LCO 3.4.3. However, the change was not integrated into the BNA.

Fire Prevention and Protection SSCs and Design Requirements Conclusions

The reviewed fire protection engineered design features are capable of performing their functions to protect the facility workers and the public. Some fire suppression components have not been appropriately classified as NFPA 70 Class I, Division 2 components and the Building 12-066 heat detectors are not evaluated to be classified as credited components. Although CNS has long-term plans to address the effect of vulnerabilities in the zone 11 HPFL on the safety function of the system in zone 12 south, they have not taken short-term actions to mitigate the risk. While CNS has been proactive in addressing the faults on the Det-Tronics fire detection system, CNS has not yet verified that the detection system can perform its safety function when a detector is in a fault condition.

3.4 TSR Surveillances and Inspection, Testing, and Maintenance

The objective of this portion of the assessment was to verify proper performance of TSR surveillances and other inspection, testing, and maintenance (ITM) activities on fire protection systems.

Overall, the surveillance and ITM of the fire protection systems demonstrate that the systems are capable of accomplishing their safety functions and continue to meet applicable system requirements and performance criteria. Reviewed surveillance and test procedures are adequate to confirm that key operating fire protection system parameters are maintained within acceptance criteria, ensuring conformance with safety basis requirements.

EA interviewed personnel involved in performing the required surveillances and ITM, and determined that they were appropriately knowledgeable of their work tasks. For example, production technicians responsible for implementing SRs during bay operation were sensitive to the combustible and flammable vapor controls that they implement. Additionally, maintenance technicians conducting fire protection system maintenance evolutions were aware of the key steps that supported the surveillances and the necessary actions in response to any unexpected results.

In the following cases, ITM requirements for the SC fire protection systems were not being completed, and the identified acceptance criteria were not applicable as required by DOE Order 420.1C attachment 2, chapter II, section 3.d.(1)(c). (See **Finding F-CNS-1**.) Inadequate maintenance can lead to fire protection systems that may not perform their safety function when required.

- Building 12-066 SC heat detectors are tested annually as CNS considers them to be a SC design feature, however they are not treated as an active SC component with an appropriate SR.
- The five-year internal piping inspection procedure does not ensure that branch mains on the system are being inspected/flushed if corrosion is found. According to the procedure, the technician decides which pipes to test. The NFPA 25 requirement for internal inspections is intended to reveal the presence of microbiologically induced corrosion or inorganic material such as rust and scale. EA did not identify any examples where piping was not inspected; however, the potential for a problem remains.
- SR 4.4.3.1, *Perform Flow Test Main Drain*, for performing the fire suppression main drain test is not in accordance with the applicable NFPA 25 requirement. The SR requires an investigation when the full flow pressure test result deviation is greater than 20 pounds per square inch (psi) when compared to the prior test. This criterion is contrary to the NFPA 25 requirement of a 10% reduction (which would be a deviation less than 20 psi) and could result in the reduction of water supply pressure not being appropriately identified and investigated for cause. The new TSR change package will change the SR to use the 10% reduction criterion.
- The interiors of site fire water storage tanks (tanks #15-24, #15-33, and #15-34) are not being inspected at a frequency in accordance with NFPA 25. NFPA requires inspections for signs of pitting, corrosion, spalling, rot, other forms of deterioration, waste materials and debris, aquatic growth, and local or general failure of interior coating, on a five-year frequency. Due to operational demands, these tanks have not been inspected for more than five years. CNS identified the code violation prior to the beginning of the assessment, however the corrective actions to address the issue only included actions to perform the inspections and did not identify any interim or compensatory actions to take. The corrective actions were not yet complete at the time of this assessment.

EA observed maintenance in Building 12-104 that rendered the fire system non-functional and did not follow the fire system impairment process to develop compensatory measures per WI 02.01.05.03.03,

Establishing Compensatory Measures for Planned and Unplanned Fire System Impairments. EA observed on August 16 and 17 that the deluge system in Building 12-104 for the bay where the maintenance was occurring was left in the "in process" (out of service) status overnight. Similarly, a second bay in Building 12-104 was in the in-process status for several weeks with the deluge valve disassembled, while awaiting a procedure update. While the status of Building 12-104 is tracked on the list of fire alarms on the control panel, a fire protection engineer did not review the status to determine if compensatory measures were needed, which would be required by the fire system impairment process.

Finding Follow-Up

2015 Finding F-CNS-PX-01: *Contrary to requirements found in 10 CFR 830 and DOE Guide 423.1-1B, there is no basis for the frequency of TSR surveillance rounds to ensure that the building temperature in the HPFL pump houses is adequate to prevent freezing of the small diameter water sensing line that provides the HPFL low system pressure input for the safety class diesel fire pump auto-start signal.*

EA concludes that CNS has appropriately addressed this finding. At the time of the 2017 follow-up review, Pantex used undersized, non-safety electric heaters in the pump houses and therefore established weekly operator rounds to verify that pump house temperatures were at or above 40 degrees, however there was no basis for the weekly frequency. The actions taken in response to this finding since 2015 are documented in issue number PER-2015-0050. CNS completed modifications to add a temperature sensor that continuously monitors room temperature, a local fire alarm control panel, and circuitry to the FARS, all appropriately classified SC or safety significant. EA also confirmed that TSR SR 4.4.4.14, which requires verification of the pump house temperature alarm functionality, is performed annually consistent with NFPA 72, *National Fire Alarm and Signaling Code*.

TSR Surveillances and Inspection, Testing, and Maintenance Conclusions

Overall, TSR SRs and ITM are properly performed. However, EA noted four examples where the requirements are not sufficiently incorporated into procedures, creating the potential to improperly conduct the ITM so that fire protection systems may not perform their safety functions when required.

3.5 DOE Field Element Oversight

The objective of this portion of the assessment was to verify that NPO line management has established and implemented an effective oversight process to evaluate the adequacy of CNS's FPP implementation, including management of fire protection issues.

The NPO line management oversight process is established in NPO-3.4.1.1, *NPO Oversight Planning and Implementation Process*, which adequately incorporates the requirements of DOE Order 226.1B. NPO uses a risk-based, graded approach to plan oversight of CNS, which prioritizes assigning resources to the highest risk activities. NPO's oversight of fire protection is sufficiently thorough. EA reviewed completed assessments and determined that they were well documented, and the scope appropriately incorporated known issues and nuclear safety risk to prioritize use of assessment resources. At the time of this assessment, NPO was conducting an assessment of the Det-Tronics fire detection system issues. Although anticipated to be completed prior to the end of this assessment, the report had not yet been finalized; EA will follow up on that report once it is finalized.

EA reviewed 19 documented fire protection issues identified by NPO staff from 2018 to 2021, including 12 observations, 5 performance problems, 1 finding, and 1 management concern. The NPO issues

management process allows for a graded approach, and the issues reviewed were all appropriately categorized. The reviewed issues were closed out and effectively corrected in a timely manner, and issues in progress were on track.

EA also reviewed three NPO-approved equivalencies. The equivalency requests provided sufficient information for NPO to make informed decisions, and the NPO approvals clearly described the basis for the approvals. Additionally, EA reviewed NPO's approval of the 2019 Pantex BNA. See discussion in section 3.1, Baseline Needs Assessment, for observations on the BNA approval.

NPO personnel who provide fire protection oversight are appropriately qualified and sufficiently experienced to perform their roles. NPO-60, the NPO Environment, Safety, Health, and Quality organization, is responsible for FPP oversight. The FPP SME has the individual responsibility for line oversight of FPP implementation; this FPP SME is a qualified fire protection engineer with multiple years of experience conducting oversight at NPO. Additionally, a safety system oversight (SSO) engineer from NPO-10, Nuclear Safety and Engineering, is responsible for oversight of fire protection systems. The SSO completed the DOE technical qualification requirements and has multiple years of experience at Pantex.

The FPP SME and SSO for fire protection systems work collaboratively with Facility Representatives and other NPO staff to evaluate FPP implementation at Pantex. In addition to formal assessments, the NPO staff conduct operational awareness activities and follow up on identified issues. Although travel restrictions associated with the COVID-19 pandemic reduced in-person operational awareness activities, NPO staff continued to maintain awareness and seek opportunities to increase engagement remotely. All NPO staff interviewed demonstrated appropriate familiarity with the fire protection systems, the facilities, and CNS fire protection staff.

DOE Field Element Oversight Conclusions

NPO line management effectively performs oversight of CNS's FPP implementation, including management of fire protection issues. NPO personnel have continued to be successful even with the added challenges associated with the COVID-19 pandemic.

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.

- CNS has a very effective combustible control program that adjusts for the movement of fuel packages through the facility. Minimal combustible material was observed in the facility, and the material present was logged and evaluated. Fire modeling documented in ESD-005 evaluates fires from representative fuel packages to ensure that the appropriate minimum separation distances are used. A rigorous combustible control program limits the ability of an incipient fire to spread to an explosives package.

5.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the

public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for findings. Cognizant DOE managers must use site and program-specific issues management processes and systems developed in accordance with DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*, to manage the corrective actions and track them to completion.

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Finding F-CNS-1: CNS has not properly implemented all ITM requirements for the safety class fire systems. Inadequate maintenance can lead to fire protection systems that may not perform their safety functions when required. (DOE Order 420.1C, attachment 2, chapter II, section 3.d.(1)(c))

- Building 12-066 safety class detectors are not tested as an active safety class component with an appropriate surveillance requirement.

- The five-year internal piping inspection procedure does not ensure that all branch mains on the system are being inspected/flushed if corrosion is found. Surveillance requirement 4.4.3.1 for performing the fire suppression main drain test does not reflect the applicable NFPA requirement.

- The interiors of site fire water storage tanks (tank #15-24, tank #15-33, and tank #15-34) are not being inspected at a frequency in accordance with NFPA 25. Due to operational demands, the tanks have not been inspected in more than three years.

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.

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Deficiency D-CNS-1: CNS has not completed the required system evaluation of the Building 12-066 heat detectors as a safety support system to the safety class fire door interlock. (DOE-STD-3009-94, section 4.3)

Deficiency D-CNS-2: CNS has not implemented a short-term plan to address the immediate risk associated with degraded zone 11 HPFL ductile iron pipe and cathodic protection and ensure a reliable water supply and distribution system. (DOE Order 420.1C, attachment 2, chapter II, paragraph 3.c (3)(e))

Deficiency D-CNS-3: CNS has not shown that the safety class fire detection system can perform its safety function with a single active LON CPU fault. (DOE Order 420.1C, attachment 2, chapter I, paragraph 3.b (7))

7.0 OPPORTUNITIES FOR IMPROVEMENT

The assessment team identified four OFIs 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.

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OFI-CNS-1: CNS should consider including more detailed information on the design, function, and boundaries of safety class fire systems in the FHA.

OFI-CNS-2: CNS should consider implementing a justified recurrence frequency for flammable liquid pool fire training for fire department personnel.

OFI-CNS-3: CNS should consider accelerating the evaluation of the potentially non-conservative ESD-031 safety class fire water system reliability rates that are cited in the sitewide SAR.

OFI-CNS-4: CNS should consider developing hazardous classifications drawings, conveying where potential flammable vapors exist within the system during normal operations, for the vent/purge pipe as part of the Det-Tronics Eagle Quantum Premier fire protection system upgrade.

8.0 ITEMS FOR FOLLOW-UP

EA will follow up on the identification and resolution of the Det-Tronics fire detection system fault causes, and the NPO assessment of CNS's management of the faults.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: July 26-29 and August 16-17, 2021

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