

**Office of Enterprise Assessments
Review of Explosives Safety Program Implementation
at the Pantex Plant**



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Acronyms

CAS	Contractor Assurance System
CNS	Consolidated Nuclear Security, LLC
CRAD	Criteria, Review, and Approach Document
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
ESC	DOE Explosives Safety Committee
ESP	Explosives Safety Program
ESR	Explosives Safety Representative
FR	Facility Representative
HE	High Explosive
IHE	Insensitive High Explosive
IPRO	Integrated Production Planning and Execution System
LLPS	Lightning Location and Position System
LMA	Lightning Mapping Array
LMS	Learning Management System
LPI	Lightning Protection Institute
LPS	Lightning Protection System
MAA	Material Access Area
NEW	Net Explosive Weight
NEXRAD	Next-Generation Radar
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NPO	NNSA Production Office
OC	Operations Center
OFI	Opportunity for Improvement
PER	Problem Evaluation Report
PPE	Personal Protective Equipment
PSS	Plant Shift Superintendent
R&D	Research and Development
SME	Subject Matter Expert
SMP	Safety Management Program
STD	Standard
TQP	Technical Qualification Program
WI	Work Instruction
Y-12	Y-12 National Security Complex

Office of Enterprise Assessments Review of Explosives Safety Program Implementation at the Pantex Plant

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA), Office of Environment, Safety and Health Assessments, conducted an independent review of explosives safety program implementation at the Pantex Plant. The National Nuclear Security Administration (NNSA) Production Office (NPO) provides Federal oversight of the prime management and operating contractor, Consolidated Nuclear Security, LLC (CNS). The primary mission of the Pantex Plant is the assembly, disassembly, in-process testing, and evaluation of nuclear explosives in support of the NNSA stockpile stewardship program. Pantex also conducts synthesis, manufacturing, and machining of insensitive and conventional high explosives for use in nuclear explosives; conducts research and development in conventional high explosives; and serves as an interim storage site for discontinued legacy materials. EA conducted its onsite review on April 6-9 and April 20-23, 2015.

Overall, CNS has implemented a comprehensive explosives safety program. In most cases, CNS has established and effectively implemented controls for reducing the risk associated with explosives operations. The flowdown of explosives safety requirements is well documented and implemented. In particular, development and implementation of the Integrated Production Planning and Execution System (which provides real-time weights of explosives in various operating locations to prevent exceeding explosive weight limits) is considered a best practice. Explosives systems engineers, scientists, facility management, and operating personnel are well trained through a comprehensive training and qualification program, and workers are conscientious and knowledgeable of explosives operations and processes. Overall, worker conduct of operations in these facilities was acceptable.

Several deficiencies were identified during the review. The most significant weakness was the stationing of personnel in the Zone 12 ramps as a compensatory measure during inoperability of a blast door interlock. This is identified as a significant weakness because these personnel could be exposed to significant overpressure in case of an accidental explosion, and they would not be afforded the Class II levels of protection specified by DOE-STD-1212-2012, *Explosives Safety*.

In addition, another weakness was noted after reviewing the Pantex 2010 explosives safety assessments. The results indicated numerous non-compliances with the LPSs, ranging from minor to significant. In addition, the staffing levels and LPS-related training and qualifications of the electrical crafts personnel have not been sufficient to ensure adequate inspection and repair of lightning protection systems. Many of the non-compliances remained unresolved at the time of this review. However, CNS has implemented compensatory measures (e.g., standoff distances from exterior walls for explosives staging) to maintain safe explosives operations in the interim.

NPO has established management processes to implement line oversight of explosives safety, and the last NPO explosives safety assessment, conducted in 2013, was in compliance with the five-year assessment frequency specified in NNSA supplemental directive NA-1 SD 226.1A, *Line Oversight and Contractor Assurance*. However, given the breadth and complexity of the explosives safety program implementation and the issues that have been identified through the CNS assessments, NPO should consider establishing annual assessments with smaller scopes addressing only a portion of the explosive safety program elements each year such that all program elements are assessed within the required five-year period.

The assigned NPO explosives safety SME has completed numerous Department of Defense and DOE explosives safety courses but has limited experience in the implementation of an explosives safety

program. NPO has several staff members with many years of explosives safety experience who can mentor the individual until sufficient experience is obtained.

With a few exceptions the explosives safety program at Pantex is comprehensive, well implemented, and provides a safe work environment for personnel and explosive materials.

Office of Enterprise Assessments Review of Explosives Safety Program Implementation at the Pantex Plant

1.0 PURPOSE

The U.S. Department of Energy (DOE) independent Office of Enterprise Assessments (EA) conducted a review of the Pantex Plant explosives safety program (ESP). The purpose of the EA review was to evaluate the Consolidated Nuclear Security, LLC (CNS) implementation of program requirements, the adequacy of controls designed to reduce the risk resulting from activities associated with high explosive (HE) materials, and the National Nuclear Security Administration (NNSA) Production Office (NPO) oversight of the ESP. This review was designed to evaluate the selected ESP elements and to provide information to the sites and responsible DOE line management organizations for benchmarking their program's effectiveness. EA conducted the onsite portions of this review during April 6-9 and April 20-23, 2015.

Existing EA criteria, review, and approach documents (CRADs) were adapted to establish a focused set of review criteria, activities, and lines of inquiry for the review in coordination with a facility-specific review plan. EA reviewed the ESP as implemented at the Zone 12, Zone 11, and Zone 4 East locations.

This report discusses the scope, background, methodology, results, and conclusions of the review. During this review, EA identified 1 finding and 17 opportunities for improvement (OFIs).

2.0 SCOPE

EA conducted this review of the explosives safety processes and activities at Pantex in accordance with a review plan, focusing on evaluation of ESP elements to ensure that adequate controls are identified and implemented to prevent or to reduce the risk associated with handling and storage of explosives materials and the likelihood of an accidental HE violent reaction at the Pantex Plant facilities. This review was adapted from existing EA CRADs to establish a focused set of inspection criteria, activities, and lines of inquiry.

This ESP implementation review evaluated the effectiveness of the flowdown of the DOE-approved ESP and associated requirements, as expressed in approved explosives safety documentation, associated safety basis documentation, and operational procedures for activities with explosives materials. The review also evaluated the effectiveness of NPO's oversight of CNS ESP implementation.

3.0 BACKGROUND

NPO is responsible for the oversight of both the Pantex Plant and the Y-12 National Security Complex (Y-12). In June 2012, the former Pantex Site Office and Y-12 Site Office were merged into NPO because a single management and operating contract was being awarded for the operation of both Pantex and Y-12. NPO maintains a cadre of staff at Y-12 and Pantex.

CNS manages and operates the Pantex Plant under a five-year contract. Contract transition from the previous contractor was completed July 1, 2014, when CNS assumed responsibility for operation of both plants. CNS member companies include Bechtel National, Inc.; Lockheed Martin; Alliant Techsystems (ATK) Launch Services; and SOC, LLC, with Booz-Allen Hamilton as a teaming subcontractor.

EA's oversight program is designed to enhance DOE safety and security programs by providing DOE and contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements and the effectiveness of DOE and contractor line management performance in safety and security and other critical functions as directed by the Secretary of Energy. The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, and EA implements the program through a comprehensive set of internal protocols, operating practices, inspector's guides, and process guides.

4.0 METHODOLOGY

EA's plan for this review utilized the criteria from CRAD 32-01, *Explosives Safety* to evaluate the ESP. In accordance with the plan, the EA review team focused on the performance and implementation of site ESP processes. When performance weaknesses were identified, EA evaluated these weaknesses to identify potential causes.

The review process was divided into several phases, including offsite planning, onsite scoping visit, onsite data collection activities, report writing, validation, and review. Planning included discussions with responsible site personnel, determination of the details of the ESP to be reviewed, scheduling of the review, collection of applicable site procedures and documents, and document reviews. At the conclusion of onsite data collection, EA briefed its initial observations to key NPO and CNS personnel. A draft independent review report identifying overall perspectives, deficiencies, and OFIs was prepared and made available to line management for factual accuracy verification and feedback. Finally, the results of the review were provided to key DOE managers before publication of the report. The members of the EA review team, the Quality Review Board, and EA management responsible for this review are listed in Appendix A. A detailed list of the documents reviewed, personnel interviewed, and observations relevant to the findings and conclusions of this report, is provided in Appendix B.

Non-compliances that were identified during the review that did not have a sufficient level of significance to warrant a finding were communicated directly to NPO for resolution.

5.0 RESULTS

5.1 Overall Explosives Safety Program Effectiveness

Criteria:

The site contractor explosives safety program has been effectively implemented in support of the full scope of facilities engaged in developing, manufacturing, handling, storing, transporting, processing, or testing explosives, pyrotechnics, and propellants, or assemblies containing these materials, and to the safe management of such operations (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-1

An adequate number of explosives safety program personnel are assigned and available to support facility activities (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-3 .

EA conducted walkdowns in manufacturing and laboratory explosives operating facilities, in explosives storage areas, and at the firing site as well as detailed work observations in an explosives machining building. Overall, CNS has implemented a comprehensive ESP. The flowdown of explosives safety requirements is well documented and implemented, and many of the documents are comprehensive. The Integrated Production Planning and Execution System (IPRO) provides real-time levels of net explosive

weight (NEW) in various explosives operating locations in order to prevent exceeding explosives weight limits in bays and/or buildings. EA considers the development and implementation of the IPRO a best practice. A lightning location and position system (LLPS) installed in the operations center (OC) provides advance notice of approaching lightning activity. A lightning warning system has been implemented, and personnel involved in explosives activities are notified to take preventive actions/ measures when lightning approaches within a pre-determined distance. The conduct of operations in these facilities is excellent.

The CNS Nuclear Explosives Surety Department provides oversight and support of the ESP. Department personnel are generally assigned to support specific explosives operating facilities or areas, or various operations. They provide ongoing observations of explosives operations, inspect tooling to ensure explosives decontamination before items are released from the facility, and are available on short notice to provide safety-related guidance to facility or area personnel. Department personnel appear to be extremely knowledgeable of their respective assigned areas, and the Department is adequately staffed with well qualified personnel.

5.2 Implementation of Explosives and Personnel Limits and Quantity-Distance Criteria

Criteria:

Explosives and personnel limits and control have been established and are controlled (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-5

Site Contractor has developed and implemented quantity-distance and level of protection criteria that provides specific levels of personnel and property protection from the effects of potential fires and explosions within and outside of DOE/NNSA installations (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-8

The Pantex Explosives Safety Site Plan (SB-ES-941277) has been approved by the appropriate authorities and details the explosives limits for all operating and storage buildings on the site. It indicates the required protection for all related and unrelated facilities. The enclosed quantity-distance maps provide the explosives safety arcs required for each building and display the intermagazine, intraline, and inhabited building distances as required for the specific locations. In addition, the special distances required for intentional detonations are provided for the Firing Site locations. The use of Facility Procedure, Specific Safety Requirements, contains detailed administrative procedures for controlling the explosives loading and personnel limits of the bays and ensures that each operation being conducted does not violate explosives quantity-distance requirements.

With a few minor exceptions, the distances meet the explosives safety quantity-distance requirements of Department of Defense (DoD) 6055.09-M, *DoD Ammunition and Explosives Safety Standards*, and DOE Standard (STD) DOE-STD-1212-2012, *Explosives Safety*. All of the minor exceptions have appropriate compensatory measures in place to provide an acceptable level of safety, and these are noted in the plan. The plan also notes where facilities have waivers or do not meet current explosives safety standards because they were built under older standards. Employees are knowledgeable and correctly answered all questions posed by EA regarding DoD and DOE explosives safety and quantity-distance requirements. The plan limits on NEW and the number of personnel allowed were randomly checked against the posted limits on buildings and bays/cells, and the posted limits were correct and properly displayed. The plan states that it will be revised when:

- The primary use of a facility changes.
- The footprint of a facility increases.
- The allowable NEW at any location increases.

- Explosives are introduced where none were previously allowed.
- A different explosives hazard class/division is introduced.
- Additional personnel performing a different function are added.
- Any facility built-in safety feature is compromised.

The plan contains a note addressing the contract between DOE and the City of Amarillo concerning use of two locations at the Amarillo Airport for transshipment of explosives materials. The note indicates that the Nuclear Explosives Surety Department is attempting to confirm the siting distances that exist and to compare them with current explosives safety requirements. There are a number of letters and memoranda to and from the city concerning this issue, but no documentation indicates resolution of the question about meeting the explosive safety siting requirements (see **OFI-CNS-01**).

The plan document revision history notes a series of proposed revisions due to:

- Changes in format required by DOE-STD-1212-2012
- Increased explosive weight limits for operational reasons at five locations
- Added siting for newly constructed facilities
- Changes in siting requirements for facilities containing 1.4S and 1.4 UL explosives
- Revisions due to a newly issued DoD 6055.09-M.

These revisions, along with related discussions with facility managers, are indicative of an extensive review process for identifying any revisions to Plant standards and procedures needed to address changing requirements from all potential sources.

Certain operations in explosives areas allow the use of small containers with closures that involve screw threads. A facility management waiver (DOE 27, Issue 5, December 12, 2012) allows the use of up to 100-milliliter glass and plastic screw closure containers and prohibits the use of metal components. However, the current issue of DOE-STD-1212-2012 does not prohibit the use of screw-type closures, but it does require prevention of the ingress of explosives into the threading. The noted waiver is not needed, since the cited “Screw-type container closures should not be used” statement upon which it is based has been removed from the current version of the DOE Standard (see **OFI-CNS-02**).

A potential safety issue exists when personnel are assigned as compensatory measures to control entry to nuclear explosives operating bays while the blast door interlocks are inoperable. The bay entries are located in an area that is normally considered to be a “non-occupied or unoccupied area” per DOE-STD-1212-2012, which defines such areas as “A location where occupancy is of a transitory nature such as building corridors, access ramps, and facility roads.” In contrast, placing an individual in the building corridor (i.e., ramp) to control entry to an explosives operating bay could expose him/her to overpressures and hazardous fragments or debris greater than allowed by class II levels of protection in case of an accidental explosion inside the operating bay or an adjacent explosives operating bay. This situation is not “occupancy of a transitory nature” and constitutes a de facto negation of the non-occupied or unoccupied designation of the area where the person is stationed to control entry (see **Finding-CNS-01**).

Similarly, benches have been installed in some ramp areas for personnel to don/doff personal protective equipment (PPE) but EA observed that personnel also use the benches during breaks. This usage may result in unnecessary exposure of transient personnel (workers unrelated to explosives operations) who stop there to interact with the individuals, and raises question as to whether the ramp areas continue to meet the definition of non-occupied or unoccupied areas.

During all EA visits to explosives storage and operating facilities, the senior plant person present determined the number of persons in the facility and restricted entry to some of the EA team members when necessary to ensure that the personnel limits for the facility were not exceeded.

When fully implemented, the IPRO system used for tracking explosives quantities present in locations and in transit on the site has the potential to significantly reduce the chance of exceeding explosives limits and avoid incompatibility issues at all related locations. Although it does not currently track all intra-facility movements, the overall concept is that it will eventually do so in all facilities and their internal work locations. In addition to tracking the quantities of explosives, the IPRO system:

- Prohibits transfer of explosives to facilities not authorized to store or process explosives
- Ensures that explosives are not transferred to a facility containing other explosives with which the explosives being transferred are incompatible (i.e., lists the hazard classes and compatibility groups allowed in each building and compares this with the materials being moved)
- Lists the transportation route for moving explosives and any in-transit restrictions
- Accomplishes a recheck of the movement rules evaluated prior to movement approval.

IPRO system improvements that are under consideration include:

- Wireless scanning of departure and arrival of explosives
- Radio frequency identification of materials in transit and their location.

A couple of Facilities does not use the IPRO system to track intra-facility explosives movements but uses Form PX-3717, Explosives Weight Control Log, to track the movement of explosives in each of the bays or rooms. EA noted that the building logs were current and up to date.

5.3 Explosives Safety Exemptions and Waivers

Criterion:

Exemptions and waivers to DOE-STD-1212-2012 must be approved at the appropriate DOE/NNSA and contractor management level, as applicable (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-10

The *Pantex-specific Explosives Safety Manual*, Pantex MNL-240176 (based on DOE Manual 440.1-1A, *Explosives Safety Manual*, which was superseded by DOE-STD-1212-2012), Revision 9K, dated May 25, 2011, is annotated to show the approved site-specific exemptions and waivers to the Pantex manual, making it easy for all users to understand that a variance to a particular requirement is in effect. The waivers list the compensatory measures in place to provide equivalent safety. However, the Pantex manual has not been updated to reflect the current version of DOE-STD-1212-2012, issued in June 2012, which contains new explosives safety requirements (see **OFI-CNS-03**). Moreover, DOE-STD-1212-2012 has not yet been added to the CNS contract (see **OFI-NPO-01**).

5.4 Explosives Material Operations Compliance with Explosives Safety Requirements

Criteria:

Site contractor has implemented general operational safety guidelines to protect workers from exposures to potentially toxic materials, ensure clean workplaces, and to ensure that the hazards related to explosives operations are minimized (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-11

Remote explosives operations shall be performed in facilities where the construction of the operating bay or the control room affords sufficient protection to personnel to prevent serious injuries (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-12

Site contractor has implemented applicable requirements for explosives storage (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-14

The PPE prescribed as administrative controls by CNS was appropriate for the workplace hazards involved, and employees' use of PPE (e.g., safety eyewear, safety shoes, gloves, coveralls) was adequate. PPE, such as face shields, that is located in eye hazard locations was clean and in good condition. Employees were conscientious about adjusting the sashes on exhaust hoods to the proper height to ensure adequate air flow. Half-face air purifying respirators are located near potential airborne hazards generated when mock explosives are dry-machined during equipment setup. With one exception, respirator fit-test cards issued to the employees who were interviewed were current (see **OFI-CNS-04**).

Housekeeping in facilities, bays, connecting ramps, and outside areas was adequate. Means of egress from facilities was not impeded by improper equipment or material storage.

CNS has implemented a comprehensive electrical safety program for explosives operating facilities. Work Instruction (WI) 02.01.07.04, *Perform Facility Electrical Evaluations*, is used to verify compliance of facility electrical systems (e.g., wiring, fixtures, electrical process support equipment, lightning arrestors, and surge suppressors) with the requirements of DOE-STD-1212-2012. The WI is also used to verify compliance following facility/equipment upgrades or modifications. Facility electrical equipment and wiring was well maintained and appeared appropriate for explosives operating locations defined in DOE-STD-1212-2012 and the National Electrical Code as Hazardous (Classified) Locations, Classes I, II, III, Divisions 1 and 2. In these locations, the use of process or support electrical or electronic equipment that is not approved by Underwriters Laboratory or a nationally recognized testing laboratory (e.g., Factory Mutual, Canadian Safety Association) for hazardous locations must be approved by the Nuclear Explosives Surety Department using implementing procedure P7-0804-5, *Approval of Electrical Equipment in Hazardous Areas*. If approved for use, a "pink sticker," Form PX-461, *Approval of Electrical Equipment in Hazardous Locations*, is affixed to the equipment, approving its use in a specific location. A running inventory of approved equipment is listed in Table-0131, *Electrical Equipment Approved by PX-461 for Use in Hazardous Areas Production Areas*. The EA review team did not observe any equipment in use during the walkdown that did not have a location-specific PX-461. Moreover, a good management process embedded in the PX-461 program is that the hazardous classification of a facility can be changed by this process following an evaluation by facility management, the Nuclear Explosives Surety Department, and Fire Protection Engineering.

Engineering Technicians were diligent in checking machine and bay door interlocks during pre-operation checks, and supervisors double-checked machine setup parameters and machine programming downloads. The checks are recorded on Form PX-3257, *Daily Machine Tool Checklist*. Workers set up remote explosives machining operations inside of bays equipped with interlocked doors that, when opened, will de-activate the machining operation. The Engineering Technicians view the operations via remote cameras, and all machining operations are videotaped. EA observed the Engineering Technicians operating the main disconnect switch on the power distribution panel that supplies power to the remote machining operating console. When questioned whether they were authorized to operate the disconnect switch, a CNS Production Section Manager provided EA with a previously conducted analysis that showed the operation to be non-hazardous and were authorized.

A facility management waiver exempts the remote operations in several older buildings from being monitored by audio or video equipment, since they are performed inside closed chambers and cannot be

monitored visually. The additional safety precautions including audible and visual alarms described in the waiver are appropriate and provide an acceptable level of alternate protection.

The daily pre-operational standup meeting that EA observed was comprehensive. Two Production Section Managers conducted the meeting, and 18 Engineering Technicians and the HE Manufacturing Department Manager were in attendance. Work assignments for the day were made and/or verified, Plant-specific lessons learned related to injuries and accidents were discussed, and Plant parking rules and recent parking lot infractions were reviewed, as was security guidance concerning the proper way to report remotely operated drones observed on or over the Plant.

With few exceptions, explosives storage in the facilities reviewed was excellent. Housekeeping was adequate, explosives were properly stored, and NEWs were not exceeded. Where possible, explosives were separated in a manner that reduced the potential for propagation within the specific location. Storage racks were manufacturer-rated for the posted weight limits. The overall housekeeping in the Zone 4 East storage magazine area was acceptable. No explosives were stored within the established sideflash distances in the facilities visited, and the established sideflash boundaries were well marked. (Sideflash is the electrical spark caused by differences of potential between conductive metal bodies and components of the lightning protection systems, or LPSs.)

EA evaluated exhaust ventilation and machining coolant systems in the facilities where they were present and reviewed the cleaning and maintenance processes with workers and supervision. Also, EA reviewed the processes for removal of waste explosives and explosives contaminated wastes. In each instance, the processes were conducted in accordance with DOE-STD-1212-2012 and Plant standard operating procedures.

The *High Explosives Performance and Surveillance Operations Department Operating Procedure* (P6-5700) is well-written and provides details of the operations of each function of the department. The procedure provides the general procedures for each firing site. It also covers the potential for non-standard occurrences (e.g., misfires, lightning warnings) and provides the related emergency procedures. The operating procedure includes a requirement for calculating the hazard distance for any fragmenting explosives items on a case-by-case basis to ensure that the safety distance requirements are met.

CNS has not established an Explosives Storage Review Committee, but has instead appointed an Explosives Storage Review Coordinator. The current coordinator was just recently appointed. These actions may have contributed to the recent facility management discovery that the annual explosives inventory required by DOE-STD-1212-2012 and WI 02.01.07.03.05, *Perform Explosives Storage Review*, had not been conducted for 14 of the 74 facilities of concern (see **OFI-CNS-05**).

Another exception is that CNS uses service magazines for long-term storage of explosives, specifically for long-term storage of design laboratory materials and legacy items. On December 12, 2012, CNS management approved Issue No. 22 of a Facility Management Waiver, DOE 7, Deviation from Advisory Requirement of DOE Explosives Safety Manual Chapter II, Paragraph 17.6.2.a (1) and (2). This waiver allows service magazines to be used to store materials, other than those used in service of related line operations, for periods in excess of the 180-day limitation established by DOE-STD-1212-2012 (which also states that such storage should be used no longer than necessary). The primary reason cited for this storage situation is that the service magazines have environmental controls that are not available in Zone 4. While exceptions could logically be made for storage of explosives related to the operations supported by the magazine, this storage is for explosives not related to such functions. This waiver, which has been in place for approximately seven years, does not meet the intent of DOE-STD-1212-2012 (see **OFI-CNS-06**).

The metal shipping containers used for explosives storage were correctly labeled with the NEW but not with the gross weight of the containers, so it was difficult to determine whether the posted weight limits of the storage racks were exceeded (see **OFI-CNS-07**). When EA questioned this situation, CNS verified that the gross weight of each metal storage container and the number of containers on the shelves did not exceed the posted maximum storage capacity of the shelving system.

EA visited the firing ranges used by the protective force and discussed the use of the ranges with range managers. CNS range management maintains a list of the acceptable munitions for use on the ranges. EA found that the list included no munitions that might result in unexploded ordnance remaining on the site.

5.5 Lightning Protection System and Facility Maintenance

Criterion:

Maintenance of process buildings and storage facilities and equipment to support facility explosives operations is adequate and current (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-4

With few exceptions, the maintenance of process buildings and equipment was adequate and current. Overhead hoists were properly load tested, and a color scheme was used to indicate hoist travel direction for the operator. Gauges, torque wrenches, temperature controllers, and thermometers were within their calibration dates. Form PX-4505, Safety System Check Sheet is filled out daily before use to verify all the safety systems on the steam ovens used for heating explosives. The inspection process used to detect any explosives contamination on tooling used (annotated on PX-455, *Explosives Decontamination Tag*) was excellent. Emergency eye washes and emergency showers in explosives operating buildings were properly installed, tested, and inspected. Local exhaust ventilation systems and exhaust hoods were tested as required to ensure that they were operating properly. A large maintenance pit under an HE pressing machine had been evaluated and determined not to be a confined space, although it was not labeled. A larger pit under an HE pressing machine had been evaluated and posted as a confined space. Fire extinguishers, including those on explosives transportation vehicles, were installed correctly, properly rated, and within their respective test dates. Half-face air purifying respirators were properly located in close proximity to potential airborne exposures in HE machining facilities, labeled with the individual employees' names, properly sealed in plastic bags, and placed inside wall-mounted cabinets for protection. Double tiered storage racks for explosives storage in the Zone 4 magazines were manufacturer-rated for the load capacity indicated. Forklifts had been load tested and were within test dates. Vegetation control around the Zone 4 storage magazines was acceptable, and housekeeping inside the magazines was well above average.

However, EA noted some deficiencies associated with facility maintenance. A hydraulic pallet jack in Zone 4 had not been weight tested and did not have a property number displayed, indicating that it may not be on a maintenance schedule. Metal explosives storage containers in a Zone 4 storage magazine were properly labeled with the NEW but were not labeled with their gross weight. Two metal storage racks in the corridor outside a Zone 12 bay were not anchored to prevent tipping. In the same bay, EA found a rubber water hose running behind the conduit on an energized wall-mounted 480 VAC receptacle, and the hose had been forced behind the receptacle in a manner that caused a considerable kink in the hose. EA notified the Building Manager of these non-compliances, and CNS took immediate corrective actions.

Lightning Protection Systems

DOE-STD-1212-2012 requires explosives facilities to be protected from the effects of lightning by properly designed, installed and maintained LPSs. LPSs are installed on explosives operating facilities in all of the Plant's explosives operating areas to protect personnel and facilities from the effects of lightning. National Fire Protection Association (NFPA) 780, *Standard for the Installation of Lightning Protection Systems*, and DOE-STD-1212-2012 contain installation requirements for LPSs. The Pantex implementing procedure for these standards is WI 02.01.07.01.12, *Implementing Requirements for Lightning Protection for Explosives Facilities*. The primary purpose of LPSs is to protect explosives and the personnel working in or near explosives areas from the consequences of an explosives incident resulting from a lightning strike. DOE-STD-1212-2012 also requires explosives to be placed in locations within facilities (or bays) that are outside the sideflash distance (i.e., separated from a possible electrical spark caused by differences of potential between conductive metal bodies and components of the LPSs). The approved types of LPSs are mast, catenary, integral air terminal, and Faraday cage or Faraday-like shield systems. DOE-STD-1212-2012 states that Faraday cage or Faraday-like shield systems are preferred for new structures where applicable. One of the four approved types of LPSs is currently in use to protect each conventional (non-nuclear) explosives operating facility at Pantex, and Faraday-like shield LPSs are used to protect nuclear explosives facilities. However, Pantex has taken the initiative to provide additional protection for new nuclear or non-nuclear explosives operating facilities by using both Faraday-like shield and catenary LPSs. For example, the High Explosive Pressing Facility (HEPF) have both Faraday-like shield and catenary LPSs, which Pantex LPS systems engineers stated provide optimum protection. However, a 2010 inspection conducted by Burns and McDonnell found the catenary system in Zone 12 to be improperly installed and that the U.S. Army Corps of Engineers construction contractor incorrectly installed the catenary system on the HEPF. CNS is developing corrective actions with the Corps of Engineer's construction contractor.

From January-March 2010, the Pantex Nuclear Explosives Surety Department conducted an assessment (ENG-10-04, SB-ES-941558, *Explosives Safety Program Independent Assessment for Lightning Protection Systems*) of the LPSs installed on 11 non-nuclear explosives facilities in Zones 4, 11, 12, and 16 to determine the level of compliance with the LPS requirements of DOE Manual 440.1-1A (predecessor of DOE-STD-1212-2012). The assessment concluded that the LPSs for the facilities had a significant number of non-compliances with NFPA 780 and DOE-STD-1212-2012, as well as operability and maintenance issues, and also identified 43 findings, 15 weaknesses, and 5 observations. This concern is discussed further in Section 5.8 of this report (see **OFI-CNS-08**).

Following the assessment, the Pantex contractor contracted with Burns and McDonnell, an engineering design firm, to inspect the LPSs on the remaining 76 non-nuclear explosives operating facilities and the catenary LPSs installed on nuclear explosives operating facilities to determine the extent of condition. Their final report, issued December 2010, found deficiencies in each of the facilities, ranging from minor (a frayed conductor) to significant (inoperable LPS needing replacement). EA concluded that some LPSs had a reduced ability to protect facilities and personnel from the effects of lightning and that LPS-related training and qualification of the electrical crafts was not maintained at a level sufficient to ensure adequate inspection and repair of LPSs. Moreover, CNS safety management personnel stated that CNS reduced the electrical craft's staffing level by approximately one-half upon contract transition (July 2014) by offering voluntary early retirement packages and voluntary in-plant transfers (see **OFI-CNS-09**).

EA asked CNS about the status of the deficiencies found during the Burns and McDonnell inspection, and CNS provided copies of six work orders dated February 2011 to repair LPS deficiencies on six explosives operating facilities. The work was completed in March 2011. CNS couldn't provide additional evidence of the status of other deficiencies found during the Burns and McDonnell inspection. However, CNS has

maintained implementation of the compensatory measures established by the previous Pantex contractor to reduce the risk associated with explosives operations in some facilities pending repair of the LPSs.

Recently, CNS contracted with the Lightning Protection Institute (LPI) to provide training on the LPS requirements of DOE-STD-1212-2012 and NFPA 780 for 20 Pantex employees. LPI is a not-for-profit nationwide organization used as a resource for information about lightning protection and system requirements.

The *DOE Explosives Safety Manual* (now superseded) was revised effective January 9, 2011, to require lightning arrestors, surge protection, and surge capacitors on the electrical services feeding explosives operating facilities, leading to additional non-compliances in the Pantex LPSs. On January 17, 2013, to address these new requirements (and non-compliances), the Pantex contractor management approved a three-year extension to ongoing Waiver DOE 29, Deviation from Advisory Requirement of DOE Explosives Safety Manual Chapter II, Paragraph 8.3 to this advisory provision in the Pantex manual, as permitted by both the *DOE Explosives Safety Manual* and DOE-STD-1212-2012. This waiver will be in effect until all corrective actions have been completed to bring all facilities' electrical service entrance into compliance with DOE-STD-1212-2012. While in effect, this waiver will be reviewed and updated as needed every three years. The waiver lists the compensatory measures that have been implemented to ensure that equivalent safety is achieved during explosives operations.

Moreover, CNS has an ongoing waiver to extend visual and electrical testing frequencies of LPSs. Issue 8 of Waiver DOE 20, *Deviation from Advisory Requirements of DOE Explosives Safety Manual Chapter X. Paragraphs 3.2.1.a, 3.2.1.c, and 3.2.1.d*, was again approved on December 12, 2012, to extend the recommended visual inspection frequency of catenary, integral, and mast LPSs from 7 months to 12 months and to extend the recommended electrical testing of the systems from 14 months to 47 months. EA reviewed maintenance records for three randomly selected facilities and, explosives storage magazine, which indicated that the visual and electrical tests were conducted at these extended intervals. However, when considering the number of deficiencies on the LPSs, and the minimum number of qualified maintenance personnel to conduct electrical testing and visual inspections, extending the inspection and testing intervals on LPSs at this time appears not warranted (see **OFI-CNS-10**).

The EA review team met with LPS systems engineers and the Electromagnetics Group Manager to discuss the testing and maintenance programs for the Faraday-like shield LPSs currently used to protect nuclear explosives facilities at Pantex. The interview group stated that the transfer impedance testing uses an improved variation of the test methodology described in DOE-STD-1212-2012. CNS submitted a proposal to the DOE Explosives Safety Committee (ESC) on May 19-21, 2015, requesting the ESC revise DOE-STD-1212-2012 to reflect this improved testing methodology.

Lightning Threat Detection

DOE-STD-1212-2012 states: "Facility Management shall ensure that a plan is established for (1) detecting when lightning is in the near vicinity and when there is a potential for lightning and (2) notifying appropriate personnel of these conditions. Lightning Threat Detection Systems are generally of three types, (1) those that detect the electrical gradient buildup, (2) those that detect actual cloud to cloud or cloud to ground electrical discharges, and, (3) an independent weather monitoring service, such as the National Lightning Detection Network or Next-Generation Radar (NEXRAD) that notifies the Facility when lightning is in the vicinity."

Pantex has designed and installed an advanced-state-of-the-art LLPS to detect cloud-to-ground lightning activity in the vicinity of the Plant. The LLPS uses eight sensors, four of them belonging to the National Weather Service, installed around the Plant perimeter to detect the unique electromagnetic signal

generated by a lightning strike and then triangulate its location. At least three of the eight sensors must be on-line for CNS to consider the LLPS to be operational. Sensor status and the LLPS are monitored in the OC. Lightning strikes are displayed on a computer screen and show the location of the strike(s) and the direction of movement. The OC also monitors the National Weather Service NEXRAD Doppler radar system for storm/lightning activity. A lightning threat warning is issued by the OC when lightning is detected within a 35 mile radius of the Plant; a lightning warning is issued when lightning is detected within a 10 mile radius.

When lightning warnings are issued, the duty plant shift superintendent (PSS) notifies Security and Transportation managers and Facility Representatives (FRs)/Designees in facilities containing lightning-sensitive components, Hazard Division 1.1 or 1.2 explosives, or insensitive high explosives (IHE) with detonators attached. The managers have 20 minutes to notify the PSS to verify that the warning was received. The warning announcements and verifications are recorded on Form PX-5424, *Lightning Warning Communications*. EA validated that Form PX-5424 was accurately completed following issuance of the last lightning warning.

CNS effectively maintains the LLPS. The four Pantex sensors are installed within fenced enclosures in a circular array around the Plant in Pampa, Happy, Boys Ranch, and Clarendon, Texas. CNS maintenance inspects the sensors annually, using Form PX-5064, *Material Condition Walk-down Checklist*, to document any degradation. Any defects or concerns are noted on one or more of the 18 items on the checklist as applicable. For example, any loose vegetation within the enclosure is trimmed, and components are inspected for rust, corrosion, or discoloration. The sensors are self-testing, and the system continuously monitors the signals between each sensor and the LLPS for several parameters, such as signal strength and distortion. Each major component of the system is tested on a three-year cycle.

Pantex has initiated three research and development (R&D) projects to improve the accuracy and effectiveness of the LLPS. A team of engineers from Pantex Systems Engineering have conceptually designed a system that uses an array of photo diodes to detect and positively locate lightning strikes near Pantex. The objective of this project is to enhance the detection reliability and locating ability of the existing LLPS. Another R&D project is to investigate the effectiveness of a Lightning Mapping Array (LMA) that can detect the electrical activity in an area surrounding the Plant. This array would use the high frequency characteristics of cloud-to-ground, cloud-to-cloud, and intra-cloud lightning discharges; cloud-to-cloud and intra-cloud electrical activity is known to precede cloud-to-ground lightning by up to an hour in most cases, depending on atmospheric conditions. For the third R&D project, a team of engineers and scientists from Pantex Systems Engineering and Explosives Technology has conceptually designed a system to detect and positively locate lightning strikes near Pantex. This system is designed to assist in calibrating strike locations detected by the LLPS and LMA systems and to provide data to help determine whether a strike indication was erroneous.

Pantex also had a static monitoring system in the late 1980s or early 1990s that measured the voltage gradient of the air to detect storms that could be developing in the immediate vicinity of the Plant. Static warnings were issued when the voltage gradients reached a pre-determined level indicating the potential for a lightning strike, and some explosives operations were suspended. The use of this system was discontinued (date could not be determined), but no basis for discontinuation was available (see **OFI-CNS-11**).

EA noted good management performance during the review of explosives operating bays. Each operating bay or area within an explosives operating building posts "Safety Item Status" sheets near the entrance. The sheets list each safety item installed in the facility, including the fire detection and alarms, lightning protection, blast door interlocks, and sump pit pumps, along with the last and next scheduled maintenance. The sheets are color-coded for ease of understanding. The next scheduled test dates for the

LPSs is shown on the status sheets, coincide with the next test dates shown on the maintenance work orders.

5.6 Explosives Safety Training and Qualifications

Criterion:

The site contractor has established a training and qualification program with established qualification requirements to ensure personnel have been properly trained before they are assigned to explosives operations(10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-7

Overall, the CNS training and qualification program for explosives operations is comprehensive. CNS uses internally developed Process Document 02.03.02.03, *Process for CNS Pantex Training and Qualification Program*, which provides line management, training management, and training organization processes for analyzing, designing, developing, implementing, and evaluating training. This process document provides guidance and references to various WIs, such as WI 02.03.02.03.02, *Identifying Training Needs and Conduct Training Needs Analysis*; WI 02.03.02.03.05, *Conducting Training*; and WI 02.03.02.03.07, *Processing and Maintaining Training Records*.

All CNS employees training and qualifications are tracked on the Pantex Learning Management System (LMS). On a monthly basis, the CNS managers are sent a report generated from the LMS database that updates the managers on the status of their direct report employees' training and qualifications. The database report is fairly intuitive; entries are color coded to show the number of days remaining before qualification expires – e.g., 60 days (green), 30 days (blue), and qualification expired (red).

EA noted one concern about implementation of the training and qualification program for explosives operations. EA selected one employee at random and asked to see the employee's respirator fit-test card, which turned out to be outdated. The CNS manager was able to provide evidence in the LMS that the worker was qualified, but the updated fit-test card had not been issued. The CNS manager stated that it takes more than eight weeks for employees to receive their laminated respirator fit-test cards after completing the training (see **OFI-CNS-04**).

5.7 Implementation of Emergency Controls

Criterion:

For emergency control purposes, firefighting hazard identification symbols (as specified in DoD 6055.09-M or NFPA 704) shall be displayed consistently on buildings and work areas throughout an entire facility to warn of potential hazards from explosives and to provide information for emergency situations (10 CFR 851 Appendix A 3.(b) Explosive Safety) CRAD-32-01, Criterion ES.1-9

Pantex uses the DoD firefighting hazard identification symbols consistently to warn of potential explosives related hazards, and EA observed that the proper firefighting hazard identification symbols were displayed in conspicuous locations. However, in some facilities, the firefighting hazard identification symbols displayed were significantly faded, to the extent that emergency response personnel might find them hard to read. In addition, one Building displayed a hazard/division 1.4 firefighting hazard identification symbol but was not included in the explosives safety site plan as an explosives storage location. Only scrap materials were stored in the building (see **OFI-CNS-12**).

5.8 Contractor Explosives Safety Assessment Program

Criterion:

The site contractor has established an assessment program to confirm the adequacy of the explosives safety program in support of facility activities (10 CFR 851 Appendix A 3. (b) Explosive Safety) CRAD-32-01, Criterion ES.1-2

Overall, CNS has established and implemented an effective assessment program for the ESP in accordance with the contractor assurance system (CAS). As required by the Pantex CAS, CNS evaluated the hazards associated with the explosives activities, and a risk ranking value was calculated and assigned to the safety management program (SMP) controlling the explosives hazards; i.e., ESP. The risk ranking allows CNS to relate the ESP to all other SMP's across the site. CNS uses the ranking to prioritize assessment activities for the fiscal year. The ESP ranked high among the other SMPs across Pantex, and CNS routinely conducts assessments of the ESP implementation. The following summaries illustrate the comprehensiveness of these assessments:

- *Explosives Operations Independent Assessment January 27, 2015 - March 13, 2015 (Report A-15-03):* This assessment of IHE machining operations found that IHE machining produces quality parts safely and in compliance with explosives safety, conduct of operations, and machine guarding requirements. However, the CNS independent assessment team identified three findings, two weaknesses, and two observations. The findings and weaknesses are annotated in the Problem Evaluation Report (PER) database (PER-2015-0124, -0125, -0126, -0127).
- *CNS Explosives Packaging Operations Management Self-Assessment November 2014 - January 2015 (NES-15-01)* the self-assessment team walked down the facilities, reviewed procedures and records, observed operations, and interviewed facility personnel. Based on the evaluation of the developed criteria and explosives packaging operations in those Buildings, the self-assessment team determined that the operations complied with the evaluated packaging requirements and related requirements of DOE-STD-1212-2012. The self-assessment team identified no findings or weaknesses, but identified two observations related to requirement flowdown and one observation related to an advisory requirement for procedure content. The self-assessment concluded that the explosives packaging operations carried out in the packaging bays of these buildings maintain acceptable compliance with DOE-STD-1212-2012.
- *Material Access Area (MAA) Lightning Protection Systems Management Assessment June 1, 2014 - October 31, 2014 (DGM-NES-14-03):* The Pantex management team conducted walkdowns of the facilities, reviewed procedures and records, observed operations, and interviewed facility personnel. The team identified 12 findings, 3 weaknesses, and 4 observations. The assessment found that the catenary and integral LPS systems appeared to be in good condition for the buildings conducting nuclear explosive activities. The findings and observations were about preventive maintenance that may be overdue. Four findings and one observation identified the lack of flowdown of the requirements from DOE-STD-1212-2012 or inadequate record keeping. One finding and one observation identified the need to update procedures. One finding found that two facilities do not have an LPS that meets the requirements of DOE-STD-1212-2012, Chapter X, Sections 2 and 3, and two findings identified inadequate sideflash protection. One weakness stated that visible grounding bonds for all facilities assessed have not been identified or documented, and are not being tested every five years as required.
- *Explosives Safety Program Independent Assessment for Lightning Protection Systems, ENG-10-04 SB-ES-941558, dated March 31, 2010:* This assessment concluded that the LPSs for non-nuclear

explosives facilities have a significant number of compliance issues, operability issues, and maintenance issues with respect to NFPA 780 and DOE-STD-1212-2012. This conclusion is supported by the number of facilities that were determined to have compliance issues (9 of 11), the number of facilities that were determined to have inoperable LPSs (3 of 11), the observed inadequacy of the LPS maintenance inspection and testing processes, and the total number of findings and weaknesses identified during the assessment. Overall, the assessment identified 43 findings, 15 weaknesses, and 5 observations. The findings and weaknesses were annotated in the PER database. Of the 43 findings, 18 remain open in the PER database (Findings 4, 7, 8, 9, 10, 11, 12, 13, 15, 16, 18, 19, 21, 22, 23, 24, 25, and 26, listed as PER 2010-0324 and PER 2010-0325). Many of these open findings have no defined path for closure (see **OFI-CNS-08**).

Even though CNS has evaluated, risk ranked, and prioritized assessments for the ESP implementation, CNS has not prepared organizational performance metrics to indicate the overall health of ESP implementation. Without performance metrics, CNS cannot readily communicate the overall health of the ESP to NPO and CNS management. One important objective of the CAS is to communicate program health so NPO can understand program performance and use it when selecting NPO oversight activities for the upcoming fiscal year (see **OFI-CNS-13**).

5.9 NPO Explosives Safety Oversight

Criteria:

Facility Representatives provide effective oversight to determine that the contractor is operating DOE facilities in a safe manner. (DOE-STD-1063-2011 sec.4.1) CRAD 45-21 DOE Field Element Facility Representative Program Inspection Criteria-4

The DOE field element has an issues management process that is capable of categorizing findings based on risk and priority, ensuring relevant line management findings are effectively communicated to the contractors, and ensuring that problems are evaluated and corrected on a timely basis. (DOE O 226.1B 4b(4)) CRAD 45-21 DOE Field Element Line Management Oversight Inspection Criteria-3

NPO has eight qualified FRs assigned to Pantex. Monthly, each FR is required to conduct five quick checks and one backshift quick check (generally related to maintenance). Quarterly, the FR group performs one assessment of conduct of operations.

During the oversight activity the FR reviewed the standup meeting record, pre-operational checklist, and daily operations status, as well as the in-progress operating procedure for HE milling machine activities. The FR was thorough and extremely knowledgeable, and provided a step-by-step description of what was observed and reviewed. The FR's observation of work being performed was on a "not-to-interfere" basis while the worker performed the task. The FR observed the following:

- The CNS worker followed the work planning procedure during the remote milling process.
- Upon entering the milling machine area, the CNS worker was wearing appropriate PPE.
- The CNS worker followed the work procedure to complete the milling task and to set up for the next new task.

All observed work was performed as prescribed in the work packages and in accordance with established controls.

EA reviewed a sample of five quick checks, all of which were comprehensive and satisfactory. The NPO Operations Management Division (NPO-30) performed assessments of *the Pantex Fourth Quarter Fiscal Year 2014 Independent Verification Program* and the *Pantex Second Quarter Fiscal Year 2014*

Corrective Action Effectiveness Report. These assessments noted that CNS has established a dual verification program and continues to work at closing findings and weaknesses, whether self-identified or FR-identified.

NPO has implemented adequate management processes for line oversight of explosives safety; however, the last NPO explosives safety assessment (beyond shadowing CNS assessments) was in 2013. NNSA supplemental directive NA-1 SD 226.1A, *Line Oversight and Contractor Assurance*, implements the requirements of DOE Order 226.1A, *Implementation of DOE Oversight Policy*, at NNSA sites. SD 226.1A allows for an assessment periodicity of up to five years for a safety management program, such as the ESP. NPO is currently within the five-year assessment window and is in compliance with the expectations of SD 226.1A.

Between the five-year assessments of the ESP, NPO conducts operational awareness activities and relies on CNS self-assessments to identify issues in program implementation. However, given the breadth and complexity of the ESP implementation and the issues that have been identified through the CNS self-assessments, the five-year program assessment frequency may not provide adequate assurance of program effectiveness (see **OFI-NPO-02**).

The NPO subject matter experts (SMEs) and FRs also conduct operational awareness activities of the explosives safety program implementation, and the results of the operational awareness activities are documented through quick check forms and communicated to NPO management. NPO management formally transmits any findings and weaknesses identified through the NPO operational awareness activities to CNS for resolution. CNS findings and weaknesses are tracked in the Problem Evaluation Request/Electronic Suspense Tracking and Routing System, also commonly referred to as PER/ESTARS. NPO continues to oversee CNS actions to close findings and weaknesses identified through operational awareness and assessments.

As part of the NPO oversight model, NPO conducts periodic follow-up on previous issues to verify proper closure. As a result of the follow-up activities, NPO-30 developed the *Pantex Second Quarter Fiscal Year 2014 Corrective Action Effectiveness Report*. The report assessed the effectiveness of the corrective actions that CNS implemented in response to the 40 FR-identified issues (oversight activities dating back to 2008) to determine whether the issues could be closed in the NPO Issues Tracking System. Three findings, two performance problems, and two observations were identified as a result of this assessment. The findings and performance problems are previously-identified issues whose closure/correction could not be completely validated. Except for the areas where the corrective actions could not be validated, CNS was addressing the FR-identified issues.

NPO maintains a comprehensive and rigorous technical qualification program (TQP) for its FRs and uses its site-specific standard (NPO-2.2.3.1.4, Facility Representative Program Qualification Standard), which is inclusive of DOE-STD-1151-2010, *DOE Facility Representative Functional Area Qualification Standard*, and DOE-STD-1063-2011, *Facility Representatives*. Additionally, NPO maintains a comprehensive, site-specific training program and complies with NPO-2.2.3.1.2, *Technical Qualification Program Site Specific Standard*, which provides the basis for the NPO TQP.

Although there is no requirement for a qualification standard for the explosives safety functional area, NPO is considering implementing a site-specific explosives safety qualification standard similar to that implemented by NNSA Headquarters. The NPO Explosives Safety Representative (ESR) has completed several explosives safety courses, has knowledge of nuclear explosives activities through weapons quality assurance duties, and has completed several elements of a TQP (e.g., completed qualification requirements for General Technical Base, Quality Assurance, Weapon Quality Assurance, and Technical Base “Gap Card”). The ESR has also completed two explosives safety courses: one through the DoD

(Explosives, Propellants & Pyrotechnics), and the other through DOE (Explosives Safety). However, the ESR does not currently have in-depth knowledge and experience of explosives safety and general industry safety standards, but NPO has several staff members with many years of explosives safety experience which could be used for mentoring the ESR while qualification are being completed.

To obtain additional experience, the ESR is shadowing the contractor during assessments. The ESR recently participated in the review of the *Explosives Safety Siting Plan* (revision 6), prepared the approval basis for the plan, and presented it to NPO management (see **OFI-NPO-03** and **OFI-NPO-04**).

6.0 CONCLUSIONS

Overall, CNS has implemented a comprehensive ESP. In most cases, CNS has established and effectively implemented controls for reducing the risk associated with explosives operations. The flowdown of explosives safety requirements is well documented and implemented. In particular, development and implementation of the IPRO system (which provides real-time weights of explosives in various operating locations to prevent exceeding explosives weight limits) is a best practice. Furthermore, the explosives and personnel limits and controls have been established and rigorously implemented, and workers are adequately protected from exposures to potentially toxic materials related to explosives. Explosives systems engineers, scientists, facility management, and explosives operating personnel are well trained through a comprehensive training and qualification program, and workers are conscientious and knowledgeable of explosives operations and processes. Overall, worker explosive safety and conduct of operations in these facilities was acceptable.

Although overall ESP implementation is adequate, there were deficiencies in a few areas. The most significant explosives safety deficiency was the practice of assigning personnel as compensatory measure to control entry to nuclear explosives operating bays when the blast door interlocks are inoperable. The compensatory measure places personnel in an area designated as a non-occupied area, potentially exposing them to significant overpressure in case of an accidental HE detonation. In addition, the practice is non-compliant with the required Class II levels of protection specified in the ESP.

Many non-compliances with the LPSs were identified during the 2010 explosives safety assessments remain unresolved with no current priority for correction. Also, the placing of benches for donning/doffing PPE in some ramp areas outside of the break rooms in explosives operating facilities may increase exposure to unacceptable overpressure from an accidental HE detonation. In addition, the waiver process is being inappropriately used to permit long-term storage of laboratory materials and legacy items in service magazines, which are intended for storage for no more than 180 days.

NPO has established management processes to implement line oversight of explosives safety. NPO SMEs and the FRs conduct operational awareness activities for ESP implementation, and the results of the operational awareness activities are documented through quick check forms and communicated to upper management. However, no NPO explosives safety assessments (beyond shadowing CNS assessments) have been conducted since 2013. NPO currently relies heavily on CNS self-assessments to identify programmatic issues associated with program implementation. The assigned NPO explosives safety SME has completed numerous DoD and DOE explosives safety courses but lacks experience in the implementation of an ESP.

7.0 FINDINGS

This review identified one finding for CNS. As defined in DOE Order 227.1, *Independent Oversight Program*, findings are significant deficiencies or safety issues 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. Findings may identify aspects of a program that do not meet the intent of DOE policy or Federal regulation. DOE line management and/or contractor organizations must develop and implement corrective action plans for EA appraisal findings. Cognizant DOE managers must use site and program-specific issues management processes and systems developed in accordance with DOE Order 227.1 to manage these corrective action plans and track them to completion.

Finding-CNS-01: Contrary to the requirements of DOE-STD-1212-2012, *Explosives Safety*, personnel are stationed directly outside a bay in the ramp area as a compensatory measure to control entry to nuclear explosives operating bays when the blast door interlocks are inoperable. Stationing personnel outside a bay in the ramp area violates the non-occupied area requirements and could expose those personnel to unacceptable HE hazards because they lack the required explosive safety Class II levels of protection.

8.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified 17 OFIs during this review. These potential enhancements 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 minor issues identified during the review. In some cases, OFIs address areas where program or process improvements can be achieved through minimal effort. It is expected that the responsible line management organizations will evaluate these OFIs and accept, reject, or modify them as appropriate, in accordance with site-specific program objectives and priorities.

NNSA Production Office

OFI-NPO-01: Consider implementing DOE-STD-1212-2012 into the CNS contract.

OFI-NPO-02: Consider conducting annual ESP assessments with smaller scopes addressing only a portion of the explosive safety program elements each year such that all program elements are assessed within the required just a few ESP elements, and complete assessments of all elements within a five-year period.

OFI-NPO-03: Consider having the ESR attend more explosives safety and general/construction industry safety courses to gain the knowledge, skills, and abilities needed for appropriate oversight and an in-depth understanding of requirements and hazard identification. Some recommended courses for consideration are courses similar to AMMO-29, Navy Electrical Explosives Safety, and AMMO-36, Explosives Safety for Naval Facility. Courses are offered through the Defense Ammunition Center, McAlester, Oklahoma. In addition, the 30-hour Occupational Safety and Health Administration General Industry/Construction course and the Advanced Safety Certificate program are offered through local chapters of the National Safety Council.

OFI-NPO-04: Consider developing a site-specific qualification standard for explosives safety, and utilize experienced NPO staff to mentor the candidate during qualification.

Consolidated Nuclear Security, LLC

OFI-CNS-01: Consider refocusing efforts on obtaining a final resolution with the City of Amarillo concerning the explosives pads at the Amarillo Airport.

OFI-CNS-02: Consider cancelling Facility Management Waiver DOE 27, Issue 5, December 12, 2012, because the cited “Screw-type container closures should not be used” statement upon which it is based has been removed from the current version of DOE-STD-1212-2012.

OFI-CNS-03: Consider retitling the Pantex-specific Explosives Safety Manual to be consistent with DOE-STD-1212-2012. Doing so would indicate that CNS has reviewed the latest revision of DOE-STD-1212-2012 and has implemented any site-specific updates or revisions.

OFI-CNS-04: Consider issuing laminated respirator fit-test cards upon completion of fit testing.

OFI-CNS-05: Consider appointing an Explosives Storage Review Committee to ensure compliance with the explosives storage requirements of DOE-STD-1212-2012.

OFI-CNS-06: Consider discontinuing the storage of explosives (e.g., laboratory materials and legacy items) in service magazines for periods exceeding 180 days, in accordance with DOE-STD-1212-2012.

OFI-CNS-07: Consider establishing a process to ensure that metal shipping containers used for explosives storage are correctly labeled with the gross weight of the containers to facilitate determination of whether the posted weight limits of storage racks are exceeded.

OFI-CNS-08: Consider reevaluating the findings of the 2010 explosives safety assessment, as well as the 2010 Burns and McDonnell report, and verify that closure actions were appropriate.

OFI-CNS-09: Consider providing ongoing LPS-related training for electrical crafts personnel to maintain their skills at a level sufficient to inspect and repair LPSs consistent with DOE-STD-1212-2012 and NFPA 780 requirements.

OFI-CNS-10: Consider implementing electrical and visual inspections of LPS at the frequencies recommended by DOE-STD-1212-2012 (i.e., 7 months visual and 14 months electrical). These inspections would help ensure that LPSs are correctly installed, properly maintained, and electrically effective.

OFI-CNS-11: Consider providing justification for suspending the use of the static warning system. Doing so would document that the decision was based on a thorough analysis to determine whether the lack of the system increased the risk to personnel involved in some explosives operations.

OFI-CNS-12: Consider removing the hazard/division 1.4 firefighting hazard identification symbol from a building improperly marked to clearly indicate to emergency responders and others that the building is not an explosives facility.

OFI-CNS-13: Consider developing ESP health metrics to better communicate program health to NPO so that NPO can apply a better understanding of program performance when selecting oversight activities for the upcoming fiscal year.

Appendix A Supplemental Information

Dates of Review

Onsite Review: April 6-9 and April 20-23, 2015

Office of Enterprise Assessments (EA) Management

Glenn S. Podonsky, Director, Office of Enterprise Assessments
William A. Eckroade, Deputy Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
William E. Miller, Director, Office of Nuclear Safety and Environmental Assessments
Patricia Williams, Director, Office of Worker Safety and Health Assessments

Quality Review Board

William A. Eckroade
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William E. Miller
Michael A. Kilpatrick

EA Site Lead for NPO

Jimmy S. Dyke

EA Reviewers

Jimmy S. Dyke - Lead
Kevin E. Horace
James L. Brown
Thomas F. Hall

Appendix B

Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

- NPO 2.2.3.1.2, *Technical Qualification Program Site Specific Standard*
- NPO 2.2.3.1.4, *Facility Representative Program Qualification Standard*
- NPO 3.4.1.4, *NPO Facility Representative Program*
- NPO-30 Operations Quick-check, Activity Reference: HE Machining, 2/25/15 - Material moves.
- NPO-30 Operations Quick-check, Activity Reference: HE Pressing, 11/13/14 - HE Extrusion Operations using procedure P7-0688
- NPO-30 Operations Quick-check, Activity Reference: HE Machining, 12/01/14 - HE Extrusion operations with inert material.
- NPO-30 Pantex Second Quarter Fiscal Year-2014 Corrective Action Effectiveness Assessment Report, 8/14
- NPO-30 Pantex Fourth Quarter Fiscal Year-2014 Independent Verification Program, 11/14
- B&W Pantex Revision 6 of the Explosives Safety Site Plan, SB-ES-941277, 8/10/12
- Process Document (PD) 02.01.07.01, *Process for the Pantex Explosives Safety Program*, Issue 3
- PD 02.01.07.03, *Process for Explosives Storage Safety*, Issue 3
- PD 02.03.02.03, *Process for CNS Pantex Training and Qualification Program*, Issue 4
- WI 02.01.07.01.01, *Defining the elements of the Pantex Explosives Safety Program*, Issue 1,
- WI 02.01.07.01.02, *Administration of the Pantex Explosives Safety Program*, Issue 1
- WI 02.01.07.01.03, *Verify Compliance with the Pantex Explosives Safety Program*, Issue 4
- WI 02.01.07.03.03, *Establish Storage Review Requirements for Explosives*, Issue 3
- WI 02.01.07.03.06, *Perform Explosives Storage Review*, Issue 3
- WI 02.01.07.01.05, *Implementing General Requirements for Explosives Operations*, Issue 1
- WI 02.01.07.01.06, *Implementing Electrical Requirements for Explosives Operations*, Issue 1
- WI 02.01.07.01.07, *Implementing Requirements for the Decontamination, Collection, and Treatment of Explosives Waste*, Issue 2
- WI 02.01.07.01.08, *Implementing Requirements for the Processing and Testing of Explosives*, Issue 1
- WI 02.01.07.01.09, *Implementing the Requirements for the Handling, Transportation and Storage of Explosives*, Issue 1
- WI 02.01.07.01.10, *Implementing the Requirements for Explosives Facility Limits and Facility Siting*, Issue 2
- WI 02.01.07.01.011, *Implementing the Requirements for the Development and Hazard Classification of New Explosives*, Issue 1
- WI 02.01.07.03.01, *Assign Hazard Class/Division and Storage Compatibility Grouping for Bulk (Unconsolidated) Explosive*, Issue 3
- WI 02.01.07.03.02, *Assign Hazard Class/Division and Storage Compatibility Grouping for Consolidated Explosives and Explosives Components*, Issue 5
- WI 02.01.07.03.03, *Establish Storage Review Requirements for Explosives*, Issue 3
- WI 02.01.07.03.04, *Combine Explosives Storage Compatibility Groups in Storage/Staging Areas*, Issue 3
- WI 02.01.07.03.05, *Perform Explosives Storage Review*, Issue 3
- WI 02.03.02.03.02, *Identifying Training Needs and Conduct Training Needs Analysis*, Issue 7
- WI 02.03.02.03.05, *Conducting Training*, Issue 5
- WI 02.03.02.03.07, *Processing and Maintaining Training Records*, Issue 8
- WI 02.01.07.03.06, *Inventory Requirements for Explosives Staging and Storage*, Issue 11
- PX-3257, *Daily Machine Tool Checklist*

- PX-4505, Safety System Checklist
- PX-455, *Explosives Decontamination Tag*
- CNS A-15-03, *Explosive Operations Independent Assessment Report*, 1/27/15 – 3/13/15
- NES-15-01, *Explosives Packaging Operations Management Self-Assessment (Bldgs. 11-42, 12-71 and 12-95)*, 11/14 – 1/15
- DGM-NES-14-03, *MAA Lightning Protection Systems Management Assessment*, 6/01/14 – 10/31/14
- Pantex Lightning Protection Project Team Final Report, Rev 1, 4/99
- Engineering Assessment for Lightning Protection Systems at B&W Pantex, Burns and McDonnell, 12/16/10
- NSR&D Proposal Request, Lightning Flash Detection System (LFDS) for Pantex
- NSR&D Proposal Request, Investigation of Lightning Mapping Array for Better Advance Lightning Detection
- NSR&D Proposal Request, Optical Lightning Detection System (OLDS) for Pantex
- B&W Pantex Explosives Safety Site Plan, SB-ES-941277, Rev 6
- Contract, United States Atomic Energy Commission Amarillo Area Office, and the City of Amarillo, Use of Amarillo Air Force Flight Line Facilities (Contract AT (29-2) 2249) 05/16/67
- Pantex MNL-240176, DOE M 440.1-1A, Revision 9K as of May 25, 2011, DOE Explosives Safety Manual, PANTEX/LLNL Version
- Site Wide Safety Analysis Report, AB SAR 313353, Rev 253, 3/30/15 (UCNI)
- General Employee Response Manual, Issue 04
- Industrial Hygiene Hazard Assessment, Building 11-55, Synthesizing and Recrystallizing HE, 9/5/2014
- Email, Pantex Fire Department to Nuclear Explosives Surety, Subject, 12-63 B1, "Pit in Bay 1 is not a confined space."
- Pantex Non-Nuclear Facilities Safety Systems Manual, Rev 23
- Bulletin, Safety Standards for Lightning Protection, Lightning Protection Institute
- National Fire Protection Association 780, Standard for the Installation of Lightning Protection Systems, 2011 Edition
- National Fire Protection Association 70, National Electrical Code, 2011 Edition
- Work Orders
- Zone 4, Magazine Lightning Protection System 47 month electrical test, 8/26/13
- Zone 4, Magazine Lightning Protection System visual tests, 2011-2014
- HEPF Lightning Protection System 47 month electrical test, 3/14/12
- HEPF Lightning Protection System visual tests, 2011-2014
- Zone 12 Building Lightning Protection System 47 month electrical test, 5/07/11
- Zone 12 Building Lightning Protection System visual tests, 2011-2014
- Facility Management Waivers to the DOE Explosives Safety Standard, Numbers 04, 07, 16, 20, 24, 27, 29 and 30.
- Explosives Development Phase Approvals, Table-0051, Issue 004
- Explosives Storage Requirements Bulk Explosives, Table-0054, Issue 005
- Safety Item Status Sheets
- Tracked Item Status sheets
- FPC-Building 11-55 & 11-55A Pre-Operational Checklist
- FPC-Building 12-121 Pre-Operational Checklist
- Facility Procedure, Specific Safety Requirements
- Operating Procedure, Requirements for High Explosives Performance and Surveillance Operations Department, Issue C, 11/03/14
- Independent Assessment, EAG-12-410-07

- Independent Assessment, DGM-NES-13-03
- Management Self-Assessment, NES-15-01
- Unseen HPI (Human Performance Indicators) Precursors Create "Shocking" Near Miss, 2009-AO-PTX-1106, 11/18/08
- Clear Roles, Responsibilities and Communication Make Procedures Robust Barriers, 2009-PTX-LL-0604, 6/22/09

Interviews

- Assistant Manager, Environment, Safety, Health & Quality
- Deputy Assistant Manager, Environment, Safety, Health & Quality
- Deputy Assistant Manager, Operations Management
- NPO Weapons Quality Assurance/Explosives Safety
- NPO Facility Representative
- Systems Engineers
- Electromagnetics Group Manager
- Building Supervisor
- Zone 4 High Explosives Storage Supervisor
- Explosives Transportation Worker
- Building Supervisor/Explosives Storage Review Coordinator
- Laboratory Technicians
- Production Section Managers
- Engineering Technician II
- Engineering Technician
- Plant Shift Superintendents
- HE Manufacturing Department Manager
- Nuclear Explosives Surety Department personnel
- Department Scientist/Explosives Sensitivity Committee
- Protective Force Operations Manager
- Firing Site Manager
- Nuclear Explosives Surety Department Manager

Observations

- Plan of the Day and Operations
- Zone 4, Walkdown
- Zone 12, Walkdown
- Zone 11, Walkdown
- Operations Center Tour
- FS-1 Walkdown
- FS-10 Walkdown
- FS-24 Walkdown