Volume II
Technical Appendices

Independent Oversight
Inspection of
Environment, Safety,
and Health Programs
at the

Pantex Plant

ISM

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INSPECTION OF
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Acronyms

AHA	Activity Hazards Analysis
AIHA	American Industrial Hygiene Association
AM	Assistant Manager
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BWXT	BWXT Pantex, LLC
CA/MP	Causal Analysis/Mistake Proofing
CAS	Contractor Assurance System
CBDPP	Chronic Beryllium Disease Prevention Program
CFR	Code of Federal Regulations
CWIV	Contaminated Waste Isolation Valve
CY	Calendar Year
D&D	Decontamination and Decommissioning
DCP	Design Change Package
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
ECP	Employee Concerns Program
EH	Office of Environment, Safety and Health
EMS	Environmental Management System
ES&H	Environment, Safety, and Health
FEOSH	Federal Employee Occupational Safety and Health
FR	Facility Representative
FRAM	Functions, Responsibilities, and Authorities Manual
FTTF	Firearms Tactics and Training Facility
FY	Fiscal Year
HCE	Hazard Control Evaluation
ISM	Integrated Safety Management
ISO	International Organization for Standardization
JEHA	Job Environment Hazards Analysis
JSHA	Job Safety and Health Analysis
MSDS	Material Safety Data Sheet
NEEP	Nuclear Explosive Engineering Procedure
NEOP	Nuclear Explosive Operating Procedure
NNSA	National Nuclear Security Administration
OA	Office of Independent Oversight and Performance Assurance
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
PER	Problem Evaluation Report
PHA	Process Hazards Analysis
PM	Preventive Maintenance
PPE	Personal Protective Equipment
PSM	Process Safety Management
PT	Production Technician
PXSO	Pantex Site Office
QAPM	Quality Assurance Procedures Manual
RWP	Radiation Work Permit

SAR	Safety Analysis Report
SME	Subject Matter Expert
SSO	Safety System Oversight
SS21	Seamless Safety for the 21st Century
SWP	Safe Work Permit
TQP	Technical Qualification Program
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question

APPENDIX C

Core Function Implementation (Core Functions 1-4)

C.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluated work planning and control processes and implementation of the first four core functions of integrated safety management (ISM) for selected Pantex Plant activities. The OA review of the ISM core functions focused on environment, safety, and health (ES&H) programs as applied to four selected aspects of Pantex Plant activities:

- Nuclear explosive operations (see Section C.2.1)
- Applied Technology Division operations (see Section C.2.2)
- Maintenance activities (see Section C.2.3)
- Subcontractor construction activities (see Section C.2.4).

For all the above areas, OA reviewed procedures, observed ongoing operations, toured work areas, observed equipment operations, interviewed managers and technical staff, reviewed interfaces with ES&H staff, reviewed ES&H documentation (e.g., plant standards, permits, and safety analyses), and examined waste management activities. Specific processes in each area and OA team activities are discussed further in the respective results sections.

C.2 RESULTS

In addition to evaluating the selected four aspects of Pantex Plant activities, OA also evaluated the collective results of the application of the core functions in the four selected areas to identify commonalities. As discussed below, the evaluation of the collective results provides perspectives on the sitewide work control processes.

Pantex Site Office (PXSO) and BWXT Pantex, LLC (BWXT) have an extensive system of institutional policies, standards, and procedures to implement the Pantex Plant ISM system. PXSO and BWXT have focused much of their attention on the quality and safety of nuclear weapons and nuclear explosive operations and other high priority efforts such as environmental protection. With some exceptions, hazards associated with nuclear weapons, nuclear explosives, and environmental management are well analyzed and controlled, including detailed procedures and expectations for strict compliance. Behavior-based safety programs have been implemented and have contributed to the reported low and decreasing injury and illness rates.

However, management has not sufficiently focused on other aspects of ISM, such as activity-level hazards analyses, and some aspects of industrial hygiene, radiation protection, hoisting and rigging, and worker safety in activities other than nuclear weapons and explosive operations (including maintenance, construction, and certain laboratory, support, and non-nuclear/explosives programmatic activities). Implementation of the core functions of ISM was less effective in these areas as discussed in the following sections. In addition, there were two systemic findings that affect multiple Pantex Plant organizations. These two findings are presented below for easy reference and are briefly discussed. Additional observations contributing to these two findings are discussed and referenced to the applicable finding in the results section for each of the four areas reviewed (subsections C.2.1 through C.2.4).

The first systemic finding reflects weaknesses in establishing and communicating adequate controls for protecting the health and safety of workers. In a number of instances, management has not ensured that systems are in place to identify, analyze, and document activity-level hazards (other than nuclear explosive and explosive hazards) and ensure that adequate controls are identified and communicated to the workforce. In addition, procedures and work practices (with the exception of nuclear explosive operation procedures) rely on the knowledge and experience of individual workers rather than clear safety standards and documented hazards and controls, as required by ISM. As discussed throughout this appendix, the hazards analysis and controls processes are effective for hazards associated with nuclear explosives and explosives. However, weaknesses are evident in the hazards analysis and controls processes as applied to worker safety elements, such as industrial hygiene, chemical storage, hazards communication, and some aspects of radiation protection. These weaknesses are evident in a wide range of Pantex Plant work activities, including production (e.g., disassembly and inspection), laboratory operations, support activities, and maintenance. Similar concerns are also evident in construction activities, which are typically performed by subcontractors using other work control processes.

Finding #1. With the exception of nuclear explosive and conventional explosive hazards, BWXT line management and support organizations have not ensured that hazards are analyzed and documented and that controls are specified for work activities prior to authorization of the work.

The second systemic finding reflects the lack of a required comprehensive and effective exposure assessment program. BWXT organizations have a number of processes for identifying, analyzing, and controlling workplace exposures to chemical, physical, biological, or ergonomic hazards. However, these processes are not comprehensive, integrated, and consistently applied, and do not adequately ensure that worker exposures are sufficiently analyzed, sampled/monitored, documented, and that the results are effectively communicated to line management and integrated into work documents.

Finding #2. BWXT has not implemented a comprehensive exposure assessment program that utilizes recognized exposure assessment methodologies, as required by DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*.

The two findings above, in combination with other findings and observations in the subsections below, indicate that there is still significant reliance on an expert-based approach to safety for activities other than nuclear explosives and explosive hazards, rather than on the ISM principle of clear standards and requirements.

C.2.1 Nuclear Explosive Operations

OA's review of nuclear explosive operations included field observation of W-56 dismantlement operations and B-61 and W-76 disassembly, inspection, and test component assembly activities. Inspection activities also included review of associated procedures, support operations, permits, and other planning and design documents, and interviews with production technicians (PTs), radiological control personnel, waste management personnel, supervisors, program managers, and process engineers.

Core Function #1: Define the Scope of Work

The scope of weapons program work is clearly defined in project plans and task-specific implementing procedures. BWXT develops project plans to meet DOE stockpile program and individual program campaign direction based on input from multidisciplinary project planning teams, including personnel from the design agencies. The resulting project plans provide a detailed scope of work and are used to guide the development of the manufacturing process. A key prerequisite for performing work in this process is the preparation of manufacturing procedures – nuclear explosive operating procedures (NEOPs) and nuclear explosive engineering procedures (NEEPs) – that contain task-specific scopes of work. The NEOPs and NEEPs for W-56, B-61, and W-76 provided a high level of detail and clearly defined the scope of work for assembly, disassembly, and inspection activities.

Summary. The scope of work for weapons programs is well defined, from initial planning through the task-specific implementing procedures that contain detailed instructions for performing assembly, disassembly, and inspection activities.

Core Function #2: Analyze the Hazards

A multitiered process is used for analyses of weapons program work hazards. Safety analysis reports and other sitewide and facility-specific approved authorization basis documents provide appropriate hazards analyses applicable to multiple facilities or programs, such as bay or cell performance. The initial hazards analysis for a specific type of weapon is performed under the requirements of the DOE Nuclear Explosive Safety Program. For each specific weapons program, the design agency provides a weapons safety specification document that contains information on weapons design and associated intrinsic hazards unique to the weapon, including radiological hazards and other possible hazardous constituents. At the task-specific level, a project team analyzes hazards and develops new procedures related to assembly, disassembly, and related nuclear explosive operations. Additionally, an environmental aspects questionnaire is completed for weapons program work to identify potential hazards to the environment.

The radiological hazards associated with hands-on work with different weapons programs can vary significantly. BWXT conducts comprehensive radiological hazards analyses through a combination of processes, including review of design agency documentation, task team meetings and communications, process knowledge, and historical data from the routine weapons radiological characterization program. For example, the Pantex Plant has a rigorous program for characterizing radiation and contamination levels for various nuclear components for each weapons program. A vast amount of radiological characterization data has been collected and documented by the Radiation Safety Department and is used to develop and implement appropriate radiological controls, such as contamination control zones, hold point swipes, and external exposure controls (e.g., lead aprons).

Waste streams from nuclear weapons programs are also extensively characterized to ensure that appropriate controls can be developed. This characterization involves the use of a Process Information Flow to identify all waste streams within facilities, which aids in definition and implementation of appropriate controls. The Waste Operations Department implemented the Process Information Flow concept to proactively identify waste streams, and BWXT has performed appropriate Process Information Flows for weapons program, support, and maintenance facilities where waste will be generated.

While nuclear explosive hazards are extensively analyzed, the hazards analysis process for activity-level or worker hazards, such as exposure to chemical or industrial safety hazards, is not well documented and relies largely on professional judgment of subject matter experts (SMEs) during the procedure review process. During initial procedure development or during a change, Plant Standard 0147 requires the procedure to be routed to an ES&H coordinator, who then determines which ES&H SMEs should review the procedure to determine whether included controls are adequate. Although any review comments are documented and resolved, the actual analysis of the hazard is not documented, resulting in an inability to determine whether the hazards were fully analyzed and, in some cases, a lack of technical justification for specified controls. For example, deviations in the level of personal protective equipment (PPE) provided versus that shown in the material safety data sheet (MSDS) for a hazardous chemical are not supported by any formal technical justification for the differences. In one case, the methyl ethyl ketone MSDS specified chemical goggles but the NEOP did not address the need to use goggles. In another example, the alodine MSDS specified chemical goggles or full face shield, and recommended use of an impervious apron and boots; however, no such controls were listed in the procedure (see Finding #1).

In addition, not all activity-level hazards are sufficiently analyzed, identified, and communicated to workers. For example, OA discovered a process in the Applied Technology Division in which isocyanate exposures encountered during the viscosity testing of potting compounds were not adequately analyzed (see section C.2.2). A similar degassing process of isocyanate compounds has also been routinely performed in production areas without any evidence of program-specific exposure assessments. In the area of hazard communication, Plant Standard 3116 requires all hazards to be identified in procedures; however, most of the NEOPs or NEEPs reviewed by the OA team have not specifically identified activity-level hazards. As a result, it is up to the PTs to determine generic hazards from referenced chemicals based on their previous training, the container label, or the MSDS. The procedures do not specify these hazards, and the PTs have no other method to determine hazards specific to the activity. For example, the MSDS for alodine reflects PPE and hazards associated with the solid form of the chemical; however, the actual production use of the chemical is in solution. While controls are identified and are adequate in most cases, failure to identify and describe each activity level hazard is contrary to ISM principles and does not ensure that workers adequately understand and are able to independently verify the adequacy of listed controls (see Findings #1 and #2).

Summary. Hazards associated with weapons program work are analyzed through a variety of mechanisms. While nuclear explosives and radiological hazards analyses are adequately addressed, analyses of most of the other activity-level hazards are not well documented. In addition, activity-level hazards are not being specifically identified in NEOPs or NEEPs as required, and workers have no other adequate mechanism to determine the hazards unique to the activity.

Core Function #3: Identify and Implement Controls

A combination of engineering and administrative controls, coupled with PPE, is used to mitigate hazards associated with most weapons program work. Activity-level controls for hazards identified and analyzed in program-specific hazards analyses are flowed down into NEOPs and related operating procedures, which are the primary activity-level administrative controls for weapons program work. Technical procedures are developed using format and content instructions contained in a writer's manual for technical procedures. A plant standard on the review, approval, and revision of technical procedures provides a structured process to ensure that procedures are routed to the appropriate personnel or departments for review and approval. Another plant standard adequately addresses management expectations on procedure adherence and use.

The Seamless Safety for the 21st Century (SS21) initiative continues to enhance the safety of nuclear explosive operations at Pantex. Since the 2002 OA ES&H inspection, more weapons programs have become SS21-compliant. For example, the W-56 program is now fully SS21-compliant, and the B-61 program has SS21-compliant NEOPs and is scheduled to complete SS21 hardware upgrades this year. The SS21 initiative provides a significant reduction in the number of lifts and provides better quality procedures. The SS21-compliant procedures were generally technically accurate and complete, and provide the necessary information to perform the work. The procedures for disassembly and inspection, dismantlement, and Joint Test Assembly construction are clear and contain the appropriate information and level of detail to allow the PTs to adequately perform the work. PTs and management continue to view the SS21 initiative as an improvement in manufacturing and recognize that the tooling and procedures improve efficiency and enhance safety.

With the one exception noted below, NEOPs and other operating procedures were very effective in providing task-specific controls at the procedure step where the control was needed. For example, the use of butyl gloves, long-sleeve chemical resistant aprons, and face shields were specified in one NEOP at the point where contact with dimethyl sulfoxide was possible. In chemical cleaning steps using volatile solvents, NEOPs provided instructions for appropriate gloves and the setup of task exhaust. The NEOPs include specific container codes for each waste stream being generated, indicating the appropriate color-coded container where the waste is to be placed. Similarly, several as-low-as-reasonably-achievable controls were effectively integrated into the NEOP for disassembly and inspection work. For example, while performing ancillary tasks associated with pit inspection, the procedure required a radiation shield be placed over the pit to reduce the external exposure rates. Further, in response to an OA finding from the 2002 inspection, conditions where dose rates could exceed 100 millirem per hour were flagged as high dose rate conditions within the procedure, with an additional control specified to prevent nonessential personnel from getting closer than six feet. Lastly, the use of lead aprons was specified for those steps where high dose rate conditions were encountered.

The Waste Operations Department is effectively controlling waste management operations resulting from nuclear explosive operations. BWXT has a rigorous and noteworthy process for controlling the generation and management of waste materials to ensure proper disposition. A large part of this process relies on stringent control over waste containers. Waste generators cannot obtain an approved waste disposal container until all requirements for proper characterization of the waste stream are met. Once this process is complete and accepted by the Waste Operations Department, labeled waste containers are provided to the generator and staged within the work areas.

As discussed above, procedures were very effective at identifying appropriate hazard controls, with one exception. Specifically, NEOPs did not provide requirements for adequate protection against cuts when using knives or razor blades. Several NEOPs provided instructions for using knives or razor blades to trim excess gaskets or sealants, but did not provide the appropriate PPE. For example, a Joint Test Assembly procedure required use of these tools, but had no cautions on the hazard and did not require use of cut resistant gloves. In addition, cut-resistant gloves were not included in the list of approved materials for the activity. In a disassembly procedure, a related caution was provided, but the appropriate PPE was not specified. Administrative procedures, including the general safety requirements for production and support activities and a cutting tool policy from the industrial safety group, require the use of cut-resistant gloves when working with sharp tools (see Finding #4).

A comprehensive PT training program is in place to ensure initial and continuing qualification to perform weapons program work. Training consists of an appropriate mix of classroom and hands-on training with mock-up weapons in simulated cells and bays. Training includes requirements for oral boards and written exams. The PTs are required to attain and maintain proficiency in tasks by working with certified PTs prior to gaining full certification. Individual training requirements for personnel working in different programs are defined in the specific weapon program's training program description documents. These documents are developed for each program by line management and contain the specific training courses needed for qualification based on anticipated hazards associated with weapons program activities. Some courses, such as hoisting and rigging and beryllium awareness, are required for all types of weapons program work and are part of the basic PT qualification requirements.

As noted previously, controls for radiological work are well integrated into NEOPS and operating procedures and were effective in mitigation of radiological hazards for observed work. However, some specific deficiencies in application of the site's radiological work control process were identified as discussed below.

First, current practices used in the Manufacturing Division for controlling "Radiation Area" work do not meet some radiological work control requirements presented in the Pantex Radiological Control Manual and Pantex Radiological Operations Control Manual. Specifically, for weapons program work in a Radiation Area, radiation work permits (RWPs) are not utilized as the primary written authorization to control work. This practice conflicts with the following descriptions of the work control process presented in the institutional manuals. Section 4.2.6 of the Radiological Operations Control Manual states that "the RWP is the primary means by which RSD documents and guides work in radiologically controlled areas." Section 4.3.2 cites 10 CFR 835.501(a) with a list of five types of radiological areas as requiring an RWP but omits Radiation Area (the sixth type covered by the regulation). No explanation for the omission of RWPs for Radiation Areas is provided. Section 3.3.7 of the Site Radiological Control Manual states that an RWP is the governing document for radiological work, but that on specific occasions a technical work document reviewed and approved by a Radiation Safety Department manager or the Health Physics organization may be used in lieu of an RWP. However, in the case of weapons work performed in Radiation Areas with no other radiological postings (e.g., Radiation Areas that are not also contamination areas), RWPs are never used as the controlling work document, reflecting a use of the exception at a much higher frequency than implied by the reference to "specific occasions."

The site has a technical basis document which discusses a rationale for not using RWPs in Radiation Areas, but this document has not been updated in 13 years, references outdated procedures, is not referenced in the institutional documents, and fails to properly address certain radiological requirements such as specification of radiological conditions and Radiation Area entry controls. While the use of technical work documents in lieu of RWPs is an acceptable practice and is recognized as a potential option by the institutional radiological control manuals, many NEOPs used in place of RWPs do not contain all the information that would be provided in an RWP, as is required by the Radiological Control Manual and Radiological Operations Control Manual. Specifically, most weapons program NEOPs (W-56 is an exception) do not contain information on radiological conditions, which is a key requirement of an RWP. In addition, there is another similar requirement in the Writers Manual for technical procedures that states, "Dose rate information is to be provided at specified distances, relative to the applicable point in the assembly or disassembly process, for those operations where exposure to the worker is possible." While all procedures go through a formal review and approval process for errors, neither the Engineering Division nor the Radiation Safety Department has ensured that these requirements are followed for all weapons program NEOPs.

With respect to entry controls and use of procedures in lieu of RWPs, another concern is that some individuals who enter Radiation Areas are not working under a specific NEOP or otherwise covered by an RWP that specifies radiological hazards and controls. For example, during this OA inspection, facility managers, DOE Facility Representatives, mechanics, inspectors, and escorts entered Radiation Areas but were not covered by a specific written radiological work or entry control authorization. DOE regulations require written work authorizations to control entry into all radiological areas, including "Radiation Areas." The lack of a formal written work authorization to control entry into a radiological area is contrary to regulatory requirements and reflects another condition not adequately addressed by the site's technical basis document or institutional documents.

Finding #3. The BWXT Radiation Safety Department and Manufacturing and Engineering Divisions have not ensured that weapons program radiological work is performed in accordance with all institutional radiation protection requirements, including entry control authorizations, and that all procedures being used in lieu of RWPs provide the required information on radiological conditions.

Summary. NEOPs and other weapons program technical work documents were technically accurate and complete, contained the necessary steps to perform the work, and were generally effective in providing task-specific controls at the procedure step where the control was needed. However, there are a few deficiencies in application of the site's radiological work control processes.

Core Function #4: Perform Work within Controls

Readiness to perform nuclear explosives work is effectively verified utilizing scheduling meetings, stand-up meetings, pre-job briefs, and preoperational checks. For example, an extensive daily production meeting (Integrated Plan of the Day) addresses each weapons program to determine status and coordinate activities necessary to ensure readiness to proceed.

PTs performed nuclear explosive operations safely, in accordance with NEOP requirements. PTs appropriately used PPE when required and implemented the procedure reader/worker/verifier system in accordance with the plant standards and the DOE order for safety of nuclear explosive operations. In a contamination area, PTs demonstrated effective contamination control techniques while performing dismantlement work. The PTs demonstrated a high degree of knowledge of all observed nuclear explosive operations. PTs are fully aware of their stop work and procedure compliance responsibilities. During a review of high explosives dissolution work covered by a NEEP, a PT proactively questioned the supervisor about a missing step in the NEEP that the technician believed should be included based on prior work experience. The work was subsequently paused for several hours so that a field change request could be processed, and a revised NEEP was issued.

Waste management operations are generally being effectively implemented and meet environmental compliance and safety requirements. The nuclear explosive operations waste accumulation areas were clearly marked, and containers were properly labeled and kept closed. Waste Operations Department personnel supporting these operations were knowledgeable of waste operations. The less-than-90-day waste accumulation areas were clearly posted, required safety equipment was in place, weekly inspections were being performed, and records were being correctly managed to ensure that the 90-day limit was not exceeded. Workers managing waste in this area followed procedure P7-5656 requirements to wear PVC gloves when handling or packaging non-compatible waste and components.

Although workers displayed a high degree of compliance with NEOPs, several ES&H controls required by institutional and general safety standards, requirements, or postings were not followed:

- OA observed, in nuclear production areas and in the weapons stock room, several violations of the hazardous chemical labeling system plant standard and associated work area postings for chemical compatibility, including improper labeling of the tooling container used to store unused DMSO solution, storage of incompatible chemicals together, and failure to store liquid chemicals separate from solid chemicals.

- OA observed, in nuclear production areas, in waste management areas, and in the weapons stock room, several violations of the plant standard for carcinogen control, including failure to designate carcinogen storage areas and work areas, failure to segregate carcinogens from non-carcinogens, and failure to post proper signage warning of the presence of carcinogens.

- In one case, a general use radiological procedure was not followed, resulting in a case of poor contamination control. A NEOP step required a swipe to be taken to ensure that a pit was free of radiological contamination. Although the NEOP simply requires a swipe to be performed, the method used to perform a swipe is prescribed in a radiological procedure. In conflict with Procedure P7-0034, *Radiological Work*, the PT performing the swipe did not don new (clean) gloves before swiping to prevent the potential for cross contamination. Also, three different PTs handled the same swipe, and none had changed their gloves.

- As discussed in Core Function #3, several NEOPs did not include controls for knives or razor blades used during production activities. In these cases, the NEOPs did not include cut-resistant PPE in the procedures' lists of approved materials, indicating that cut-resistant PPE would not be allowed as part of the activity. As a result, PTs are not following a requirement in the general safety requirements procedure for production and support activities and a site policy on cutting tools.

In response to identified concerns, BWXT personnel immediately initiated actions to correct many of the individual deficiencies; however, the number of observed violations spanning various work groups, supervisors, organizations, and facilities may indicate a broader sitewide problem regarding implementation of institutional ES&H requirements that are not communicated to workers through activity-specific procedures and work instructions.

Finding #4. BWXT workers and supervisors are not meeting institutional procedure compliance expectations for some ES&H requirements contained in general use procedures, policies, and postings.

Summary. Observed work was generally performed within specified controls. When working to NEOP instructions, which address the highest-priority hazards (i.e., nuclear explosives), all activities were rigorously and effectively performed, including verbatim procedural compliance. Management attention on procedural compliance and the SS21 effort have resulted in improvements in NEOPs and procedural compliance with the NEOPS. However, in a few cases, chemical and radiological controls were not followed. In these cases, the controls are required by other institutional and general safety documents but are not specifically communicated to the workers through NEOPs or other activity-specific work instructions.

C.2.2 Applied Technology Division

The Pantex Applied Technology Division is the primary provider for three major DOE National Nuclear Security Administration (NNSA) business functions that support nuclear weapons stockpile stewardship programs: (1) high explosives and component subassembly fabrication and testing, (2) research and development of advanced technology for high explosives, and (3) weapon materials testing and analytical services. To perform these activities, the Applied Technology Division employs 158 scientists, technicians, and staff support personnel in 34 Pantex Plant buildings and firing sites.

Hazards within the Applied Technology Division are diverse and include energetic materials and explosives, non-ionizing radiation (such as lasers), high-voltage electrical equipment, ionizing radiation from radioactive materials, x-ray producing equipment, hazardous chemicals, magnetic fields, and mechanical hazards. ES&H support is provided to the Applied Technology Division through ES&H professionals located within the Pantex ES&H organization.

OA's evaluation of implementation of the first four core functions of ISM for Applied Technology Division work activities focused on evaluation and sampling of safety performance across three of the five Applied Technology departments. Work activities observed by the OA team included the sanitization (or exploding) of nuclear weapon fire sets, machining of mock explosives, management of waste, and testing of weapons program material. Operating procedures and developmental instructions, design agency specifications, process hazards analyses, ES&H policies and procedures, work spaces, and administrative and engineering controls were also reviewed.

Core Function #1: Define the Scope of Work

Pantex standards and the Pantex Plant's *Integrated Safety Management Description* describe the overall work control and ISM processes that apply to the production, developmental, and research activities conducted by the Applied Technology Division. Within the Applied Technology Division, defining the scope of work includes identifying the work authorization chain, identifying the location of the work, and establishing the resources and priorities to perform the work.

Overall, the scope of Applied Technology work is generally well defined in operating procedures and developmental instructions. In addition, some work activities within the division are also defined in job safety and health analyses (JSHAs), design specifications, requests for material analysis, and environmental management system work documents. For example, work steps for the machining of high explosives are well defined in operating procedures and developmental instructions, and each work part is accompanied by a work order that describes any unique machine settings or requirements for the specific work activity. Testing of weapons program materials (i.e., 35 Account Material, such as glues and adhesives, that may come into contact with a nuclear weapon) is described in procedures contained within design agency specifications or industry standards, such as methods developed by the American Society for Testing and Materials (ASTM). Each test conducted on a 35 Account Material is also accompanied by a request for material analysis, which provides greater specificity concerning the testing to be performed. For sanitization of fire sets, a developmental instruction is prepared for each lot of parts to be sanitized.

In addition, each Applied Technology department has established mechanisms to schedule work activities and allocate resources to perform the work. Work lists are prepared on a weekly basis and are reviewed by line management to ensure that the work activities are consistent with the Pantex mission and priorities, and that adequate resources are available to complete the scheduled work.

In preparing for work involving explosives, considerable attention to detail is included in the developmental instructions and operating procedures. However, on some occasions, less attention is devoted to defining the work, such as in preparing the work orders, if the work involves standard industrial hazards, such as hazardous chemicals. For example, in one work activity observed by the OA team (i.e., machining of mock material in Building 12-121), the work activity was not clearly defined in the work request. The work requests failed to identify the type of mock material that was to be machined. As a result, an inappropriate operating procedure was selected for this task that was based on a mock material other than the material being machined. According to the MSDSs, the two mock materials have different hazards and potentially different controls. The lack of work definition in the work order was not identified by line management until after the work activity had begun (although prior to the machining of the mock material). Once the discrepancies between the mock material that was to be machined and the mock material described in the procedure were identified by the production supervisor, work was stopped, the work orders were clarified, and a developmental instruction was prepared to revise the work procedure. However, the lack of an adequate work description in the work order was not recognized by the workers. Because machining of mock material does not involve explosives, a pre-job walkdown or briefing, which could have identified the discrepancy, was not required or conducted as part of the work planning process. A poor work definition and a lack of attention to detail during work planning resulted in work stoppage and potential consequences to worker safety.

Summary. Work scopes within Applied Technology are well defined, primarily in operating procedures and developmental instructions, or through design specifications, industry standards and methods, JSHAs, and requests for material analyses. Operating procedures and developmental procedures typically contain detailed work steps to ensure that the work is performed as designed. However, in some cases, particularly for work involving industrial hazards, insufficient attention to detail during work planning has resulted in procedures that do not accurately reflect the work being performed.

Core Function #2: Analyze the Hazards

The dominant hazards within the Applied Technology Division are associated with a variety of high explosives. The explosive hazards associated with these activities are generally well understood, analyzed, documented, and communicated to workers at all levels. Furthermore, BWXT's Process Information Flow procedure has also been effectively used in Applied Technology to identify the hazards of waste streams within a facility so that controls can be defined.

At the facility and process level, the Applied Technology Division explosive and hazardous operations are governed by the requirements of the Occupational Safety and Health Administration (OSHA) process safety management (PMS) standard as defined in 29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*. At Pantex, the PSM standard is the safety basis authorization program for non-nuclear explosive facilities, many of which are operated by the Applied Technology Division. One element of the PSM standard requires that employers identify, analyze, and document process hazards in a process hazards analysis (PHA). Applied Technology has completed the initial PHA for all processes covered under the standard (approximately 45 PHAs). The initial PHA process was useful in identifying a number of equipment and process deficiencies, which were subsequently resolved. The initial PHA process also identified additional safety items that were included in the Pantex Non-Nuclear Facilities Safety Systems Manual (MNL-00055). However, the initial PHAs do not have a well-documented, user-friendly identification and analysis of facility hazards, and controls intended to mitigate those hazards. As a result, all Applied Technology PHAs are being re-written to reflect a graded approach to hazards analysis that is more user-friendly and consistent with the approach to hazards analysis being implemented for Pantex nuclear facilities. Currently, fewer than half of the Applied Technology initial PHAs have been re-written to meet the new requirements. A schedule for completion of PHAs by the end of calendar year 2007 has been developed (see Finding #5).

At the work activity level, a variety of Pantex Plant processes have been developed to identify, analyze, and document hazards. However, collectively these processes have not been effective in identifying, analyzing, and/or documenting hazards at the work activity level within the Applied Technology Division. For example, within Applied Technology, most work is performed by procedures or developmental instructions that do not have JSHAs. The hazard identification and analysis process for work performed by procedures is principally through a formal review of procedures by line managers and SMEs, as described in Pantex Standard 0147, *Change Origination, Plant Review and Approval*.

Typically, however, the reviews conducted by SMEs do not result in a documented identification or analysis of hazards. Furthermore, few procedures or developmental instructions within Applied Technology document the hazards associated with the activity. According to the Pantex *Job Safety & Health Analysis* procedure (STD-3116), procedures associated with tasks that do not have a JSHA are to identify the hazards associated with the task. This requirement is not being met within the Applied Technology Division (see Finding #1).

JSHAs are prepared for routine activities within Applied Technology that are not performed by procedures or developmental instructions (such as industrial machine shop operations). Although the number of activities within Applied Technology that are performed with JSHAs are few (as compared to those activities performed by procedures), most of the JSHAs are outdated (e.g., 1995) or are too generic to clearly identify the associated hazards. For example, a one-page JSHA has been developed for the hazards associated with the wide variety of chemical usage in Buildings 11-16, 11-17, 11-19, 11-22, 11-51, and 11-51A. The description of the many different chemical hazards associated with these chemicals cannot be captured in a one-page JSHA, and the generic hazard statements provided in the JSHA are of limited value to the worker. For the hazardous chemical JSHA, for example, only three potential hazards are identified: (1) unfamiliarity with hazardous aspects of the chemical, (2) leaking containers, and (3) potential exposure of chemicals through inhalation. For environmental hazards, BWXT has drafted a work instruction for a job environmental hazards analysis (JEHA). Although the JEHA process may be an effective tool for enhancing environmental performance, the JEHA work instruction is still in draft and has not been implemented (see Finding #1).

The documentation and implementation of other activity-level hazard processes have not been effective in identifying, analyzing, documenting, or communicating work activity hazards. For example, most of the line managers within Applied Technology conduct pre-job briefings on a routine basis. However, the pre-job briefing process within Applied Technology is not documented, and when pre-job briefings are conducted, their purpose is often to ensure quality control rather than to discuss hazards. Similarly, Applied Technology has a robust on-the-job qualification program, with lesson plans that identify hazards as a learning objective, but the lesson plans refer to the operating procedures to achieve this objective and the operating procedures seldom describe the hazards associated with the work activity. A number of BWXT workers and line managers have incorrectly assumed that all activity-level hazards are identified in the PHAs (which is not the purpose of the PHA). Similarly, there is no activity level process for defining and applying a graded approach to hazards analysis as required by ISM (see Finding #1).

In one example observed by the OA team, the lack of a work activity-level hazards analysis process resulted in Applied Technology laboratory workers being unintentionally exposed to unknown airborne concentrations of isocyanates. During this work activity, resins containing isocyanates (specifically methylenediphenyl diisocyanate, or MDI) were being de-aerated using a vacuum pump, which discharged the de-aerated gases to the room, in the vicinity of the technicians performing the work. BWXT measured the total organic airborne concentration in the technician's breathing zone to be 0.04 parts per million for a five-second period, or one-tenth of the OSHA permissible exposure limit. Although BWXT conjectured that the oil mist from the vacuum pump may account for most of the exposure, and not the MDI, at the time of the exposure, there was no job-specific exposure analysis or data to support this assumption. ES&H had not been involved in the evaluation of this work activity. During the week following this event, air sampling data from 1995 for a related but different work activity was located, which suggests that isocyanate levels may be below regulatory thresholds. However, as a result of the exposure uncertainties and lack of an exposure assessment for this activity, BWXT initiated retrospective sampling during this OA inspection to determine the levels of airborne isocyanates. The results of this sampling indicate that airborne concentrations of MDI were below detectable levels. For this work activity, there is no record that Industrial Hygiene reviewed the test procedure, including the five types of resin compounds used, each with widely differing hazards. The most recent ES&H technical review of the 168-page design agency specification was June 2000, when the Pantex Plant was operated by a different contractor. In general, for work that is performed via design agency specifications or industrial standard committees, such as this activity, the Pantex Plant does not have a sufficient mechanism to ensure ES&H involvement in the review of work activities, including the identification and analysis of hazards (see Finding #1).

A related concern is that BWXT has not documented or implemented an effective exposure assessment program as required by DOE Order 440.1A. DOE Order 440.1A requires initial or baseline surveys of all work areas or operations to identify and evaluate potential worker health risks, and periodic resurveys and/or exposure monitoring as appropriate. In addition, DOE Order 440.1A requires documented exposure assessments for chemical, physical, and biological agents and ergonomic stressors using recognized exposure assessment methodologies. BWXT organizations have a number of processes for identifying, analyzing, and controlling workplace exposures to chemical, physical, biological, or ergonomic hazards. However, these processes are not comprehensive, integrated, and consistently applied; do not adequately ensure that worker exposures are sufficiently analyzed, sampled/monitored, and documented; and do not ensure that the results are effectively communicated to line management and integrated into work documents (see Finding #2).

The BWXT industrial hygiene program for evaluation and documentation of exposure assessments for chemical, physical (e.g., noise), and biological agents is fragmented, and the execution of the program, including documentation and communication of the results of the exposure assessment, is expert-based and inconsistent in execution. The current program does not meet some of the DOE expectations for conducting and documenting exposure assessments using recognized exposure methodologies as described in DOE Guide 440.1-3, *Occupational Exposure Assessment*, DOE-STD-6005-2001, *Industrial Hygiene Practices*, or the American Industrial Hygiene Association's (AIHA) *A Strategy for Assessing and Managing Occupational Exposures*. For example, although new draft BWXT Industrial Hygiene work instructions provide actions for requesting and performing industrial hygiene evaluations, there is limited guidance on how the industrial hygienist is to evaluate the hazards and document the results based on risk. Some guidance for conducting elements of an exposure assessment is provided in BWXT industrial hygiene work practices (e.g., WP-010, *Review of Documents/Procedures*, and WP-0011, *Industrial Hygiene Building Survey*). However, collectively, these work practices do not provide for a comprehensive exposure assessment program as described in the DOE or AIHA guidance documents. Specific elements of the BWXT program that lack the rigor described in recognized exposure methodologies include initial or baseline industrial hygiene surveys, periodic reassessments, exposure assessment documentation, technical description of the exposure assessment strategy, identification of recommended and additional control measures, linkage of exposure assessment performance and sampling/monitoring to estimated risk, and communication of results to line management. Although BWXT has performed considerable air and surface sampling for contaminants, there are no established guidelines for when sampling or monitoring is to be conducted, or how the results from such activities are to be incorporated into an exposure assessment. Most industrial hygiene sampling results are communicated to line management through memoranda, although such memoranda (including industrial hygiene recommendations) have sometimes been perceived by line management as informal and therefore have not been implemented. For example, some beryllium recommendations for sanitization of fire sets were not implemented. The current "Blue Book" system is intended to record the parameters associated with a sampling activity (e.g., sample pump calibration and flow) but is not consistently used to record the details of the work activity for which the sampling was performed, and would not suffice as an exposure assessment record. (See appendix D for additional discussion of insufficient Industrial Hygiene assessment of a chemical exposure incident.) Overall, the current industrial hygiene work practices lack guidance or thresholds that describe when or how an exposure assessment or sampling/monitoring for workplace contaminants should be conducted and documented, or how the results should be communicated to line managers (see Finding #2).

In addition, BWXT has not provided a detailed description on the process for performing baseline hazards assessments or periodic resurveys as required by DOE Order 440.1A. BWXT industrial hygiene building surveys, for example, are limited in detail about the exposure hazards of the facility, are inconsistently implemented, and for a number of facilities have not been maintained at the frequency specified in WP-0011, *Industrial Hygiene Building Survey*. As of February 4, 2005, only 33 of the 178 Priority-1 building surveys had been completed, and only 6 of the 115 Priority-2 building surveys had been performed. The quality of building surveys varies considerably among facilities. Some surveys reflect the results of housekeeping walkthroughs, while other surveys identify only those hazards for which an action is required. These surveys would not meet the requirements of DOE 440.1A for a baseline hazards assessment (see Finding #2).

In several work activities, the lack of consistent, well-documented exposure assessments contributed to hazards not being adequately controlled. The aforementioned de-aerating of resins is an example where neither BWXT line management nor industrial hygiene was able to confirm through exposure assessment data that the lab technicians were protected from exposure to isocyanates. In the example of beryllium item handling at FS-11, the lack of a documented exposure assessment protocol resulted in line managers not understanding or implementing industrial hygiene recommendations. Furthermore, the industrial hygienist who conducted the procedure review for this activity was unaware of previous recommendations provided by another industrial hygienist on this same work activity. During a BWXT management assessment of the chemical contaminants monitoring program in March 2004, BWXT Industrial Hygiene noted that methylene chloride, a hazardous chemical regulated by OSHA, was being used in numerous Pantex operations and facilities. The OSHA standard for methylene chloride requires either initial monitoring for the chemical or documented evidence that such monitoring is not required (i.e., an exposure assessment). The BWXT assessment concluded that neither monitoring nor objective evidence had been established as required by the OSHA standard. In January 2004, several BWXT employees were inadvertently exposed to airborne concentrations of hazardous chemicals while observing the operation of a prototype induction furnace in Rochester, New York. Three personnel experienced symptoms that were diagnosed to be a result of the exposure, and BWXT issued a lessons-learned bulletin. However, a formal exposure assessment was not conducted to determine the magnitude of the worker exposures that resulted in the symptoms (see Appendix D for details). Similar concerns with the BWXT exposure assessment program are also noted in other sections of this appendix (see Finding #2).

Summary. At both the facility and work activity level, the explosive hazards associated with the synthesis, manufacture, pressing, machining, and testing of high explosives in the Applied Technology Division are well understood, documented, and communicated to workers at all levels. At the facility and process level, rigorous mechanisms, such as the PHA, have been developed and implemented that identify and analyze hazards that could impact facility or worker safety, or the safety of adjacent nuclear facilities or the environment. The newer PHAs are particularly useful in clearly identifying hazard controls that are required to mitigate significant process or facility hazards, and the critical safety information is presented in a format similar to hazards analyses conducted for Pantex nuclear facilities. However, many of the older existing PHAs lack adequate hazard identification, and the purpose of the PHAs is often misunderstood by the workforce. At the work activity level, current work control processes (e.g., procedures and JSHAs) are not sufficiently rigorous, resulting in instances where hazards (other than energetic or explosive hazards) are not sufficiently identified, analyzed, documented, and communicated to the workforce. Although a substantial effort has been in place to sample the workplaces for hazardous chemicals (particularly beryllium), the program for performing exposure assessments is fragmented and does not meet all the requirements for an exposure assessment program as described in DOE Order 440.1A.

Core Function #3: Identify and Implement Controls

The ISM work process at Pantex, as described in the *Pantex Plant's Integrated Safety Management Description*, provides clear expectations for developing and implementing hazard controls for non-nuclear hazardous facilities, such as those operated by the Applied Technology Division. At the institutional level, the BWXT contract and management systems have delineated a set of management standards and requirements, as defined in the Pantex standards/requirements identification document. Pantex ES&H plant standards establish the controls for implementing the ES&H safety standards and requirements.

Engineering controls and safety systems within Applied Technology buildings are well designed and effective in controlling the hazards associated with high explosives. The Pantex Plant Non-Nuclear Facilities Safety Systems Manual (MNL-00055) identifies facility safety systems that have life safety and/or industrial safety functions for each of the Applied Technology facilities. Manual 00055 identifies actions to be taken when a safety system is inoperable, and surveillance requirements to ensure that the systems are properly maintained. In general, engineering controls for personnel protection from industrial hazards are also well maintained within the Applied Technology facilities. Most building, laboratory, and process ventilation systems are maintained and inspected on routine intervals. Eye wash stations are appropriately placed and are tested and inspected on a regular basis.

In general, environmental waste tracking systems and waste storage containers have been used effectively within Applied Technology. For example, BWXT's electronic waste tracking system effectively records locations for all containers provided by the Waste Operations Department, identifies all the waste streams for each facility, and tracks disposal documents, including the regulatory required manifest.

For Applied Technology Division facilities, the set of hazard controls at the facility level is robust. For non-nuclear explosive operations and for other non-nuclear hazardous operations facilities, the Pantex Plant has adopted the OSHA PSM as defined in 29 CFR 1910.119 as the plant-wide safety basis of operations. The Pantex Plant has expanded the OSHA PSM concept to include the *DOE Explosive Safety Manual* (DOE Manual 440.1-1), *DOE Worker Protection Management for DOE Federal and Contractor Employees* (DOE Order 440.1A), and other related DOE orders and OSHA standards. In addition, Pantex Applied Technology Division facilities have been risk categorized (low, moderate, or high) based on the operations conducted and the associated hazardous materials.

Significant progress has been achieved by BWXT in developing programs to implement the fourteen elements of a PSM standard program within Applied Technology facilities. PHAs, as required by one element of the PSM standard process, have been developed for all Applied Technology facilities, which have been categorized as low, moderate, or high. The newer PHAs (i.e., those PHAs developed by the Authorization Basis Group within the Pantex Engineering Department since August 2003) are effective in documenting a risk basis for safety systems, identifying clear hazard controls, and linking those controls to the hazards they are intended to mitigate. In addition, BWXT has established a change management system (i.e., the hazard control evaluation [HCE] process), as required by another element of the PSM standard program, to evaluate changes to equipment and procedures for those Applied Technology processes that are covered by the PSM standard.

Although BWXT has established administrative systems for implementation of the fourteen elements of the PSM standard, a number of these systems have not been effectively executed. For example, many of the older PHAs lack clearly defined hazard controls as required by the Pantex standard for PHAs. In some cases, hazard controls in the older PHAs are identified without any specificity and the controls are documented as only "technical procedure," or "training," or "equipment/facility design." Although the older PHAs provided some initial value in the identification of action items, the older PHAs are cumbersome, difficult to read, and are of limited value in evaluating ongoing changes to equipment and procedures through the HCE process. Currently, only 40 percent of the Applied Technology PHAs have been re-written to the new PHA standards, although a schedule for completion of this task has been developed.

The PSM standard requires the development of complete and accurate information about process chemicals, process technology, and process equipment. This process safety information is critical to conducting a PHA and evaluating changes to procedures and equipment within the facility. For older non-nuclear hazardous facilities within Applied Technology the establishment and maintenance of complete and accurate process safety information without a configuration management system and on facilities, processes, and equipment that were procured and installed decades ago without the benefit of current building and fabrication codes and standards is a challenge. Although Manual 00055 provides a useful mechanism for compiling process safety system information, the designation of safety items within the manual does not have a documented technical basis, because the manual often relies on historical knowledge, and the resolution of action items from older PHAs. However, without complete and accurate process information (such as process and instrument drawings, equipment specifications, and design operating limits, etc.), and a configuration management system, hazard control evaluators must often assume that the existing configuration of process equipment is the safe configuration.

The PSM standard also requires that operating procedures describe the tasks to be performed, data to be recorded, operating conditions to be maintained, and the safety and health precautions to be taken. Although Applied Technology has developed operating procedures and developmental instructions, many of these procedures and instructions do not contain all of the elements required by the PSM standard. A number of Applied Technology procedures and instructions do not meet PSM standard requirements to identify the properties and hazards of chemicals used in the process, establish operating limits, and identify emergency operations, and shutdown and startup requirements. Although these discrepancies were self-identified by BWXT during an audit conducted by Applied Technology in May 2004, the corrective actions in some cases are limited in scope (e.g., applying the corrective action to only formulation processes) or have not been substantially developed to be effective (see Appendix D). A change to the standards/requirements identification document has been initiated to address alternative mechanisms for identifying emergency operations, and shutdown and startup requirements.

The PSM standard also requires that changes to process chemicals, technology, equipment, and facilities be properly managed. To this extent BWXT developed a HCE process as defined in Pantex Standard 9555. Although the process meets the intent of the PSM standard, the process has not been effectively executed in some cases. In some cases, the thresholds for applying the HCE process are not well documented. For example, it is not clear whether the HCE process should apply to activities that may not be governed by a PSM, such as work performed to DOE design agency specifications or ASTM methods. In some cases, the HCE review had not been approved, or the review did not adequately define why the process has been exempted. In one case, the HCE for roofing work in Building 11-51 failed to evaluate the importance to safety of disconnecting the building's lightning protection system, although the disconnection of the lightning system was described in the subcontractor's work plan (see Section C.2.4). Building 11-51 contains explosives, and Manual 00055 identifies the lightning protection system as a safety item.

The PSM standard also requires program audits every three years. Although BWXT has conducted program audits, as required by the Standard, in some cases these audits were not effectively executed. Of particular concern, as further described in Appendix D, the audits have focused on the adequacy of program documents in meeting OSHA PSM standard requirements and not on program execution. In some cases, the corrective actions resulting from the review did not adequately address the extent of condition.

Finding #5. Although BWXT has implemented programs to meet the OSHA PSM standard, five elements of the PSM standard have not been effectively executed (i.e., legacy PHAs, operating procedures, process safety information, management of change, and audits).

At the work activity level, Applied Technology has developed a number of administrative and personal protection controls and has adequately implemented them. For example, chemical usage is one of the primary potential hazards within the Applied Technology work processes. To establish clear controls for chemical glove usage, BWXT has developed the Pantex Glove Callout Manual, which identifies the appropriate type and material of glove for a wide variety of chemicals in use within the Applied Technology facilities.

Training and qualification programs for Applied Technology workers are extensive, well documented, and tailored to the worker's assigned responsibilities. High explosive equipment operators are well experienced, trained, and current in their qualifications. Many operators have over 20 years of experience in their assigned work activities. In addition, the on-the-job training programs within several Applied Technology departments are extensive and well documented. Numerous on-the-job training programs have been developed and conducted for many work activities within the division.

One exception to this robust training and qualification program is that waste generator training and responsibilities are not clearly defined across Pantex organizations, as evidenced in some Applied Technology Division work activities. The Pantex Plant has a Waste Management Generator training course for line personnel that generate waste, but there is no requirement that this course be taken before the Waste Operations Department will provide waste containers. During this inspection, several locations were identified where generator waste management performance had reached levels that require improvement. Actions are being taken by the Waste Operations Department to link the requirement to take the generator training to providing waste containers and accepting waste, but these actions have not been formalized. The extent of this action is uncertain, and therefore the effectiveness in ensuring compliance is unknown.

Most work activities within Applied Technology are controlled through the use of operating procedures and developmental instructions. In general, although these procedures and instructions have limited discussion of hazards, as discussed in Core Function #2, most operating procedures and instructions identify the appropriate hazard controls. However, in some cases, hazard controls have not been adequately defined in procedures and instructions, as described in the following paragraphs.

Operating procedures and developmental instructions do not clearly link documented controls to the hazards they are intended to mitigate. In many cases, the purpose of the control is obvious, but in some cases the intent or limitations of the control is unclear to workers or line management. For example, in the machining of mock material, the operating procedure limits the stay time of visitors in the work area to one hour without respiratory protection. None of the workers or supervisors interviewed were aware that the basis of this control was to prevent overexposure of visitors to dust generated by machining of the mock material. As a result, neither the operators nor line managers recognized that mock material could contain more hazardous constituents than assumed in the industrial hygiene review and thus the controls prescribed in the operating procedure (i.e., stay times) could be insufficient (see Finding #1).

In other examples, because hazard controls for a specific work activity may be defined in a number of procedures, the minimum set of controls for a specific work activity may not be clearly defined. For example, two operating procedures have been developed for machining of mock material for different weapons systems. Although the hazards for machining the mock material are the same, the controls in the procedures differ considerably. In one procedure, the procedure writer chose to rely on controls identified in facility-level safety requirements documents rather than identify the control in the operating procedure, thus accounting for the discrepancy in controls. However, Applied Technology has not communicated expectations for the type of hazard controls that are to be included in operating procedures and developmental instructions (see Finding #1).

In some cases, hazard controls have not been adequately implemented. For example, during the machining of mock material in Building 12-121, the local ventilation system was not effectively implemented. Much of the mock material dust, which the local ventilation system was designed to capture, plated out on the lathe or dropped to the floor. Furthermore, although the MSDS indicated that the ventilation system should be explosion proof, there was no indication that the ventilation system was designed as explosion proof, nor was the system grounded. In addition, when machining was performed remotely, there was no means to determine remotely whether the local ventilation system was operational (see Finding #1).

In another example, beryllium control recommendations identified by industrial hygiene for the disassembly of fire sets at FS-11 were not clearly identified and incorporated into the developmental instruction for this activity. In this case, the potential beryllium hazard associated with the removal of a copper-beryllium clamp had been analyzed by industrial hygiene, but the recommendations were not adequately communicated to line management and incorporated into the developmental instruction. For example, controls prescribed by industrial hygiene in October 2004 for the disassembly of fire sets included the use of barrier paper and beryllium labels, and the use of gloves when handling beryllium components. None of these controls are identified in the developmental instruction for this activity (see Finding #2).

Summary. At the facility level, hazard controls for high explosive operations are well designed and adequately implemented. BWXT programs have been developed for implementing the OSHA PSM standard process, which establishes the controls for many of the Applied Technology facilities and processes. However, the PSM standard process has not been effectively implemented in several areas. At the work activity level, training and qualification programs are robust and tailored to the workers assigned responsibilities. However, some controls are not sufficiently described in procedures or implemented within facilities. In addition, the lack of mechanisms to link controls to the hazards they were intended to mitigate has resulted in some controls being inadequate for the intended purpose.

Core Function #4: Perform Work Within Controls

In general, work activities observed by the OA team within the Applied Technology Division were conducted safely, using the engineering and administrative controls and PPE as documented in procedures and developmental instructions. For work activities involving high explosives, a rigorous adherence to procedures was observed.

As a result of an aggressive injury and illness prevention program, the Applied Technology Division has continued to improve worker safety, as evidenced by a low incidence of injuries and illnesses. For example, for the 1995 to 2004 period, the Applied Technology Division recordable injury rates improved from 5.54 to 0.57. During the same period, the lost workday case rate decreased from 3.96 to 0.00, and the lost workday rate dropped from 149 to 0.

Applied Technology has also implemented a work authorization process that requires scheduling and review of all work activities by line managers prior to the conduct of work. However, in some cases, as discussed previously, work was initiated without the appropriate work procedures or without ensuring that local ventilation systems had been inspected (e.g., machining of mock material).

In a few cases, waste management activities were not performed in accordance with established controls. Some BWXT operations in Applied Technology Building 11-51 were not being performed in accordance with plant requirements for meeting regulatory requirements. Controls within Building 11-51 for managing hazardous waste are identified within the facility PHA and an Applied Technology Division operating procedure for laboratory analytical equipment, which references the BWXT hazardous waste standard (STD-3443). However, these controls were deviated from as evidenced in the following examples. In one case, three five-gallon containers labeled for hazardous waste were collecting liquid discharges from analytical equipment using tubes entering open holes in container caps, which is not allowed by applicable requirements. In another example, a small container being used to collect the liquid discharge from a laboratory process had "waste ethanol" handwritten on the container. The operator stated that the liquid discharge could be reused and therefore was not waste. Waste ethanol would be a hazardous waste under regulatory requirements and therefore the handwritten information on the container did not conform to applicable requirements. Finally, two gray trash cans were being used to collect wipes contaminated with high explosives. The waste stream had not been coordinated with the Waste Operations Department and the containers had not been issued with appropriate labeling. Collectively, using hazardous waste labeled containers for storing potentially reusable material, labeling reusable material as waste, and placing non-hazardous material into a hazardous waste container indicate deficiencies in understanding and following plant requirements for meeting regulatory requirements (see Finding #4).

In another example, poor material storage conditions in Building 12-34 has resulted in deteriorated flammable material storage drums and increased the potential for an environmental release. Although this area is under cover, the drums are exposed to rain at the ends of the shed, which has resulted in several drums being badly rusted. Because of the rust deterioration, the contents of several drums can no longer be used for its intended purpose and may become hazardous waste. Recently the fire sprinklers in this area inadvertently discharged, and the secondary containment bins holding these deteriorated drums were partially filled with water. Because immediate action was not taken to remove this water, a leak from a deteriorated drum could have overflowed the secondary containment and resulted in an environmental release of flammable material.

Summary. In general, work activities observed within the Applied Technology Division were conducted safely, using the appropriate engineering and administrative controls and PPE. For work activities involving high explosives, a rigorous adherence to procedures was observed. Injury and illness records have improved significantly during the past ten years. However, in a few cases, the work authorization process did not ensure that controls were effectively implemented prior to performing work, and work was performed outside of established environmental requirements in a few instances.

C.2.3 Maintenance

Maintenance by BWXT falls into two main categories – planned maintenance (preventive maintenance) and corrective maintenance – and entails a significant workload (about 40,000 maintenance tasks were performed in fiscal year 2004, taking over 200 person-years of effort). Because of a recent reorganization, maintenance is conducted by two separate divisions. The Infrastructure Division is primarily responsible for roads, grounds, and utilities. The Maintenance Division is responsible for weapons program equipment maintenance, support equipment, and most of the balance of plant not covered by Infrastructure. This OA inspection covered work performed by the Maintenance Division.

ISM for maintenance work is implemented through BWXT Standard 5016, *Maintenance Work Control System*, and Internal Operating Procedure 00876, *Processing Maintenance Work Orders*. The Maintenance Management Program Maintenance Planners Manual is a guide for planners to develop quality work packages. There is an extensive system of additional standards, internal operating procedures, and standard forms intended to address the broad range of potential maintenance work hazards. Work is initiated either automatically (for preventive maintenance) through the Passport system, or manually by a corrective maintenance work request.

During this inspection, OA observed preventive and corrective maintenance performed by different maintenance shops, inspected shop work areas (including waste management areas), and reviewed completed work orders. Specific tasks that were evaluated included repair of steam coils in an air handling unit, preventive and corrective maintenance on cell hoists, and inspection of shop lifting and rigging equipment. (See Appendix F for additional discussion of hoisting and rigging activities.)

Core Function #1: Define the work

Work definitions for preventive maintenance are generally accurate and clearly define the work to be performed. The procedures are written generically to cover multiple pieces of equipment that are similar, but not necessarily identical. A work order then links the procedure to a specific piece of equipment.

Planning and scheduling for preventive maintenance activities were effective; most identified preventive maintenance is performed within its scheduled periodicity. For corrective maintenance and modifications, planning and scheduling were less effective. A current project to better define maintenance work schedules is having limited effect on current scheduling practices. Scheduling remains primarily the responsibility of the individual craft shop supervisors who collect work packages that are considered ready to work. The shop supervisors then work with assigned maintenance coordinators to determine on a daily basis those tasks to be completed. Maintenance sends a representative to the integrated plan-of-the-day meeting, but that meeting is limited to those tasks that affect production. The Maintenance Division does not have a lower-level coordination and scheduling activity, plan of the day, or other coordination tool to effectively and efficiently define work schedules. Consequently, the maintenance process tends to be relatively inefficient, with craft personnel spending additional time at the job site while coordination issues are resolved. The process was repeatedly described by supervisors and craft personnel as primarily “crisis management.”

Work definitions for corrective maintenance and modifications were generally well defined. One exception involved a modification that did not contain sufficient information to determine the work to be performed**.** In this example, steel framing from existing doorways in a hallway was being removed to make equipment access easier. The work was not clearly defined as to which frames were to be removed, and how far back they should be cut. Prior to performing the modification, the workers had to spend significant time attempting to determine exactly what work was to be performed. The insufficient clarity in the work definition led to a possibility that an electrical termination box may have been within the work boundary, and may have required additional hazard controls that were not addressed in the work package.

Summary. Work was generally well defined. However, there were some isolated cases in which work was not clearly defined, and some hazards may have been missed as a result. Managers, planners, coordinators, and supervisors are not working effectively to ensure that maintenance activities, are planned, scheduled, and coordinated to ensure effective use of available resources. Deficiencies in scheduling and coordination are contributing to the deficiencies identified in Core Functions #2 and #3.

Core Function #2: Analyze the Hazards

The Maintenance Management Program Maintenance Planners Manual contains a comprehensive description of a planning process that, if conscientiously followed, would produce quality work packages that include hazards analysis and identification of appropriate controls. In addition, the Waste Operations Department applies an effective process that assesses work within facilities to identify waste streams so that controls can be defined.

However, the work planning process, as implemented for corrective maintenance activities, does not effectively identify all pertinent hazards. For maintenance work, plant standards identify two separate hazards analysis processes. For work not conducted by procedure, there is a JSHA process. For work conducted by procedure (work order instructions), there is an activity hazards analysis (AHA). Neither of these processes is effective in identifying and analyzing hazards. In OA's review of a sample of 53 of the approximately 650 JSHAs applicable to maintenance, there were numerous examples of hazards that are not identified or analyzed. Further, these JSHAs are not being reviewed or updated. For work order instructions, the Maintenance Management Program Maintenance Planners Manual identifies an AHA as a means for the planner to quickly identify hazards associated with the work being planned. The AHA uses two forms, a screening form and an analysis form. The forms used for this process are generic and do not effectively link hazards to standard established controls. None of the work packages reviewed included the AHA form (PX-4772), which is intended to link procedure steps to hazards and controls. The screening form (PX-4771) was included in each work package, but provided little useful information.

Analysis of identified hazards is minimal and does not adequately support subsequent identification of controls. For example, when noise level is identified as a hazard, there is no reference to any sound surveys or other data, such as exposure assessments, that would indicate what level of hearing protection is necessary. In another example, the hazards analysis for a hoist removal and reinstallation did not include any considerations for hazards associated with using a special frame and forklift for lowering and raising the hoist from the overhead rails. Observation of the work indicated there were multiple potential hazards associated with lateral loading of the hoist assembly and the forklift, but no engineering analysis of the lift method was performed. In a third example, work was conducted inside an air handling unit to repair a leaking coil, which had been leaking water into the plenum for approximately 2 to 3 months. Consequently, the plenum had been warm and damp for 2 to 3 months. The potential for a mold hazard to exist within the plenum was not identified, and there was no evidence that Industrial Hygiene had evaluated the potential mold hazard prior to authorizing the work (see Findings #1 and #2).

The 12-81 battery shop had an analysis of hydrogen generation during battery charging that made several assumptions (e.g., normal exhaust flow of 1000 cubic feet per minute [cfm] driven by roof ridge vent fans, uniform distribution of hydrogen, and calculation of the hydrogen generation rate based on a specified finish rate). Without air flow, the calculation determines that the lower explosive limit for hydrogen (4 percent) will be reached in approximately 24 hours. The National Fire Protection Association limit of 1 percent would be reached in 6 hours. No discussion of hydrogen collecting in low flow areas was included. The results of this analysis were not used to develop any controls on battery charging procedures (see Core Function #3), and the calculation was not attached to or included in any applicable JHSA for battery charging.

Summary. Hazard identification and analysis is not effective for maintenance activities. Hazard identification and analysis tools are dependent on an individual work planner's expertise, and do not provide sufficient thresholds or linkages to more detailed analysis or adequately identify the need to seek additional expertise, particularly for hazards that may not be encountered on a daily basis. Hazards analysis that is performed is not detailed, and is generally not used or referenced (see Finding #1).

Core Function #3: Identify and Implement Controls

BWXT has a large set of plant standards addressing a broad range of hazard controls**.** Those standards tend to be comprehensive in addressing requirements associated with various types of work. For example, central control of waste containers by the Waste Operations Department helps ensure proper management of waste streams, and was being effectively implemented during maintenance activities to control waste generation.

The Pantex Plant is currently developing a requirement for pipe fitters, sheet metal mechanics, and others who might work on or near waste systems (e.g., bathrooms and waste piping) to be vaccinated against Hepatitis A and B. Once workers receive the vaccination, their supervisor is provided written notification. It is not clear that the work control system will be capable of ensuring that the vaccination has been administered as a prerequisite for work near waste systems.

Controls necessary to address work hazards are not always clearly defined or identified in work packages. Typical controls for maintenance work involve use of such PPE as safety shoes, safety glasses, gloves, hard hats, or respirators, and these controls were observed in the conduct of work. Other controls, such as lockout/tagout points, Industrial Hygiene surveys of work sites, or scaffolding inspections, either are not clearly identified or are not included.

For lockout/tagout, the Passport system contains data on isolation points. For balance-of-plant equipment, there is no configuration control, so the isolation points entered in Passport are not considered reliable and are treated as guidance by the workers. These isolation points are not reviewed as part of work package development. Consequently, although isolation points are provided in the work package, the final decision on isolation points is left solely to the worker at the time work is performed. For example, during the air handling unit coil repair job, the work order instructions identified five isolation points. When the work was observed during this inspection, the workers used all five isolation points, and then also added tags to the vent points for the coil, which were not included in the work order instructions. When the identical task was performed in December 2004 (approximately one month earlier), the mechanics did not lock out all five isolation points identified in the work order instruction, and did not consider the vent path.

Instructions provided for the conduct of lockout/tagout and the completion of associated forms are ambiguous. The instructions provided on the lockout/tagout form do not clearly specify how and when a worker is required to record component positions, and whether the Authorizing Official is required to authorize the lockout/tagout before or after the authorized employee has identified the isolation points. According to the Pantex lockout/tagout procedure, the Authorizing Official must sign the lockout/tagout sheet before the lockout is hung. The mechanic performing the work should identify the isolation points on the lockout/tagout sheet before obtaining the signature of the authorized individual. It is not clear from work observed that isolation points are always identified before the Authorizing Official signs the tagout sheet.

For scaffolding, OSHA standards require that scaffolding be inspected by a competent person each shift, prior to use. BWXT has not established requirements that define standards for competency, and has not included requirements in standards or work procedures for inspecting scaffolding prior to use by each shift. While work packages list standards that apply to the work, relevant controls from those standards are not always clearly identified within the work instructions. Instead, the process relies on an individual worker's knowledge of the standards.

Controls identified in work packages are often boilerplate, with limited applicability to the work performed, and do not consider all pertinent information. For example, all work orders for conducting preventive maintenance of overhead hoists in bays and cells contain a generic warning not to operate any spark-producing equipment, including electric motors, until the deluge system has been disabled. In all cases, mechanics performing the maintenance used a man-lift either before the deluge system was disabled or without disabling the deluge system. In one case (11-55 Bay 2), a written evaluation was available from the Facility Manager that approved the use of the lift with some additional conditions (e.g., visual inspection of the motor casing). However, the additional conditions had not been added to the annual inspection, and were not included in the work order instructions. In other cases, the mechanics indicated that the lifts used had been added to the maintenance equipment list for the nuclear explosives safety program. The Maintenance Division Manager has indicated that he wants to reduce the amount of boilerplate in work orders, but specific actions are not yet developed to accomplish this objective.

Very few work order instructions contained procedures. Most work is performed by skill-of-the-craft, even complex maintenance tasks on safety systems. For example, a safety-class hoist was removed from one cell and reinstalled in another cell without a detailed procedure. The post-maintenance test did have a detailed procedure. The process for removing and reinstalling the hoist involved a complex lift with a special frame, forklift, and manlifts. All workers were aware of the general process to remove and reinstall the hoist, but there were several occasions where the hoist could have been damaged because portions of the air system were pinched between components, and force was being applied with crow-bars. Additionally, excessive force could have been applied to the supporting rails by the forklift. Without benefit of a procedure, the method could not be subjected to an engineering review.

The battery charging room analysis (see Core Function #2) makes several assumptions that were critical to ensuring that hydrogen did not build up to flammable or explosive levels during battery charging. These assumptions were not translated into controls for battery room operation procedures or battery charging procedures. For example, the calculation assumes that two roof-ridge vent fans are operating to provide 1000 cfm of air flow through the room. The battery room procedure states "Ensure exhaust fans are on in Buildings 12-18 and 12-81." When questioned, the mechanic in the room believed that statement referred to the exhaust fan on the exterior wall of the building, which was not operating during the inspection. The calculation makes an assumption of the finish rate for the battery, but the battery charging procedure makes no reference for determining the actual finishing rate or establishing limits for the finishing rate. The manufacturer's reference sheet, which is provided with the calculation, states that inlet air ducts should be placed at shoulder height or lower to provide air movement across the charging room and across the batteries. While there were two shop fans blowing air across the room, those fans were well above shoulder height, were not referenced in the procedures, and were not required to be operating.

In several maintenance shops signs and postings related to waste management were incorrect or outdated. A less-than-55-gallon hazardous waste accumulation area in one shop identified the former supervisor as the point of contact. In two shops, cans that were labeled for oily rags stated the cans were to be emptied daily. However, the workers and managers in the shops did not know the source for this requirement and, in both locations, the cans were only emptied once a week. Such incorrect or outdated postings reduce the effectiveness of waste operations.

Summary. Implementation of controls for maintenance activities is not effective. Appropriate controls are not clearly identified in plant standards or hazards analyses, and are not translated into work procedures or instructions. Although there are signs posted in multiple locations throughout the plant pointing to the need to follow procedures, very few, if any, detailed procedures are used to perform corrective maintenance activities, and procedures that do exist are often not performed in a stepwise sequence. Instead, there is almost total reliance on an individual craft person's knowledge of the plant standards. Consequently, there is insufficient assurance that personnel are aware of all applicable controls, particularly for hazards that are not encountered on a day-to-day basis, or that controls will remain established over time. Additional attention is needed to ensure that detailed procedures are provided when appropriate, and to ensure that the procedures and instructions can be performed as written (see Finding #1).

Core Function #4: Perform Work Within Controls

Workers comply with most clearly identified controls. All workers understood the need to follow procedures when procedures were provided. With regard to waste management, BWXT maintenance shops were effectively operating less-than-55-gallon hazardous waste accumulation areas. Logs showing the addition of waste were being maintained. In several locations, the different waste streams used color-coded signs for hazardous, non-hazardous, and universal waste. The containers were being kept closed, were provided by the Waste Operation Department, and were properly labeled for the waste stream, as required.

There are detailed procedures for conducting preventive maintenance activities, although those procedures are identified as "general use" and do not clearly indicate whether they should be followed in stepwise order. According to Pantex Plant Standard 0150, general use procedures may require steps to be conducted in order "as specified in the procedure." Preventive maintenance procedures reviewed did not indicate whether the steps should be conducted in order or not, and workers conducted portions of the procedure in the order they believed appropriate.

Workers and supervisors in the 12-81 charging room were not aware of, did not have ready access to, and did not know the technical aspects of procedures and standards that applied to the battery charging room. After searching and making several phone calls, the supervisor was able to determine the procedures were included in the required reading book for the shop. However, it was clear that neither the supervisor nor the worker interviewed had reviewed the required reading recently enough to be knowledgeable of the contents.

Although less-than-55-gallon waste storage areas are being effectively operated, maintenance shop personnel are moving and collecting wastes in an ad hoc manner prior to placing the waste into these areas. Within the shop areas, waste is being managed by a number of workers before being placed in the designated container (which is provided by the Waste Operations Department). For example, malfunctioning aerosol cans from the pipe shop are taken to the paint shop aerosol container instead of having a designated container in the pipe shop area. Blasting grit from the small operation in the pipe shop is taken to the paint shop where a large blasting operation has a container provided by the Waste Operations Department. Because these ad hoc activities can result in mismanagement of waste, the Waste Operations Department is working with the shops to improve the processes.

Compliance with requirements for hoisting and rigging equipment not related to technical safety requirements (TSRs) was not effective. Multiple cases were identified in which hoisting and rigging equipment was in use but had not been inspected or weight tested in accordance with plant procedures (see Appendix F and Finding #18).

Summary. Maintenance workers generally perform maintenance work in accordance with established procedures, when such procedures exist. There were weaknesses identified in complying with plant requirements for control and testing of hoisting and rigging equipment. Weaknesses associated with procedural compliance are partially attributable to weaknesses in ensuring that plant standards are effectively communicated in work instructions at the activity level.

C.2.4 Subcontractor Activities

BWXT uses subcontractors to support environmental remediation and construction activities, including upgrading site facilities and infrastructure to better support current mission objectives. The OA team assessed safety and waste management associated with these activities, including the decontamination and decommissioning (D&D) of buildings previously used for machining high explosives, installation of new facilities for treatment of contaminated ground water, construction of new administrative and records storage buildings, roofing work on existing buildings, construction of an electric substation, and assembly of perimeter barriers for site security. Subcontractor work for the D&D and groundwater treatment projects was managed by the BWXT Environmental Remediation Division, and construction subcontractor activities were managed by the BWXT Capital and Expense Projects Division. These divisions are responsible for safety and for providing direction and monitoring safety of their assigned projects.

Core Function #1: Define the Work

Most construction and environmental remediation at Pantex is performed by subcontractors. BWXT has established appropriate mechanisms to ensure that the scope of this work is clearly defined in subcontracts and to ensure that tasks are identified and expectations are established for performing the work safely.

The BWXT Procurement Manual and the BWXT construction safety standard include appropriate mechanisms for defining the scope of work in subcontracts and for defining tasks to be performed in field-level documents. These documents specify appropriate involvement by ES&H representatives in the planning, development, and execution of subcontracted work. BWXT Waste Operations Department personnel are appropriately involved in the development, award, and execution of subcontracts. A Waste Operations Department representative reviews statements of work and waste management plans and attends meetings with subcontractors to provide direct support on waste management requirements. These mechanisms were effectively implemented for most environmental remediation and construction activities. For example, the scope of work for the subcontract for the maintenance and operation of the Pump and Treat Facility project is well defined in contracts and in field-level documents, including subcontractor safety plans, BWXT safe work permits (SWPs), and AHAs for both construction and environmental restoration activities. Similarly, construction safety representatives are appropriately involved in the planning and execution of most subcontracted construction projects. The scope of work is adequately defined in subcontracts, and tasks to be performed at the field level are adequately described in AHAs and SWPs for most of these projects. However, as discussed under Core Function #2, the process was not effectively implemented for construction of perimeter security barriers.

BWXT has established safety expectations for construction work by incorporating safety requirements in contracts and by conveying expectations for compliance through various meetings and safety monitoring and assurance activities.

Summary. Appropriate mechanisms have been established to ensure that the scope of environmental remediation and construction work is clearly defined in subcontracts. Appropriate ES&H representatives have been integrated into the planning and execution of most of this work.

Core Function #2: Analyze the Hazards

The primary mechanisms used to document hazards associated with subcontractor work activities are the AHA and SWP. The use of SWPs to supplement individual subcontractor AHAs provides a suitable mechanism for augmentation or amplification of most activity-level hazards analyses conducted by subcontractors. The AHA process provides an appropriate framework for identifying hazards associated with specific work scopes, and some subcontractors have required workers to review and acknowledge their understanding of the AHA.

While adequate systems for hazards analysis are in place, ineffective implementation of these systems has, in some cases, resulted in incomplete or ineffective hazards analysis. For example, hazards analysis of potential chemical exposures associated with a construction subcontractor did not identify asphalt fumes as a hazard in the AHA; BWXT Construction Safety did not identify them as a hazard on the SWP; and neither the subcontractor nor the BWXT Industrial Hygiene staff assessed worker exposures (see Finding #2). In addition, the SWP and the AHA did not identify hazards or controls associated with removal and disposal of switches containing mercury on an environmental remediation project (see Finding #6).

Deficiencies were also noted in identification of worker fall hazards and falling object hazards associated with elevated work. A fall hazard for a drill rig operator working at a height greater than six feet over dangerous equipment was not identified in the BWXT SWP or the subcontractor AHA; thus, controls required by OSHA were not established, and hazards associated with falling objects were not identified in the SWP or AHA for two construction projects. Hazards associated with removal of a portion of a safety-related lightning protection during roofing work at a facility containing high explosives were not identified in an SWP or AHA, and the facility HCE did not address lightning protection, even though the subcontract authorized the contractor to remove lightning protection during the work day.

In one case involving construction of a perimeter security barrier, radiological hazards were not identified; a subcontractor was allowed to conduct activities in a radiologically controlled location without appropriate hazard review and established controls. A pre-construction conference held to ensure that the subcontractor understood safety requirements was not attended by radiation safety representatives; the construction group did not conduct a pre-job walkdown as required; and, radiological hazards were not included in the SWP prepared by Construction Safety or in the AHA approved by Construction Safety. Appropriate radiological controls were not established by the Radiation Safety

Department. Both the subcontractor and construction safety representative failed to recognize that a soil disturbance had occurred. Thus, appropriate radiological controls were not established, resulting in violation of area postings and the potential for the uncontrolled spread of radiological contamination (see Findings #1 and #6).

Additionally, exposures to some identified hazards, including exposures to noise and chemical hazards, were not adequately analyzed. For example, AHAs typically identify noise above 90 decibels adjusted (dBA) as a hazard for which hearing protection is required, but noise levels are not routinely measured at construction or environmental restoration sites. As a result the requirements for hearing protection are not based on a documented exposure assessment, and hearing protection is not always worn when required. Additionally, the safety plan for the Pump and Treat Facility identifies several chemicals of concern, including hexavalent chromium, which is present in facility influent, but there is no documented assessment of occupational exposure hazards associated with these chemicals. In addition, hazards identified on MSDSs are not always fully analyzed. AHAs typically refer to MSDSs for identification of hazards and controls associated with chemicals, but exposure hazards identified on these sheets often require measurements or other analysis to determine necessary controls (see Finding #2).

Summary. Formal mechanisms are established for identifying and analyzing hazards associated with subcontracted work activities. However, insufficient rigor is applied to implementation of these processes, resulting in hazards that have not been properly identified or analyzed. The hazards for some activities have not been evaluated and documented such that appropriate controls can be ensured.

Finding #6. BWXT has not ensured that subcontractors have sufficiently identified or analyzed hazards such that appropriate controls could be established.

Core Function #3: Identify and Implement Controls

BWXT project subcontract technical representatives and construction safety representatives manage and monitor the development and implementation of safety controls. These individuals have been effectively integrated into the subcontractor work control process to assist subcontractors in developing and implementing hazard controls, defining ES&H expectations, and monitoring and assessing subcontractor safety performance. Responsibilities and duties for these individuals are clearly assigned in BWXT standards, and their capability has been recently increased by establishing training and qualification requirements for project subcontract technical representatives and increasing the number of construction safety representatives from two to four.

Engineered controls are used where appropriate to reduce hazards for subcontracted work. For example, ventilation and chemical conveyance systems are used to reduce exposures to chemicals at the Pump and Treat Facility, and after-burners were used on vents from a roofing tar kettle to reduce asphalt fumes.

The flowdown of requirements into subcontracts has generally been effective. PXSO and BWXT have established an appropriate set of safety requirements in the in the Pantex standards/requirements identification documents. Adopted standards include OSHA construction safety standards in 29 CFR 1926, applicable worker protection requirements in DOE Order 440.1A, and hoisting and rigging standards in DOE-STD-1090-2004. The DOE/BWXT contract specifies that BWXT is responsible for compliance with these requirements regardless of who performs the work. To ensure compliance, BWXT has significantly strengthened safety requirements in its subcontracts in recent months by incorporating safety requirements from the Pantex standards/requirements identification document into Master Division 1 Specifications and into specific construction and environmental remediation subcontracts. Most applicable requirements have been incorporated into these subcontracts, but the hoisting and rigging standards in DOE-STD-1090-2004 are a significant exception. The requirements from this standard have not been imposed on subcontractors, and some of the requirements are not being met (see Appendix F and Finding #19). With the exception of the hoisting and rigging standards, the BWXT efforts to include safety requirements in subcontracts effectively addresses a deficiency from the 2002 OA ES&H inspection.

While most applicable safety requirements have been included in subcontracts, expectations for compliance with these requirements have not yet been effectively conveyed to these subcontractors as evidenced by the number of examples of non-compliance. BWXT understands the need for improvement in this area and has taken steps to more effectively communicate expectations, including increasing the number of construction safety inspectors and chartering a Subcontractor Oversight Board to communicate safety expectations to subcontractor management.

The BWXT work control process informs subcontractor workers of applicable controls through AHAs, which are developed by subcontractors and approved by BWXT, and through SWPs issued by the BWXT Construction Safety staff. Although BWXT mechanisms provide the essential elements necessary for flowdown of requirements to workers, they lack sufficiently detailed instructions and sufficient rigor to ensure consistent and fully effective implementation. In particular, requirements in subcontracts provide little detail regarding the expected format and content of AHAs, and BWXT has not developed criteria for use by Construction Safety Representatives for review and approval of AHAs. AHAs are not formatted consistently and some are not structured to provide clear correlation of activities, hazards, and controls. For example, some AHAs include a requirement for workers' signatures indicating that they have read or been briefed on the AHA, while others do not. Some controls specified in AHAs are not defined with sufficient specificity. For example, statements such as "use proper PPE" do not reflect thorough pre-job planning and are not adequate to assure protection. Similarly, some of the controls required by Division 1 Specifications are not included in AHAs, and hazards and controls specified on MSDSs are not always included on AHAs. Additionally, AHAs are not always updated to specify controls for new hazards specified in SWPs or new hazards encountered in the field (see Finding #7).

Deficiencies in the quality of field-level documents have reduced the effectiveness of the flowdown of requirements from Division 1 Specifications to subcontractor workers. Several required controls were not specified in AHAs, SWPs, or subcontractor safety plans and thus were not implemented. As examples, warning lines installed on a roof for fall protection did not meet OSHA requirements, the use of mechanical equipment for roof work where safety monitoring systems were being used did not meet OSHA requirements, a check valve was not installed in the fuel line between the butane fuel source and tar kettle burners, and fire extinguishers were not tagged as required by Division 1 Specifications. In each of these examples, a requirement stated or referenced in Division 1 Specifications was not identified in field-level work control documents and was not met. Additionally, requirements for waste generation training were not addressed in field-level documents, and compliance with these requirements was not confirmed by BWXT or its subcontractors (see Finding #7).

ES&H SMEs have not been effectively integrated into the construction management and subcontractor work planning process. BWXT Industrial Hygiene SMEs have not been assigned responsibility for monitoring subcontractor exposures to workplace hazards (other than beryllium). They have been given verbal direction to not monitor subcontracted work (other than that involving potential for beryllium exposures) and they do not routinely assess exposures to noise or hazardous chemicals and materials other than beryllium. As a result, the responsibility for the performance of exposure assessments for construction work is unclear. Additionally, the BWXT hoisting and rigging SME does not support or review lift plans developed by Construction Management and defers these evaluations to the Construction Safety Inspector (see Finding #7).

BWXT has not required subcontractors to ensure that their workers understand the hazards and controls specified on AHAs and SWPs. Subcontractors are required to conduct daily safety briefings but these briefings do not always include hazards and controls specified in AHAs and SWPs. In addition, there is a disparity across subcontractors; some subcontractors require their workers to read and acknowledge an understanding of AHAs and SWPs before working on projects covered by these documents, but others do not require such a review. Some workers acknowledged their lack of familiarity with the AHAs and SWPs (see Finding #7).

Summary. PXSO and BWXT have established an appropriate set of requirements for controlling hazards associated with subcontracted work at Pantex and most of these requirements have been imposed on subcontractors. However, a number of these requirements have not been effectively conveyed to the workforce and have not been implemented. Process improvements are needed to improve performance in this area to improve the quality of AHAs and to more effectively integrate BWXT SMEs in the oversight of subcontractor safety.

Finding #7. BWXT has not ensured that hazard controls are specified in SWPs, AHAs, or safety plans in sufficient detail to ensure worker safety for construction activities performed by subcontractors.

Core Function #4: Perform Work Within Controls

Subcontractors are conducting daily safety briefings for their workers, as required by BWXT. Some subcontractors made good use of pre-job or tailgate meetings to define daily work evolutions. These mechanisms provide adequate assurance of readiness to perform work within construction management operations, environmental remediation facilities, and D&D operations. However, no requirements or guidance have been provided to subcontractors to include AHA and/or SWP information in these briefings.

A number of construction subcontract work activities observed by the OA team were conducted safely and in accordance with the established controls. Subcontract workers and line management were knowledgeable of their operations and facilities and had considerable experience within their areas of expertise. A number of work evolutions were performed safely in accordance with established controls, including the asbestos abatement and beryllium controls associated with Building 12-26 roofing work. This activity was an example of a work evolution that followed all required controls, including appropriate PPE. Operator rounds at the Pump and Treat Facility were performed in accordance with the procedure and included the appropriate controls. Excavation of a high-pressure fire loop was performed safely and followed all applicable requirements. Waste management activities conducted by subcontractors included effective operation of a less-than-55-gallon hazardous waste accumulation area. Logs were maintained, containers were kept closed, and containers were properly labeled and maintained as required.

With a few exceptions, requirements were followed when they were clearly stated in AHAs or SWPs. One instance where established controls were not followed involved omitting a step in a lift plan that required support pads to be placed under crane outriggers. In a second example, access restrictions were not imposed to limit access to areas where barricades were installed to protect workers from falling objects. Although the barricades were established to address an OA team concern about potential risks to workers from falling objects, workers either did not heed barriers, or direction given to workers was not explicit. Examples of non-compliance with electrical hazard controls were observed. In one case, electrical cords were used in a "daisy chained" configuration, with one cord having a cut in the line and sitting in a puddle of water. At a second subcontractor construction location, an electrical cord that had a cut in its protective insulation was in use and was tied off to a metal railed man-lift.

In other cases, work was allowed to continue when unanticipated hazards were encountered. Examples included roof work that was allowed to continue with inadequate lighting while a generator was repaired, even though procedures and good practices would require a pause until adequate lighting could be provided. Additionally, the OA team noted several instances where work was not stopped and AHAs were not revised when new hazards were encountered. For example, the AHA for the 12-24 D&D project was not revised following discovery of mercury bearing components (i.e., switches). In another example, new hazards (i.e., radiological postings for Soil Contamination Area) did not trigger reentry into the hazards analysis process (AHA, SWP, or safety plan). Additionally, radiological hazards were not addressed in worker training or work planning documents for perimeter barrier assembly work (see Findings #6 and #7).

Summary. With a few exceptions, requirements were followed when they were clearly stated in AHAs or SWPs. However, some controls were not effectively implemented, procedures were not always followed verbatim in a few cases, and work was not always stopped to address potential safety concerns.

C.3 CONCLUSIONS

As discussed below, effectiveness in implementing the core functions of ISM varies across the four activities reviewed (nuclear explosives operations, Applied Technology, maintenance activities, and construction activities).

In general, nuclear explosive operations are planned and performed safely in accordance with the core functions of ISM. The SS21 initiative continues to improve the quality of nuclear explosives operations using improvements in tooling, procedures, and the process. Work governed by NEOPs was effectively defined, analyzed, and controlled and was performed within specified controls with rigorous and effective procedure compliance. However, activity-level hazards analyses for hazards other than nuclear explosive or conventional explosive hazards are not always systematically reviewed and are not well documented. In addition, most activity-level hazards are not identified in NEOPs as required, and PTs have no other documentation of the hazards unique to the activity. Some institutional radiation protection requirements, including use of RWPs, specification of radiological conditions, and entry controls, are not adequately defined and followed. While procedure compliance to NEOP requirements was rigorous, many ES&H requirements contained in general use procedures or other documents were not properly followed. Increased management attention is warranted in these areas to ensure that safety management is integrated into the weapons program processes for all hazards related to worker safety.

Within Applied Technology, work scopes are well defined, primarily in such work control documents as operating procedures and developmental instructions. Explosive hazards associated with high explosives in the Applied Technology Division are well understood, documented, controlled, and communicated to workers at all levels. Training and qualification programs are robust and tailored to the workers' assigned responsibilities, and work is generally performed safely, as evidenced by the continually improving safety metrics within the division. At the facility level, PSM requirements have been implemented within programs, but in a number of areas, PSM standard requirements have not been effectively executed. At the work activity level, current work control processes (e.g., procedures and

JSHAs) are not sufficiently rigorous for hazards other than energetic or explosive hazards (i.e., chemical, physical, biological, or ergonomic hazards) in identifying, analyzing, documenting, and communicating hazards to the workforce. In addition, elements of the BWXT exposure assessment program do not meet some of the requirements defined in DOE Order 440.1A.

For maintenance activities, the Pantex Plant has appropriate plant standards that define the work control process. The standards, procedures, and manuals for processing work requests provide a comprehensive set of instructions that, if implemented conscientiously, can produce well-planned work packages that include appropriate instructions, precautions, and procedures. Most maintenance work is completed safely as evidenced by the low accident and injury statistics. However, the BWXT work planning and control process as implemented is not sufficiently rigorous to ensure that all pertinent hazards are adequately identified and analyzed, and that appropriate controls are identified and implemented prior to conducting the work. Managers have not established high standards for work planning, and planners are not devoting sufficient attention to the details of the job being planned. Craft supervisors and workers, in the desire to get work done, are accepting poor quality work packages, and are relying on their own professional skill and expertise to prevent accidents and injuries. In some cases, particularly in hoisting and rigging operations, operators are not ensuring that requirements are being met prior to conducting work. In other cases, workers are simply not aware of some pertinent hazards and consequently are not equipped to evaluate the work, and do not recognize the need to obtain additional expertise to ensure that appropriate controls are applied.

For subcontractor activities, BWXT understands the need for further improvement and is taking actions to drive improvements. Recent initiatives have significantly improved the flowdown of requirements into subcontracts, strengthened the qualifications and training of project subcontract technical representatives, and increased safety monitoring and assessment of subcontractor safety. However, additional improvements are needed in the rigor of identification and analysis of hazards, as evidenced by a number of hazards that were not properly identified and others that were identified but not adequately analyzed. Improvements are also needed to ensure that hazard controls are specified in SWPs, subcontractor AHAs, and safety plans in sufficient detail to ensure worker safety. Several controls that were required in subcontracts were not effectively conveyed to workers and thus were not implemented. In general, the level of compliance with contractual ES&H requirements needs improvement. Appropriate requirements have been imposed but expectations for compliance have not been effectively conveyed.

Overall, PXSO and BWXT have effectively applied ISM principles and core functions to nuclear explosive hazards. These hazards have received extensive management attention and are subject to rigorous controls and clear expectations for procedural compliance. As a result, few deficiencies were identified in these areas. However, there are weaknesses in industrial hygiene, some aspects of radiation protection, and worker safety for activities other than nuclear weapons and explosive operations (including maintenance, construction, and certain laboratory, support, and non-nuclear/explosives hazards and controls). Management has not sufficiently focused on these areas, and implementation of the core functions of ISM was less effective in these areas.

C.4 RATINGS

PANTEX ACTIVITY	CORE FUNCTION RATINGS			
	Core Function #1 – Define the Scope of Work	**Core Function #2 – Analyze the Hazards**	**Core Function #3 – Identify and Implement Controls**	**Core Function #4 – Perform Work Within Controls**
Nuclear Explosives	Effective Performance	Needs Improvement	Effective Performance	Effective Performance
Applied Technology	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance
Maintenance Activities	Effective Performance	Significant Weakness	Significant Weakness	Effective Performance
Subcontractor Activities	Effective Performance	Significant Weakness	Needs Improvement	Needs Improvement

C.5 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

BWXT – Site Wide

1. **Develop and implement a BWXT process for the identification, analysis, and documentation of activity-level hazards.** Specific actions to consider include:

   - Consider the adoption or development of an automated work AHA process that can be applied to production and development work (at a minimum). Similar systems are now operational throughout the DOE complex.
   - Establish clear requirements and methods for documenting activity-level hazards in operating procedures and developmental instructions, JSHAs, or some other work-specific document.
   - Enhance the existing JSHA process to ensure that JSHAs adequately describe the work activity hazards, and provide a mechanism for routinely updating JSHAs and communicating JSHA hazard information to workers.
   - Ensure that the ES&H SMEs are afforded the opportunity to review all work activities that involve hazards, including work performed via design agency specifications and ASTM methods.
   - Develop and document a graded approach to activity-level hazards analysis that enables the appropriate ES&H resources and line management to be allocated to the planning and review of a work activity based on risk to workers, the facility, and the environment.

- At the site and divisional levels, establish policies for performing pre-job reviews that include a review of hazards and controls (administrative, engineering, and PPE) prior to performing work.

- Ensure that activity-level hazards are linked to hazard controls, and that workers recognize the purpose and limitations of hazard controls.

- Consider expanding hazard tables in the NEOP or NEEP general safety sections to include all activity-level hazards (specific chemicals and associated hazards, specific industrial hazards, radiological hazards, etc.) and associated controls.

- Determine root causes for failing to include identification of hazards in operating procedures as required.

- Establish clear requirements and methods for documenting results of hazards analysis activities conducted during ES&H Procedure Reviews such that the technical justification for defined controls can be established and retrieved.

2. **Develop and implement an exposure assessment program that is based on recognized exposure assessment methodologies.** Specific actions to consider include:

   - Establish guidance and thresholds for when an exposure assessment is to be performed and documented (e.g., health hazard rating, use of carcinogens, unexpected exposure of BWXT workers to unknown levels of hazardous materials, and employee complaints and follow-up).

   - Define a consistent format for the conduct and documentation of exposure assessments that clearly identifies the purpose for the exposure assessment, the work activity, conditions and limitations, controls in effect, bases for sampling and/or monitoring (or not), risk assessment, and recommendations.

   - Establish a mechanism whereby exposure assessments can be easily retrieved and referenced in work documents (e.g., procedures, JSHAs).

   - Ensure that sampling and monitoring data, when performed to support an exposure assessment, can be correlated to the exposure assessments and easily retrieved.

   - Develop requirements for communicating the results of an exposure assessment to line managers, and develop a feedback mechanism to verify that recommendations from exposure assessments are adequately incorporated into work documents and appropriately dispositioned.

   - Define the process by which BWXT complies with the baseline hazard assessment requirements of DOE Order 440.1A, and integrate this process with the exposure assessment process.

3. **Increase management attention on controls for waste generator activities to ensure compliance with Pantex and external requirements and that waste management work is performed within controls.** Specific actions to consider include:

   - Evaluate the effectiveness of waste generator training. Consider mandatory training for BWXT generators and their supervisors, mandatory BWXT or equivalent generator training for subcontractors, a process to confirm that the generator’s waste management training is current, waste generator training conducted by a knowledgeable Waste Operations Department manager, and a certification process for becoming a waste generator.

- Ensure that signs and other posting involving waste management functions at the point of generation are current and reflect actual requirements.
- Evaluate the ad hoc movement and collection of waste to ensure that such activities remain within plant and external requirements.
- Ensure that the material evaluation forms reflect the actual processes that generated the waste.
- Ensure that waste generators clearly understand plant and external regulatory requirements and recognize that incorrect labeling can inadvertently create confusion as to when hazardous material becomes hazardous waste.
- Ensure that less-than-55-gallon hazardous waste accumulation areas are managed within applicable plant and external requirements.

BWXT – Nuclear Explosives Operations

1. **Ensure that processes for control of radiological work and entries into Radiation Areas meet all institutional and regulatory requirements and that radiological information is included in all written radiological work authorizations, whether via RWP or procedure.** Specific actions to consider include:

    - Revise the Radiological Control Manual and Radiological Operations Control Manual to properly address radiological work control mechanisms used to control work in weapons program radiation areas.
    - Revise the technical basis document to ensure consistency with institutional and regulatory requirements, and provide appropriate linkages to institutional manuals.
    - Develop general RWPs to address individuals who enter Radiation Areas that are not working under an alternate radiological work control document, such as a NEOP.
    - Determine the root causes for the failure of both Engineering and Radiation Safety to ensure that all NEOPs contain radiological conditions, as is required by institutional documents.
    - Ensure that all radiological work authorization documents, whether RWPs or procedures, contain information on the magnitude and type of radiological hazards present.

2. **Strengthen mechanisms to ensure compliance with ES&H requirements that are not specified in a NEOP or NEEP.** Specific actions to consider include:

    - Reinforce management expectations for compliance with ES&H requirements through training, safety meetings, and other employee communications.
    - Ensure that NEOPs and NEEPs either contain all required steps extracted from general use procedures or provide specific references to the general use procedures at the appropriate NEOP/NEEP step.

- Consider establishing a requirement for review of all general use procedures referenced in a NEOP prior to performing work.

- Provide enhanced remedial training on chemical compatibility hazards and controls. Ensure that training reinforces expectations to follow posted requirements.

- Consider developing a consolidated set of general ES&H hazards and requirements tailored specifically for PTs or other job positions based on a job task analysis.

BWXT – Applied Technology

1. **Improve the implementation and execution of the BWXT PSM program within the Applied Technology Division.** Specific action to consider include:

   - Ensure that Manual 00055 is updated to reflect the safety items and controls identified in the new PHAs.

   - Establish a risk-based safety baseline for structures, systems, and components for each Applied Technology facility covered by the PSM standard.

   - Develop a configuration management system and system engineering approach for non-nuclear hazard facilities and/or processes that are important to safety.

   - Ensure that the Applied Technology Division operating procedures and developmental instructions include a discussion of hazards.

   - Conduct an assessment of the effectiveness of the execution of the BWXT PSM standard program, with a particular focus on the HCE process.

BWXT – Maintenance

1. **Implement an effective schedule management process for maintenance craft that gains commitments from all necessary support personnel and minimizes coordination issues between shops.** Specific actions to consider include:

   - Conduct daily Maintenance plan-of-the-day meetings that include shop supervisors or coordinators, planners, and representatives from other organizations that may be required to support maintenance activities (e.g., fire department, industrial safety, industrial hygiene, and operations).

   - Use the daily meetings to review a 7-day look-ahead schedule.

   - Conduct weekly meetings to review a 30-day look-ahead schedule.

   - Publish schedules so that all necessary support personnel have the requisite information.

   - Implement an effective project management software system that can be used to track scheduled maintenance activities.

- Establish performance criteria for scheduled versus unscheduled maintenance. On a daily basis, track hours spent by shop on scheduled versus unscheduled maintenance activities. Set a goal (e.g., 80 percent) for the percentage of craft hours spent on scheduled maintenance activities.

2. **Improve hazards analysis performed in connection with work planning.** Specific actions to consider include:

   - Provide planners with a tool that clearly links identified hazards to the appropriate control standards, including specific recommended controls that can be included in the work package.

   - Establish clear standards for conducting job site walkdowns as part of the planning process. Include requirements for planners, supervisors, craft personnel, industrial hygiene personnel, and safety personnel as part of the walkdowns when specific hazards are identified that may be beyond the hazards encountered every day (such as mold, hazardous chemicals, stray electrical currents, asbestos, and beryllium).

   - As part of the current process to collect JSHAs into a common location, conduct detailed, critical reviews of existing JSHAs to ensure that hazards are appropriately analyzed and that specific controls are identified.

   - Make JSHAs more readily available to affected crafts, and ensure that the JSHAs are useful and used by the craft as part of pre-job briefs.

3. **Improve identification of controls within work packages.** Specific actions to consider include:

   - Use signature verification prior to that start of work to verify that specific controls are understood and implemented prior to work.

   - Conduct regular observations of work by managers and supervisors to ensure that controls are appropriately applied during work.

   - Ensure that when controls are specified, they are supported by appropriate analysis that validates that the control is sufficient (e.g., noise surveys, air sampling, work site evaluations, and/or reference to an MSDS).

BWXT – Subcontractor Construction

1. **Convey expectations for strict compliance with ES&H requirements in subcontracts.** Specific actions to consider include:

   - Use the Subcontractor Oversight Board as a forum to periodically provide feedback to subcontractors on the extent to which past activities have met expectations.

   - Increase the focus on compliance with safety requirements in subcontracts during safety inspections.

   - Consider more frequent use of the provision in subcontracts (Specification 01561, Part 1, Section 1.8.E) to hold subcontractors accountable for costs associated with non-compliance.

2. **Ensure that competent persons designated by subcontractors have sufficient knowledge of hazards and required controls.** Consider interviewing each proposed competent person to ensure that he/she has the requisite knowledge of hazards and controls.

3. **Formalize requirements for SME involvement in hazards and exposure assessments for activities where subcontractors do not demonstrate sufficient knowledge of DOE standards or where DOE imposes expectations that are more stringent than general industry expectations.** Specific actions to consider include:

   - Establish a set of subcontractor activities or tasks that should be reviewed by BWXT SMEs on a routine basis (e.g., beryllium, hoisting and rigging, radiological, and chemicals with American Conference of Governmental Industrial Hygienists threshold limit values) and require that these activities be reviewed by a BWXT SME.

   - Establish formal guidance for BWXT SME review and approval of AHAs.

   - Document required follow-up actions from project subcontract technical representatives, construction safety and radiation safety personnel, or SME reviews, and provide administrative controls, such as hold points in AHAs, to ensure future compliance.

4. **Increase efforts to ensure that workers are aware of identified hazards.** Specific actions to consider include:

   - Require the utilization of toolbox or pre-job briefs and incorporate discussion of AHA and SWP hazards and appropriate controls relevant to the work to be conducted.

   - Develop a checklist or similar tool to be used by individuals conducting briefings to workers. Ensure that items from AHAs, such as potential hazards and requisite controls, are described and that the planned activities in which those hazards could be encountered are discussed.

   - Attach documentation to worker briefings for reference, such as Industrial Hygiene exposure assessments, hot work or dig permits, or other such documents.

5. **Increase the rigor associated with evaluation and implementation of hearing protection requirements and monitoring of noise levels to ensure that representative sampling is conducted for such activities as drilling operations or construction jobs that involve power tools and/or equipment with the potential for generating noise levels greater than 90 dBA.** Specific actions to consider include:

   - Evaluate current drilling or other heavy equipment to determine whether monitoring data is adequate to ensure that appropriate controls have been established and whether other hearing conservation program requirements are warranted.

   - Provide additional guidance to subcontractors concerning implementation of noise monitoring or personal dosimeter sampling in order to obtain accurate assessments of the potential for worker exposures.

   - Consider the use of personal noise dosimetry to supplement direct measurements of sound levels.

6. **Improve the quality of documented AHAs.** Specific actions to consider include:

- Conduct a review of current JSHAs/AHAs to ensure that requirements and expectations outlined in SWPs and Division 1 Specifications are sufficiently applied at the working level.

- Develop AHA and SWP guidance documents to address the specific format and information to be included in each of these documents, and provide additional guidance to ensure that BWXT expectations are met.

- Include hazards and controls specified in MSDSs in AHAs.

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APPENDIX D

Feedback and Continuous Improvement (Core Function 5)

D.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluation of feedback and improvement processes at the Pantex Plant included an examination of the DOE Pantex Site Office (PXSO) and BWXT Pantex, LLC (BWXT) environment, safety, and health (ES&H) programs and performance. The OA team examined PXSO line management oversight of Pantex Plant integrated safety management (ISM) processes and implementation, including selected aspects of management roles, responsibilities, and authorities. The OA team also reviewed BWXT institutional processes, such as assessments and inspections, corrective action/issues management, injury and illness investigation and reporting, lessons learned, the employee concerns program (ECP), and activity-specific processes, such as post-job reviews.

D.2 RESULTS

D.2.1 National Nuclear Security Administration (NNSA) and PXSO Line Management Oversight

NNSA Headquarters

NNSA has primary responsibility for the Pantex Plant. The NNSA Office of the Deputy Administrator for Defense Programs is the lead program secretarial office for the Pantex Plant. As such, it has overall Headquarters responsibility for programmatic direction, funding of activities, and ES&H at the site.

The Office of Operations and Construction Management prepares a quarterly report for senior NNSA management in accordance with DOE Policy 450.5, *Line Environment, Safety and Health Oversight.* Reports for the third and fourth quarters of fiscal year (FY) 2004 provided summary-level ES&H information for senior management. No formal procedure guiding the production or distribution of these reports was available.

Roles, responsibilities, and authorities for ES&H/landlord management flow from the DOE Functions, Responsibilities, and Authorities Manual (FRAM), through the NNSA FRAM, to the PXSO FRAM, to the PXSO Quality Assurance Plan. NNSA Headquarters and PXSO managers communicate regularly, including several scheduled weekly phone calls. Senior PXSO managers frequently participated in NNSA leadership coalition meetings. The PXSO Senior Technical Advisor participates in a weekly phone call with the Chief of Defense Nuclear Safety on nuclear safety issues.

PXSO

Roles, Responsibilities, and Authorities. PXSO personnel demonstrated an adequate understanding of their assigned roles, responsibilities, and authorities. PXSO Procedure 103.4.0, *Functions, Responsibilities and Authorities Manual (FRAM),* and PXSO Procedure 101.1.0, *Quality Assurance Program (QAP),* adequately define the PXSO responsibilities and reflect the requirements of the DOE and NNSA FRAMs. PXSO procedures generally provide adequate guidance on assigned roles, responsibilities, and authorities. PXSO and other site tenants (i.e., Office of Secure Transportation and the Sandia Weapons Evaluation Test Laboratory) have established adequate Memorandums of

Agreement. Service Level Agreements between PXSO and the NNSA Service Center are current and support an adequate understanding of roles, responsibilities, and authorities. However, there is currently no Service Level Agreement to support PXSO Federal Training and Technical Qualification Programs (TQPs).

Federal Employee Occupational Safety and Health Program (FEOSH). Pantex Procedure 510.6.1 requires periodic surveys of Federal workplace areas, and appropriate correction of any deficiencies identified. Some limited-scope assessments (e.g., testing of drinking water for copper and lead, and several ergonomics assessments) were conducted in the past year, and improvements have been implemented as a result. According to the FY 2005 self-assessment schedule, a FEOSH program self-assessment is planned for late FY 2005. However, the PXSO FEOSH Manager indicated that the most recent comprehensive workplace survey was conducted several years ago, and documentation of that assessment and identified deficiencies/corrective actions was not available.

Quality Assurance. PXSO has an approved *Quality Assurance Plan* that adequately describes roles, responsibilities, and authorities. Weapons quality assurance is defined by the Quality Assurance Procedures Manual (QAPM), which is administrated by NNSA. The QAPM is outdated and is in need of revision (planned later this year). Quality assessments are typically conducted every three years; the most recent quality assessment review of the Federal and BWXT weapons quality assurance programs was conducted in May of 2001, and assessments of PXSO and BWXT programs are planned for April 2005 and June 2005, respectively.

There have been substantial reductions in the number of Federal quality assurance personnel assigned to the Pantex Plant in the past three years. However, an engineer and quality assurance specialist have been added to PXSO staffing in recent months. Despite challenges associated with staff reductions and transition, the PXSO staff exceeded the quality assurance goals (for scheduled surveys) in three of four areas in FY 2004.

The technical quality and rigor of assessments/surveys reviewed were adequate. Findings are formally communicated to the contractor, corrective action plans are developed, corrective actions are tracked to closure, and corrective actions are validated in most cases. Each specialist and engineer is responsible for record retention, filing, and corrective action tracking. No automated system is available to manage issues or track corrective actions.

Technical Qualification Program. PXSO is effectively managing the TQP. PXSO has an effective system for the follow-up and reporting of TQP status and planning, and maintains good files and records. However, the most recent comprehensive assessment of the PXSO TQP was conducted in October of 1999, and no self-assessment of the TQP is scheduled for 2005. Such assessments are generally conducted every three years.

Issues Management and Corrective Action Tracking. PXSO is currently transitioning to a new system – PER/E*STARS – for issues management, tasking, lessons learned, required reading, and corrective action tracking. The new system is currently being populated with data. PXSO staff have received initial training on the system, and additional training, including practical applications, is scheduled in the near future. A previous issues management procedure has been cancelled, and a new procedure is not yet developed to provide direction on issues management implementation.

The PXSO FRAM identifies the Assistant Managers (AMs) as having the responsibility to ensure adequate issues management tracking/trending of operational awareness data, and for tracking and validating corrective actions. Issues management tracking is currently accomplished by various informal methods within the AM organizations, including weekly reports (AM Oversight & Assessments, and AM Nuclear Engineering) and weekly division staff meetings (AM Operations, AM Contract Administration and Business Management, and AM Environmental and Site Engineering Programs). Although the weekly reporting processes are not performed according to a structured process, they are effective in communicating operational awareness and issues management information to the AMs, and AMs are adequately relaying operational awareness information to PXSO senior management at weekly staff meetings.

However, document reviews and interviews indicate that corrective actions are not always being tracked to closure and validation of corrective actions is not always accomplished. There is no routine mechanism for tracking the status of open corrective actions resulting from assessments of the Pantex Plant contractor. In addition, PXSO does not have a structured process for trending assessment and operational awareness results across PXSO (i.e., above the AM level).

Finding #8. PXSO has not ensured that all corrective actions are tracked to closure and validated to be effective (as required by PXSO procedures), that operational awareness data is analyzed for trends, and that deficiencies in construction, maintenance, and worker safety aspects of production/operations are adequately identified and corrected.

Some actions are underway to partially address this deficiency. BWXT is establishing a mechanism (an Intranet webpage) that will provide information on assessments (including internal, external, and third-party), and a corrective action tracking system that will support both BWXT and PXSO. PXSO personnel indicated that corrective actions from previous assessments would be re-visited the next time that the corrective action functional area is assessed. The AM for Contract Administration and Business Management plans to validate closure of corrective action plan items from several assessments conducted in the last year, including the NA-124 review of contractor training. In addition, the AM for Operations has an informal system for tracking readiness assessment pre- and post-start findings, nuclear explosive safety study findings, and authorization basis "conditions of approval."

Facility Representative (FR) Program. The FR program documentation is outdated, and current procedures are not reflective of the current organization and current processes (e.g., no mention of FR weekly reporting, and requires use of the Issues Management and Tracking Program/Field Activity Database, which has been discontinued). PXSO indicated that revisions of FR documents are in the approval process.

The PXSO AM for Oversight and Assessments indicated that their staffing goal is nine FRs and that that level of staffing would be adequate to cover nuclear explosive operations and high explosive operations at Pantex. PXSO currently has six fully qualified FRs, two recently hired individuals (one awaiting clearance, another to report in March 2005), and plans to hire one FR intern to support the FR pipeline initiative.

While the current staffing shortages are being addressed through new hires, FRs currently spend about half of their time on operational readiness reviews/readiness assessments. As a result, FRs are not available to cover their assigned facilities for extended time periods (up to several weeks at a time) and are not performing the primary function of FRs, as delineated in PXSO program documentation and DOE STD-1063-2000, *Facility Representatives*.

The AM indicated that assignment of an FR to readiness assessment activities does not unacceptably degrade operational awareness because all other PXSO FRs provide some level of coverage, and the FRs are interchangeable (there are no differences in the qualifications of PXSO FRs). However, the AM indicated that further reductions in FR field time (should the Service Center not provide required technical personnel to support readiness assessment activities) would not be acceptable.

The results of this OA inspection indicate that FRs are focusing primarily on nuclear safety. As discussed in Appendix C, the controls for nuclear explosive hazards have improved and are conducted with rigor and strict procedural compliance, indicating that the FRs' focus on nuclear explosive hazards has had a positive impact. However, as indicated in Appendix C, there are weaknesses in a number of areas (maintenance, construction, and worker safety) in nuclear facilities or that could impact nuclear facilities. These results indicate that PXSO (either through FRs or other assessment/operational awareness activities) are not sufficiently focusing on activities that impact worker safety and that could credibly impact facility safety (see Finding #8).

PXSO reports FR performance indicators but does not have an adequate auditable basis for their reported numbers. DOE-STD-1063-2000, *Facility Representatives*, and a PXSO procedure require PXSO to report performance indicator information (e.g., FR field time) on a quarterly basis. This performance indicator information is compiled at DOE Headquarters and used to brief Secretarial Officers of the Department and the Defense Nuclear Facilities Safety Board. Additionally, this information is used to evaluate the performance of field element managers and the overall FR program across DOE/NNSA. However, no formal records are maintained to document the basis for the reported performance indicator data. Further, the guidance for classifying activities (e.g., which activities are to count as field time) is inconsistent and unclear. In some cases, PXSO practices are not consistent with the issued guidance (e.g., time spent preparing for readiness assessments may be counted as field time). A clear understanding of what should be credited as "field time" and what is more appropriately "contractor oversight time" is needed. Because of these factors, the performance indicator data is not sufficiently reliable to support FR staffing and coverage decisions and required Headquarters performance indicator reporting.

Finding #9. PXSO does not have an adequate technical basis for reporting FR performance indicators, or for assumptions in analyzing FR coverage.

PXSO Assessment Program. PXSO Procedure 110.2.1, *PXSO Assessment Program*, was approved in August 2004 and is generally adequate. It describes a graded approach for the required rigor and formality of assessments. PXSO develops annual line oversight plans that delineate the assessments to be performed during the year by each cognizant AM. While the plans are a useful initial step, they do not provide information about the assessment scope, the assessment team leader, or the planned duration of the assessment. In addition, PXSO has not developed a longer range master assessment schedule that provides a comprehensive list of required assessments over a longer period (e.g., 3 to 5 years).

The PXSO assessments that were reviewed by OA, most of which were performed before the new procedure was finalized, varied in their technical content and rigor. Some assessments had well-defined scopes and criteria, while others provided limited information about the assessment and the results. In a number of instances, PXSO assessments identified deficiencies effectively. However, as discussed relative to Finding #8, tracking and validation of corrective actions was not consistently adequate. Further, the results of this OA inspection indicate that PXSO has not been effective in identifying and correcting deficiencies in maintenance, construction, and production operations (excepting hazards associated with nuclear explosives and explosives). As discussed in the BWXT section of this appendix, NNSA directed PXSO to perform an assessment of ISM implementation. PXSO directed BWXT to perform the assessment, and PXSO personnel participated on the activities. The assessment identified a number of issues, but there were weaknesses in the quality and rigor (see Finding #8).

PXSO Self-Assessment Program. PXSO has made good "first strides" in putting a self-assessment process in place. PXSO has developed a procedure, *PXSO Self-Assessment Program*, which is responsive to guidance provided by NNSA.

However, there are weaknesses in several aspects of the PXSO self-assessment program. The self-assessments did not always demonstrate sufficient evaluation of program efficacy, evaluation for possible systemic issues, prompt entry of corrective actions into a tracking system, timely documentation of closure and validation of closure, support for lessons learned, and timely implementation of corrective actions. In addition, PXSO's annual report of its self-assessment program, which was forwarded to Headquarters, did not include a summary of results of the self-assessments conducted and did not include an overall assessment of the PXSO program. Further, PXSO does not have a longer term (e.g., 3 to 5 years) master assessment schedule that outlines the planned PXSO self-assessment activities and demonstrates a comprehensive approach to assessing the full spectrum of PXSO functional areas. PXSO established annual schedules for planned self-assessment activities, but the schedules provide no information on the scope, planned duration, or leadership of self-assessment activities.

Although there are weaknesses in the current self-assessment program, PXSO is making improvements in several areas. The PXSO AM for Contract Administration and Business Management has developed a FY 2005 *CABM Self Assessment Plan* that demonstrates a significant improvement in self-assessment planning. A recent self-assessment of the implementation of the safety systems oversight program that was performed in accordance with the new procedure was of good technical quality and rigor, and was consistent with the intent of NNSA guidance.

Employee Concerns Program. Contrary to the requirements of DOE Order 442.1A, *Department of Energy Employee Concerns Program*, PXSO does not have a documented program plan describing methods and processes used to implement program requirements. The order requires an annual management assessment of the program; the most recent formal assessment of the program was in FY 2000. There have been no safety-related concerns submitted to the PXSO ECP for the last two years. Some BWXT employees indicated that they had been told that the PXSO ECP was not intended for BWXT employees; PXSO and BWXT need to ensure that correct information is communicated about the availability of the PXSO ECP to all site personnel, including Federal, contractor, and subcontractor employees. The web site address provided on the plant ECP posters is not functional, and has been non-functional since at least May 2004.

Finding #10. PXSO does not have a documented program plan/procedure for implementing the employee concerns program requirements.

Contract Management and Assessment of Contractual Performance Fees. The AM for Contract Administration and Business Management has a draft procedure that describes an effective process for contract fee administration. However, the procedure has been in draft since June 2004 and has not been approved and issued. Although the procedure is in draft, PXSO has effectively implemented the general process described in the procedure for the past year and has developed adequate performance evaluation plans and performance evaluation reports for FY 2004. ES&H issues were appropriately identified and contributed to the assigned scores. PXSO's midyear feedback was effectively communicated to and used by BWXT, contributing to improved end-of-year performance.

Lessons Learned. The PXSO FRAM requires the AM for Oversight and Assessment to monitor and assess the contractor's lessons-learned program and to participle in the DOE-wide sharing of lessons learned. The AM for Operations has drafted a lessons-learned procedure for his division, but PXSO does not have a comprehensive lessons-learned process. In addition, PXSO is not conducting oversight of the BWXT Lessons Learned Program, and PXSO personnel are not routinely receiving lessons-learned information.

Finding #11. PXSO has not established and implemented a lessons-learned program as required by NNSA and PXSO Functions, Responsibilities, and Authorities Manuals.

D.2.2 BWXT

BWXT has made a number of improvements in feedback and improvement processes and performance since the 2002 OA inspection. As discussed below, the basic processes of feedback and improvement have been established, but implementation weaknesses still exist in a number of areas.

Assessments. BWXT conducts a variety of assessment activities that identify deficiencies in safety processes, conditions, and performance, and has instituted process improvements and initiatives to improve assessment products. BWXT organizations use a risk-based model to prioritize formal independent and management assessments of safety and business-related processes and functional areas. Each division identifies and schedules its assessments annually, based on resource determinations and the results of a scoring system that includes consequences and probability grades in the areas of quality, safety, security, and performance. As part of this process, numerous functional area assessments are identified by the ES&H organization and the Emergency Services Division. The division-specific assessment schedules are compiled into a master Contractor Assurance System (CAS) schedule, which is monitored by the Quality and Performance Assurance Division and communicated to PXSO, and forms a part of the overall assessment of the contractor's performance.

In addition, several organizations conduct less formal inspection activities. Infrastructure department first line supervisors conduct numerous, documented walkthrough inspections and observations of work. Manufacturing first line supervisors and safety representatives conduct numerous documented observations of work activities focusing on procedure adherence. Industrial Safety Department representatives conduct periodic, planned inspections of all Pantex facilities, focusing on OSHA requirements and using formal checklists. Independent assessments related to safety processes and validations of corrective actions to Price-Anderson Amendments Act issues are conducted by the Quality and Performance Assurance Division.

Construction subcontract technical representatives and safety representatives conduct routine, documented health and safety inspections of subcontractor work sites and activities. Recent additions to the construction safety staff have allowed for more frequent inspections and have resulted in identification of more performance issues for corrective action. BWXT management has recently implemented several initiatives to improve the effectiveness of its assessments. A Quality Assurance Six Sigma review of the management assessment program was performed in July 2003 to address the problem that assessments were not consistently performed to identify and evaluate processes; this review resulted in four corrective actions. The plant standard for independent and management assessments was revised, and a management assessment guidance manual was published in September 2003. Tutoring and training on conducting assessments is provided by Quality and Performance Assurance Division personnel when requested by line managers. The Quality Assurance Department performs evaluations of all management self-assessments and provides feedback to assessment team leaders. The adequacy of

BWXT self-assessments (including a focus on the reasons that field execution issues were not being sufficiently identified) was the subject of discussions and presentations at a recent meeting of the Executive Issues Review Board, at the request of the Deputy General Manager. During this OA inspection, an ISM and Business Management Office was created and a Program Director for ISM reporting to the General Manager was appointed. One of the stated objectives of this new program management organization, reporting directly to the General Manager, is to bring about a more strict level of adherence to self-assessment requirements and an increased understanding about the formality of operations, an expectation of ISM.

Despite the above positive attributes and initiatives, BWXT assessments have not been sufficiently focused on worker safety and the attributes of ISM or rigorous enough to consistently and effectively identify ISM process and performance deficiencies. The plant standard for assessments has not been updated to reflect the new issues management process, which was implemented in the summer of 2004. In addition, the terminology is inconsistent and/or terms for assessment results are not defined in various standards and program documents that describe independent assessments, management assessments, and issues management. The plant standard and guidance do not specify any formal communication/validation process for assessment results between the assessors and the assessed organization. BWXT is drafting new process description documents and work instructions that will replace plant standards; these new documents are being developed as part of a comprehensive conversion of the sitewide document system to a process-driven approach.

Production line management self-assessment plans do not sufficiently focus on industrial safety, industrial hygiene, or work planning and control. The primary safety focus has been limited to explosives and nuclear safety, and much of the overall assessment activity is related to quality. Industrial Hygiene personnel do not participate in safety inspections of facilities, and checklists were primarily limited to industrial safety functional areas. Management or user involvement in the safety inspections are limited to the line Facility Representative, and completed checklists are not distributed to the affected organization or inspection participants. With the exception of some feedback and improvement system management assessments by Quality and Performance Assurance, no management or independent assessments of the guiding principles or core functions of ISM were scheduled for FY 2004, and only one division (Infrastructure) has scheduled an ISM assessment for FY 2005.

Many assessments do not have sufficient depth, rigor, and focus on performance and safety programs to effectively measure the adequacy of processes and performance. Many assessments involved little observation of work or verification that requirements in plant standards were being properly implemented. For example, a 2004 assessment of maintenance equipment determined that a criterion for identifying and addressing damaged or worn tools was met because a plant standard required inspection of hoisting and rigging equipment. OA field inspections of non-nuclear hoisting and rigging equipment identified that inspections were not being performed, resulting in a BWXT decision to temporarily suspend all related operations until the deficiencies were addressed. A 2004 Infrastructure assessment of the use of maintenance history and analysis of problems for work planning addressed feedback with regard to preventive maintenance procedures and determined that criteria were met, but failed to address the fact that safety and planning issues were not being documented on work orders by crafts and supervisors at the end of corrective maintenance activities. Similar weaknesses were noted in an assessment of post-maintenance testing. The OA team identified several instances where conclusions in the NNSA-directed ISM assessment conducted in August and September 2004 were in error or non-conservative. The results of this extensive, three-part assessment were not clearly categorized using the terminology specified in the plant standard; all deficiencies were categorized as “Areas for Improvement,” and many of the results statements were not clearly written to describe the issue and were not clearly supported by the assessment text. A June 2004 ES&H assessment of the Pantex PSM program (for non-nuclear explosive safety operations per 29 CFR 1910.119) did not identify process inadequacies such as those noted by OA in this inspection (e.g., safety hazards in operating procedures not identified, management of change criteria not effective, and deficiencies in process hazards analysis and process safety information and audits).

Finding #12. BWXT has not implemented a fully effective assessment and oversight program that rigorously and proactively evaluates safety management systems and performance.

Issues Management. BWXT has made a number of changes to issues management tools and processes in the last year. Several examples clearly demonstrate that adverse trends and unsafe conditions/practices have been identified by analysis of injuries and safety observations, and that effective corrective/preventive actions have been identified and implemented or are in progress. For example, BWXT identified adverse trends with laceration injuries and instituted a cutting tools/cut resistant gloves policy; since the new policy was implemented, there have been no laceration injuries resulting from cutting tools. Studies and corrective actions are ongoing to address slips, trips, and falls, and a new sitewide traffic safety program is being instituted based on events and observations collected from the behavior-based safety program. A new issues tracking system called PER/E*STARS provides an effective tool for identifying and tracking all aspects of issues and their resolution. Over a thousand issues have been documented as problem evaluation requests (PERs) since May 2004. The issues tracking tool is also used to manage the disposition of lower significance issues that may not be compliance deficiencies (i.e., observations and opportunities for improvement). The process for conducting critiques, analyzing issues, and developing corrective actions, which BWXT calls Causal Analysis/Mistake Proofing (CA/MP), was enhanced in 2003, including training of process facilitators by an external consultant.

Monthly meetings of the Executive Issues Review Board, comprised of senior managers from all divisions and programs and chaired by the Deputy General Manager, is an effective tool for communicating significant issues and responses to events and the status of corrective/preventive actions to senior management. Minutes of these meetings reflect proactive, self-critical analysis of events and corrective actions.

Despite these improvements in issues management tools and processes, weaknesses in the issues management plant standards and inconsistent and inappropriate implementation of those standards adversely impact the effectiveness of issues management at the Pantex Plant. The plant standard for issues and deficiencies management contains a number of ambiguities and other weaknesses that inhibit its value as a management tool. The standard does not provide any guidance or direction for timeliness of documenting issues on PERs or in developing corrective action plans. The issues management standard and the FY 2005 CAS Plan imply that a CA/MP process is used for every issue, but the CA/MP standard allows management to exempt an issue from this process. The PER form does not have a field for documenting the explanation or justification for exempting an issue from CA/MP. The critique and CA/MP standards have not been updated to reflect the PER/E*STARS issues management process. The CA/MP standard does not reflect the revised causal analysis approach and still refers to the use of forms that have been canceled. These standards are being converted to process descriptions and work instructions but the issue dates have been delayed and the disconnect between written procedures and actual practice has continued for approximately six months. Training on PER/E*STARS is voluntary and has been limited to the mechanics of the process rather than the purpose of the tool and the requirements of the issues management process.

More significantly, issues management-related standards and management expectations are not being implemented consistently or appropriately by line organizations, and line management has not been held accountable for inadequate implementation. Numerous deficiencies were identified with PER documentation and causal analyses, indicating a lack of discipline and training by division point of contacts and line and support organizations, insufficient direction and monitoring by program owners, and inadequate implementation planning to ensure consistent and accurate use of the new processes and tools.

A number of organizations are not using the PER/E*STARS tool for managing issues. The Safeguards and Security Division uses its own issues tracking system, in part because of the need to limit distribution of security-related information. However, excluding non-security issues from the institutional process bypasses the established requirements for issues management and excludes issue data from trend analysis processes. Engineering is not documenting identified deficiencies in calculations on PERs. Manufacturing management self-assessments do not identify results using the same terminology as specified in the plant standard and did not document any issues from its self-assessments on PERs in FY 2004 or calendar year 2005. Quality and Performance Assurance has documented weekly Defense Nuclear Facilities Safety Board reports into PERs, but designated them for “tracking only” without ensuring that any identified issues have been addressed by the process. Quality Assurance does not document inadequate closures of Price-Anderson Amendments Act issues when they are identified during validation assessments. Rather than using the PER process to drive management of issues, PERs are being written after the completion of evaluations and determinations of actions, sometimes months after the event or identification of a deficiency.

Formal CA/MPs are not always performed when appropriate. At the time of this inspection, over 260 of almost 600 open PERs were overdue for closure, and many were months overdue, some with action due dates as old as May 2004. Contrary to the plant standard, corrective actions for Occurrence Reporting and Processing System (ORPS) events documented on PERs are not identified or tracked using the PER process. Actions were logged into the old tracking system even when a PER had been written for an issue. The PER fields for extent of condition, safety significance, and generic implications are often marked as not applicable, even when the issues clearly relate to potentially systemic problems or have applicability beyond the specific examples cited. For example, an Applied Technology self-assessment cited one specific example of an issue describing a lack of chemical hazard identification in operating procedures. No CA/MP was held for this issue, the PER field for extent of condition was marked as not applicable, and the corrective action only indicated that the cited procedure would be updated during planned reviews of operating procedures. There is no indication that this issue was evaluated for applicability to other procedures in the department being evaluated, to other departments in the Division, or to other Pantex organizations. Fields for closure evidence are often marked as not applicable, although required by the plant standard. PER 2004-0587 was closed by citing that the issue did not belong to the assigned organization, with no transfer to a new owner and therefore no resolution of the issue.

Many formal causal analyses are being performed and many of those are performed well. However, root causes are not consistently accurately identified, and appropriate recurrence controls are not always identified for events and issues documented on PERs. For example, the CA/MP for a June 2004 reportable event (related to inadequate post-modification corrective actions) was limited to fixing the specific hardware and related drawings. However, with the exception of issuing a lessons-learned bulletin focused on the specific conditions of this system and equipment, the PER did not address analysis or recurrence controls for the specification of inadequate testing or the inappropriate response of test personnel to testing anomalies identified in the issue description. The analysis and specified corrective actions for another recent reportable event (involving the lack of backfill gas in a sealed insert container) reflected many of the above deficiencies. Although the issue was determined to be caused by inadequate controls in a technical procedure, the PER fields for extent of condition, safety significance, and generic implications were marked not applicable, and the analysis and actions did not address the possibility of similar deficiencies in other processes or procedures. All closure documentation fields were marked not applicable, and the cited causes addressed for each corrective action were statements of the problem, not causes. The CA/MP report did not adequately describe two identified root causes (referred to in the report as "main" causes) and did not provide linkage between the identified causes and corrective/preventive actions. For example, one of the causes cited was "possible distractions of Production Technicians…" but the possible distractions were not identified. The PER specified seven "long term corrective actions" but did not address, document, or provide closure evidence for sixteen immediate interim corrective actions listed in the CA/MP. One of the final corrective actions was to change the category of the involved technical procedure from General Use to Specific Use, but the need for this was not identified as a contributing cause or discussed in the CA/MP report. The fact that this event was not reported until six days after identification was not addressed in this PER. Several other administrative weaknesses in this CA/MP report included a lack of a date on the report and a lack of signatures by all team members.

Numerous other examples of inadequate issues management implementation were identified by the OA team and several more are described in the following section on injury and illness investigation.

Finding #13. BWXT has not fully or effectively implemented issues management processes that ensure that safety deficiencies are appropriately documented, rigorously categorized, and evaluated in a timely manner, with root causes and extent of condition accurately identified, and appropriate recurrence controls identified.

Lessons Learned. The Pantex lessons-learned program is in transition and has made significant progress in management, processes, and tools since the 2002 OA inspection. A variety of lessons learned and safety alerts are posted to the internal BWXT database and are communicated to Pantex workers through a variety of mechanisms, including bulletin board postings, electronic mail to managers and staff, and presentations at safety meetings. With a few exceptions, the recently revised standard defines an adequate lessons-learned program. The new Program Manager is engaged, conscientious, and progressive. The Program Manager conducted a formal self-assessment of the program in March 2004, resulting in a revision to the plant standard and lessons-learned processes. The intranet website database provides a comprehensive searchable database of information going back to 1997 with over 700 lessons learned and the linkage to PER/E*STARS provides formal electronic communication and documentation in one location. The website provides easy search capabilities and access to lessons learned, tools, templates, and instructions for developing lessons learned, and links to other lessons-learned sources and databases. A formal four-hour classroom training session on the management of lessons learned has been developed for division and department points of contact, department and program managers, and work planners and is planned for February 2005.

One significant positive attribute was the Infrastructure training organization's aggressive and proactive program that searches out appropriate lessons learned and incorporates them into routine safety meeting agendas and ongoing training courses. This department publishes a monthly ISM newsletter, with a number of articles communicating safety-related lessons learned. The organization also solicits questions and feedback from Infrastructure workers and supervisors, many related to safety, and publishes the answers, and posts them for widespread access.

Notwithstanding the progress made in this feedback and improvement program, lessons learned are still not being consistently screened for applicability, with appropriate actions identified and applied, and internal lessons learned are not being shared with the DOE complex. Although the lessons-learned plant standard indicates that SMEs identify lessons learned from external sites and notify the Program Manager, the standard does not clearly identify personnel or delegate a specific responsibility to SMEs to search out, identify, or review for applicability external lessons learned. Further, BWXT does not have a defined list of topical/functional SMEs. SMEs have not been included in the population of personnel targeted for the upcoming lessons-learned training. Available lessons-learned information from DOE Headquarters Office of Environment, Safety, and Health (EH) is not being effectively screened for applicability and used at Pantex to prevent safety deficiencies and events. The EH special report on hoisting and rigging (January 2004) and a subsequent report in the June 2004 Operating Experience summary, which addressed events related to cranes and hoists similar to those used at Pantex, were not reviewed or communicated to Pantex personnel as lessons learned. Similarly, the EH special report on electrical safety, citing many DOE complex events and lessons learned, was not identified as a lesson learned at Pantex. Likewise, the six associated electrical "Just-In-Time" lessons-learned reports by EH issued in March 2004 (addressing excavation and blind penetration events, wiring errors, and contact with overhead wiring events) were not addressed by the Pantex lessons-learned program. Subsequent to the issue date of these special lessons-learned reports from EH, Pantex experienced several similar events, including arcing when a screwdriver contacted energized equipment in a cabinet, which was very similar to an event at another site included in the EH special report. Other recent similar Pantex events included a recent cutting of a natural gas line, hitting an energized line during blind penetration (similar events were specifically cited in the special report and one of the Just-In-Time reports), and cutting of an energized overhead line by a subcontractor.

A variety of other weaknesses in the BWXT lessons-learned program are limiting its effectiveness. Personnel interviewed by the OA team, including lessons-learned points of contact, were unable to access the Pantex lessons learned database. Input of lessons learned to the intranet database is not complete, and several months of recent lessons are not available online. The Training Review Board deleted section, department, and program managers and work planners from the target population for the planned training course on lessons learned. There has not been sufficient emphasis on documenting clear determinations of applicability of lessons and on specific actions; the primary focus has been on dissemination for reading or discussion at safety meetings. BWXT is not sharing lessons learned with the rest of the DOE complex. No Pantex lessons learned were posted to the DOE lessons-learned website in 2004. The lessons-learned plant standard specifies only that lessons from events classified as Category 1, 2, or R, a specific requirement of DOE Order 231.1, *Occurrence Reporting and Processing of Operations Information,* be posted to the website. Even when a formal sitewide lessons-learned notification is not warranted, post-job reviews and documented feedback are not being used by workers, supervisors, and managers to identify, document, and correct lessons learned from work activities.

Finding #14. BWXT has not implemented fully effective processes that consistently and rigorously identify adverse trends and lessons learned from completed work activities and external events resulting in the identification and application of appropriate preventive actions.

Injury and Illness Investigations. BWXT recordable and lost workday rates are very low compared to the rest of NNSA and the DOE complex and have been dropping for several years. Most occupational injuries and illnesses, including cases classified as first aid cases, are documented on PERs and subjected to formal investigation, typically using the CA/MP process. Injured or exposed workers complete an initial incident report when reporting to the medical clinic, describing the conditions and details of the incident. The Industrial Safety Department and the employee’s supervisor complete a Supervisor’s Accident Investigation Report form to document the evaluation of the incident and specify corrective actions. In most cases, where formal investigations were performed with PER CA/MP and reported on the Supervisor's Accident Investigation Report, they were generally well done and addressed the appropriate issues.

However, implementation of the injury and illness investigation process was not consistently performed in a few cases, in part because of weaknesses in the plant standard and in part because of inadequate implementation. Although required by the plant standard, investigations are not being performed for all injuries and illnesses, including a few cases in 2004 that had work planning and control deficiency implications. Determination of whether an investigation will be performed is made by the ES&H organization, but no criteria have been established, and justifications for not performing an investigation are not documented.

For example, nine BWXT employees were observing testing of a prototype furnace at a vendor's offsite facility when an operational event occurred and three of the employees were overcome by fumes. Subsequently, two of the workers reported to the Pantex medical clinic citing continuing respiratory symptoms. One worker exhibited symptoms for approximately one month after exposure and went to the medical clinic for three follow-up visits. The other worker went to the medical clinic for one follow-up visit. Although the standard requires immediate reporting of injuries, the event was not reported until workers returned to Pantex four days after the event. No investigation report was completed by Industrial Safety or the supervisor, and the issues management standard was not followed, even though there were work control and reporting issues and the potential for OSHA recordable exposures. A meeting between two of the exposed workers and BWXT Industrial Hygiene and Industrial Safety personnel was conducted the day after the workers returned to Pantex. The notes from this meeting indicated two further actions: to issue a lessons learned, and to analyze a gas sample collected during the event. Analysis of samples from the day of the event and a gas sample taken from the bell jar enclosing the furnace almost two months after the event indicated high levels of several toxic chemicals (e.g., from the latter test, a benzene concentration of 74 parts per million [ppm] was estimated, and the American Conference of Governmental Industrial Hygienists' specified threshold limit value of 0.5 parts ppm and a ceiling concentration of 2.5 ppm for benzene). However, the BWXT Industrial Hygienist commentary on the test results did not identify the relevance of the data to possible personnel exposure and did not identify any conclusions. Further, no formal exposure assessment was prepared by Industrial Hygiene or BWXT medical staff. Industrial Hygiene did not determine the need for continued monitoring or communication of potential over-exposures to all of the affected workers. Although a formal internal BWXT lessons learned was issued, the recommended actions were never translated into any changes in plant work planning and control processes governing offsite activities. Further, exposure to chemicals above specified limits constitutes an ORPS reportable event as defined in DOE Order 231.1A. Although meetings were held and actions were taken related to safety for the activity, there was an overall lack of rigor and conservative decision making in following plant standards for reacting to and documenting this event, analyzing exposures and causes of the event, and identifying and implementing actions to prevent recurrences for other offsite activities.

Weaknesses in the plant standard may contribute to inconsistent implementation. The plant standard has not been updated to reflect the PER process. A number of terms and expectations are not defined in the standard, such as "minority report" on the Supervisor's Accident Investigation Report; who determines the level of investigation required for each case and to what criteria; who assigns an investigation board, what criteria determines the need for a board, and just what is expected for investigations less than a formal board; and when the formal issues management process must be invoked.

Ownership and responsibility for completing the injury and illness investigations does not appear to be adequately assigned to and accepted by line management. Although a Supervisor's Accident

Investigation Report is the primary document for recording the investigation and is signed by the supervisor, in actual practice the investigation process is performed by the ES&H organization.

Employee Concerns. BWXT employees have numerous vehicles to express safety concerns, and reported concerns are being appropriately evaluated and dispositioned in a timely manner. Several processes are available and advertised that allow workers to express and get resolution of employee safety concerns, including the safety hotline, the No More Surprises program, and the formal ECP. The BWXT policy is that workers should first address concerns to their supervisors or to ES&H representatives; the above-listed processes are available to communicate concerns anonymously or confidentially. A module related to the ECP, ethics, and the BWXT code of business conduct is presented to all new employees. The safety hotline receives approximately 25 calls a year, and all calls and their resolutions are documented in a log. The resolution of hotline concerns was timely and appropriate. Feedback is provided to callers if they leave a means of contact.

The No More Surprises program, managed by the ECP office, provides a very visible and responsive process to address any kind of complaint. The formality of documentation for this process has improved since the 2002 OA inspection, although the process is still not defined in a formal procedure or plant standard. Resolutions are timely, with much improvement in the last 18 months. Few issues remain open over 30 days, except for some with long-term or capital improvement solutions. Answers are responsive and are published on the intranet. Many communications from workers to the No More Surprises program are not safety-related, and the safety-related issues are often relatively minor in nature (e.g., many parking, traffic, and walking hazards concerns or questions). This program receives approximately 50 calls each month, all of which are reviewed by the General Manager. A video presentation on the No More Surprises program by the ECP Manager and the BWXT General Manager was communicated on the site TV agenda last summer. The No More Surprises issues are being reviewed by the ECP office and the ES&H organization to identify adverse trends and multiple examples of issues with actions initiated to address the issues on a more global, preventive basis. One example is an ongoing, comprehensive report being compiled on slips/trips/falls and walking surface issues, which constitute one of the most frequently occurring types of worker injuries at Pantex; the goal of this report is to provide senior management with information to drive a more focused set of actions to improve infrastructure and worker safety awareness.

Very few safety-related issues are being communicated through the formal ECP, and the few reported issues have been of low safety significance. There are a number of weaknesses in the existing plant standard (e.g., no reference to the use of the issues management process, insufficient information on records to be maintained, and insufficient definition of the administrative process for investigating/resolving concerns in the ECP office, including the communication and maintenance of anonymity or confidentiality). The standard does not acknowledge that workers can go directly to the ECP office with concerns without first going to supervisors or using other reporting means. The No More Surprises process is not defined in the standard. A new process description and an implementing work instruction have been drafted that may address these weaknesses, but they have not yet been approved and issued.

Other Feedback and Improvement Processes. Well-attended Monthly Executive Safety Council meetings provide effective forums for communication of ES&H concerns and performance data between management and safety personnel. Meetings are conducted to a structured agenda, with formal presentations on safety performance and issues, presentations of details of reportable events and injuries by line managers, and a question and answer session. Minutes and action items are documented and tracked.

BWXT has effectively employed a behavior-based safety observation program that provides real time communication of unsafe behavior and identification and correction of safety issues based on analysis of observation data. Over 3,000 trained observers make between 1,500 and 2,000 safety observations monthly. The program is administered by eight steering committees, and three internal consultant SMEs provide oversight. The observation data is collected and analyzed, resulting in various reports identifying performance statistics, potential problem areas, and adverse trends in at-risk behaviors. Steering committees issue periodic newsletters to their organizations sharing lessons learned stories and reminders related to safety topics, adverse trends in specific at-risk behaviors, and details about the behavior-based safety program. Innovative approaches to addressing unsafe conditions identified by this program include month-long efforts to focus attention on fixing easily addressed, low-cost deficiencies (called “Can Do”).

D.3 CONCLUSIONS

PXSO is making progress on developing processes and procedures to implement DOE and NNSA expectations for line management oversight. However, a number of processes and procedures are not yet developed and others are not yet mature and effective. PXSO, through assessments, FRs, and contract evaluation is providing feedback to the contractor in a number of areas, which is contributing to improvements in various aspects of safety management. The primary focus of PXSO assessments, FRs, and operational awareness activities is on the highest priority hazards at Pantex (i.e., nuclear safety) and on the environmental program, and the results of this OA inspection indicate that PXSO has contributed to the generally effective Pantex Plant programs in these areas. However, PXSO has not been sufficiently effective in identifying and correcting weaknesses in BWXT processes for controlling other hazards (e.g., chemical hazards). Management attention is needed to ensure that timely improvements are made in a number of areas, including issues management, trending of operational awareness data, tracking and validation of corrective actions, application of lessons learned, the ECP, FR coverage, and FR performance indicator reporting.

BWXT has made a number of improvements in feedback and improvement processes and performance since the 2002 OA ES&H inspection, including establishing the basic processes of feedback and improvement. Safety issues are being identified and resolved, adverse trends and systemic deficiencies have been identified, and preventive actions are being identified and implemented. BWXT has developed annual CAS plans that define the elements of assessment and issues management processes and identify planned assessment activities. However, the development of more rigorous processes is incomplete, and line management has not consistently or rigorously implemented feedback and improvement processes. As a result, the BWXT assurance system is not fully effective in identifying, correcting, and preventing ISM-related deficiencies and events. There is an overall lack of discipline in the development, maintenance, and adherence to plant standards that is impeding the effectiveness of the contractor’s assurance system.

D.4 RATING

Core Function #5 – Feedback and Continuous Improvement…........................NEEDS IMPROVEMENT

D.5 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible DOE and contractor line management and prioritized and modified as appropriate, in accordance with site-specific programmatic objectives.

PXSO

1. **Develop and/or issue needed procedures, guidance, and program documentation for line management oversight functions**. Specific actions to consider include:

   - Develop a Service Level Agreement to support a clear understanding of shared roles, responsibilities, and authorities with regard to the PXSO Federal Training and Technical Qualification Programs.

   - Plan, schedule, and conduct an assessment of the PXSO TQP.

   - Finalize and issue a PXSO fee administration procedure.

   - Develop and issue an ECP procedure/process.

   - Monitor self-assessment activities and ensure their quality and rigor.

   - Develop a process for reporting FR performance indicators that ensures their reliability and an adequate auditable basis. Use the information to support FR staffing and coverage decisions.

   - Collectively, evaluate the current processes for assessments, FR activities, and operational awareness activities. Identify process improvements in the areas of line management oversight of construction, maintenance, and operations for hazards other than nuclear explosives and explosives. Determine the best approach to allocating resources and performing line management oversight in a way that continues to place high priority on nuclear explosive and explosive hazards and environmental programs, while increasing the focus on other hazards.

   - Develop a master assessment schedule that provides a list of all assessments (e.g., contractor, self-assessments, and external assessments) that are required (e.g., by CFR, DOE directives, or PXSO process requirements) to be accomplished during a 3 to 5 year window. Ensure that scopes, durations (level of effort), and assessment leaders are described. Develop processes for using the master assessment schedule to plan work and load level resources, to ensure that coverage is sufficiently comprehensive over the period, and to identify external resource needs (e.g., NNSA Service Center and Core Technical Group).

BWXT

1. **Prioritize and accelerate the approval and issuance of the new process descriptions and work instructions replacing the existing plant standards for feedback and improvement processes to ensure clear understanding of expectations and specified requirements.**

2. **Improve the rigor and effectiveness of the self-assessment program.** Specific actions to consider include:

   - Schedule mandatory, routine institutional and divisional assessments of ISM core functions.

   - Establish senior management review and approval of proposed assessment schedules to ensure that appropriate attention is being paid to safety function reviews.

   - Ensure that division management reviews and approves completed assessment reports.

   - Refocus or expand the independent quality reviews of management assessments to ensure that assessments are sufficiently rigorous in scope and execution. Increase the visibility of the review results by forwarding them to division and senior site management.

   - Conduct additional training and mentoring on the techniques for conducting and documenting effective assessments. Consider making training mandatory for assigned assessors and managers.

   - Expand the involvement of line personnel and Industrial Hygiene SMEs into the facility inspection program and formalize the distribution of inspection results to management and facility owners. Consider requiring line management participation in these inspections.

3. **Establish/strengthen routine line management walkthroughs that specifically include safety as part of physical condition inspections and interactions with workers.**

4. **Strengthen the management of issues to ensure that all safety deficiencies are being properly documented and evaluated, with effective corrective actions and recurrence controls identified and implemented.** Specific actions to consider include:

   - Senior management should clearly communicate to all employees the expectations and requirements for the applicability and implementation of the institutional issues management process at Pantex.

   - Conduct mandatory training on the issues management process, with a focus on expectations, its purpose, and identifying opportunities for improving the process to facilitate its effective application. Tailor training to suit the various audiences (i.e., workers, managers, points of contact, CA/MP participants).

   - Conduct focused routine monitoring, trending, and periodic program assessments of the implementation of the issues management process, addressing the generation of PERs wherever required and the quality of the generated PERs and CA/MP reports to ensure that requirements and expectations are being achieved by all organizations. Provide formal feedback to line and senior management on observed deficiencies.

   - Establish more rigorous processes for conducting and reporting on trend analysis of PERs and other issues management data (e.g., timeliness of ORPS notifications and actions) to ensure that this information is available and is used by senior management to drive performance improvement.

- Establish and formally publish metrics on issues management performance that are used by senior management to ensure that expectations for performance are being met (e.g., ensure that overdue PER actions and closures are completed or formally extended with appropriate justifications).

5. **Continue to improve the lessons-learned program to ensure that appropriate lessons learned are consistently developed, screened, and applied to processes and work activities at BWXT.** Specific actions to consider include**:**

    - Establish and maintain a formal listing of assigned Pantex SMEs and clearly assigned responsibilities for these SMEs to screen for, to identify externally generated lessons learned, and to perform technical evaluations of lessons learned for applicability and needed actions.

    - Ensure that recommended actions based on lessons learned are tailored to the intended audience and that tangible actions are taken where appropriate, in addition to dissemination and discussion at safety meetings for information.

    - Other divisions should consider emulating the practices used by the Infrastructure Training Department for identifying, communicating, and incorporating lessons learned into training.

    - Strengthen the post-job review processes in line management administrative and work instructions to promote and formalize the documentation and disposition of positive and negative lessons learned from work activities to promote continuous improvement.

6. **Improve the rigor of evaluation and investigation of injuries and illnesses.** Specific actions to consider include:

    - Ensure that Supervisor's Accident Investigation Reports are completed for all occupational injuries and exposures. Ensure that PERs and CA/MP investigations are performed whenever work planning or control issues are apparent, regardless of the severity of the incident or near miss. Document justifications for not conducting CA/MP evaluations on the PER and/or the Supervisor's Accident Investigation Report.

    - Ensure that work instructions and actual practice clearly establish supervisors and line management as the owners of injury and illness investigations, with ES&H personnel serving as advisors, evaluators, and subject matter experts.

7. **Improve the rigor of evaluation and investigation of employee concerns issues.** Specific actions to consider include:

    - Use the PER/E*STARS process to document adverse trends and manage the resulting evaluation and action plans.

    - Increase the rigor and formality of case file documentation for employee concerns cases.

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APPENDIX E

Safety System Functionality

E.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluated safety systems at the Pantex plant. The purpose of a safety system functionality assessment is to evaluate the functionality and operability of selected systems and subsystems that are essential to safe operations. The review criteria are similar to the criteria for the Defense Nuclear Facilities Safety Board Recommendation 2000-2 implementation plan reviews; however, OA reviews also include an evaluation of selected portions of system design and operation.

This assessment addressed several safety components at the Pantex plant, including safety-class cranes used to support nuclear weapon assembly and disassembly activities, and blast valves and contaminated waste isolation valves (CWIVs) used to isolate the weapon processing cells in case of an accident. The OA team evaluated design, configuration management, surveillance and testing, maintenance, and operation of the safety systems. The reviews included analyses of system calculations, drawings and specifications, vendor documents, facility-specific technical procedures, and facility walkdowns, and interviews with system engineers, design engineers, maintenance and testing engineers, operators, technical managers, and other technical support personnel.

E.2 RESULTS

E.2.1 Engineering Design

The safety functions of the safety-class components reviewed are generally well defined in the Pantex safety analysis reports (SARs). For example, the safety function of cranes is to prevent hoisted material from falling on a nuclear component or explosive, to prevent dropping or challenging a nuclear component, and to maintain their functionality in case of a seismic event. The CWIVs are normally closed and function as a passive pressure boundary in the cells in case of a high explosive detonation. The blast valves, located in cell air supply and exhaust systems, are normally open and automatically close to prevent the release of radioactive material during an explosive detonation. The SARs appropriately describe some specific functional requirements and controls for these safety-class components, such as closure time and leakage through the blast valves. In general, the SAR provides a good technical basis for establishing the design requirements for safety-class components.

Most of the components reviewed were designed over twenty years ago in accordance with the industrial standards in place at that time. For example, the cranes were designed in accordance with the B30 series of American Society of Mechanical Engineers (ASME) standards, and the CWIVs were designed in accordance with American National Standards Institute (ANSI) standards. The blast valve design documents do not identify applicable industrial standards, in part because of their unique design and functional requirements. However, the blast valves underwent some appropriate qualification testing to provide assurance that they could perform their intended safety function. For example, a full-scale test of an explosive detonation in a nuclear weapon assembly/disassembly cell was performed to test the capture efficiency of the gravel gertie roof. This test also demonstrated the operation of two prototype blast valves. Small scale tests were also performed.

BWXT Pantex, LLC (BWXT) has initiated significant efforts to improve the design of the safety-class cranes. For example, BWXT has added drop lugs to the hoists to prevent them from failing if the hoist trolley wheels or axles malfunction. Furthermore, because of concerns with meeting certain vendor-recommended maintenance activities, uncertainty in load path, and difficulties in seismically qualifying the cranes, BWXT has decided to replace the hoisting components on its safety-class hoists to the nuclear grade standard NUM-1. This replacement is scheduled to occur over the next five years. Compensatory measures during the five-year overhaul schedule are already included in preventive maintenance (PM) procedures. The principal compensatory items in those procedures include: (1) annual 100-percent load tests, (2) special brake tests, (3) annual disassembly of manual hoists, and (4) frequent inspections. BWXT also improved the blast valve design by changing the valve material from carbon steel to stainless steel.

Although most aspects of the safety function and design were appropriately identified and performed, two weaknesses were identified with SAR analyses:

- **The safety-class function served by the drain line to the CWIV has not been defined in the SAR.** The safety function of the CWIV is clearly defined as limiting the overall facility leak path to mitigate the consequences of a high explosive detonation. However, the function of the drain pipe connecting the cell to the CWIV is not addressed. Additionally, there is no surveillance testing associated with this safety-class piping, such as periodic non-destructive examination or hydrostatic testing to ensure pressure integrity. The piping configuration and location are not documented on drawings, and the material condition of the piping is unknown. This issue was identified by BWXT and DOE during the implementation of SAR controls for the CWIV.

- **The basis for some technical safety requirements (TSRs) and other SAR controls has not been established in the SAR.** The TSR surveillance procedure does not adequately define the analytical basis for the acceptance criteria for the force required to close the blast valve. The analysis, OE-96-0002, does not consider all of the force components acting on the valve disk to resist valve closure and does not consider the most conservative cell volume arrangement in determining the force required to close the valve. Further, the analysis establishes the blast valve activation force acceptance criteria but does not quantitatively consider the most conservative blast pressure attenuation at the blast valve location. Several other factors are not quantitatively considered either, such as valve disk weight, the force required to overcome friction, the fan shutoff head, and the momentum of the air flow. The force acceptance should be based on the minimum blast that could cause an unacceptable release of radioactive material if the valve remained open. Furthermore, the maximum leak rate for the blast valves and the valve closure time credited in the accident analysis do not have an analytical basis. Although experience has indicated that the force to close the valve is small and closure time is short, the adequacy of these controls has not been formally established. Similarly, the adequacy of the valve leak rate has not been formally established.

These analysis weaknesses should have been identified and addressed during the 10 CFR 830 compliant SAR development.

Finding #15. NNSA and BWXT have not adequately analyzed and documented the design of some important aspects of the safety-class systems during the development and review of the 10 CFR 830 compliant SAR.

Another concern with the safety analysis was that, although the new 10 CFR 830 compliant SAR adequately described the system design, it did not address deviations from current safety design criteria that are identified in the BWXT contract (standards/requirements identification document). Specifically, the SAR did not establish the basis for not meeting single failure criteria for the blast valves. These components were designed prior to Pantex adopting design requirements contained in DOE Order 6430.1A, *General Design Criteria,* which specify that the safety-class components be redundant and meet single failure criteria. The current SAR does not address these design criteria and the acceptability of not meeting them. BWXT and Pantex Site Office (PXSO) are establishing a backfit process to provide an assessment of current controls against new requirements and standards. This process should result in an adequate documented basis for the exception to conformance to the single failure criteria or justify modifying the system to add redundancy.

OA also identified concerns with the quality and rigor of important-to-safety engineering calculations and evaluations:

- **Five calculations of the ability of crane trolley stops and bridge stops to withstand the impact of a moving trolley/bridge contained non-conservative errors and oversights.** These errors and the informality of these calculations indicate a lack of appropriate rigor in addressing a parameter explicitly required in the authorization basis (i.e., the ability of such stops to withstand impact). The errors also call into question the quality of the peer review and approval for these documents, because the peer reviews did not identify the errors. The contractor indicated that these calculations would be revised. Similar concerns in this area were recently identified in a PXSO assessment of the BWXT system engineering program, which are being addressed as part of a BWXT action plan.

- **The TSR surveillance frequency for crane inspections for loose fasteners was increased from quarterly to annually (in 2000) based on an insufficient engineering analysis of inspection data.** The engineering analysis did not evaluate sufficient inspection data. Two sets of inspection data were evaluated, one of which contained several loose and missing fasteners. Although the impacts of the loose or missing fasteners were analyzed, the inspection data did not support increasing the surveillance frequency from quarterly to annually. However, subsequent annual inspection data indicated that the change in frequency was valid. Even though post-analysis of the decision to increase the surveillance frequency validated the decision, the original engineering analysis lacked the appropriate rigor and the data to support this decision.

Although an appropriate procedure for engineering evaluations exists, a probable contributing factor to these weaknesses is that there is no BWXT standard or procedure for performing engineering calculations, as required by 10 CFR 830.122, *Quality Assurance*. Such a standard is needed to prescribe the requirements for development, documentation, content, format, rigor, review, and approval of engineering calculations and other similar engineering output documents.

Finding #16. BWXT has not established appropriate processes for ensuring that engineering calculations and analyses meet the quality standards of 10 CFR 830.

Summary. The safety-class nuclear cranes, CWIVs, and blast valves reviewed were, in general, adequately designed to perform their safety functions. Furthermore, important modifications have been made to improve the design of these components. However, there were deficiencies in some analyses supporting some important controls, such as the leak rate and closure time for the blast valves. Furthermore, BWXT has not established appropriate processes for controlling engineering analyses and calculations, and several calculations and engineering analyses contained errors.

E.2.2 Configuration Management

The purpose of the configuration management program is to ensure that the design remains adequate and within the requirements of the SAR. OA evaluated several components of the Pantex configuration management program, including document and change control, procurement, and the unreviewed safety question (USQ) process.

Document and Change Control. In 1994, Pantex had a stand-down in operations due to configuration management concerns. In essence, there was no effective formal configuration control program. Since that time, Pantex contractors have made important improvements. Currently, configuration management is well controlled via several standards, including STD -0147, *Change Initiation Review and Approval*, STD – 9045, *Plant Standard, Configuration Control for Plant Structure, Systems and Component Equipment*, and MNL-054, *Infrastructure Configuration Management Conduct of Operations*. MNL-054 is the primary controlling document for configuration management. It details configuration control responsibilities, control of drawings, vendor manuals and other engineering documents, the design control process, and design recovery and walkdown processes.

BWXT has made significant improvements in the configuration management and documentation of technical bases for its safety systems during the development and implementation of the 10 CFR 830 compliant SARs, in particular during the process for ensuring the adequacy of TSR-identified controls. During SAR implementation, BWXT develops safety basis datasheets that show the linkage of controls to supporting engineering analyses.

During this evaluation, OA requested and reviewed several design change packages (DCPs) to determine whether the document and change control processes were effective. BWXT was able to readily retrieve the work packages requested, and the packages, for the most part, were complete. The design change and maintenance work records were well documented. Although post-maintenance test results are not included in the DCP package, they were included in maintenance files, and the configuration control department was able to quickly obtain the records.

Procurement. An important element of configuration management is the process used to ensure that procured components meet appropriate quality requirements. In October 2004, the procurement and control of material process used for safety-class systems, structures, and components was identified as deficient by BWXT. In direct response, a limited suspension of maintenance work on safety-class systems was put in place, a thorough investigation was performed to determine the extent of condition, and procurement process improvements were established and implemented. The key weakness was that maintenance personnel were permitted to use parts obtained via Acquisition Level 2 (rather than Acquisition Level 1) in safety systems without system engineering design specifications, acceptance testing, and post-maintenance testing approval.

Pantex made appropriate improvements to their procurement process for safety systems material to address these weaknesses. For example:

- Specifications for safety-class material are being developed and approved by the system engineers (documented on form PX-5045).

- Specification information for Acquisition Level 1 material is being electronically captured in the computerized maintenance management system (Passport).

- Safety-class material is being identified during the receiving inspection process, and is being labeled, segregated, and controlled at the warehouse.

- Work package bills of materials correlate to specifications approved by engineering and are included in Passport.

- Qualified suppliers have been identified and are being used for procurement of safety-class components.

Unreviewed Safety Question. An important component of nuclear facilities configuration management is the USQ program. The site USQ standard generally provides appropriate guidance in accordance with 10 CFR 830 requirements and the DOE implementation guide. Furthermore, BWXT and PXSO have worked together to refine the standard and process to improve its usability. However, some weaknesses were identified in the USQ standard instructions for processing "new information" that can impact the safety basis:

- The "New Information Processing Form" and the "New Information" procedure are not referenced or otherwise identified in the site USQ standard.

- The USQ procedures or forms do not explicitly state who is responsible for formally identifying "New Information" with the form.

- The "New Information" procedure is inappropriate because it is an internal operating procedure that applies only to Authorization Basis and Nuclear Explosives Safety Department personnel in the Engineering Division. This conflicts with the "New Information" requirements in the USQ standard.

- The USQ standard does not address that the approved SARs exist in two forms – implemented and not implemented – and that the USQ process (including processing of new information) is applicable to both SAR forms.

The weaknesses above have contributed to weaknesses in implementing the USQ standard. Specifically, the approved (but not implemented) SAR stated that trolley stops had been evaluated for their ability to absorb the energy of impact from a fully loaded trolley moving at 100 feet per minute for the pneumatic trolleys and 120 feet per minute for the manual trolleys. Systems Engineering subsequently identified through engineering analyses that, with the exception of the trolleys in Building 12-44, Cells 2 through 6, they could not meet these requirements. According to the BWXT USQ standard, the USQ process should have been entered to address this information with respect to both the approved (but not implemented) SAR and the current SAR. Contrary to this requirement, the process was not entered for this discrepancy. Conversations with the system engineer for the cranes and with Authorization Basis Department Managers indicated that this failure to follow the USQ standard resulted from the weaknesses in the USQ standard regarding the SAR version to which it is applicable and in inadequate training.

Finding #17. The BWXT USQ standard and attendant documents do not adequately define roles, responsibilities, and processes for addressing identified SAR discrepancies.

A contributing factor for these weaknesses was that, contrary to 10 CFR 830 provisions, BWXT did not submit the entire USQ procedure to DOE for approval. Although the basic Pantax USQ standard was submitted to and approved by DOE, four other documents integral to the USQ process, which provide critical guidance and policy information (beyond how to fill out the forms), have not been submitted and approved by DOE. These include the USQ evaluation form, the USQ evaluation form instructions, the "New Information Processing Form," and the "New Information" procedure. Another weakness in the USQ program is that the USQ standard's experience requirements for USQ evaluators do not include experience in the technical field in which the individual will perform evaluations. However, current practice is to require six months experience in the technical field to be evaluated.

OA also identified concerns with the system engineers' processing of engineering issues that need to be addressed and that, upon further evaluation, may have an impact on the safety basis. BWXT system engineers did not utilize the issue reporting process (i.e., PERs) described in Plant Standard 6161, *Issues Reporting*, which requires that "At a minimum, a PER is generated for…in-process discoveries of noncompliant conditions." This process has been established to assure that such "noncompliant conditions" are formally documented and reported such that their resolution can be effectively managed, tracked, trended, and assured. Examples of such conditions that were not entered into the process as required included concerns with engineering calculations that were identified during this review (see Finding #13).

Summary. BWXT has established an effective program for control of documents. BWXT has made important configuration management improvements, both in the program and in the technical basis for specific safety-class components as part of the TSR integration implementation plan. Furthermore, the procurement process has recently undergone significant revision to ensure that safety-related components are procured under the appropriate quality controls. The USQ program generally provides appropriate guidance in accordance with 10 CFR 830 requirements and the implementation guide. However, weaknesses were identified in the USQ standards instructions for processing new information that may impact the safety basis.

E.2.3 Surveillance and Testing

10 CFR 830 requires that surveillances and tests be defined in the TSRs to ensure that safety systems, structures, and components and their support systems required for safe operation are maintained; that the facility is operated within safety limits; and that limiting control settings and limiting conditions for operations are met. In most instances, the Pantex TSR surveillance requirements are appropriately derived from the safety analysis. BWXT is currently performing, as part of their TSR implementation process, a detailed evaluation to ensure that each control in the SAR is captured as a TSR surveillance requirement and that an appropriate surveillance procedure has been developed.

The instruction for performing TSR surveillances are contained in PM procedures. Standard 9050, *Surveillance/In-Service Inspection Programs,* provides appropriate guidance for establishing PMs for the surveillances. The PMs, with one exception, were adequate, and all the TSR requirements associated with the reviewed systems were appropriately surveilled in the procedures. A formal crosswalk document has been established to ensure that all vendor and standards requirements are included in the PM procedures. TSRs and in-service inspection requirements are included and specifically identified in the individual PM procedure steps. In most cases, the PMs are performed by maintenance in a rigorous manner and the datasheets are carefully and completely filled out.

OA identified two deficiencies with the TSR surveillances: an inadequately defined in-service inspection, and an inadequate PM procedure for implementing a TSR requirement.

- The TSR in-service inspection requirement for the blast valves does not include an adequate inspection for evaluating the valve leakage criteria. Instead of quantitatively measuring the leakage area or the leakage rate to verify that the criteria are met, the TSR specifies a qualitative evaluation of the sealing surface. A similar concern was identified for the closure time of blast valves (i.e., it is not quantitatively measured). While it is unlikely that the exact closure time is sufficiently critical to warrant periodic verification, the analytical basis for this conclusion has not been established.

- The initial conditions for the blast valve annual in-service inspection test contained in a PM procedure are not adequately controlled. When testing the exhaust blast valve, the exhaust fan is required to be off. When testing the supply or return blast valve, the air handling and dehumidifier are required to be operating, but no requirement is stated for the status of the exhaust fan. Exhaust fan operation will change the amount of air flow through the return line. As a result, operating status of the exhaust fan will affect the force test results of the return blast valve. The operating status of the exhaust fan should be controlled and documented when testing the return blast valves.

BWXT ensures that PMs are performed on time by issuing work order packages to maintenance with assigned due dates via Passport. Further, facility managers (also referred to as Facility Representatives at Pantex) are responsible for ensuring that surveillances are current. Facility managers are required to prepare a facility PM tracking board for each operating unit, such as a bay, cell, facility, or system. The tracking board should include a list of required surveillance/in-service inspections requirements, frequency, procedure, completion date, and next due date. The facility managers, with one exception, were keeping the facility status tracking boards up to date. To ensure that the facility managers are aware of changes, when maintenance completes a PM work order package, the results are provided to the facility manager for review. In general, the facility status tracking boards are providing an effective method to ensure that surveillances are current.

Although this tracking process serves as a good tool for ensuring that surveillances are up to date, one facility status tracking sheet contained an error. It listed one surveillance as current based on the previously completed surveillance rather than the most recently completed surveillance (completed on January 13, 2005). The tracking sheet was inaccurate (not well maintained). Although there was no actual safety impact with this situation, it indicated a lack of rigor in performing this important administrative task.

Summary. In most cases, the surveillance requirements in the TSRs have been appropriately translated into detailed PM procedures. The surveillance/PM procedures are being performed when appropriate and are being completed in a rigorous manner. In most cases, facility managers are ensuring that the surveillances/PM procedures are current in their assigned facilities. Two TSR surveillance deficiencies were identified: a TSR in-service inspection did not adequately test blast valve leakage, and a surveillance/PM procedure did not adequately define initial conditions for the blast valve annual in-service inspection. Although some isolated deficiencies were found with surveillance and testing, overall the program is well defined and appropriately implemented.

E.2.4 Maintenance Program

The OA team reviewed several aspects of the BWXT programs for maintaining safety systems, including preventive, corrective, predictive, and life-cycle maintenance, as well as work control processes and material conditions.

The maintenance program is appropriately defined in the BWXT *Pantex Plant Site Maintenance Plan* and in several other key documents, including *Maintenance Work Control System*, *Maintenance Management*, and *Processing Maintenance Work Orders*. As stated previously, BWXT uses PM procedures to perform TSR-required surveillances as well as other PM activities. For example, the PM procedures are used for performing PM activities specified in vendor manuals and in codes and standards. Safety-class cranes are inspected in accordance with applicable ASME code requirements. Furthermore, CWIV and blast valve internals and sealing surfaces are inspected on a periodic basis (every two years for CWIVs and every three years for blast valves). The PM procedures are well written, detailed, and controlled to provide assurance that the safety-class components are operable and reliable. The maintenance department has established an adequate formal training/qualification program to ensure that the mechanics are properly trained to perform the PMs associated with the reviewed system. During the review, maintenance mechanics demonstrated proficiency with performing the PMs during interviews and observations of work.

OA found that the PMs were appropriately performed and any equipment deficiencies identified during the PMs were corrected in a timely manner. Corrective maintenance for the systems is also being identified and completed in a timely manner, and as a result, there is no maintenance backlog for these systems. A recent listing of outstanding corrective maintenance shows that safety-related tasks are not overdue.

Although BWXT has not established a sitewide approach to predictive maintenance processes, some beneficial predictive maintenance tasks are being conducted. For example, the maintenance department conducted hoist gear box oil sampling over the last year to establish a baseline to compare with future sample results. The goal is to ensure that the oil in each gear box is appropriate for preventing component wear by trending oil sample particulate count. Water percentage is also measured to ensure that oil contamination can be detected. In addition, some electrical component thermal imaging is being routinely conducted. Thermal imaging is being performed on the main transformers (12,000 volts) and has found hot spots, which were repaired. At present, thermal imaging is not routinely preformed on the 480-volt motor control centers but on occasion is performed as part of electrical panel troubleshooting. Other potential area predictive maintenance activities have not been addressed, including, for example, performing routine vibration measurements on the various motors and fans throughout the site.

To support equipment life-cycle maintenance, BWXT is in the process of reestablishing a condition assessment survey program. BWXT Pantex has adopted the condition assessment survey program developed by DOE, based on the approach developed by the Lawrence Livermore National Laboratory. The Pantex condition assessment survey facility inspections are planned in a 12-month block and will take three years to cover all Pantex facilities. The first complete review of all facilities is expected to be completed in FY 2006. Inspectors have been trained in the process, and preparation for a specific facility inspection is appropriately supported by the listing of completed work order packages, listings of systems/equipment from Passport, and the current condition assessment survey database. The inspectors are properly documenting their inspection results on inspections sheets, which are entered into the condition assessment survey database. BWXT recognizes that formal procedures on the condition assessment survey process have not been developed, and this task is being pursued. For the safety systems reviewed on this OA inspection, the nuclear cranes/hoists were included in the condition assessment survey database, and the CWIVs and blast valves were not included in this first cycle of reviews, but are planned for inclusion in the next full cycle.

The OA team conducted system walkdowns to ascertain the physical condition of the system and identify any gross material degradation. No significant material degradation was identified during walkdowns of the system, and housekeeping was very good.

Although most aspects of maintenance were effective, some isolated weaknesses were observed, particularly in work package documentation. Specifically:

- A monthly hoist work order package (29188240) contained several blank datasheets that were not annotated to explain why they were not filled out.

- A hoist PM work order (29216200) listed datasheets required to be completed for the hoist PM, but they were not completed, and no explanation was provided in the work package.

- A work order (29239023) for repairing the CWIV Pyrotonics C-35 module did not include the required procurement data (i.e., form PX-5045).

- A work order package (29181336) to replace CWIVs did not have the appropriate rigor in the work order task instructions and post-maintenance testing. The work order task instruction stated "see attached document" with no additional information, and the post-maintenance testing that was performed was stated as "check valve for operation." The quarterly test was performed but was not documented in the work package.

Furthermore, maintenance tracking and trending are not rigorous. The current method for documenting completed maintenance work is not sufficient to support effective performance trending. Some limited tracking and trending analysis is being conducted by the system engineers for the reviewed system, and was evident for the nuclear crane assemblies and the blast valves. Since April 2004, quarterly reports have been issued for the cranes that record and evaluate the crane deficiencies and assess the effectiveness of corrective actions. For blast valves, a graph was created showing valve failures (excessive force to latch, found closed, would not latch) since 1994. However, no analysis document was associated with the review.

Inadequacies in the tracking and trending process were previously identified by an assessment and are being addressed by a corrective action plan. Overall, the approach for correcting the deficiencies is appropriate. The blast door interlocks system has been selected as the pilot system. Key objectives are to update the system engineers manual with the new tracking and trending process, establish a standard output report, incorporate a tracking/trending data sheet in the work order packages for the maintenance craft to update, ensure that system engineers review completed work packages prior to closure, track design changes, and ensure that corrective actions are tracked in PER/E*STARS.

Summary. The programs for maintaining safety systems at the Pantex Plant have several positive attributes. The PM program is well defined, and procedures are well written and appropriately contain input from vendor manuals and codes and standards. The PMs are performed when required, and deficiencies are noted and corrected in a timely manner. The maintenance staff is adequately trained to perform their assigned PM tasks. For the systems reviewed, corrective maintenance is current and material condition for the systems is adequate. Further enhancements to the maintenance program are warranted in some areas. Some predictive maintenance is being performed, but a sitewide program has not been defined. Pantex has made significant progress in re-establishing a condition assessment survey process, but continuing effort is needed to complete full implementation. A few work order packages were deficient with regard to properly documenting the work performed. Finally, continued weaknesses were identified with tracking and trending; however, appropriate corrective actions are being appropriately pursued.

E.2.5 Operations

The OA team evaluated operating procedures and nuclear technician training for the selected safety-class components as well as the knowledge and capability of nuclear technicians and facility managers to operate the systems under normal conditions and to take appropriate actions in the case of abnormal and accident conditions. For the systems reviewed, only the safety-class cranes are operated during normal operations. The blast valves are, in essence, check valves that should only operate during an emergency, and the CWIVs are normally in their safe position (closed) and are only operated during surveillances.

Operating Procedures. The BWXT safety-class cranes are used to move components to support weapon assembly and disassembly operations. The specific hoisting operations are controlled in step-by-step "critical use" procedures. Each weapons assembly/disassembly operation has its own specific procedure. In addition, BWXT has established two general use procedures that provide general safety requirements and other general operation instructions for weapons programs activities, including instructions on safe load path and emergency operations. The procedures reviewed were clearly written and provided appropriate instructions. In addition, the Pantex Plant contractor improved the hoisting process in the mid-1990s by adding a safety observer to support all hoisting operations. The responsibilities of the safety observer are appropriate and are clearly stated in one of the general use procedures.

However, some weaknesses were identified in the operations procedures. For example, important crane operation precautions and emergency instructions are contained in the general use procedures and are not specifically referred to in caution statements or precautions in the weapons operation procedure specific to a given assembly/disassembly operation. The general use procedures contain over 100 pages of instructions, some more pertinent than others regarding day-to-day operations. Furthermore, inconsistencies were identified in the approach used to perform verification of some hoisting operations. For example, some procedures had operators verify proper rigging (including a check of the safety latch) while others did not, and one procedure did not include a step verifying that push pins were appropriately locked in place. This verification is very important and BWXT had established a TSR control for it. Specifically TSR 5.7.46 specifies that each failure to both connect and verify the load path components shall be considered a TSR failure. Considering that the procedure does not require this verification, it is not clear how this TSR can be met.

Furthermore, inconsistencies were identified with TSR administrative controls for lifts. Specifically, the TSR for the W-62 program requires that "Technicians shall minimize lift heights of nuclear material, and explosives, minimize lift heights of any item over nuclear explosive, nuclear materials or energetic components and shall not lift over nuclear explosives, nuclear materials or energetic components unless required by the process." This requirement is not included for other weapon programs. This inconsistency should be corrected when the TSR integrated implementation plan is completed.

Finally, a weakness was identified in the *Personnel Response Procedure* (MNL -0068). The procedure does not address such actions as shutting down ventilation to help minimize the release of radioactive material from an explosion event. Facility managers indicated that this is an action they may take in the event. It is not clear whether this is an appropriate action; however, it should be clear to facility managers when it might be appropriate and how to perform this action.

Operator Training and Qualification. The SAR specifies that the operator training program must meet DOE Order 5480.20A. BWXT has established an effective training program for crane operations that includes both initial training and refresher training. Training includes a practical exam that includes performing a lifting operation. Training on specific weapons processes is performed using a full-size mock-up of a cell and bay that includes a full-scale crane and actual rigging equipment used in the lifting operations. The training includes discussion of lessons leaned and emphasizes emergency situations. Furthermore, nuclear technicians receive program-specific training (i.e., training on specific weapon assembly or disassembly operations including actual performance of all required activities, including hoisting).

Controls/Indications. The components reviewed have relatively simple controls and indications. The cranes are pneumatically controlled via a pendent that travels with the hoist. The left, right, forward, and back controls are color coded corresponding to matching colors on the bay and cell walls. Parking locations for the hoist are identified so that the hoist will not obscure fire detectors. CWIVs are normally closed and are only operated to support surveillances. CWIVs have a control indicator displayed in an equipment room. This indication is checked each day to ensure that the valves are closed. The blast valves do not have any indications. If the valve closes during normal operations, changes in ventilation flow would provide technicians and facility managers with indications of the valve closure. However, there is no indication of whether the valve appropriately functioned during an accident.

Operator Knowledge and Performance. The purpose of operations procedures, training, and system controls is to provide the tools and knowledge for proper operation of the safety systems. To evaluate this area, a hoisting demonstration performed by four nuclear technicians in a training bay and an actual nuclear weapon disassembly operation were observed; additionally, the nuclear technicians and two facility managers/representatives were interviewed.

During the hoisting demonstration at the training facility, the nuclear technicians demonstrated a good understanding of operation of the hoist and worked very well as a team. The technicians appropriately performed pre-operational checks of the hoist, and appropriately followed the procedure in a step-by-step manner, with one person reading the procedures, one technician operating the crane, and two technicians serving as safety observers and supporting rigging operations. The technicians followed good hoisting practices identified in one of the general use reference procedures (e.g., safe load path and returning the hoist to the proper parking location following the lift). Furthermore, the technicians had a good understanding of their responsibility for operations in case of a crane malfunction, consistent with procedure guidance.

During the actual nuclear component disassembly operation, the rigging and hoisting operations were also appropriately performed in a step-by-step manner. However, during both the demonstration and the actual hoisting operation, the technicians did not consistently perform a second verification of the load path. For example, the push pins that are used to support certain rigging fixtures were not "second-verified," and the attachment of the hook to the lid of the transfer container was not formally verified and logged in the procedure. This deficiency is attributable to weaknesses in the procedure for the operations.

The facility managers who were interviewed demonstrated a good understanding of controls and operations of the CWIV and blast valves. The facility managers were knowledgeable of the location of controls for both the CWIV and the ventilation system that contains the blast valves. The facility managers were knowledgeable of their emergency response responsibilities. However, the facility managers indicated that they would shut off ventilation in case of an emergency. This action may be appropriate, but it is not identified in the emergency procedure.

Summary. BWXT has established procedures and performed training that have, in general, adequately prepared the nuclear technicians to operate the safety-class cranes. The operators demonstrated the capability to operate the cranes in a safe manner and to take appropriate emergency actions in case of a crane malfunction. For the most part, system controls and indications were adequate to support system operations. Facility managers were knowledgeable of their duties during emergency conditions. Some weaknesses were identified in the procedure, in particular in the formal verification of proper rigging.

E.3 CONCLUSIONS

The components reviewed are generally robust, simple, and appropriately designed to perform their safety function. Furthermore, most aspects of the surveillance and testing and maintenance programs are well defined and implemented. Surveillances and tests were appropriate in most cases; the procedures were well written; and all surveillance and tests were performed on time. The PM program is robust, and adequate and timely corrective maintenance is being performed on the reviewed systems. The material condition of the systems reviewed was good. BWXT has established an effective program for training operators to perform hoisting and rigging to support nuclear operations that includes hands-on operations and a performance test. Operators demonstrated their ability to effectively operate cranes.

Although the components evaluated are relatively simple, some analyses supporting the SAR have not been adequately performed or documented. For example, the safety function of the drain line to the CWIV was not defined in the SAR, and blast valve controls were not adequately supported by testing or analysis. Furthermore, concerns were identified with the quality and rigor of some engineering calculations and evaluations, and BWXT has not established appropriate processes for controlling engineering calculations to ensure that they meet the quality standards of 10 CFR 830.

Weaknesses were also identified in two areas of the configuration management program: the USQ program, which ensures that the SAR is maintained, and the site issues reporting process, which ensures that issues are appropriately tracked and resolved. Furthermore, concerns were identified with two TSR surveillances that did not adequately test SAR controls, documentation of some maintenance work packages, and operation procedures that did not provide adequate direction for performing a second verification that rigging requirements were met.

Although none of the weaknesses identified raised significant concerns as to whether the reviewed safety-class systems would adequately perform their intended safety functions, the identified weaknesses did result in some uncertainty in the systems' functionality for some events. Furthermore, the weaknesses indicate the need to improve in the rigor and quality of some analyses and the rigor with which TSR controls are ensured to be implemented.

E.4 RATINGS

Engineering ....NEEDS IMPROVEMENT
Configuration Management ....NEEDS IMPROVEMENT
Surveillance and Testing .... EFFECTIVE PERFORMANCE
Maintenance .... EFFECTIVE PERFORMANCE
Operations .... EFFECTIVE PERFORMANCE

E.5 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

BWXT

1. **Reconstitute archived original design calculations for the blast valves and CWIV systems.** Currently, there are no documented design analyses for these systems.

2. **Improve engineering calculations and analyses.** Specific actions to consider include:

   - Develop and implement a detailed sitewide engineering calculation/analysis standard that specifies the requirements for development, documentation, content, format, rigor, review, and approval of engineering calculations and other similar engineering output documents to assure that such documents meet the quality requirements of 10 CFR 830 and industry standards of ANSI N45.2.11.

   - Enlist the expert assistance of a design engineering organization whose forte is engineering analyses, such as an architect/engineering firm with nuclear-related experience, to assist in creating a proper standard, diagnosing causes for the current weaknesses in this area, identifying corrective actions, providing additional review of existing calculations and engineering evaluations, and training of personnel.

   - Perform a structured review of current existing safety-related calculations/analyses/ evaluations to locate other specific errors, and make appropriate corrections.

   - Generate training on the newly created calculation procedure for all personnel whose responsibilities include calculation or evaluation generation, review, or approval.

3. **Enhance the USQ program.** Specific actions to consider include:

   - Revise and obtain DOE approval of the USQ sitewide standard to incorporate all of the requirements presently espoused in the "New Information" procedure, all of the USQ forms, including the "New Information Processing Form," and the USQ evaluation form instructions.

   - Specifically designate in the USQ standard the person(s) responsible for formally identifying new information to be considered by the USQ process.

   - If the USQ process is to be applied differently in any manner for approved/not-yet-implemented SARs versus the approved/implemented SARs, explicitly describe and justify the differences in the standard, so that they can be clearly understood by standard users and by DOE, which must approve the standard.

   - Change the standard's experience requirements for qualification as a USQ evaluator to include at least six months in the technical field in which evaluations will be performed.

- Revise and implement sitewide USQ training to ensure that the above-described USQ process changes are clearly understood and implemented.

4. **Improve the maintenance program for safety systems.** Specific actions to consider include:

   - Review and correct, as appropriate, the blast valve annual in-service inspection test to ensure that the initial conditions when testing a return blast valve are properly defined, especially with regard to the operating condition of the exhaust fan.

   - Review and define a sitewide predictive maintenance program for safety systems, structures, and components.

   - Concerning work order package documentation deficiencies, correct the identified deficiencies and consider establishing a review process, potentially including a checklist to ensure that work order package documentation is correct prior to closing the package.

   - Ensure that implementation plans for the condition assessment survey process and for tracking and trending are implemented as scheduled.

5. **Improve operations procedures.** Specific actions to consider include:

   - Review the nuclear explosive operating procedures to ensure consistency in the manner in which rigging and load path connections are verified. Add guidance on the proper method for verification of push pin connections and locking.

   - Rewrite the TSR control on load point verification to improve clarity.

APPENDIX F

Management of Selected Focus Areas

F.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) inspection of environment, safety, and health (ES&H) at the DOE Pantex Plant included an evaluation of the effectiveness of the Pantex Site Office (PXSO) and BWXT Pantex, LLC (BWXT) in managing selected focus areas. Based on previous DOE-wide assessment results, OA identified a number of focus areas that warrant increased management attention because of performance problems at several sites. During the planning phase of each inspection, OA selects applicable focus areas for review based on the site mission, activities, and past ES&H performance. In addition to providing feedback to National Nuclear Security Administration (NNSA), PXSO, and BWXT, OA uses the results of the review of the focus areas to gain DOE-wide perspectives on the effectiveness of DOE policy and programs. Such information is periodically analyzed and disseminated to appropriate DOE program offices, sites, and policy organizations.

Focus areas selected for review at the Pantex Plant were:

- Implementation of DOE Order 450.1, *Environmental Protection Program* (see Section F.2.1)
- Hoisting and rigging (see Section F.2.2)
- Safety systems oversight of engineered safety systems (see Section F.2.3)
- Chronic beryllium disease prevention program (see Section F.2.4)
- Safety in protective force training (see Section F.2.5).

OA has also identified corrective action management as a focus areas. Corrective action management systems, as implemented by PXSO and BWXT, are discussed in Appendix D as part of the overall feedback and improvement process.

The scope of the review activities for each of these areas is further discussed in the respective subsections in Section F.2. Where applicable, the results of the review of these focus areas are considered in the evaluation of the core functions and feedback and improvement systems.

F.2 RESULTS

F.2.1 Environmental Management System

OA identified the environmental management system (EMS) as a focus area across the complex in response to DOE Order 450.1, *Environmental Protection Program*, which requires implementation of the EMS at DOE facilities by December 31, 2005. OA reviewed PXSO and BWXT implementation activities focusing on the requirements of DOE Order 450.1 and ISO 14001, an international standard for environmental management. The OA team reviewed environmental policies, environmental requirements, plant procedures, guidance, implementation plans, and plant publications; observed work associated with environmental programs; and interviewed PXSO and BWXT line, environmental, and support personnel.

Pantex Site Office. PXSO has established a performance milestone for BWXT that encourages and rewards timely and effective implementation of an EMS. Specifically, PXSO established milestones and incentives for BWXT to implement the EMS by June 2005, which is six months earlier than the DOE order deadline, and to obtain certification of the Pantex EMS by the Texas Commission on Environmental Quality under the Clean Texas program. PXSO personnel were knowledgeable about EMS actions being taken by BWXT. PXSO also arranged for DOE and contractor personnel from the Kansas City Plant and the Albuquerque Service Center to conduct a third-party assessment of the ESM prior to PXSO declaration of EMS implementation as required.

BWXT. BWXT has established an effective program for achieving an EMS as required by DOE Order 450.1. This program includes senior management support, development of documents necessary for implementation, sitewide training, and internal and third party assessments. As an indicator of senior management support, the BWXT General Manager recently presented the status of EMS implementation to the PXSO Manager. The discussions between these two managers during the presentation clearly demonstrated their knowledge of the EMS concepts and the actions being taken to meet milestones for implementation.

To provide guidance for implementing the ISO 14001 elements for environmental management, BWXT has developed an EMS manual that tailors the elements to BWXT actions. Documents that will require implementation of these elements of the EMS have been or are being added to a BWXT electronic document system, which is currently in development. This system will have a section that provides EMS documents in an interactive format that links the EMS documents with other procedures, Pantex standards, and other ISM documents.

BWXT has performed comprehensive reviews to identify environmental aspects for BWXT, tenants, and PXSO operations and activities. As part of these reviews, a data request process was used to identify functions and activities that could impact the environment. Concurrently, environmental monitoring and waste generation data for BWXT activities was evaluated to identify operations that impact the environment. These two actions were then cross-checked to ensure that all environmental aspects from BWXT operations, tenant activities and DOE operations were identified. Using a software program recommended by the Environmental Protection Agency, the data were evaluated to identify significant environmental aspects and determine objectives and targets. Line organizations, environmental expertise, and senior managers were involved to ensure that EMS objectives and targets were comprehensive. As a result, the objectives and targets are accepted by the line organizations and supported by senior management. BWXT also established a "Green Advocate" position to promote sound environmental procurement activities and work with Pantex organizations to revise procurement processes and standards to reflect affirmative environmental procurement; this approach is consistent with Executive Order 13101 and 13148 requirements for incorporating pollution prevention in procurement activities.

BWXT has effectively communicated EMS goals and requirements through training and various communication techniques (e.g., the plant newspaper). The EMS requires an Employee EMS Awareness Training Program. In addition, a read and sign process was used to provide training to plant workers, and the General Employee Training has been expanded to address EMS goals and requirements. To ensure that these initiatives are supported and coordinated, personnel from the training and public affairs offices are members of the EMS implementation team.

Concurrent with EMS implementation, numerous pollution prevention opportunity assessments are performed to identify operational improvements, which has reduced the amount of generated waste.

These assessments have been applied to excess material in procurement, sub-contractor performed work, and line operations and activities. Because Pantex currently exceeds the Secretary of Energy's Waste Reduction Goal, a specific review was performed to identify ways to reduce the amounts of sanitary waste. As a result of these actions, Pantex has received a number of pollution prevention awards.

Although BWXT has a strong pollution prevention opportunity assessments program, the work instruction for executing this program has not been issued. When implemented, this work instruction has the potential to be an effective tool for enhancing pollution prevention activities. In addition, a work instruction for conducting a job environmental hazards analysis, which will be a companion to the job safety analysis, has been developed but not issued. This draft work instruction also has the potential to be an effective tool for enhancing environmental performance. Finally, the comprehensive reviews that were used to identify environmental aspects for BWXT, tenants, and PXSO operations and activities were performed early in the EMS development process. Therefore, subsequent changes in the status of some environmental aspects may not be fully reflected in objectives and targets.

Summary. PXSO and BWXT have established a comprehensive and effective set of actions to implement an EMS. Several aspects of the action are noteworthy, including: senior PXSO and BWXT management involvement and support for EMS, involvement of BWXT managers from line and support organizations, coordination of training and communication organizations, and structured processes for identifying risk-ranked objectives and targets. As part of EMS, Pantex continues to have a proactive pollution prevention program. Issuing a few work instructions and processes or updating reviews would further enhance the current EMS approach.

F.2.2 Hoisting and Rigging

OA identified hoisting and rigging as a focus area because OA inspection results and site occurrence reports indicate a number of sites have experienced events, near misses, and injuries during hoisting and rigging activities. OA reviewed hoisting and rigging activities performed by BWXT during programmatic and maintenance work and by subcontractors during construction activities. The review of BWXT hoisting and rigging activities included observation of lifting activities and crane maintenance, review of hoisting and rigging procedures, and inspection of hoists, slings, lifting fixtures, and cranes, both in the bays and cells (related to technical safety requirements [TSRs]) and elsewhere on site, such as shop areas and work sites (non-TSR related). Subcontractor hoisting and rigging activities observed during the assessment included a transformer lift in the north substation and lifts performed as a part of roof replacement at Building 12-26.

BWXT. General requirements for hoisting and rigging work by BWXT are contained in BWXT Standard 3333, *Hoisting & Rigging*. This standard complements the DOE Hoisting and Rigging Manual, which is identified in the BWXT standards/requirements identification document. The identified subject matter expert for hoisting and rigging is a member of the DOE hoisting and rigging committee, and is very knowledgeable of the applicable requirements.

BWXT procedures and requirements for testing and inspection of hoisting and rigging equipment are in accordance with the DOE Hoisting and Rigging Manual**.** BWXT uses the plant property identification number to identify equipment that is due for inspection and testing. Weight testing requirements established for hoists are more rigorous than the Standard 3333 requirements, including certification every three years. Although not required by the standard, BWXT affixes a maintenance sticker or stencil on lifting equipment that indicates when the equipment is due for its next annual inspection. Records of the inspection are maintained and readily available.

Training and certification of hoisting and rigging inspectors is conducted by an outside contractor on an annual basis, and certification lasts three years. The course materials adequately cover the range of equipment used by BWXT, and the training records are adequately maintained and readily retrievable.

Procedures for preventive maintenance (PM) on safety-related (TSR) hoists are detailed and strictly followed. Procedures for non-TSR hoists, while followed, are not followed in a stepwise manner. For example, the annual PM on the 11-55 two-ton hoist in Bay 2 was conducted in accordance with a written PM procedure, but steps were not performed in the order specified. Although the procedure called for the weight test last, the mechanics normally performed the weight test prior to conducting the other inspections, indicating that the weight test could introduce failures that would be subsequently identified by the PM inspections. The procedure is listed as a general use procedure, and states that action steps in the procedure are for guidance and are not intended to be performed step by step, but the procedure has not been modified to indicate the order in which the steps are normally performed.

All hoisting equipment used in weapons procedures has three markings. The first is a brass tag stamped with the date the weight test was performed. The second is a sticker affixed to the back of that brass tag indicating when the next visual inspection is due. The third is a laminated tag attached to the equipment indicating when the annual preventive maintenance was conducted, and when the next annual maintenance is due. Procedures include steps that require operators to verify that the inspections and weight tests are current. The system used by the weapons program is straightforward and facilitates the operator’s determination that the equipment is ready and safe to use. However, hoisting and rigging equipment used elsewhere on the plant site (non-weapons work) does not have similar markings, even though the weight checks, inspections, and maintenance are conducted by the same shop personnel as for weapons program equipment. There is no plant standard that defines which tags will be applied to hoisting and rigging equipment, when those tags will be affixed, and what information those tags should contain. As a result, maintenance personnel cannot readily determine whether hoisting and rigging equipment has been tested and is safe to use for non-weapons work.

Workers are not always complying with inspection and test requirements for non-TSR related hoisting and rigging equipment**.** Inspection of hoisting and rigging equipment available for use in maintenance shop areas indicated that much of the equipment is clearly marked with tags indicating when the slings and hoists are due for inspection, but a significant number of slings and hoists were either overdue for inspection or were not marked. A computerized tool list is used to generate a list of slings in each of the shops that are due for inspection. This list indicates that over 300 items are overdue for inspection. In some cases, the slings may have been lost or destroyed. However, the list has not been maintained and does not provide a reliable indication of the number of hoists or slings that are available for use or that are due for inspection.

There were four cases identified during this inspection where hoisting was performed with outdated or missing weight tests. The first was a York Hercu-Lift portable crane in the sheet metal shop. When questioned, the shop supervisor indicated that the crane had been used the previous week and is used frequently within the shop. The lift was clearly stenciled with an inspection due date of September 2004.

The second instance was identified in the 12-81 battery maintenance shop. The forklift batteries weigh approximately 3,700 pounds, requiring a two-ton hoist installed in the shop to remove and maintain the batteries. According to the mechanic, the 12-81 shop hoist is used frequently, almost daily. The crane inspection checklist that the operator completes daily prior to using the crane had two entries, January 18, 2005, and January 19, 2005, both indicating that the inspection was completed. One of the checks is that the weight test and inspection are current. The tag hanging on the controller for the crane indicated the inspection for the crane expired in September 2004, indicating the operators either did not understand the tag, or ignored it. A review of the records for the crane revealed that the last three-year inspection was completed in February 2002, indicating that the inspection tag should have indicated February 2005. Therefore, the crane was actually within its three-year inspection limit, but the operators did not properly perform their daily inspections.

The third case occurred in the 12-104 equipment room, where a commercial portable gantry crane was used to perform repairs on the compressor. That crane is stenciled as rated for one-ton, but was not weight tested prior to being placed in service. There was no Pantex property identification tag on the frame, which would allow a determination about whether the crane had been entered into the maintenance record system for PM. Further, there were two one-ton hoists attached to the frame. Both chain hoists had weight test tags that expired in August 2004. One of the hoists was missing the latch on the hook, which should have been detected in the pre-use inspection and resulted in corrective action prior to use of the crane hoists. The A-frame had a tag that directed the mechanic to consult the operating and safety instructions for further information, but those instructions were not available in the mechanics shop. The work order that replaced the compressor did not reference the plant standard for hoisting and rigging, nor did it include any requirements to ensure that rigging equipment inspections and weight tests are current.

The fourth case involved two mobile manually operated shop cranes in the weapons machine shop and three equipment lifts, which are typically used daily. None of this equipment had any indication of an initial weight test or inspection, or any stenciled markings to indicate when the inspections were due.

For non-weapons (non-TSR) hoisting and rigging equipment, the above instances indicate that mechanics/operators have not been adequately trained to identify lifting equipment that has not been properly inspected. Discussions with the training division personnel matrixed to the maintenance division indicate that no training has been provided to mechanics that would explain or clarify the inspection requirements. Shop supervisors are not ensuring that all lifting equipment in their shop is properly maintained and inspected prior to use. On February 2, 2005, BWXT began an assessment of all non-nuclear hoisting and rigging activities as a result of these observations.

Finding #18. Hoisting and rigging equipment (other than that covered by TSRs) is not being properly maintained and inspected prior to use, resulting in the potential for deficient equipment to be used and increasing the risk of personnel injury.

Construction Subcontractors. For the observed lift activities, lift plans were generated by the subcontractor prior to performing any crane hoisting operations at the Pantex Plant, as required by the applicable subcontracts. These lift plans are detailed and include the maximum weight of the intended lift, the boom angle associated with the lift, the proposed lifting radius, the boom length, a map of the proposed lifting location, the name of the crane operator, the name of the safety officer, the name of the rigger, a copy of the load chart, and a current annual inspection of the crane. Furthermore, the lift plans must be submitted to and approved by BWXT before crane operations are performed. The designated approval official is the contracting officer technical representative, although, in practice, BWXT Construction Safety and Construction Management Division personnel review and approve the plans.

For the most part, subcontractor crane operations and BWXT expectations for subcontractor crane operations meet the provisions identified in 29 CFR 1926.550, and the applicable provisions are addressed in the subcontractor's safety plan. Lift plans were consistent with these requirements, with one exception. In the lift conducted at the north substation, pads were not placed under the crane outriggers as required by the lift plan, and one outrigger was sinking into the gravel. Subcontractor job hazards analyses, activity hazards analyses, safety plans, and operations in the field address the Occupational Safety and Health Administration (OSHA) requirements. However, BWXT did not flow down the requirements of the DOE hoisting and rigging standard to their construction subcontractors. As a result, requirements for the conduct of critical lifts as specified in the DOE hoisting and rigging standard were not used to develop the BWXT Construction Management safe work plan and lift plan or included in the subcontractor's activity hazards analysis. Furthermore, neither BWXT Construction Safety nor the BWXT hoisting and rigging subject matter expert assessed the rigor of the lift plan or the quality of lifting hardware against the DOE standards requirements. Additionally the DOE standard's testing requirements for lifting fixtures and associated hardware and marking of lifting hardware (e.g., wire ropes and shackles) were not considered in BWXT standards or lift plans and were not met.

Finding #19. BWXT has not ensured that its subcontractors comply with DOE hoisting and rigging requirements.

Summary. BWXT generally has established appropriate standards and requirements for hoisting and rigging, and TSR-related hoisting and rigging activities are performed in accordance with the requirements. However, workers do not appropriately implement all standards and requirements for non-TSR related rigging activities. Personnel are not verifying that inspection labels are current, equipment inventories are not being maintained, and shop supervisors are not enforcing site requirements. Further, site standards are not sufficiently detailed to describe exactly how the DOE hoisting and rigging manual is implemented at the site. BWXT has applied OSHA hoisting and rigging requirements to subcontractors and has required the use of lift plans to ensure compliance with these requirements. However, BWXT has not imposed the more conservative NNSA hoisting and rigging requirements, which are included in the BWXT prime contract, on its subcontractors.

F.2.3 Safety System Oversight

OA selected safety system oversight (SSO) as a focus area because DOE requirements in this area are relatively new, and previous OA inspection results indicate that a number of deficiencies in engineered safety systems could be corrected and prevented by effective SSO. To assess this area, OA interviewed PXSO and BWXT personnel, reviewed various documents and procedures, and examined training and qualifications. OA focused on PXSO and BWXT oversight of the safety systems that were reviewed by OA during this inspection (see Appendix E).

NNSA/PXSO. The PXSO Functions, Responsibilities, and Authorities Manual (FRAM) appropriately outlines the PXSO program for SSO, with specifics provided in a PXSO procedure issued in August 2004. The operating procedure appropriately defines roles and responsibilities, staffing, and training, and is consistent with program expectations delineated in DOE Manual 426.1-1A. Furthermore, the PXSO procedure generally describes the relationship between Facility Representatives and SSO personnel, appropriately identifying that SSO personnel will focus on the details of safety system operability implementation, with the Facility Representatives focusing on day-to-day operations. SSO personnel also assist authorization basis personnel in the review of the documented safety analysis applicable to their system and the implementation of TSRs.

PXSO has identified 22 safety systems that fall within its oversight program and have assigned four personnel to perform the requisite SSO: a mechanical engineer, an electrical engineer, a fire protection engineer, and an SSO lead. SSO personnel are responsible for remaining cognizant of the assigned safety systems, performing assessments, monitoring performance of the contractor's system engineer program, and confirming configuration management.

PXSO has a well-defined qualification program and is making good progress in qualifying its SSO personnel and the SSO lead (two personnel are fully qualified, one is mostly qualified, and a recent hire has started qualification). The mechanical engineer qualification was reviewed and found to be very detailed and to include appropriate competencies.

The SSO engineers who were interviewed had appropriate engineering education and work experience and demonstrated the ability to perform detailed evaluations of various areas supporting safety system operability. For example, the mechanical engineer provided technically detailed and effective assessments of a tooling stress analysis and confinement leak path sealing. The SSO program has performed two formal scheduled and documented assessments of BWXT: a contractor system engineering program review, and an assessment of the contractor walkdown program. Both of these assessments were rigorous and appropriately documented. The assessments provided good insights into the contractor programs and identified strengths, weaknesses, and appropriate recommendations for improvement.

OA identified some weaknesses in the SSO program. Specifically:

- PXSO has assigned SSO personnel to oversee all active safety systems and some passive safety systems, such as the facility structure. However, SSO personnel have not been assigned to all appropriate passive safety systems and components, such as specially designed tooling used to manipulate nuclear components.

- The SSO procedure does not provide details on oversight of configuration management and does not provide details on some currently performed duties, such as review of implementation of new TSR controls.

- PXSO has not established appropriate plans for performing proactive detailed assessments of safety systems or components. Rather, current plans are for some programmatic reviews and reactive system or component assessments, as needed. However, PXSO is in the process of reviewing, in detail, safety system controls as part of the TSR integrated implementation plan.

- PXSO has not established an appropriate system for tracking issues identified during its assessments. (PXSO recognizes this deficiency and is working to establish a system using PER/E*STARS).

- PXSO has not established effective programs for monitoring safety system performance. (This situation is attributed, in large part, to deficiencies in the contractor system performance monitoring program.)

Although the newly developed SSO program is consistent with DOE Manual 426.1-1A and is generally well defined, these weaknesses indicate the need for further detail in the SSO program definition, improvements in rigor of execution, and a re-evaluation of priorities for performing assessments.

BWXT. In 2003, BWXT established a system engineer organization to serve as technical authority for safety-related systems in nuclear and high explosive facilities. Although BWXT is not currently contractually required to meet DOE Order 420.1A (which is scheduled to be included in the next annual update to the contract standards/requirements identification document), BWXT has established most elements of an effective cognizant system engineer program as specified in the order. The program is generally well defined in the engineering division and system engineering department manuals, and system engineering responsibilities are clearly defined, including responsibilities for (1) ensuring that the system physical configuration agrees with associated documentation, (2) ensuring that only approved modifications are made, (3) ensuring that the system is sufficiently tested, (4) evaluating the data and input necessary for tracking and trending, (5) reviewing design packages, (6) maintaining the integrity of the system safety basis, and (7) reviewing and approving in-service inspection and surveillance requirements procedures. These responsibilities are generally consistent with requirements in DOE Order 420.1A.

Personnel have been assigned to each of the safety systems. Currently, fourteen personnel are assigned specific systems, while four other engineers support such activities as monitoring the TSR integrated implementation plan. Currently, the engineers' work load is heavy, with a number of ongoing efforts and initiatives, such as performing vital safety system assessments and integrated implementation plan actions.

BWXT has established well-defined and appropriate qualification requirements. Qualification encompasses many elements, including education, experience, training, required reading, mentoring, and walkdowns. BWXT used a systematic approach for developing the training and qualification program that first identified duties and then performed a tabletop analysis, where system engineers and training personnel participated in identifying appropriate training methods. The qualification requirements are appropriate to ensure that system engineers are capable of performing their duties. All system engineers are in the qualification process, with 75 percent scheduled to be qualified by June 30, 2005. New system engineers are expected to be qualified within two years of their date of hire.

As part of its safety system functionality evaluation, OA interviewed several BWXT system engineers and evaluated products that were developed or reviewed by the system engineering organization, including vital safety system assessment reports and design information summaries. Vital safety systems assessments have been performed for most safety-class systems, and BWXT plans are to complete all such assessments in FY 2005. BWXT is working to institutionalize vital safety system assessments and is defining the process in the BWXT system engineering and configuration management manual. The assessments appropriately used DOE's criteria, review and approach document that was developed to meet the Defense Nuclear Facilities Safety Board 2000-2 recommendation. BWXT has initiatives underway to improve the vital safety system assessments and walkdowns to address PXSO recommendations.

The system engineering department is also responsible for developing and maintaining the design information summaries. The design information summaries that were reviewed are generally well formatted and can serve as a good resource for information on the system. However, the purpose of the design information summaries is not well defined in the system engineering manual or in the summaries. Furthermore, some sections were not completed. All the system engineers who were interviewed had a very good understanding of the systems that OA evaluated and were able to describe current configuration, maintenance activities, and ongoing issues and improvement items. The system engineers demonstrated a sense of ownership for the systems.

Although many aspects of the cognizant system engineer program have been established, a program for tracking and trending of system performance has not. A contributing factor is that maintenance packages do not have enough detail to gather needed data (such as what the damage was and how the repair was performed). This weakness has been identified by BWXT and PXSO, and efforts are underway to address it. Furthermore, as discussed in Appendix E, system engineers have not rigorously implemented the unreviewed safety question process and the issue reporting process (problem evaluation requests) to address system or engineering deficiencies, such as inadequate analyses or calculations.

Summary. PXSO and BWXT have established most elements of effective safety system oversight programs. Engineers who were interviewed were technically competent and in most respects very knowledgeable of their assigned systems. PXSO assessments performed to date are detailed and have identified weaknesses and areas for improvement in contractor programs and activities related to safety systems. Weaknesses were identified in PXSO's issues tracking and PXSO's plans for independent system or component functionality assessments. The BWXT system engineer program has weaknesses in tracking and trending safety system performance and processing engineering deficiencies via BWXT protocols.

F.2.4 Chronic Beryllium Disease Prevention Program

DOE has established regulatory requirements for the chronic beryllium disease prevention program (CBDPP) in 10 CFR 850 (64 Federal Register 68854). The rule is intended to protect and prevent workers from exposure to beryllium; it establishes medical surveillance requirements to ensure the early detection of chronic beryllium disease; and it requires a reduction in the number of workers currently exposed to beryllium in their workplace. DOE also developed guidance (DOE Guide 440.1-7A) to assist line managers in meeting their responsibilities for implementing the CBDPP. The OA review focused on PXSO and BWXT implementation of the CBDPP plan.

The formal Pantex CBDPP was approved by NNSA in April 2000. In 1999, following a formal Beryllium Notice from DOE Headquarters, Pantex instituted standard methodologies to identify and characterize site activities and sources of beryllium, all associated beryllium workers, and a facility-based sampling plan to identify any potential sources of contamination. Based on over 20,000 samples per year in the 2001-2002 timeframe, 35 Pantex facilities and several air handling units were identified as having contamination exceeding the housekeeping standard of 3 micrograms per 100 centimeters squared (cm^2). To expedite the identification and cleanup of all facilities, and recognizing the need to rapidly process the 1,300 employees identified as associated workers, PXSO and BWXT management accelerated the CBDPP process and dramatically reduced the initial proposed timeframes for the initial medical surveillance and cleanup activities (from several years to less than one year).

Currently, the Pantex CBDPP is a highly visible site program that is actively supported by both PXSO and BWXT management. The Industrial Hygiene Division has primary responsibilities for the administration of the site-specific program; however, the Occupational Medicine organization also has parallel responsibilities for implementing the medical sections of the plan. BWXT Plant Standard 3233, established in 2000, defines the roles, responsibilities and authorities for the beryllium program and provides the necessary details needed to implement the beryllium program. Beryllium awareness and beryllium worker training is available to DOE, BWXT, and any subcontractor involved in a beryllium project. The inclusion of subcontractors is an additional measure to help protect and monitor all workers associated with beryllium on the Pantex site. Industrial Hygiene and medical personnel participate in the beryllium orientation and training programs, and have approved all training lesson plans associated with the CBDPP.

Beryllium samples are processed at the Pantex site by a laboratory that is accredited by the American Industrial Hygiene Association. Beryllium samples have the highest site priority and can be processed in less than a day if needed to determine potential contamination sites. Pantex laboratory personnel have been active in the DOE-wide beryllium working group and have had significant input into the beryllium oxide digestion problems that have been encountered at some DOE sites.

The beryllium medical surveillance program is formally documented and very well organized. The program has effective protocols for all of its responsibilities, including records management, consent forms, notifications, statistics, and follow-up activities. During the past four years, over 3,000 BeLPT blood tests have been conducted, and 14 individuals have been diagnosed as having chronic beryllium disease. Over 1,400 employees are monitored either annually if sensitized or tri-annually if identified as a beryllium associated worker. Consistent with DOE expectations, medical surveillance and testing is voluntary for the workers.

PXSO and BWXT participated in reviewing their CBDPP following formal lessons-learned notifications and have provided formal responses to the Nevada Test Site report, the safety notification for beryllium in grinding wheels, and the potential surface contamination of beryllium components from Kansas City Plant. However, no formal assessments of the CBDPP or program self-assessments have been performed in the past several years.

The current CBDPP has been submitted to PXSO for approval of several technical revisions. Several additional modifications to the appendix have been suggested in response to this OA inspection based on questions concerning the appropriate controls for handling beryllium components that have surface contamination above detection limits but below the housekeeping contamination threshold (see Appendix C).

Summary. The Pantex Plant has an effective CBDPP and is in compliance with 10 CFR 850. The site standard adequately documents the roles, responsibilities, and authorities necessary to provide a comprehensive program that protects and monitors workers potentially exposed to beryllium. The 2001 beryllium initiative to clean all areas of the plant that may have contamination above the housekeeping standard has reduced the number of workers that could be exposed to residual beryllium contamination. A voluntary beryllium medical surveillance program is effectively publicized and aggressively supports beryllium associated workers during the identification, testing, and follow-up phases of the program. Additional attention is needed to evaluate the need for controls when handling beryllium components with detectable surface contamination below regulatory requirements and additional requirements for scheduling regular program self-assessments to assure the quality and effectiveness of all program activities.

F.2.5 Safety Management for Protective Force Training

A recent Inspector General report identified weaknesses in some aspects of site Basic Security Police Officer Training Programs and identified a need for increased safety management for protective force training. The DOE corrective action plan for weaknesses identified in the Inspector General report committed OA to examine selected aspects of protective force training from a safety management perspective on OA ES&H inspections.

At Pantex, OA reviewed the BWXT Pantex contract for DOE firearms training and qualification requirements. The review of Pantex security force training consisted of observing student live fire and dynamic entry exercises at Range 8. In addition, reviews were conducted of the live-fire course documentation, including safeguards and security standards, Firearms Tactics and Training Facility (FTTF) procedures, Security Police Officer Dynamic Entry lesson plans, live-fire range safety briefings and checklists, certification of instructors, industrial hygiene monitoring, and industrial hygiene survey data for noise and lead. Risk assessment reports that are required by DOE Order 440.1A were reviewed for safety and health applicability and effectiveness. In addition, OA evaluated the FTTF for appropriate hazards analysis and safety documentation of its firearms training facility. OA also reviewed selected aspects of BWXT feedback and improvement activities and PXSO line management oversight as it applies to protective force training activities.

Firearms Range Safety and Hazards Analysis During Protective Force Training. The observed live fire exercises were well controlled and consistent with the associated course documentation. Prescribed protective equipment was in place, and range instructors constantly re-enforced the safe handling of loaded weapons and live ammunition. Student/instructor ratios were maintained throughout the exercise evolutions. Industrial hygiene monitoring data was available for all live-fire ranges and all weapons systems as required by DOE regulations. All fire range personnel are monitored for lead exposure under a specific medical surveillance program.

Three recent accidental discharges of firearms at the FTTF ranges, which resulted in two minor injuries, were investigated in detail by site inter-disciplinary committees. The committees recommended numerous corrective actions, which have been implemented and verified. PXSO was involved in the investigation process and have concurred with the corrective action plans.

Although most aspects of hazards analysis were effective, risk assessment reports were overly generic and somewhat lengthy, listing 20-plus pages of potential hazards for a single live-fire course. Also, in the case of the "Weapons Cleaning Risk Assessment Report," many of the initial hazards listed in the report did not directly pertain to firearms cleaning at the site cleaning facility, and information from the material safety data sheets was not included in the recommended controls section of the report.

Security Training Feedback and Improvement. DOE and contractor firearms safety reviews and self-assessments for 2004 were completed as required by DOE STD-1091-96. The BWXT self-assessment process utilizes a checklist style form that is completed by the assessor. BWXT Performance Assurance performs activity-based assessments that include firearms safety activities.

The Safeguards and Security Division uses the PER/E*STARS lessons-learned process and has contributed to both internal and external lessons-learned notices following the accidental firearms discharge investigations. In addition, the Pantex Safeguards and Security Division has elected to maintain an internally controlled issues management and corrective action plan program that is separate from the recently revised Pantex Plant-wide system, because most of the safeguards and security assessment issues and corrective actions need to be controlled and limited in their distribution due to security classification concerns. A review of several recent BWXT Pantex corrective actions resulting from a 2004 PXSO annual assessment indicated that specific findings identified by reviewers were quickly corrected. For example, annual industrial hygiene monitoring at all ranges was quickly implemented in response to an identified deficiency.

PXSO Oversight. PXSO involves several of its key staff in the oversight of protective force training, including personnel from the Office of Safety Health and Quality Assurance, the Safeguards and Security Division, and the Office of Oversight and Assessments. Formal self-assessments are conducted annually by PXSO personnel and are officially transmitted to BWXT senior management, and the corresponding corrective actions are tracked to completion. Recent PXSO assessments have effectively identified security training activity strengths, weaknesses, and recommendations that have improved the sites ability to comply with firearms safety requirements. PXSO also participates in the site Firearms Safety Committee, special investigation reports, and firearms instructor certifications. PXSO also formally interfaces with the Office of Transportation Safeguards personnel that are assigned to the Pantex site and use the FTTF.

Summary. PXSO is effectively involved and integrated in the ES&H aspects of security protective force training. In the areas of live-fire range instruction and range instruction documentation, protective force training was effectively managed by BWXT. Risk assessment reports that are required by DOE Order 440.1A were somewhat generic and lengthy for effective use by students and instructors.

F.3 CONCLUSIONS

PXSO and BWXT have appropriately addressed the complex issues associated with most of the focus areas reviewed during this inspection, and have implemented or initiated appropriate actions to meet applicable requirements. The PXSO and BWXT efforts to implement the EMS are comprehensive and effective, and several aspects are noteworthy, such as senior PXSO and BWXT management involvement and support for EMS. PXSO and BWXT have established most elements of effective safety system oversight programs. PXSO is effectively involved and integrated in the ES&H aspects of security protective force training. The CBDPP is supported by PXSO and BWXT senior management and is in compliance with 10 CFR 850. Although additional actions and improvements are needed in each of these focus areas, PXSO and BWXT have devoted appropriate resources and management attention to these areas and have an adequate understanding of the residual deficiencies and needed actions.

Increased attention is needed, however, in the area of hoisting and rigging for non-TSR (non-nuclear explosives) activities. While BWXT has established appropriate standards and requirements for hoisting and rigging and while TSR-related hoisting and rigging activities are performed in accordance with the requirements, implementation of hoisting and rigging standards and requirements for non-TSR related rigging activities is not effective, with deficiencies in inspection labels, equipment inventories, communication of requirements, procedure compliance, and flowdown of requirements to subcontractors.

F.4 OPPORTUNITIES FOR IMPROVEMENT

This OA review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

PXSO

1. **Enhance the SSO processes and the rigor of implementation.** Specific actions to consider include:

    - Establish protocols for performing and documenting each type of assessment performed by the SSO. Include protocols for distribution of results and any tracking requirements.

    - Establish protocols for equipment performance history tracking. Coordinate with BWXT to ensure that the PXSO system is compatible with data to be obtained from the BWXT.

    - Establish protocols and schedules for the periodic assessment of safety systems. Enhance the current walkdown guidelines to provide additional information concerning review of the design and configuration management. Consider utilizing a vertical slice approach.

- Further define the relationship between the contractor Facility Representatives and SSO, and authorization basis personnel and SSOs. Establish protocols for information sharing. In addition, define the process for SSO support of the authorization basis, including review of unreviewed safety questions and authorization basis implementation.

- Expand the SSO program to include passive systems. Review the contractor's safety system assignments to identify passive systems that may warrant oversight by PXSO. Consider the importance and complexity of the passive systems to determine priorities for oversight.

- Review the FRAM and the SSO procedure to improve flowdown for requirements. The FRAM is based upon DOE Order 420.1A, while the internal operating procedure is based upon the Federal Technical Capability Manual. Although the requirements are similar, some differences exist that can be minimized or better documented.

BWXT - Environmental Management System

1. **Implement a process to ensure that comprehensive reviews (i.e., those used to identify environmental aspects for BWXT, tenants, and PXSO operations and activities) are routinely updated**. Ensure that the updated reviews are used to revise objectives and targets to reflect changes in the status of environmental programs and operations.

2. **Consider integrating the work instruction for conducting job environmental hazards analyses (currently in draft form) with the work instruction for conducting job safety hazards analyses to ensure that the EMS is an integral part of integrated safety management**.

BWXT – Hoisting and Rigging

1. **Establish a plant standard that defines labels and tags for hoisting and rigging equipment**. Specific actions to consider include:

   - Adopt the tagging and labeling requirements currently used by the Manufacturing Division for nuclear explosive operating procedures.

   - Train all personnel that use hoisting and rigging equipment on the labeling requirements.

   - In all work orders involving hoisting and rigging, include steps for signature verification that all equipment is current on inspections and weight tests.

   - Conduct regular inspections of shop and work areas to identify hoisting and rigging equipment that is overdue for inspection or a weight test.

   - Ensure that requirements flow down to subcontractors and are effectively implemented.

BWXT – Safety System Engineers

1. **Improve the consistency and flowdown of system engineer responsibilities identified in BWXT program documents.** Ensure that BWXT documents that delineate system engineer requirements are consistent, and that the hierarchy of documents is clear.

2. **Improve processes and implementation of system tracking and trending.**

BWXT - CBDPP

1. **Revise the CBDPP, Appendix A, and Plant Standard 3223 to clearly establish the hazards and controls associated with the handling of beryllium-alloy weapons components that have surface contamination that is above detection but does not exceed the housekeeping standard of 3 micrograms per 100 cm2.** Specific actions to consider include:

   - Revise the CBDPP plan and Plant Standard 3223 to accurately reflect current Industrial Hygiene recommendations for working with items that have detectable beryllium contamination below the housekeeping threshold, including use of barrier paper, specific labels, and gloves to prevent surface contamination from spreading or accumulating on the hands.

   - Provide additional guidance on controls when working with beryllium components that have detectable surface contamination.

2. **Establish and formalize a self-assessment schedule that would review the various elements of the CBDPP to continually ensure the quality and effectiveness of the program.**

   - Ensure that the frequency of assessments is defined and meets DOE and site requirements.

   - Consider dividing the assessments into several parts to allow for a complete program review at the established frequency (e.g., every two years).

3. **Establish processes to sample and control beryllium on internal surfaces and gearing inside common machine shop equipment, such as milling machines, lathes, and band saws.** Specific actions to consider include:

   - Revise procedures to recognize the potential for internal contamination even though external surface samples were below detection limits.

   - Ensure that controls are in place to prevent the release for excess sale or transfer of equipment to non-governmental operations until adequate sampling is performed.

   - Establish a sampling program for machine shop equipment to reduce the potential for contamination of workers.

BWXT – Safety of Protective Force Training

1. **Review and revise risk assessment reports for the FTTF as necessary to ensure that relevant hazard and control information is captured in the assessment reports.** Ensure that the controls and hazard information is concise and relevant, to include removing overly generic or unneeded lengthy hazard information that is not directly relevant to the task.