DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

November 12, 2015

The Honorable Frank G. Klotz
Administrator
National Nuclear Security Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0701

Dear Administrator Klotz:

Members of the Defense Nuclear Facilities Safety Board's (Board) staff recently reviewed the maintenance program at the Pantex Plant (Pantex) and identified a number of issues of concern to the Board. The enclosed report documents deficiencies in several elements of the maintenance program, as well as deficiencies in procedure adherence and execution.

We understand that the National Nuclear Security Administration (NNSA) Production Office (NPO) already tasked the Pantex contractor to respond to several of the issues identified by the Board's staff. The enclosed report provides additional details on those issues and on other deficiencies identified by the Board's staff. It is provided for your information and use as NNSA and NPO pursue opportunities to improve Pantex safety management programs.

Sincerely,

Joyce L. Connery
Chairman

Enclosure

c: Mr. Geoffrey Beausoleil
Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

August 27, 2015

MEMORANDUM FOR: S. A. Stokes, Technical Director

COPIES: Board Members

FROM: T. Hunt

SUBJECT: Maintenance Program, Pantex Plant

Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed the nuclear maintenance program at the Pantex Plant (Pantex). The management and operating contractor at Pantex is Consolidated Nuclear Security, LLC (CNS), and the National Nuclear Security Administration (NNSA) Production Office (NPO) is responsible for contract management and oversight of Pantex operations. Staff members R. Arnold, Z. Beauvais, T. Hunt, J. Mercier, and Outside Expert D. Boyd performed the on-site portion of the review during the week of June 1, 2015. The staff review team discussed its preliminary observations and concerns with senior CNS and NPO personnel during an outbriefing on June 4, 2015, and held a formal closeout meeting on July 29, 2015. Additional information in support of the review was provided by Pantex personnel on August 5, 2015, in response to lines of inquiry generated by staff members subsequent to the on-site review.

Background. This review follows up on an assessment of Pantex maintenance activities undertaken by the Board's staff in September 2012. The goal of the review was to reevaluate the adequacy of the maintenance program and its implementation in support of safe operations at the high-hazard nuclear facilities. The staff review team followed up on actions taken over the past two years by NPO and contractor organizations to address the numerous concerns regarding conduct of maintenance (i.e., quality of maintenance procedures, compliance with maintenance procedures, predictive maintenance, performance measures, authorization to perform maintenance, personnel safety conditions, and grace periods) communicated to site personnel during two outbriefings subsequent to the September 2012 review.

Observations of Contractor Processes and Activities. The Board's staff team reviewed the conformity of the Pantex maintenance program to the requirements and guidance in Department of Energy (DOE) Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*; DOE Guide 433.1-1A, *Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1B*; DOE Order 430.1B, *Real Property Asset Management*; DOE Order 420.1C, *Facility Safety*; DOE Order 422.1, *Conduct of Operations*; and associated guides, technical standards, and site-specific documents. In support of the review, the Board's staff team discussed program objectives with key CNS and NPO personnel and observed plan-of-the-day

meetings, pre-job briefings, CNS facility representatives' turnovers, and periodic maintenance program meetings, as well as corrective and preventive maintenance (PM) activities, tests, and surveillances supporting defense nuclear facilities. The following sections detail observations concerning the quality of maintenance procedures, formality of maintenance operations, work authorization, pre-job briefings, predictive maintenance, fire system labeling, performance measures, work planning, and system engineering support.

Quality of Procedures—As a significant part of this review, the staff team evaluated the content, format, and human factors aspects of maintenance procedures during implementation. The review team observed the execution of all, or portions of, more than 15 maintenance technical procedures and work documents. The staff team identified documentation deficiencies associated with workability, level-of-detail, flowdown of hazards and controls, or human factors during all activities.

Based on its review of the work documents, the review team concluded that the preventive, corrective, and surveillance maintenance procedures need to be more clear and accurate to reflect actual conditions and practices in the field. Most of the conditions identified are inconsistent with the procedural requirements and expectations delineated in the contractor's HNDBK-0006, *Infrastructure Management Work Control Planning Handbook*; MNL-352214, *Conduct of Maintenance and Utility Operations at Pantex*; and/or DOE-STD-1029, *Writer's Guide for Technical Procedures.* The staff review team noted missing, inconsistent, conflicting, and confusing directions and information, making some of the procedures unable to be implemented as written. A sampling of work document deficiencies is listed below.

- TP-MN-04482H/L, *5-Year Fire Protection System PM, 12-84-16/20*, Specific Use:

  – Special Instruction 3(5) states that "Repairs or replacement of any fire system component are not allowed for this PM." This is inconsistent with Special Instruction 3(28), which permits some corrective maintenance to be performed within the PM activity. Also, some performance steps in TP-MN-04482L allow replacement of system parts/components; e.g., diaphragm, springs, and gaskets (Steps 5.1.6(25), 5.1.6(26), and 5.1.10(10)).

  – Form PX-3170, *Work Performance Record*, did not indicate that a single source lockout was required for a high pressure fire loop valve.

  – Workers[1] did not initially understand how they were to verify that water was flowing from the main drain, per procedure step 5.1.5(2) of TP-MN-04482L. After discussing among themselves whether it was acceptable to listen for flow through piping, the workers decided to go outside to visually observe the flow from the drain outlet.

[1] The term "worker" is used generically throughout this report to identify the various craft disciplines performing maintenance activities. The disciplines include electricians, electronic technicians, area mechanics, pipefitters, fire system special mechanics, impairment and restoration mechanics, and sheetmetal workers.

- Step 5.1.6(6) in TP-MN-04482L indicates there is more than one Y trim strainer in the system when only one exists.

- Step 5.1.9(17) in TP-MN-04482L contains three distinct actions.

- Multiple valves with the same name, such as alarm test valves, are not further identified by location or specific function. The number of valves with the same name is not stated.

- A Note informing the workers that they should be prepared to quickly perform the two subsequent steps to prevent water from flowing beyond the riser should be a Caution statement. The staff review team observed the workers fail to perform the steps correctly, resulting in several gallons of water flowing from sprinkler heads and wetting down special tooling.

- The procedure does not include a post-maintenance testing section—as required by MNL-FO-1010, *Post Maintenance Testing Guidance Manual*—for maintenance that involves disassembly and reassembly activities.

- TP-MN-05794, *Annual Hoist PM*, Specific Use:

  - The procedure allows steps to be performed out of order. However, the procedure steps should be written to more closely match the order in which the workers execute them.

  - A Special Instruction states that blocks placed before steps are for placekeeping convenience and are not required to be checked. However, placekeeping is required for Specific Use procedures, per MNL-352214.

  - The pre-job review section of a PX-3170 form indicates a single-source lockout is required to perform the task but does not specify where the workers should apply the lock and tag.

  - A step states to park the crane as shown on the posted operator aid or, if no aid is posted, to the as-found position. A Warning before the step states that failure to comply with this step may result in a technical safety requirement (TSR) violation. The subject step is not marked to show TSR importance. Also, the step should reference TSR criteria for parking the crane instead of depending on the as-found position to be correct.

- Work Order 0029803530, *Two Detectors in Alarm for All Combinations*, unknown use category:

  – Test operations are performed at the fire alarm control panel outside the bay and at the fire riser in the bay equipment room, but the procedure does not indicate where each step is to be performed.

  – The Note before step 4.1.4(1) is incomplete, and the Caution after step 4.1.4(1) should come before the step to which it applies.

  – Different sections of the procedure use valve names inconsistently (e.g., 2.0(1), 4.1.3, 4.1.4(1)).

- TASK-PM-5341, *Quarterly PM of Film Processor in 12-84-10*, unknown use category:

  – Workers performed work in accordance with task instructions dated September 17, 2009. The outdated format lacked important attributes of current work order instructions or technical procedures.

  – The instruction lacks a prerequisite or a step to remove equipment covers to inspect processor pump operation.

  – Steps direct actions per recommendations in the manufacturer's manual. However, the work package did not include this information.

  – A step to check voltage settings and dryer lamps should be separated into two steps because the actions are performed at different times during the task.

  – The instruction does not provide criteria or tolerances for steps to verify that the processor table is level or determine if processor temperature accuracy and replenishment rates are acceptable.

- Work Order 0029804862, *Repair Hoist Oil Leaks, 12-84-18*, unknown use category:

  – A PX-3170 form included a single source lockout for an air valve without identifying the valve by label information.

- TP-MN-04396, *12-84-11 Hoist Pendant Changeout*, General Use:

  – The work package did not include the post-maintenance testing instruction (PMT-INS-02009) for cranes and hoists.

  – The procedure did not include instructions for parking the crane upon completion of work.

- TP-MN-02300, *RAMS Functional Test*, General Use; and TP-MN-06475, *RAMS Monitor Change Out*, unknown use category:

  – Procedures for monthly radiation monitor functional checks and change out of monitors do not include or flow down any steps to check for proper application of the seismic straps to prevent the monitors from falling off the shelf during a seismic event.

- TP-MN-06578, *Monthly Manual Chain Hoist TSR, 12-96*, Specific Use:

  – The Section 5.0 Warning statement is identified in such a way that it can be easily overlooked. The work order only requires that Sections 5.1 through 5.6 be performed.

  – Step 3.3 states that placekeeping "blocks before steps are for convenience, not mandatory." However, placekeeping is required for Specific Use procedures.

  – The Special Instructions section contains action steps (e.g., Steps 3.6, 3.8).

- TP-MN-06598, *15-33A Weekly Fire Pump Inspection*, Specific Use:

  – Steps are not written in the order in which rounds would logically be performed.

  – A Caution statement after step 5.4(16) should be identified as a Warning.

- PX-1188 Form, *Confined Space Entry Checklist/Permit:*

  – The form does not require verification that the air quality monitor is in current calibration.

The number and significance of the identified procedure weaknesses indicate that the Pantex maintenance procedure development, verification and validation, and change processes require improvement. Following the September 2012 maintenance program review, the Board's staff team informally forwarded a detailed list of approximately 140 technical procedure comments identified during observations of work and tabletop reviews to cognizant Pantex personnel for their consideration. Contractor personnel subsequently indicated that they reviewed and/or updated the specific maintenance procedures in which deficiencies were identified, but many similar errors were noted during the recent review. Due to the number of deficiencies, it seems clear that Pantex did not undertake the rigorous extent-of-condition review necessary to make improvements in the quality of all maintenance procedures. As another part of the corrective actions to address procedure quality issues after the staff team's 2012 review, the contractor committed to the staff review team in a May 2013 corrective action status briefing to provide technical writing training to all work control planners. Development of the training course has been delayed due to a series of instructor turnovers and subsequent reassignments of this responsibility. The contractor has hired a new instructor and assigned the individual responsibility for development of the course. The contractor conducted a training needs analysis

and established the expected training completion date as January 2017, with a retraining interval of every three years.

Formality of Operations—The Board's staff team observed maintenance procedures/work orders performed by several craft disciplines on facilities and safety-related structures, systems, and components (SSCs). Pantex administrative procedures require workers to adhere to the procedure as written, follow a formal operational communications protocol, and use place keeping during execution of all Critical and Specific Use procedures (also recommended for General Use procedures). The Board's staff team noted deviations from strict adherence to procedures, insufficient formality in communicating actions during execution of Critical and Specific Use procedures, and the inconsistent use of place keeping. Examples of each follow.

Procedure Adherence: Pantex administrative procedures require maintenance workers to stop or pause work and contact their supervisor anytime procedures cannot be followed as written or there is uncertainty regarding execution of the step or procedure. Several examples of deficient procedure adherence or work practices observed by the review team during implementation of Critical Use and Specific Use procedures are noted below. The review team identified similar procedure compliance issues during its September 2012 review.

- Workers removed a solenoid valve from fire suppression system piping without procedural authorization. The procedure was written to evaluate the valve while in its installed, system location. The workers then reinstalled the valve, also without procedural guidance.

- Workers failed to perform a step to clean a valve removed from fire suppression system piping with soap and water. A worker stated that the valve "looks clean enough."

- A worker wiped clean 15 test areas, in violation of the procedure, prior to taking initial electrostatic discharge resistance readings on a bay floor.

- Workers could not perform a procedure step to remove a lock from a main line strainer because there was no lock installed. With the supervisor's approval, the workers installed a lock on the strainer (without procedural authority) then immediately removed the lock so the intent of the step could be met.

- Workers installed a lockout/tagout on a high pressure fire loop post indicator valve without procedural direction. The supervisor indicated that the worker's training allowed this.

- Workers could not identify all of the components referred to in the fire suppression system PM procedure.

- Workers expressed uncertainty among themselves related to the deluge trim piping system boundaries and the intent of steps to remove the piping. The workers did not

immediately stop work for clarification but continued to remove the trim piping outside the intent of the procedure. Workers then reconnected the piping without procedural guidance after inspecting the internals.

- During functional testing of ultraviolet (UV) detectors, workers failed to follow the procedure. They did not silence fire alarm control panel notification devices, as required, and did not record certain parameters in the procedure.

- Workers cleaned a refractometer with fire system water without procedural guidance.

- During the five-year inspection and testing of the fire protection system, workers performed procedure steps incorrectly, causing the unintended activation of the fire protection system. Several gallons of water flowed from sprinkler heads and wetted down special tooling in the bay. (No nuclear explosives or material were in the facility at the time.)

- A worker stationed at a fire alarm control panel in support of fire system testing did not have a copy of the procedure present in the immediate work area and instead relied solely on the reader located in a separate facility to direct the required actions.

- There was no prerequisite or task performance step in the film processor PM procedure to remove equipment covers in order to inspect process pumps for operation and leaks. Instead of pausing or stopping work and contacting a supervisor, the workers removed covers and started working. Unanalyzed electrical and mechanical hazards existed when the workers performed steps with the film processor operating and the covers removed.

- There was absorbent material and visible evidence of past leakage under the film processor. Workers reported no leakage during this PM. The area under the processor should have been cleaned to facilitate detecting new leakage in the future.

- Maintenance workers did not perform required functional tests of the blast door interlocks following change-out of an alpha monitor.

Operational Communication: MNL-00040, *Pantex Plant Conduct of Operations Manual*, states that transmitting and receiving operating instructions and feedback on the results of operations must be conducted in a formal and disciplined manner. Although not explicitly required by the work documents or site procedures, it is the practice of maintenance management to assign at least two maintenance workers to each task related to SSCs serving a safety function. This creates a need for clear, concise, and correct verbal communications between the workers, especially when instructions are being read by one worker to another worker. During the execution of Critical Use and Specific Use procedures, the review team observed senders and receivers communicating in an informal manner. Weaknesses in the process included receivers not repeating or acknowledging that the directed actions were understood; multiple steps and associated substeps being read at once; Notes, Cautions, and Warnings not being read to the

receiver; and communication between sender and receiver sometimes being informal. Examples of deficiencies in the operational communication protocol included the following:

- Certain safety-related information, particularly the "SR" and "ISI" icons (surveillance requirement and in-service-inspection, respectively) located in the procedure margins, was not communicated as part of the procedure step.

- The entire step was not always communicated or communicated as written.

- Warning, Cautions, and Notes were not consistently communicated.

- Feedback from the receiver to the person communicating the step was not always clearly accomplished when the step was received and when it was successfully completed.

- Noisy facilities made it difficult for the workers to clearly and unambiguously communicate.

- During functional testing of UV detectors, repetitive tasks were observed where the formality of communications declined as the steps were repeated.

Placekeeping: The review team observed that workers did not consistently document and implement placekeeping of procedural steps as they were completed. As noted in DOE-STD-1029, placekeeping is a best practice to minimize the potential that a worker will skip a procedural step or perform it more than once during the execution of complex, infrequently exercised, or safety-consequential procedures. In accordance with Pantex WI 02.03.16.01.01, *Adhere to Procedures*, "Placekeeping is required for all Critical Use and Specific Use procedures unless the procedure in use specifically and clearly states that place keeping is not required." MNL-352214 requires placekeeping each step as it is completed for Critical Use and Specific Use procedures before proceeding to the next step and also recommends placekeeping for General Use procedures. Pantex WI 02.06.04.02.04, *Execute Maintenance Work and Provide Feedback*, specifies four methods for documenting completion of each step (i.e., blanks, boxes, data sheets, or other method to facilitate placekeeping), yet most procedures observed being executed used these methods for selected steps or sections only, and did not provide one of the placekeeping options for each action step. These procedural deficiencies may have contributed to the staff team's observation that some maintenance personnel were performing Critical Use and Specific Use procedures without marking *each* step as being completed before proceeding to the next step. This is a particularly risky practice when steps are permitted to be performed out of the order listed in the procedure, or if they are required to be performed more than once.

Many of the maintenance workers performed their assigned tasks adequately. The review team believes, however, that management's expectations for the formality of work in the areas of procedure adherence, operational communications, and placekeeping need to be reinforced. Increased emphasis on formality and conformance to recognized conduct of operations principles would help to ensure the behaviors of all maintenance workers support safe and reliable operations.

Work Authorization—The process Pantex personnel use to ensure the facility is in a configuration that allows for safe and efficient performance of maintenance is not always effective. The staff team observed two instances where the conditions in the facility were not accurately characterized when maintenance personnel were authorized to perform work and entered the facility.

- Prior to workers entering a facility to test continuous air monitors and associated equipment interfaces within the radiation alarm monitoring system, review team members observed the maintenance supervisor briefing the crew without being aware of all the potential hazards in the facility. In accordance with DESKAID-0431, *Guidance for Effective Pre-Job Briefings Conducted by Pantex Infrastructure Personnel*, the responsible supervisor shall ensure that all of the hazards and controls are communicated and understood during the pre-job briefing. TABLE-0068, *Safety Checklist*, requires the supervisor to contact the facility manager if there is a question regarding the contents of the facility. The supervisor did not adhere to either of these requirements, and the maintenance workers entered the facility without being briefed on all of the hazards and associated controls.

- Maintenance personnel had to pause work twice for the same issue during performance of a hoist PM activity. The work authorization process failed to recognize that large storage cabinets in the work envelope created interferences and the workers had to move them to allow access to the hoists.

Maintenance representatives do not participate in the walkdowns performed by the facility manager and production section manager prior to authorization to perform maintenance. DOE Order 422.1, *Conduct of Operations*, requires a "thorough, accurate transfer of information and responsibilities … that results in the safe and effective transfer of equipment status and in-progress or planned activities from one shift or workgroup to the next." The Board's staff review team believes that one of several options to enhance the work authorization process would be for the maintenance organization to be more actively involved.

Pre-job Briefings—The review team attended numerous pre-job briefings, or portions thereof, and identified several areas for improvement. Many of the briefings did not meet the guidance for the content and conduct described in DESKAID-0431, *Guidance for Effective Pre-Job Briefings—Conducted by Pantex Infrastructure Personnel*. The craft supervisor performs the briefings using a PX-3170 form. The form includes a Pre-Job Review section with a list of nine topics to be checked off, as applicable, and a Pre-Job Briefing/Comments section with several blank lines for additional information to be communicated to the workers. In one case, the Pre-Job Review section had none of the nine topical areas checked for discussion (e.g., steps to complete task, mitigating actions for hazards/issues), and in other instances the single source lockout item was neither checked, nor the component identified, when required. The Pre-Job Briefing/Comments section, in many cases, contained generic statements such as reminders to wear proper personal protective equipment, follow bay/cell entry requirements, read posted signs before entering the area, secure the facility, repair any deficiencies found if allowed by the procedure, and be cautious of slips, trips, and falls. Consideration should be given, for example,

to including more job specific information, lessons learned applicable to the work, or a review of responses to emergencies, if applicable.

The DESKAID lists 14 questions or talking points expected to be addressed during a pre-job briefing, but they do not align with the nine topics listed in the Pre-Job Review section of the PX-3170 form. Reconciling the DESKAID and PX-3170 form would help ensure that safety information is being communicated to the workers during the pre-job briefings, prior to the conduct of field work. Some of the talking points not addressed during the review team's observations were how mistakes can be made, the important steps of the activity, what can go wrong, whether all hazards have been identified, whether everyone understand their roles and responsibilities, whether any hold points or other sign-offs are required, and reminders not to act on direction related to the job from anyone outside their management chain. One of the guidelines in the DESKAID for conducting an effective pre-job briefing is for the supervisor to prepare thoroughly and understand every facet of the work. As noted in the *Work Authorization* section above, this is not consistently achieved.

Predictive Maintenance (PdM) Program—Pantex does not have a functioning PdM program that could implement equipment evaluation methodologies in support of its nuclear facilities, such as vibration monitoring of rotating equipment and thermographic measurements of electrical and mechanical equipment. A contractor management self-assessment identified the lack of a PdM program for balance-of-plant SSCs in a June 2014 report. CNS subsequently issued a memo to NPO stating that a PdM improvement plan was being developed but abandoned the project without making any apparent improvements.

The PdM process is not defined in any of Pantex's implementing documents. DOE Order 433.1B requires that the site's Nuclear Maintenance Management Program clearly address "the process for utilization of appropriate types of maintenance (i.e., preventive maintenance, predictive maintenance, reliability-centered maintenance, surveillance and testing, and corrective maintenance) to provide for safe, efficient, and reliable operation of safety SSCs." In accordance with the Federal Energy Management Program Guide on *Operations and Maintenance Best Practices*, the advantages of PdM include increased efficiency, increased component reliability, and reduced probability of sudden equipment failures.

The Board's staff team believes a vigorous PdM program at Pantex could improve equipment reliability and overall nuclear maintenance program efficiency. The lack of a technically rigorous PdM program—in part, due to the current funding profile, as reported in the CNS response to the staff review team's lines of inquiry—hinders the collection of the type of information needed to optimize maintenance strategies and methodologies. CNS personnel indicated that they plan to initiate a PdM program for the High Explosives Pressing Facility and other newly-constructed facilities, but they have not committed to expand the PdM capabilities to equipment supporting defense nuclear facilities.

Fire System Labeling—The components of the wet pipe and deluge system fire risers in the nuclear explosive bays and cells are inadequately labeled. Ineffective equipment labeling increases the probability of operator and maintenance errors resulting from incorrect identification of facility equipment. The staff observed the performance of five-year PM

activities on the fire suppression systems in two bays and noted that labeling of valves, gauges, piping, etc., with alpha-numeric identifiers and unique names was essentially nonexistent. Valves that are operated or have their position verified per procedure steps are unlabeled. In some cases, the maintenance workers appeared to be confused as to what component was being called out in the procedure or what the boundaries of the system were. DOE Order 422.1 specifically identifies that fire protection systems require labeling. The potential for errors during system operation and maintenance could be reduced by developing and implementing a labeling program that clearly identifies the components required for safe operation and maintenance of the fire protection system.

Performance Measures—The CNS Infrastructure organization at Pantex developed numerous performance indicators to help identify potential maintenance issues requiring corrective action and to improve dissemination of lessons learned; however, the program does not capture and analyze data resulting from maintenance rework activities or entries into Limiting Conditions for Operation (LCO). As a result, information that could be used to improve the reliability and availability of critical equipment is not available for analysis and trending. According to DOE Guide 433.1-1A, "the selection of core performance indicators should reflect the most important elements of mission and safety performance." DOE Guide 433.1-1A goes on to list LCOs due to equipment failure and maintenance rework as typical maintenance indicators. MNL-352214 provides additional guidance that "maintenance effectiveness can be improved through a maintenance rework identification and control process that offers timely identification of human performance and organizational weaknesses. The process provides guidance for identifying, documenting, trending, analyzing, and assessing the effectiveness of corrective actions regarding rework and repeat issues relating to maintenance, engineering, procedures, operations, parts, and personnel performance." The review team believes the collection and evaluation of rework and LCO entry data should be considered as part of the overall maintenance feedback and improvement process at Pantex. CNS personnel informed the review team that there is no immediate plan to add these metrics to their database. They have, however, been evaluating how best to capture maintenance rework information in an automated format, but their computerized maintenance management system does not currently lend itself to collecting such data.

Work Planning—The review team identified hazards during observations of maintenance activities that had not been properly analyzed and mitigated/controlled in the work documentation. Incomplete and conflicting hazard control information was also identified in some work orders. Examples of work planning deficiencies include:

- Workers performed elevated work during hoist repairs using a scissor lift that had not been analyzed for hazards and mitigations/controls during the job planning process. The elevated work platform analyst instead evaluated a crank-up ladder.

- The identified hazards for a film processor PM task did not include a >50 volt electrical hazard that would be encountered when measuring voltage settings inside the operating processor. In addition, workers faced a mechanical hazard of exposed fan blades on a temperature-controlled motor that started and stopped automatically.

These conditions went unrecognized by the workers and supervisors; thus, they did not pause/stop work to report the unanalyzed hazards and resolve the situations.

System Engineering Support—CNS personnel reported that the five-year inspection and testing of the FPS observed by the review team was being performed for only the second or third time by the fire system workers. Numerous questions were raised by the workers during execution of the procedure regarding steps out of logical order, as well as missing, confusing, and vague steps. This uncertainty led to multiple calls to the fire protection program system engineers who came to the job site after a good portion of the procedure had been accomplished. The safety significance and complexity of the system, as well as the infrequency of implementation of the subject procedure, make it desirable for a system engineer familiar with system components and operation to be present when newly developed, infrequently exercised, or complex procedures are being performed. MNL-00054, *System Engineering and Configuration Management Program*, identifies a process for observing implementation of PM procedures but does not provide guidance on when and how often this should be done. Several years ago, the contractor's process engineering group developed guidelines for increased interactions with the workers and periodic observations of procedure implementation by the procedure owners, a program that should be considered for appropriation into the individual performance objectives of maintenance procedure owners.

Conclusions. The Board's staff team noted numerous deficiencies and opportunities for improvement in the Pantex conduct of maintenance program. While no imminent safety issues were identified, the number of missed opportunities to adhere to DOE and Pantex requirements is concerning. The staff identified many of the same types of deficiencies and weaknesses during a maintenance review in September 2012, but the corrective actions taken to date have not been effective in addressing the staff team's concerns. The staff team's chief concerns remain the formality of maintenance operations and the quality of the procedures, some of which the staff review team found unable to be implemented as written. Significant gaps also exist in the programs for work authorization, pre-job briefings, predictive maintenance, and fire protection system labeling. Continued diligence to resolve these issues will contribute to making the maintenance program at Pantex more effective and will better ensure the reliability of safety SSCs.