DEFENSE NUCLEAR FACILITIES SAFETY BOARD
Washington, DC 20004-2901

August 13, 2021

The Honorable Jennifer Granholm
Secretary of Energy
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Granholm:

In December 2018, a ventilation system-related safety significant alarm failed at the Waste Isolation Pilot Plant (WIPP). This system was designed during the 2015 WIPP restart effort—in the aftermath of a fire and a later radiological event that led to the three-year shutdown of WIPP—and was intended to aid in the protection of worker health and safety. The Board's staff initiated specific lines of inquiry focused on this event, and the actions taken to respond and ultimately correct the component failure. WIPP personnel have now taken appropriate corrective actions for this event, but there are important lessons to be learned from it to strengthen the performance and capabilities of the Carlsbad Field Office and the WIPP contractor.

The Board is sending the enclosed report to you for your information and use, as an aid to guide your oversight of the field office and its contractor.

Sincerely,

Joyce L. Connery

Joyce L. Connery
Chair

Enclosure

c: Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Report

April 30, 2021

Review of the Safety Instrumented Alarm System (SIAS) Failure at the Waste Isolation Pilot Plant (WIPP) on December 9, 2018.

Summary. The Defense Nuclear Facilities Safety Board's (Board) technical staff completed a review of the SIAS failure, which occurred at WIPP on December 9, 2018. The review included an evaluation of the supporting documentation associated with the event as well as the Carlsbad Field Office's (CBFO) assessment team's formal response, documented in its report, *Carlsbad Field Office (CBFO) External Review Assessment to Validate the Issues Identified by the Defense Nuclear Facilities Safety Board (DNFSB) December 2018 Pertaining to the Safety Instrumented Alarm System (SIAS) Failure at the Waste Isolation Pilot Plant (WIPP),* dated September 30, 2020. The Board's review team conducted a total of seven notable interactions in support of the SIAS failure:

1. The Board's staff conducted a site visit during the week of January 14, 2019;

2. The Board's staff conducted a teleconference with CBFO and Nuclear Waste Partnership, LLC (NWP), personnel on March 20, 2019;

3. The Board's staff stood up a review team that discussed a factual accuracy agenda via correspondence with CBFO and NWP between July 3, 2019, and August 22, 2019;

4. The review team conducted a teleconference with CBFO to discuss the path forward on October 17, 2019;

5. The review team emailed the consolidated NWP responses with the review team's technical evaluation of those responses to CBFO on February 20, 2020;

6. CBFO conducted a management level out-briefing teleconference with the review team on September 9, 2020; and

7. CBFO conducted a detailed out-briefing teleconference with the review team on September 28, 2020.

The purpose of this review was to identify and promote the resolution of observations related to a failure of the safety significant SIAS and subsequent response/recovery actions. The two objectives for this review were to:

1. Communicate to CBFO the potential issues the review team observed that, if addressed, could improve both contractor and federal programs.

2. Understand any current or future plans by CBFO to address or disposition the review team observations.

This review was focused less on the SIAS fault and the initial response on December 9, 2018, and more on the follow-on actions and the quality controls associated with the actions. The review represents a case study touching on several of WIPP's safety management programs with the identification of 27 observations in the form of lines of inquiry (LOI) for action/consideration.

The review team grouped and categorized the 27 observations under event investigation, software management and control, logkeeping, Occurrence Reporting and Processing System (ORPS) reporting, work control documents, and engineering oversight. This report discusses each category based on Department of Energy (DOE) requirements, review team observations, and CBFO assessment team conclusions.

Initially, CBFO and NWP were slow to acknowledge the review team's observations as potential issues. CBFO did not respond to the staff teams LOIs for 14 months and did so only after they stood up their own assessment team and came to their own conclusions. The staff's experience has been that DOE field offices generally respond to LOIs expeditiously. Since the formation of the CBFO assessment team, CBFO and NWP have been proactive in dealing with the observations and appear to be actively implementing the feedback and improvement element of their integrated safety management system (ISMS). On September 30, 2020, a CBFO assessment team's report provided a formal response to the review team's observations for the 2018 SIAS failure event and identified planned corrective actions. In the report, CBFO agrees, in full or in part, with all 27 observations of the review team as well as self-identifying 19 additional related issues during its investigation. The CBFO assessment team's report documents six findings, eight opportunities for improvement, and a significant number of corrective actions that are considered closed. According to the report, recent leadership changes within CBFO and NWP, as well as a more productive interactions internally and externally, appear to be promising. CBFO, however, continues to struggle with oversight due to staffing shortfalls, particularly with respect to facility representatives and safety system oversight personnel. Had this been a more significant event, the field office could not have afforded to delay its responses to the event or the lines of inquiry.

Overall, the review team believes that CBFO has addressed, partially addressed, or is in the process of addressing the observations with corrective actions. This review ultimately resulted in a positive outcome and showed the value of constructive staff-to-staff interactions. The review team will continue to monitor and verify the progress of CBFO and NWP related to its observations.

Background. SIAS is a safety significant support system that was initially designed during the 2015 WIPP restart effort and was intended to provide alarms if selected design parameters were outside allowed values. The monitored parameters primarily included safety significant high-efficiency particulate air filter differential pressures (dP), but also included

building-to-environment dPs, dPs across key underground bulkheads[1], and the fire suppression water tank level. Due to schedule constraints WIPP only connected the dP signal for Bulkhead 308 before restart.

SIAS, as implemented, provides a single safety significant alarm in the central monitoring room (CMR). It monitors the proper operation of the underground ventilation system by measuring the dP across Bulkhead 308 to ensure contamination control is maintained between the clean and contaminated sides of the underground and confirming that air on the contaminated side is directed up the exhaust shaft. The dP is monitored as a vacuum and must remain adequately negative to ensure air on the contaminated side does not flow to the clean side. If adequate vacuum is not maintained, the alarm occurs.

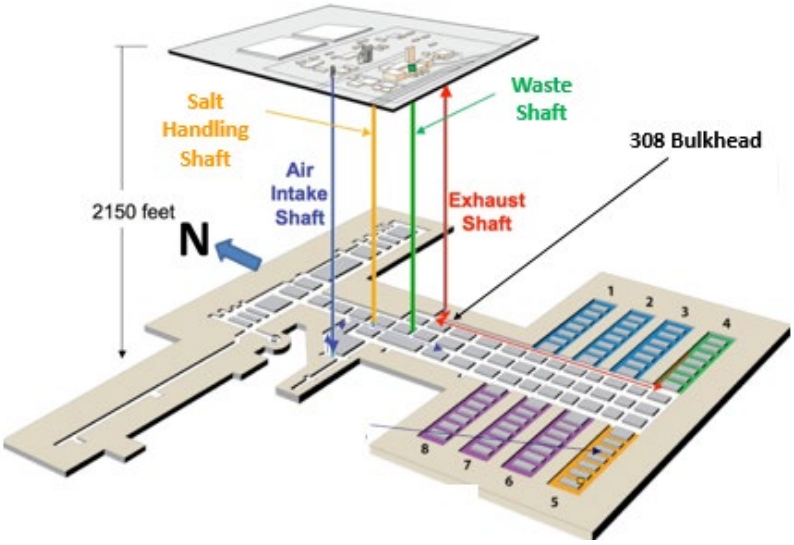

Figure 1. *WIPP Underground Ventilation*

In referring to Figure 1, the original underground ventilation system (UVS) design was for air to enter the underground from the air intake shaft, the salt handling shaft, and the waste shaft. The air would be distributed in the underground and exhausted through the exhaust shaft unfiltered. The ventilation system was designed to switch to filtered exhaust upon detection of an underground radiological release.

Since the radiological release events in 2014, UVS has been maintained in continuous filtration mode. This reduces the air intake rate and therefore puts limits on allowable underground operational activities. With the introduction of the supplemental ventilation system, the air intake rate to the underground increased, specifically for the construction area, and a portion of the air from the construction area is exhausted unfiltered through the salt handling shaft. The rest of the underground air, including the air of the disposal area, continues to be directed through the exhaust shaft and filtered.

[1] Bulkheads are ventilation barriers in the underground designed to block and direct airflow.

Differential pressure is monitored at Bulkhead 308 to ensure that potentially contaminated air from the disposal area does not pass to the construction area (clean side) of the underground, ensuring that potentially contaminated air is filtered before it is released to the environment.

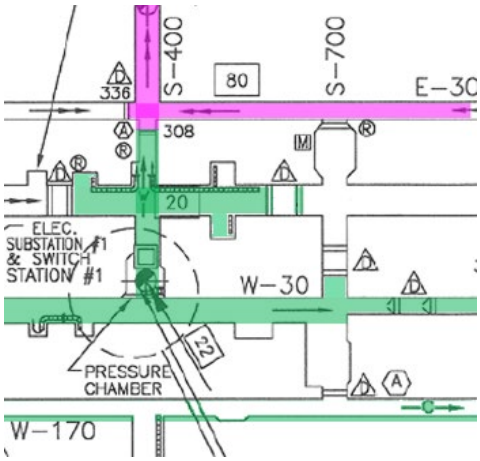

Figure 2. *Bulkhead 308*

In referring to Figure 2, air from the waste handling building is pulled down the waste shaft and passes by Bulkhead 308 on its way through the underground and to the exhaust shaft. Green represents the clean air side of the underground coming from the salt handling shaft and the waste shaft. Magenta represents the potentially contaminated exhaust air side going to the exhaust shaft.

If the dP across Bulkhead 308 is sufficiently higher on the clean side of the S-400 cross drift[2] then air will go up the exhaust shaft. Assuming all else in the exhaust circuit is working as designed then any airborne contamination in the disposal panel will also be sucked up the exhaust shaft and not leak into other areas where it could be released to the environment through other shafts, e.g., the salt handling shaft.

Pre-Review Activities—NWP determined that the SIAS panel had failed on December 9, 2018. A summary of the timeline of events is contained in Appendix A. The SIAS failure was initially captured in an ORPS report on December 19, 2018. The Board's staff inquired about the failure event during a January 2019 site visit. The Board's staff became more interested when inconsistencies were observed in the overall picture painted by the reported observations and actions associated with this failure event.

NWP correctly recognized that the SIAS failure required entry into a limiting condition for operation (LCO). Initial troubleshooting led to the determination that the issue was related to the software in a programmable logic controller (PLC). The PLC reacted to the software error by dumping its program. Ultimately the software was reloaded and NWP considered the issue to be resolved.

[2] Drifts are the horizontal passages or tunnels cut through the salt.

Discussion. This review was focused not on the SIAS fault itself and the initial response, but rather on the follow-on actions and the quality control process associated with the actions. The Board's staff initially determined that NWP did not perform a fact-finding or critique of the event; was unable to provide documentation related to the troubleshooting and repair activities; did not complete an operability evaluation prior to returning the system to service; and did not generate a corrective action tracking document (WIPP Form).[3]

After conflicting information was provided to the Board's staff during discussions with CBFO and NWP, NWP management concluded that it would hold a fact-finding meeting and issue an engineering document to capture information from the subcontracted system designer and PLC vendor. But NWP never conducted the fact-finding meeting. Based on that and the fact that discussions with CBFO and with NWP continued to turn up conflicting information, the Board's review team requested responses to some written LOIs to ensure accurate details were captured. The Board's staff conducted a teleconference on March 20, 2019, to discuss the LOI responses. The Board's staff ultimately elected to assemble a review team and conduct a documentation review of records associated with the SIAS failure event.

The documentation review was designed to identify observations related to the failure of the safety significant SIAS and subsequent response/recovery actions. The review team provided 27 observations in the form of LOIs for action/consideration to the site on July 3, 2019. (See Appendix B). There were two objectives the review team hoped to achieve by sharing these LOIs:

1. Ensure the review team's observations, based on the documentation review, were accurate.

2. Understand any current or future plans by CBFO and NWP to address or disposition the review team observations.

NWP provided written responses regarding the factual accuracy of the 27 observations on August 6, 2019. No CBFO responses were received at that time; the review team therefore could not completely achieve the second objective of the review. The Board's review team recognized some discrepancies internal to the NWP responses and requested clarification. On August 22, 2019, NWP provided the review team with written revisions to its initial responses to support the request for clarification. The review team subsequently consolidated all NWP responses (see red text of Appendix B).

NWP Responses—NWP's revised written responses agreed with 21 of the review team's 27 observations. Notably, several key observations such as the lack of an event investigation/fact-finding or unreviewed safety question (USQ) determination were not accepted. NWP proposed corrective actions for 18 of the observations. Actions included work control

[3] CBFO uses the Issue Collection and Evaluation (ICE) System to capture concerns for further action by NWP and DOE to address programmatic and systemic weaknesses. NWP uses the WIPP Form to document and track all issues and findings.

document policy changes, improvements to the software quality assurance program, initiation of two WIPP Forms, and an operability retest. The Board's review team requested documentation associated with corrective action completion, but corrective actions were only verifiable for four of the observations, due to the lack of evidence. The review team conducted a teleconference on October 17, 2019, with CBFO to discuss the need for CBFO's responses to support the second objective.

On February 20, 2020, the review team provided its written technical evaluation feedback to CBFO on the NWP responses. (See green text of Appendix B.) Although some of the observations had been or were planned to be satisfactorily addressed, others still warranted further action to bring NWP operations into full compliance with the requirements that touched upon this event. On February 25, 2020, CBFO committed that the new CBFO Facility Oversight Division director would formally respond with any current or future plans by CBFO to address or disposition the Board's review team's observations.

CBFO Assessment Team—There was no formal response to the review team's LOIs by CBFO until the spring of 2020. On April 6, 2020, CBFO informed the review team that an assessment team would be formed to conduct its own investigation and validate NWP's planned corrective actions. The purpose of the CBFO assessment team was also to provide a formal response to the Board's review team's observations. CBFO's initial responses to the 27 observations were captured in WIPP Form WF 20-682 on June 30, 2020. (See blue text of Appendix B.)

On September 9, 2020, the CBFO assessment team leader provided a management level out-briefing to the review team, and on September 28, 2020, he provided a more detailed out-briefing to the review team. On September 30, 2020, the CBFO assessment team's report was completed, providing the formal response to the factual accuracy agenda for the 2018 SIAS failure event and planned corrective actions. The review team received the CBFO final assessment report on November 23, 2020. In its report, the CBFO assessment team noted the responses provided by NWP in 2019 were inadequate or lacked the analysis necessary to address causal factors and root causes in order to eliminate or reduce failure recurrence.

Additionally, the report concluded that CBFO's initial response to the failure of a safety significant system was weak. The assessment team's final conclusion determined that CBFO exhibited a direct failure to understand the initial issues affecting the SIAS processes; failure to ensure NWP conducted appropriate retesting where needed; and finally, a failure to address the original review team's observations pertaining to SIAS. The assessment was prolonged in order to determine the full extent of current conditions, primarily due to significant changes in NWP and, in some cases, CBFO management. The response to the COVID-19 pandemic may also have prolonged the assessment.

The CBFO assessment team's report documents six findings, eight opportunities for improvement, and a significant number of corrective actions are considered closed. The CBFO assessment team identified 11 broad areas needing improvement and management attention to ensure that work is performed consistently in a safe and secure manner. The broad areas include:

1. Conduct of operations;

2. Work control planning and execution;

3. ISMS feedback and improvement;

4. Document control processes;

5. Software quality assurance procurement and implementation/acceptance testing;

6. Implementation of lessons learned;

7. Implementation of and adherence to an issues management program;

8. Safety culture and consistent management focus on communication of priorities and safety;

9. Contractor assurance system (CAS) and knowledge of CAS by NWP personnel;

10. Timely notifications/ORPS requirements; and

11. Training implementation and defining roles, responsibilities, authorities, and accountabilities applicable to training requirements for technical staff.

CBFO's assessment team identified oversight weaknesses, program implementation concerns, or in some cases a lack of implemented safety management program critical elements including conduct of operations, training and qualification, configuration management, and contractor assurance, that lined up with the observations initially identified by the Board's review team. CBFO's assessment team agreed, in full or in part, with all 27 review team observations, as well as self-identifying 19 additional related issues during its investigation. Further, an extent-of-condition review looked at projects such as the new utility shaft and the safety significant confinement ventilation system. By the time the assessment team's report had been issued, CBFO reported that approximately 80 percent of the proposed corrective actions had been completed by NWP or were close to being finalized. Most open items pertained to conduct of operations and logkeeping program implementation. NWP was also in the process conducting associated training for more than 300 personnel.

Review Team's Observations. The review team grouped and categorized the 27 observations under event investigation, software management and control, logkeeping, ORPS reporting, work control documents, and engineering oversight. This report will discuss each category based on DOE requirements, review team observations, and CBFO assessment team conclusions.

Event Investigation—One of the review team's most significant observations was related to the lack of an event investigation or fact-finding associated with the SIAS failure event. The review team considers a fact-finding, or other data gathering, to be an opportunity to collect and

share information related to an event and to be in keeping with a continuous improvement approach to safety. Based on the number of discrepancies identified by the review team during its review of the response to the SIAS failure, this was a missed opportunity to implement the feedback and improvement element of ISMS. DOE Policy 450.4A, Chg.1, *Integrated Safety Management Policy,* establishes the approach to integrate safety into all aspects of work at DOE facilities.

WP 04-CO.01-6, *Conduct of Operations Program–Investigation of Abnormal Events, Conditions and Trends*, WP 15-MD3102, *Event Investigation*, and WP 15-CA1007, *Fact-Findings and Critiques*, are the three primary WIPP procedures that define event investigations, fact-findings, and critiques, as well as how the DOE and site-specific requirements are met.

No event investigation/fact-finding was conducted for the failure of SIAS (see details in LOI 1 of Appendix B). WP 04-CO.01-6 identifies several conditions that could have met the requirements for an investigation. Those conditions included:

- Abnormal or unexpected system performance that adversely affects operations or safety (e.g., improper instrument readings, automatic control failure, chemical analysis).
- Abnormal or unexpected safety conditions (e.g., stray voltage, safety feature or interlock malfunction).
- Equipment failure that could affect safety or mission.

The CBFO assessment report concluded that the event investigation observation identified by the review team could be attributed to three separate findings and two opportunities for improvement (OFI). The findings and OFIs have been captured in the CBFO ICE system for further action by NWP and CBFO to address programmatic and systemic weaknesses. CBFO also noted one improvement based on feedback from the review team. Details of the CBFO assessment team's conclusions related to the one event investigation-related LOI, and how they were or are being dispositioned as of September 30, 2020, are provided below.

LOI	***Observations*/CBFO Conclusions** [1]
1	*No investigation/fact-finding was conducted for the failure of SIAS. Multiple conditions for a required investigation could have been met per WP 04-CO.01-6.* **Finding** – NWP did not follow the expected fact-finding process outlined in WP 15-CA1010, *Reporting Occurrences in Accordance with DOE Order 232.2A*, and WP 15-MD3102. **Finding** – NWP must revise WP 15-CA1007, as it still references Significance Category 1. The procedure associated with this document is currently in revision and should be approved and training needs determined for staff in a timely manner. **Finding** – Multiple NWP procedures referring to or directly implementing the fact-finding process must be reviewed for consistency. NWP has committed to correcting this deficiency through significant revision and development of a conduct of operations manual, which will be the company-level directive governing the overall processes.

	OFI - Timely Order No. 19:005, *Fact-Finding for ORPS Occurrences*, originally issued 2/6/2019 but later cancelled, should be reinstated and communicated to all NWP staff ensuring proper management expectations are codified pertaining to issues that trigger an ORPS report, including a Group 10 Management Concern. **OFI** - CBFO facility representatives should consider including a review of the conduct of operations manual in FY2021 when it becomes available from NWP to determine overall conduct of operations program effectiveness with a focus on event investigation and fact-finding implementation. **Improvement Noted** - NWP has revised WP 04-CO.01-6 and is utilizing this process when conducting fact-findings. Several fact-findings have been observed by CBFO staff, namely those under the Facility Operations Division housing the facility representatives. There has only been one recent example where a fact-finding was not held by NWP (September 4, 2020 – waste transporter sheared pin). Despite procedural disconnects, feedback from the facility representatives indicates NWP has improved on its fact-finding process and has produced better conclusions that have made it possible to demonstrate the contractor has a fully functional review process under conduct of operations.

WIPP Form WF 18-853 was originally issued to address corrective actions for the SIAS failure. This WIPP Form documented that a critique was not held after the failure of the Bulkhead 308 alarm panel, contrary to the narrative found in WP 15-CA1007. This WIPP Form identified that a planned fact-finding was scheduled to be held January 7, 2019, but to date, the WIPP Form has not been closed. The review team requested a copy of the fact-finding but it had not been received as of September 2020. Therefore, the review team and the CBFO assessment team concluded it had not been completed. This also demonstrates a fundamental breakdown of the issues tracking system.

NWP's initial response to the Board's review team was that no fact-finding was required or warranted. The review team did not agree with that determination. CBFO fully agreed that the review team's observation was valid and that NWP had missed an opportunity to implement the feedback and improvement element of ISMS. It was the CBFO assessment team's judgment that a fact-finding under these conditions would have been expected. CBFO and current NWP operations management agree that the SIAS event should have triggered a fact-finding, per WP 15-CA1007. Overall, the review team believes that WIPP has addressed the significant shortfall in convening an event investigation or fact-finding. CBFO appears to have communicated its expectations to NWP and revisions to several WIPP documents have been identified. Proper implementation of these revised procedures should help ensure expectations are met going forward.

Software Management and Control—Four of the review team's observations are related to software management and control of safety significant software associated with the SIAS failure event. As outlined in DOE Guide 424.1-1B, Chg. 2, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, USQ screenings/determinations are applicable to safety significant structures, systems, and components (SSC)—in this case, software. WP 16-2, *Software Screening and Control*, specifically requires that documentation be

submitted to obtain a USQ determination for safety software. WP 16-2 also states that "A USQ screening must be completed prior to software installation and checkout."

Software management and control, as defined in DOE Order 414.1D, *Quality Assurance*, establishes process-specific quality requirements to be implemented under a quality assurance program for nuclear safety software. Specifically, DOE Order 414.1D, Attachment 4, prescribes the safety software quality assurance (SSQA) requirements for DOE nuclear facilities. These include requirements to consider (based on software grading level) the SSQA work activities.

WP 09-CN.13, *Safety Instrumented Alarm System Software Quality Assurance Plan*, and WP 10-WC3011, *Work Control Process*, are the two primary WIPP procedures that define its safety significant software requirements and how the DOE and site-specific requirements are met.

Specific elements of software management and control that exhibited implementation and/or documentation issues contrary to DOE and/or site-specific requirements (and detailed in LOIs 2-5 of Appendix B) include:

- No USQ determination (or screening) was performed to support installation and testing of safety significant software in accordance with WP 16-2.
- No work order documentation for troubleshooting/software reload/system restoration was developed or used in accordance with WP 10-WC3011.
- No specific documents or procedures were identified that supported the existence of quality assurance records required for configuration control of the safety significant software including a software requirements specification and a software design description.

The CBFO assessment report concluded that one of the software management and control observations identified by the review team rose to the level of a finding and one was documented as an OFI. The findings and OFIs have been captured in the ICE system for further action by NWP and CBFO to address programmatic and systemic weaknesses. Details of the CBFO assessment team's conclusions as to all four software management and control-related LOIs, and how they were or are being dispositioned as of September 30, 2020, are provided below.

LOI	***Observations*/CBFO Conclusions**
2	*No USQ determination (or screening) was identified to support installation and testing of safety significant software in accordance with WP 16-2.* **Finding** - The USQD process for reviewing and installing safety significant software was not followed and does not meet requirements in DOE Order 414.1D. This issue is considered corrected and **CLOSED**. NWP has taken the necessary steps to address this USQD including issuing a revision to software controls and training work control planners on the new process.
3	*There was no work order for troubleshooting/software reload/system restoration.*

	CLOSED. Both NWP and the CBFO assessment team agree that no work control document existed to address this concern. WP 10-WC3011 was revised to incorporate the changes pertaining to safety significant software process control systems as recommended by the NWP's engineering department and now includes troubleshooting. This LOI has been reviewed and the CBFO assessment team determined the actions and evaluation by NWP addressed the initial software safety concern.
4	*Although general requirements for software configuration management are discussed in WP 16-2, no specific procedure(s) was identified that described all elements of configuration management described in Nuclear Quality Assurance (NQA-1).* **OFI** – Perform a software quality assurance assessment focusing on NWP procedure implementation, which may include preparations for (non-nuclear) issues management database replacements. Note: The CBFO assessment was conducted after a significant change to the software quality assurance program documents to address the staff observation. No further corrective action was cited by CBFO for NWP. The noted OFI for NWP is for consideration.
5	*Contrary to the conclusion in WF 19-281, troubleshooting and system restoration are outside the scope of WP 16-2. As such, these items should have followed the WP 10-WC3011.* **CLOSED**. NWP has corrected the original Board issue by revising key software process control documents and has briefed the work control planners on the contents. This process remains in place as verified by the CBFO assessment team. No further actions were recommended with the exception of CBFO performing an SQA assessment on configuration management. See OFI for LOI 4.

NWP initially identified that the work control process procedure, WP 10-WC3011, excludes all software changes to process control systems, including safety significant software. Therefore, NWP did not prepare work control documents to control the troubleshooting and software reloading activities associated with the SIAS failure event. The lack of work control documents also precluded the performance of a USQ screening/determination. The review team pointed out that WP 16-2, Revision 16, had added requirements to perform a USQ determination for safety software prior to software installation and testing. WP 16-2 also specifies the creation of certain software documentation, consistent with SSQA work activities specified by DOE Order 414.1D. The review team had additional questions regarding software configuration management and pointed out that WP 16-2 did not describe all elements of configuration management outlined in NQA-1.[4]

[4] WIPP uses the American Society of Mechanical Engineers (ASME) NQA-1-1989 version, which was issued before the consensus standard was consolidated with NQA-2. ASME NQA-2a, 1990 Addenda, Part 2.7, *Quality Assurance Requirements of Computer Software for Nuclear Facility Applications*, was incorporated into NQA-1, Part II, Subpart 2.7, during the 1994 revision. NQA-1-2008, with NQA-1a-2009 addendum, is the latest version

In May 2019, NWP developed WP 09-CN.13 to address configuration management elements including problem reporting, corrective action, troubleshooting, and the procedures related to work control as identified by the review team. This SQA plan applies specifically to the software system associated with the SIAS failure event and addresses the SSQA work activities identified in DOE Order 414.1D. However, since this plan was not initiated at the beginning of the software life cycle, it has limited effectiveness as a quality assurance process. Key work activities such as software requirements specification, software design description, verification, and validation were not performed.

In November 2019, NWP revised WP 10-WC3011 to address safety significant software changes to process control systems, including software troubleshooting as identified by the review team. The work control process was revised to reflect that troubleshooting and software reloading activities must be performed with work control documents. This specifically addressed a key process control observation and work activity requirements identified in DOE Order 414.1D.

NWP's actions to address software management and control observations were initially slow but ultimately addressed the requirements of DOE Order 414.1D as well as the guidance of DOE Guide 424.1-1B, Chg. 2. The development or revision to WIPP procedures, including WP 09-CN.13 and WP 10-WC3011, adequately addressed and identified software management and control requirements. CBFO's assessment occurred after these revisions were in place and therefore the report does not clearly address conditions prior to the assessment. Overall, the staff believes that WIPP has addressed significant shortfalls in following software management and control requirements as they apply to safety software for nuclear facilities. Proper implementation of these revised procedures should help ensure expectations are met in the future.

Logkeeping—DOE Order 422.1, *Conduct of Operations*, Attachment 2, Paragraph 2.K, states that "the operator must establish and implement operations practices to ensure thorough, accurate, and timely recording of equipment information." Logkeeping, a component of conduct of operations, is the program that fulfills this function. An effective logkeeping program provides an accurate history of facility operations and aids in controlling equipment and system status.

WP 04-CM2005, *Central Monitoring Room Electronic Logkeeping*, and WP 04-CO.01-11, *Conduct of Operations Program–Logkeeping*, are the two primary WIPP procedures that define NWP's logkeeping program and how the DOE and site-specific requirements are met. The review team identified numerous CMR electronic logkeeping requirements, as they relate to the SIAS failure event, which were not being reliably met. Specific elements of logkeeping that exhibited implementation and/or documentation contrary to documented DOE or site-specific requirements (and detailed in LOIs 6-19 of Appendix B) include:

---

endorsed by the Nuclear Regulatory Commission. DOE Order 414.1D references this version of NQA-1 as an acceptable consensus standard to use for software development. The review team understands the origins of CBFO's use of the outdated standard NQA-2 vice NQA-1 as the acceptable standard for quality assurance requirements of computer software for nuclear facility applications.

- Log entry reports did not consistently provide data in chronological order to allow determination of an event sequence, based on logkeeping practices observed by the review team. Management review of the CMR electronic log at shift end to ensure completeness, accuracy, legibility, and to monitor for adverse trends was inconsistently documented with a log entry.
- Evidence of the required quarterly management reviews of the CMR electronic log was not documented in the log.
- The CMR electronic log did not consistently document when an LCO action was entered/exited.
- Information recorded in each log entry did not always include the position or title of person(s) involved and notified.
- The WIPP procedure on electronic logkeeping was not clear on management's expectations for how all entries should be logged.
- There were numerous examples of missing or incorrect information in the logs.
- There were many instances of acronyms or abbreviations used that were not on the authorized list or, alternatively, defined upon first use.
- The protocol for logging late entries was not always followed.
- In one instance, the same action appeared in two different log entries.

The CBFO assessment team concluded that two of the logkeeping issues identified by the review team rose to the level of a finding and three were documented as an OFI. The two findings and three OFIs have been captured in the ICE system for further action by NWP and CBFO to address programmatic and systemic weaknesses. Details of the CBFO assessment team's conclusions as to all 14 logkeeping-related LOIs, and how they were or are being dispositioned as of September 30, 2020, are provided below.

LOI	***Observations*/CBFO Conclusions**
6	*The log entries are not in consecutive and chronological order as required by WP 04-CM2005.* **Finding** - CMR logkeeping database (WebEOC) cannot demonstrate an accurate, timestamped event timeline. **Improvement Noted** - NWP has begun conduct of operations training including logkeeping to a larger percentage of staff.
7	*The facility shift manager's (FSM) review of the CMR electronic log at shift end is not being consistently documented with a log entry as required by WP 04-CM2005.* **OFI** - Ensure supervisors document results of their log reviews. **Improvement Noted** - NWP added a human performance improvement element to conduct of operations training.
8	*Quarterly review of CMR electronic log is not clearly being conducted and documented as required by WP 04-CM2005.*

	LOI remains **OPEN** until the NWP conduct of operations manual is approved, training is provided, and CBFO verifies periodic reviews are being performed.
9	*An incorrect electronic log entry related to the ORPS reporting level was made following the SIAS failure event.* NWP will include conduct of operations checks for future ORPS data input. LOI is **CLOSED**.
10	*The CMR electronic log record does not consistently document when an LCO action becomes effective/ineffective.* LOI is **CLOSED**. **OFI** - CMR does not have an equipment status board to delineate entry/exit of LCOs which would be helpful to understand current operational status.
11	*The CMR electronic log record does not consistently identify the person who observed, verified, or reported a reading from the field as required in WP 04-CO.01-11.* **Finding** – NWP has not fully implemented the conduct of operations section of DOE Order 422.1 for establishing proper turnover and assumptions. There is a lack of data indicating who has made log entries, which does not allow for consistent turnover or for the ability to get clarification on any of the data to the next individual coming on duty. This LOI remains **OPEN** until NWP can review, update, and verify WP 04-CM2005 meets the intent of logkeeping entries. Note: The staff judges that this finding does not fully address the staff observation but aligns more closely with LOI 15. NWP has, however, self-declared it will review DOE Order 422.1 requirements for logging information reported from the field, which aligns with this LOI.
12	*LCO actions were sometimes recorded under the same or different log entry numbers, which makes it more difficult to track actions that must be performed at prescribed periodicities.* LOI remains **OPEN** based on the ongoing conduct of operations course that includes human factors.
13	*WIPP appears to have two different logkeeping practices: one amends an existing record to add multiple additional related actions in that record and the other is to create a new record for each action.* LOI remains **OPEN** with a path forward for NWP to review WP 04-CM2005 to address electronic logs that may have multiple records for the same event.
14	*There were CMR electronic log entries where not all required data fields were filled out.*

	LOI remains **OPEN** with a path forward to create a working group to determine the data fields.
15	*Watch relief entries for oncoming CMRO* [central monitoring room operator], *roving watch, and FSM were not always consistent with WP 04-CM2005.* LOI is considered **CLOSED** with actions taken to review relevant WIPP conduct of operations procedures and interview FSMs. Two shift turnovers were observed to be conducted satisfactorily.
16	*Numerous acronyms and abbreviations used throughout the log were neither on the authorized list nor defined on first use as required by WP 04-CM2005 through referral to WP 04-CO.01-4, Conduct of Operations – Communications.* LOI is **CLOSED** based on reviews and creation of a WIPP Form to address unapproved acronyms and abbreviations. Conduct of operations training covers this area. **OFI** – NWP should consider keeping a supplemental list of additional acronyms and abbreviations utilized by the CMR and FSMs.
17	*The method to record a "Late Entry" was not consistent with logkeeping requirements identified in WP 04-CM2005.* LOI **CLOSED** as it is being addressed through training in conduct of operations. CBFO will continue to assess conduct of operations and log entries through FR oversight. NWP and CBFO are discussing these issues monthly.
18	*Numerous log entries misidentified an exhaust fan by using the wrong acronym.* LOI is **CLOSED**. Acronyms and abbreviations issues are covered via LOI 16.
19	*The CMRO entered the same action in two different records at two different times.* LOI is **CLOSED**. CBFO determined corrective actions are not warranted as the data entries for this example can be entered using WebEOC.

Approximately half the review team's observations associated with the SIAS failure event were related to [electronic] logkeeping. Based on the conclusions in the CBFO assessment report, there are currently initiatives identified and ongoing to address short- and long-term problems with logkeeping. Since logkeeping is an element of conduct of operations, many of the corrective actions to address the review team's observations deal with revising the *WIPP Conduct of Operations Program* manual as well as evaluating the *Central Monitoring Room Electronic Logkeeping* procedure for possible changes or incorporation into the manual. Several of the corrective actions also rely on conduct of operations training and CBFO validation to resolve. CBFO reported that NWP management estimates it will have all aspects of the conduct of operations manual, integration of conduct of operations into flowdown documents, and training for all activity level work personnel completed by late-2021. NWP issued a *Conduct of Operations Project Plan* on December 16, 2020, that projectizes the review of the *Central Monitoring Room Electronic Logkeeping* procedure and the revision of the *WIPP Conduct of Operations Program* manual. Overall, the review team believes WIPP has taken positive steps

to address the identified logkeeping observations and will need to follow up after proposed documentation revisions and training are complete to verify that they effectively resolved the concerns.

ORPS Reporting—DOE Order 232.2A, Chg. 1, *Occurrence Reporting and Processing of Operations Information,* is the directive that provides requirements on notifying DOE personnel about events that could adversely affect the health and safety of the public or the workers. DOE Order 232.2A states that "occurrence reports must be written clearly and concisely." Further, "locally approved processes and procedures must ensure that the requirements of the order for reporting are initiated for events specified in the occurrence reporting criteria (Attachment 2) of the order." DOE Order 422.1 also provides expectations for identifying and responding to abnormal events in the section on investigation of abnormal events, conditions, and trends. Six other sections of the DOE conduct of operations order call out the need for accurate information in both written and oral communications.

WP 15-CA1010 is the primary WIPP procedure that defines its occurrence reporting program and flows down DOE Order 232.2A requirements, with WP 15-CA1007, providing additional details on how the DOE and site-specific requirements are to be met.

Specific elements of the ORPS reporting associated with the SIAS event that exhibited implementation and/or documentation contrary to DOE or site-specific requirements (and detailed in LOIs 20-22 of Appendix B) included:

- The date and time of the event discovery were incorrectly recorded in the ORPS report based on when the event was determined to be reportable, not the point at which facility staff became aware of the failed safety system.
- Categorization in accordance with the reporting criteria occurred roughly two days after the SIAS event, not within two hours of discovery.
- The ORPS report incorrectly stated that the operability of the alarm panel was restored two days earlier than it actually was. In addition, the requirement to log repairs to safety significant components was not carried out (see Logkeeping section).

The CBFO assessment team concluded that none of the ORPS reporting issues identified by the review team rose to the level of a finding or OFI. Details of the CBFO assessment team's conclusions as to all three ORPS-related LOIs, and how they were or are being dispositioned as of September 30, 2020, are provided below.

LOI	***Observations*/CBFO Conclusions**
20	*Date and time discovered is not correct in the final ORPS report. The date should be 12/09/2018 vice 12/11/2018; the time should be 13:24:30. This is the time that LCO 3.2.3 A was entered as recorded in the CMR electronic log record 170441.* This issue is considered **CLOSED** with no further action other than to continue with the conduct of operations training program for NWP designated employees. Corrective actions by NWP, when notified of the mistake, were taken in a timely manner.

21	*As identified in the final ORPS report, the time to categorize was greater than the two hour requirement for this low level ORPS. Categorization occurred almost two days after discovery.* Corrective actions by NWP have been taken to address this specific ORPS report. Additional training on ORPS requirements will be covered through conduct of operations courses underway. This LOI is considered **CLOSED** as the initial ORPS information has been corrected in the database.
22	*The description of occurrence incorrectly stated that the operability of the alarm panel was restored on December 10, 2018. The alarm panel was not tested and verified for operability until December 12, 2018.* LOI is **CLOSED**. Corrective actions by NWP have been taken to address entry/exit of LCOs. The procedure is being implemented as verified by CBFO.

Both the initial WIPP response to the review team's observation noted in LOI 20 and the conclusion of the CBFO assessment team contend that the date and time of the event discovery were correctly based on when the event was determined to be reportable; in this case, nearly two days after the SIAS failed. The review team disagrees with this interpretation of DOE Order 232.2A, which defines discovery date and time as "The point at which facility staff discover or become aware of an event or condition. Discovery date is NOT the date and time when the event or condition is determined to be reportable." WP 15-CA1010 has similar language. Based on the fact that CBFO and NWP personnel have an apparent misunderstanding of when a reportable occurrence discovery occurs, it is reasonable to assume that appropriate corrective actions for LOI 20 have not been taken to remedy the misinterpretation of the DOE directive and applicable WIPP procedure.

To address the fact that the event categorization occurred roughly two days after the SIAS event, not within two hours of discovery (LOI 21), WIPP committed to train a large number of its staff on the requirements of conduct of operations, which is to include ORPS reporting criteria and timeframes for notification. The review team's issue was with the timeframe for event categorization, not notification. In a corrective action for LOI 20, NWP intends to use the ongoing conduct of operations course to promote the importance of understanding the two-hour categorization times, which should satisfactorily cover the issue documented by the review team in LOI 21.

The review team notes in LOI 22 that the ORPS report incorrectly stated the operability of the alarm panel was restored two days earlier than the completion of an operability test. The facility, however, did not exit the LCO until the completion of the operability test.[5] WIPP subsequently published a new procedure, WP 04-AD3020, *Entry and Exit of Limiting Conditions of Operations*, which addressed this potential issue. Section 5.3 of the procedure addresses the understanding of operability in the statement that "testing to satisfy the LCO operability statement" is required to exit an LCO. Although WP 04-AD3020 does not define the terms

[5] Successful completion of the operability test is considered satisfactory evidence that the equipment has been restored to a fully functional working status. The next set of LOIs (23 through 25) will deal with the fact that the review team ultimately discovered that the operability test itself was flawed.

"operable" or "operability test," the new procedure does identify the need for justification for exiting an LCO while ensuring an operability statement is met. The CBFO assessment team also reported that training on this procedure has been completed. Overall, the review team considers the issue documented in LOI 22 to be largely addressed. As noted above, evidence presented does not show that LOI 20 has been resolved.

Work Control Documents—Three of the staff's observations are related to the quality, change control, and/or implementation of work control documents (WCD). DOE Order 422.1, Attachment 2, addresses requirements for WCDs in the Technical Procedures section (Paragraph 2.P). WP 10-WC3011, WP 10-WC3012, *Work Control Document Writer's Guide*, and WP 10-WC3013, *Work Control Document User's Guide*, are the primary WIPP management procedures that define its WCD program and how the DOE and site-specific requirements are to be met. WP 10-WC3011 lists WIPP activities that are typically covered by WCDs as preventive, predictive, and corrective maintenance on facilities, systems, and equipment, as well as modifications and construction. Work evolutions performed by waste operations, radiological protection, and facility operations, for example, are done in accordance with a different, i.e., p*rocedures*, program. Some key requirements from the DOE directive and WIPP implementing documents that were not met in relation to the SIAS event and follow-up were:

- Operators will use written procedures for operations, will perform them as written, and will stop work and notify management when procedures cannot be executed as written.
- Procedures are technically accurate and capable of being performed as written.
- Procedures incorporate appropriate information from applicable source documents.
- Procedures are technically and administratively accurate, instructions and information are correct.
- Procedure reviews include comparisons to source documents to verify accuracy.

Specific elements of WCDs that exhibited implementation and/or documentation issues contrary to DOE and/or site-specific requirements (and detailed in LOIs 23-25 of Appendix B) included:

- Configuration management of a WCD was not maintained when a change was directed by a source document.
- Several specified changes were not incorporated into the WCD and one was incorrectly incorporated.
- The WCD (used to confirm SIAS operability) was technically inaccurate and could not be performed as written.
- An operator incorrectly marked a WCD step as satisfactorily completed instead of stopping work and notifying management that the step could not be executed as written.

The CBFO assessment team concluded that none of the WCD issues identified by the Board's staff rose to the level of a finding, but one was documented as an OFI. Details of the CBFO assessment team's conclusions as to the three WCD-related LOIs, and how they were or are being dispositioned as of September 30, 2020, are provided below.

LOI	***Observations* and CBFO Conclusions**
23	*Several directed changes were not properly and accurately incorporated into the functional [operability] test WCD.* The short-term action to revise the WCD to reflect the correct tolerances and information was completed. WCD control, change management, and configuration management are being emphasized in the ongoing conduct of operations training as a longer-term corrective action. CBFO considers LOI **CLOSED**.
24	*A WCD test step did not have the correct verification action specified.* An immediate corrective action was to prepare a new work order and complete the retest. The retest was satisfactorily completed on August 15, 2019. Conduct of operations training on procedural development, adherence, and configuration management is an ongoing corrective action. **OFI** - NWP should consider an extent-of-condition review in conjunction with the conduct of operations training to ensure principles are being followed. LOI is **OPEN**. NWP has resolved the initial LOI concern but safety culture will be under further evaluation by CBFO in FY 2021 and beyond.
25	*An operator marked a completed WCD test step incorrectly, a verbatim procedure compliance issue. The WCD was also deficient as it could not practicably be executed as written.* The original issue was corrected with reissuance and re-performance of the WCD. Conduct of operations training continues to emphasize procedural adherence and to provide management expectations on pause/stop work when procedures are in question. CBFO considers LOI **CLOSED**.

Based on the conclusions in the CBFO assessment report, there were short-term or immediate actions taken to address the observations relative to the specific WCDs of concern. Since WCDs (or technical procedures) are a key element of conduct of operations, a longer-term corrective action to address the staff's observations deals with providing conduct of operations training.

NWP issued a *Conduct of Operations Project Plan* on December 16, 2020, to integrate issues such as procedures, logkeeping, and training with an improvement plan to address the suite of conduct of operations elements. The staff notes that one of the subprojects is to cancel WP 10-WC3012. It is unknown where the direction currently provided in this document will land.

Overall, the staff believes WIPP has recognized the accuracy of the staff's observations and understands the need to better manage WCD development, implementation, and change control. The staff will monitor that conduct of operations training continues to emphasize

procedural quality, configuration management, and operator adherence as well as reiterates management expectations on pausing/stopping work, when appropriate.

Engineering Oversight—Two of the staff's observations are related to federal and contractor engineering oversight of SSCs. As outlined in DOE Order 420.1C, *Facility Safety*, key elements of the contractor's cognizant system engineering (CSE) program are the designation of CSEs who are responsible for maintaining overall awareness of assigned safety systems and providing systems engineering support for operations and maintenance. CSEs also are tasked with furnishing technical support to line management to ensure continued operational readiness of the safety systems for which they are responsible. WP 09, *Conduct of Engineering*, flows down the duties and responsibilities of the WIPP CSEs (sometimes referred to locally as cognizant engineers) from DOE Order 420.1C.

The federal safety system oversight (SSO) specialist, as defined in DOE Order 426.1A, *Federal Technical Capability Program*, is responsible for overseeing contractor management of safety systems at DOE defense nuclear facilities. In accordance with DOE Order 426.1A, SSO personnel are to be "highly qualified people who perform assessments and investigations to confirm performance of assigned safety systems in meeting established safety and mission requirements and review sections of the Documented Safety Analysis (DSA) related to these systems." DOE Order 426.1A also requires that field element managers "ensure that SSO staffing needs are filled."[6]

Some key requirements from the DOE directives and/or WIPP implementing document that were not met in relation to the SIAS event and follow-up were:

- A qualified CSE must be assigned to each active system within the scope of the program, which included the SIAS.
- Large, complex, or very important systems [such as the safety significant SIAS] may require assignment of more than one CSE.
- SSO staffing needs must be filled.

Specific elements of engineering oversight that exhibited implementation and/or documentation issues contrary to DOE and/or site-specific requirements (and detailed in LOIs 26-27 of Appendix B) included:

- The CSE assigned to SIAS was not qualified but was in training.
- No alternate CSE for the safety significant SIAS was assigned.
- The CBFO manager did not ensure the SSO organization was adequately staffed.

The CBFO assessment report concluded that neither of the engineering oversight issues identified by the Board's staff rose to the level of a finding but one was documented as an OFI. Both LOIs remain open. Details of the CBFO assessment team's conclusions as to the two

[6] SSO duties, responsibilities, knowledge, skills, and abilities were removed from DOE Order 426.1A when revision 1B was issued in March 2020. DOE has committed to develop an SSO Functional Area Qualification Standard, as yet unfinished, to codify the duties and responsibilities previously spelled out in DOE Order 426.1A.

oversight-related LOIs, and how they were or are being dispositioned as of September 30, 2020, are provided below.

LOI	*Observations*/CBFO Conclusions
26	*Revision 62 of the system assignment list, dated September 21, 2018, indicates that the CSE for the SIAS is not qualified, but in training. No alternate CSE for SIAS is assigned during this same period.* This LOI remains **OPEN** and is a concern to CBFO management in demonstrating that nuclear safety functions and operations of the hazard category 2 nuclear facility are being overseen by the contractor. **OFI** - Based on the importance and roles of the CSEs, NWP should accelerate the qualifications as soon as possible to become compliant with DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, and to qualify at least one individual that can oversee SSCs without compensatory measures.
27	*Revision 62 of the system assignment list does not identify a CBFO SSO but rather identifies the position as "to be determined" (TBD). Revision 63 of the system assignment list, dated March 11, 2019, lists "J. Carrasco w/SME" as the CBFO SSO with a note directing contact with CBFO federal director for assigned person. It is unclear as to who is the qualified/assigned SSO for SIAS.* This LOI remains **OPEN** and a concern to CBFO management. Recruiting actions are underway to bring on at least one additional SSO candidate that must be trained over an approximately 18-month period based on the requirements in DOE Order 426.1A. CBFO senior management is aware of the current hiring difficulties and intends to utilize other federal employees or contractor supplemented support to provide day-to-day oversight of vital safety systems.

The review team noted potential issues in the NWP and CBFO oversight programs that call into question the ability of the CSEs and SSOs to foresee and fully comprehend the potential vulnerabilities affecting the operability and reliability of the safety systems to which each are assigned. Based on the analysis in the CBFO assessment report, NWP has indicated it has developed a WIPP Form to address the need for maintaining a staff of qualified CSEs, however, the CBFO assessment team found no evidence of such a WIPP Form. The review team is not confident that NWP will increase the number of CSEs through accelerated hiring practices—which would allow alternate CSEs to be assigned to key SSCs—or have them qualified in a timely manner to perform their duties without compensatory measures in place.

At the time the CBFO final report was issued in September 2020, there were two qualified SSOs in the site office. Since then, one has retired. The CBFO report notes that CBFO is in the process of acquiring a confinement ventilation system engineer who will also be designated as an SSO with compensatory measures applied. In the interim, CBFO has relied on technical support from a qualified individual borrowed from the DOE Savannah River Site to oversee safety systems and to perform surveillances. Neither of these two actions will resolve the concern that federal oversight has no long-term plan to address the number of SSOs needed

to adequately oversee the 17 safety significant SSCs and more than 100 SSCs overall that have an assigned CSE. Overall, the staff believes WIPP needs to apply additional management attention to shore up its contractor and federal engineering oversight staffing and capabilities.

Conclusion. Initially, CBFO and NWP were slow to acknowledge the review team's observations as potential issues. Since the formation of the CBFO assessment team, CBFO and NWP have been proactive in dealing with the observations and appear to be actively implementing the feedback and improvement element of ISMS. According to the CBFO assessment report, recent leadership changes within CBFO and NWP, as well as a more productive interaction internally and externally, appear to be promising. CBFO, however, continues to struggle with oversight due to staffing shortfalls, particularly facility representatives and safety system oversight personnel. Had this been a more significant event, the field office could not have afforded to delay its responses to the event or the lines of inquiry.

Overall, the review team believes that CBFO has addressed, partially addressed, or is in the process of addressing the observations with corrective actions. This review ultimately resulted in a positive outcome and showed the value of constructive staff-to-staff interactions. The review team will continue to monitor and verify the progress of CBFO and NWP related to its observations.

References

[1] Carlsbad Field Office, *Carlsbad Field Office (CBFO) External Review Assessment to Validate the Issues Identified by the Defense Nuclear Facilities Safety Board (DNFSB) December 2018 Pertaining to the Safety Instrumented Alarm System (SIAS) Failure at the Waste Isolation Pilot Plant (WIPP),* September 30, 2020.

[2] Department of Energy, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, DOE Guide 424.1-1B, Chg. 2, June 2013.

[3] Department of Energy, *Quality Assurance,* DOE Order 414.1D, Change 2, September 2020.

[4] Department of Energy, *Facility Safety,* DOE Order 420.1C, Change 3, November 2019.

[5] Department of Energy, *Conduct of Operations,* DOE Order 422.1, Change 1, October 2019.

[6] Department of Energy, *Federal Technical Capability Program,* DOE Order 426.1A, January 2017.

[7] Department of Energy, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities,* DOE Order 426.2, Change 1, July 2013.

[8] Department of Energy, *Implementation of Department of Energy Oversight Policy,* DOE Policy 226.1A, April 2011.

[9] Nuclear Waste Partnership, LLC, *Central Monitoring Room Electronic Logkeeping,* WP 04-CM2005, Revision 3, May 2018.

[10] Nuclear Waste Partnership, LLC, *Conduct of Operations – Communications,* WP 04-CO.01-4, Revision 6, April 2019.

[11] Nuclear Waste Partnership, LLC, *Conduct of Operations Program – Investigation of Abnormal Events, Conditions and Trends,* WP 04-CO.01-6, Revision 7, January 2019.

[12] Nuclear Waste Partnership, LLC, *Conduct of Operations Program – Logkeeping,* WP 04-CO.01-11, Revision 6, May 2018.

[13] Nuclear Waste Partnership, LLC, *Conduct of Engineering,* WP 09, Revision 43, April 2017.

[14] Nuclear Waste Partnership, LLC, *Safety Instrumented Alarm System Software Quality Assurance Plan,* WP 09-CN.13, Revision 0, May 2019.

[15] Nuclear Waste Partnership, LLC, *Work Control Process,* WP 10-WC3011, Revision 42, November 2019.

[16] Nuclear Waste Partnership, LLC, *Work Control Document Writer's Guide,* WP 10-WC3012, Revision 5, September 2020.

[17] Nuclear Waste Partnership, LLC, *Work Control Document User's Guide,* WP 10-WC3013, Revision 1, September 2014.

[18] Nuclear Waste Partnership, LLC, *Fact-Findings and Critiques,* WP 15-CA1007, Revision 1, August 2016.

[19] Nuclear Waste Partnership, LLC, *Reporting Occurrences in Accordance with DOE O 232.2A,* WP 15-CA1010, Revision 30-FR1, May 2017.

[20] Nuclear Waste Partnership, LLC, *Event Investigation,* WP 15-MD3102, Revision 10-FR1, March 2017.

[21] Nuclear Waste Partnership, LLC, *Software Screening and Control,* WP 16-2, Revision 16, May 2017.

[22] Nuclear Waste Partnership, LLC, *NWP Conduct of Operations Project Plan*, December 2020.

Appendix A

Timeline of Events
(Listed Times are Mountain Time)

12-9-2018 (Sunday)	0558: Safety instrumented alarm system (SIAS) alarm panel tested - satisfactory (SAT) (central monitoring room (CMR) electronic log record 170339). [This identifies the last satisfactory report for the SIAS panel.] 1322: Facility shift manager (FSM) declares entry into limiting condition for operation (LCO) 3.2.3, Condition A, because Panel 711-AP-451 power alarm is active (CMR electronic log record 170441). Note 1: Neither electronic log record contains an entry identifying when the panel first went into alarm, nor actions by CMR staff to address it (e.g., conducting a lamp test, which initially cleared the alarm horn; shortly afterward, when it went into alarm again, observing that the lamp test did not stop the horn; deciding to stop the horn by disconnecting power to the panel). Note 2: The sequence described in Note 1 is **not** consistent with the processor being the root cause of the INITIAL alarm. If the lamp test was able to be performed AFTER the initial alarm, this implies that the processor was successfully executing its software program. The subsequent inability to silence the alarm horn is consistent with the processor failing to execute its software program and is consistent with the observed error codes when trouble shooting on the processor was later performed. 2355: Midnight Status includes "LCO 3.2.3 A 308 DP OOS" (CMR electronic log record 170487).
12-11-2018 (Tuesday)	1323: Operations management determines the failure of Panel 711-AP-451 is ORPS reportable, "Group 4 subpart A(1)RL-1" [*sic*] (CMR electronic log record 170689). After listening to the WIPP morning status meeting ("T-0"), a staff member sends an internal Defense Nuclear Facilities Safety Board (Board) e-mail of pertinent items that includes the fact that the Waste Isolation Pilot Plant (WIPP) had reportedly entered LCO 3.2.3, Condition A, for Bulkhead (BH) 308 differential pressures (dP) alarm out of service and LCO 3.2.1, Condition A, for central monitoring station (CMS) dP out of service.
12-12-2018 (Wednesday)	0959: Nuclear Waste Partnership, LLC (NWP), completes a work order for the functional test (WO 1815385) of the SIAS. Note: It was later identified that steps of this work order could not be accomplished as written, but the operator did not recognize this discrepancy during the task. Board's staff analysis identified that the work order identified

	inappropriate functional test acceptance criteria. (See entries for 2-18-2019 and 3-20-2019.) 1028: The facility shift manager completes and signs the engineering package to place alarm Panel 711-AP-451 back in service, and exit LCO 3.2.3, Condition A.
12-16-2018	In response to queries, Carlsbad Field Office (CBFO) notifies the Board' staff that no fact-finding was held for the SIAS event, nor was a WIPP Form generated.
12-19-2018	Occurrence Reporting and Processing System (ORPS) report is issued and identifies the incorrect dates and times of (a) discovery for the SIAS internal processor issue, (b) operability of the alarm panel was restored, and (c) a work package required to perform a final retest on this safety significant equipment was developed. Note 1: The ORPS statement regarding the correction of the internal processor issue was not supported by subsequent fact-finding. It was never confirmed that the INITIAL failure was the result of an internal processor issue. Note 2: Operability was declared prior to completion of a functional test, but the facility remained in LCO 3.2.3, Condition A.
1-14-2019 to 1-18-2019	Board's staff conducts a site visit. Staff members met with representatives from NWP and the newly appointed CBFO safety system oversight engineer. - Neither NWP nor the vendor understood the error code provided by the programmable logic controller (PLC). - NWP acknowledged that they did not perform any operability determination. Rather, they reloaded the software, performed a basic functional test, and returned the system to service. Board's staff members met with the CBFO facility representative who was on call when the SIAS panel failed. - The facility representative was told by the deputy facility operations manager that NWP would replace the PLC, perform a test, and return the system to service. - The facility representative was not aware of whether or not a fact-finding had been held for the event. Board's staff members met with the central monitoring room operator (CMRO) who was on shift when the SIAS panel failed. - The CMRO reported that the only indication was that the audible alarm was sounding and the only light that was on was the green power light. The trouble alarm was not illuminated, and the normally illuminated pushbutton switches for silencing the alarm and performing a lamp test (and one similar lighted button) were off. The CMRO could not silence the horn.

	Staff Observation: If a fact-finding had been held, this could have resulted in more coherent, consistent, and integrated answers from NWP operations management, NWP technical staff, and CBFO staff.
1-17-2019	Board's staff e-mails 10 lines of inquiry related to the SIAS panel failure to CBFO, requesting a factual accuracy check. 1. Were SIAS alarm panel components replaced, and if so, why? 2. What work packages were used for trouble-shooting and repair? 3. Was there any relationship between the 12-9-2018 event and the decision to perform the preventive maintenance task for replacing the batteries? 4. How long has the light emitting diode on the panel been inoperable? 5. How was the error code detected? 6. How was operability determined? 7. What procedure was used to restart the system? 8. Was it a software or hardware problem, and if unknown, why is the system considered operable? 9. Who wrote the ORPS report, as it seems to be incorrect? It says the system failed on 12-9-2018, the internal processor was corrected and operability restored on 12-10-2018, and the functional test was performed on 12-11-2018. (Before the meeting with NWP Engineering, an NWP operations manager said the ORPS report wording is wrong; technical safety requirement operability was not declared until 12-11-2018.) 10. Was the alarm panel battery replaced within the required periodicity? NWP confirms that they did not replace any hardware and indicates that they might be conducting a fact-finding on this topic the next day. (Subsequently, neither the Board's staff nor CBFO could find any indication NWP held a fact-finding.)
2-18-2019	The Board's staff receives a copy of WO 1815385 (functional test) that was used to return the SIAS alarm panel to service.
3-20-2019	The Board's staff elects to stand up a "review team" to conduct a formal review. The review team conducts a teleconference with CBFO and NWP on the 10 lines of inquiry provided during the January 2019 site visit. The review team requests a copy of the original installation procedure used to verify the system was functioning properly when installed in 2016. By reviewing the old acceptance test, the staff recognizes that the acceptance criteria used in step 5.6.4 of WO 1815385 on 12-12-2018 were incorrect; NWP had failed to incorporate an approved work change notice (WCN-2) to the original installation procedure, WO 1616261, into the new work order.

3-21-2019	The review team sends an e-mail to CBFO management sharing the discovery that the 12-12-2018 test acceptance criteria failed to incorporate WCN-2 from the original installation procedure.
4-5-2019	The review team transmits an information request to support further review of the SIAS failure.
5-13-2019	The review team makes an additional information request.
5-15-2019	NWP issues an Apparent Causal Analysis Report for the SIAS reloading investigation for WIPP Form 19-281. The report says, "per WP 10-WC3011, use of a work procedure was not required."
6-4-2019	NWP sends the Apparent Causal Analysis Report to the Board's review team.
7-3-2019	The review team sends 27 identified observations via a "factual accuracy" agenda to CBFO. (See Appendix B.)
8-6-2019	CBFO provides NWP's initial 2019 responses to the factual accuracy agenda for the 27 observations. No CBFO responses were included.
8-8-2019	The review team recognizes some discrepancies with NWP's responses and requests clarification. The review team inquires whether the lack of CBFO responses was intentional.
8-15-2019	NWP re-performs the functional test with corrected acceptance criteria (WO 1926401).
8-22-2019	NWP completes revised written responses to all 27 observations. CBFO again chooses to provide no response.
10-17-2019	In response to Board's staff inquiries, CBFO identifies issues with staffing and higher priority tasking that are delaying their response.
10-23-2019	The review team emails the consolidated NWP 2019 responses to CBFO, requesting comment. (See Appendix B.)
2-20-2020	The review team emails (1) the consolidated NWP responses and (2) the review team's technical evaluation of the NWP responses to CBFO. (See Appendix B.)
2-25-2020	CBFO identifies that the new CBFO Facility Oversight Division director will be formally responding to the 27 observations made in the SIAS factual accuracy agenda.
4-6-2020	The review team has an informal call with CBFO discussing the SIAS update and path forward. CBFO discusses plans for the formation of a CBFO assessment team to evaluate the 27 observations.
7-8-2020	CBFO provides NWP's updated (2020) responses to the factual accuracy agenda for the 27 observations in WIPP Form 20-682. (See Appendix B.)
9-9-2020	The CBFO assessment team leader provides a management level out-briefing to the Board's review team.
9-28-2020	The CBFO assessment team leader conducts a detailed out-briefing to the Board's review team.
11-23-2020	The review team receives the detailed CBFO assessment final report.
12-16-2020	The review team briefs the Board on the SIAS failure and subsequent response and recovery actions.

Appendix B

Safety Instrumented Alarm System (SIAS) Lines of Inquiry (LOI) With Consolidated Waste Isolation Pilot Plant (WIPP) Responses and Defense Nuclear Facilities Safety Board (Board) Review Team Evaluations

The Board's review team's LOIs as originally sent are identified in BLACK text.

The WIPP 2019 responses are identified in RED text for each of the LOIs. Evaluations of the contractor's responses were also requested from Carlsbad Field Office (CBFO) but not provided.

The review team evaluation and/or technical justification of WIPP 2019 responses are identified in GREEN text for each of the LOIs.

The WIPP 2020 responses are identified in BLUE text for each of the LOIs.

For all four colors, *Italicized* text is information extracted verbatim from referenced documents.

Event Investigation

1. No investigation/fact-finding was conducted for the December 2018 failure of SIAS. Multiple conditions for a required investigation could have been met per WP 04-CO.01-6, Rev. 6-FR1, *Conduct of Operations Program – Investigation of Abnormal Events, Conditions and Trends*. The following events noted in step 3.1.1 below are relevant examples:

   3.1 Criteria for Events Requiring Investigation

   - *3.1.1 The following events shall be investigated:*

     b. Abnormal or unexpected system performance that adversely affects operations or safety (e.g., improper instrument readings, automatic control failure, chemical analysis).

     c. Abnormal or unexpected safety conditions (e.g., stray voltage, safety feature or interlock malfunction).

     h. Equipment failure that could affect safety or mission.

   WIPP 2019 Response: No Fact-Finding required. Not warranted.

   Review Team Evaluation: The review team considers a fact-finding or other data gathering to be an opportunity to collect and share information related to an event and in keeping with a continuous improvement approach to safety. Based on the number of discrepancies identified by the review team during its review of the response to the SIAS

failure, this was a missed opportunity to implement the feedback and improvement element of the integrated safety management system.

No explanation was provided as to why the event did not trigger any of the thresholds listed in Section 3.1.1 of WP 04-CO.01-6. The review team believes that any of the 3.1.1 conditions documented above could have precipitated an investigation in this case. At a minimum, an investigation should have been undertaken as a best practice. On a related note, the WIPP fact-finding/critique procedure (WP 15-CA1007, *Fact-Findings and Critiques*) was not updated when DOE Order 232.2A, *Occurrence Reporting and Processing of Operations Information*, was revised on January 17, 2017. WP 15-CA1007, Revision 1 (current at time of event), requires a critique for Occurrence Reporting and Processing System (ORPS) events categorized as Significance Category 1, which has not existed for more than two years.

WIPP 2020 Response: A review of the associated WIPP Form (WF) 18-853 and WF 19-052 was conducted. WP 04-CO.01-6 is now on Revision 7. Data previously contained in Section 3.1.1 is now contained in Section 3.1, the information is verbatim.

The event should have triggered a fact-finding per WP 15-CA1010, *Reporting Occurrences in Accordance with DOE Order 232.2A*; Group 4A(1)L, "Performance degradation of any Safety Class (SC) or Safety Significant (SS) Structure, System, or Component (SSC), OR any support system that is required for safety operation of the SC or SS SSCs, which prevents satisfactory performance of its design function when it is required to be operable." WP 04-CO.01-6, Section 3.1 states: "The following events shall be investigated per WP 15-MD3102, *Event Investigation*… Abnormal or unexpected system performance that adversely affects operations or safety (e.g., improper instrument readings, automatic control failure, chemical analysis)… Abnormal or unexpected safety conditions (e.g., stray voltage, safety feature or interlock malfunction), or… Equipment failure that could affect safety or mission."

WF 18-853 was not sufficient to address the SIAS failure. No corrective actions were identified and the WIPP Form was closed referencing that the condition was documented in the WIPP Form as found-fixed condition by the committee and closed on 1/7/2019.

WF 19-052 documents issue collection and evaluation (ICE) 1029. The WIPP Form documented that a critique was not held after the failure of the Bulkhead 308 alarm panel, contrary to WP 15-CA1007. To date this WIPP Form has not been closed. The WIPP Form indicated that a fact-finding was scheduled to be held January 7, 2019, a copy of the fact-finding has been requested. Timely Order No.19:005, *Fact-Finding for ORPS Occurrences*, was issued February 6, 2019. The timely order was cancelled August 5, 2019, with the statement, "All FSMs [facility shift managers] have been briefed and procedure reflects the requirements." The facility operations manager (FOM) does not recall which procedure is the one being referenced. Evaluation of the possible procedures that could/should reflect the requirement is being conducted; if it is determined to be inadequate, the timely order will be reopened.

WP 15-CA1007 still references Significance Category 1, the procedure is currently in revision. A WIPP Form will be written to document this issue.

It has been identified that the three procedures implementing event investigations/fact-findings/critiques are not in alignment. All conduct of operations procedures are being consolidated into a conduct of operations manual. Having two separate procedures, one in Operations and one in Contract Assurance that do not align has caused issues with properly implementing/conducting/documenting event investigations/fact-findings/critiques. A WIPP Form will be written to document this issue.

Unreviewed Safety Question (USQ) Determination

2. No USQ determination (or screening) was identified to support installation and [testing] of safety significant software in accordance with steps 5.4.9 and 5.5.6.8 of WP 16-2, Revision 16, *Software Screening and Control*.

   WIPP 2019 Response: This comment is accurate; there was no work control document [WCD] issued for software reloading, no USQ was performed. (Note: A USQ screening was performed on Work Order (WO) 1815385 for the functionality and operability test associated with this activity.)

   Review Team Evaluation: WIPP staff ultimately identified the need for WCDs to support safety significant software installation (also discussed in LOI 3). A USQ screening was performed in association with the functionality and operability test work performed under WO 1815385. DOE Guide 424.1-1B Chg. 2, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, provides guidance on USQ screening/determinations that seems to be applicable to the work performed in response to the December 9, 2018, event.

   The response indicates no USQ screening/determination was required because no work order was initially developed and used to reload and test the subject software. This contention is specious as a WCD should have been developed and subsequently a USQ screening/determination should have been performed.

   WIPP 2020 Response: WP 10-WC3011, *Work Control Process*, was revised to incorporate the changes pertaining to safety significant software changes to process control systems as recommended by engineering. This revision includes troubleshooting. WP 10-WC3011, Revision 42, was issued November 12, 2019. Briefing on new changes and interactive discussion with planners occurred on November 13, 2019.

   WO 1815385 (which was USQ screened) verified the SIAS was functional.

   Ref: WF 19-281, *Apparent Causal Analysis Report, Safety Instrumented Alarm System Software Reloading Investigation,* Actions 5 and 6

Work Control Document

3. There was no work order for troubleshooting/software reload/system restoration.

   WIPP 2019 Response: This comment is accurate; there was no WCD.
   (Note: The work control process procedure WP 10-WC3011, currently excludes software changes to process control systems; this exclusion is presently being re–evaluated and is tracked via WF 19-281. In addition, WP 09-CN.13, *Safety Instrumented Alarm System Software Quality Assurance Plan* [SQAP], was issued May 2019 to address configuration management elements including issues reporting, problem reporting, corrective action, troubleshooting, and the procedures related to work control. SQAP serves to identify the configuration control processes supporting management of SIAS. Section 3.3 states that implementation shall be performed with an approved work control document per WP 10-WC3011.

   Review Team Evaluation: At the time of the December 2018 event, the SQAP that was in effect had been developed by the software developer, REP-15017-013, *Software Quality Assurance Plan*. It explicitly stated it did not apply to operations and maintenance of the system. The review team also notes that WP 10-WC3011, Revision 42, was issued in November 2019, after the Nuclear Waste Partnership, LLC (NWP), response provided above.

   WIPP staff re-evaluated the software change requirements and revised their SQAP to perform work with an approved WCD. WP 09-CN.13, the new SQAP, is, however, not clear on whether troubleshooting will now be performed (going forward) using a WCD, since the term "implementation" is not explicitly defined. However, the revision to WP 10-WC3011 resolves this question.

   WP 09-CN.13 was issued in May 2019 ostensibly "to address... troubleshooting, and the procedures related to work control," and "implementation shall be performed with an approved work control document per WP 10-WC3011." WF 19-281 concluded that the diagnosis and error code retrieval and the subsequent downloading of the original software program into the SIAS panel did not fall under the guidance of WP 10-WC3011, which was in effect at the time, and did adhere to the approved guidance outlined in WP16-2. WF 19-281 further states that WO 1815385, a Type 1 WCD, provided the necessary steps to verify and validate the downloaded original software and provides evidence that the SIAS was functioning as intended.

   The NWP statements in their response related to the prior revision of WP 10-WC3011 not being applicable are debatable. The exclusion is for "software changes to Process Control Systems." As the software was not changed, the troubleshooting and reloading of the safety significant software should have been performed with a WCD.

   WIPP 2020 Response: WP 10-WC3011 was revised to incorporate the changes pertaining to safety significant software changes to process control systems as recommended by engineering. This revision includes troubleshooting. WP 10-WC3011,

Revision 42, was issued November 12, 2019. Briefing on new changes and interactive discussion with planners occurred on November 13, 2019.

WO 1815385 (which was USQ screened) verified the SIAS was functional.

Ref: WF 19-281, Actions 5 and 6

4. Although general requirements for software configuration management are discussed in WP 16-2, no specific procedure(s) was identified that described all elements of configuration management described in Nuclear Quality Assurance (NQA-1) (Part I, Requirement 3, Section 802, and Part II, Subpart 2.7, Section 203). This includes software storage medium, software storage location, location of any backup to the original medium, and the procedures related to physical control and installation. (NOTE: WP 16-2 references American Society of Mechanical Engineers (ASME) NQA-2A-1990 instead of NQA-1.)

   WIPP 2019 Response: Comments are accurate.
   (Note: WP 16-2 is a management control procedure implementing the requirements of WP 13-1, *Nuclear Waste Partnership LLC Quality Assurance Program Description* (NWP QAPD), for software quality assurance (SQA), consistent with CAO-94-1012 *Carlsbad Field Office Quality Assurance Program Document*, as required by contract DE-EM-0001971. To define a rigorous approach to SQA requirements, the SIAS software quality assurance plan was developed.)

   WP 09-CN.13 was issued May 2019 to address configuration management elements including software storage medium (Section 4.2, *Configuration Control*), software storage location (Section 4.2, *Configuration Control*), location of any backup to the original medium (Section 4.2, *Configuration Control*, and Section 9.7, *Disaster Recovery*), and the procedures related to physical control and installation (procedures are identified throughout the SQAP pertaining to each phase of the software lifecycle). The SQAP serves to prescriptively identify the configuration management and configuration control processes and procedures supporting the lifecycle of the SIAS.

   Review Team Evaluation: WIPP developed and issued the SQAP in May 2019 to address configuration management elements including those identified above. During previous review team interactions with WIPP, the existence of a software requirements document for SIAS was specifically explored—the review team was informed that such a document did not exist.

   While the SQAP addresses certain configuration management elements such as software storage location, backups, and disaster recovery, the review team has not observed evidence that the actual software is under a lifecycle control process. Necessary elements of a lifecycle control process are the development and control of software requirements (Section 3.1 of the SQAP) and documentation of the software design (Section 3.2 of the SQAP).

[WIPP 2020 Response was not provided for LOI 4.]

5. Contrary to the conclusion in WF 19-281, troubleshooting and system restoration are outside the scope of WP 16-2. As such, these items should have followed the WP 10-WC3011.

WIPP 2019 Response: The comment that the troubleshooting and system restoration are outside of the scope of WP16-2 is accurate, however at the time of the activity WP 10-WC3011, Revision 40-FR1, excluded software changes to process control systems.

(Note: WP 09-CN.13, Revision 0, was issued May 2019 to address configuration management elements including issues reporting, problem reporting, corrective action, troubleshooting, and the procedures related to work control. The SQAP serves to identify the configuration control processes supporting management of the SIAS. In Section 3.3, *Implementation Phase*, implementation shall be performed with an approved work control document per WP 10-WC3011. Although WP 10-WC3011 specifically excludes software changes to process control systems (Section 1.2, Bullet 9), no software was changed during reloading. NWP recognizes that WP 09-CN.13 identifies troubleshooting as a necessary element of the operations and maintenance phase of the software lifecycle. NWP has an opportunity for improvement to close a procedural gap that exists in the scope of troubleshooting process control systems. The gap is being evaluated and tracked via WF 19-281.

Review Team Evaluation: The review team is encouraged that WIPP recognizes that a procedural gap exists in the scope of troubleshooting process control systems and needs to be addressed. This corrective action has also been included in the issued SQAP. As previously stated, the exclusion in WP 10-WC3011 for changes to the software is not applicable to troubleshooting and reloading of safety significant software.

Per WF 19-281, WP 09-CN.13 was issued in May 2019 ostensibly "to address... troubleshooting, and the procedures related to work control," and "implementation shall be performed with an approved work control document per WP 10-WC3011." WP 09-CN.13 is not clear on whether troubleshooting will now be performed (going forward) using a WCD since the term "implementation" is not explicitly defined. However, the recent revision to WP 10-WC3011 may resolve this topic. (See review team evaluation for LOI 3, as well.)

WIPP 2020 Response: WP 10-WC3011 was revised to incorporate the changes pertaining to safety significant software changes to process control systems as recommended by engineering. This revision includes troubleshooting. WP 10-WC3011, Revision 42, was issued November 12, 2019. Briefing on new changes and interactive discussion with planners occurred on November 13, 2019.

WO 1815385 (which was USQ screened) verified the SIAS was functional.

Ref: WF 19-281, Actions 5 and 6

Central Monitoring Room (CMR) Electronic Log Review

6. The log entries as received on April 5, 2019, are not in consecutive and chronological order as required by Step 5.2.1[C] of WP 04-CM2005, Revision 3, *Central Monitoring Room Electronic Logkeeping*.

   WIPP 2019 Response: The log entries that were sent to the Board's staff were copied and pasted to a Word™ document as they were found in the log entries. The log entries in the CMR electronic log are in order.

   Review Team Evaluation: WIPP appears to have two different logkeeping practices: one is to amend an existing record to add multiple additional related events in that record, and the other is to create a new record for each event; in some cases, related events. These different practices appear to create electronic log records that are not entirely in chronological order, as required. The review team believes that a new record for each event is the only action that will explicitly meet the procedural requirement to log entries in chronological order.

   To evaluate WIPP's response to the LOI, the review team subsequently requested the actual central monitoring room (CMR) electronic log (not the cut and paste version), which was received in October 2019. The records were still not entirely in chronological order. In general, the entries on each page were in chronological order, with several exceptions, however many of the pages as forwarded electronically were not in order. The review team believes the processes to produce and reproduce log records in chronological order, similar to paper logs, should be improved to allow easy recovery and analysis of recorded events.

   WIPP 2020 Response: WP 04-CM2005, Section 5.2.1 [C] states:

   [C] Entries are in consecutive and chronological order.
   [D] If late entries must be made then enter the following:
   [1] "Late Entry" at beginning of log entry.
   [2] Entry narrative including date and time when the event or activity described actually occurred.
   [3] Initials of the person making the late entry.

   CMR electronic log has a feature named "Update Record"; if this is selected to make a correction to an entry then the correction is collocated with the original entry. This then puts the log entries out of chronological order.

Example from current COVID-19 pandemic daily log:

Using the Update Record feature does not allow entries to be in chronological order.

WP 04-CM2005 will be evaluated and revised if necessary to clarify management expectations with regard to updating CMR log entries in the electronic log. A WIPP Form will be written to capture this revision. Training the cognizant CMR staff on the proper method to record late entries will also be added to the WIPP Form as a corrective action.

7. The FSM's review of the CMR electronic log at shift end is not being consistently documented with a log entry as required by Step 5.3.2 of WP 04-CM2005. (See December 12, 2018 evening shift).

WIPP 2019 Response: There are times that the FSM did not log review of logs and turnover of responsibilities (WF 19-173).

Review Team Evaluation: WF 19-173 corrective action ACT19-173-2 is not associated with the topic of CMR electronic log review at shift end, as indicated by the WIPP response. No corrective actions were provided to ensure this important management function is performed as procedurally required.

The November 2019 presentation to the Executive Safety and Quality Review Board (ESQRB) for the conduct of operations safety management program (SMP) was rated as yellow (marginal), including the logkeeping program element. It appears that the corrective actions of ACT19-173-2 have not been effective.

WIPP 2020 Response: Previously identified WF 19-173 does not address the concern identified. WP 04-CM2005, Section 5.4.2 states:

> *5.4.2 FSM or Designee, review CMR Electronic Log at shift end to ensure completeness, accuracy, legibility, and authenticity of the log and to monitor any adverse trends.*
> *[A] FSM or Designee document review with a log entry.*

An action will be added to the WIPP Form written for the [Board's review team's] LOI 6 to validate that the FSM or designee has [performed] his or her CMR electronic log [review] at the end of shift and documented his or her review in the CMR electronic log. If the evidence is not sufficient to evaluate, follow on corrective actions will be added to the WIPP Form for corrective training and assessment of effectiveness to ensure the corrective actions were sufficient.

8. Based on initial discussion with the FOM, it is not clear if the quarterly review of the CMR electronic log is being conducted and documented as required by WP 04-CM2005.

WIPP 2019 Response: *All reviews were complete. They are conducted on a monthly basis in order to obtain information for monthly key performance indicators. However, not each review was documented in the CMR daily log. (* corrected response based on follow-up clarification request)

Review Team Evaluation: No corrective actions were provided to ensure that proof of this important management function being conducted is documented, as procedurally required. A standard conduct of operations axiom is "Actions not logged are actions not taken."

WIPP 2020 Response: WP 04-CM2005, Section 5.5 states:

5.5 QUARTERLY LOG REVIEW
5.5.1 Facility Operations Manager or Designee perform the following:

[A] Review CMR Electronic Log quarterly.
[B] Document review in CMR Electronic Log.

An action will be added to the WIPP Form written for the [Board's review team's] LOI 6 to validate that the FOM or designee has documented their quarterly review of the CMR electronic log and documented their review in the CMR electronic log. If the evidence is not sufficient to evaluate, follow on corrective actions will be added to the WIPP Form for corrective training and assessment of effectiveness to ensure the corrective actions were sufficient.

9. The CMR electronic log entry (Record 170689) indicates the ORPS reporting level is "RL-1". There is no such reporting level as "RL-1", only high (H), low (L), or informational (I), as documented in Department of Energy (DOE) Order 232.2A. The ORPS report in the DOE system indicates the reporting level was entered as "L," low.

WIPP 2019 Response: *Log entry 170689 has a typo of the correct report level. Should have been "l" (low) not 1. (* corrected response based on follow-up clarification request).

Review Team Evaluation: This observation reflects the importance of the facility shift manager's daily electronic log review and operator attention to detail.

The correct entry should have been an "L," not an "l," to limit confusion with the "Informational" reporting level, "I." (See review team evaluation in LOI 7.) This LOI and proposed corrective action are also related to LOI 20 and LOI 21. WIPP should also consider correcting the erroneous log entry.

WIPP 2020 Response: A review of the M&O contract was conducted to validate that the DOE Order 232.2A is applicable, it is.

DOE Order 232.2A occurrence reporting criteria were reviewed. Attachment 2 states:

Report Levels provide a means to reflect the impact associated with a given occurrence in terms of health, safety and security to personnel, the public, the environment, and the operational mission. The three report levels are: High (H), Low (L), and Informational (I).

A review of WP 15-CA1010, Section 1.0 states:

Report Levels provide a means to reflect the impact associated with a given occurrence in terms of health, safety and security to personnel, the public, the environment, and the operational mission. The three report levels are: High (H), Low (L), and Informational (I). Determination of Report Levels for each specific Reporting Criteria is based on the conditions listed below.

An action will be added to the WIPP Form written for [the Board's review team's] LOI 6 to validate that the CMR electronic log entry (Record 170689) was updated to reflect "L."

10. The CMR electronic log (Record 170441) does not consistently document when a limiting condition for operation (LCO) action becomes effective/ineffective. At times during performance of LCO 3.2.3, the required action is A.2.1 and at other times the required action is A.2.2. In one instance there is no log entry stating that the underground is no longer manned (i.e., action A.2.2 has now replaced action A.2.1 as the effective LCO required action) and, in another case, there is no log entry stating that the underground is now manned (i.e., action A.2.1 has now replaced action A.2.2 as the effective LCO required action). Step 5.2.3 of WP 04-CM2005 notes that the CMR electronic log should record "entry into LCO conditions [and] entering and exiting actions."

WIPP 2019 Response: There are entries that are not consistent with the requirements of 04-CM2005 and conduct of operations. Facility Operations already has WIPP Form action ACT19-173-2 associated with this topic.

Review Team Evaluation: WF 19-173 corrective action ACT19-173-2 is not associated with the topic of logging LCO entries and exits, as indicated by the WIPP response. Training the cognizant CMR staff on properly recording entries and exits to/from LCOs should be a standalone corrective action based on its importance to safety.

WIPP 2020 Response: Previously identified WF 19-173 does not address the concern identified. Operations recently issued a new procedure WP 04-AD3020, *Entry and Exit of Limiting Conditions of Operations*, on March 25, 2020. Attachment 1, LCO Entry and Exit Condition Worksheet, captures the decision-making identified in Section 5.2.

5.2 LCO ENTRY
5.2.1 Using Attachment 1, Section 1 - LCO Entry, complete the following:

[A] The FSM shall review the WCD/procedure for TSR [technical safety requirements] affected steps and document WCO/Procedure No. or reason for entry.

[B] Document component(s) change(s) that will drive entry into LCO.

[C] Document work to be performed while in the LCO condition and the action driving entry into the LCO condition.

[D] After reviewing all LCO conditions in the TSR, the FSM shall document selected LCO condition.

[E] Document all SRs [surveillance requirements], procedures, or post maintenance testing associated with the exit of the LCO (this should include SRs the FSM will expect to receive prior to exit of the LCO).

[F] Circle unplanned or planned entry.

[G] Circle all affected areas and current mode applicability at the time of entry (if situation changes this will allow the FSM to evaluate if original conditions will remain or change based on plant configuration).

[H] Document the following for the applicable LCO;

- *Required actions.*
- *Required completion times/frequencies, as defined by the LCO condition.*
- *Time the action was first met.*

[I] Define the method used for tracking all completions that will be documented in the CMR log.

[J] If a general LCO will be utilized, then circle the LCO and state how and when the general LCO will apply to the entry or exit of the LCO.

[K] Document additional comments, as needed (e.g., expected changes, notifications to fire watches or other organizations, as well as specific information related to the LCO entry).

[L] Prior to FSMs final signature to enter the LCO, have peer check completed by another FSM, FOSE [facility operations shift engineer], FacOps [facility operations] management, or nuclear safety.

[M] Document Time of Operation.

[N] Sign Attachment 1, Section 1 - LCO Entry, Final Approval.

An action will be added to the WIPP Form written for [the Board's review team's] LOI 6 to evaluate WP 04-AD3020 effectiveness in minimizing the possibility that a required action would be overlooked or missed.

11. The CMR electronic log (Record 170441) has an entry in which a local reading of the Bulkhead 308 dP gauge is recorded but the person who observed and reported the reading is not logged. There are also numerous entries where "Verification performed of UVS/IVS [underground ventilation system/interim ventilation system]", but who did the verifying is not logged. This conflicts with a requirement in WP 04-CO.01-11, *Conduct of Operations Program – Logkeeping*, Step 3.3.8, that "WHO (position or title) was involved" should be entered.

WIPP 2019 Response: There are entries that are not consistent with the requirements of 04-CM2005 and conduct of operations. Facility Operations already has WIPP Form action ACT19-173-2 associated with this topic.

Review Team Evaluation: WF 19-173 corrective action ACT19-173-2 is not associated with the topic of logging the identity of personnel responsible for observing and reporting remote equipment data, as indicated by the WIPP response. Training the cognizant CMR staff on properly recording the identity of personnel responsible for observing and reporting remote equipment data should be added to the list of corrective actions.

WIPP 2020 Response: The requirements outlined in WP 04-CO.01-11 Section 3.3.8 state:

3.3.8 Sufficient information should be entered to answer the following questions as they apply to the situation:

- *WHAT was done or what happened?*
- *WHEN did it occur?*
- *HOW was it done?*
- *WHERE did the action occur?*
- *WHO (position or title) was involved and notified, as applicable?*

The correlating requirement outlined in WP 04-CM2005, Section 5.2.1 [B] states:

[B] Sufficient detail is included to describe changes in system configuration, situations, or events to convey an understanding of the situation or event, its significance and cause, actions taken in response, and the current status of the situation or event.

WP 04-CM2005 is silent with regard to the topic of logging the identity of personnel responsible for observing and reporting remote equipment data. An action will be added to the WIPP Form written for [the Board's review team's] LOI 6 to evaluate DOE Order 422.1, *Conduct of Operations*, requirements for logging information reported from the field. Evaluation of WP 04-CM2005 will also be conducted to ensure that the procedure supports the order requirements.

12. Condition A of LCO 3.2.3 has Required Actions to locally verify differential pressure of Bulkhead 308 dP gauge if underground is manned or verify UVFS/IVS fans are properly aligned if the underground is unmanned. The applicable action is required to be performed every 4 hours. CMR electronic log (Record 170523) shows a Bulkhead 308 dP reading at 2350 on December 11, Record 170769 shows UVFS/IVS lineup verifications at 0100 and 0430 on December 12, and the next Bulkhead 308 dP reading is shown in Record 170801 at 0654 on December 12. It is confusing to have 3 of 4 consecutive LCO actions on different records.

WIPP 2019 Response: No requirement that the log entries have to be made by updating the original log entry.

Review Team Evaluation: From a human factors standpoint, having related LCO actions recorded under different electronic log record numbers makes it more difficult to track actions that must be performed at prescribed periodicities. WIPP should consider requiring CMR logkeepers to record periodically collected LCO data in chronological order under a single electronic log record number or record each LCO entry under a different electronic log record number. Consistency in the way log entries are recorded, especially those related to LCO actions, would minimize the possibility that a required action would be overlooked or missed.

WIPP 2020 Response: An action will be added to the WIPP Form written for [the Board's review team's] LOI 6 to evaluate WP 04-CM2005 on logging LCO actions. This will tie to the evaluation of WP 04-AD3020.

13. A large percentage of the information associated with the inoperable Bulkhead 308 dP alarm event (i.e., 27 entries) is logged in Record 170441. Records 170689 and 170801 each have one entry associated with the event, and Record 170523 has three entries associated with the event. Based on this spread of records, the process for data entry is unclear.

    WIPP 2019 Response: No requirement that the log entries have to be made by updating the original log entry

    Review Team Evaluation: As previously identified, WIPP appears to have two different logkeeping practices: one is to amend an existing record to add multiple additional related events in that record, and the other is to create a new record for each event. These different practices appear to create electronic log records that are not entirely in chronological order, as required. The review team believes that a new record for each event is the only action that will explicitly meet the procedural requirement to log entries in chronological order. The WIPP procedure on electronic logkeeping, WP 04-CM2005, is silent on management's expectation for how these entries should be logged.

    WIPP 2020 Response: WP 04-CM2005 will be evaluated and revised if necessary to clarify management expectations with regard to updating CMR log entries in the electronic log. (Reference [the Board's review team's] LOI 6.)

14. Each CMR electronic log record has a place where "Event Type" is to be entered. It appears that a pull-down menu is used to select events such as "Alarms," "Plant Conditions," "Underground," and "Other." In 35 of 37 records generated by a particular CMR, no event type was selected. Management's expectation for providing such information is unclear.

    WIPP 2019 Response: There are entries that are not consistent with the requirements of 04-CM2005 and conduct of operations. Facility Operations already has WIPP Form action ACT19-173-2 associated with this topic.

Review Team Evaluation: WF 19-173 corrective action ACT19-173-2 is not associated with the topic of recording event type, as indicated by the WIPP response. Training the cognizant CMR staff on properly recording the event type should be added to the list of corrective actions.

WIPP 2020 Response: Previously identified WF 19-173 does not address the concern identified. WP 04-CM2005 is silent with regard how to record/select event type. An action will be added to the WIPP Form written for [the Board's review team's] LOI 6 to evaluate and if necessary revise WP 04-CM2005 on the use of the "Event Type" option in CMR electronic log entries.

15. WP 04-CM2005, Step 5.1.2, requires "Oncoming CMR, Roving Watch, and FSM enter… time and date followed by "assumed duties." In numerous cases, the time and date does not precede "assumed duties" and the term "assumed duties" is rarely used, as such (e.g., relieved by, assumed responsibilities, taking over the duties, assumed by, assumed watch, assumed FSM duties). It is unclear what should be flagged during daily log reviews by the facility shift manager

    WIPP 2019 Response: There are entries that are not consistent with the requirements of 04-CM2005 and conduct of operations. Facility Operations already has WIPP Form action ACT19-173-2 associated with this topic.

    Review Team Evaluation: WF 19-173 corrective action ACT19-173-2 does not address the misuse of the term "assumed duties," as indicated by the WIPP response. Training the cognizant CMR staff on proper use of "assumed duties" should be added to the list of corrective actions.

    WIPP 2020 Response: An action will be added to the WIPP Form written for [the Board's review team's] LOI 6 to evaluate and revise if necessary in WP 04-CM2005 the log entry requirements for assuming duties.

16. WP 04-CM2005 refers to WP 04-CO.01-4, *Conduct of Operations – Communications*, for the list of acceptable acronyms and abbreviations to be used in the CMR electronic log. There are numerous acronyms and abbreviations used throughout the log that are neither on the list nor defined on first use (e.g., TCO, SVS, IS&H, FB, ORRP, CHWH).

    WIPP 2019 Response: There are entries that are not consistent with requirements of 04-CM2005 and conduct of operations. Facility Operations already has WIPP Form action ACT19-173-2 associated with this topic.

    Review Team Evaluation: A corrective action in ACT19-173-2 was to brief CMR personnel responsible for log entries on the requirements with respect to the use of acronyms and abbreviations. WIPP provided objective evidence that this had been completed. WP 04-CO.01-4 (Revision 6), however, had not been updated to define any of the acronyms/abbreviations used by CMR logkeepers and listed in the LOI.

WIPP 2020 Response: WF 20-159 was written independent of this assessment but identified the same concern with regard to abbreviation and acronym use at WIPP.

WP 04-CM2005, Rev 3-FR1, was issued 5/22/2019. Section 5.2.1 reflects the requirement for log entries with regard to abbreviations and acronym use:

5.2.1 Ensure the following for CMR Electronic Log entries:
[A] Entries include approved abbreviations, acronyms, symbols IAW WP 04-CO.01-4, Conduct of Operations – Communications, Attachment 1, Acronyms and Abbreviations.
OR
If an entry includes abbreviations, acronyms, or symbols not found in WP 04-CO.01-4, then spell out acronym with first use.

An additional action will be added to WF 20-159 to evaluate and include appropriate abbreviations and acronyms that the CMR logkeepers are using to the approved list.

An additional action will be added to WF 20-159 to train the FSM and CMR personnel on adherence to the approved abbreviation and acronym list.

17. WP 04-CM2005, Step 5.2.1[D][1], requires late entries to include "Late Entry" at the beginning of the log entry and date and time when the event actually occurred. Record 170743 has a late entry that does not place "Late Entry" at the beginning of the entry (it comes after "CMR"). Records 170441, 170638, 170884, and 171945 do not include the date (and time in some cases) the event actually occurred in the late entries.

WIPP 2019 Response: There are entries that are not consistent with the requirements of 04-CM2005 and conduct of operations. Facility Operations already has WIPP Form action ACT19-173-2 associated with this topic.

Review Team Evaluation: WF 19-173 corrective action ACT19-173-2 does not address the process to record late entries, as indicated by the WIPP response. Training the cognizant CMR staff on the proper method to record late entries should be added to the list of corrective actions.

WIPP 2020 Response: Previously identified WF 19-173 does not address the concern identified. Adherence to WP 04-CM2005 in documenting late entries will be tied to the WIPP Form written for [the Board's review team's] LOI 6. The expected actions will be training and an effectiveness review of the corrective actions.

WP 04-CM2005, Section 5.2.1 [D] states:

[D] If late entries must be made then enter the following:
[1] "Late Entry" at beginning of log entry.
[2] Entry narrative including date and time when the event or activity described actually occurred.

[3] Initials of the person making the late entry.

18. LCO 3.2.3, Required Action A.2.2, is to "Verify UVFS/IVS exhaust fan(s) in service … if the UNDERGEROUND is unmanned…." Numerous log entries for performance of this action misidentify the fans as "UVS/IVS".

    WIPP 2019 Response: There are entries that are not consistent with the requirements of 04-CM2005 and conduct of operations. Facility Operations already has WIPP Form action ACT19-173-2 associated with this topic.

    Review Team Evaluation: WF 19-173 corrective action ACT19-173-2 does not explicitly address the need for attention to detail when making log entries, as indicated by the WIPP response. A corrective action in ACT19-173-2 does, however, require a briefing to CMR personnel on increased management observation. The training on, and implementation of, increased management observation is designed to catch the type of error noted in the LOI, but no evidence was provided to the review team by WIPP in ACT19-173-2 that this action has been completed and documented.

    WIPP 2020 Response: Previously identified WF 19-173 does not address the concern identified. Adherence to WP 04-CM2005 in documenting components using approved abbreviations and acronyms will be tied to WF 20-159 as discussed in [the Board's review team's] LOI 16. The expected actions will be training and an effectiveness review of the corrective actions.

19. The same completed action—"Verification performed (00:35) of UVS/IVS in lineup 4. REQUIRED ACTION A.2.2 met"—appears in two different records, 170601 and 170441. The CMR staff entered the actions at two different times; i.e., 00:34:52 and 00:36:15, respectively.

    WIPP 2019 Response: There are entries that are not consistent with the requirements of 04-CM2005 and conduct of operations. Facility Operations already has WIPP Form action ACT19-173-2 associated with this topic.

    Review Team Evaluation: WF 19-173 corrective action ACT19-173-2 does not explicitly address the need for attention to detail when making log entries, as indicated by the WIPP response. A corrective action in ACT19-173-2 does, however, require a briefing to CMR personnel on increased management observation. The training on, and implementation of, increased management observation is designed to catch the type of error noted in the LOI, but no evidence was provided to the review team by WIPP in ACT19-173-2 that this action has been completed and documented.

    WIPP 2020 Response: WP 04-CM2005 will be evaluated and revised if necessary to clarify management expectations with regard to updating CMR log entries in the electronic log. (Reference [the Board's review team's] LOI 6.)

ORPS Report

20. Date and time discovered is not correct in the final ORPS report. The date should be December 9, 2018, vice December 11, 2018. The time should be 13:24:30. This is the time the LCO 3.2.3 A was entered as recorded in the CMR electronic log Record 170441.

    WIPP 2019 Response: Agree with observation. The ORPS report was developed from information in the WIPP Management Notification Report (MNR) that identified the time of discovery as 1000 hours on December 11, 2018. When the issue occurred on December 9, 2018, the facility staff did not realize this issue was a reportable occurrence. On December 11, 2018, the FSM was made aware (discovered) this issue was a reportable occurrence. Because the FSM on duty, when the issue occurred on December 9, 2018, did not recognize this as a reportable occurrence a WIPP Form was issued to retrain all FSMs and facility shift engineers on the importance of understanding discovery, two hour categorization times, ORPS reporting groups, and to understand that equipment degradation is still reportable if LCO actions are taken.

    Review Team Evaluation: WIPP indicated it generated a WIPP Form to retrain all FSMs and facility shift engineers on the importance of understanding discovery, two-hour categorization times, ORPS reporting groups, and to understand that equipment degradation is still reportable if LCO actions are taken. The review team requested the subject WIPP Form and received WF 18-856, which did not address any of the issues noted related to ORPS reporting. Either the review team was provided the incorrect WIPP Form or the applicable WIPP Form does not exist. WIPP should also consider modifying the ORPS report to address the errors noted by the review team.

    WIPP 2020 Response: Previously identified WF 18-856 is the incorrect WIPP Form. Upon reviewing the associated occurrence report, EM-CBFO-NWP-WIPP-2018-0013, and searching IMPS [Issues Management Processing System] using 711-AP-451, WF 18-853 was identified as the WIPP Form written for this occurrence. The WIPP Form condition document was identified as found-fixed by the WIPP Form committee and coded as track and trend only with no corrective actions. No WIPP Form has been identified that documents the retraining of FSMs and facility shift engineers on the importance of understanding discovery, two-hour categorization times, ORPS reporting groups, and to understand that equipment degradation is still reportable if LCO actions are taken. A new WIPP Form will be written to document the concern identified and ensure that the corrective actions are sufficient to capture required training and follow up effectiveness assessment(s).

    Notification was also made to the WIPP ORPS coordinator on revising EM-CBFO-NWP-WIPP-2018-0013 to reflect the correct date and time.

21. As identified in the final ORPS report, the time to categorize was greater than the two hour requirement for this low level ORPS. Categorization occurred almost two days after discovery. (The initial notification requirements are for the DOE facility representative

and contractor duty officer to be contacted within two hours of categorization, not discovery. These requirements were apparently met.)

WIPP 2019 Response: This is a correct statement. The degradation of the equipment was not initially recognized as meeting ORPS criteria.

Review Team Evaluation: Although the WIPP response does not identify any corrective actions, WIPP indicated in LOI 20 that it generated a WIPP Form to retrain all FSMs and facility shift engineers on two-hour categorization times, etc. The review team requested the subject WIPP Form and received WF 18-856, which did not address the issue noted related to two-hour categorization times. Either the review team was provided the incorrect WIPP Form or the applicable WIPP Form does not exist.

WIPP 2020 Response: As discussed in [the Board's review team's] LOI 20, an action will be added to document the concern identified and ensure that the corrective actions are sufficient to capture required training and follow up effectiveness assessment(s).

22. The description of occurrence incorrectly stated that the operability of the alarm panel was restored on December 10, 2018. The alarm panel was not tested and verified for operability until December 12, 2018. (Note: If the operability of the alarm panel was restored on December 10, 2018, it would be documented in the log as such. WP 04-CM2005, Step 5.2.3[A], requires repairs to safety significant SSCs be logged. There is no entry in the log that states that testing was completed on December 10, 2018.)

WIPP 2019 Response: Agree with observation. The WIPP MNR stated that on December 10, 2018, the panel was restored to operability by resolving the internal processor issue and that a work package was being created to retest the safety significant equipment. The LCO actions would remain in place until the retest verification was performed. The retest verification was completed on December 12, 2018, and the system was returned to service.

Review Team Evaluation: It is not clear that WIPP agrees that the ORPS report was technically incorrect. WIPP seems to be taking a position that the panel became operable by "resolving the internal processor issue" when this was not confirmed until the testing verified proper operability two days later. WIPP should consider providing refresher training to CMR personnel on when systems become "operable" after maintenance or repair. WIPP should also consider modifying the ORPS report to address the errors noted by the review team.

WIPP 2020 Response: As discussed in [the Board's review team's] LOI 20, an action will be added to document the concern identified and ensure that the corrective actions are sufficient to capture required training and follow up effectiveness assessment(s). Additionally, Operations recently issued a new procedure WP 04-AD3020, on 3/25/2020. Section 5.3 covers LCO exit criteria:

5.3 LCO EXIT

5.3.1 Using Attachment 1, Section 2 - LCO Exit, complete the following:

[A] Document exit actions performed (this would include specific SRs and testing to satisfy the LCO operability statement).

- *Document justification proving LCO operability statement will be met (e.g., fire pump auto start capability returned, SRs complete).*
- *List all applicable SRs or documents used to prove operability.*

[B] Prior to FSMs final signature to exit the LCO, have a peer check completed by another FSM, FOSE, FacOps Management, or Nuclear Safety.

[C] Document Time of Exit.

[D] Sign Attachment 1, Section 2 - LCO Exit, Final Approval.

The new procedure is in line with the understanding that "testing to satisfy the LCO operability statement" is required to exit an LCO.

WO 1815385 – Functional Test of SIAS Panel.

23. Several items from work change notice (WCN) 2 of WO 1616261 (*New Instrument Loop Upgrade*) were not incorporated into the functional test work order. Item 8 of WCN 2 was incorrectly incorporated using a value of -0.09 inWC [inches of water column] vice the required value of -0.06 inWC.

WIPP 2019 Response: The factual response is accurate.

a. WCN 2 (Step 6.6.4) of WO 1616261 had a value between -0.06 inWC and -0.14 inWC. The actual reading was at -0.09 inWC, this value is within the acceptance range.

Review Team Evaluation: The WIPP response (a) addresses the correct range of WO 1616261 instead of the incorrect range of WO 1815358 regardless of the actual reading. The review team does not disagree with WIPP response (a), however, the review team was referring to Step 5.7.5 of WO 1815385.

b. The factual response is correct in stating the value range that is in Step 5.7.4 [*sic;* should have been 5.7.5]* is -0.09 inWC and -0.14 inWC, instead of a range of -0.06 inWC and -0.14 inWC in WCN 02 of WO1616261. (Note: this is a tighter tolerance). * edit by review team.

Review Team Evaluation: The discrepancy in response (b) is that the wrong range was entered on a controlled document. WIPP's identification that the range is tighter in tolerance and the value recorded was satisfactory does not off-set the discrepancy. The range in step 5.7.5 should match range called out in step 5.7.4 table; i.e., -0.06 inWC to -0.14 inWC. The typographical errors did not negatively affect the outcome of the functional test in this case; however, the procedure change verification process may warrant enhancement.

WIPP Response 2020: Procedure writers (planners) do not understand the importance of accurate and workable procedures. Frequent group meetings are held and regularly discuss the importance of procedure compliance and following our PPA [Procedure Professionals Association]-based writer's guide. Work instructions receive peer reviews and formal review/approval from affected organizations (defined in WP 10-WC3011).

In the case of a Type 1 work package involving a safety significant system, it is typical for crafts, quality assurance, safety, engineers, subject matter experts, work control management, nuclear safety, and facility operations to all review and approve before the document is released to work. Human error factors must be considered due to the sheer number of work packages that are developed, reviewed, approved, and worked on site daily.

Work control cannot answer to the cognizant system engineer's (CSE) management of test procedure configuration per WP 09-CN.13.

24. [Original] Step 5.6.4 of WO 1815385 was not corrected as required by WCN 2 **to 1616261** (emphasis added) and would not give indications as described in the step. If the equipment was operating properly, the described response would not be met. Therefore, this step should have been marked UNSAT if the equipment was operating properly or SAT if the equipment was not operating properly.

    [Clarifying Material] Item 7 of WO 1616261, WCN 2, changed test procedure step 6.5.4 to "VERIFY that the trouble alarm lamp (711-YL-0018) and the acknowledge alarms pushbutton lamp (711-YL-001B) **turn on steady**" (emphasis added). In the original test procedure (WO 1616261) used to confirm operability of alarm system after the software reload, this test step incorrectly verifies that "the acknowledge alarms pushbutton lamp (711-YL-001B) **begin to flash**" (emphasis added). Step 6.5.4 of WO 1616261 and step 5.6.4 of WO 1815385 are the same step. WO 1815385 step 5.6.4 did not have the correction (i.e., "turn on steady"). Therefore, the correct verification was not specified by the test step.

    WIPP 2019 Response: *Factual accuracy is correct, the information from Item 7 of WCN2 for Step 6.5.4 of original WO 1616261 was not incorporated into Step 5.6.4 of WO 1815385 therefore the step was not specified correctly. As a result of this error, on August 15, 2019, WO 1926401 was prepared and issued to re-perform the "SIMULATE A FAILED BATTERY" test. Copies of the test and test results were provided to indicate that the system/equipment is operating properly. (*Corrected response based on follow-up clarification request.)

    Review Team Evaluation: Due to review team interactions, the work order was ultimately revised to adequately incorporate WCN-2 and the battery test was successfully completed and documented. There was no indication in the WIPP response, however, that the discrepancy was addressed with procedure writers to understand the importance of accurate and workable procedures, or that controls were instituted to prevent future occurrences.

According to Section 3.4 of WP 09-CN.13, the CSE is responsible to ensure the testing addresses all requirements outlined in the design documents and maintains configuration control of test items. In this case, it appears that the test procedure configuration was not properly managed based on two identified discrepancies (LOI 23 and LOI 24).

WIPP Response 2020: Procedure writers (planners) do not understand the importance of accurate and workable procedures. Frequent group meetings are held and regularly discuss the importance of procedure compliance and following our PPA-based writer's guide. Work instructions receive peer reviews and formal review/approval from affected organizations (defined in WP 10-WC3011).

In the case of a Type 1 work package involving a safety significant system, it is typical for crafts, quality assurance, safety, engineers, subject matter experts, work control management, nuclear safety, and facility operations to all review and approve the document before it is released to work. Human error factors must be considered due to the sheer number of work packages that are developed, reviewed, approved, and worked on site daily.

Work Control cannot answer to the CSE's management of test procedure configuration per WP 09-CN.13.

25. [Original] Given the entry SAT **for step 5.6.4** (emphasis added for clarification) in the existing completed WO **1815385**, the operator incorrectly marked the step SAT or the equipment was actually not functioning properly.

    [Clarifying Material] The test performer marked test step 5.6.4 of WO 1815385, as written, as "SAT" indicating they observed a **flashing** acknowledge alarms pushbutton lamp, contrary to WCN 2 of 1616261. There are two possible explanations for this as described in the fact-finding comment. The operator **incorrectly marked** the step as "SAT" or the equipment **was not operating properly.**

    WIPP 2019 Response: *Factual accuracy is correct, test performer incorrectly marked the step as SAT on WO 1815385. As a result of this error, on August 15, 2019, WO 1926401 was prepared and issued to re-perform the "SIMULATE A FAILED BATTERY" test. Copies of the test and test results were provided to indicate that the system/equipment is operating properly. (*Corrected response based on follow-up clarification request.)

    Review Team Evaluation: The revised work order was adequate, and the retest of the battery test was successfully completed and documented. There was no indication in the WIPP response, however, that the operators who incorrectly marked the step SAT were retrained on the importance of verbatim procedure compliance and stopping work if the procedure cannot be executed as written. This may be indicative of either a lack of operator training or procedural compliance.

WIPP Response 2020: End users (operators or crafts) have input into the development of work instructions and the goal of their review is to ensure they fully understand what they are being asked to perform.

Work Control will have to default to Maintenance on whether operators were retrained on the importance of verbatim procedure compliance (again, it is emphasized in work control meetings) and stopping work if the procedure cannot be executed as written.

WIPP CSE Assignment Lists w/CBFO Safety System Oversight (SSO)

26. Revision 62 of system assignment list, dated September 21, 2018, indicates that the CSE for the SIAS (system CM06) is not qualified, but in training. No alternate CSE for SIAS is assigned during this same period of time.

    WIPP 2019 Response: That is correct. Response 26 is less than adequate as it should address how the engineering training process requires the trainee's work to be reviewed by the CSE manager for the SIAS.

    Review Team Evaluation: The review team agrees that WIPP's response is less than adequate. According to the DOE-approved WIPP Training Implementation Matrix (TIM), the systems engineering job positions of CSE and alternate CSE are "qualified" positions (that is, positions for which a formal qualification process must be completed in order to perform the functions of the position). The fact that the CSE had not completed the qualification process at the time of the event is contrary to the WIPP TIM. This also highlights the importance of having a qualified alternate CSE in the event the primary CSE is unavailable.

    The review team is aware of the relatively high turnover rate for this CSE position, and notes that revision 65 (December 2019) of the system assignment list shows both the CSE and alternate CSE are in training.

    [WIPP 2020 Response not provided for LOI 26.]

27. Revision 62 of the system assignment list does not identify a CBFO SSO but rather identifies the position as TBD. Revision 63 of the system assignment list, dated March 11, 2019, lists "J. Carrasco w/SME" as the CBFO SSO with a note directing contact with CBFO federal director for assigned person. It is unclear as to whom is the qualified/assigned SSO for SIAS.

    WIPP 2019 Response: The annotation on the system assignment list was provided by CBFO and included to support coordination. CBFO has provided J. Carrasco as the SSO and the CBFO federal director will provide the assigned SME [subject matter expert] name.

    Review Team Evaluation: Revision 65 of the CSE assignment list notes that an SSO is assigned. Based on the footnote, this requires the CBFO Facility Engineering Division

Director be contacted for the associated subject matter expert. The review team questions the protocol to have an SSO who appears to be unqualified on the SIAS act as the SSO with the support of an unspecified subject matter expert. The procedure defining this arrangement, if extant, was not provided to the review team for review in support of the WIPP response.

[WIPP 2020 Response not provided for LOI 27.]

References

[1] Nuclear Waste Partnership, LLC, *Logkeeping Practices*, WIPP Form 19-173, February 2019.

[2] American Society of Mechanical Engineers, *ASME Nuclear Quality Assurance (NQA-1)*, 1989.

[3] Nuclear Waste Partnership, LLC, *CMR Electronic Log Records*, December 8-13, 2018.

[4] Department of Energy, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, DOE Guide 424.1-1B, Chg. 2, June 2013.

[5] Department of Energy, *Occurrence Reporting and Processing of Operations Information*, DOE Order 232.2A, Chg. 1, January 2017.

[6] Department of Energy, *Conduct of Operations,* DOE Order 422.1, Change 1, October 2019.

[7] Waste Isolation Pilot Plant, *Equipment Degradation: Safety Significant Support System - 308 Bulkhead Alarm Panel*, ORPS EM-CBFO-NWP-WIPP-2018-0013, December 19, 2019.

[8] RJR Engineering, P.C., *Software Quality Assurance Plan (Project Title: Safety-Significant Instrument Loops)*, REP-15017-013, March 2016.

[9] Waste Isolation Pilot Plant, *WIPP Technical Safety Requirements*, DOE/WIPP 07-3373, Rev. 5b, April 2016.

[10] Nuclear Waste Partnership, LLC, *Fact-Finding for ORPS Occurrences*, Timely Order No.19:005, February 6, 2019.

[11] Nuclear Waste Partnership, LLC, *WIPP Cognizant System Engineer (CSE) Assignment Lists w/CBFO Safety System Oversight (SSO)*, Revision 62, September 2018.

[12] Nuclear Waste Partnership, LLC, *WIPP Cognizant System Engineer (CSE) Assignment Lists w/CBFO Safety System Oversight (SSO)*, Revision 63, March 2019.

[13] Nuclear Waste Partnership, LLC, *WIPP Cognizant System Engineer (CSE) Assignment Lists w/CBFO Safety System Oversight (SSO)*, Revision 65, December 2019.

[14] Nuclear Waste Partnership, LLC, *Alarm Response to Bulkhead 308 High dP Alarm*, WIPP Form 18-856, December 2018.

[15] Nuclear Waste Partnership, LLC, *Apparent Causal Analysis Report, Safety Instrumented Alarm System Software Reloading Investigation*, WIPP Form 19-281, March 2019.

[16] Washington TRU Solutions, *WIPP Training Implementation Matrix*, Revision 8, March 2007.

[17] Nuclear Waste Partnership, LLC, *Work Change Notice (WCN) 2 of WO 1616261 (New Instrument Loop Upgrade),* Work Change Notice (WCN) 2 of WO 1616261, April 2016.

[18] Nuclear Waste Partnership, LLC, *Provide 120VAC Power to Annunciator Panel 711-AP-451*, Work Order 1616261, March 2016.

[19] Nuclear Waste Partnership, LLC, *Testing of Safety Instrumented Alarm System 711-AP-451 Panel*, Work Order 1815385, December 2018.

[20] Nuclear Waste Partnership, LLC, *Reperform Failed Battery Test on 711-AP-451 SIAS Panel in CMR*, Work Order 1926401, August 2019.

[21] Nuclear Waste Partnership, LLC, *Entry and Exit of Limiting Conditions of Operations*, WP 04-AD3020, March 2020.

[22] Nuclear Waste Partnership, LLC, *Central Monitoring Room Electronic Logkeeping,* WP 04-CM2005, Revision 3, May 2018.

[23] Nuclear Waste Partnership, LLC, *Conduct of Operations – Communications,* WP 04-CO.01-4, Revision 6, April 2019.

[24] Nuclear Waste Partnership, LLC, *Conduct of Operations Program–Investigation of Abnormal Events, Conditions and Trends,* WP 04-CO.01-6, Revision 7, January 2019.

[25] Nuclear Waste Partnership, LLC, *Conduct of Operations Program–Logkeeping,* WP 04-CO.01-11, Revision 6, May 2018.

[26] Nuclear Waste Partnership, LLC, *Safety Instrumented Alarm System Software Quality Assurance Plan,* WP 09-CN.13, Revision 0, May 2019.

[27] Nuclear Waste Partnership, LLC, *Work Control Process,* WP 10-WC3011, Revision 42, November 2019.

[28] Nuclear Waste Partnership, LLC, *Fact-Findings and Critiques*, WP 15-CA1007, Revision 1, August 2016.

[29] Nuclear Waste Partnership, LLC, *Reporting Occurrences in Accordance with DOE O 232.2A,* WP 15-CA1010, Revision 30-FR1, May 2017.

[30] Nuclear Waste Partnership, LLC, *Event Investigation,* WP 15-MD3102, Revision 10-FR1, March 2017.

[31] Nuclear Waste Partnership, LLC, *Software Screening and Control*, WP 16-2, Revision 16, May 2017.