DEFENSE NUCLEAR FACILITIES SAFETY BOARD
Washington, DC 20004-2901

August 6, 2020

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

Dear Secretary Brouillette:

The Defense Nuclear Facilities Safety Board has been monitoring the progress of upgrades to the high pressure fire loop at the Pantex Plant, including construction of replacement main water lines and lead-in lines to nuclear explosive bays and cells. Recently, we reviewed quality assurance measures applied to the lead-in replacement at the 12-96 nuclear explosive cell; our staff had observed deficiencies in similar work that the Pantex contractor had performed in the 12-98 cells in 2016. Our most recent review found that the Pantex contractor has improved quality assurance measures for this work but has not fully corrected deficiencies related to the identification and control of safety basis and construction quality assurance requirements.

The enclosed report provides more detail on this matter. Pursuant to 42 USC §2286b(d), the Board requests a report within 90 days outlining how NNSA plans to ensure that construction projects at Pantex's nuclear facilities correctly identify safety basis controls and invoke quality assurance requirements commensurate with a project's importance to safety.

Yours truly,

Bruce Hamilton
Chairman

c: Ms. Lisa E. Gordon-Hagerty
Mr. Joe Olencz

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Report

May 22, 2020

Quality Assurance of Structural Repairs Associated with High Pressure Fire Loop Lead-in Replacement at Pantex Plant Nuclear Explosive Cells

Summary. Members of the Defense Nuclear Facilities Safety Board's (Board) staff reviewed structural repair activities at the Pantex Plant 12-96 nuclear explosive cell as part of the high-pressure fire loop (HPFL) lead-in replacement project. The staff conducted this follow-up review to determine how effectively the Pantex management and operating contractor, Consolidated Nuclear Security, LLC (CNS), implemented lessons learned from previous HPFL lead-in replacement construction at 12-98 Cells 2 and 4.

For repair of the 12-98 cells in 2016, CNS misidentified the portion of the structure being repaired as non-safety related, did not maintain adequate quality control of procured materials, and allowed a project subcontractor to place concrete of insufficient strength and quality. This substandard construction had the potential to prevent the structure from being able to perform its safety-class function. As a direct result of the Board's staff's review, the faulty repair was identified, demolished, and re-repaired with appropriate quality assurance measures. The Department of Energy (DOE) operating experience program issued a lessons learned [1] (see Appendix A) in December 2016 in response to that event.

The Board's staff observed a marked improvement in quality assurance measures applied to reinforced concrete construction on the 12-96 project when compared to the original 12-98 HPFL lead-in replacement. Nonetheless, the Board's staff has reviewed the implementation of lessons learned from the 12-98 project as applied to the 12-96 project and determined that the control of safety basis and nuclear quality assurance requirements on construction projects requires further improvement.

In response to the issues identified during the 12-98 cell repairs, CNS created a new process to develop a system requirements document (SRD) to formally identify and control system requirements on construction projects. However, CNS did not apply the SRD process to the recent 12-96 repair, and several key project documents again failed to identify the cell structure as safety class.

The Board's staff also reviewed the application of the SRD process to other recent construction activities associated with safety-class systems and determined that CNS failed to identify the safety designation for the majority of those systems. This is in part due to the SRD process description and template, which do not explicitly require identifying safety designations. As a result, the Board's staff concluded that the currently implemented SRD process for construction projects has not resolved previously identified deficiencies associated with control of safety-related requirements.

Background (12-98 Faulty Repair). The Pantex cell structures are credited safety-class features designed to withstand Performance Category (PC)-3 natural phenomena hazard events,[1] mitigate the release of nuclear material after an accidental high explosive reaction, and provide Faraday cage protection for nuclear explosives during a lightning strike. The cell structure is a reinforced concrete shear wall building consisting of a personnel corridor, an equipment airlock, a main corridor, a mechanical room (in some designs), equipment and material staging rooms, and the assembly/disassembly "round" room. The assembly/disassembly room is covered by a gravel mound supported by catenary cables and wire mesh. The gravel mound and round room configuration is commonly referred to as a "Gravel Gertie." In addition, both the personnel corridor and equipment airlock have pairs of blast doors. To prevent the release of material outside the cell facility following an accidental high explosive reaction, the building structure and blast doors are designed to withstand blast pressure and the gravel mound is designed to vent overpressure and filter nuclear material.

In 2015, CNS fire system engineers suspected the existence of, but could not locate, a leak in the site HPFL system. On August 13, 2015, a CNS facility representative discovered water on the floor in a 12-98 cell [2]. CNS determined that the water came from a leak in the HPFL lead-in line and that both 12-98 Cells 2 and 4 were affected. To access the piping, CNS created moderately sized (five foot by five foot) holes in the floors of the inert parts staging rooms adjacent to the cell round rooms. After installing new HPFL lead-in lines, CNS mechanically spliced the reinforcing steel for the replacement floor slab to the in-place reinforcing steel in February 2016 and placed concrete over the rebar in March 2016.

The week after CNS placed the concrete for the 12-98 repairs, the Board's staff performed a structural infrastructure review at Pantex [3]. The review coincided with the annual structural in-service inspection of the 12-98 cells. During observation of the in-service inspections, the Board's staff asked questions about the 12-98 floor repairs and learned that CNS personnel had not applied nuclear quality assurance practices. CNS did not consider the floor of the inert parts staging room to be part of the safety-class structure credited for structural integrity. The CNS personnel involved did recognize that the rebar in this room's floor slab performed a safety-class function to provide Faraday cage protection from a lightning strike, and, as such, had confirmed that adequate conductivity existed across the rebar splices.

The Board's staff observed that the floor slab was integral to the safety-class function to maintain structural integrity in the event of an accidental high explosive reaction in the cell. As a result, CNS decided to validate the strength of the repair via concrete core testing [4]. CNS personnel drilled concrete cores from the repaired floors and tested their compressive strength. All of the tested cores failed to meet minimum design strengths, with the average tested strengths only 70 percent of the required minimum strength [5]. As a result, CNS declared the repair faulty, submitted a formal report in the DOE occurrence reporting system [6], and decided to remove the repair.

---

[1] Performance categories are assigned for existing facilities based on potential consequences from an unmitigated accident, in accordance with DOE-STD-1021-1993, *NPH Performance Categories Guidelines for Structures, Systems, and Components*. Performance categories are assigned based on the least severe (PC-1) to the most severe (PC-4) unmitigated accident consequences. PC-3 is the highest designation assigned to DOE non-reactor facilities.

CNS conducted a critique to determine what events led to the installation of the faulty repair [7]. It concluded that failures had occurred within multiple organizations and that the structural repair plans should have been vetted through the Pantex design change process, which would have included a review by safety analysts. CNS found that, following an acceleration of the project schedule and changes to the splice technique used in the project, the CNS design engineering group requested that the facility engineering group—not safety analysis personnel—determine whether the cell floor was designated as safety class. A facility engineering staff member informally responded that the floor in the inert parts staging room was not credited as safety class for its structural integrity. This informal determination outside an established design change process led CNS to wrongfully categorize the repair and conduct it without required nuclear quality assurance practices.

CNS management concluded, as the Board's staff had, that the repaired slab should have been treated as part of the safety-class structure and that nuclear quality assurance practices should have been applied. In addition, the critique revealed that the design engineering group changed the concrete mix specification to allow using rapid set concrete material. Rapid set concrete, especially when produced in small batches, was inappropriate for the size of the repair and contributed to the low concrete compressive strength results. In addition, designating the repair as non-safety related allowed CNS to procure materials not compliant with American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-1 [8] requirements.

The Board's staff closely followed the corrective repair activities, which included a review of commercial grade dedication (CGD) documentation and field observations of the demolition and subsequent repair. CNS completed the re-repair in January 2017 [9]. The staff concluded that CNS applied adequate quality assurance measures for the re-repair and had restored the structural integrity of the cell structure.

To address the root cause of the 12-98 structural repair issues, CNS issued a set of internal standing orders [10 – 13]. The standing orders identify corrective actions to properly identify and track safety-related requirements for new and modified structures, systems, and components (SSCs). The standing orders also emphasize the importance of proper work planning to ensure that appropriate personnel, such as system owners and safety analysts, are involved in identifying safety-related functional requirements for SSCs. In addition, these issues were documented as a lessons learned [1] under the DOE operating experience program which noted:

> *The engineers reviewed safety basis documentation, but did not recognize the safety function of the floor in this specific area. The changed designation was informally communicated to the project team. The change in the design was not formally reviewed because the changed designation reduced requirements….[C]hanges in designs of safety systems must be recognized and formally reviewed to include Authorization Basis and the Unreviewed Safety Question review process. Formal reviews are necessary even when those changes are initiated from reduced requirements.*

The Board's staff decided to evaluate implementation of these lessons learned on the next cell lead-in replacement project. Unlike bay structures, cell structures (with the exception of the 12-44 cells) require more invasive structural demolition and repair activities to replace the HPFL lead-in line. The next cell structure slated for lead-in repair was the 12-96 cell.

12-96 Construction. From 2019 through early 2020, CNS conducted HPFL lead-in replacement activities at the 12-96 nuclear explosive cell. This was the third cell at Pantex to have its HPFL lead-in line replaced; the first two were 12-98 Cells 2 and 4 as discussed above. Unlike a 12-98 cell, which has one common lead-in riser for both the facility wet pipe and deluge fire suppression systems, the 12-96 cell has separate lead-ins for each. This required CNS to create two holes in the cell floor for HPFL lead-in line replacement. The holes were necessary to access newly placed, directionally drilled high-density polyethylene pipes that branch off from the main HPFL water supply network.

The Board's staff reviewed design documentation, project specifications, and construction quality assurance records associated with the 12-96 lead-in replacement and observed floor demolition and repair at various stages. In addition, the Board's staff conducted an on-site review of concrete construction quality assurance for this project during the week of January 13, 2020, and discussed lines of inquiry with National Nuclear Security Administration Production Office and CNS personnel. The objective of the Board's staff review was to evaluate implementation of corrective actions from 12-98 HPFL lead-in replacement.

The Board's staff observed a marked improvement in quality assurance for reinforced concrete construction at Pantex compared to the original 12-98 HPFL lead-in replacement. Many of these improvements were corrective actions identified during the 12-98 re-repair. However, the staff found that deficiencies related to safety-related control identification and CGD persist. These deficiencies, along with a few staff observations, are discussed below.

Safety-Class Control Identification—In response to the misidentification of the 12-98 repairs as non-safety related, CNS created the new SRD process to formally identify, review, and approve safety-related requirements early in project execution. However, CNS did not apply the new SRD process for the 12-96 lead-in replacement, even though the initial project statement of work [14] was issued 15 months after the standing order requiring the SRD process [11]. Several key project documents for the 12-96 lead-in replacement failed to identify the facility structure as safety class, including:

- Division 01400, *Quality Assurance Requirements for Construction Projects*, 1.5(B), of the master technical specifications [15] formally identifies safety-related SSCs for the project. The facility structure is not appropriately identified as a safety-class SSC despite the fact that this list undergoes safety analysis engineering (SAE) review.

- The Functional and Operational Requirements (F&OR) document [16] did not identify the structure in the list of safety-class and important-to-safety SSCs.

- The initial and updated project statements of work [14, 17] recognize safety-class SSCs will be affected by this project, but do not specify which ones.

- The quality assurance plan [18] identifies safety-related controls affected by the project, except the facility structure.

- While the floor repair CGD plan [19] appropriately invokes ASME NQA-1 [8] and specifies performance requirements of the rebar, rebar splices, and concrete, the plan does not mention the safety-class designation of the facility structure.

Later in this report, the implementation of the SRD process on other construction projects at Pantex is discussed. The Board's staff identified several additional examples of projects where CNS used the SRD process yet failed to identify safety-related controls affected by construction activities.

Commercial Grade Dedication—The Board's staff reviewed quality assurance records associated with the reinforced concrete repair of the 12-96 structural floor slab. CNS procured reinforcing steel from an NQA-1 vendor but acquired mechanical rebar splices and concrete commercially from local suppliers. CNS purchases rebar splices "off-the-shelf" [2] from a local distributor. A subcontractor batches concrete at the on-site batch plant. The 12-96 floor repair CGD plan identified critical characteristics to which these construction materials are dedicated.

The Board's staff notes that the CGD plan inadequately identifies material critical characteristics required of rebar splices and concrete material. Although the CGD plan identifies mechanical strength and electrical resistivity as critical characteristics, CNS should also require specific material characteristics for the reinforced concrete constituents. This would better assure that the repaired structural slab would be able to perform and maintain its safety-critical function.

CNS acquired rebar splices for the 12-96 concrete construction from a local distributor without certified material test reports, heat lot records, or other evidence of traceability back to the manufacturer. These documents broadly ensure that the manufacturer fabricated the splices according to CNS requirements and therefore they are appropriate for installation in a nuclear facility. The rebar splices procured did not have unique identifiers such as serial numbers or heat lot markings that would normally be required in a construction CGD plan. Instead, CNS relied on non-unique manufacturer markings—such as product part numbers commonly applied to all splices of the same size—to establish traceability to the manufacturer. The only inspection activity that the CGD plan identifies is to "[v]erify submittal from the mechanical splices matches their respective purchase order and packing slip."

The importance of establishing that commercial grade items can be traced to the manufacturer is discussed in DOE-HDBK-1230-2019, *Commercial Grade Dedication Application Handbook* [20], which states:

> *When determining the homogeneity of a lot being sampled, objective evidence of the supplier's ability to provide acceptable items through its manufacturing*

---

[2] In this context, "off-the-shelf" refers to items purchased commercially with no assurance that the items come from the same manufacturing heat lot. Generally, items procured via this pathway require additional testing to assure that they meet CNS requirements.

> *product controls is a key factor. It is important to recognize that heat number, manufacturer lot number or other manufacturing identification intended to demonstrate traceability to common production cannot be used unless the traceability can be verified back to the source of manufacture. Groups of components or commodities obtained through a distribution chain without traceability control established through [quality assurance] audit or commercial survey cannot be considered homogenous.*

Product traceability would provide assurance that splices acquired by the distributor were from a sole source manufacturer and do not contain suspect/counterfeit items. Records that CNS provided to the Board's staff only provided traceability of splices from CNS to the distributor, not the manufacturer. Validating that the splices are from a sole source manufacturer would justify CNS's use of the CGD testing sampling plan selected based on guidance in Electric Power Research Institute (EPRI) TR-017218-R1, *Guideline for Sampling in the Commercial-Grade Item Acceptance Process* [21]. The sampling plan CNS selected for the acquired splices assumes a line item/single product manufacturer lot with traceability back to the manufacturer, which CNS was not able to determine.

The Board's staff also identified deficiencies in the CGD plan for batched concrete. Although both strength and durability are important performance properties of concrete, the CGD plan only identifies strength requirements. Specifying material critical characteristics for concrete constituents (aggregates, admixtures, and water) during dedication would better assure adequate strength and durability. CNS provided documented evidence that aggregate and admixtures procured complied with relevant American Society for Testing and Materials (ASTM) requirements; however, the CGD plan did not specify that this be verified. Inclusion of ASTM requirements for concrete constituents within the CGD plan would ensure that CNS procures materials with verified properties. Lastly, the CGD plan does not address material storage requirements that could impact concrete quality. For example, certain admixtures have temperature storage requirements that should be specified in the CGD plan to preserve their properties and prevent damage.

The Board's staff found that the subcontractor that operates the on-site batch plant does not measure and record the temperature of a freeze-vulnerable admixture to verify it conforms to the manufacturer's material storage requirements. Since neither CNS nor the batch plant subcontractor monitors temperature, they cannot ensure that cold temperatures have not damaged admixtures, potentially resulting in inadequate concrete durability.

Additional Staff Observations—In addition to the concerns noted above, the Board's staff has the following observations from the 12-96 HPFL lead-in concrete construction review.

- The Board's staff reviewed several documents related to quality assurance of the on-site batch plant and walked down that facility. CNS's and Golden Spread's (the local concrete supplier for CNS in Amarillo) pursuit of National Ready Mixed Concrete Association accreditation for the on-site batch plant is a beneficial effort toward ensuring concrete quality.

- As was done on the 12-98 HPFL lead-in replacement project, the 12-96 project also uses Type 1 mechanical rebar splices, which are not allowed for use in a nuclear facility. American Concrete Institute (ACI) 349-13, *Code Requirements for Nuclear Safety-Related Concrete Structures* [22], states:

  > *In a structure undergoing inelastic deformations during an earthquake, the tensile stresses in reinforcement may approach the tensile strength of the reinforcement. The ACI 349-13 requirements for mechanical splices are intended to avoid a splice failure when the reinforcement is subjected to high stress levels in beyond-design-basis earthquake shaking. The Type 1 splices of ACI 318-08 are not permitted in nuclear safety-related reinforced concrete structures.* [emphasis added]

  For 12-98 HPFL lead-in replacement, CNS informally justified the use of Type 1 splices due to space limitations (Type 2 splices require a longer splice and rebar overlap length) and because repairs were being done in locations of lower seismic demands. According to the 12-96 splice test reports, CNS demonstrated that the splices met Type 2 testing requirements. However, CNS should formally document the justification for the continued use of Type 1 splices with respect to the ACI 349-13 language.

- CNS took several positive actions to correct issues encountered during the 12-96 HPFL lead-in replacement project. CNS properly determined that a batch of concrete did not meet the mix design for the project, discarded that batch, and obtained a correct mix. CNS appropriately identified, analyzed, and repaired an accidentally damaged grade beam below the cell floor. However, CNS could improve its work planning prior to demolition to avoid unnecessary structural damage on future construction work.

Overall, the Board's staff concludes that CNS implemented adequate quality assurance measures for the 12-96 repair and that it has preserved the structural integrity of the cell. However, the observations noted above provide opportunities to improve quality on future safety-related concrete construction work.

SRD Process Implementation. CNS created the SRD process to ensure that systems requirements, including those that are safety related, are properly identified and reviewed early in a project. This formal control of requirements can help ensure subsequent design and construction activities are conducted with the appropriate level of quality and rigor. CNS has indicated that the F&OR is an initial communications tool for requirements on a project and that the SRD is a flow-down document from the F&OR.

To understand how CNS implements the SRD process on other construction projects at Pantex, the Board's staff reviewed a sample of SRD documents [23 – 29] from recent projects affecting or interfacing with safety-class systems. Only the two oldest SRDs reviewed (i.e., the 12-44 Equipment Room Re-Configuration Project and the 12-84 Bay 16 Electrostatic Discharge Flooring Replacement Project) appropriately identify the safety-related SSCs affected by construction activities. In addition, only one SRD invokes ASME NQA-1 for quality assurance. When reviewing the work order for welding on recent 12-117 seismic upgrades [30], the Board's staff noted that the building structure is incorrectly designated as safety significant; CNS acknowledged this resulted from the SRD [24] not explicitly identifying the loading dock structure as a credited safety-class control.

The format and content of the SRDs vary significantly, particularly among different technical disciplines. This can partly be attributed to the fact that the SRD process is relatively new. However, the Board's staff believes that the lack of detail in the SRD template [31] regarding what specific requirements must be documented (e.g., safety-related designations for affected systems) contributes to this variability. The SRD lacks a well-communicated purpose within CNS project planning, and the template does not provide adequate guidance for the SRD to fulfill its intended purpose described below.

The *Pantex Projects Engineering Department Manual*, MNL-352199 [32], discusses the purpose of the SRD and identifies what personnel should be involved in its development and review:

> *The primary vehicle for identifying and controlling system requirements for a project is the SRD….It is important to anticipate; even at the earliest stages of a project, the potential for new safety class or safety significant controls as part of the project. Safety structures, systems, or components require forethought on strategy and functions. As a result, early interaction of appropriate design and safety functions is needed to formulate safety strategy. To ensure appropriate interaction, team members should include safety analysts (e.g., SE [system engineer]/Safety Analysis Engineering (SAE), Nuclear Explosive Surety (NES), and fire hazards analysis personnel) where the potential for safety basis-related requirements exist.*

While system, facility, and project engineers reviewed and approved all of the SRD documents evaluated by the Board's staff, none of the documents included approval by a safety analyst from the SAE department. The Pantex projects engineering manual further requires: "[f]or nuclear facilities or projects/tasks within nuclear facilities, obtain a signature of the assigned SAE engineer or obtain an e-mail from the SAE engineer that their signature is not required." From this language, it is not clear to what level of detail SAE is required to review an SRD and what specific aspects of the document SAE is validating. CNS failed to identify the facility floor slab as part of the safety-class structure in the 12-98 HPFL lead-in replacement project because system and facility engineers did not clearly understand the system boundaries credited to mitigate the consequences of a high explosive accident; this might have been avoided by including a safety analyst from SAE in the review. Requiring SAE approval of the SRD, particularly for work affecting nuclear facilities, would provide added assurance that CNS properly identifies safety-related designations early in construction projects.

Based on the Board's staff review, the SRD process as implemented does not correct the causes of—nor does it address the main lessons learned from—the 12-98 faulty concrete repairs. The staff found continued deficiencies in the identification of safety-related requirements for the projects reviewed. In addition, the distinction between the SRD and F&OR documents is not clear, and neither the F&OR nor the SRD are required to undergo safety-related change control. Requiring safety-related change control of the SRD and/or F&OR could provide added assurance that credited functions and boundaries of a system are understood and properly flowed into project specifications, design documents, and construction work orders.

Conclusion. The Board's staff believes that Pantex can improve and formalize the process for controlling safety basis and nuclear quality assurance requirements on construction projects. CNS created the SRD process to ensure that systems requirements are properly identified and reviewed early in a project. Requiring the SRD to explicitly identify safety-related controls affected by a construction project will help ensure safety-related requirements are not overlooked or misidentified. In addition, a more detailed SRD template will help result in a more uniform and consistent application across different technical disciplines. Lastly, a review of the SRD by safety analysts, particularly for projects affecting nuclear facilities, would help ensure safety basis requirements and system boundaries are properly identified and controlled. The Board's staff has also identified opportunities for improvement related to CGD, particularly related to the identification of material critical characteristics. Implementation of these improvements would ensure that CNS procures materials with verified properties.

References

[1] Department of Energy, *Design changes must be formally reviewed, even when the change is from reduced requirements*, Lessons Learned Entry: PMLL-2016-PTX-OTH-10857, December 1, 2016.

[2] Defense Nuclear Facilities Safety Board, *Pantex Plant Activity Report for Week Ending August 14, 2015*.

[3] Defense Nuclear Facilities Safety Board, *Pantex Plant Activity Report for Week Ending March 11, 2016*.

[4] Defense Nuclear Facilities Safety Board, *Pantex Plant Activity Report for Week Ending May 13, 2016*.

[5] Defense Nuclear Facilities Safety Board, *Pantex Plant Activity Report for Week Ending May 27, 2016*.

[6] Department of Energy, *Zone 12 South Facility return to work identified concrete quality problem,* ORPS Report: NA--NPO-CNS-PANTEX-2016-0030, June 2, 2016.

[7] Defense Nuclear Facilities Safety Board, *Pantex Plant Activity Report for Week Ending June 3, 2016*.

[8] American Society of Mechanical Engineers, *Quality Assurance Requirement for Nuclear Facility Applications*, NQA-1a-2009, August 31, 2009.

[9] Defense Nuclear Facilities Safety Board, *Pantex Plant Activity Report for Week Ending January 13, 2017*.

[10] Consolidated Nuclear Security, LLC, *Standing Order: Planning Engineering Work at the Pantex Site*, SO-ENG-16-016, December 2016.

[11] Consolidated Nuclear Security, LLC, *Standing Order: Identification and Control of Systems Requirements*, SO-ENG-16-017, Rev. 1, December 2016.

[12] Consolidated Nuclear Security, LLC, *Standing Order: Construction Project Reviews for Safety Class/Safety Significant Systems*, ENG-16-021, Rev. 1, September 2016 (Original Issue Date).

[13] Consolidated Nuclear Security, LLC, *Standing Order: Project Management, Project Managers/Operations Manager document development and Mission Engineering interface criteria*, PROJ-17-001, Rev. 1, January 2017.

[14] Consolidated Nuclear Security, LLC, *Statement of Work for HPFL Lead-In Replacement Building 12-096*, Revision 0, March 7, 2018.

[15] Consolidated Nuclear Security, LLC, *Master Specifications for 12-096 HPFL Lead-in Replacement – Quality Assurance Requirements for Construction Projects*, DIV-01400, March 2018.

[16] Consolidated Nuclear Security, LLC, *Functions and Operational Requirements for HPFL Lead-in Replacement – Building 12-096*, March 20, 2018.

[17] Consolidated Nuclear Security, LLC, *Statement of Work for HPFL Lead-In Replacement Building 12-096*, Revision 1, August 8, 2018.

[18] Missouri Valley, Inc., *Project Specific Quality Assurance Plan: 12-96 HPFL Lead-in Replacement*, Rev. 2, January 2019.

[19] Consolidated Nuclear Security, LLC, *Commercial-Grade Dedication Plan for External Contractor Activities – HPFL Lead-in Floor Repair*, CGD-18-061, Issue 2, September 25, 2019.

[20] Department of Energy, *Commercial Grade Dedication Application Handbook,* DOE-HDBK-1230-2019, July 2019.

[21] Electric Power Research Institute, Inc., *Guideline for Sampling in the Commercial-Grade Item Acceptance Process*, EPRI TR-017218-R1, January 1999.

[22] American Concrete Institute, *Code Requirements for Nuclear Safety-Related Concrete Structures*, ACI 349-13, August 2013.

[23] Consolidated Nuclear Security, LLC, *System Requirements Document for 12-44 Equipment Room Re-Configuration Project*, February 2018

[24] Consolidated Nuclear Security, LLC, *System Requirements Document for 12-84 Bay 16 Electrostatic Discharge Flooring Replacement Project*, November 2018.

[25] Consolidated Nuclear Security, LLC, *System Requirements Document for 12-117 Loading Dock Seismic Upgrades*, February 2019.

[26] Consolidated Nuclear Security, LLC, *System Requirements Document for Ramp and Corridor Appurtenance Seismic Upgrades*, April 2019.

[27] Consolidated Nuclear Security, LLC, *(U) System Requirements Document for Building 12-104, Bay 7 Product of Inertia Conduit Upgrade*, Revision 2, May 2019.

[28] Consolidated Nuclear Security, LLC, *System Requirements Document for* Ramp and Corridor Bracing Seismic Upgrades, June 2019.

[29] Consolidated Nuclear Security, LLC, *System Requirements Document for 12-98 Cell 4 Hoist Installation*, August 2019.

[30] Consolidated Nuclear Security, LLC, *Weld Inspection Record – Zone 12 Ramp Seismic Upgrade Loading Dock 12-117 Bracing*, WIR 0331-19/WO 0020019201, July 2019.

[31] Consolidated Nuclear Security, LLC, *System Requirements Document Template*, Version H, July 25, 2019.

[32] Consolidated Nuclear Security, LLC, *Pantex Projects Engineering Department Manual,* MNL-352199, Issue 9, January 2020.

APPENDIX A

Department of Energy Lessons Learned Entry: PMLL-2016-PTX-OTH-10857 [1]

Title: *Design changes must be formally reviewed, even when the change is from reduced requirements*

Date: December 1, 2016

Statement: Changes in design of safety class systems must be formally reviewed in order to ensure that the system meets safety basis requirements. Formal change control is required on all projects after initial designs have been reviewed and approved.
Discussion: During a project to replace fire system piping, 5-foot by 5-foot sections of a concrete floor were removed to allow access to connect the new piping to facility fire risers. The area of the floor removal was in an inert part staging room. There was discussion of the designation of the floor in this area during the design as to its designation as safety class or non-safety class. The Project Engineer and Facility Engineer conservatively specified the floor as safety class in the design. During execution, questions remained as to the structural function of the floor in this area. After further review of documentation, the floor was wrongly determined to be a non-safety class structure, however, the change was not formally submitted or reviewed as a change to the design. This prevented an opportunity for a formal design change review to catch the error in the designation of the floor. With the changed designation, the replacement of the floor patch commenced as a non-safety class installation. Deviations from the original design were processed through the Request for Information (RFI) process. After the floor patches were installed, questions emerged as to how the patch had been performed. It was later determined that the floor was safety class and the patch should have been installed per safety class standards.
Analysis: The incorrect designation of the floor as non-safety class was made by engineering. The engineers reviewed safety basis documentation, but did not recognize the safety function of the floor in this specific area. The changed designation was informally communicated to the project team. The change in the design was not formally reviewed because the changed designation reduced requirements. The Project Engineer did not follow departmental procedures to submit this change through formal design change control.
Recommended Actions: Project Engineers, Project Managers and Facility Engineers must recognize changes in designs. Specifically, changes in designs of safety systems must be recognized and formally reviewed to include Authorization Basis and the Unreviewed Safety Question review process. Formal reviews are necessary even when those changes are initiated from reduced requirements.