Office of Enterprise Assessments
Review of Waste Isolation Pilot Plant
Engineering and Procurement Processes

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Office of Nuclear Safety and Environmental Assessments
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Table of Contents

ACRONYMS

acfm	Actual Cubic Feet per Minute
ACGLF	Adjustable Center of Gravity Lift Fixture
AR/VR	Approval Request/Variance Request
ASME	American Society of Mechanical Engineers
CAM	Continuous Air Monitor
CBFO	Carlsbad Field Office
CE	Cognizant Engineer
Cfm	Cubic Feet per Minute
CFR	Code of Federal Regulations
CH	Contact Handled
CHAMPS	Computerized History and Maintenance Planning System
CM	Configuration Management
CRAD	Criteria, Review and Approach Document
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
ECO	Engineering Change Order
EDMS	Electronic Document Management System
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
IVS	Interim Ventilation System
NCR	Nonconformance Report
NQA	Nuclear Quality Assurance
NWP	Nuclear Waste Partnership, LLC
OFI	Opportunity for Improvement
P&ID	Piping and Instrumentation Diagram
PISA	Potential Inadequacy in the Safety Analysis
PM	Preventive Maintenance
QA	Quality Assurance
QAPD	Quality Assurance Program Description
QMIS	Quality Management Information System
RH	Remote Handled
RJR	RJR Engineering
SDD	System Design Description
SR	Surveillance Requirement
SSC	Structures, Systems, and Components
SVS	Supplemental Ventilation System
TOE	Technical Operability Evaluation
TRUPACT	Transuranic Package Transporter
TSR	Technical Safety Requirement
UGS	Underground Ventilation System
UPS	Uninterruptable Power Supply
USQ	Unreviewed Safety Question
VFD	Variable Frequency Drive
WHB	Waste Handling Building
WIPP	Waste Isolation Pilot Plant

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), conducted a review of engineering and procurement processes at the Waste Isolation Pilot Plant. The purpose of this EA review effort was to evaluate the effectiveness of engineering processes and procurement processes used by the contractor, Nuclear Waste Partnership, LLC (NWP).

EA examined the flowdown of safety basis requirements to the system design descriptions and from those documents to lower tier piping and instrumentation diagrams, calculations, system design descriptions, and other design documents. The review of engineering processes focused on the quality of engineering procedures governing essential areas of the design function, supplemented by review of engineering deliverables produced using those procedures. EA also reviewed the cognizant system engineer and configuration management programs to examine the collective role of those programs in implementing adequate design change control. Finally, EA looked at the procedures and other implementing documents controlling the procurement process, including a detailed review of actual procurements and associated oversight and inspection-related documentation.

The cognizant system engineer program is adequately implemented. The qualification process is well-established, as is the cognizant system engineer's role in the configuration management process as defined in DOE Order 420.1C, *Facility Safety*. System design descriptions adequately described safety basis requirements. The NWP procurement program is compliant with requirements (ASME/NQA-1-1989, DOE Order 414.1D, *Quality Assurance*, and 10 CFR 830). NWP effectively implemented the procurement program requirements in the procurement activities for the interim ventilation system, the supplemental ventilation system, and the dry de-duster system, although preventive maintenance requirements have not yet been developed for newly procured components already received and in storage.

Although some engineering procedures governing the design function were adequate, EA found problems in the design change process and configuration management program. The design change procedure provides adequate guidance on the development of a change package, but does not require justification or a technical basis for why a planned change is technically acceptable. The engineering procedure for calculations provides inadequate guidance in several areas; for instance, there is no process for tracking and closure of unverified assumptions, and calculations containing unverified assumptions are used as the basis for physical modifications to the facility. Inadequacies in this procedure led to technical inadequacies in the limited sampling of calculations reviewed. Problems were also noted with the procedures for design verification, technical operability evaluation, and system health reporting.

The configuration management program is weak in both design change control and document control. Engineering processes for identifying impacted documents during the change process proved to be poorly implemented and multiple instances were found where physical configuration did not match issued design drawings. Document control processes are overly reliant on hard copy documents with restricted access, while the electronic record management system is used only for archival purposes.

This review was limited in scope; however, the findings reflect an engineering program in need of improvements in key processes. A sampling review of deliverables indicated that process inadequacies resulted in technical inadequacies in the engineering products. Based on these conclusions, a timely review of the technical design basis for safety related systems and systems important to safety, and the supporting calculations, for technical adequacy and consistency with the current physical configuration of the facility is warranted.

Office of Enterprise Assessments
Review of Waste Isolation Pilot Plant Engineering and Procurement Processes

1.0 PURPOSE

The U.S. Department of Energy (DOE) independent Office of Enterprise Assessments (EA) conducted a review of engineering and procurement processes at the Waste Isolation Pilot Plant (WIPP). The purpose of this EA review was to evaluate the effectiveness of engineering and procurement processes within the contractor engineering organization. Nuclear Waste Partnership, LLC (NWP) is the contractor at WIPP.

EA performed this review of the WIPP site from July 7 through August 13, 2015. This report discusses the scope, background, methodology, results, and conclusions of the review, as well as the findings and opportunities for improvement (OFIs) identified by the review team.

2.0 SCOPE

EA examined the procedures that implement WIPP engineering and procurement processes, along with a representative sampling of engineering and procurement deliverables produced under the processes. This review scope is consistent with the *Plan for the Office of Enterprise Assessments Review of Engineering and Procurement Processes at the Waste Isolation Pilot Plant*, dated July 2015.

3.0 BACKGROUND

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

The engineering portion of this review is part of a series of reviews established by EA in coordination with the Carlsbad Field Office (CBFO) in response to issues identified at WIPP following two emergency events in 2014. The procurement component of this review was added at the request of the DOE Office of Environmental Management to provide an independent look at NWP capabilities and processes in that area.

4.0 METHODOLOGY

Criteria used to define the scope of this review are derived from Criteria, Review and Approach Document (CRAD) 31-13, *Conduct of Engineering*, and Section II of CRAD 64-17, *Nuclear Facility Safety System Functionality Inspection Criteria, Inspection Activities, and Lines of Inquiry*. Each CRAD includes inspection criteria, activities, and lines of inquiry structured to support the review.

EA divided the review process into several stages, including offsite and onsite planning, onsite data gathering activities, report writing, validation, and review. Planning included discussions with

responsible site and CBFO personnel, scheduling of the review, collection of applicable site procedures and documents, and document reviews. After the onsite data collection period conducted July 7-9 and August 4-13, 2015, EA prepared a draft independent review report identifying overall perspectives, deficiencies, and OFIs and made it available to line management for review and feedback.

EA initially identified and reviewed the engineering and procurement procedures governing key processes for the development of engineering and procurement deliverables and control of the facility configuration. EA examined the flowdown of safety basis requirements, both from the documented safety analysis (DSA) to the system design descriptions (SDDs) and from those documents to lower-tier piping and instrumentation diagrams (P&IDs), calculations, specifications, and other design documents. EA also interviewed personnel responsible for developing and executing the processes, including working level engineers who use those processes on a daily basis.

During this review, EA discussed all identified deficiencies and other observations with CBFO and NWP on a real time basis. Significant deficiencies are reflected in the findings of this report (summarized in Section 6.0), and suggested program or process improvements for management consideration are listed in the OFIs in Section 7.0. The members of the EA review team, the Quality Review Board, and EA management responsible for this review are listed in Appendix A. Appendix B provides detailed list of the documents reviewed and personnel interviewed relevant to the findings and conclusions of this report.

EA conducted previous reviews of the WIPP engineering processes in June and December 2014, which documented a finding regarding the engineering calculation process. During this review, EA examined the status and effectiveness of corrective actions addressing that finding.

5.0 RESULTS

5.1 Engineering Process Review

Criteria
Design engineering work is performed consistent with technical standards, DOE requirements, and safety basis requirements and commitments, using approved procedures and sound engineering/scientific principles in accordance with the requirements of 10 CFR 830. (CRAD 31-13)

EA assessed NWP engineering processes by reviewing key engineering procedures and interviewing engineering personnel to establish an understanding of how those procedures are implemented. EA then reviewed various engineering documents to assess the implementation of those processes and the overall effectiveness of the engineering program.

5.1.1 Engineering Procedures

WP 09-CN3018, *Design Verification*, details both the design verification process and the design review process. It describes a review approach with a commonly recognized technique for independent review for non-safety related structures, systems, and components (SSCs) and a design review process involving contributions from other facility organizations for safety-related SSCs. The multi-discipline review process for safety-related changes is important to ensure that all relevant aspects of a proposed change are adequately identified and considered. However, it is not equivalent to the independent review process defined for design verification and is not likely to produce the in-depth validation of design inputs that should result from the design verification process. This type of multi-discipline review process is normally applied to augment the design verification process, not to replace it. (See **OFI-NWP-01**.)

NWP issued Revision 5 of WP 09-CN3031, *Engineering Calculations*, during the EA review. Previous revisions of this procedure were the subject of past EA reviews, which noted problems in compliance with 10 CFR 830; American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-1, 1989; and the NWP quality assurance (QA) program description (QAPD). Those reviews found that calculations prepared under previous revisions were not numbered and were not issued as standalone documents, but were included in Engineering Change Order (ECO) packages without discrete identification. EA noted this concern in EA Operational Awareness Records EA-WIPP-2014-06-23 and EA-WIPP-2014-12-02 as a retrievability issue and a likely non-compliance with the NWP QAPD, which states that engineering calculations must be identifiable and retrievable as records. Revision 5 of this procedure added requirements for assigning calculation numbers but still contains shortcomings:

- The new calculation coversheet requires that assumptions be listed and identified as verified or unverified. However, the procedure contains no process for tracking unverified assumptions to closure, no requirement to ensure closure, and no limits on using the calculation in the facility design basis before closure/resolution of unverified assumptions.
- The procedure is unclear in defining the checking/design review process. No specific requirement for checking is included, and the design review/verification process described in WP 09-CN3018, *Design Verification*, is not structured to take the place of the checking process.
- Approved calculations are stored in the engineering file room in hard copy. There is no requirement to create or maintain electronic record copies, so accessibility is limited and the potential for loss of control of these design basis records is significant. (See **OFI-NWP-02**.)

This topic is discussed further with the results of individual document reviews in Section 5.1.2. The procedural shortcomings discussed above were, for the most part, identified in June 2014 by an NWP internal review team and by EA. NWP prepared Revision 5 of the calculation procedure to address these issues. This revision was approved 14 months after the initial identification of the issues but did not address the issues in a technically and programmatically sound manner. (See **Finding F-NWP-01**.)

WP 09-CN3007, *Engineering Change Order Preparation and Design Document Change Control*, describes the design change process. The ECO is used to create design change packages. It is also used as a cover document for new engineering documents, such as calculations and technical operability evaluations, and to add vendor documentation to equipment files. The procedure contains the expected instructions for identifying and completing the requisite forms for each intended purpose, but it does not adequately define the various status markers that may be applied to an ECO package during the approval and implementation processes. Further, it does not require a technical basis or justification for a design change – that is, not why the change is happening, but why the actual change made is acceptable from a design standpoint (e.g., code compliance, analytical margin). This omission is significant, since it procedurally allows changes to safety-related SSCs without an explanation of any impacts on the facility design basis. (See **Finding F-NWP-02**.)

WP 09-11, *NWP Configuration Management Plan*, provides an overview of the configuration management (CM) process. It provides a roadmap to where different types of documents are stored – i.e., what is in SharePoint, the Quality Management Information System (QMIS), Drawing Registry, and the Computerized History and Maintenance Planning System (CHAMPS) – and states that the CM program is compliant with DOE-STD-1073-2003. It also states that drawings are to reflect the as-built configuration after a modification but does not specify the timing for updating drawings or limit the number of outstanding changes before an update. Further, it does not mention Documentum, the electronic document management system (EDMS). The CM process is discussed in more detail in Section 5.3 of this report.

WP 09, *Conduct of Engineering*, establishes the cognizant system engineer (CSE) program. It references DOE Order 420.1C requirements for that program; establishes the roles, responsibilities, accountabilities, and authorities for specific positions within engineering; and contains CSE position requirements, including expectations for CM and safety basis compliance. It also provides specifics on the CM program and references DOE Order 430.1B, *Real Property Asset Management*, but it omits DOE Order 413.3B, *Program and Property Management for the Acquisition of Capital Assets*, which is applicable to WIPP and contains limited requirements for the CM program. WP 09 requires use of the ECO process to document new designs, changes to existing designs, and temporary modifications.

WP 09-12, *Evaluation of Technical Operability Adequacy of Facility Systems, Structures, and Components*, addresses completion of the Technical Operability Evaluation (TOE) form for operability evaluations, evaluation of facility operational aspects such as off-normal conditions, assessing compliance with the technical baseline, establishing commercial grade dedication of piece parts, and evaluation of supplier services and processes. The procedure includes instructions for completing the TOE form, resolving comments, and gaining approvals. However, the procedure is very basic in general and offers no guidance on the considerations necessary to develop a technically adequate evaluation for any of the situations noted above. (See **OFI-NWP-03**.)

WP 09-CN3025, *Annual System Health/Walkdown/Requalification*, defines the process for an annual system walkdown by the CSE and for generation of the annual system health report. The walkdown process is also used to establish re-qualification of the CSE on an annual basis. The procedure permits the walkdown for a system to be accomplished over a 12-month period, culminating in the annual report. A system health report form attached to the procedure identifies very specific topics to be addressed by the CSE and is generally structured to drive the annual system assessment to be comprehensive and informative. Open work orders and ECOs are to be listed and their impact described. However, EA noted three areas where the report format and function did not fully address requirements:

- The system health report format does not list all corrective action reports (WIPP Forms) open against components or documents within the system.
- Section 7.c of the report format is to be used to document results of trending analyses. DOE Order 420.1C, *Facility Safety*, states that the CSE must identify trends from operations and maintenance, but this section of the report format does not require trending of all active components, nor does it require evaluation of present performance against past performance, identification of potential degradation, or evaluation of vibration monitoring for rotating equipment.
- System health reporting functions to inform facility management of the conditions and any issues affecting the performance of a system. Annual reports are not adequate to accomplish this function for safety related systems. DOE Order 420.1C requires "periodic reviews of system operability, reliability, and material condition," and the facility system health reporting process is normally structured to support compliance with that requirement. It also specifies that "A graded approach must be used in applying the requirements of the CSE program," which would normally include more frequent reviews of safety-related systems and components. (See **OFI-NWP-04**.)

5.1.2 Design Basis Document Review

The design basis for a nuclear facility generally consists of those documents necessary to establish and ensure that the facility design is in compliance with the approved safety basis. DOE-STD-1073-2003, *Configuration Management*, notes that these documents may include:

- Design input documents, such as facility or system description documents

- Design constraints, such as industry codes and standards, regulatory commitments, and QA requirements
- Design analysis and calculations necessary to convert the design inputs into design outputs and demonstrate compliance
- Design outputs in the form of functional requirements, procurement specifications, drawings, etc.

EA reviewed a sample of NWP engineering documents, including ECOs, calculations, P&IDs, and other drawings, to determine whether they were categorized according to safety significance and prepared with clearly defined design inputs and technically justified assumptions, and whether unverified assumptions were identified and tracked to resolution. EA also reviewed the engineering documents to determine whether they were prepared consistent with design criteria and safety basis, accessible and retrievable in their most current version, and verified by an independent verifier.

Calculations

The EA review of the calculation procedure documented in Section 5.1.1. above noted several problems with that procedure. A limited sampling of calculations also indicated problems with the implementation process as evidenced by the examples below.

In reviewing aspects of the Interim Ventilation System (IVS) design, EA determined that no calculation or other design basis document exists showing the capacity, currently applied loads, or design margin for electrical subpanel 7. This panel will be used to power the IVS fans. The capacity of the panel had to be determined empirically using field measurements and nameplate data in order to support the IVS addition.

The General Plant Design Description states in Section 2.9.1 that the exhaust duct elbow atop the exhaust air shaft is designed to withstand the design basis earthquake. EA requested a copy of the seismic calculation, but NWP was unable to find it until after the review was complete. That calculation will be included in a follow-up review.

The potential impact of an unverified assumption in a calculation can be seen in ECO 12686, *Removal of Battery Vent Hood in CH Bay*. This ECO removed the vent hood from a battery charging station in order to allow ductwork installation for another ECO. The removal of the vent hood was technically justified by a calculation that concluded, "Current rate of air flow far excess the requirement to maintain the hydrogen concentration below the LEL [lower explosive limit] at 4% with a safety factor of at 1%. With 100cfm [cubic feet per minute] leak rate the ventilation is not even needed." However, in the Inputs and Assumptions for the calculation, it states, "Assume a 100cfm air exchange rate from building leakage." The calculation provided no source for that datum and no technical basis for its determination. Thus, the entire validity of the calculation is based on an unverified leak rate assumption. Furthermore, the calculation assumed that uniform mixing occurs without identifying or providing technical justification for that assumption. (See **Finding F-NWP-01**.)

Incremental changes to the design basis may also have unintended consequences. An example is the fire suppression system for the Waste Handling Building (WHB), Building 411. The safety significant fire suppression system in the WHB is supplied from a firewater loop around the building, as shown schematically in Figure 1. The loop is fed from either of two water tanks located west of the WHB, and pressurized by either of two fire pumps (one electric, one diesel). The building has three separate risers:

- The north riser feeds the north side of the CH bay and the Waste Hoist Tower.
- The east riser feeds the remote handled (RH) area.
- The south riser feeds the south side of the CH bay and the TRUDOCKs.

Numerous isolation valves are present in the system to allow for maintenance, testing, and continued operation during system impairments. The valves are omitted from the figures below to enhance clarity.

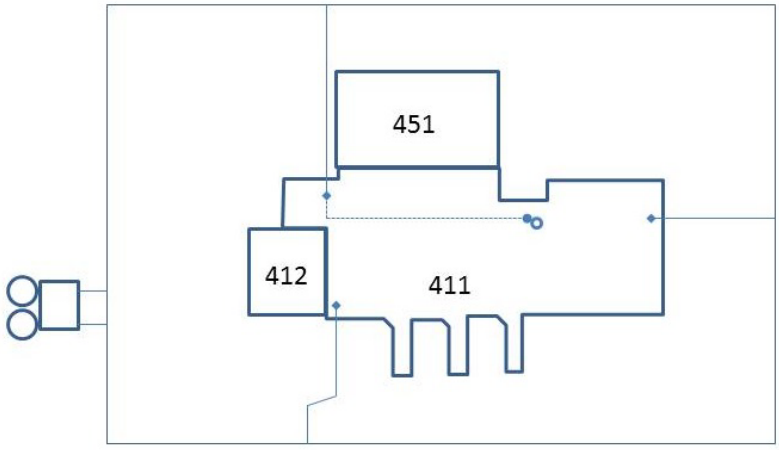

Figure 1. Simplified Firewater Supply Diagram
Note that the loop feeds three risers in the building, and the riser fed from the north side of the loop feeds the sprinklers for the Waste Hoist Tower.

ECO 12037, *Fire Water Supply Extension Connection,* was prepared, approved, and installed to address an impairment impacting the south fire suppression system riser. The ECO provided a 6" diameter pipe to supply water between two separate risers (north and south) in Building 411. Figure 2 shows the firewater extension. Calculations at the time showed that bringing in water from the north riser's supply would be sufficient to meet the demand at the areas served by the south riser. An unreviewed safety question (USQ) screening was performed and documented as USQS-08-493, *ECO #12037 and WO #0804244M, Install Fire Water Supply Extension.* The USQ screening noted that applicable DSA and technical safety requirement (TSR) sections required "the fire suppression system in the WHB be supplied by three risers with specified valves locked open." The USQ screening also stated that "Incorporating this modification can result in one of the WHB fire suppression risers being supplied by an alternate source…during this time CH and RH LCO 3.1.1 cannot be met and DOE permission is required for continued operation. This alternate configuration was presented and approved by Justification for Continued Operation NS-RP-2008-02." However, the screening question "Does the proposed activity represent a change to the facility or procedures as described in the safety basis?" was answered in the negative. Likewise, the screening question "Does the proposed activity represent conditions (e.g., new or changed hazards) that have not been analyzed in the existing safety basis?" was also answered in the negative. No calculations were performed to evaluate the hydraulic adequacy of using the south riser's supply to meet demands in the areas served by the north riser, or to evaluate the impact of the new flow path to supply the Waste Hoist Tower sprinklers. The USQ screening concluded, "The proposed activity screens negative and no USQD [USQ determination] is required."

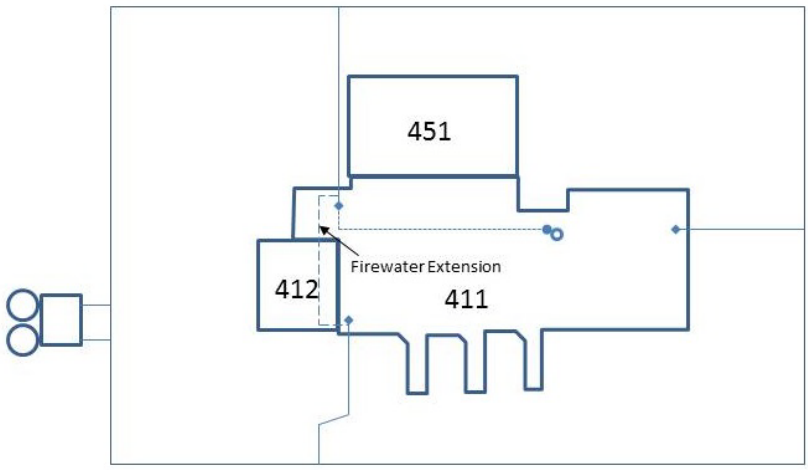

Figure 2. Simplified Firewater Supply Diagram Showing Firewater Extension
The firewater extension is shown connecting the north and south risers.

ECO 11286, *Calculation - Pressure and Flow for Hoist Tower Sprinklers*, was performed several years before the installation of the firewater supply extension connection on ECO 12037. The calculation addressed the highest elevation protected by the safety significant fire suppression system, and examined the ability of the aging pumps to supply that location with adequate water.

The sprinklers at the top of the Waste Hoist Tower are fed from the north riser. When the hydraulic calculation was performed, it used the non-conservative shortest path around the Building 411 fire suppression supply loop, as depicted in Figure 3. A USQ screening did not identify this shortcoming. Although the calculation in ECO 11286 resulted in meeting performance requirements, little operating margin remained.

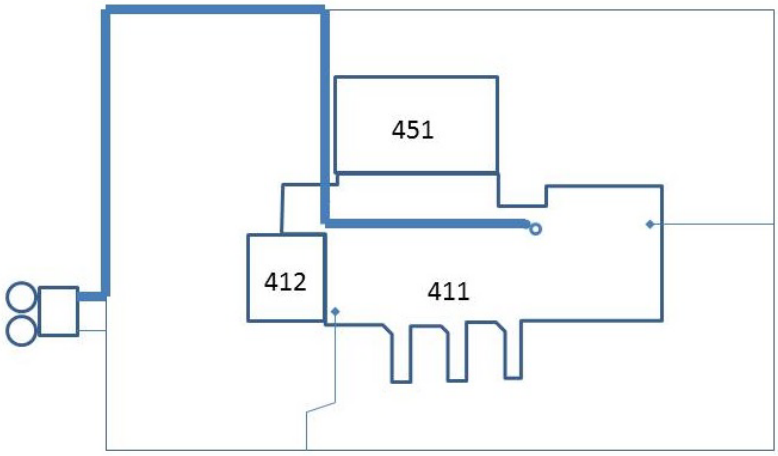

Figure 3. Firewater Flow Path Analyzed in ECO11286
The analyzed flow path is shown with bold lines.

Subsequent impairments in the fire suppression system supply piping have resulted in the north riser now being supplied from the south riser's supply. This mode of operation was not analyzed when ECO 12037 was processed. In addition, a second impairment on the Building 411 fire suppression supply loop requires water to travel most of the loop before it reaches the south riser supply point. Figure 4 illustrates

the impairments that existed in August 2015, along with the path of firewater supply to the Waste Hoist Tower. This combination of impairments has placed the supply to the Waste Hoist Tower far outside of what has been analyzed. (See **Finding F-NWP-03**.) When informed of this issue by EA, NWP declared a potential inadequacy in the safety analysis (PISA).

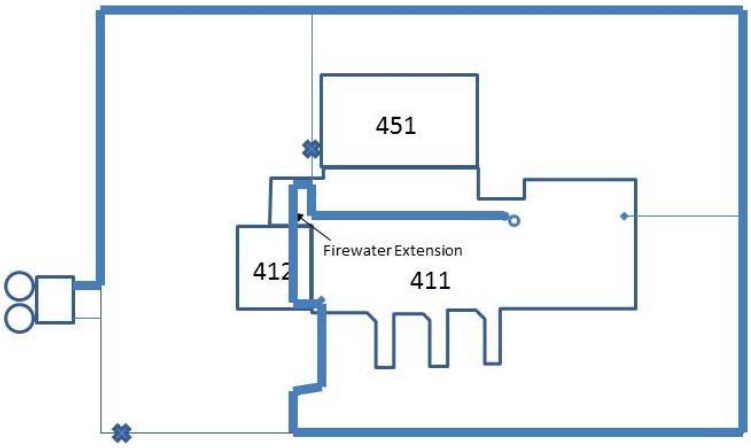

Figure 4. Firewater Route to Waste Hoist Tower due to Impairments
Impairments on the southwest portion of the loop and the branch line feeding the north riser are identified with an X.

In addition, ECO 11286 is the basis for the pressure used in TSR surveillance requirement (SR) 4.1.1.7, "Pump Output - To provide the necessary amount of fire water to the sprinkler systems, each fire pump must be capable of pumping ≥ 1,500 gpm at ≥ 105 psig (ECO 11286). This SR verifies on an annual basis that the fire pumps can perform this function. The annual frequency meets the requirements of NFPA [National Fire Protection Association] criteria." Since the calculation used non-conservative values for determination of pressure loss, the adequacy of the TSR SR cannot be assured. (See **Finding F-NWP-04**.) (See **OFI-NWP-05**.)

Drawings

Modifications to drawings are made using ECOs. These include planned changes to drawings as a result of new or modified equipment installation, as well as updates to drawings to restore alignment between the installed equipment and its associated design drawings when discrepancies are discovered. Design drawings are allowed to accumulate unincorporated changes with no procedural limits on the number of outstanding changes or a time limit for incorporating them. As a result, drawings do not always reflect as-built conditions. EA noted that discrepancies between drawings and actual field conditions also occur which result from inadequate configuration control. Various CSEs interviewed stated that they had found discrepancies between their system drawings and actual field configuration while performing their duties. EA identified a TOE of the underground maintenance shop facility that described two discrepancies between design drawings and the actual configuration. WIPP Form 15-035 documents that insulation was removed and heat trace tape was added to piping associated with the diesel fire pump using a work order rather than an ECO, creating new drawing discrepancies.

Some drawings contained inadequate information. For example, the "facility pallet" is a passive design feature used to protect waste drums from fire. From Section 4.4.2.3 of the DSA, "The facility pallet is required to have a metal surface. The solid metal surface is required to prevent direct flame impingement on CH [contact handled] waste containers while on the facility pallet." The facility pallet is depicted in

the following design drawings:

Drawing 41-D-011-W1, Waste Handling Facilities Facility Pallet Assembly Eqpt. No. 52-Z-002, Revision J
Drawing 41-D-011-W2, Waste Handling Facilities Facility Pallet Assembly Eqpt. No. 52-Z-002, Revision D
Drawing 41-D-011-W3 Waste Handling Facilities Facility Pallet Assembly Eqpt. No. 52-Z-002 A, B, Revision A.

However, there is no reference or technical basis for the minimum metal thickness of the solid metal surface necessary to prevent direct flame impingement on CH waste containers. The drawings show the metal plate to be Type 304 stainless steel, nominally 0.19 inch thick. Since no special tolerance is applied to this dimension, it is subject to the standard dimensional tolerance (as shown on the drawing) of +/- 0.10 for a two-place decimal number. As a result, the metal surface could be as thin as 0.09 inch and still be in compliance with the design drawing. Lack of an analytical basis for required metal thickness leaves the acceptability of this 50% reduction indeterminate. (See **OFI-NWP-06**.)

Although P&IDs indicated system boundaries, such as the division between FP01 (Fire Water Supply and Distribution System) and FP02 (Fire Suppression System), engineering drawings were not categorized by safety significance, nor were safety significant system boundaries identified on the drawings. (See **OFI-NWP-07**.)

EA reviewed the fire protection system P&IDs for several buildings, including the WHB, the Transuranic Package Transporter (TRUPACT) maintenance building, the salt handling shaft hoist house, and the exhaust filter building. Legends defining the drawing symbols were present on P&IDs for some buildings, but not for others. Each P&ID had a drawing note describing how to apply necessary prefixes to the valve number shown on the drawing in order to create a complete valve tag. However, the information necessary to create an instrument tag using the instrument number found on the drawing was not described, and it differs from the information used to create a valve tag; the worker would have to refer to WP 09-CN3021, *Component Indices*, in order to ensure that a tagged field instrument was the same component depicted on the P&ID. P&IDs are identified as "essential" technical baseline information in WP 09-11, *NWP Configuration Management Plan*. The current method of tagging instruments can impede the ability to quickly identify a field component as the one depicted on the P&ID (via clearly defined symbols and complete tag numbers) and creates a source of potential error in off-normal situations. (See **OFI-NWP-08**.)

Technical Operability Evaluations

Engineering procedure WP 09-12, *Evaluation of Technical Operability Adequacy of Facility Systems, Structures, and Components*, provides direction for the development of engineering TOEs. Section 5.1.1 above includes review comments on this procedure. EA examined seven TOEs to assess procedure compliance and technical adequacy in this area.

ETO-P-131, *Engineering Evaluation of Waste Hoist Being Powered by the Standby Diesel Generator(s)*, assessed the use of the standby diesel generators to power the waste hoist and concluded that they were not a viable option. It provides adequate justification for the conclusion reached.

ETO-G-199, *Diesel Fire Pump Leak*, evaluated a solenoid valve found to be leaking water into a coolant line for a diesel fire pump. The leak was identified when the coolant line froze in January 2014. NWP engineering prepared this TOE in July 2015. The TOE appropriately concluded that the leaking valve should be repaired prior to onset of freezing conditions and established a completion date of November 1,

2015. The TOE also stated that the fire pump starts automatically on pressure drop in the fire header. NWP confirmed that the start function is driven by tubing from the fire header to a pressure transmitter which also contains water and would be similarly subject to freezing. When questioned about this potential impact, NWP provided documentation showing that this issue was identified on WIPP Form 15-035, a causal analysis was performed, and corrective actions were identified to correct the issue before November 2015.

ETO-Z-194, *Evaluation of Underground Maintenance Shop Ventilation and MSHA Regulations*, concluded that the underground vehicle maintenance shop does not meet 30 CFR 57.4761 requirements for fire protection in an underground shop facility, since air flow through the exhaust shaft is no longer available. It required compensatory measures identified by the fire protection engineer and recommended upgrading the bulkheads in the longer term to meet one of the options presented in the regulation. A fire watch was proposed as an interim measure during periods of activity in the shop. The evaluation and proposed resolution were technically sound and appropriate. However, the write-up in the TOE identified two situations with regard to the underground shop facility that reflect inadequate configuration control and did not identify those two issues for resolution or follow-up corrective action:

- "The bulkhead drawing notes indicate that the bulkhead is covered with sheet metal on both sides and insulated with 2" of Rockwool insulation. A field inspection [by the evaluator] has determined that the drawing is incorrect and the bulkheads are not insulated with Rockwool."
- "Power to the control panel was removed several years ago to allow for ground control work in the E300/S90 area. Since that time, power has been restored to the area however the louvers have not been reconnected to the control panel. As of this writing the louvers can only be operated manually." (See **OFI-NWP-09**.)

ETO-P-056, *Evaluation for Spare Transformer on the Waste Hoist 31P-TR15/1*, documented the evaluation of a replacement transformer. No issues were identified during EA review of this TOE.

ETO-I-060, *Evaluate ACGLF Counterweight Drive Wear for Operability*, evaluated whether adjustable center of gravity lift fixtures (ACGLFs) could be employed for various activities after degradation was found in some of the existing fixtures. The evaluation was comprehensive, including communication with other ACGLF users at Idaho National Laboratory. The problem was evaluated, an acceptable response was determined, and the appropriate preventive maintenance (PM) procedure was revised to prevent recurrence.

ETO-K-071, *Evaluation of System Effects Due to Changing Weather Conditions*, summarized the susceptibility of the VU01 subsystem to weather extremes. It concluded, based on the original design requirements, that the system was built to withstand the expected conditions, including temperature extremes, snow accumulation, hail, rainfall, and wind up to the design basis values. VU01 was not designed to resist tornado forces. However, in focusing on original design requirements, the evaluator did not consider or take into account subsequent degradation that may have compromised the capacity of exposed components to resist physical loadings, such as snow mass accumulation and wind loads. (See **OFI-NWP-10**.)

ETO-P-103, *Evaluation of Local Processing Units (LPU) and Uninterruptable Power Supply (UPS) for the Surface and Underground at WIPP*, identifies open action requests pending with Maintenance and asks that they be addressed as soon as possible, based on their status from previous test attempts. No technical evaluation was required by the preparer. No issues were identified during EA review of this TOE.

This portion of the review identified a less than adequate evaluation of VU01 above ground components

and noted ancillary issues in two other TOEs. The remaining TOEs, however, were generally adequate and provided appropriate technical bases for the conclusions reached.

5.1.3 Engineering Process Review Conclusion

Overall, NWP has effectively developed and implemented some of the key engineering procedures necessary for the reviewed processes. However, this EA review identified several issues in engineering processes at WIPP:

- The design review/verification process does not adequately validate design inputs and is used instead of a formal checking process. EA noted problems in the identification of impacted documents.
- The calculation process has no defined checking element and is inadequate in its treatment of unverified assumptions, allowing design changes to be implemented and placed into service without closure of these open inputs. Calculations do not always exist to support elements of the design basis. The calculation procedure, WP 09-CN3031, *Engineering Calculations*, before Revision 5 (issued August 6, 2015), did not require calculations to be issued as standalone documents, significantly limiting their retrievability. EA noted quality problems in several of the reviewed calculations. One calculation supporting the fire protection system design basis was non-conservative, resulting in a PISA when the problem was identified by EA.
- The engineering change process does not require technical justification or validation for design changes made, so there is no basis for determining the technical adequacy of those changes.
- The processes for performing TOEs and preparing system health reports and SDDs were generally adequate, but a few problems were noted.
- The drawings that EA reviewed were generally adequate, with only minor issues noted, however, the fidelity with which issued drawings depict actual field configurations is a concern which will be the subject of a follow up review.

5.2 Cognizant System Engineer Program

Criteria
A cognizant system engineer (CSE) program has been implemented in accordance with the requirements of DOE Order 420.1B to ensure continued operational readiness of identified systems to meet their safety functional requirements and performance criteria. (CRAD 31-13)

WIPP procedure WP 09, *Conduct of Engineering* establishes the CSE program. NWP engineering designates CSEs – also called cognizant engineers (CEs) – for each site system. WIPP systems are given an overall system designator, such as VU00 for underground ventilation, and each system is then divided into subsystems with designators such as VU01, VU02, and so on. One CSE may be responsible for the overall system and some of its subsystems, while other CSEs may be assigned responsibility for other subsystems within that overall system. Each subsystem is generally assigned both a CSE and an alternate, backup CSE.

WP 09 states, "CEs are the owners of the design of their assigned system(s) and are the primary authority for approving changes to the design details of their system(s)." Interviews with CSEs indicated that the CSEs are also the primary preparers of design changes (ECOs) for their systems. The CSE for an affected system is also required to approve ECOs against their system at issuance. At closure of an ECO, the CSE validates that the work packages are completely and correctly implemented. In evaluating this aspect of the CSE program, EA questioned three CSEs about the process each would use to establish the current design basis for an SSC affected by a planned design change (using the planned IVS addition as the posed

example). The first stated that a CSE should start with the original design and update it using all subsequent changes that impacted it. The second, who was involved in that design change, did not perform the design review, but took field measurements and nameplate data to establish the current configuration. The third, also involved with that design change, stated that validation of design inputs was not a CSE responsibility, but that of the design verifier. The first response was the only response consistent with the approach detailed in interviews with engineering management. (See **OFI-NWP-11**.)

5.2.1 CSE Qualification and Training

A qualification program is in place that establishes requirements for CSE qualifications and tracks completion of those requirements. The qualification process concludes with an oral examination board to test system knowledge. Annual requalification is required, in the form of a system walkdown and preparation of an annual system health report. EA examined the requalification records of three CSEs questioned about the design change process and identified no issues.

5.2.2 System Design Descriptions

CSEs are responsible for maintaining SDDs. SDDs contain requirements for system design, operation, and maintenance, as well as narrative descriptions of the system and its components. DOE Standard DOE-STD-3024, *Content of System Design Descriptions,* provides a format and desired content for the various SDD sections. SDDs and supporting design documents must be identified and kept current using formal change control and work control processes. WP 13-1, *Quality Assurance Program Description*, states that "Design control measures for changes shall include provisions to ensure that the design analyses for the item are still valid."

NWP has 16 SDDs, including the General Plant Design Document. Each SDD has multiple subsystems. The SDDs have varied formats; the most recently revised SDDs are formatted to comply with DOE-STD-3024-98 (dated 1998), *Content of System Design Descriptions.* NWP has committed (in response to CBFO-CAR-15-006) to bring six SDDs into compliance with the DOE-STD-3024-98 format by September 30, 2015. The current version of DOE-STD-3024 is the 2011 version. (See **OFI-NWP-12**.)

Many of the SDDs that were previously revised to follow the format of DOE-STD-3024-98 do not fully comply with the standard. For example, SDD CF00-GC00, *Plant Buildings, Facilities, and Miscellaneous Equipment System Design Description,* includes requirements for safety class and safety significant SSCs, but there is no associated basis statement for any of the requirements. Both DOE-STD-3024-98 and DOE-STD-3024-2011 mandate that requirements have an associated basis statement. (See **OFI-NWP-12**.)

Although the SDDs describe the current state of the various systems, they do not provide the design basis to determine whether sufficient excess capacity exists to support a modification. As an example, the CSE for the compressed air system stated verbally they are planning to replace selected compressors. Because the basis for capacity of the compressed air system is not documented in the SDD, the planned capacity for the new compressors is currently based on the observed cycle times of the existing compressors. The SDD does not reference plant drawings or calculations that show the total compressed air demand for the site.

Changes to SDDs are accomplished using an ECO, which provides a traceable record of formally controlled changes. A USQ screening is required for all ECOs, in accordance with WP 09-CN3007, *Engineering Change Order Preparation and Design Document Change Control.* EA questioned 10 CSEs about the USQ process, and many of them stated that the process, in which USQ evaluations are prepared by the nuclear safety group, ensures that planned modifications would not exceed the authorized safety

basis. CSE reliance on another group to ensure safety basis compliance reflects poorly on CSE ownership of the technical baseline. The CSEs are responsible for maintaining the SDDs, which are asserted to define the technical baseline of the safety significant and safety class SSCs. In reviewing the SDDs, EA noted several minor items. These include:

- Operability and surveillance requirements in SDD-WH00, *Waste Handling System System Design Description*, can be misinterpreted to apply only to certain underground liquid fueled waste handling vehicles (7.5 ton capacity diesel-powered forklift), instead of to all liquid fueled waste handling vehicles as required by DOE/WIPP 07-3373, *Waste Isolation Pilot Plant Technical Safety Requirements*.
- SDD-HV00, *Heating, Ventilation and Air Conditioning System System Design Description (SDD)*, includes subsystem CW02, Chilled Water Cooling System. Section 2.11 of CW02, titled Codes and Standards, says: "Refer for Section 2.11 of Chapter G for codes and standards." However, the relevant section of Chapter G has no standards for the piping used in the chilled water system.
- An operability requirement for continuous air monitors (CAMs) in SDD-RM00, *Radiation Monitoring (RM00) System Design Description*, includes the statement: "These CAMs are not required to meet the requirements of 10 CFR 835." Further investigation revealed that although the instruments themselves are required to meet 10 CFR 835 operability requirements, 10 CFR 835 does not require air monitoring at the specific locations where these particular CAMs will be used. The use of CAMs at additional locations beyond those required by 10 CFR 835 is not adequately explained in this SDD.

SDD-UH00, *Underground Hoisting System Design Description,* has several design requirements stated in such a way that they may be considered impossible to satisfy. This is because nominal values are presented as absolute requirements, without regard for manufacturing tolerance, fabrication tolerances, or wear from use. As examples, the Air Intake Shaft hoist has the requirement "The wire rope diameter shall be 1.25 inches…"; the Salt Handling hoist "rope diameter shall be 1 ½ inches"; "the cross sectional plan dimensions of the crosshead and platform shall be10 ft x 14 ft and 10 x 15 ft 4 inches, respectively"; "The inside shaft diameter of the concrete lined section shall be 14 feet"; and, "The single wire ropes on each winch shall be 1 inch diameter." Any measurable deviation from these dimensions, no matter how small, would result in the system being out of compliance with SDD requirements. (See **OFI-NWP-12**.)

5.2.3 System Health Reports

WP 09-CN3025, *Annual System Health/Walkdown/Requalification*, defines the process for an annual system walkdown by the CSE and generation of the annual system health report. As discussed in Section 5.1.1 of this report, EA identified several problems with this procedure. After EA's onsite review, NWP provided additional documentation and explanation demonstrating the process in place for monthly senior management reviews of overall system health, with each monthly meeting including a more specific presentation on individual subsystems. This process included review of system issues, a color coded summary status, and feedback from the CSEs on the actions necessary to improve or correct system performance deficiencies. Although the process, as described, adequately demonstrates that NWP engineering management is taking measures to track system overall status, the process is not fully effective considering the problems with WP 09-CN3025 as described in Section 5.1.1 (see **OFI-NWP-04)**.

EA reviewed the annual system health reports for three systems: VU01, exhaust fans and filters; ED05, 480v motor control centers; and CF01, surface "special facilities."

The VU01 Annual System Walkdown Report, dated February 27, 2015, covers the above-ground portion

of the underground ventilation system (UGS), including the exhaust ductwork, fans, filters, and filter housings. It provides a comprehensive status for the VU01 subsystem and includes lists of work orders and ECOs and an evaluation of individual PM work orders. It also has an attached report by an independent reviewer from June 2014 that critically examined system vulnerabilities and identified areas of concern from the standpoint of ensuring continued operability. This report otherwise includes very little trending analysis and does not identify open corrective action documents. However, it does identify areas of degradation and challenges to long-term functionality.

The ED05 Annual System Walkdown Report, dated June 28, 2015, covers a portion of the power distribution system. It notes that many PM work orders are late. Some responses to the listed questions are terse and do not provide sufficient information to understand the issue (5b, 5f). The section 7b response reflects either inadequate understanding of the intended action or complete lack of trending analysis of system performance. Section 13b notes that discrepancies were found between the drawings and the actual field configuration and states that they will be corrected via ECO, and although it does not identify any ECO number, it does capture this item on an action list in the report.

The CF01 Annual System Walkdown Report, dated April 30, 2015, covers "special facilities" on the surface, defined as facilities in proximity to or interfacing with the safety class WHB. EA identified no issues in the content of this report.

5.2.4 Cognizant System Engineer Program Conclusion

NWP has made a significant effort toward implementing a sound CSE program, with a well-established qualification process and documented guidance for the assigned CSEs. The CSEs are involved in the design and management of their systems. Weaknesses included disparities in CSE understanding and acknowledgement of design basis ownership and a pervasive lack of trending and analysis in the system health reporting process.

5.3 Configuration Management Program

Criteria
A documented configuration management (CM) program has been established and implemented in accordance with DOE Order 420.1B that ensure consistency among system requirements and performance criteria, system documentation and physical configuration of the systems within the scope of the program. (CRAD 31-13)

The NWP CM program is described in WP 09-11, *NWP Configuration Management Plan*. The plan discusses the graded approach, the SSCs that are subject to CM, and the role of the site component indices, or master equipment list. WP 09-11 states that "Configuration management is a process which ensures that design requirements, physical configuration, and associated documentation of the structures, systems, and components (SSCs) within the WIPP facility remain consistent throughout the life of the facility, even as changes are made."

5.3.1 Design Change Control

ECOs are the design change method used by NWP, in accordance with WP 09-CN3007. The ECO process is described in Section 5.1.1, above. The ECO provides a traceable record of the design change, the documentation of the USQ screening, environmental review, As Low As Reasonably Achievable (radiation exposure) considerations, and the design verification. Included in an ECO package are drawing change sheets for each drawing impacted by the design change. ECO addendum sheets are added to address design changes required after the initial approval of the ECO, such as field changes.

Although the ECOs provide traceable documentation of design changes, they do not ensure that the change propagates to all affected documents. As an example, ECO 13456, *Updating Drawings for Configuration Control for HV01*, was needed to update drawing 41-F-059-W, *Waste Handling Building 411 CH Area HVAC - Room Differential Pressure & Exhaust P & ID*, because a previous design change for installation of the TRUPACT Model III facility updated only the SDD, not the P&ID. (See **OFI-NWP-13**.)

The cumulative impacts of design changes are not analyzed to determine the remaining margin or capacity of systems. EA identified this issue in the electrical system, the compressed air system, and the fire protection system.

As discussed previously, when CSEs perform annual walkdowns of their assigned systems, they sometimes discover undocumented design changes. CSEs then initiate ECOs to align the design documents with the undocumented design changes discovered in the field. The following ECOs are examples of this process:

- ECO 13458, *Configuration Management Changes to VU00/VU03 System Drawings*, updated 13 drawings and inactivated 3 others.
- ECO 13530, *Configuration Management Update of the VU02 System*, made changes to a drawing to reflect test and balance results of work performed 14 months earlier.
- ECO 13589, *Numbering Dampers and Instrument Valves for HV04 HVAC* [heating, ventilation, and air conditioning] *and HEPAs* [high efficiency particulate air filters], assigned component indices (unique component numbers) to dampers and instrument valves that had not been entered into CM since the Exhaust Filter Building was constructed.
- ECO 13606, *RM03 As-Built System Configuration Management*, corrected information on 12 drawings, including inactivating several drawings where the equipment on the drawings could not be located at the WIPP site.

Although it is commendable that the CSEs are conscientious about discovery of undocumented design changes, the fact that such changes occur illustrates a breakdown in the design change control process. (See **OFI-NWP-13**.)

5.3.2 Document Control

The NWP processes for controlling various records and documentation have been subjected to past EA reviews, as discussed in EA Operational Awareness Records EA-WIPP-2014-06-23 and EA-WIPP-2014-12-02. This EA review included follow-up reviews of issues identified in those reports and interviews with NWP engineering management. The paragraphs below summarize the issues and provide an updated status.

WIPP has an EDMS called Documentum, which is used only as a final, archival repository for records.

Most new records produced at WIPP are stored in other electronic systems. WP 09-11, *NWP Configuration Management Plan*, provides a roadmap to where different types of documents are stored (i.e., what is in SharePoint, QMIS, Drawing Registry, and CHAMPS). An NWP internal management assessment performed in October 2014, *MA-OPS2014-28* (report issued December 16, 2014), identified the following:

- Drawings are in the Drawing Registry on a server in engineering.
- Procedures are in QMIS.
- The mechanical equipment list is in CHAMPS.
- Safety basis documents are in SharePoint.
- ECOs are in the ECO Registry.

This summary is useful in demonstrating that the document control process at WIPP is dispersed and controlled by several unrelated procedures using multiple software systems, but it does not include EDMS. Inquiries regarding the availability of access to EDMS indicated that all site personnel are allowed to have access, but no site personnel are permitted to electronically store any record in EDMS. All records that have to go into EDMS are shipped from the WIPP site to an office in Carlsbad. (See **OFI-NWP-14**.)

Electronic records do not exist in any controlled system for some categories of records such as calculations. Likewise, ECO packages are kept only in hard copy in the engineering file room until the affected design modifications are field complete and all affected documents have been revised. The engineering file room is normally locked, with access provided by administrative personnel during normal working hours. The operations group holds a key for access during off-normal hours. (See **OFI-NWP-14**.)

Vendor data is problematic from a records control standpoint. Vendor information such as vendor manuals for procured equipment is required to be processed by the CSE for the affected system. The CSE must ensure that the hard copy gets to the file room and is filed properly. No electronic records are created for this information, therefore it is subject to loss if the CSE does not submit it as required.

When new drawings or drawing revisions are issued, the approved drawing is sent to an outside vendor that photographs the drawing onto microfiche and creates an aperture card, which then becomes the record copy of that drawing. It is kept in the engineering file room, similar to other hard copy records. When engineering personnel want to use the official copy of that drawing, a print is created from the aperture card. The Design Support Supervisor stated that NWP will have to move away from the aperture card system in the future because they can no longer find a vendor to support it. He further noted that NWP is currently considering what procedural changes will be needed to let electronic file copies of drawings become the record copy for use. (See **OFI-NWP-15**.)

One of the referenced previous EA reviews also examined the process for incorporating changes into drawings after a modification is field complete and identified that there is no process for notifying drafting that an ECO is complete and ready for incorporation. The Design Support Supervisor noted that drafting can run a report to see what is available to be worked on, but this approach does not support putting higher priority on essential drawings. Drafting currently has a backlog of 48 ECOs needing incorporation. Only 4 of those are over 12 months old, and another 13 are between 6 and 12 months old. The overall backlog is trending down positively. (See **OFI-NWP-16**.)

In aggregate, these observations describe a document control process that is overly complicated, poorly controlled, and inappropriately reliant on hard copy records. Limited access encourages use of non-

record copies and presents unnecessary barriers to information that might be needed during an off-normal event. (See **Finding F-NWP-05**.)

5.3.3 Configuration Management Program Conclusion

Although the ECOs provide traceable documentation of design changes, EA's configuration management review identified several concerns:

- Discrepancies between issued drawings and actual physical configuration are more frequent than would be expected for a facility under configuration control.
- The sampling review of ECOs found examples where documents impacted by a change were not identified and revised as required, making it necessary to issue supplemental ECOs to fix those documents.
- NWP has an electronic records management system, but relies on it only for archival record storage. On site, NWP remains reliant on hard copy records of calculations, drawings, ECOs, and vendor documents. This approach significantly affects accessibility and therefore productivity, and could be problematic if an event occurred during off-normal hours.
- Drawing updates are not prioritized, and changes are allowed to accumulate in the absence of procedural limitations on either the number of outstanding changes or the time allowed for incorporating those changes.

These issues reflect weaknesses in both design change control and document control, two important aspects of an effective configuration management program.

5.4 Procurement Processes

Criteria
Processes are established for procurement and verification of items and services and ensure that approved suppliers continue to provide acceptable items and services in accordance with ASME NQA-1, Quality Assurance Requirements for Nuclear Facilities Applications, Requirement 4 – Procurement Document Control, Requirement 7 – Control of Purchased Items and Services, Requirement 8 – Identification and Control of Items, and Requirement 15 – Control of Nonconforming Items. (CRAD 64-17)

5.4.1 NWP Procurement Program and Procedures

EA verified that the documented NWP procurement program and procurement-related procedures are compliant with the procurement program requirements of ASME NQA-1-1989, DOE Order 414.1D, and 10 CFR 830, Subpart A. WP 13-1, *Nuclear Waste Partnership LLC, Quality Assurance Program Description*, Section 2.3, appropriately incorporates the NQA-1 requirements for procurement document control, control of purchased items and services, identification and control of items and services, and control of nonconforming items. Detailed implementation responsibilities and requirements for these procurement processes have been established and are appropriately addressed in a management policy document, procurement instructions, management procedures and related forms, and instructional training courses.

5.4.2 Commercial Grade Procurement for Specific Systems

EA also assessed procurement program implementation by reviewing documentation and conducting interviews associated with ongoing commercial grade procurement activities for the Interim Ventilation

System (IVS), the Supplemental Ventilation System (SVS), and the Dry De-duster Ventilation System.

Although the IVS procurement process was not complete, the NWP IVS procurement activities reviewed were appropriately implemented and resulted in at least one NWP lesson learned following discovery of several non-conformances during receipt inspection. Once operational, the IVS is designed to facilitate periodic replacement of expended HEPA filters while maintaining minimum mine ventilation and also to provide an additional 54,000 actual cubic feet per minute (acfm) exhaust fan air flow and radioactive particulate HEPA filtration capability for the WIPP underground ventilation System. Given the need to quickly establish an additional and alternative HEPA filter ventilation capability to support WIPP recovery plans from the February 2014 underground radiological release, the scope of activities required to support the IVS procurement, the limited existing NWP staffing levels as a management and operating contractor, and the involvement of the NWP parent company (URS/now part of AECOM) in preliminary design work, NWP provided justification for a sole source procurement with URS. In accordance with WP 09-CN3005, *Graded Approach to Application of QA Controls*, NWP established IVS QA control requirements for design, engineering, procurement, construction, and operation commensurate with an expected nuclear safety designation of "important to safety."

The NWP Purchase Order 503008 scope of work included all necessary design and engineering services, materials, labor, tools, consumables, equipment, supervision, technical support, quality control, and all incidentals necessary for detailed design, fabrication, documentation, and shipment of a nuclear grade skid-mounted HEPA filtered ventilation system. NWP engineering representatives stated that, despite the current WIPP hazard analysis not requiring the IVS to be treated as safety significant, the selected management level determination and associated QA requirements and required documentation could facilitate commercial grade item dedication in accordance with WP 09-CN3040, *Commercial Grade Item Dedication*, should that become necessary. EA reviewed the following documents associated with the IVS procurement for adequacy and conformance with NWP procurement program requirements: requisition, purchase orders, scope of work, Qualified Supplier Listing, Request for Consent to Award Subcontract, Engineering Change Orders, Formal Design Reviews, design basis documentation, Approval Requests/Variance Requests, failure modes and effects analysis, QA Oversight Plans, source/receipt Inspection criteria documentation, and nonconformance reports (NCRs). EA verified that the reviewed documents conformed to program requirements and noted the following additional observations:

- In a novel approach, URS documented an IVS failure modes and effects analysis to support development of a critical spare parts list.
- Although the IVS subcontract assigned to URS the QA responsibility for IVS design, engineering, fabrication, and shipping, NWP appropriately established and implemented WP 13-QA.53, *Quality Assurance Oversight Plan for the Interim Ventilation System*, which incorporated hold point, review, observation, and witness point requirements.
- URS appropriately documented an NCR based on NWP and URS's joint discovery of shipping damage to the filter housing on the IVS filter/fan skids during WIPP onsite initial receipt inspection. NWP did not accept the equipment and therefore was not responsible for authoring the NCR that was later submitted to NWP for approval using the Approval Requests/Variance Requests (AR/VRs) process.
- The URS extent-of-condition evaluation identified additional weld defects requiring rework. URS appropriately developed and submitted a rework plan to NWP for approval using the AR/VR process.
- NWP developed and appropriately documented a *Quality Assurance Oversight Plan for "Rework" of the Interim Ventilation System*.
- NWP developed and appropriately documented a *Quality Assurance Oversight Plan for Construction and Installation of the Interim Ventilation System*.

- NWP's final receipt inspection and acceptance of the IVS filter/fan skids was not complete when the onsite portion of this EA review ended.
- Storage and PM requirements for IVS components once received, particularly the fan motors, VFDs, and controls, had not been established when the onsite portion of this EA review ended. (See **OFI-NWP-17**.)

NWP adequately implemented the required IVS procurement activities. Because the IVS was a commercial procurement from a supplier with an NQA-1 compliant QA program who was contractually responsible for the QA of its subcontractor's activities, NWP's oversight of URS subcontractor activities (such as the percent of welding to be observed/inspected and the adequacy of the shipping configuration) exceeded that which should have been necessary. In retrospect, as a lesson learned, given the importance of the adequacy and time sensitivity of receipt of the IVS, the NWP QA Oversight Plan manager stated they will consider the need to require submittal of a shipping plan for procurements of similar importance.

Although the SVS procurement process was not complete, the reviewed NWP SVS procurement activities were also appropriately implemented. Once operational, the underground SVS is intended to provide an additional 130,000 acfm air flow to the North and Construction circuits of the underground ventilation system to facilitate limited mining or waste emplacement, but not both at the same time. The quality control requirements for this commercial grade procurement were appropriately established in the related Management Level -2 determination and scope of work. Key features of the system include a fan with VFD, a modulating regulator to compensate for seasonal variations in mine natural ventilation pressure differentials, a fan noise silencer, an interlock to shut down the SVS on loss of the underground ventilation system and IVS, controls, and instrumentation. The shutdown interlock is particularly important since it is designed to prevent reverse flow of potentially contaminated air in the waste handling shaft. EA verified that SVS procurement documentation conformed to NWP procurement program requirements and noted the following additional observations:

- A May 27, 2015, change notice to the purchase order, reflecting an IVS shipping lesson learned, added a requirement to "Develop and submit a written and approved plan for packaging, shipping, unloading, and handling the SVS Fan assembly, including subassemblies and individual components such as instrumentation." However, ECO 13703 dated June 30, 2015, only required the SVS contractor to submit a "Securing and Shipping Procedure" for NWP approval with a due date of "two weeks after shipment." Submission of the procedure after the shipment was made would have defeated the purpose of the additional PO requirement. Fortunately, NWP had already received and approved the "WIPP Underground Fan Securing and Shipping Procedure" using the AR/VR process on June 29, 2015.
- NWP QA appropriately conducted a source inspection of SVS ductwork at the sub-tier contractor facilities, identified three units requiring rework, and subsequent verified through 100% weld inspection the acceptability of all 13 units available for inspection.
- NWP QA, in the company of a CBFO QA representative, witnessed the SVS fan assembly factory acceptance testing. Identified issues involving an expired manufacturer's inspector's annual eye examination, missing required documentation, inconsistencies between engineering drawings and fabrication details, and minor workmanship issues were appropriately resolved or committed to be addressed in the final AR/VR submittals.
- The SVS receipt inspection identified items with chipped paint, missing bolts, and bent copper tubing with a conditional release for assembly pending acceptance of the final data package. NWP appropriately issued NCR 2015-07 to address the identified shipping damage.
- Storage and PM requirements for received SVS components, particularly the fan motors, VFDs, and controls were reported by the CSE to be under development at the time the EA onsite review was completed.

Overall, NWP effectively implemented the procurement process for the SVS.

Although the Dry De-duster System procurement process was far from complete, the reviewed NWP Dry De-duster System initial procurement activities were also appropriately implemented. Once operational, the underground Dry De-duster System is designed to remove salt dust generated by mining activities in the underground WIPP facility's Construction ventilation circuit, particularly when the SVS is operational, to protect personnel and equipment while minimizing the salt dust loading challenge to the life expectancy of HEPA exhaust filters located on the surface. The applicable quality controls for the proposed commercial procurement of the equivalent of a balance-of-plant system were appropriately designated Management Level -4. EA reviewed the available documentation associated with the Dry De-duster System procurement for adequacy and conformance with NWP procurement program requirements. The reviewed documents were verified to conform to program requirements and the following additional observations were noted:

- The requisition request for proposals required a fan and dry dust removal capability based on 30,000-60,000 cfm airflow with consideration of two optional configurations: 1) fan attached to ventilation tubing, and 2) fan set in a bulkhead. The requisition for the Dry De-Duster System only identified two possible vendors and did not address a potentially important performance criterion related to minimizing underground filter maintenance requirements. Both potential vendors offered systems that could meet the unstated performance criterion; however, other potential vendors need to be made aware of all criteria that may be the basis for awarding the contract. (See **OFI-NWP-18**.)
- The first full sentence in the February 5, 2015, PO 503452, section 5.01, Quality Requirements, under MANAGEMENT LEVEL, references a management level determination for "The HIGH Profile Diesel/Electric Roof Bolters" without further explanation of why that is pertinent to this PO. (See **OFI-NWP-19**.)
- The August 31, 2015, Plan of the Day Schedule appropriately assigns responsibilities and due dates for required Dry De-duster System documentation, including QA receipt inspection, PM procedures, critical spare parts list, spare parts purchase requisition and entry into inventory, and development of training material.

For the most part, NWP effectively implemented the procurement process for the reviewed Dry De-duster System procurement activities and documents.

5.4.3 Procurement Processes Conclusion

The NWP procurement program complies with the requirements of ASME/NQA-1-1989, DOE Order 414, and 10 CFR 830. Overall, NWP effectively implemented the procurement activities for the IVS, the SVS, and the Dry De-duster System. Despite the fabrication problems and shipping damage discovered during initial IVS receipt inspection, the NWP-developed QA oversight plans for the IVS design, fabrication, testing, and receipt were of appropriate scope given the more comprehensive URS QA responsibilities for their subcontractor's performance. However, NWP still needs to develop and document PM requirements for procured IVS, SVS, and Dry De-duster System components now in storage or expected to be placed in storage once delivered.

6.0 FINDINGS

As defined in DOE Order 227.1, *Independent Oversight Program*, findings are significant deficiencies or safety issues that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. Findings may identify aspects of a program that do not meet the intent of DOE policy

or Federal regulation. DOE line management and/or contractor organizations must develop and implement corrective action plans for EA appraisal findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 227.1 to manage these corrective action plans and track them to completion.

Finding F-NWP-01 The NWP calculation process lacks a tracking and closure process for unverified assumptions, permits calculations based on unverified assumptions to be used in the implemented design basis for the facility, and provides inadequate control and accessibility of calculation records. (10 CFR 830, Subpart A and DOE-STD-1189-2008.)

Finding F-NWP-02 WP 09-CN3007, *Engineering Change Order Preparation and Design Document Change Control*, permits changes to the facility without documentation of the technical basis and justification for those changes. (10 CFR 830, Subpart A.)

Finding F-NWP-03 Fire suppression in Building 411 is outside of analyzed hydraulic conditions, and its performance cannot be assured. (10 CFR 830, Subpart B.)

Finding F-NWP-04 The basis of TSR 4.1.1.7, Pump Output, does not ensure the system's capability to meet DSA requirements. (10 CFR 830, Subpart B.)

Finding F-NWP-05 The document control and records handling processes do not adequately control the creation and maintenance of records and do not provide sufficient accessibility to support facility operations. (10 CFR 830, Subpart A.)

7.0 OPPORTUNITIES FOR IMPROVEMENT

This EA review identified 19 OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are suggestions offered by the EA review team that may assist site management in implementing best practices, or provide potential solutions to minor issues identified during the review. In some cases, OFIs address areas where program or process improvements can be achieved through minimal effort. It is expected that the responsible line management organizations will evaluate these OFIs and accept, reject, or modify them as appropriate, in accordance with site-specific program objectives and priorities.

OFI-NWP-01 Consider extending design verification requirements to encompass changes to safety-related SSCs to augment the design review process and provide additional validation of design inputs in the absence of a checking process.

OFI-NWP-02 Consider creating electronic record copies of all calculations when they are issued and establishing EDMS as the official source of those records.

OFI-NWP-03 Consider enhancing WP 09-12, *Evaluation of Technical Operability Adequacy of Facility Systems, Structures, and Components*, to provide direction beyond boilerplate requirements including specific direction as to what considerations might be appropriate in developing an assessment of operability.

OFI-NWP-04 Consider revising the WP 09-CN3025, *Annual System Health/Walkdown/ Requalification* system health report format to include:

- Corrective action reports
- Trending of all active components
- Evaluation of present performance against past performance
- Identification of potential degradation
- Evaluation of vibration monitoring for rotating equipment
- More frequent health assessments for safety-related systems.

OFI-NWP-05 Consider performing a comprehensive technical adequacy review of calculations used to support or demonstrate compliance with the safety bases and calculations performed in support of design changes to safety related SSCs.

OFI-NWP-06 Consider providing documented references to supporting calculations and analyses on design output drawings.

OFI-NWP-07 Consider adding identification of SS and SC system boundaries to related P&IDs.

OFI-NWP-08 Consider adding a reference to the legend drawing defining all P&ID symbols and providing the information necessary to construct complete instrument tags from instrument numbers to P&IDs.

OFI-NWP-09 Consider a project to update drawings to reflect the as-built configuration of underground facilities.

OFI-NWP-10 Consider evaluating the current condition of VU01 ducting, dampers, and supports for degradation that could compromise these SSCs' ability to perform their design functions under all postulated environmental conditions and challenges.

OFI-NWP-11 Consider providing additional guidance to CSEs regarding maintenance of the design basis and design basis ownership.

OFI-NWP-12 Consider revising SDDs to:

- Comply with DOE-STD-3024-2011.
- Incorporate a basis statement for each requirement.
- State unambiguous, technically accurate requirements.

OFI-NWP-13 Consider adding a design check process to the ECOs, in addition to design verification, in order to identify CM impacts.

OFI-NWP-14 Consider the following with regard to all facility records:

- Migrating all records to EDMS and using it as the official record source for all facility records and documents.
- Develop capability to enter electronic records into EDMS on site.
- Enhance record accessibility and availability by eliminating reliance on hard copy records of any type.

OFI-NWP-15 Consider revising affected procedures to place record copies of drawings into

EDMS to permit access by key plant personnel.

OFI-NWP-16 Consider revising the ECO closure process to require notification to drafting when ECOs are field complete and ready for incorporation.

OFI-NWP-17 Consider the need to establish an NWP procurement program expectation that storage and periodic PM requirements for procured equipment be established before components arrive on site.

OFI-NWP-18 Consider the need to reinforce the NWP procurement program expectation for potential seller competition by ensuring that future requisition requests for proposals include all known performance expectations important to qualification for award of the PO/subcontract.

OFI-NWP-19 Consider the need to revise the Dry De-duster System PO/subcontract, section 5.01, to remove or provide explanation for the need to discuss the Management Level determination for "The HIGH Profile Diesel/Electric Roof Bolters."

8.0 ITEMS FOR FOLLOW-UP

The seismic calculation for the exhaust duct elbow was not provided until after the review period ended and therefore was not included in the scope of this review. This calculation will be impacted by the addition of the IVS ducting and will be subjected to follow-up review.

Several discrepancies between drawings and actual field configuration were noted. This is a configuration control issue which will be subjected to follow-up review.

Appendix A
Supplemental Information

Dates of Review

Onsite Review: July 7-9, 2015
August 4-13, 2015

Office of Enterprise Assessments (EA) Management

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

Quality Review Board

William A. Eckroade
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Jeff Snook

EA Reviewers

Charles Allen - Lead
Timothy Martin
Gregory Teese

Appendix B
Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

AECOM-URS Energy & Construction Qualified Supplier Record, May 1, 2014
Dry Dedusting System requisition, request for proposals, August 5, 2014
IVS Design Basis Document, Revision 0
IVS Management Level Determination 1802, May 3, 2014
IVS Sole Source Justification, May 3, 2014
IVS Source/Receipt Inspection Verification Correspondence, March 30, 2015
IVS Statement of Work, June 4, 2014
NWP SSM Trip Report for SVS Ductwork weld inspections at RJR's contractor's facilities, June 26, 2015
NWP QA Inspection Report witnessing SVS Fan Assembly Factory Acceptance Testing, July, 7, 2015
Plan of the Day, July 31, 2015
Procurement Instructions, Revision 1
Purchase Specification for Dry De-duster System, 08-05-2014
Quality Clause List
Regulator Actuator Drawing SVS, October 23, 2007
RJR Engineering Qualified Supplier Record, January 23, 2015
Qualified Supplier List, June 26, 2015
SVS Combined NWP Review Comments, March 17, 2015
SVS Construction Mode Air Flow Diagram – information, February 2, 2015
SVS Design Review checklist d-DRAFT, May 19, 2015
SVS Design Review Meeting Minutes, May 18, 2015
SVS Fan Assembly section-info only,
SVS Management Level Determination, Revision 1
SVS Waste Handling Mode Air Flow Diagram – info, February 2, 2015
URS Oversight Report, IVS Project PP1, Inspection Trip Report, January 6, 2015
URS Source Inspection Filter Housing PP1 Inspection Trip Report, February 5, 2015
WIPP AHJ Determination for Combustible Controls for Building 413, Revision 3a
WIPP AHJ Determination of Combustible Controls for Interim Ventilation Installation, Revision 0
WIPP Interim Ventilation System Project Scope of Work, June 2014
WIPP Interim Ventilation Project QA Oversight Trip Report from Dave Maduras, URS, January 11, 2015
WIPP Interim Ventilation Project QA Oversight Trip Report from Dave Maduras, URS, February 19, 2015
WIPP Ventilation Projects Presentation Slides, February 5, 2015
97-D-510-01, *Seismic Evaluation Waste Isolation Pilot Plant Site Southeastern New Mexico,* Revision 1, December 8, 1978
AA:15:01062, *Submittal of the Revised NWP Safety Basis Strategy,* April 20, 2015
AR VR 001, *SVS Approved*, May 1, 2015
AR VR 001, *SVS Completed Appendix A (Data Sheet S-90 Underground Fan) and Fan Performance Curve,* May 1, 2015
AR VR 003-1, *Approved SVS Silencers*, March 2, 2015
AR VR 003-1, *SVS Request Approval of Selected Underground Fan Silencer,* March 2, 2015
AR VR 003-2, *SVS Request Approval General Arrangement Axial Fan Drawing #871 0735FOO,* Revision G, May 29, 2015
AR VR 003-3, *SVS Fan Regulator Drawings (revise),* April 14, 2015
AR VR 003-3, *SVS Request Approval Drawings of Damper Assembly and Linkage,* May 29, 2015
AR VR 003-4, *SVS Request Approval of Drawings*, June 24, 2015

AR VR 003-5, *SVS Inlet Bell and Diffuser,* May 8, 2015
AR VR 003-5, *SVS Request Approval "General Arrangement Inlet Bell & Diffuser Drawing,* May 29, 2015
AR VR 003-6, *SVS Request Approval of Drawings,* June 8, 2015
AR VR 003-6, *SVS Silencers Design Performance,* May 8, 2015
AR VR 003-7, *SVS Fan Views,* Revision A, May 11, 2015
AR VR 003-7, *SVS Request Approval of Drawings,* June 25, 2015
AR VR 003-8, *SVS Fan Skid,* Revision A, May 15, 2015
AR VR 003-8, *SVS Request Approval of Drawings,* May 29, 2015
AR VR 003-8-1, *SVS Drawings Conditionally Approved Pending Resolution of Red lines and Comments,* June 24, 2015
AR VR 003-8-2, *SVS Approved Drawings,* July 28, 2015
AR VR 003-8-3, *SVS Approved Drawings,* July 28, 2015
AR VR 003-9, *SVS Request Approval of Drawings,* June 26, 2015
AR VR 003-10, *SVS Request Approval of Calculation (NWP Underground Fan Skid Design),* June 26, 2015
AR VR 003-10-1, *SVS Approval of Calculation (NWP Underground Fan Skid Design,* June 29, 2015
AR VR 005, *SVS Fan Speed Analysis (original),* April 15, 2015
AR VR 005, *SVS Request Approval Calculation #CALC-15008-004, Rev. A. Supplemental Ventilation System (SVS) - Fan Speed Analysis,* May 5, 2015
AR VR 007-1 *Approved SVS VFD,* February 23, 2015
AR VR 007-1, *SVS Request Approval of Selected Fan VFD,* February 23, 2015
AR VR 007-2, *Approved SVS Motor,* February 23, 2015
AR VR 007-2, *SVS Request Approval of Selected Fan Motor,* February 23, 2015
AR VR 007-3, *SVS Approved Sola UPS,* March 23, 2015
AR VR 007-3, *SVS Request Approval of Selected UPS,* March 23, 2015
AR VR 008, *SVS Request Approval of Factory Acceptance Test Report,* Revision E, June 27, 2015
AR VR 008-1-1, *SVS Approval of Factory Acceptance Test Report,* Revision 0, July 22, 2015
AR VR 009, *SVS Request Approval of Manufacturing Schedule,* June 24, 2015
AR VR 010-1, *SVS Approved ControlLogix,* March 19, 2015
AR VR 010-1, *SVS Request Approval for Purchase of Selected PLC Controller,* March 19, 2015
AR VR 010-2, *SVS Request Approval of Drawings,* June 2, 2015
AR VR 010-2, *SVS Utility Drawings,* Revision B, May 11, 2015
AR VR 010-2-1, *SVS Approved Drawings,* July, 22, 2015
AR VR 010-2-2, *SVS Approved Drawings,* July, 22, 2015
AR VR 010-3, *SVS One Line Diagram,* Revision B, May 7, 2015
AR VR 010-3, *SVS Request Approval of Drawings,* June 2, 2015
AR VR 010-4, *SVS Control Panel,* Revision 8, May 7, 2015
AR VR 012, *SVS Approved Instrument Data Sheets,* May 1, 2015
AR VR 012, *SVS Instrument Data Sheets,* March 31, 2015
AR VR 14-2, *Approved submittal of SVS Securing and Shipping Procedure,* June 29, 2015
AR VR 015, *SVS Spare Parts,* Revision A, May 8, 2015
AR VR 023, *SVS Conditionally Approved, #CALC 15008-001 NWP Underground Fan Pressure Loss and Fan Performance Curve,* May 1, 2015
AR VR 025, *SVS Control Strategy,* Revision 8, May 6, 2015
AR VR 026, *SVS V&ID,* Revision, May 6, 2015
AR VR 027, *SVS Input Output,* Revision C, May 8, 2015
AR VR 028, *SVS Instrument List,* Revision C, May 8, 2015
AR VR 029, *SVS Fan Logic* Revision A, May 6, 2015
AR VR 030, *SVS Wiring Diagrams,* May 8, 2015
AR VR 031, *SVS Architecture,* Revision B, May 7, 2015

AR VR 032, *SVS Loop Diagram,* Revision B, May 7, 2015
AR VR 033, *SVS Approved Control Schedule,* March 19, 2015
AR VR 034, *SVS Approved Fan Schedule,* March 19, 2015
AR VR 035, *SVS Instrument Accuracy,* May 11, 2015
AR VR 036, *SVS Cabinet Temperature,* May 14, 2015
AR VR 0118, *IVS Use-As-Is Uninspected Covered Weld,* February 3, 2015
AR VR 0119, *IVS Use-as-Is Fan Components Without CMTR After Added Inspection,* February 3, 2015
AR VR 0122, *IVS NCR SS Fan Shaft that was to be Mild Steel,* March 17, 2015
AR VR 0123, *IVS NCR Use-As·ls Fan Bolt Hole Spacing out of Tolerance,* March 17, 2015
AR VR 0128, *IVS Approval Variation Request,* March 2, 2015
AR VR 0131, *IVS NCR HEPA Filter Labels Lacked Required Info,* March 18, 2015
AR VR 0137, *IVS Testing Shall be 100% of the Total Fabricated Duct Weld Surface Area,* April 9, 2015
AR VR 0138, *IVS A Bubble Test may be Substituted for a Constant Pressure Test,* April 9, 2015
AR VR 0140, *IVS Proposed Changes in Damper Data Sheet,* April 9, 2015
AR VR 0142, *IVS Proposed Change to Carbon Steel Priming and Coating Specification,* April 10, 2015
AR VR 0149, *IVS NCR for Bent Skid Lifting Lugs,* June 12, 2015
AR VR 0176-2, *IVS NCR for Shipping Damage,* July 20, 2015
AR VR 0177-1, *IVS NCR Revision for Shipping Damage,* April 14, 2015
AR VR 0180-1, *IVS NCR Revision for ECO Weld Repairs,* July 9, 2015
AR VR 0184, *IVS NCR for Weld Rework,* July 17, 2015
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ASME AG-1-2012, *Code of Nuclear Air and Gas Treatment,* May 30, 2013
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CON 004, *Procurement Qualification Training,* Revision 6
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DOE/CBFO-14-0055, *Department of Energy Approval of the Underground Re-Entry Evaluation of the Safety of the Situation (ESS-2014-03, Revision 4),* August 4, 2014
DOE/CBFO-15-1304, *Department of Energy Approval to Delete Control Addressing Direct Frisk of Station A Filters from Active Evaluations of the Safety of the Situation,* February 11, 2015
DOE/CBFO-15-3551, *Review Plan for the Documented Safety Analysis and Technical Safety Requirements Waste Isolation Pilot Plant, WIPP-07-3372 & WIPP 07-3373 Revision 5,* April 28, 2015
DOE/WIPP 07-3372, *Waste Isolation Pilot Plant Documented Safety Analysis,* Revision 4
DOE/WIPP 07-3373, *Waste Isolation Pilot Plant Technical Safety Requirements,* Revision 4
DOE/WIPP 11-3467, *Safety Evaluation Report for Approval of DOE/WIPP 07-3372 Waste Isolation Pilot Plant Documented Safety Analysis, Revision 4 and DOE/WIPP 07-3373 Waste Isolation Pilot Plant Technical Safety Requirements Revision 4,* Revision 3
DOE/WIPP 14-3521, *Safety Evaluation Report for Approval of ESS-2014-01 WIPP Habitability Evaluation of the Safety of the Situation, Revision 1,* Revision 1
DOE/WIPP 14-3523, *Safety Evaluation Report for Approval of Safety Basis Supplement Shipping Container Venting Operations NS-SB-2014-01, Revision 0, Waste Isolation Pilot Plant Documented Safety Analysis DOE/WIPP 07-3372, Rev. 4, and Waste Isolation Pilot Plant Technical Safety Requirements DOE/WIPP 07-3373, Rev.4,* Revision 0
DOE/WIPP 14-3527, *Safety Evaluation Report for Approval of ESS-2014-03 Underground Re-Entry Evaluation of the Safety of the Situation, Revision 4,* Revision 3
DOE/WIPP 14-3527, *Safety Evaluation Report for Approval of Directed Page Changes to ESS-2014-03 Underground Re-Entry Evaluation of the Safety of the Situation, Revision 5,* Addendum 1 to Revision 3
DOE/WIPP 14-3528, *Safety Evaluation Report for Approval of ESS-2014-04 Impact of Underground Radiological Release On Surface Waste Handling In The Waste Handling Building Revision 0,* Revision 0
DOE/WIPP 14-3529, *Authority Approval Safety Evaluation Report for Approval of ESS-2014-06 Revision*

2 Addition of Auxiliary Air Source, Revision 0
DOE/WIPP 14-3530, *Authority Approval Safety Evaluation Report for Approval of ESS-2014-05 Revision 2 Change-out of Underground Ventilation System Filters,* Revision 1
DOE/WIPP 14-3531, *Safety Evaluation Report for Approval of ESS-2014-08 Revision 2 Temporary Outage of Underground Ventilation Revision 2,* Revision 2
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DOE/WIPP 14-3535, *Safety Evaluation Report for Approval of ESS-2014-09 Revision 1A Evaluation of the Safety of the Situation Bolting Operations and Panel/Room Closure,* Addendum 1 to Revision 0
DOE/WIPP 14-3541, *WIPP Subsidence Monument Leveling Survey 2014,* December 8, 2014
DOE/WIPP 15-3543, *Safety Evaluation Report for Approval of ESS-2014-10, Revision 0a Evaluation of the Safety of the Situation for Interim Ventilation System Construction and Installation,* Revision 0
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DR-2015-001, *Design Review Package SVS Fan,* Revision B
DR-2015-001, *Design Review Package SVS Fan Meeting Attendance List,* Revision B
DR 2015-01, *NWP Formal SVS Design Review Plan,* August 2, 2015
Drawing 1060FAN8-Model, January 27, 2015
Drawing 24-C-048-W, *Site Utilities Water Fire Water,* Revision AA
Drawing 38-S-001-W, *Salt Handling Shaft Hoist House Bldg. 384 Fire Protection Sprinkler System P & ID,* Revision D
Drawing 41-D-011-W1, *Waste Handling Facilities Facility Pallet Assembly Eqpt. No. 52-Z-002,* Revision J
Drawing 41-D-011-W2, *Waste Handling Facilities Facility Pallet Assembly Eqpt. No. 52-Z-002,* Revision D
Drawing 41-D-011-W3, *Waste Handling Facilities Facility Pallet Assembly Eqpt. No. 52-Z-002 A, B,* Revision A
Drawing 41-S-001-W, *TRUPACT Maintenance Building 412 Fire Protection Sprinkler System P & ID,* Revision M
Drawing 41-S-002-W, *Exhaust Filter Bldg. 413 Fire Protection Sprinkler System P & ID,* Revision H
Drawing 41-S-003-W1, *Waste Handling Building 411 Fire Protection Sprinkler System P & ID,* Revision L
Drawing 41-S-003-W2, *Waste Handling Building 411 Fire Protection Sprinkler System P & ID,* Revision R
Drawing 41-S-003-W3, *Waste Handling Building 411 Fire Protection Sprinkler System P & ID,* Revision D
Drawing 41-S-003-W4, *Waste Handling Building 411 Fire Protection Sprinkler System P & ID,* Revision L
Drawing 41 -Z-117-W2-2, *Interim Ventilation System,* March 24, 2015
Drawing 53-S-002-W, *Underground Fuel Station 2 Dry Chemical Fire Suppression/Detection System P & ID,* Revision F
EA09CN3007-1-0, *Engineering Change Order Form,* Revision 2
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EA09CN3040-1-0, *CGDI Evaluation Form,* Revision 3
EA13QA1003-1, *Source-Receipt Inspection Verification Sheet,* Revision 17
EA13QA1003-1, *SVS Source/Receipt Inspection Verification Sheet,* July 7, 2015
EA13QA1006-1-0, *QA Inspection Report,* Revision 4
EA15PC3609-3-0, *Certificate of Conformance Form,* Revision 3
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ECO 12686, *Removal of Battery Vent Hood in CH Bay,* October 7, 2010
ECO 13392, *Temporary Isolate Instrument Air to HEPA Filter Isolation Damper 413-HD-056-004,* March 27, 2014
ECO 13437, *Room Closure Bulkhead in Panel 7 Room 7 S2180 Exhaust,* September 9, 2014
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ECO 13449, *Design Requirements for the Interim Ventilation System,* July 8, 2014
ECO 13450, *Installation of Civil/Structural Components for the Interim Ventilation System Modification,* December 15, 2014
ECO 13456, *Updating Drawings for Configuration Control for HV01,* July 10, 2014
ECO 13458, *Configuration Management Changes to VU00/VU03 System Drawings,* July 29, 2014
ECO 13500, *Installation of New Electrical Utilities for Trailers 902, 903, and 904,* October 6, 2014
ECO 13503, *Creating Design Specification for IVS Control Strategy,* November 4, 2014
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ECO 13524, *Add 2 New Roof Bolters, and 2 New Forklifts, and Update CHAMPS Database,* November 3, 2014
ECO 13529, *Replacement of Power Supply for Fan Alarm in 412-CP-066-01,* October 21, 2014
ECO 13530, *Configuration Management Update of the VU02 System,* October 22, 2014
ECO 13544, *U/G Fire Suppression Vehicle,* November 6, 2014
ECO 13546, *Creating Design Specification D-0114 for the Design and Procurement of an Underground Fan System for the SVS,* November 20, 2014
ECO 13569, *Changes to WIPP Mine Ventilation Plan 00CD-0001 Rev. 37,* February 6, 2015
ECO 13584, *Replace 74-B-401 with New Bulkhead and Doors,* February 24, 2015
ECO 13589, *Numbering Dampers and Instrument Valves for HV04 HVAC and HEPAs,* March 3, 2015
ECO 13602, *Repairs to Bulkhead 313,* March 17, 2015
ECO 13605, *Provide Power to Supplemental Ventilation System in the Underground,* April 12, 2015
ECO 13606, *RM03 As-Built System Configuration Management,* February 24, 2015
ECO 13612, *Remove Bulkhead 74-B-410 at S1950/W155,* March 4, 2015
ECO 13614, *Revise Specification D-0114, Specification for Design & Procurement of an Underground Fan System for the SVS,* May 1, 2015
ECO 13619, *Update SDD CM00-PC-00,* April 9, 2015
ECO 13620, *Installation of Automatic Fire Suppression Systems,* April 15, 2015
ECO 13622, *Install New Bulkhead and Doors for Airlock at N215/W360 (AIS Drift),* May 21, 2015
ECO 13625, *Fabrication of Metal Detector Test Platform,* March 26, 2015
ECO 13629, *RM00 System Design Description Rev. 20,* March 24, 2015
ECO 13637, *Revision 3 to Specification E-H-011 for Underground CH Waste Transporters,* May 1, 2015
ECO 13659, *Documenting Engineering Equivalency Evaluation for 856/857 Mod and High Efficiency Filters,* June 1, 2015
ECO 13665, *25P-DP04/5 Update Drawings,* May 9, 2015
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ESS-2014-01, *WIPP Habitability Evaluation of the Safety of the Situation,* Revision 1
ESS-2014-03, *Underground Re-Entry Evaluation of the Safety of the Situation,* Revision 4
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ESS-2014-04, *Impact of Underground Radiological Release on Surface Waste Handling in the Waste Handling Building Evaluation of the Safety of the Situation,* May 6, 2014
ESS-2014-05, *Evaluation of the Safety of the Situation Change-out of Underground Ventilation System Filters,* Revision 2
ESS-2014-06, *Evaluation of the Safety of the Situation Addition of Auxiliary Air Source,* Revision 2

ESS-2014-08, *Evaluation of the Safety of the Situation Temporary Outage of Underground Ventilation,* Revision 2
ESS-2014-09, *Evaluation of the Safety of the Situation Bolting Operations and Panel/Room Closure,* Revision 2
ESS-2014-10, *Evaluation of the Safety of the Situation Interim Ventilation System Construction and Installation,* Revision 0a
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PO 503452, *Dry De-Duster System*, February 5, 2015
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PRELIM SHT 3-043115 *Skid Details*
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SDD-CM00-PC00, *Plant Monitoring and Communications System Design Description (SDD),* Revision 20
SDD-ED00, *Electrical System (ED00) System Design Description (SDD),* Revision 11
SDD-EM00, *Environmental Monitoring (EM00) System Design Description (SDD),* Revision 12
SDD-FP00, *Fire Protections System (FP00) System Design Description (SDD),* Revision 19

SDD-HV00, *Heating, Ventilation and Air Conditioning System Design Description (SDD),* Revision 16
SDD-PT00, *Packaging and Transportation System (PT00) System Design Description (SDD),* Revision 8
SDD-RM00, *Radiation Monitoring (RM00) System Design Description (SDD),* Revision 20
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Interviews
Chief Nuclear Engineer
Compressed Air Cognizant System Engineer
Configuration Management Engineer
Configuration Management Manager
CBFO Program Manager
Deputy Engineering Manager/Acting Process System Engineering Manager
Design Engineering Manager
Design Support Supervisor
Dry De-duster Contract Subcontractor Technical Representative
Electrical Distribution Cognizant System Engineer
Engineering Manager
Engineering Program Performance Assurance Manager
Fire Protection Engineer
Fire Protection Engineering Manager
Fire Suppression System Cognizant System Engineer
Interim Ventilation System Cognizant System Engineer
Interim Ventilation System Contract Subcontractor Technical Representative
Mine Ventilation Consultant
Nuclear Safety Manager
Process Equipment Engineering Manager
Procurement Services Manager
Project Engineering Manager
Quality Assurance Oversight Program Manager
Site Procurement Services Manager

Special Facilities Cognizant System Engineer
Supplemental Ventilation System Contract Subcontractor Technical Representative
Underground and Surface Surveying Cognizant System Engineer
Underground Hoisting System Cognizant System Engineer
Underground Ventilation System Cognizant System Engineer
Ventilation Exhaust Monitor Cognizant System Engineer
Waste Handling Equipment Cognizant System Engineer

Observations
Walkdown of Compressed Gas Storage Locations with Cognizant Engineer
Walkdown of Underground Hoisting Equipment and Control Rooms with Cognizant Engineer
Walkdown of Waste Handling Building HEPA Filtration Systems with Cognizant Engineer
Walkdown of Waste Handling Building with Safety System Oversight Representative
Walkdown of VU01 Above Ground Ventilation System Ducting and Equipment with Cognizant Engineer