UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 E. LAMAR BLVD.
ARLINGTON, TX 76011-4511

June 10, 2016

Mr. Adam C. Heflin, President and
Chief Executive Officer
Wolf Creek Nuclear Operating Corporation
P.O. Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION – NRC COMPONENT DESIGN BASES INSPECTION REPORT 05000482/2016007

Dear Mr. Heflin:

On April 28, 2016, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Wolf Creek Generating Station. On April 28, 2016, the NRC inspectors discussed the results of this inspection with Mr. J. McCoy, Vice President, Engineering, and other members of your staff. Inspectors documented the results of this inspection in the enclosed inspection report.

NRC inspectors documented four findings of very low safety significance (Green) in this report. All of these findings involved violations of NRC requirements. The NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest the violations or significance of these NCVs, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator, Region IV; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC resident inspector at the Wolf Creek Generating Station.

If you disagree with a cross-cutting aspect in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the Regional Administrator, Region IV; and the NRC resident inspector at the Wolf Creek Generating Station.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390, “Public Inspections, Exemptions, Requests for Withholding,” of the NRC's "Rules of Practice and Procedure," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records (PARS) component of the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Thomas R. Farnholtz, Branch Chief
Engineering Branch 1
Division of Reactor Safety

Docket No. 50-482
License No. NPF-42

Enclosure:
Inspection Report 05000482/2016007
w/Attachment: Supplemental Information

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Letter to Adam C. Heflin from Thomas R. Farnholtz, dated June 10, 2016

SUBJECT: WOLF CREEK GENERATING STATION – NRC COMPONENT DESIGN BASES INSPECTION REPORT 05000482/2016007

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U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Docket:	05000482
License:	NPF-42
Report No.:	05000482/2016007
Licensee:	Wolf Creek Nuclear Operation Corporation
Facility:	Wolf Creek Generating Station
Location:	1550 Oxen Lane NE Burlington, KS 66839
Dates:	March 28 through April 28, 2016
Team Leader:	C. Smith, Reactor Inspector
Inspectors:	A. Palmer, Senior Technology Instructor W. Sifre, Senior Reactor Inspector J. Watkins, Reactor Inspector
Accompanying Personnel:	G. Nicely, Contractor Beckman and Associates M. Yemini, Contractor, Beckman and Associates
Approved By:	Thomas R. Farnholtz, Chief, Engineering Branch 1 Division of Reactor Safety

Enclosure

SUMMARY

IR 05000482/2016007; 03/28/2016 – 04/28/2016; Wolf Creek Generating Station Baseline Inspection, NRC Inspection Procedure 71111.21, “Component Design Bases Inspection.”

The inspection activities described in this report were performed between March 28, 2016, and April 28, 2016, by three inspectors from the NRC’s Region IV office, one inspector from the NRC’s Technical Training Center, and two contractors. Four findings of very low safety significance (Green) are documented in this report and all four of these findings involved violations of NRC requirements. The significance of inspection findings is indicated by their color (Green, White, Yellow, or Red), which is determined using Inspection Manual Chapter 0609, “Significance Determination Process.” Their cross-cutting aspects are determined using Inspection Manual Chapter 0310, “Aspects Within the Cross-Cutting Areas.” Violations of NRC requirements are dispositioned in accordance with the NRC‟s Enforcement Policy. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, “Reactor Oversight Process.”

Cornerstone: Mitigating Systems

Green. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, “Design Control,” which states, in part, “The design control measures shall provide for verifying or checking the adequacy of design, such as by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program.” Specifically, prior to April 28, 2016, the licensee failed to verify the adequacy of the design of the Class 1E electrical equipment, because it failed to perform adequate analyses demonstrating 1) that the degraded voltage relay setpoints specified in technical specifications would ensure adequate voltage to safety-related equipment, 2) adequate voltage would be available to the safety-related loads during transient voltage conditions caused by load sequencing, and 3) that the degraded voltage relay-associated time delays provide timely separation from offsite power and transfer to the emergency diesel generator to ensure that the Class 1E safety-related loads can achieve their safety function without protective device tripping. In response to these issues, the licensee performed preliminary analyses to demonstrate that the Class 1E electrical equipment would function at degraded voltages and was operable. This finding was entered into the corrective action program as Condition Reports 47791, 104253, 104098, 104389, and 104390.

The team determined the licensee’s failure to ensure the adequacy of the design of the Class 1E electrical equipment was a performance deficiency. The performance deficiency was more-than-minor, and therefore a finding, because it related to the design control attribute of the Mitigating Systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee’s electrical analyses failed to verify degraded voltage relay setpoints specified in technical specifications would ensure adequate voltage to safety-related equipment, that adequate voltage would be available to the safety-related loads during transient voltage conditions caused by load sequencing, and that degraded voltage relay time delays would provide timely separation from offsite power and transfer to the emergency diesel generator to ensure that the Class 1E safety-related loads can achieve their safety function without protective device tripping. In accordance with

Inspection Manual Chapter 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated July 19, 2012, the finding screened as having very low safety significance (Green) because it was a design or qualification deficiency that did not to result in loss of operability or functionality; did not represent an actual loss of safety function of the system or train; did not result in the loss of one or more trains of non-technical specification equipment; and did not screen as potentially risk-significant due to seismic, flooding, or severe weather. This finding did not have a cross-cutting aspect because the most significant contributor did not reflect current licensee performance. (Section 1R21.2.1)

- Green. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," which states, in part, "The design control measures shall provide for verifying or checking the adequacy of design, such as by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program." Specifically, prior to April 28, 2016, the licensee failed to verify the adequacy of the design of the fuel oil transfer pump control circuitry to ensure that the thermal overloads associated with the fuel oil transfer pump would not activate, trip the pump, and render the emergency diesel generator inoperable in the case of excessive cycling. In response to this issue, the licensee conducted a preliminary evaluation of the fuel oil transfer pump and confirmed there is not any significant active leakage on the day tank which would lead to excessive cycling, and that starting currents are sufficiently below the thermal overload trip settings and are unlikely to trip the pump. Additionally, the licensee planned to initiate a program to determine fuel oil leakage from the day tank and require operators to initiate interim corrective actions until final corrective actions can be determined. This finding was entered into the licensee's corrective action program as Condition Report 104066.

  The team determined the failure to evaluate the effects of cyclical fuel oil transfer pump operation was a performance deficiency. The performance deficiency was more-than-minor, and therefore a finding, because it related to the design control attribute of the Mitigating Systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the design of the fuel oil transfer pump control circuity does not prevent activation of the pump thermal overloads that would trip the pump and render the emergency diesel generator inoperable in the event of cyclical operation of the fuel oil transfer pump. In accordance with Inspection Manual Chapter 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated July 19, 2012, the finding screened as having very low safety significance (Green) because it was a design or qualification deficiency that did not represent a loss of operability or functionality; did not represent an actual loss of safety function of the system or train; did not result in the loss of one or more trains of non-technical specification equipment; and did not screen as potentially risk-significant due to seismic, flooding, or severe weather. This finding did not have a cross-cutting aspect because the most significant contributor did not reflect current licensee performance. (Section 1R21.2.16.b)

  Green. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," which states, in part, "The design control measures shall provide for verifying or checking the adequacy of design, such as by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program." Specifically, prior to April 28, 2016, the licensee failed to verify the design of the essential service water piping because the analyses assumed that the essential service water piping upstream of the containment air coolers was full of water after a loss of offsite power. However, the essential service water pump check valve was never tested to ensure water would not drain from the essential service water piping. In response to this issue, the licensee conducted a preliminary evaluation using data from the last surveillance test and inspection of the check valve, and concluded that the worst-case expected leakage through the check valve was not large enough to cause a water hammer event in the piping that exceeded operability criteria. This finding was entered into the licensee's corrective action program as Condition Reports 104222 and 104184.

The team determined that the failure to verify the adequacy of the design of the essential service water piping was a performance deficiency. The performance deficiency was more-than-minor, and therefore a finding, because it related to the design control attribute of the Mitigating Systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the failure to account for check valve leakage in the essential service water system led to a non-conservative assumption that the piping upstream of the containment air coolers would not drain after a loss of offsite power, which contributes to water hammer events that could challenge the integrity of the piping. In accordance with Inspection Manual Chapter 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated July 19, 2012, the finding screened as having very low safety significance (Green) because it was a design or qualification deficiency that did not represent a loss of operability or functionality; did not represent an actual loss of safety function of the system or train; did not result in the loss of one or more trains of non-technical specification equipment; and did not screen as potentially risk-significant due to seismic, flooding, or severe weather. This finding was assigned a cross cutting aspect in the area of problem identification and resolution, specifically operating experience, because the water hammer issue was previously documented in several NRC inspection reports, the licensee made recent modifications to the system, and a 'companion' check valve in the normal service water system was installed and correctly categorized in the inservice testing basis document. The operating experience cross-cutting aspect requires that the licensee systematically and effectively collects, evaluates, and implements relevant internal and external operating experience in a timely manner [P.5]. (Section 1R21.2.17.b)

- Green. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," which states, in part, "Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected." Specifically, prior to April 28, 2016, the licensee failed to correct deficiencies identified in 2012 for operator time critical actions associated with control room habitability; in 2013 after revising training materials for control room habitability time critical actions; in a 2014 condition report documenting the failure to validate scenarios in the time critical action program; and again in a 2015 self-assessment of the time critical action program. During the inspection, five out of six operators in a test crew failed to complete the control room habitability scenario within the required two minutes. In response to this finding, the licensee performed just-in-time training to remediate the crews and ensure time critical actions can be met. After re-training, each crew successfully performed the control room habitability time critical action within the two-minute requirement. This finding was entered into the licensee's corrective action program as Condition Reports 103910, 103915, and 103658.

- The team determined the failure to correct the deficiencies with the control room habitability time critical action was a performance deficiency. The performance deficiency was more-than-minor, and therefore a finding, because it related to the human performance attribute of the Mitigating Systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, operators failed to meet the time critical action for the control room habitability scenario within the required two minutes. In accordance with Inspection Manual Chapter 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated July 19, 2012, the finding screened as having very low safety significance (Green) because it was a design or qualification deficiency that did not represent a loss of operability or functionality; did not represent an actual loss of safety function of the system or train; did not result in the loss of one or more trains of non-technical specification equipment; and did not screen as potentially risk-significant due to seismic, flooding, or severe weather. This finding had a cross-cutting aspect in the area of human performance associated with training because the licensee failed to provide training and ensure knowledge transfer to maintain a knowledgeable, technically competent workforce and instill nuclear safety values [H.9]. (Section 1R21.4.b)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

This inspection of component design bases verifies that plant components are maintained within their design basis. Additionally, this inspection provides monitoring of the capability of the selected components and operator actions to perform their design basis functions. As plants age, modifications may alter or disable important design features making the design bases difficult to determine or obsolete. The plant risk assessment model assumes the capability of safety systems and components to perform their intended safety function successfully. This inspectable area verifies aspects of the Initiating Events, Mitigating Systems, and Barrier Integrity cornerstones for which there are no indicators to measure performance.

1R21 Component Design Basis Inspection (71111.21)

.1 Overall Scope

To assess the ability of the Wolf Creek Generating Station equipment and operators to perform their required safety functions, the team inspected risk-significant components and the licensee's responses to industry operating experience. The team selected risk-significant components for review using information contained in the Wolf Creek Generating Station probabilistic risk assessments and the U. S. Nuclear Regulatory Commission's (NRC) standardized plant analysis risk model. In general, the selection process focused on components that had a risk achievement worth factor greater than 1.3 or a risk reduction worth factor greater than 1.005. The items selected included components in both safety-related and nonsafety-related systems including pumps, circuit breakers, heat exchangers, transformers, and valves. The team selected the risk-significant operating experience to be inspected based on its collective past experience.

To verify that the selected components would function as required, the team reviewed design basis assumptions, calculations, and procedures. In some instances, the team performed calculations to independently verify the licensee's conclusions. The team also verified that the condition of the components was consistent with the design basis and that the tested capabilities met the required criteria.

The team reviewed maintenance work records, corrective action documents, and industry-operating experience records to verify that licensee personnel considered degraded conditions and their impact on the components. For selected components, the team observed operators during simulator scenarios, as well as during simulated actions in the plant.

The team performed a margin assessment and detailed review of the selected risk-significant components to verify that the design basis have been correctly implemented and maintained. This design margin assessment considered original design issues, margin reductions because of modifications, and margin reductions identified as a result of material condition issues. Equipment reliability issues were also considered in the selection of components for detailed review. These included items such as failed performance test results; significant corrective actions; repeated maintenance; 10 CFR 50.65(a)1 status; operable, but degraded, conditions; NRC resident inspector input of problem equipment; system health reports; industry operating experience; and licensee problem equipment lists. Consideration was also given to the uniqueness and complexity of the design, operating experience, and the available defense in-depth margins.

The inspection procedure requires a review of 15 to 25 total samples that include risk-significant and low design margin components, components that affect the large early release frequency, and operating experience issues. The sample selection for this inspection was 16 components, 1 component that affects large early release frequency, and 5 operating experience items. The selected inspection and associated operating experience items supported risk-significant functions including the following:

a. Electrical power to mitigation systems: The team selected several components in the electrical power distribution systems to verify operability to supply alternating current (ac) and direct current (dc) power to risk-significant and safety-related loads in support of safety system operation in response to initiating events such as loss of offsite power, station blackout, and a loss-of-coolant accident with offsite power available. As such the team selected:

- 4.16 kV switchgear NB002
- 480 V motor control center NG002A
- Emergency diesel generator NE002
- Transformers No. 2 XNB02 and No. 5 XNB05
- 125 Vdc bus NK04
- Pressurizer pressure operated relief valve solenoid BBPCV0456A
- Essential service water “A” (ESWA) pump room supply fan GDCGD01A
- Thermal barrier cooling flow transmitter BBFT0017
- Diesel fire pump pressure switch 1PSFP003

b. Components that affect large early release frequency: The team reviewed components required to perform functions that mitigate or prevent an unmonitored release of radiation. The team selected the following components:

- Reactor containment structure

c. Mitigating systems needed to attain safe shutdown: The team reviewed components required to perform the safe shutdown of the plant. As such the team selected:

- Turbine-driven auxiliary feedwater pump PAL02
- Residual heat removal pump DPEJ01A
- Safety injection motor-operated valves HV8801A, HV8801B
- Control room and switchgear air conditioning systems

- Emergency diesel fuel oil transfer pump PJE01A
- Essential service water pump PEF01B (and associated piping modification)

.2 Results of Detailed Reviews for Components:

.2.1 4.16 kV Class 1E Switchgear NB002:

a. Inspection Scope

The team reviewed the updated safety analysis report, design basis documents, current system health report, selected drawings, maintenance and test procedures, and condition reports associated with 4.16 kV class 1E switchgear NB002 to ensure design basis requirements and specifications were met. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Component maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Calculations for electrical distribution, system load flow/voltage drop, short-circuit, and electrical protection to verify that bus capacity and voltages remained within minimum acceptable limits

- Protective device settings and circuit breaker ratings to ensure adequate selective protection coordination of connected equipment during worst-case short circuit conditions

- Degraded and loss of voltage relays and associated time delays were set in accordance with calculations, and that associated calibration procedures were consistent with calculation assumptions, associated time delays and set point accuracy calculations

- Selected portions of the licensee response to NRC Generic Letter (GL) 2006-02, "Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power," dated February 1, 2006

- Coordination and interface with the transmission system operator for plant voltage requirements and notification set points were reviewed

- Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry and vendor guidance

- Corrective action documents and system health reports to determine whether there were any adverse operating trends and to assess the station's ability to evaluate and correct problems

- Visual non-intrusive inspection to assess material condition, the presence of hazards, and consistency of installed equipment with design documentation and analyses.

b. Findings

Inadequate Degraded Voltage Analyses of Class 1E Systems

Introduction. The team identified several examples of a Green non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to verify the adequacy of the design of the Class 1E electrical equipment. Specifically, the licensee failed to perform adequate analyses demonstrating that:

a. Degraded voltage relay setpoints specified in technical specifications would ensure adequate voltage to safety-related equipment

b. Adequate voltage would be available to the safety-related loads during transient voltage conditions caused by load sequencing

c. Degraded voltage relay time delays provide timely separation from offsite power and transfer to the emergency diesel generator to ensure that the Class 1E safety-related loads can achieve their safety function without protective device tripping

Description. In 2011, the NRC issued Regulatory Issue Summary (RIS) 2011-12, "Adequacy of Station Electric Distribution System Voltages," to clarify voltage studies necessary for determining the proper settings for degraded voltage relays. Regulatory Issue Summary 2011-12 provided the NRC staff's position for the licensee's transmission network/offsite power system design to meet the requirements of General Design Criterion 17 to 10 CFR Part 50, Appendix A.

The team identified the following five examples of the performance deficiencies in electrical calculations that contributed to the failure of the licensee to verify and assure adequate voltages to safety-related equipment during a degraded voltage condition and/or design basis event with offsite power available in accordance with the guidelines in RIS 2011-12:

Example 1: Electrical calculation XX-E-009 failed to ensure that all safety-related loads, motors, and motor-operated valves have adequate starting and/or operating voltage when the 4160 V safety buses are operated at the Technical Specification 3.3.5.3 minimum degraded voltage dropout setpoint. The calculation did not address starting voltage capability for motors that may be started after load sequencing is completed when voltages on the bus may be slightly above the degraded voltage dropout setting. The use of higher 4160 V voltages associated with minimum grid voltage and degraded voltage relay reset point is non-conservative and would predict load terminal voltages higher than previously analyzed. After identification the licensee entered the issue into the corrective action program as Condition Report 47791.

Example 2: Electrical calculation XX-E-012 failed to ensure that safety-related control circuits have adequate voltage to pick up and operate when the 4160 V safety buses are operated at the Technical Specification 3.3.5.3 minimum degraded voltage dropout setpoint. The use of 4160 V associated with minimum grid voltage and degraded voltage relay reset point is non-conservative and would predict higher control circuit voltages than would actually exist; therefore, the control circuit contactors may not have adequate voltage to energize. After identification the licensee entered the issue into the corrective action program as Condition Report 104253.

Example 3: Electrical calculation XX-E-006 failed to perform analysis to ensure that sequenced low voltage safety-related motors and motor-operated valves have adequate starting voltage during minimum voltage dips during design basis accident load sequencing of large upstream 4160 V safety-related motors when on offsite power. The use of steady-state voltages instead of transient voltages is non-conservative and would predict higher voltages than would actually exist; therefore, the motors may not have adequate voltage to energize until after the upstream 4160 V starting motors have accelerated. The licensee also failed to evaluate the potential time delay or stall torque heating impact for affected motor-operated valves on the updated final safety analysis report accident analyses. After identification, the licensee entered the issue into the corrective action program as Condition Report 104098.

Example 4: Electrical calculation XX-E-012 failed to perform analysis to ensure that the motor control center (MCC) control circuits have adequate pickup and operating voltage for sequenced safety-related motors and motor-operated valves during minimum voltage dips during design basis accident load sequencing of large upstream 4 kV safety-related motors load sequencing when on offsite power. The use of steady-state voltages instead of transient voltages is non-conservative and would predict higher control circuit voltages than would actually exist; therefore, the control circuit contactors may not have adequate voltage to energize until after the upstream 4160 V starting motors have accelerated. The licensee also failed to evaluate the potential time delay impact for affected motor-operated valves on the updated final safety analysis report accident analyses. After identification the licensee entered the issue into the corrective action program as Condition Report 104098.

Example 5: Electrical calculation XX-E-009 failed to perform analysis to ensure that protective devices for safety-related loads during a degraded voltage condition for both the accident and non-accident time delays associated with Technical Specification 3.3.5.3 will not prevent the safety-related loads from performing their safety function upon transfer to the emergency diesel generator. For a sustained degraded voltage between the degraded voltage dropout setting and the loss of voltage setting, motors may be damaged or stall and trip out on overcurrent conditions, potentially resulting in unavailability of required safety loads during an event and may require manual operator actions to reset those protective devices. After identification the licensee entered the issue into the corrective action program as Condition Reports 47791 and 104390.

<u>Analysis</u>. The team determined the licensee's failure to ensure the adequacy of the design of the Class 1E electrical equipment was a performance deficiency. The performance deficiency was more-than-minor, and therefore a finding, because it related

to the design control attribute of the Mitigating Systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee's electrical analyses failed to verify degraded voltage relay setpoints specified in technical specifications would ensure adequate voltage to safety-related equipment, that adequate voltage would be available to the safety-related loads during transient voltage conditions caused by load sequencing, and that degraded voltage relay time delays would provide timely separation from offsite power and transfer to the emergency diesel generator to ensure that the Class 1E safety-related loads can achieve their safety function without protective device tripping. In accordance with Inspection Manual Chapter 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated July 19, 2012, the finding screened as having very low safety significance (Green) because it was a design or qualification deficiency that did not to result in loss of operability or functionality; did not represent an actual loss of safety function of the system or train; did not result in the loss of one or more trains of non-technical specification equipment; and did not screen as potentially risk-significant due to seismic, flooding, or severe weather. This finding did not have a cross-cutting aspect because the most significant contributor did not reflect current licensee performance.

<u>Enforcement</u>. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," which states, in part, "design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program." Contrary to the above, the licensee failed to provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Specifically, prior to April 28, 2016, the licensee failed to verify the adequacy of the design of the Class 1E electrical equipment, because it failed to perform adequate analyses demonstrating 1) that the degraded voltage relay setpoints specified in technical specifications would ensure adequate voltage to safety-related equipment, 2) adequate voltage would be available to the safety-related loads during transient voltage conditions caused by load sequencing, and 3) that the degraded voltage relay-associated time delays provide timely separation from offsite power and transfer to the emergency diesel generator to ensure that the Class 1E safety-related loads can achieve their safety function without protective device tripping. In response to these issues, the licensee performed preliminary analyses to demonstrate that the Class 1E electrical equipment would function at degraded voltages and was operable. This finding was entered into the corrective action program as Condition Reports 47791, 104253, 104098, 104389, and 104390. Because this finding was of very low safety significance and has been entered into the licensee's corrective action program, this violation is being treated as a non-cited violation, consistent with Section 2.3.2.a of the NRC Enforcement Policy: NCV 05000482/2016007-01, "Inadequate Degraded Voltage Analyses of Class 1E Systems."

.2.2 480 V Safety-Related Motor Control Center NG002A

a. Inspection Scope

The team reviewed the updated safety analysis report, design basis documents, the current system health report, selected drawings, maintenance and test procedures, and condition reports associated with motor control center NG002A to ensure design basis requirements and specifications were met. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Component maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Calculations for electrical distribution, system load flow/voltage drop, short-circuit, and electrical protection to verify that bus capacity and voltages remained within minimum acceptable limits

- Protective device settings and circuit breaker ratings to ensure adequate selective protection coordination of connected equipment during worst-case short circuit conditions

- Calculations for the motor control center control circuit voltage drop and motor-operated valves terminal voltage and associated mechanical design torque and thrust for selected motor-operated valves

- Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry and vendor guidance

- Corrective action documents and system health reports to determine whether there were any adverse operating trends and to assess the station’s ability to evaluate and correct problems

- Visual non-intrusive inspection to assess material condition, the presence of hazards, and consistency of installed equipment with design documentation and analyses

b. Findings

No findings were identified.

.2.3 Emergency Diesel Generator NE002

a. Inspection Scope

The team reviewed the updated safety analysis report, design basis documents, the current system health report, selected drawings, maintenance and test procedures, and condition reports associated with emergency diesel generator NE002 to ensure design basis requirements and specifications were met. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Emergency diesel generator support component maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Loading calculations to determine whether the capacity of the emergency diesel generator is adequate to supply worst-case accident loads

- Voltage and frequency calculations and operating procedures to determine whether steady-state limits are adequate to assure the adequacy of power to load equipment

- Protective device settings and circuit breaker ratings to ensure adequate selective protection coordination of connected equipment during worst-case short circuit conditions

- Emergency diesel generator feeder breaker dc control calculations to ensure that the spring charging motor and breaker closing and trip coils have adequate voltage to operate at the end of battery discharge

- Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry and vendor guidance

- Last loss of offsite power/loss of coolant surveillance test to ensure that the voltage and frequency dips and recovery were within the RG 1.9 acceptable limits

- Corrective action documents and system health reports to determine whether there were any adverse operating trends and to assess the station’s ability to evaluate and correct problems

- Visual non-intrusive inspection to assess material condition, the presence of hazards, and consistency of installed equipment with design documentation and analyses

b. Findings

No findings were identified.

.2.4 ESF No. 2 Transformer XNB02 and No. 5 Transformer XNB05

a. Inspection Scope

The team reviewed the updated safety analysis report, design basis documents, the current system health report, selected drawings, maintenance and test procedures, and condition reports associated with the No. 2 transformer XNB02 and No. 5 transformer XNB05 to ensure design basis requirements and specifications were met. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Transformer maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry and vendor guidance

- No. 5 transformer the periodic testing and maintenance for the automatic load tap changers including supporting calculations to ensure adequate voltage to the control circuits and tap changer motor when required to operate

- Loading calculations to determine whether the capacity of the transformer is adequate to supply worst-case loading

- Voltage calculations and operating procedures to determine whether transformer taps and administrative controls for switchyard voltage were adequate to assure the availability of offsite power during accident conditions

- Corrective action documents and system health reports to determine whether there were any adverse operating trends and to assess the station's ability to evaluate and correct problems

- Visual non-intrusive inspection to assess material condition, the presence of hazards, and consistency of installed equipment with design documentation and analyses

b. Findings

No findings were identified.

.2.5 Safety-Related 125Vdc Bus NK04

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, the current system health report, selected drawings and calculations, maintenance and test procedures, and condition reports associated with safety-related 125 Vdc bus NK04. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Component maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Calculations for electrical distribution, system load flow/voltage drop to verify that bus capacity and voltages remained within minimum acceptable limits

- Sizing calculations to verify input assumptions, design loading, and environmental parameters are appropriate and that the distribution boards, batteries, and battery chargers are sized to perform the design basis function

- Procedures for preventive maintenance, inspection, thermography, and testing to compare maintenance practices against industry and vendor guidance

- Modifications made to the distribution boards

- Material condition of the dc distribution boards, batteries, battery chargers, to insure that design criteria and maintenance requirements are met

b. Findings

No findings were identified.

.2.6 Pressurizer Power Operated Relief Valve (PORV) Solenoid BBPCV0456A

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, the current system health report, selected drawings and calculations, maintenance and test procedures, and condition reports associated with the power operated relief valve solenoid BBPCV0456A. The team also reviewed photographs of the installed conditions of the equipment and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Component maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Design specifications, installation drawings, modifications, and upgrades made to the system

- Vendor manuals for installation and maintenance

- Procedures for preventive maintenance, procedures for operation, inspection, and testing to compare maintenance practices against industry and vendor guidance

b. Findings

No findings were identified.

.2.7 Essential Service Water “A” (ESWA) Pump Room Supply Fan GDCGD01A

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, the current system health report, selected drawings and calculations, maintenance and test procedures, and condition reports associated with the essential service water train A GDCGD01A pump room supply fan. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Maintenance and testing activities performed on the fan and associated dampers in accordance with industry standards

- Mechanical and material condition of fan, dampers, and associated control and power equipment

- Vendor manuals for installation and maintenance

- Procedures for preventive maintenance, procedures for calibrations, inspection, and testing to compare maintenance practices against industry and vendor guidance

b. Findings

No findings were identified.

.2.8 Thermal Barrier Cooling Flow Transmitter BBFT0017

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, the current system health report, selected drawings and calculations, maintenance and test procedures, and condition reports associated with thermal barrier cooling flow transmitter BBFT017. The team also reviewed photographic information pertaining to the installed equipment and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Maintenance and testing activities performed on the flow transmitter in accordance with industry standards

- Mechanical condition of the flow transmitter

- Replacement history

- Design specifications

- Installation drawings

- Vendor manuals for installation, maintenance, and testing of the flow transmitter

- Seismic and environmental qualifications and calculations for the installation of the flow transmitter, conduit, conduit supports, equipment seal assembly, and electrical conductor splicing methods to insure installation requirements met the design criteria for the environment of the equipment

b. Findings

No findings were identified.

.2.9 Diesel Fire Pump Pressure Switch 1PSFP003

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, the current system health report, selected drawings and calculations, maintenance and test procedures, and condition reports associated with pressure switch 1PSFP003 associated with the diesel-driven fire pump. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Maintenance and testing activities performed on the diesel-driven fire pump control panel and the associated pressure switch in accordance with industry standards

- Material condition of the diesel driven fire pump control panel, which is the enclosure for the pressure switch, to ensure the panel design criteria and maintenance requirements are met

- Design specifications

- Installation drawings

- Vendor manuals for installation, maintenance, and testing of the pressure switch and associated diesel driven fire pump control panel

b. Findings

No findings were identified.

.2.10 Reactor containment structure

a. Inspection Scope

The team reviewed the updated safety analysis report, design basis documents, the current system health report, selected drawings, maintenance and test procedures, and condition reports associated with the reactor containment building to ensure design basis requirements specification were met. The team also conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Reactor containment surveillance and testing procedures and results
- Reactor containment inspection results and corrective action documents
- Reactor containment worst-case pressure and temperature analysis for a main steam line break

b. Findings

No findings were identified.

.2.11 Turbine-driven auxiliary feedwater pump PAL02

a. Inspection Scope

The team reviewed the updated safety analysis report, design basis documents, the current system health report, selected drawings, maintenance and test procedures, and condition reports associated with turbine-driven auxiliary feedwater pump PAL02 to ensure design basis requirements specification were met. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Pump flow, head, and net positive suction head analyses
- Pump minimum flow and pump runout evaluations
- Preventive maintenance activities were verified to maintain the system according to manufacturer recommendations
- Surveillance test procedures and test results for the last three years and associated trend data
- Calculations associated with the transfer of suction from the condensate storage tank to the essential service water system

- Calculations and testing associated with the digital controls modification

b. Findings

No findings were identified.

.2.12 Turbine-driven auxiliary feedwater pump check valve ALV0054

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, the current system health report, selected drawings and calculations, maintenance and test procedures, and condition reports associated with turbine-driven auxiliary feedwater pump check valve ALV0054. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of the fuel transfer system to perform its safety-related design basis function. Specifically, the team reviewed:

- Check valve maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry benchmarks

- Vendor requirements established for the proper operation of the check valve to ascertain that the valve will operate as designed and to assure that the testability feature of the valve is properly executed

- Impact of reverse flow rate through the valve to verify that the established limits will not jeopardize pump operation

b. Findings

No findings were identified.

.2.13 Safety Injection Motor-Operated Valves HV8801A/HV8801B

c. Inspection Scope

The team reviewed the updated safety analysis report, design basis documents, the current system health report, selected drawings, maintenance and test procedures, and condition reports associated with safety injection motor-operated valves HV8801A, and HV8801B to ensure design basis requirements specification were met. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Valve diagnostic tests and validations for the past five years

- Valve and actuator replacement and maintenance records

- Valve modifications in response to generic communications on pressure locking.

- Motor calculations that establish the motor voltage drop, protection and coordination, motor biological hazard potential requirements, and short circuit for the motor power supply and feeder cables

- Calculations for the degraded voltage at the motor-operated valve terminals to ensure the proper voltage was utilized in the team's review of motor-operated valve torque calculations

- Calculations that establish motor-operated valve control circuit voltage drop, short circuit, and protection/coordination including thermal overload sizing and application

d. Findings

No findings were identified.

.2.14 Residual Heat Removal Pump DPEJ01A

a. Inspection Scope

The team reviewed the updated safety analysis report, design basis documents, the current system health report, selected drawings, maintenance and test procedures, and condition reports associated with residual heat removal pump DPEJ01A to ensure design basis requirements specification were met. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of this component to perform its desired design basis function. Specifically, the team reviewed:

- Pump flow, head, and net positive suction head analyses

- Pump minimum flow and pump runout evaluations

- Preventive maintenance activities were verified to maintain the system according to manufacturer recommendations

- Surveillance test procedures and test results for the last three years and associated trend data

b. Findings

No findings were identified.

2.15 Control room and switchgear air conditioning systems

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, the current system health report, selected drawings and calculations, maintenance and test procedures, and condition reports associated with control room and switchgear room heating, ventilation, and air conditioning systems. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of the fuel transfer system to perform its safety-related design basis function. Specifically, the team reviewed:

- The heat removal capability of each of the air conditioners to ascertain that it is capable of removing the entire heat load at the most demanding conditions

- Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry

- Vendor requirements established for the proper operation of the heating, ventilation, and air conditioning units to ascertain that they will operate as designed and that the limits established for them are not exceeded

- Impact of a loss of a component and operator actions required to bring it back to service

b. Findings

No findings were identified.

2.16 Emergency diesel fuel oil transfer pump PJE01A

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, the current system health report, selected drawings and calculations, maintenance and test procedures, and condition reports associated with emergency diesel generator fuel oil transfer pump PJE01A. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of the fuel transfer system to perform its safety-related design basis function. Specifically, the team reviewed:

- Component maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry

- Vendor requirements and limits established for the operation of the fuel oil transfer pumps to ensure that the pumps will operate as designed and to assure that specific limits of operation are not exceeded

- Thermal overloads protection for the fuel oil transfer pumps to assure that they remain available when needed

- Operator rounds and operator actions associated with the fuel oil transfer pumps and the fuel level in the day tank to verify that pump condition is monitored

- Day tank elevation, venting capability, and flame arrestors, as well as day tank level instruments and setpoints, to assure that the day tank remains available at all times containing sufficient amount of fuel oil and to assure that the pumps will not cycle excessively

b. Findings

Failure to Protect the Fuel oil Transfer Pump from Excessive Cycling.

Introduction. The NRC identified a Green non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to verify the adequacy of the design of the emergency diesel generator's fuel oil transfer pump. Specifically, the licensee failed to ensure the diesel fuel oil pump control circuitry would not activate the thermal overloads that would stop the pump and render the emergency diesel generator inoperable.

Description. The emergency diesel generator fuel oil transfer pump provides the motive force to transfer fuel oil from a large underground storage tank to a smaller day tank mounted above ground in the diesel generator building near the diesel engine. The fuel oil transfer pump control circuits receive start and stop signals from level switches in a standpipe located on top of the day tank. The volume of diesel fuel oil between the pump start and pump stop setpoints is small (approximately 1 gallon) compared to the flow rate of the fuel oil transfer pump (35 gallons per minute). If a low-level setpoint is reached on the day tank, the fuel oil transfer pump will start pumping fuel oil and operate for one or two seconds before it stops and shuts off when the level reaches the high-level setpoint of fuel oil. The configuration of the fuel oil transfer system allows for cyclical operation of the fuel oil transfer pump if fuel drains from the day tank. The NRC inspection team performed a review of day tank level. The data showed that the day tank was gradually leaking and, as expected, the pump cycled to keep the tank above the low-level setpoint. The licensee did not establish a limit on the number of fuel oil transfer pump starts per hour, nor were they able to get the information from the pump or motor manufacturer. Excessive cycling would eventually cause the thermal overloads associated with the fuel oil transfer pump to activate. There is no analysis to demonstrate that the thermal overloads will not trip the motor, which would stop pump operation and render the emergency diesel generator inoperable.

In 1994, the fuel oil transfer pump control circuitry was modified to bypass the day tank level setpoints and allow for continuous fuel oil transfer pump operation while the diesel engine was running. This modification was done to increase the reliability of the pump. However, in the standby configuration when the diesel engine is not running, the fuel oil transfer pump control circuitry still relies on the level setpoints to automatically start and start the pump which does not prevent excessive cycling.

Analysis. The team determined the failure to evaluate the effects of cyclical fuel oil transfer pump operation was a performance deficiency. The performance deficiency was more-than-minor, and therefore a finding, because it related to the design control attribute of the Mitigating Systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the design of the fuel oil transfer pump control circuity does not prevent activation of the pump thermal overloads that would trip the pump and render the emergency diesel generator inoperable in the event of cyclical operation of the fuel oil transfer pump. In accordance with Inspection Manual Chapter 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated July 19, 2012, the finding screened as having very low safety significance (Green) because it was a design or qualification deficiency that did not represent a loss of operability or functionality; did not represent an actual loss of safety function of the system or train; did not result in the loss of one or more trains of non-technical specification equipment; and did not screen as potentially risk-significant due to seismic, flooding, or severe weather. This finding did not have a cross-cutting aspect because the most significant contributor did not reflect current licensee performance.

Enforcement. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," which states, in part, "The design control measures shall provide for verifying or checking the adequacy of design, such as by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program." Contrary to the above, prior to April 28, 2016, the licensee failed to provide measures for verifying the adequacy of the design, such as by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Specifically, the licensee failed to verify the adequacy of the design of the fuel oil transfer pump control circuitry to ensure that the thermal overloads associated with the fuel oil transfer pump would not activate, trip the pump, and render the emergency diesel generator inoperable in the case of excessive cycling. In response to this issue, the licensee conducted a preliminary evaluation of the fuel oil transfer pump and confirmed there is not any significant active leakage on the day tank which would lead to excessive cycling, and that starting currents are sufficiently below the thermal overload trip settings and are unlikely to trip the pump. Additionally, the licensee planned to initiate a program to determine fuel oil leakage from the day tank and require operators to initiate interim corrective actions until final corrective actions can be determined. This finding was entered into the licensee's corrective action program as Condition Report 104066. This violation is being treated as an non-cited violation, consistent with Section 2.3.2.a of the Enforcement Policy. The violation was entered into the licensee's corrective action program as Condition Report 104066. (NCV 05000482/2016007-02, "Failure to Verify the Adequacy of Design of the Control Circuitry of the Fuel Oil Transfer Pumps.")

.2.17 Essential service water pump PEF01B and associated piping modifications

a. Inspection Scope

The team reviewed the updated safety analysis report, system description, design basis documents, selected drawings and calculations, procedures, and condition reports associated with the essential service water pumps and the recent modification installed to minimize the magnitude of a water hammer associated with loss of offsite power – with and without a loss-of-coolant accident. The team also performed walkdowns and conducted interviews with system engineering personnel to ensure the capability of the pump to perform its safety function and the capability of the modified discharge piping with the vacuum breakers and newly installed service water check valve to minimize the magnitude of a water hammer following a loss of offsite power. Specifically, the team reviewed:

- Pump maintenance history and corrective action program reports to verify the monitoring of potential degradation

- Corrective action documents issued in the past 5 years to verify that repeat failures, and potential chronic issues, will not prevent the essential service water pump and associated components from performing their safety function

- Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry and vendor guidance

- Testing methodology, the values assigned to acceptance criteria, and whether the values supported design parameters and assumptions

- Correspondence detailing the Wolf Creek response and commitments regarding Generic Letter 96-06 to verify that all actions were adequately implemented

- Water hammer analysis performed for the essential service water discharge piping (downstream of the containment fan coolers), taking credit for the modified piping, newly installed vacuum breakers and newly installed check valve to verify the adequacy of the analysis, and to ascertain that assumptions are adequate and that the correct design inputs were used

- Design of the vacuum breakers and the method used to test them to verify that the vacuum breakers will operate as designed and as assumed in piping analyses

- Performance record of the vacuum breakers, special actions taken to monitor excessive chattering, and accelerated maintenance due to chattering to ascertain that they will perform as designed when they are required to open

- Corrective actions associated with previous NRC violations on the subject of discharge piping water hammer analysis to verify that the licensee did not leave any issues outstanding

b. Findings

Inadequate analysis of essential service water piping

Introduction. The NRC identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, “Design Control,” for the licensee’s inadequate analysis associated with the essential service water piping. Specifically, the essential service water piping analyses incorrectly assumed the piping sections upstream of the containment air coolers were full of water.

Description. In 2015, the licensee modified the essential service water piping system to mitigate rapid pressure spikes known as water hammer events. During normal operations, normal service water supplies components in the essential service water system. During a loss of offsite power, normal service water pumps stop. Approximately thirty seconds later, after the emergency diesel generators start and power the emergency buses, the essential service water pumps start to provide cooling water to the essential service water loads. During these 30 seconds when no pumps are running, the essential service water system partially drains. The starting of the essential service water pumps rapidly fill the system, which leads to the rapid collapse of the voided (drained) piping sections with the inrush of water and causes water hammer. Such water hammer events have previously caused leaks in sections of essential service water piping. The NRC previously identified violations for the water hammer issues in Inspection Reports 05000482/2012007, 05000482/2010006, and 05000482/2009007. On November 26, 2014, NRC Region IV staff sent a letter to Wolf Creek summarizing the previous inspection findings and the licensee’s planned actions to address the water hammer issues in the essential service water system. A copy of this letter is available in ADAMS (Accession No. ML14330A485).

The 2015 modification added vertical pipe sections downstream of the containment air coolers with vacuum breaker vent valves at the high points. This modification mitigated some of the water hammer effects of the piping downstream of the containment air coolers by admitting air into the system to cushion the collapse that occurs as water encounters voided piping sections. However, the modification and associated analyses incorrectly assumed that the piping upstream of the containment air coolers was hydraulically locked (full of water).

The NRC reviewed the inservice testing basis document for the essential service water pump discharge check valves, component tag numbers EFV0001 (train A) and EFV0004 (train B), and found the valves are listed as “no safety function to close.” The check valves are required to close upon loss of offsite power to prevent the drainage of large sections of essential service water piping to avoid water hammer. Although the valves were listed as having no safety function to close, the inservice testing basis document specified that the leakage past the check valve would be acceptable provided that the associated essential service water pump shaft did not rotate backwards. However, the licensee was unable to quantify how much leakage it would take to rotate the pump shaft backwards. Previous operational experience from NRC inspection findings, as documented in Inspection Report 05000321/2012008 (ML12285A443), showed that the leakage required to rotate the pump backwards for a similar type service water pump was more than 3,000 gallons per minute. Further, because of the configuration of the piping system, the licensee did not have any guidance on how to discriminate leakage past the check valves and water leakage from the piping section upstream of the check valves. Since construction, the essential service water check valves were never tested in the closed position and, therefore, did not prevent drainage of essential service water piping.

In addition, the 2015 modification added check valves EFV0470 (train A) and EFV0471 (train B) in the normal service water piping system at the piping tee that cross-connects to the essential service water piping. The NRC reviewed the inservice testing basis document for valves EFV0470 and EFV0471 and noted the valves have leakage acceptance criteria in the closed position of less than 2.5 gallons per minute. The addition of valves EFV0470 and EFV0471 prevented leakage of water through the normal service water piping and pumps; however, water was still free to drain from the essential service water piping and pumps through the essential service water check valves EFV0001 and EFV0004.

Because the leakage past check valves EFV0001 and EFV0004 was greater than zero (and theoretically up to 3,000 gallons per minute to rotate the pump backwards), the analyses for the essential service water system incorrectly assumed the essential service water piping was full of water. As a result of this invalid assumption, the water hammer analyses were non-conservative because the voided sections of piping would cause larger water hammer pressure spikes compared to piping full of water.

Analysis. The team determined that the failure to verify the adequacy of the design of the essential service water piping was a performance deficiency. The performance deficiency was more-than-minor, and therefore a finding, because it related to the design control attribute of the Mitigating Systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the failure to account for check valve leakage in the essential service water system led to a non-conservative assumption that the piping upstream of the containment air coolers would not drain after a loss of offsite power, which contributes to water hammer events that could challenge the integrity of the piping. In accordance with Inspection Manual Chapter 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated July 19, 2012, the finding screened as having very low safety significance (Green) because it was a design or qualification deficiency that did not represent a loss of operability or functionality; did not represent an actual loss of safety function of the system or train; did not result in the loss of one or more trains of non-technical specification equipment; and did not screen as potentially risk-significant due to seismic, flooding, or severe weather. This finding was assigned a cross cutting aspect in the area of problem identification and resolution, specifically operating experience, because the water hammer issue was previously documented in several NRC inspection reports, the licensee made recent modifications to the system, and a 'companion' check valve in the normal service water system was installed and correctly categorized in the inservice testing basis document. The operating experience cross-cutting aspect requires that the licensee systematically and effectively collects, evaluates, and implements relevant internal and external operating experience in a timely manner [P.5].

Enforcement. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," which states, in part, "The design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program." Contrary to the above, prior to April 28, 2016, the licensee failed to verify or check the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. Specifically, the licensee failed to verify the design of the essential service water piping because the analyses assumed that the essential service water piping upstream of the containment air coolers was full of water after a loss of offsite power. However, the essential service water pump check valve was never tested to ensure water would not drain from the essential service water piping. In response to this issue, the licensee conducted a preliminary evaluation using data from the last surveillance test and inspection of the check valve, and concluded that the worst-case expected leakage through the check valve was not large enough to cause a water hammer event in the piping that exceeded operability criteria. This finding was entered into the licensee's corrective action program as Condition Reports 104222 and 104184. Because this finding was of very low safety significance and has been entered into the licensee's corrective action program, this violation is being treated as a non-cited violation, consistent with Section 2.3.2.a of the NRC Enforcement Policy: NCV 05000482/2016007-03, "Inadequate Analysis of Essential Service Water Piping."

.3 Results of Reviews for Operating Experience

.3.1 NRC Information Notice 2012-06, "Ineffective Use of Vendor Technical Recommendations"

a. Inspection Scope

The team inspected the licensee's review of NRC Information Notice 2012-06, "Ineffective Use of Vendor Technical Recommendations." The information notice described that the NRC's review of recent operating experience involving ineffective use of vendor technical recommendations indicates that many of these events potentially allow latent failures to exist undetected and become an underlying cause of risk-significant initiating events. Many, if not most, of these events are preventable. Ineffective use of vendor technical recommendations can cause or contribute to operational transients, scrams, and component failures. The team reviewed the licensee's evaluation of the potential impact of the identified issues to determine if the issues in the information notice were directly applicable to Wolf Creek Generating Station and that appropriate corrective actions were taken if applicable.

b. Findings

No findings were identified.

.3.2 NRC Information Notice 2012-16, "Pre-Conditioning of Pressure Switches before Surveillance Testing"

a. Inspection Scope

The team reviewed the licensee's evaluation of Information Notice 2012-16, "Pre-conditioning of Pressure Switches Before Surveillance Testing," to verify the licensee performed an applicability review and took appropriate corrective actions, if appropriate, to address the concerns. The team verified that the licensee's review adequately addressed the issues in the information notice.

b. Findings

No findings were identified.

.3.3 NRC Information Notice 2010-25, "Inadequate Electrical Connections"

a. Inspection Scope

The team reviewed the licensee's evaluation of Information Notice 2010-25, "Inadequate Electrical Connections," to verify the licensee performed an applicability review and took appropriate corrective actions, if appropriate, to address the concerns. The team verified that the licensee's review adequately addressed the issues in the information notice.

b. Findings

No findings were identified.

.3.4 NRC Information Notice 2015-05, "Inoperability of Auxiliary and Emergency Feedwater Auto-Start Circuits on Loss of Main Feedwater Pumps"

a. Inspection Scope

The team reviewed the licensee's evaluation of Information Notice 2015-05, "Inoperability of Auxiliary and Emergency Feedwater Auto-Start Circuits on Loss of Main Feedwater," to verify that a program was in place to address issues identified by the NRC staff concerning the operation of main feedwater systems in such a manner that would disable the automatic initiation of auxiliary or emergency feedwater on loss of all main feedwater pumps. The team verified that the licensee's review adequately addressed the issues in the information notice.

b. Findings

No findings were identified.

.3.5 NRC Information Notice 2014-07, "Degradation of Leak-Chase Channel Systems for Floor Welds of Metal Containment Shell and Concrete Containment Metallic Liner"

a. Inspection Scope

The team reviewed the licensee's evaluation of Information Notice 2014-07, "Degradation of Leak-Chase Channel Systems for Floor Welds if Metal Containment Shell and Concrete Containment Metallic Liner," to verify that a program was in place to address issues identified by the NRC staff concerning degradation of floor weld leak-chase channel systems of steel containment shell and concrete containment metallic liner that could affect leak-tightness and aging management of containment structures. The team verified that the licensee's review adequately addressed the issues in the information notice.

b. Findings

No findings were identified.

.4 Results of Reviews for Operator Actions

a. Inspection Scope

The team selected risk-significant components and operator actions for review using information contained in the licensee's probabilistic risk assessment. This included components and operator actions that had a risk achievement worth factor greater than two or Birnbaum value greater than 1E-6.

For the review of operator actions, the team observed operators during simulator scenarios associated with the selected components as well as observing simulated actions in the plant.

The selected operator actions were:

- Scenario 1 was designed to cause a failure of the pressurizer level control circuitry. The scenario was initiated by failing one controlling channel low and the other channel failed as-is. The crew manually controlled charging and letdown flow and stabilized the plant using applicable procedures. After the failed channel was de-selected from the controlling circuitry and the charging and letdown flows were balanced, the scenario and timed action was completed.

- Scenario 2, Part 1: The second scenario was a manual reactor trip following an anticipated transient without scram (ATWS). The event was initiated by a spurious turbine trip which should have resulted in a reactor trip at full power. The crew recognized a reactor trip was needed, did not occur, and initiated a manual reactor trip within the required time period.

- Scenario 2, Part 2: The second part of the second scenario was a failure of the manual reactor trip using the reactor trip switches. The crew manually removed power to the control rod drive motor generators from the control room in accordance with applicable procedures. After the rods fell into the core, the timed actions and scenario was completed.

- Scenario 3, Part 1: The first event is a trip of the operating component cooling water (CCW) pump and failure of the other CCW pump in that train to start, which resulted in a loss of CCW flow. The crew identified the loss of CCW flow, started a CCW pump in the other train, and transferred the inservice CCW loss of offsite power to the operating CCW loss of offsite power.

- Scenario 3, Part 2: Then the second part of the scenario was an inadvertent safety injection. The scenario ended within the required time frame when the operations crew terminated the inadvertent safety injection by closing the boron injection tank inlet and outlet valves.

- In-plant job performance measure: This job performance measure was designed for the control room operators to don self-contained breathing apparatus (SCBAs) for a toxic environment in the control room affecting habitability in accordance with Procedure OFN RP-013 within two minutes. This time critical action is described in the Updated Safety Analysis Report, Section 6.4.

b. Findings

Introduction. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," for the licensee's failure to correct deficiencies with time critical operator actions. Specifically, the inspectors determined that the licensee failed to correct deficiencies with the control room habitability operator actions identified in 2012 and identified that five out of six operators failed to meet the time requirements for a simulated control room habitability scenario as part of the inspection.

Description. The updated safety analysis report documents a requirement for operators to don portable respirators, known as self-contained breathing apparatus (SCBA), within two minutes of a toxic gas release that would affect the control room habitability. During the component design basis inspection, the NRC team observed a simulation of the toxic gas control room habitability scenario. The NRC team identified that five of six operators on one crew and one operator on a second crew failed to complete the required actions within the two minutes as required. The SCBA scenario was difficult because the time critical action program failed to adequately train and test the operators. Specifically, the licensee is currently transitioning from one brand SCBA to another brand SCBA. However, the new brand SCBA is not one-size-fits-all like the old brand, so depending on the operation crew composition, several new-style SCBAs are required in various sizes. Additionally, if operators require eye glasses, special corrective lenses had to be inserted into the SCBA mask. Finally, during previous SCBA time critical action drills, the SCBAs were either pre-staged in the simulator or the drill was conducted in a classroom setting that afforded ample space for maneuvering. The normal storage location of the portable SCBAs was not conducive to maneuvering.

The NRC team found that in 2012, the licensee identified a condition adverse to quality and generated a condition report because the SCBA time critical operator action drills performed in the simulator did not replicate the actual control room conditions. Specifically, the portable SCBAs were pre-staged and easily accessible, rather than the actual conditions in the control room where the SCBAs are stored in a narrow passageway. The corrective action for the simulator fidelity issue was to revise the training given to operators and the condition report was closed. However, in 2013, the SCBA time critical operator action was performed in a classroom setting, rather than the simulator. In 2014, the licensee generated another condition report because the time critical actions were not being properly validated. In response to the 2014 condition report, the procedure for validating time critical operator actions was revised and the action was closed. In October 2015, the station performed a component design bases self-assessment (SA-2015-0107) and concluded that "simulator scenario time critical actions are tracked for performance, although unofficially."

Analysis. The team determined the failure to correct the deficiencies with the control room habitability time critical action was a performance deficiency. The performance deficiency was more-than-minor, and therefore a finding, because it related to the human performance attribute of the Mitigating Systems cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the licensee did not take timely corrective actions to resolve time critical action program deficiencies associated with the control room habitability scenario, which resulted in a test crew's failure to meet the two minute time requirement. In accordance with Inspection Manual Chapter 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At Power," dated July 19, 2012, the finding screened as having very low safety significance (Green) because it was a design or qualification deficiency that did not represent a loss of operability or functionality; did not represent an actual loss of safety function of the system or train; did not result in the loss of one or more trains of non-technical specification equipment; and did not screen as potentially risk-significant due to seismic, flooding, or severe weather. This finding had a cross-cutting aspect in the area of human performance associated with training because the licensee failed to provide training and ensure knowledge transfer to maintain a knowledgeable, technically competent workforce and instill nuclear safety values [H.9].

Enforcement. The team identified a Green, non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," which states, in part, "Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected." Contrary to the above, the licensee failed to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances were promptly identified and corrected. Specifically, prior to April 28, 2016, the licensee failed to correct deficiencies identified in 2012 for operator time critical actions associated with control room habitability; in 2013 after revising training materials for control room habitability time critical actions; in a 2014 condition report documenting the failure to validate scenarios in the time critical action program; and again in a 2015 self-assessment of the time critical action program. During the inspection, five out of six operators in a test crew failed to complete the control room habitability scenario within the required two minutes. In response to this finding, the licensee performed just-in-time training to remediate the crews and ensure time critical actions can be met. After re-training, each crew successfully performed the control room habitability time critical action within the two-minute requirement. This finding was entered into the licensee's corrective action program as Condition Reports 103910, 103915, and 103658. Because this finding was of very low safety significance and has been entered into the licensee's corrective action program, this violation is being treated as a non-cited violation, consistent with Section 2.3.2.a of the NRC Enforcement Policy: NCV 05000482/2016007-04, "Failure to Promptly Correct Deficiencies With Operator Time Critical Actions."

4. OTHER ACTIVITIES

Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity

4OA2 Problem Identification and Resolution (71152)

The team reviewed action requests associated with the selected components, operator actions, and operating experience notifications. Any related findings are documented in prior sections of the report.

4OA6 Meetings, Including Exit

Exit Meeting Summary

On April 28, 2016, the inspectors presented the inspection results to Mr. J. McCoy, Vice President, Engineering, and other members of the licensee staff. The licensee acknowledged the issues presented. The licensee confirmed that any proprietary information reviewed by the inspectors had been returned or destroyed.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

D. Dandreo, Supervisor, Design
J. Ernest, Mechanical Design
N. Good, Licensing
K. Hinterweger, Mechanical Design
R. Hobby, Licensing
A. Jamar, Electrical Design
V. Kanal, Electrical Design
B. Ketchum, Risk Assessment
J. Knust, Licensing
D. Mand, Manager, Design
J. McCoy, Vice President, Engineering
B. Meyer, Operations
B. Muilenburg, Supervisor, Licensing
B. Schafer, Civil Design
R. Sims, Operations
C. Williams, Electrical Design

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

05000482/2016007-01	NCV	Inadequate Degraded Voltage Analyses of Class 1E Systems (Section 1R21.2.1.b)
05000482/2016007-02	NCV	Failure to Verify the Adequacy of Design of the Control Circuitry of the Fuel Oil Transfer Pumps (Section 1R21.2.16.b)
05000482/2016007-03	NCV	Inadequate Analysis of Essential Service Water Piping (Section 1R21.2.17.b)
05000482/2016007-04	NCV	Failure to Promptly Correct Deficiencies With Operator Time Critical Actions (Section 1R21.4.b)

LIST OF DOCUMENTS REVIEWED

Calculations

Number	Title	Revision Date
NK-E-001	125 Vdc Class 1E Battery System Sizing, Voltage Drop and Short Circuit Studies	4
03-73.0-F	Conduit Supports	1
03-73.0-F	Conduit Supports	2
E-100-00017	Environmental Qualification Test Report of Raychem WCSF-N In-Line Bolted Splice Assemblies for Raychem Corporations	W01
J-301-00086	Qualification Report for Conduit Seal Model 353 C Rosemount Report No. D83000152 Revision D	W03
E-15000	Electrical Cable and Raceway List	67
EM-M-017	Thrust / Torque Calculation for EMHV8801A, EMHV8801B, EMHV8803A, EMHV8803B	8
SA-91-011	Analysis of Equipment Cables / Surface Temperature During a Main Steamline Break Accident	0
AL-M-017	Hydraulic Calculation for Addition of Turbine-Driven Auxiliary Feedwater Pump Standby Tanks (TAL01A, TAL01B, & TAL01C)	1
AN-97-004	Updated Containment Pressure and Temperature Response Analysis for the Limiting Loss-of-Coolant Accident (LOCA) Scenario, Accounting for Additional Time Delay for Fan Coolers Activation	0
AN-05-016	Wolf Creek MSLB Containment Temperature and Pressure Response Analyses with GOTHIC for the MSIV / MFIV Replacement Project	0
AL-19	Auxiliary Feedwater System – Calculate the Design Downstream Pressure for Use in Sizing the Pump Minimum Flow Restriction Orifices	0
AL-02	Auxiliary Feedwater System – Calculate the Turbine-Driven Auxiliary Feedwater Flow Requirements to Determine the Flow Requirements of the Pump and its Turbine Drive to be Included in the Equipment Specification	0
10466-M-021	Design Specification for Auxiliary Feedwater Pumps and Turbine Drive for Standardized Nuclear Unit Power Plant System	December 26, 1979

Calculations

Number	Title	Revision Date
AL-M-021	Establishment of the Auxiliary Feedwater (AFW) Pump Comprehensive Test Error Allowances and Minimum Operability Limit Curves	0
AL-02-W	AFW System – Maximum Allowable Recirculation Flow for Motor Driven Pumps PAL01A and PAL01B	0
AL-20	Turbine-Driven Auxiliary Feedwater Pump – Determine the Total Head for the Turbine-Driven Auxiliary Feedwater Pump at the Design Conditions and at the Low Main Steam Pressure Condition	September 23, 1983
AL-16-W	Determine the NPSH of the Auxiliary Feedwater Pumps with Dissolved Nitrogen in the Condensate Storage Tank	1
EJ-M-058	Establishment of the Residual Heat Removal (RHR) Pump Comprehensive Test Error Allowance and Minimum Operability Limit Curve	0
95-0313	Margin Optimization for Motor-Operated Valves EMHV8801A, EMHV8801B, EMHV8803A, EMHV8803B	0
M-JE-321	Emergency Diesel Storage Tank and Day Tank Volumes and Level Limits	2
25707-000-M0C-WS-00001	ESWS Replacement Piping System Design Pressure and Temperature	5
EF-M-0076	Hydraulic Analysis for ESW System Following a Loss of Offsite Power	3
EF-M-078	Evaluation of Wolf Creek ESW System Modification During LOOP [loss of offsite power] LOCA Conditions	1
GK-M-001	Cooling and Heating Load Calculation for Control room HVAC System Capabilities, Normal and Emergency Operation	3
GK-M-011	Cooling and Heating Load for Control Building Class 1E Electrical Equipment Areas During Normal Operation	0
GD-234	Essential Service Water Pump House	1
AN-97-004	Containment Pressure and Temperature Response Analysis for the Limiting LOCA Scenario Impact of Containment Cooler Replacement and ESW Water Hammer Mitigation Modification	0
XX-E-004	AC Motor-Operated Valve (MOV) Minimum Terminal Voltage	13

Calculations

Number	Title	Revision Date
XX-E-006	AC System Analysis	7
XX-E-009	System NB Under/Degraded Voltage Relay Setpoints	0
XX-E-012	MCC Control Circuit Allowable Wire Lengths	3
XX-E-018	Determination of Nominal Torque for MOVs	0
EM-M-017	Thrust/Torque Calculation for EMHV8801A/B	8
WCNOC-171	Associated Circuit Study	3
H-08	System NB Protective Relays	5
NE-E-001	Emergency Diesel Generator Transient Load Analysis	0

Drawings

Number	Title	Revision Date
E-020-00007	General Electric Class 1E Separation Group 4 NK 44	4
E-020-00009	NK54, 182C69615-9 Sheet 14	W08
E-020-00018	NK04, 182C69615-9 Sheet 8	W14
E-020-0024-03	Wiring Diagram NK 44	2
E-11NK01	Class 1E 125 VDC System Meter and Relay Diagram	17
E-11NK02	Class 1E 125 VDC System Meter and Relay Diagram	13
KD-7496	One Line Diagram	59
E-013	Electric Motor Data Sheet Appendix B 10466-M-619.2-089-01	2
E-K3GD01	Schematic Diagram ESW Pump Room Supply Fan A	7
E-K3EF01	Schematic Diagram Essential Service Water Pump A	21
E-K3EF11	In Service and Spare Cables to ESW Pump house	18
E-K3GD03	Schematic Diagram ESW Pump Room Exhaust Dampers	4
E-K3GD04	Schematic Diagram ESW Pump Room Miscellaneous Circuits	7
M-619.2-0242-05	ESW Ventilation Fan Motor Curves	NA
M-619.2-087-01	Westinghouse Electric ESW Ventilation Fan Motor Data Sheet 10466	NA

Drawings

Number	Title	Revision Date
J-110-00569	ESW Pumphouse HVAC System Air Supply and Recirculation Control	W06
J-110-0563	ESW Pumphouse HVAC System Air Supply and Recirculation Control	W06
J-110-00935	Auxiliary Feedwater System Auxiliary Feedwater Flow Steam Generator D	W06
M-627A-0175-01	American Warming and Ventilating NH-91 and NH-92 Single Phase Actuator Wiring Diagram	NA
J-K2GDO1(Q)	Essential Service Water Pump House HVAC Supply Fans	5
M-619.2-0007	Buffalo Forge Co. Type-S Adjustax Vane Axial Fans Arrangement No. 4	6
M-619.2-00040	ESW Pump House Supply Vane axial Fan Data Sheet Appendix A	7
M-619.2-108	Westinghouse Electric Corporation AC Motor FQ #324 TC2Type 'T' Non-Ventilated for ESW Supply Fan	1
CS33613C-N34551A	Schematic Diagram FD4 Diesel Engine Fire Pump Controller Sheet 1 of 2	1
E-1005-FP03	Schematic Diagram Diesel Fire Pump	34
M-12BB02	Piping and Instrumentation Diagram Reactor Coolant System	23
M-12BB03	Piping and Instrumentation Diagram Reactor Coolant System	15
E-13NB13	Schematic Diagram Class 1E Bus NB01 Feeder Breaker 152NB0109	7
E-13NE10	Schematic Diagram 4.16 kV Diesel Generator Feeder Breaker 152NB0111	20
D01137	Schematic Diagram WCNOC Release 2 Breakers	April 25, 2005
E-13NB15	Schematic Diagram Class 1E Bus NB02 Feeder Breaker 152NB0212	7
E-13NE11	Schematic Diagram 4.16 kV Diesel Generator Feeder Breaker 152NB0211	17
E-17000A Sheet 5	Termination of Selected Class 1E Devices W/Pigtails	15

Drawings

Number	Title	Revision Date
E-17000A Sheet 5B	Termination of Selected Class 1E Devices W/Pigtails	17
E-1R8900 Sheet 36B	Raceway Notes, Symbols, and Details	28
M12AL01	Piping and Instrumentation Diagram Auxiliary Feedwater System	28
M-19EF13	Hanger location Drawing Small Pipe ESW System	8
M-13EF19	Piping Isometric ESW System A & B Trains Vertical Loops	2
E-13JE01	Schematic Diagram Emergency Fuel oil Transfer Pump	7

Vendor Manuals

Number	Title	Revision Date
M-021A-00011	Instruction Manual for Terry Turbine Digital Controls Replacement / Retrofit	February 13, 2013
M-021-00061	Instruction Manual for Auxiliary Feedwater Pumps	April 2, 2015
M-223F-004	Operation and Maintenance Manual for Crispin Model VR-41 Vacuum Relief Check Valve	W01
M-620-00154	Coil Performance Topical Report	W02

Design Change Packages

Number	Title	Revision Date
CCP 09116	Margin Optimization for Motor-Operated Valves EMHV8801A, EMHV8801B, EMHV8803A, EMHV8803B	0
EM-M-017-008-CN001	Calculation Change Notice: Enhances Actuator Output Capacity Via a Gear Modification for MOVs EMHV8801A and EMHV8803B	September 17, 1999
CCP 013613	PFSSD - Install Meggitt Fire Resistive Cable to Protect BNHV8812B Control Circuit	3
012957	Install Turbine-Driven Auxiliary Feedwater Pump Standby Tanks	19
012958	Turbine-Driven Auxiliary Feedwater Pump Control Modification	13

Design Change Packages

Number	Title	Revision Date
SA-90-064	Analysis Issues with the Current LOCA Mass and Energy Releases	1
AN-97-004-CN004	Updated Containment Pressure and Temperature Response Analysis for the Limiting LOCA Scenario, Accounting for Additional Time Delay for Fan Coolers Activation	0
AN-97-004-CN003	Containment Temperature and Pressure Response Analysis for the Limiting LOCA Scenario, Impact of Containment Cooler Replacement and ESW Water Hammer Modification	0
AN-97-004-CN002	Updated Containment Pressure and Temperature Response Analysis for the LOCA Scenarios, Based Upon Revised Mass & Energy Releases with Consideration of Additional Time Delay for Fan Cooler Activation and Initial Containment Temperature Uncertainty	0
AN-97-004-CN001	Updated Containment Pressure and Temperature Response Analysis for the Limiting LOCA Scenario, Accounting for Additional Time Delay for Fan Cooler Activation & Initial Containment Temperature Uncertainty	0
AN-05-016-CN005	Wolf Creek MSLB Containment Pressure and Temperature Response Analysis with GOTHIC for the MSIV / MFIV Replacement Project, Impact of Containment Cooler Replacement and ESW Water Hammer Mitigation Modification	0
AN-05-016-CN004	Wolf Creek MSLB Containment Pressure and Temperature Response Analyses with GOTHIC for the MSIV/MFIV Replacement Project	0
AN-05-016-CN003	Updated MSLB Containment Pressure and Temperature Response Analyses for the Limiting Cases, Accounting for the Uncertainty of the Initial Containment Temperature	0
AN-05-016-CN002	Linking with the New Calculation that Establishes the Tube-Plugging Criterion for the Containment Fan Coolers as Part of the Disposition of Condition Report # 2007-003499	0
AN-05-016-CN001	Containment Pressure and Temperature Response of the Limiting MSLB Scenarios, Assuming no Fan Coolers Operation	0

Design Change Packages

Number	Title	Revision Date
M-021-04	Evaluate Material Changes made by Hydroaire During Refurbishment Activities to an Auxiliary Feedwater Pump Rotating Assembly	13
M-021-03	Approve a material change which also requires allowing the ASME B&PV Code Section III 1974 Edition Summer 1975 Addenda	13
EJ-30-CN002	RHR Pumps A & B NPSH	3
AL-30-WC-CN004	AFW System Setpoints: Pump Suction Pressure; Automatic ESW Switchover; and CST Low Level	3
04253	Change Package, Emergency Fuel Oil Pump Logic Change	July 28, 1997
15-024-GK	SGK05B/B Class 1E Air conditioning Unit	0

Procedures

Number	Title	Revision Date
AP 21-001	Conduct of Operations	76
AP 15C-001	Procedure Writers Guide	28
AP 21-004	Operator Response Time Program	4B
AI 21-016	Operator Time Critical Actions Validation	11
AI 21-017	Timed Fire Protection Actions Validation	2
STN TCA-001	Manual Time Critical Action Timing	4
ALR 00-032C	PZR LO LEV DEV	12
ALR 00-052C	CCW to RCP FLOW LO	13A
OFN EG-004	CCW System Malfunctions	18A
OFN SB-008	Instrument Malfunctions	44
BD-OFN SB-008	Instrument Malfunctions	13
OFN RP-013	Control Room Not Habitable	19
OFN RP-17	Control Room Evacuation	48
EMG E-0	Reactor Trip or Safety Injection	38
BD EMG E-0	Reactor Trip of Safety Injection	26A

Procedures

Number	Title	Revision Date
EMG FR-S1	Response to Nuclear Power Generation/ATWS	23
BD EMG FR-S1	Response to Nuclear Power Generation/ATWS	13
GT1245302	Self-Contained Breathing Apparatus User	14
SA-2015-0107	2015 CDBI Self-Assessment	February 29, 2016
I-ENG-005	Infrared Thermography	4
I-ENG-005	Infrared Thermography	9
STS NB-005	Breaker Alignment Verification	27
STS NB-005	Breaker Alignment Verification	28
MPE BA-007	DC Distribution Bus Inspection	4
MGE TL-001	Wiring Termination and Lug/Connector Installation	22
MGE TL-002	Infrequently Performed Wiring Termination and Lug/Connector Installation	4
STS-NB-005	Breaker Alignment Verification	28
MPE ML-001	Motor Sampling and Lubrication PM Activity on Various Equipment	14
STN FP-209	Fire Pump Performance and Sequential Start Test	24
STN FP-209	Fire Pump Performance and Sequential Start Test	26
INC C-1003	Calibration of Transmitters	8B
STN FP-211	Diesel Fire Pump 1FP01PB Monthly Operation and Fuel Level Check	35
STS BB-204	RCS Inservice Valve Test	15
STS BB-204	RCS Inservice Valve Test	16
STS IC-463	Channel Calibration Reactor Coolant Pump (RCP) a Thermal Barrier Coolant Flow Instrumentation Loop BB LPF-0017	4
29765	NK044 – 125 Volt DC Distribution Board Inspection and Thermography	
29767	NK054 – 125 Volt DC Distribution Board Inspection, Cleaning, and Thermography	
SYS1408801	Site Building HVAC Training Manual	10

Procedures

Number	Title	Revision Date
SYS1408801	Site Building HVAC Training Manual	11
STN FP-209	Fire Pump Performance Test	December 3, 2013
STN FP-209	Fire Pump Performance Test	June 14, 2014
STN FP-209	Fire Pump Performance Test	June 17, 2015
PQE-J-301-P01	Plant Qualification Evaluation of Electrical Equipment Rosemount Pressure and Differential Transmitters Models 1153 Series D With Code P or R Electronics and 1154 With Code R Electronics	1
PQE-J-301-P03	Plant Qualification Evaluation of Electrical Equipment Rosemount Conduit Seal, Model 353 C	0
PQE-E-01013-P06	Plant Qualification Evaluation of Electrical Equipment In-Line Bolted Connections and Splices	0
PMR 02377	Plant Modification Verification	December 1988
E-100-00003	Raychem WCSF-N In-Line Splice Application Guide	1
STS EM-205B	Train B Safety Injection System Inservice Valve Test	0
STS EM-205A	Train A Safety Injection System Inservice Valve Test	0
STS EM-205	Safety Injection System Valve Test	5
MPM LT-001	Limitorque Operator Minor Maintenance, Lubrication, and Inspection	14
MGE LT-099	MOV Diagnostic Testing	13
MGE LT-008	Routine Electrical Limitorque Operator Maintenance	7
STS BN-206	Borated Refueling Water Storage System Inservice Valve Test	21
STS BN-206	Borated Refueling Water Storage System Inservice Valve Test	23
STS AL-211	Turbine-Driven Auxiliary Feedwater System Flow Path Verification and Inservice Check Valve Test	34
STS EJ-100	RHR System Inservice Pump A Test	50
STS EJ-100A	RHR System Inservice Pump A Test	51

Procedures

Number	Title	Revision Date
STS PE-018	Containment Integrated Leakage Rate Test	9
STS PE-265	Containment Structure Surface Inspection	3
STS MT-044	Containment Tendon Inspection	8
STS AL-103	TDAFW Pump Inservice Pump Test	66
STS AL-211	TDAFW Comprehensive Pump Testing, Flow Path Verification & CV Testing	38
STS-EF-100A	ESW System Inservice Pump A & ESW A CV Testing	44
STS PE-10A	Control room A/C System Flow Rate Verification A Train	3A
STS PE-10B	Control room A/C System Flow Rate Verification B Train	3
STS KJ-15A	Manual/Auto Fast Start, Synch and Loading of EDG NE01	39
STS-EF-100B	ESW System Inservice Pump B and ESW B CV Testing	47

Miscellaneous

Number	Title	Revision Date
M-223F	Design Specification for 150 Pound Air and Vacuum Check Valves 2-1/2 inches and Larger Carbon Steel ASME Section III	4
10884/10786	Design Specification for ESW Pumps	8
n/a	50.59 Evaluation for DCP 13424, ESW Water Hammer Mitigation- Hydraulic Analysis	1
M-10JE	System Description – Emergency Fuel Oil System	2
ET 15-0025	Letter, Wolf Creek to the US NRC, Response to Generic Letter 96-06	October 20, 2015
OE GK-15-015	SGK 05B – B Class IE Air Conditioning Unit	0
M-610.2 (Q)	Technical Specification for Miscellaneous Safety-Related Fans	11
WCRE-34	Fourth 10 Year Interval Inservice Testing Basis Document	2

Condition Reports

72165	92106	51789	70256	29389
103767	56945	96084	63362	92412
102211	65624	104251	104243	103560
102983	103666	65653	100129	94616
102984	91424	65606	31039	65624
102988	101902	99965	99768	99301
101020	102728	102518	95547	84388
63776	42227			

Condition Reports (CRs) Generated During the Inspection

104427	104322	104323	104268	104269
104266	104267	104264	104243	104251
104253	104249	104239	104222	104208
104184	104175	104139	104135	104098
104063	104073	104066	103984	103952
103931	103915	103918	103910	103916
103902	47791	103904	103909	103906
103864	103845	103849	103767	103801
103822	102947	103736	103733	103735
103724	103732	103697	103698	103560
103658	103666	103642	104389	104390

Work Orders

15-400613-000	15-704407-000	15-704408-000	15-704409-000	12-360808-000
87-04890	10-326222-000	98-200874-000	10-327547-000	07-296838-000
10-333701-000	13-365864-000	14-393892-000	14-390597-003	11-337794-002
13-380491-000	08-304083-000	10-335509-000	03-256319-001	06-290427-000
98-200874-000	11-344968-000	03-256388-000	15-398948-002	15-398946-001
98-127663-013	98-127663-014	98-127663-015	11-339003-005	11-339003-008
11-339003-009	11-339003-010	11-339003-011	11-339003-012	11-339003-013
11-339003-014	11-339003-015	11-339003-016	11-339003-017	11-339003-017

Work Orders

11-339003-018	11-339003-019	11-339003-020	11-339003-021	11-339003-022
11-339003-023	11-339003-024	11-339003-025	11-339003-026	11-339003-027
11-339003-028	11-339003-030	11-339003-032	11-339003-033	11-339003-034
11-339003-035	11-339003-036	11-339003-039	11-339003-042	11-339003-044
11-339003-045	11-339003-049	11-339003-050	11-339003-052	11-339003-054
11-339003-055	11-339003-056	11-339003-057	11-339003-059	05-272120-000
05-272120-001	05-271995-000	05-271995-001	00-218803-000	00-218803-001
00-218803-002	00-218803-003	00-218803-004	00-218803-005	00-218803-006
00-218803-007	15-400311-000	15-398502-000	15-399771-000	14-391500-000
14-387808-000	14-387808-001	13-379127-000	14-383601-000	13-375010-000
13-373618-000	13-373618-001	13-372352-000	13-366999-000	13-365489-021
12-351167	13-379452	10-324537	08-302303	13-379454
12-352718	11-345794	15-401308	13-379453	