UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
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December 18, 2017

Mr. Richard Bologna
Site Vice President
First Energy Nuclear Operating Company
Beaver Valley Power Station
P. O. Box 4
Shippingport, PA 15077-0004

SUBJECT: BEAVER VALLEY POWER STATION, UNITS 1 AND 2
DESIGN BASES ASSURANCE INSPECTION REPORT 05000334/2017007
AND 05000412/2017007

Dear Mr. Bologna:

On November 17, 2017, the U.S. Nuclear Regulatory Commission (NRC) completed a team inspection at Beaver Valley Power Station (BVPS), Units 1 and 2, and discussed the inspection results with Mr. Mark Manoleras, Engineering Director, and other members of your staff. The results of this inspection are documented in the enclosed report.

In conducting the inspection, the team examined the adequacy of selected components and modifications to mitigate postulated transients or accidents, maintain containment integrity, and minimize the potential for initiating events. The inspection involved field walkdowns, examination of selected procedures, calculations and records, and interviews with station personnel.

This report documents one finding of very low safety significance (Green) which was also determined to involve a violation of NRC requirements. The NRC is treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2.a of the NRC's Enforcement Policy.

If you contest the violation or significance of the NCV, 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 I; the Director, Office of Enforcement; and the NRC Senior Resident Inspector at BVPS. This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC's Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Mel Gray, Chief
Engineering Branch 1
Division of Reactor Safety

Docket Nos. 50-334 and 50-412
License Nos. DPR-66 and NPF-73

Enclosure:
Inspection Report 05000334/2017007 and 05000412/2017007
w/Attachment: Supplementary Information

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SUBJECT: BEAVER VALLEY POWER STATION – DESIGN BASES ASSURANCE INSPECTION REPORT 05000334/2017007 and 05000412/2017007 DATED DECEMBER 18, 2017

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REGION I

Docket No.	50-334 and 50-412
License No.	DPR-66 and NPF-73
Report No.	05000334/2017007 and 05000412/2017007
Licensee:	FirstEnergy Nuclear Operating Company (FENOC)
Facility:	Beaver Valley Power Station (BVPS), Units 1 and 2
Location:	Shippingport, PA
Dates:	October 29 through November 17, 2017
Inspectors:	S. Pindale, Senior Reactor Inspector, Division of Reactor Safety (DRS), Team Leader D. Werkheiser, Senior Reactor Inspector, DRS J. Brand, Reactor Inspector, DRS M. Orr, Reactor Inspector, DRS M. Yeminy, NRC Mechanical Contractor S. Kobylarz, NRC Electrical Contractor
Approved By:	Mel Gray, Chief Engineering Branch 1 Division of Reactor Safety

SUMMARY

IR 05000334/2017007 and 05000412/2017007; 10/29/2017 – 11/17/2017; Beaver Valley Power Station; Engineering Team Inspection.

The report covers the Design Basis Assurance Inspection conducted by a team of four U.S. Nuclear Regulatory Commission (NRC) inspectors and two NRC contractors. One finding of very low safety significance was identified. The significance of most inspection findings is indicated by their color (i.e., greater than Green, or Green, White, Yellow, Red) and determined using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process (SDP)," dated April 29, 2015. Cross-cutting aspects are determined using IMC 0310, "Aspects Within the Cross-Cutting Areas," dated December 4, 2014. All violations of NRC requirements are dispositioned in accordance with the NRC's Enforcement Policy, dated November 1, 2016. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 6, dated July 2016.

Cornerstone: Mitigating Systems

- Green. The NRC team identified a finding of very low safety significance (Green) involving a non-cited violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," because FENOC staff did not establish measures to assure that the design bases were correctly translated into specifications, drawings, procedures, and instructions. Specifically, for the recirculation phase following a postulated small break loss-of-coolant accident, engineering staff determined the maximum differential pressure for motor-operated valves MOV-1SI-863A and MOV-1SI-863B to be the low head safety injection pump shutoff head, but the actual configuration could have resulted in a higher differential pressure at the valve due to allowable reactor coolant system leakage past downstream pressure isolation valves. In response, FENOC staff initiated corrective action program condition reports and assessed the deficiency, and concluded that affected motor-operated valves remained functional although with reduced valve thrust design margin.

  This finding was more than minor because it was associated with the Design Control attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. In accordance with IMC 0609.04, "Initial Characterization of Findings," and Exhibit 2 of IMC 0609, Appendix A, "The SDP for Findings At-Power," the team determined that this finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in the loss of operability or functionality. This finding was not assigned a cross-cutting aspect because the issue did not reflect current licensee performance. (Section 1R21.2.1.6)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

1R21 Design Basis Assurance Inspection (71111.21M)

.1 Inspection Sample Selection Process

The team selected six risk significant components for review using information contained in the Beaver Valley Power Station (BVPS) Probabilistic Risk Assessment and the NRC's Standardized Plant Analysis Risk model for BVPS. Additionally, the team referenced the Risk-Informed Inspection Notebook for BVPS in the selection of potential components for review. 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 components selected were associated with both safety-related and non-safety-related systems, and included a variety of components such as pumps, transformers, electrical busses, and valves. Manual operator actions were also considered.

The team also selected six modifications that potentially affected the design or licensing basis of the plant; or affected the performance capability of the associated structures, systems, and components. The team selected modifications completed in the last three years that had not been previously inspected by an NRC modification team using Inspection Procedure 71111.17T. The team selected modifications that were performed on risk significant components that were associated with the Initiating Events, Mitigating Systems, or Barrier Integrity cornerstones. The team selected a sample of electrical and mechanical modifications. Additionally, the complexity of the modification was considered in selecting the modifications reviewed.

The team initially compiled a list of components based on the risk factors previously mentioned. Additionally, the team reviewed the previous Component Design Bases Inspection and Evaluations of Changes, Tests, or Experiments and Permanent Plant Modifications inspection reports. The team then performed an assessment to narrow the focus of the inspection to six components, six modifications, and three operating experience (OE) items. The team selected one sample based on large early release frequency implications. The team's assessment evaluated the possibility of low design margin, and considered original design issues, margin reductions due to modifications, or margin reductions identified as a result of material condition/equipment reliability issues. The assessment also included items such as failed performance test results, corrective action history, repeated maintenance, Maintenance Rule (a)(1) status, operability reviews for degraded conditions, NRC resident inspector insights, and industry OE. Finally, consideration was given to the uniqueness and complexity of the design and the available defense-in-depth margins.

The inspection performed by the team was conducted as outlined in NRC Inspection Procedure 71111.21M, “Design Bases Assurance Inspection (Teams).” This inspection effort included walkdowns of selected components and modifications; interviews with operators, system engineers, and design engineers; and reviews of associated design documents and calculations to assess the adequacy of the components to meet design basis, licensing basis and risk-informed beyond design basis requirements.

Additionally, for the modification portion of the inspection, the team determined whether the modifications were adequately implemented; and that procedures and design and license basis documentation affected by modification had been adequately updated to reflect any changes to the design or license basis of the facility. The team verified that any changes to the design and/or licensing bases had been performed in accordance with NRC guidance and regulations.

Summaries of the reviews performed for each component, modification, and OE sample are discussed in the subsequent sections of this report. Documents reviewed for each section of this report are listed in the Attachment.

.2 Results of Detailed Reviews

.2.1 Results of Detailed Component Reviews (6 samples)

.2.1.1 Unit 2 Service Water Pump, BV-2SWS-P21A

a. Inspection Scope

The team inspected the ‘21A’ service water (SW) pump, BV-2SWS-P21A, at Unit 2 to evaluate whether it was capable of performing its design basis functions. Specifically, the team evaluated whether the SW pump provided adequate flow so that the SW system was capable of transferring the maximum heat loads from primary and secondary plant heat sources to the environment. The team reviewed applicable portions of the Updated Final Safety Analysis Report (UFSAR), the system design basis document (DBD) and technical specifications (TS) to identify the design and licensing bases for the pump in order to evaluate whether the pump capacity was sufficient to provide adequate flow to the safety-related components supplied by the SW system. The team reviewed design calculations and drawings to assess available pump net positive suction head, submergence requirements, limiting pump run-out conditions, and hydraulic phenomena. The team also assessed whether macro- and micro-fouling adversely affected the SW system. The team reviewed the SW pump in-service test (IST) results and SW system flow verification tests to determine if adequate system flow was available. Specifically, the team reviewed pump data trends for vibration, pump differential pressure, and flow rate test results to verify that acceptance criteria were met and acceptance limits were adequate. This review included an assessment of the SW pump discharge check valve, whose proper closure is necessary to prevent loss of SW flow from a redundant operating SW pump. The team reviewed pump head capacity curves to determine whether FENOC staff used the appropriate acceptance criteria in pump test procedures. The team also inspected the design and proper operation of the pump’s associated vacuum breaker to assure that the vacuum breaker opened upon cessation of SW flow and closed when sufficient air entered the upstream pipe column. Support systems, including the heating, cooling and ventilation equipment were reviewed to assess their capability to provide an operating environment within the SW system design bases.

The team reviewed normal and abnormal operating procedures to assess the adequacy of instructions and guidance provided to the plant operators for normal operations and for abnormal conditions.

Motor data and voltage drop calculation results were reviewed to confirm that the pump motor would have sufficient voltage and power available to perform its safety function at degraded voltage conditions. The maximum power demand of the pump motor was reviewed to verify it was properly reflected in the alternating current (AC) distribution system and diesel generator loading analyses. The team conducted a walkdown of the pump and interviewed the system and design engineers to evaluate the pump's material condition and assess the pump's operating environment. Finally, the team reviewed corrective action documents and the system health report to determine whether there were adverse operating trends and to assess FENOC's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.2 Unit 1 Emergency Diesel Generator No. 2 (Electrical), BV-1EE-EG-2

a. Inspection Scope

The team inspected selected control components for the No. 2 emergency diesel generator (EDG) at Unit 1, BV-1EE-EG-2, to determine whether it was capable of meeting its design basis functions. The adequacy of voltage at selected diesel starting and generator operating control components (generator field and field flash controls, diesel starting air solenoids, generator breaker closure circuit, and selected diesel engine control relays) was reviewed to confirm the capability of the emergency diesel generators to start and provide onsite power for design basis conditions. The team reviewed design and licensing documents, including the UFSAR and TSs, the system DBD, drawings, and other design documents to determine the specific EDG design functions. Additionally, the team reviewed maintenance schedules, procedures, and completed work records to determine whether the selected EDG components were being properly maintained. The team interviewed system and design engineers and walked down the EDG to independently assess the material condition and to determine if the operating environment was consistent with design requirements, assumptions, and operating requirements. Finally, the team reviewed corrective action documents and the system health report to evaluate whether there were adverse operating trends and to assess FENOC's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.3 Unit 1 Turbine-Driven Auxiliary Feedwater Pump Discharge Check Valve, BV-1FW-33

a. Inspection Scope

The team inspected the turbine-driven auxiliary feedwater (AFW) pump discharge check valve, BV-1FW-33, at Unit 1 as a representative sample to evaluate whether the valve was capable of performing its design basis functions. The team also considered check valves of similar design and application (i.e., discharge check valves in other AFW trains and other plant systems). The turbine-driven AFW pump discharge check valve is one of 12 normally closed, bolted bonnet swing check valves in the Unit 1 Train 'A' and 'B' AFW piping system between the AFW pumps and the injection lines to the three steam generators. The team reviewed the UFSAR, the TSs, the system DBD, drawings, and procedures to identify the design basis requirements of the valves and to verify that the valves have been tested in accordance with TS and IST requirements. The team conducted system walkdowns with FENOC staff to assess the material and environmental conditions, discussed the valves' performance/trending, and reviewed maintenance and IST results history for the AFW system check valves as well as check valves of similar design in the Unit 1 main feedwater system. The team verified system margin was conservatively determined and accounted for instrumentation uncertainties, and the team reviewed the methodology used to verify intra-system back-leakage through the valves.

Additionally, the team reviewed FENOC's response to NRC Bulletin 88-04, "Potential Safety Related Pump Loss," (issues with back flow through check valves leading to dead-heading of pumps) and subsequent actions associated with AFW system check valves to verify that the design basis for the system was being maintained. The team also reviewed FENOC's responses to a selection of NRC Information Notices related to operational experience and various problems regarding check valves. Finally, the team reviewed corrective action documents and the system health report to evaluate whether there were adverse operating trends and to assess FENOC's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.4 Unit 2 'B' 125 Volt DC Bus 2-2, BV-DC-SWBD2-2

a. Inspection Scope

The team inspected the 125 volt direct current (Vdc) Bus 2-2, BV-DC-SWBD2-2, at Unit 2 to evaluate whether the bus was capable of performing its design basis functions to provide DC power to associated switchgear following postulated design basis accidents. The team reviewed the UFSAR, TSs, TS Bases, the system DBD, drawings, and procedures to identify the performance requirements for the DC bus. The team reviewed the design and operation of the switchgear bus and associated distribution panels. The review evaluated whether the loading of the DC bus was within equipment ratings and determined whether the bus could perform its design basis function to reliably power the associated loads under limiting assumed design basis conditions. Specifically, the team reviewed calculations and drawings, including voltage drop calculations, short circuit analyses, and load study profiles, to evaluate the adequacy and appropriateness of design assumptions.

The team walked down the 125 Vdc bus and distribution panels to independently assess their material condition and to determine if the system alignment and operating environment was consistent with design basis assumptions. Finally, the team reviewed corrective action documents and the system health report to evaluate whether there were adverse operating trends and to assess FENOC staff's performance to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.5 Unit 1 'B' (DF) 4 kV Vital Bus, BV-4KVS-1DF

a. Inspection Scope

The team inspected the 4 kilovolt (kV) AC vital bus, BV-4KVS-1DF, at Unit 1 to determine whether it was capable of performing its design basis functions. The team reviewed the system DBD, UFSAR and electrical distribution calculations, including load flow, voltage regulation, and short-circuit analyses. This review was performed to evaluate the adequacy and appropriateness of design assumptions, to evaluate whether bus capacity was exceeded, and to assess if bus voltages remained above minimum acceptable values under design basis conditions. The team reviewed the bus voltage profile history to assess whether voltage conditions were consistent with the analytical limits in the voltage regulation study. The team also reviewed the design and test results for automatic and manual transfers of AC offsite power sources to determine whether they satisfied the design basis requirements. The team reviewed the electrical overcurrent, undervoltage, and ground protective relay settings for selected circuits to evaluate whether the trip set points ensured the ability of the supplied equipment to reliably perform their safety function, but were also set to provide adequate bus protection. The loss of voltage and degraded voltage relay surveillances and calibration results were also reviewed to verify that they ensured the associated TS requirements were met. The team reviewed system maintenance test results, interviewed system engineers, and conducted field walkdowns to verify that equipment alignment, nameplate data, breaker positions, and relay settings were consistent with design drawings and to assess the material condition of the bus and associated switchgear. Finally, the team reviewed corrective action documents and the system health report to evaluate whether there were adverse operating trends and to assess FENOC's performance to evaluate and correct problems. This also included a review for the adequacy of FENOC's long-term corrective and compensatory actions to mitigate a postulated degraded grid voltage with regard to design basis events.

b. Findings

No findings were identified.

.2.1.6 Unit 1 Low Head Safety Injection Pump Discharge to High Head Safety Injection Motor-Operated Valve MOV-1SI-863B

a. Inspection Scope

The team inspected MOV-1SIS-863B, which is the low head safety injection (LHSI) pump discharge to high head safety injection motor-operated valve (MOV), at Unit 1 to verify that the valve was capable of performing its design basis functions. The valve is a normally closed MOV and is required to open automatically on a low refueling water storage tank level signal during the recirculation phase of a postulated loss-of-coolant accident in order to provide sump water to the suction of the high head safety injection/charging pumps. The team reviewed design and licensing documents, including the UFSAR, TSs, system DBD, IST basis document, and drawings to determine the specific design requirements of the valve.

The team reviewed MOV diagnostic test results and stroke-timing test data to verify acceptance criteria were met. The team also evaluated whether the MOV safety functions, performance capability, and design margins were adequately monitored and maintained in accordance with NRC Generic Letter 96-05, “Periodic Verification of Design-Basis Capability of Safety-Related MOVs,” and FENOC’s MOV Program. The MOV weak link calculation was reviewed to ensure the ability of the valve to maintain its structural integrity while stroking under design basis conditions. The team also reviewed the valve analysis to determine whether the maximum differential pressure expected across the valve during limiting assumed operating conditions was factored into the MOV design. Additionally, the team reviewed motor data and degraded voltage conditions to determine whether the MOV would have sufficient voltage and power available to perform its safety function at degraded voltage conditions. The team discussed the design, operation, and component history of the valve with FENOC engineering staff and conducted walkdowns of the MOV and associated system components to assess material condition and to determine if the installed configuration and operating environment was consistent with its design bases. Finally, the team reviewed the maintenance and operating history of the valve, associated corrective action documents, and the system health report to determine whether there were any adverse operating trends, and to assess FENOC staff's performance to evaluate and correct problems.

b. Findings

Introduction: The team identified a finding of very low safety significance (Green) involving a non-cited violation of 10 CFR 50, Appendix B, Criterion III, “Design Control,” because, regarding MOV-1SIS-863B and three other MOVs, FENOC staff did not establish measures to assure that the design bases were correctly translated into specifications, drawings, procedures, and instructions. Specifically, for the recirculation phase following a small break loss-of-coolant accident (SBLOCA), FENOC engineering staff determined the maximum differential pressure (DP) for MOV-1SI-863A and MOV-1SI-863B to be the low head safety injection (LHSI) pump shutoff head, but the actual configuration could have resulted in a higher DP at the MOV due to allowed reactor coolant system leakage past the associated pressure isolation valves.

Description: Unit 1 Calculation 8700-DMC-3092, "Torque Calculation for MOV-1SI-863A and MOV-1S-863B," determined 205 pounds per square inch differential (psid) to be the bounding maximum expected differential pressure (MEDP) for the LHSI "piggyback" motor-operated valves MOV-1SI-863A/B. This pressure corresponded to the LHSI shutoff head. This MEDP was used to demonstrate that sufficient thrust design margin existed to ensure the capability of the MOVs to open when transferring to containment sump recirculation operation during a postulated design basis accident. The team reviewed the Unit 1 emergency core cooling system design in response to a SBLOCA scenario and identified that the established MEDP design inputs for MOV-1SI-863A/B did not result in bounding DP values. Specifically, the team noted that MEDP would be higher than 205 psid MOV-1S-863B when considering that the pressure in the piping downstream of the MOV could be elevated due to reactor coolant system leakage past the downstream pressure isolation valves (PIV). In particular, each of the two LHSI system injection lines connecting to the reactor vessel contain two PIV check valves in series; and these valves are designed to maintain an interface between the low pressure LHSI piping and the high pressure reactor coolant system. While the PIVs are normally closed, TSs (Section 3.4.14) allow up to a maximum of 5 gallons per minute (gpm) back-leakage past the PIVs. The team determined that, with a small amount of back-leakage past the PIVs while at power, pressure in that piping would increase to the associated relief valve setpoint of 235 psig. The team determined that this pressure exceeded the currently established MEDP for MOV-1SI-863B, and should have been considered as the MEDP for the MOV.

In response, FENOC staff issued CR-2017-11030 to evaluate this problem and to conduct an extent of condition review. Their initial investigation identified that the redundant valve at Unit 1, MOV-1SI-863A, was similarly affected; and that the same two MOVs at Unit 2 were affected but to a lesser degree. Condition Report (CR) 2017-11191 was initiated to complete a formal Unit 2 evaluation. FENOC's initial assessment of the deficiency concluded that the four MOVs (two at each unit) remained operable but with reduced thrust design margin. Specifically, although design margin was reduced, sufficient thrust design margin existed such that the MOVs could operate against the higher DP. The most limiting valve was MOV-1SI-863B, where the margin was reduced from 65% to 42% (about a 35% thrust design margin reduction). The team reviewed the associated design documents and similarly concluded that the four MOVs remained capable of performing their intended safety function.

Analysis: The team determined that FENOC's failure to properly translate the design basis into Calculation 8700-DMC-3092, Revision 7, "Torque Calculation for MOV-1SI-863A/B" in accordance with 10 CFR 50, Appendix B, Criterion III, "Design Control," was a performance deficiency that was reasonably within FENOC's ability to foresee and correct. Specifically, the team determined the limiting assumed scenario for this configuration would be a SBLOCA, which required piggyback operation (safety injection cold leg recirculation from the containment sump through the LHSI system to the high head safety injection pump suction piping) via MOV-1SI-863A/B; and that the maximum pressure in the piping downstream of MOV-1SI-863A/B could reach the associated relief valve set point pressure of 235 psig (higher than previously considered).

Further, the following FENOC standards were not met.

- Calculation Review Checklist (Question 5) specified to ensure that the design inputs are relevant, current, and consistent with design/licensing bases and directly applicable to the purpose of the calculation, including modes of operation."

- Procedure ES-G-014, “Guidelines for Motor-Operated Valves,” stated that the design basis review for existing MOVs must “determine the design, operating, and emergency conditions under which the valve must operate, including… differential pressures, system pressures, etc.”

This performance deficiency was more than minor because it was associated with the Design Control attribute of the Mitigating Systems cornerstone and adversely affected its objective to ensure the reliability of structures, systems and components that respond to initiating evets to prevent undesirable consequences. The team benchmarked this conclusion using NRC Inspection Manual 0612, Appendix E (Examples of Minor Issues) and concluded the higher DP had more than a minimal effect on MOV calculations because it resulted in about a 35% reduction in design margin for the MOV-1SI-863B. Additionally more than one valve was affected by this performance deficiency (MOV in redundant train at Unit 1 and the two counterpart MOVs at Unit 2).

In accordance with IMC 0609.04, “Initial Characterization of Findings,” and Exhibit 2 of IMC 0609, Appendix A, “The SDP for Findings At-Power,” the team determined that this finding was of very low safety significance (Green) because it was a design deficiency confirmed not to result in the loss of operability or functionality. This finding was not assigned a cross-cutting aspect because the issue did not reflect current licensee performance because the calculation had not been reviewed in the past three years and as a result, there was not a reasonable opportunity to identify the condition.

Enforcement: Title 10 CFR Part 50 Appendix B, Criterion III, “Design Control,” requires, in part, that measures shall be established to assure that that the design bases are correctly translated into specifications, drawings, procedures, and instructions. Contrary to the above, as of November 17, 2017, measures had not been established to assure that the maximum design basis DP established in the MOV program design analysis for Unit 1 MOV-1SI-863B and three other valves was a bounding value for all postulated accident conditions. In response, FENOC staff initiated corrective action program condition reports and assessed the deficiency, and concluded that affected motor-operated valves remained functional although with reduced valve thrust design margin. Because this violation is of very low safety significance and has been entered into FENOC’s corrective action program (CRs 2017-11030 and 2017-11191), this violation is being treated as a non-cited violation consistent with Section 2.3.2.a of the NRC’s Enforcement Policy. **(NCV 05000334 and 412/2017007-01, Non-Conservative Differential Pressure Value Used in LHSI Motor-Operated Valve Design Analysis)**

.2.2 Results of Detailed Modification Review (6 samples)

.2.2.1 ECP 14-0513, Replace Unit 1 ‘A’ Containment Air Recirculation Fan Motor with Single Speed Motor

a. Inspection Scope

The team reviewed engineering change package (ECP) 14-0513-001 that replaced the Unit 1 ‘A’ containment air recirculation 2-speed fan motor with a single high-speed fan motor. The motor slow-speed was originally used to operate the fan at the higher containment pressure during containment Type A leak rate testing. Specifically, FENOC found that testing conditions were achieved more quickly without the fan because it acted as a heat source which in turn caused the stabilization of the containment to take longer.

Therefore, FENOC staff determined slow-speed fan motor operation was no longer required. The team reviewed the design and licensing bases, and reviewed whether the performance capability of the modified design had been degraded by the modification. The team reviewed the regulatory applicability determination and the 10 CFR 50.59 screen, and also the interface evaluations associated with this modification. Additionally, the team reviewed the motor breaker overcurrent settings for adequacy.
The team confirmed that the modification, post-modification, and functional testing met appropriate test acceptance criteria, and that the performance characteristics, which could have been affected by the modification, met the design bases. The review also verified that required supporting design basis documentation, including procedures and training, were updated consistent with the design change.

b. Findings

No findings were identified.

.2.2.2 ECP 12-0162, Increase Stroke Lengths of Unit 2 Atmospheric Steam Dump Valves 2SVS-PCV101A/B/C

a. Inspection Scope

The team reviewed ECP 12-0162, which increased the stroke length of the Unit 2 atmospheric steam dump valves (ASDV). This change resulted in a greater opening of each valve, thereby allowing a greater steam mass flow rate through each valve. The team determined that the change was initiated to address a previously identified ASDV modeling error by the nuclear steam supply system vendor. The team assessed the modeling error to determine the need for the modification and to assess its adequacy with respect to accounting for the specific type and magnitude of the error. The team also reviewed the effect of the modified, greater stroke length on the atmospheric steam dump valve, its structural integrity, and its actuator to determine whether the design limits were maintained. The team reviewed the impact of the increased flow rate on the steam generators cool down rate to determine whether it remained within the specified valve design limits and whether it resulted in increased radioactive release rates as specified in the UFSAR during postulated steam generator tube rupture conditions. Additionally, the team reviewed the calibration of the actuators and the increase of the speed of movement to verify that the opening time was not impacted by the increased opening length. The team reviewed the adjustment of the limit switches and the effect of the change in stroke length on spring compression and the seating force in order to validate that the modification assured sufficient seating force despite the reduction in spring compression. Finally, the team reviewed the post-modification testing to determine whether the greater valve opening was verified such that it can satisfy the expected flow rate.

b. Findings

No findings were identified.

.2.2.3 Calculation 8700-DMC-1083, Unit 1 Auxiliary Feedwater Water Supply from Primary Plant Demineralized Water Storage Tank to Buried Pipe

a. Inspection Scope

Calculation 8700-DMC-1083 is a pipe stress analysis of the buried pipe leading from the primary plant demineralized water storage tank, WT-TK-10, at elevation 737'-2" to elevation 735'-2". The team reviewed the calculation for accuracy to validate the assumptions and the design inputs. The team also reviewed the structural design criteria to assure that the plant's design and seismic criteria were properly incorporated.

The team verified that the correct yield strength, pipe schedule and wall thickness were used to determine whether the design was sufficient to withstand all structural and seismic design bases. Additionally, the team reviewed the Charpy V-Notch Test, the material specification, and the minimum temperature of the water in the pipe allowed through the containment penetration to ascertain its integrity with respect to Nil Ductility Transition Temperature and the possibility of brittle fracture.

b. Findings

No findings were identified.

.2.2.4 ECP 12-0180/15-0468, Installation of Cooling Unit in the Unit 2 Battery Rooms

a. Inspection Scope

The team reviewed modification ECP 12-0180, which is the temporary modification for supplemental cooling to the Unit 2 safety-related batteries, and ECP 15-0468, which converted the temporary modification into a permanent modification. The safety-related batteries provide 125 volt DC power to vital instrumentation and equipment to support safe shutdown and other design basis events. Condition Report 2011-01337 documented various issues from the system health report that were attributed to elevated battery room temperature (approximately 7 degrees Fahrenheit higher than nominal). This higher than nominal temperature affected inter-battery cell voltages and eventually could adversely impact battery capacity, requiring premature battery replacement. The ECP installed a self-contained air-conditioning unit in each battery room to assist the installed ventilation system.

The team reviewed the modification to verify that the design and licensing bases and performance capability of the battery systems had not been adversely impacted by the modification. The team also reviewed the seismic and environmental qualifications for the supplemental air conditioners to determine whether they were acceptable. Additionally, the team evaluated the supplemental cooling system alignment to ensure that it did not introduce any new failure modes for the batteries, which could impact the battery's ability to support design basis loads for its required time. The team reviewed the installation work order and post-modification test package and results to ensure battery parameters met the established acceptance criteria. The team interviewed design and system engineers, reviewed evaluations, and performed a walkdown of the modification to ensure it was installed in accordance with the design, and to assess the overall material condition of the battery rooms.

b. Findings

No findings were identified.

.2.2.5 ECP 15-0571, Replace Unit 2 Reactor Coolant System Power-Operated Relief Valve Orifices for BV-2RCS-PCV455C/455D/456

a. Inspection Scope

The team reviewed modification ECP 15-0571-001 that installed orifices in all three of the Unit 2, power-operated relief valves (PORVs). This modification was implemented to address prior PORV challenges associated with maintaining the PORV loop seal temperature requirements. Specifically, the associated heat trace on the PORVs (2RCS-PCV455C, 455D, and 456) did not consistently maintain the loop seal water at the required temperatures. Heat trace was required on the PORV piping to reduce the severity of the fluid transient in the event that one or more PORV opened in order to prevent exceeding the design limits of the piping and associated supports. The orifices were designed to slow down the opening time of the PORVs, thus reducing the severity of the fluid transient while still maintaining the design basis function of the PORVs.

The team reviewed the modification to determine if the design basis, licensing basis, or performance capability of the PORVs had been degraded by the modification. The team interviewed system and MOV Program engineers to gain understanding of maintenance issues and overall reliability of the valves, and reviewed the associated work order instructions and documentation to verify that maintenance personnel had implemented the modification as designed. Additionally, the team reviewed the results of post-modification testing to determine whether sufficient margin for valve operation and mechanical stresses remained. The team reviewed periodic verification diagnostic test results and stroke test documentation to verify acceptance criteria were met and consistent with the design basis. The team reviewed associated system health reports and corrective action documents to verify deficiencies were properly identified and resolved, and that the PORVs were properly maintained. The 10 CFR 50.59 applicability review and screening associated with this modification were also reviewed.

b. Findings

No findings were identified.

.2.2.6 Calculation 8700-DQC-0024, Namco Limit Switch Models EA180/740 Qualified Life for 60-Year License, Unit 1

a. Inspection Scope

The team reviewed a revision to calculation 8700-DQC-0024, which updated the environmental qualification (EQ) of two Namco limit switches and the receptacle/connectors for FENOC's additional 20-year license extension of BVPS. Specifically, the objective of the revised calculation was to demonstrate qualification of Namco Limit Switch models EA180 and EA740 with EC210 or EC290 Receptacle/Connectors consistent with license extension assumptions. The equipment had been previously qualified for use in Unit 1 for the original 40-year operating license. The Namco limit switches are expected to provide valve position indication throughout their installed life in accordance with FENOC procedure MAP-1BV-2201, "BVPS Unit 1 Electrical Equipment Qualification Maintenance Assessment."

The revision documents the qualified life of these limit switches and connectors for various locations within BVPS Unit 1 for 60-years, or the necessary replacement interval for installation locations with a qualified life less than 60 years.

The team assessed the calculation to determine whether the design and licensing bases and applicable EQ program requirements were adversely impacted by this revision. The team reviewed EQ program-related procedures, including maintenance, storage and shelf life evaluation procedures, component EQ files, qualification test reports, and the analysis methodology and the design inputs used in the qualified life computations. The team interviewed the EQ Program Manager and plant staff knowledgeable of the design, maintenance, and operation of the components to evaluate whether FENOC staff properly maintained the EQ for these limit switches. The team also performed walkdowns of selected accessible locations of equipment adjacent to these switches (e.g., main steam isolation valves, atmospheric steam dump valves, and fast-acting feedwater isolation valves) to assess material condition and verify the environmental conditions were consistent with those assumed in the evaluations. Finally, the team reviewed the regulatory applicability determination and 10 CFR 50.59 screening associated with this modification.

b. Findings

No findings were identified.

.2.3 Results of Review of Industry Operating Experience (3 samples)

The team reviewed selected OE issues for applicability at BVPS. The team performed a detailed review of the OE issues listed below to verify that FENOC staff appropriately assessed potential applicability to site equipment and initiated corrective actions when necessary.

.2.3.1 Flowserve 10 CFR Part 21 Report - Wedge Pin Failure of an Anchor Darling Double Disc Gate Valve at Browns Ferry Nuclear Plant Unit 1

a. Inspection Scope

The team reviewed FENOC's assessment and disposition of a Flowserve 10 CFR Part 21 report associated with double disc gate valve wedge pin failures. The Part 21 (February 25, 2013) report discussed issues concerning a wedge pin failure of an Anchor Darling double disc gate valve at Browns Ferry Nuclear Plant Unit 1. An investigation revealed that the wedge pin had broken due to excessive load on the pin, and the disc retainer had fallen from the wedge assembly to between the valve discs. A topical report, developed by the Boiling Water Reactor Owners Group (BWROG), provided a recommended industry response to the Flowserve 10 CFR Part 21 report. FENOC staff documented their evaluations and recommended actions from the BWROG report in CR-2013-06879 and CR-2013-18679, initially identifying 11 valves at BVPS (Unit 1 only) as being applicable to the Part 21 report. However, FENOC's associated evaluations subsequently documented that six of those 11 valves screened out as being not susceptible to the wedge pin failure as the pin shear capabilities for the six valves exceeded all actuator output torque values.

In response to revisions of the BWROG report in June and August 2017, FENOC staff confirmed that its initial evaluation of the Part 21 remained valid per the revised guidance. The team reviewed CR-2017-06390, CR-2017-06710 and CR-2017-09022, where FENOC staff had documented their completed actions related to stem rotation checks, a historical review for operational issues, IST data results, and closing torque values compared to the required opening torques under design basis accident scenarios. In addition, the team reviewed FENOC's wedge pin shear capability evaluation (that concluded the loads were within the shear capacity of the wedge pins on the six screened-out valves) and verified that FENOC followed the industry recommendations for all of the potentially susceptible valves. The team reviewed FENOC's completed and planned actions associated with the remaining five valves, which included increasing static testing frequency (stem rotational checks). The team also reviewed the associated diagnostic test data on each valve that demonstrated that there were no trace anomalies and FENOC's video-taped visual inspections of the valve stems during valve stroke testing to confirm that there was not excessive stem rotation.

The team interviewed design engineers and the MOV program engineer and performed walkdowns of several of the accessible MOVs. Finally, the team reviewed associated system health reports and corrective action documents to independently assess the susceptibility at BVPS to this failure mechanism and the adequacy of FENOC's corrective actions taken to date.

b. Findings

No findings were identified.

.2.3.2 NRC Information Notice 2010-23, Malfunctions of Emergency Diesel Generator Speed Switch Circuits

a. Inspection Scope

The team reviewed FENOC's assessment and disposition of NRC Information Notice (IN) 2010-23, "Malfunctions of Emergency Diesel Generator Speed Switch Circuits." Specifically, the team reviewed Order 200436628, which documented FENOC staff's review of the issues described in the IN. The IN described EDG failures caused by inadvertent actuation of speed switches due to high AC ripple voltage fluctuations (electric noise) on the annunciator DC power supply circuits. The AC noise was greater than the filtering capacity of the circuit. The team verified that corrective actions were implemented to address the concerns stated in the IN, including new actions to monitor the output voltage/frequency of the associated battery chargers and verifying it was within the manufacturer's specification. In addition, the team performed a visual inspection of the Unit 1 EDG speed switches and reviewed engineering evaluations, preventive and corrective maintenance history, surveillance test results, and corrective action condition reports associated with the EDG speed switches to assess their material condition and the potential of the EDG speed switches at Beaver Valley to malfunction in ways similar to those discussed in the IN.

b. Findings

No findings were identified.

.2.3.3 NRC Information Notice 2013-05, Battery Expected Life and its Potential Impact on Surveillance Requirements

a. Inspection Scope

The team reviewed FENOC staff's assessment and disposition of NRC IN 2013-05, "Battery Expected Life and its Potential Impact on Surveillance Requirements." Specifically, the team reviewed CR 2013-00457, which documented FENOC's review of the issues described in the IN. The team reviewed the similarity between the IN issues that lead to improper battery capacity and life determination and FENOC's determination of critical battery parameters used to establish maintenance and surveillance criteria. The team also reviewed engineering evaluations, preventive and corrective maintenance history, surveillance test results, and corrective action condition reports associated the safety-related station batteries to assess their material condition and to assess the potential to adversely affect battery life.

The team interviewed the battery program engineer, reviewed the battery capacity test results and evaluated whether FENOC's program was consistent with guidance in Institute of Electrical and Electronics Engineers (IEEE) Standard 485, "IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Application," which addressed proper calculation of battery parameters.

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

4OA2 Identification and Resolution of Problems (71152)

a. Inspection Scope

The team reviewed a sample of problems that FENOC staff had previously identified and entered into their corrective action program. The team reviewed these issues to verify an appropriate threshold for identifying issues and to evaluate the effectiveness of corrective actions. In addition, CRs written on issues identified during the inspection were reviewed to verify adequate problem identification and incorporation of the problem into the corrective action system. The specific corrective action documents that were sampled and reviewed by the team are listed in the Attachment.

b. Findings

No findings were identified.

4OA6 Meetings, including Exit

On November 17, 2017, the team presented the inspection results to Mark Manoleras, Engineering Director, and other members of the BVPS staff. The team reviewed proprietary information, which was returned to FENOC at the end of the inspection. The team verified that no proprietary information was documented in the report.

ATTACHMENT: SUPPLEMENTARY INFORMATION

SUPPLEMENTARY INFORMATION
KEY POINTS OF CONTACT

FENOC Personnel

M. Manoleras, Engineering Director
M. Berg, Electrical Design Engineering
D. Bloom, Design Engineer
A. Booth, Maintenance Engineer
S. Buffington, Senior Engineer
D. Byers, System Engineer
G. Cacciani, Design Engineering
J. Crawford, Design Engineering
K. Deberry, System Engineer
A. Dometrovich, Regulatory Compliance Engineer
J. Flaherty, Electrical Design Engineering
K. Frederick, Senior Consulting Design Engineer
R. Garver, Supervisor, Balance of Plant Engineering
S. Gattuso, Senior Reactor Operator
D. Hoover, Design Engineer
M. Jansto, EQ Program Engineer
D. Jones, IST Program Engineer
L. Kalkstein, Design Engineering
M. Kienzle, System Engineer
R. Lubert, Supervisor of Electrical Design Engineering
K. Lynch, Electrical Design Engineer
S. Mercer, System Engineer
A. Ryan, Design Engineer
A. Schertz, Design Engineering
W. Tobac, Electrical Design Engineering
D. Wacker, Regulatory Compliance Engineer
B. Welt, Design Engineer
D. Wilson, Technical Services Engineer
M. Wimmel, MOV Program Engineer

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened and Closed

05000334&412/2017007-01	NCV	Non-Conservative Differential Pressure Value Used in Low Head Safety Injection Motor-Operated Valve Design Analysis (Section 1R21.2.1.6)

LIST OF DOCUMENTS REVIEWED

Calculations and Engineering Evaluations

10080-DQC-0008, BV Unit 2-Rockbestos Cable Qualified Life for 60-Year License and Post-Accident Operability for EPU, 9/2/09
10080-E-075, 125V DC Class 1E Voltage at Loads, Revision 5
10080-E-087, Verification of DC Cable Sizes, Revision 5
10080-E-202, DC System Management - BAT*2-2/BAT*CHG2-2, Revision 2
10080-E-207, Short Circuit Analysis, Class-1E 125 Vdc System, Revision 1, Addendum 0 - 7
10080-E-271, BVPS Unit 2 Transient Stability Analysis, Revision 1, Addendum 0 - 4
10080-E-524, Unit 2 Protective Settings Calculations for 125 Vdc Systems; Batteries 2-1, 2-2, 2-3, and 2-4, Revision 1, Addendum 1 and 2
12241-NP(B)-173, Service Water System - Water Hammer Analysis, Revision 0, Addendum 1
12241-NP(B)-173, Service Water System - Water Hammer Analysis, Revision 0
8700-DMC-1083, AFW Supply from PPDWST to Buried Pipe, Revision 2, Addendum 1
8700-DMC-2230, AFW Pump (1FW-P-2/3A/3B) Maximum Recirculation Flow Rates, Revision 2
8700-DMC-2750, Torque Calculation for MOV-1RW-113A, MOV-1RW-113B, MOV-1RW-113C and MOV-1RW-113D, Revision 6, Addendum 1
8700-DMC-2755, Torque Calculation for MOV-1SI-860A and MOV-1SI-860B, Revision 8
8700-DMC-2771, Torque Calculation for MOV-1RH-720A and MOV-1RH-720B, Revision 7, Addendum 1
8700-DMC-2772, Torque Calculation for MOV-1SI-890A, MOV-1SI-890B and MOV-1SI-890C, Revision 8, Addendum 1
8700-DMC-2811, Maximum Torque Output Accounting for Degraded Voltage for Selected 1S Motor-Operated Valves, Revision 8
8700-DMC-3092 Addendum 1, Torque Calculation for MOV-1SI-863A/B, Revision 7, 10/25/13
8700-DMC-3092, Torque Calculation for MOV-1SI-863A and MOV-1SI-863B, Revision 7, Addendum 1
8700-DMC-3092, Torque Calculation for MOV-1SI-863A/B, Revision 7, 10/15/10
8700-DMC-3615, Auxiliary Feedwater Pump Performance, Revision 0
8700-DMC-3629, BV-1 EDG Building Heatup Analysis Using MAAP-DBA, Revision 0
8700-DQC-0024, Namco Limit Switch Models EA180 and EA740 with EC210 or EC290 Receptacle/Connector Qualified Life for 60-Year License and Post-Accident Operability Time for EPU, Revision 7
8700-DQC-0211, Unit 1-Limitorque Valve Actuators and Actuator Motors Qualified life for 60-Year License and Post Accident Operability Time for EPU, 6/5/07
8700-E-0271, Unit 1 Transient Stability Analysis, Revision 3, Addendum 0 - 3
8700-E-0343, Unit 1 Electrical Protective Device Settings Calculations for 4160 Vac Emergency Bus 1DF, Revision 0 and Addendums A1 and A2
8700-E-202, DC System Management - BATR1-2/BAT-CHG1-2, Revision 2
8700-E-222, 4160 and 480 Vac Load Management and Voltage Profile Calculations Relating Bus 1DF, 11/8/94
8700-N-0193, Evaluation of the Unit 1 EDG Air Start System, Revision 0
BV1-VBF-1, Protective Device Setpoints for BV-1DF 4160 Vac bus, Revision 3
DCP 2028, 125 Vdc Switchboard 2-1 and 2-2 Breaker Coordination, Revision 0
EM 116203, Minimum 125 Vdc Voltage for 4 kV and 480 Vac Circuit Breaker Testing, 4/9/98
SCE-048-2, B31.1 Pipe stress Analysis, 6/6/80
TER 11012, Replace MOV-SI-863A Valve Body, Revision 0
TER 13663, BV2 Battery 2-2 Equalizing Voltage Setting Change, Revision 0

Modifications

ECP 05-0280, Simultaneous Hot and Cold Leg SI Recirculation, Revision 7
ECP 11-0096, Replace EQ NAMCO Limit Switch, Receptacle, and Cable Assembly, Revision 1

ECP 12-0162, Increase Stroke Lengths of Unit 2 Atmospheric Dump Valves 2SVS-PCV101A/B/C, Revision 1
ECP 12-0180, Temporary Cooling AC Unit in the Unit 2 2-1 and 2-2 Battery Room, Revision 1
ECP 14-0513, Replace Unit 1 'A' CAR Fan Motor with Single Speed Motor, Revision 1
ECP 15-0468, Unit 2 Battery Room Cooling Installation, Rooms 2-2 and 2-4, Revision 1
ECP 15-0571, Replace PORV Orifices in BV-2RCS-PCV455C, 455D, and 456, Revision 3
ECP 16-0303, Replacement of Unit 2 EDG 2-1 Speed Relay 19-VE210, Revision 1
ECP/ID 02-0141-04, Connect BV-2EGS-EG2-2 Exciter Panel, Install CTs, Test, Revision 0
EQ-HE-09, U-2, Equipment Qualification Package for PORVs, Revision 1

Procedures

1/2-ADM-2106, River/Service Water System Control and Monitoring Program, Revision 6
1/2-CMP-E-39-366, Station Battery Jumper Installation and Restoration, Revision 5
1/2-CMP-M-75-023, Repair of Pacific Bolted Bonnet Swing Check Valves, Revision 8
1/2OM-35.4A.A, Voltage Schedule Guidance, Revision 13
1/2OM-53C.4A.35.1, Abnormal Operating Procedure - Degraded Grid, Revision 10
1/2-PIP-M16, Penetration Seals, Revision 5
1/2-PMP-E-36-015, ITE Medium Voltage Circuit Breaker Inspection and Test Model 5HK-250/350, Issue 4, Revision 20
1/2RCP-11-PC, Ground Fault Relay Calibration, ITE/ABB GR-5 and GR-200, Issue 4 Revision 7
1/2RCP-15A-PC, Westinghouse/ABB Directional OC Relay Calibration, IRV, Issue 4 Revision 7
1/2RCP-1A-PC, Calibration of Auxiliary Relays, Issue 4, Revision 12
1/2RCP-29-PC, Calibration of Westinghouse/ABB TD-5 Time Delay Relays, Issue 4 Revision 10
1/2RCP-30A-PC, Calibration of Timing Relays, Issue 4, Revision 21
1/2RCP-51-PC, Calibration of Phase Sequence and Phase Undervoltage Relays, Types ABB-47D and -47H, Issue 4 Revision 5
1MSP-36.70A-1, No. 1 EDG Air Start Solenoid Valve [SOV-1EE-101] Replacement, Issue 4, Revision 1
1MSP-36.70B-1, No. 1 EDG Air Start Solenoid Valve [SOV-1EE-102] Replacement, Issue 4, Revision 0
1MSP-36.71A-1, No. 2 EDG Air Start Solenoid Valve [SOV-1EE-103] Replacement, Issue 4, Revision 0
1MSP-36.71B-1, No. 2 EDG Air Start Solenoid Valve [SOV-1EE-103] Replacement, Issue 4, Revision 0
1OM-36.1.C, 4 KV Station Service System Description, Revision 7
1OM-36.4.AEK, EDG No. 2 Not Available or Local Panel Trouble, Issue 3, Revision 1
1OM-53A.1.1-G, Cold Leg Recirculation Actuation, Revision 0
1OM-53A.1.ES-1.3 (ISS3), Transfer to Cold Leg Recirculation, Revision 2
1OST-11.16, Leakage Testing RCS Pressure Isolation Valves, Revision 29
1OST-24.8A, 3A Motor Driven Auxiliary Feed Pump Check Valves and Flow Test, Revision 24
1OST-24.8B, 3B Motor Driven Auxiliary Feed Pump Check Valves and Flow Test, Revision 24
1OST-24.9, Turbine-Driven AFW Pump (1FW-P-2) Operability Test, Revision 57
1OST-36.2, Unit 1 EDG No. 2 Monthly Test, Revision 79
1OST-47.3L, BVPS Containment System Operating Surveillance Test, Containment Isolation and ASME Test-Work Week 8, Revision 26
1RCP-92E-PC, Calibration of Emergency Diesel Generator SST-2000 Series Speed Switch, Issue 3, Revision 0
2BVT1.39.2, Station Battery [BAT*2-2] Service Test, Issue 3, Revision 2
2MSP-39.06-E, Battery No. 2-2 Inspection and Interconnection Resistance Check, Issue 4, Revision 9
2OM-30.4.D, Spare Service water Pump Startup, Revision 19
2OM-30.4.D, Spare Service Water Pump Startup, Revision 19
2OM-30.4.E, Spare Service water Pump Shutdown, Revision 13

2OM-30.4.E, Spare Service Water Pump Shutdown, Revision 13
2OST-30.2, Service Water Pump [2SWS*P21A] Test, Revision 44
2OST-30.2, Service Water Pump [2SWS*P21A] Test, Revision 44
2OST-30.3, Service Water Pump [2SWS*P21B] Test, Revision 52
2OST-30.3, Service Water Pump [2SWS*P21B] Test, Revision 52
2OST-30.6A, Service Water Pump [2SWS*P21C] Test on Train 'A' Header, Revision 39
2OST-30.6A, Service Water Pump [2SWS*P21C] Test on Train 'A' Header, Revision 39
2OST-30.6B, Service Water Pump [2SWS*P21C] Test on Train 'B' Header, Revision 33
2OST-30.6B, Service Water Pump [2SWS*P21C] Test on Train 'B' Header, Revision 33
2OST-6.6, PORV Isolation Valve Test and Position Check, Revision 23
ES-E-004, Protective Relaying Philosophy for BVPS Unit No. 1, Revision 7
ES-G-014, BV Units 1 and 2, Guidelines for Motor-Operated Valves, Revision 8
ES-M-012, Environmental Conditions for Equipment Qualification Requirements, Revision 5
MAP-1BV-2201, BVPS Unit 1 Electrical EQ Maintenance Assessment, Revision 17
NOBP-CC-7004, Shelf Life Evaluation, Revision 1
NOP-CC-2003, Engineering Changes, Revision 23
NOP-CC-2008, Abandonment of Equipment, Revision 1
NOP-ER-3601, Motor Operated Valve Program Overview, Revision 8, 8/25/14
NOP-MS-4001, Warehousing, Revision 11
TP-MKN50745/6, Dedication Functional Test ESI S/N 3013889-1.1-1, Revision 1

Drawings
10080-RB-848, Sht. 2, Vent and Air Conditioning Secondary Plant, Revision 11
10080-RB-848, Sht. 3, Vent and Air Conditioning Secondary Plant, Revision 13
10080-RB-9A, Building Services Intake Structure, Revision 5
10080-RE-0027F, Three Line Potential Diagram - Generator and Main Transformer, Revision 14
10080-RE-1AN, BV2 125 Vdc and 120 Vac One-Line Diagram, Revision 7
10080-RE-1AR, Sht. 1, BV2 125 Vdc One-Line Diagram, Revision 22
10080-RM-0411-001, Unit 2 Low/High Head Safety Injection, Revision 23
10080-RM-444F-1, Main and Alternate Intake Structure and Cooling Tower Pump House Ventilation System, Revision 3
2006.310-073-061, Nozzle Check Valve 3-inch Class 150, DRV-Z, Revision D
2006.510-001-026, Sht. 1, Solenoid Power-Operated Relief Valve, Revision L
2006.510-001-027, Sht. 1, Solenoid Power-Operated Relief Valve, Revision M
2006.510-001-028, Sht. 1, Solenoid Power-Operated Relief Valve, Revision J
2006.510-001-029, Sht. 1, Solenoid Power-Operated Relief Valve, Revision J
8700-06.024-0065, Sht. 1, Steam Generator Auxiliary Feed Pump Piping, Revision 5
8700-06.031-0106, Pacific Valve Inc. 600 LB Cast Steel Bolted Bonnet Swing Check Valve, Flanged Ends, Sizes 1-1/2" to 12", Revision B
8700-06.048-0004, Darling Valve and Mfg Co., 10" Motor Operated Gate Valve, Revision D
8700-06.048-0020, Anchor-Darling Valve, ASA Series 1500 Screw and Yoke 10" Motor-Operated Gate Valve, Revision G
8700-06.048-0197, Anchor Darling 6"-153 Weld Ends Stainless Steel Double Disc Gate Valve with Lipseal Provision for SMB-000-5 Limitorque Actuator, Revision D
8700-06.048-0221, Anchor-Darling 4" – 150 LB Double Disc Gate Valve, Revision B
8700-06.24-778, Sht. 1, BVPS Unit 1 SG AFW Cable Vault As-Built Piping Drawing, Revision 2
8700-RB-26B, Sht. 2, Building Services Intake Structure, Revision 11
8700-RB-26C, Sht. 3, Building Services Intake Structure, Revision 7
8700-RB-8700-RB-26A, Sht. 1, Building Services Intake Structure, Revision 10
8700-RE-100A, Unit 1 4 kV Station Service System, Revision 9
8700-RE-1F, Sht. 3, 4160 Vac One-Line Diagram, Revision 19
8700-RE-1F, Sht. 3, BV1 4160 Vac One-Line Diagram, Revision 19
8700-RE-1K, Sht. 4, 480 Vac One-Line Diagram, Revision 29

8700-RE-1V, Sht. 1, 125 Vdc One-Line Diagram, Revision 33
8700-RE-21BY, Sht. 1, Diesel Generator No. 2 Engine Controls, Revision 16
8700-RE-21BZ, Sht. 2, Diesel Generator No. 2 Engine Controls, Revision 22
8700-RE-21KK, Sht. 2, Safety Injection, Revision 22
8700-RE-9GV, Sht. 2, Wiring Diagram, 480 Vac MCCI-E6 East Cable Vault, Revision 19
8700-RM-0018A, Unit 1 Feed Water, Revision 54
8700-RM-0411-001, Unit 1 Safety Injection System, Revision 28
8700-RM-0424-001, Unit 1 Feedwater System, Revision 20
8700-RM-0424-002, Unit 1 Feedwater System, Revision 20
8700-RM-0424-N, Unit 1 Feedwater System Notes and Reference Data, Revision 7
RE-0001C, BV1 Equipment One-Line Diagram, Revision 31
RE-0021CB, Sht. 1, Diesel Generator No. 2 ACB 1F9, Revision 17
RM-0059E, Sht. 1, Arrangement Intake Structure, Revision 15
RM-0059F, Sht. 2, Arrangement Intake Structure, Revision 11
RM-0430-001, Service Water Supply and Distribution, Revision 36
RM-0430-002, Service Water Primary Cooling, Revision 42
RM-0430-003, Service Water Primary Cooling, Revision 27
RM-0430-004, Service Water Secondary Cooling, Revision 29

Functional, Surveillance and Modification Acceptance Testing

1OM-53A.1.E0, Time Critical Operator Actions Time Validation, Unit 1 LBLOCA-Transfer to Cold Leg Recirculation, Including Securing 2 Recirculation Spray Pumps, performed 9/25/14
1OM-56B.4.A, Simulator and Walkthrough Scenarios, Serious Fire in PAB, performed 6/22/121
2BVT-1.39.2, Station Battery [BAT*2-2] Service Test, performed 10/4/12
2BVT-1.39.7, Station Battery [BAT*2-2] Performance Discharge Test, performed 4/30/14
1OST-36.8, AC Power Source Weekly Breaker Alignment Verification, performed 10/2/17
2OST-39.7, 125 Vdc Control System Operating Surveillance Test, performed 8/21/17
2OST-47.3M, Containment System Operating Surveillance Test, performed 9/14/15
BV-1OST-47.03F, Containment Isolation and ASME XI Test-Work Week 2, performed 3/13/17, 6/5/17, and 8/27/17
IST Stroke Time Data: MOV-1SI-863A/B per 1OST-47.3L and 1OST-47.3F, 12/10/02 - 5/13/15
IST Stroke Time Data: MOV-1SI890A/B/C per 1OST-47.3L and 1OST-47.3F, 4/14/99 - 8/28/17
1OST-36.5A, Emergency Switchgear Operation Test, performed 10/4/17
1OST-24.9, TD AFW Pump Operability Test, performed 5/9/12, 11/2/13, 5/22/15, and 10/18/16
1OST-24.8A, 3A MD AFW Check Valve/Flow Test, performed 4/12/12, 10/28/13, and 10/17/16
1OST-24.8B, 3B MD AFW Check Valve/Flow Test, performed 10/17/16
1/2-PMP-E-39-300, Station Battery Charger Inspection, performed 4/8/15
1OM-53A.1.ES-1.3 (ISS2), Time Critical Operator Actions Time Validation-Timing Record Sheet, Transfer to Cold Leg Recirculation, Revision 2, performed 9/25/14
2MSP-39.06-E, Battery 2-2 Inspection/Interconnection Resistance Check, performed 10/4/12
IST Stroke Time Data: MOV-1RW-113A/B/C/D per 1OST-30.4 and 1OST-30.5, 7/2/04 - 9/22/16
2OST-6.8, Pressurizer PORV Stroke Test, performed 5/12/17 and 5/17/17
BV-OST-30, Service Water Pump (2SWS-P21A) Test, performed 8/17/17
1/2-PMP-E-36-001, 4 kV Bus Switchgear Inspection, performed 10/14/15
2OST-39.3, 125 Vdc Distribution Panels Check, performed 10/27/17
1OST-24.11, Auxiliary Feedwater Check Valve Exercise Verification, performed 10/13/16
IST Stroke Time Data: MOV-1RH-720A/B per 1OST-10.4, 4/13/99 - 10/7/16

Design and Licensing Basis Documents

1DBD-11, Design Basis Document for Safety Injection System, Revision 13
1DBD-24B, Design Basis Document for Auxiliary Feedwater System, Revision 12
1DBD-36, Design Basis Document for 4 kV AC Power System, Revision 10
1DBD-36A, Design Basis Document for Emergency Diesel Generators, Revision 13

2DBD-30, Design Basis Document for Service water System, Revision 19
2DBD-39, Design Basis Document for 125 Vdc Power System, Revision 9
Beaver Valley Unit 1 UFSAR, Revision 30
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LIST OF ACRONYMS

AC	alternating current
AFW	auxiliary feedwater
ASDV	atmospheric steam dump valve
BVPS	Beaver Valley Power Station
BWROG	Boiling Water Reactor Owners Group
CFR	*Code of Federal Regulations*
CR	condition report
DBD	design basis document
DP	differential pressure
DRS	Division of Reactor Safety
ECP	engineering change package
EDG	emergency diesel generator
EQ	environmental qualification
FENOC	First Energy Nuclear Operating Company
IEEE	Institute of Electrical and Electronics Engineers
gpm	gallons per minute
IMC	inspection manual chapter
IN	information notice
IST	in-service test
kV	kilovolt
LHSI	low head safety injection
MEDP	maximum expected differential pressure
MOV	motor-operated valve
NCV	non-cited violation
NRC	Nuclear Regulatory Commission
OE	operating experience
PIV	pressure isolation valve
PORV	power-operated relief valve
psid	pounds per square inch differential
SBLOCA	small break loss-of-coolant accident
SDP	significance determination process
SW	service water
TS	technical specification
UFSAR	Updated Final Safety Analysis Report
Vdc	volts, direct current