UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
2100 RENAISSANCE BLVD., SUITE 100
KING OF PRUSSIA, PA 19406-2713

January 13, 2016

Mr. Bryan C. Hanson
Senior Vice President, Exelon Generation Company, LLC
President and Chief Nuclear Officer (CNO), Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT – NRC COMPONENT DESIGN BASES INSPECTION REPORT 05000317/2015007 AND 05000318/2015007

Dear Mr. Hanson:

On November 20, 2015, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at the Calvert Cliffs Nuclear Power Plant, Units 1 and 2. The enclosed inspection report documents the inspection results, which were discussed on December 2, 2015, with Mr. G. Gellrich, Site Vice-President and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. In conducting the inspection, the team examined the adequacy of selected components to mitigate postulated transients, initiating events, and design basis accidents. The inspection involved field walkdowns, examination of selected procedures, calculations and records, and interviews with station personnel.

This report documents two NRC-identified findings, both were of very low safety significance (Green). The findings were determined to be violations of NRC requirements. However, because of the very low safety significance and because they were entered into your corrective action program, the NRC is treating these findings as non-cited violations (NCVs) consistent with Section 2.3.2.a of the NRC's Enforcement Policy. If you contest any of the NCVs in this report, 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, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Senior Resident Inspector at Calvert Cliffs Nuclear Power Plant.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Docket Room or from the Publicly Available Records component of NRC's document system, 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/

Jeffrey A. Kulp, Chief
Engineering Branch 2
Division of Reactor Safety

Docket Nos. 50-317, 50-318
License Nos. DPR-53, DPR-69

Enclosure:
Inspection Report 05000317/2015007 and 05000318/2015007
w/Attachment: Supplemental Information

cc w/encl.: Distribution via ListServ

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U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket Nos.:	50-317, 50-318
License Nos.:	DPR-53, DPR-69
Report Nos.:	05000317/2015007 and 05000318/2015007
Licensee:	Exelon Generation Company, LLC (Exelon)
Facility:	Calvert Cliffs Nuclear Power Plant, Units 1 and 2
Location:	Lusby, MD
Inspection Period:	November 2 through November 20, 2015
Inspectors:	K. Mangan, Senior Reactor Inspector, Division of Reactor Safety (DRS), Team Leader S. Pindale, Senior Reactor Inspector, DRS M. Orr, Reactor Inspector, DRS S. Makor, Reactor Inspector, DRS W. Sherbin, NRC Mechanical Contractor H. Leake, NRC Electrical Contractor
Approved By:	Jeffrey A. Kulp, Chief Engineering Branch 2 Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000317/2015007, 05000318/2015007; 11/2/2015 – 11/20/2015; Calvert Cliffs Nuclear Power Plant, Units 1 and 2; Component Design Bases Inspection.

The report covers the Component Design Bases Inspection conducted by a team of four U.S. Nuclear Regulatory Commission (NRC) inspectors and two NRC contractors. Two findings of very low safety significance (Green) were identified. The findings were considered to be non-cited violations (NCVs). The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process." Cross-cutting aspects associated with findings are determined using IMC 0310, "Components Within the Cross-Cutting Areas." The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 5, dated February 2014.

NRC-Identified Findings

Cornerstone: Mitigating Systems

- Green. The team identified a finding of very low safety significance involving a non-cited violation of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion III, "Design Control," because Exelon did not ensure the operability of offsite power in design calculations. The team determined that non-conservative assumptions caused the results of the voltage calculation to predict higher 4160 Volts, Alternating Current (VAC) switchgear post-trip voltage levels than those which could occur with existing controls. Specifically, the team found that Exelon's calculation assumed a 3.2 percent switchyard voltage drop upon main generator trip, which did not bound the 5 percent alarm setting provided by the Transmission System Operator Security Analysis application. The team also determined that Exelon used a non-quantitative evaluation, which could not be verified, to adjust design basis calculation results in order to show that during a design basis event the 4160 VAC bus voltage would recover in time to reset the degraded voltage relay prior to the transient degraded voltage relay (TUR) tripping (causing a loss of offsite power). The team could not determine if offsite power would be lost during the event because these assumptions could not be validated. Exelon entered the issue into the corrective action program and performed preliminary computer modeling of the current plant configuration that showed offsite power was operable.

  The finding was determined to be more than minor because it was associated with the Mitigating Systems Cornerstone design control attribute and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences and was similar to Example 3j in Appendix E of the NRC IMC 0612. Using the NRC IMC 0609, "Significance Determination Process," Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 2, "Mitigating Systems Screening Questions," the finding was determined to be 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 it was a historical design issue not indicative of current performance. (Section 1R21.2.1.5)

Green. The team identified a finding of very low safety significance (Green) involving a non-cited violation of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion III, "Design Control," because Exelon failed to verify, in design basis calculations, that all required Class 1E alternating current (AC) components would perform their safety functions during design basis events. Specifically, the team found multiple examples where Exelon failed to ensure AC equipment operability and functionality at maximum postulated loading levels and minimum allowable voltage levels. Specifically, the team found that during design basis events several transformers exceeded their manufacturer's rating and Exelon had not performed an analysis that demonstrated voltage trip setpoints of the degraded voltage relays would ensure adequate voltage was available to supplied equipment. Exelon entered this issue into the corrective action program and performed preliminary analysis to show that there was reasonable assurance that equipment remained operable.

The finding was determined to be more than minor because it was associated with the Mitigating Systems Cornerstone design control attribute and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences and was similar to Example 3j in Appendix E of the NRC IMC 0612. Using the NRC IMC 0609, "Significance Determination Process," Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," Exhibit 2, "Mitigating Systems Screening Questions," the finding was determined to be of very low safety significance (Green) because it was a design deficiency confirmed not to result in the loss of operability or functionality.

The team did not identify a cross-cutting aspect with this finding because it did not represent current performance. (Section 1R21.2.1.7)

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

1R21 Component Design Bases Inspection (IP 71111.21M)

.1 Inspection Sample Selection Process

The team selected risk significant components for review using information contained in the Calvert Cliffs Probabilistic Risk Assessment (PRA) and the U.S. Nuclear Regulatory Commission's (NRC) Standardized Plant Analysis Risk (SPAR) model for the Calvert Cliffs Nuclear Power Plant (CCNPP). Additionally, the team referenced the Risk-Informed Inspection Notebook for the CCNPP in the selection of potential components for review. In general, the selection process focused on components that had a risk achievement worth (RAW) factor greater than 1.3 or a risk reduction worth (RRW) 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.

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 (CDBI) reports (05000317/2012007 and 05000318/2012007, 05000317/2009006 and 05000318/2009006, and 05000317/2006008 and 05000318/2006008) and excluded those components previously inspected. The team then performed a margin assessment to narrow the focus of the inspection to 13 components and 1 operating experience (OE) item. The team selected one component, containment air cooler fan, based on large early release frequency (LERF) implications. The team's evaluation of possible low design margin included consideration of 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, system health reports, and industry OE. Finally, consideration was also given to the uniqueness and complexity of the design and the available defense-in-depth margins.

The inspection performed by the team was a pilot inspection conducted as outlined in NRC Inspection Procedure (IP) 71111.21M. This inspection effort included walkdowns of selected components; 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. Summaries of the reviews performed for each component and OE sample are discussed in the subsequent sections of this report. Documents reviewed for this inspection are listed in the Attachment.

.2 Results of Detailed Reviews

.2.1 Results of Detailed Component Reviews (13 samples)

.2.1.1 Unit 1, Switchgear Heating, Ventilation, and Air Conditioning (11 HVAC)

a. Inspection Scope

The team inspected the 11 switchgear heating, ventilation and air conditioning (H) system, 11SWGR H, to determine whether it could respond to all design basis events. The team reviewed design documents and drawings to evaluate the ability of the equipment to provide adequate cooling to safety related switchgear. The team also reviewed inspection, testing, and calibration procedures to evaluate if appropriate preventive maintenance procedures were being performed. The team reviewed past test results to verify that the fan and associated heat exchanger were capable of removing the required heat load. The team reviewed fan and compressor motor data and voltage drop calculation results to confirm that the motors would have sufficient voltage and power available to perform their safety function at degraded voltage conditions. Schematic diagrams were reviewed to confirm the equipment operation conformed to the design requirements. The team reviewed cable sizing to determine whether the motor circuit cabling had adequate ampacity. The maximum power demands of the motors were reviewed to verify they were properly reflected in alternating current (AC) distribution system and diesel generator loading analyses. Additionally, the team interviewed engineers regarding the maintenance and operation of the fan and heat exchanger. Additionally, the team reviewed procedures to verify that the actions specified during a failure of the HVAC system could be performed and were in agreement with the pump room heat up calculation. The team conducted a walkdown of the fan and associated ventilation equipment to assess the material condition of the system. Finally, the team reviewed a sample of condition reports to ensure Exelon was identifying and properly correcting issues associated with the HVAC unit.

b. Findings

No findings were identified.

.2.1.2 Unit 1, 12 Salt Water Pump (12SWP)

a. Inspection Scope

The team inspected the 12 salt water pump, 12SWP, to evaluate if it was capable of performing its design basis functions. Specifically, the team evaluated whether the salt water pump provided adequate flow so that the salt water system was capable of transferring the maximum heat loads, from plant primary and secondary heat source to the environment. The team reviewed applicable portions of the Updated Final Safety Analysis Report (UFSAR) to identify the design basis requirements 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 salt water system. The team reviewed design calculations and drawings to assess available pump net positive suction head (NPSH), submergence requirements, worst case pump run-out conditions, and to evaluate the capability of the pump to provide required flow to supplied components under design basis conditions. The team reviewed the salt water pump in-service test (IST) results and salt water 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 acceptance criteria were met and acceptance limits were adequate. Additionally, the 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. Schematic diagrams were reviewed to confirm the pump operation conformed to the design requirements. The team reviewed cable sizing to determine whether the motor circuit cabling had adequate ampacity. The maximum power demand of the pump motor was reviewed to verify it was properly reflected in AC distribution system and diesel generator loading analyses. The team conducted a walkdown of the pump and interviewed the system and design engineers, and maintenance staff to evaluate the pump’s material condition, and assess the pump's operating environment. Finally, the team reviewed corrective action documents and system health reports to determine whether there were any adverse operating trends and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.3 Unit 1, “B” Emergency Diesel Generator, Mechanical (1B)

a. Inspection Scope

The team inspected the 1B emergency diesel generator (EDG) mechanical systems to determine if they were capable of supporting the design basis function of the EDG. Specifically, the team evaluated whether the mechanical support systems for the EDG would operate as required so that the 1B EDG could provide power to the 4.16 kilovolt (kV) electrical bus 14 during operational, transients, and design basis events. The team selected the EDG engine, fuel oil system, air start system, lubricating oil system, and jacket water cooling system for an in-depth review. The team reviewed the UFSAR, technical specifications (TSs), operating procedures, and design basis documents (DBDs) to identify the design basis requirements for these systems. The team also reviewed the EDG vendor manual and preventive maintenance (PM) activities to ensure that Exelon maintained an appropriate threshold for corrective actions prior to any adverse impact on engine operation. The team reviewed EDG surveillance test results, equipment operator logs, and operating procedures to ensure that the mechanical support systems were operated as designed and within the vendor design limits. The team reviewed fuel oil consumption calculations to verify TS requirements were adequate to meet design basis conditions. The team walked down the fuel oil sampling and chemistry analysis testing facility and reviewed specifications and surveillance requirements to ensure Exelon staff was following procedures adequately for oil sample receipt inspections and testing. The team also reviewed lubricating oil sample and chemistry results to assess whether Exelon staff had performed timely analysis for wear and trending, identified potential adverse trends, and to determine if proper lubrication of system components was being performed. The team reviewed the 1B engine jacket water cooler, lube oil cooler, and air cooler eddy current inspection reports along with operational trend data to determine whether the system capabilities were adequate to respond to design conditions. The team conducted several walkdowns of the EDG and support systems to inspect the material condition, assess the operating environment and potential hazards, and ensure adequate configuration control. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse operating trends and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.4 Unit 1, Steam Generator Atmospheric Steam Dump Valve (1CV3938)

a. Inspection Scope

The team inspected the 11 steam generator atmospheric steam dump valve (ADV), 1CV3938, to evaluate whether the valve was capable of performing its design basis function. The team reviewed calculations, vendor manuals, and engineering evaluations associated with the ADV to determine the design assumptions for the valve and to determine whether the valve was capable of performing in accordance with the design requirements. Surveillance test procedures were reviewed by the team to verify that design basis stroke times and valve operation were enveloped by test acceptance criteria. The team reviewed procedures for operating the valve to determine if operators could effectively implement the procedure steps when the ADV function is required during postulated events. The team interviewed engineers to ensure recommended maintenance had been established and design changes had been implemented satisfactorily in accordance with station procedures. Specifically, the team reviewed a modification that replaced the ADV's associated solenoid valve to determine if it had been installed in accordance with the manufacturer's recommendations and design assumptions. Additionally, the team conducted a walkdown of the ADV and the associated equipment to verify if the components, including seismic restraints, had been installed in accordance with the design requirements. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse operating trends and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.5 Service Transformer (P-13000-1)

a. Inspection Scope

The team inspected the 500 kV to 14 kV service transformer, P-13000-1, to determine whether it was capable of performing its design basis function. The team reviewed one line diagrams, transformer nameplate, and vendor test results for impedance data and the electrical impedance model calculation to confirm that correct transformer impedances were utilized. Additionally, the team reviewed voltage calculations and operating procedures to determine whether transformer taps and administrative controls for switchyard voltage were adequate to ensure design basis assumptions related to the availability of offsite power during accident conditions were met. The team also reviewed loading calculations to determine whether the capacity of the transformer is adequate to supply worst-case accident loads. The team confirmed the adequacy of the overcurrent relay settings for design basis loading requirements. Also, the team reviewed the transformer preventive maintenance, condition monitoring and trending results to determine if there were adverse conditions that could affect reliability. The team reviewed the modification history of the transformer for potential impact on the design basis. A team walkdown of the transformer was performed to assess material condition and to verify that the installed equipment was consistent with design documentation and analyses. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse operating trends and to assess Exelon's ability to evaluate and correct problems.

b. Findings

Introduction. The team identified a finding of very low safety significance involving a non-cited violation of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion III, “Design Control,” because Exelon did not ensure the operability of offsite power in design calculations. The team found that the voltage calculation performed by Exelon used non-quantified conservatism in the calculation in order to conclude offsite power was operable; however, the team did not find conservatisms in the calculation. Additionally, the team found non-conservative assumptions in the calculation resulting in the team questioning whether offsite power was operable.

Description. The team reviewed calculation E-94-017, “Plant Electrical AC Loadflow Analysis,” Revision 2-0008, which modeled the voltage values of the electrical transient during a loss-of-coolant accident (LOCA) and main generator trip with offsite power available. The team reviewed the calculation and found that the calculation determined the recovery voltage would reach 3812 volts, alternating current (VAC), which is less than the 3823 VAC required to reset voltage of the transient degraded voltage relays (TUR) prior to actuation. The team noted that the TURs, upon actuation, disconnect the preferred offsite power supply and transfer the Class 1E AC distribution system to the emergency diesel generator. The team’s review found that Exelon concluded in the calculation that “voltage at the SR (safety related) 4 kV busses recovers to a value above the reset of the transient undervoltage relay (TUR) relays (After the SR loads are running) such that separation from the preferred offsite power supply does not occur.” The team found that Exelon rationalized this conclusion by stating that the actual recovery voltage would exceed the TUR reset level because of conservatism in the electrical modeling used in the calculation. The team questioned the basis for this statement and what conservatisms were in the model.

The team also reviewed the Calvert Cliffs response to Generic Letter 2006-02. The response stated that Calvert Cliffs credits the Transmission System Operator's (TSO) in that the Security Analysis application used by the TSO runs approximately every minute; grid voltage resulting from removal of a CCNPP unit are evaluated; violation of the unit trip contingency voltage limit would result in notification to CCNPP; and the voltage limits provided by CCNPP are based on the plant's design basis analysis. Subsequently, the team reviewed Exelon document WC-CA-8003-1010, "Calvert Cliffs Nuclear Power Plant Units 1 and 2 Nuclear Plant Interface Requirements (NPIRs)," Revision 0 and found that the Security Analysis application alarm setting, allowed a maximum post-trip switchyard voltage drop of 5 percent. However, the team's review of calculation E-94-017 found that Exelon modeled a 3.2 percent drop in switchyard voltage during the design basis event. As a result the team questioned if offsite power would remain connected to the safety related busses assuming the maximum allowed post event voltage drop of 5 percent.

Following discussions with Exelon, the team determined that Exelon failed to perform a design basis analysis that was consistent with the 5 percent voltage limit setting provided to the TSO for use in the Security Analysis application. The team also concluded that Exelon incorrectly credited conservatisms in the analytical model to justify an unacceptable numerical result. Specifically, the team determined that Exelon could not demonstrate quantitatively that the margins are sufficient to demonstrate that vital bus voltage would recover above the degraded grid relay reset voltage in order to prevent the vital busses from separating from offsite power. As a result the team concluded that, Exelon failed to demonstrate that offsite power was operable for all design basis events.

Exelon entered this issue into their corrective action program as Condition Report (CR) 02590315 and performed additional calculations which showed that offsite power was operable in the plant current configuration and initiated actions to update the design basis calculations. The team found that results of the revised calculations to be reasonable to support operability.

Analysis. The team determined that the non-conservative assumptions, in design basis calculations used to evaluate operability limit for offsite power was a performance deficiency. Specifically, the team found the analysis to demonstrate the operability of the Class 1E AC distribution system did not verify that vital buses would remain connected to the preferred offsite power source during design basis events. The performance deficiency was determined to be more than minor because it was similar to IMC 0612, "Power Reactor Inspection Reports," Appendix E, Example 3j, because the failure to perform these evaluations resulted in a reasonable doubt on the operability of the offsite power supply. Additionally, the performance deficiency was associated with the Mitigating Systems Cornerstone attribute of Design Control and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. The team evaluated the finding in accordance with Inspection Manual Chapter (IMC) 0609, Appendix A, "The Significance Determination Process (SDP) for Findings at Power, Exhibit 2 – Mitigating

Systems Screening Questions," and determined that the finding was of very low safety significance (Green) because the finding was a design deficiency that did not result in the loss of operability or functionality. The team did not identify a cross-cutting aspect with this finding because it did not represent current performance. The inadequate calculation was developed outside of the timeframe that reflected current performance.

Enforcement. Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis are correctly translated into specifications, drawings, procedures, and instructions. 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 calculations, or by the performance of a suitable testing program. Contrary to the above, Exelon failed to verify, by calculational methods, that the switchyard low post-trip voltage alarm setting was adequate to ensure operability of the offsite power supply, the preferred redundant source to the safety related 4 kV busses. Exelon's short-term corrective actions included initiating a CR and performing evaluations to verify operability. Because this finding is of very low safety significance and has been entered into Exelon's corrective action program (CR 02590315), this violation is being treated as a non-cited violation (NCV), consistent with the NRC Enforcement Policy. **(NCV 05000317/2015007-01, 05000318/2015007-01, Inadequate Verification of Offsite Power Operability Limit)**

.2.1.6 Unit 2, 24 Containment Air Cooler Fan Unit (2HCTCLR24)

a. Inspection Scope

The team inspected containment air cooler (CAC) fan unit, 2HCTCLR24, and associated cooler to assess whether they were capable of meeting their design basis function. Specifically, the team evaluated if the equipment was capable of removing heat from the containment during certain design basis events. The team reviewed drawings, calculations, hydraulic analyses, containment analysis, and the system DBD to determine the CAC fan design and licensing bases requirements. The team evaluated if Exelon ensured, through testing and flow balance measurements of the service water (SW) system, that the cooling water flow needed to meet heat removal requirements, assumed in containment temperature and pressure response calculations, were being met. The team also reviewed fan flow test results to determine whether the fan was capable of meeting air flow requirements assumed in the containment analysis. The team verified that the CAC fan surveillance testing was performed consistent with TS requirements. The team also performed a visual examination of control room CAC fan controls and 480 VAC breakers at associated load centers. The team verified breaker overcurrent protective relay set-points were established that ensured the CAC fan motor and electrical bus were adequately protected and that the CAC unit was not subject to spurious tripping. Additionally, the team reviewed electrical diagrams associated with breaker and fan controls, and piping and instrument diagrams associated with containment ventilation and the SW system to ensure all components of the CAC unit were appropriately included in a test or maintenance program. Finally, the team reviewed corrective action documents and system health reports, and interviewed system and design engineers to determine whether there were any adverse operating trends or existing issues affecting CAC unit reliability and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.7 Unit 1, Reactor 480 Volt Motor Control Center (1B014)

a. Inspection Scope

The team inspected the reactor 480 VAC motor control center (MCC), 1B014, to determine whether it was capable of performing its design basis function. The team reviewed the UFSAR, DBDs, and electrical distribution calculations including load flow, voltage drop, short-circuit, and electrical protection coordination. This review evaluated the adequacy and appropriateness of design assumptions; if bus capacity was exceeded; and whether bus voltages remained above minimum acceptable values under design basis conditions. The team reviewed the electrical overcurrent protective relay settings for the supply and selected breakers at the load center to verify that the trip set points would not interfere with the ability of supplied equipment to perform their safety function yet ensuring the trip set points provided for adequate load center protection. The control logic design drawings of the 480 VAC supply breaker to MCC were reviewed to verify adequate breaker closing and opening circuit interlocks. Additionally, the team verified that the degraded and loss-of-voltage relays were set in accordance with calculations and that associated calibration procedures were consistent with calculation assumptions, and setpoint accuracy for assumed voltage levels. Additionally, the team reviewed system preventative maintenance records, thermography reports, internal inspection results, interviewed system engineers, and conducted field walkdowns to assess the material condition of the MCC to verify that equipment alignment, nameplate data, and breaker positions were consistent with design drawings. Finally, the team reviewed corrective action documents and system health reports to determine whether there were any adverse operating trends and to assess Exelon's ability 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 Part 50, Appendix B, Criterion III, “Design Control,” because Exelon failed to verify, in design basis calculations, that all required Class 1E AC components would perform their safety functions during design basis events. Specifically, the team found multiple examples where Exelon failed to ensure AC equipment operability and functionality at maximum postulated loading levels and minimum allowable voltage levels.

Description. The team reviewed load calculations and voltage calculations performed by Exelon developed to verify the adequacy of the electrical distribution system. The team found that Exelon referenced two calculations for AC load flow. The team reviewed these calculations: offsite load flow calculation E-94-017, “Plant Electrical AC Load Flow Analysis,” Revision 2 and the EDG loading analysis calculation E-88-015, “Diesel

Generator Loading Calculation," Revision 4. The team found that that these calculations were used to evaluate the calculated loading levels during various operating scenarios with the ratings of the electrical distribution equipment. The team's review identified, in some cases, errors in the analysis or incomplete analysis. During the review the team identified three specific issues related to the evaluation related to transformer loading, assumed lowest voltage allowed by TS to downstream equipment, and evaluation of voltage at motor terminals for starting and running voltage. The team found the thermal ratings of electrical distribution components, such as transformers, buses, and cables, were not compared with the AC distribution system loading levels calculated for various operating scenarios. The team also found that Exelon calculations did not verify that the minimum voltage requirements of all Class 1E motors, motor-operated valves (MOVs), static loads, and 120 VAC components would be maintained with the voltage at the minimum dropout settings of the TURs and the Steady State Degraded Voltage Relays (SURs).

For transformer loading, the team identified that the calculation load flow results were not compared to the distribution transformer ratings. The team noted loading profiles exceeded transformer rating. As a result, Exelon performed additional analysis during the inspection and concluded that the calculated loading levels exceeded some of the transformer ratings in a number of scenarios. From the evaluation of overload conditions the team noted the most severe case was Class 1E 4 kV to 480V Service Transformer U-440-24B in which the calculated load level was 127.9 percent of its rating.

The team's review of voltage levels for 4 kV, 480 VAC and 120 VAC, as allowed by the SUR and TUR, found that the analysis did not evaluate the lowest voltage allowed by TS to downstream running equipment. The team reviewed calculation E-94-017 which stated, "Acceptable running voltages at all loads is 90-100 percent of rated nameplate values." However, the basis for this criterion was not provided, and there was not an evaluation of the nameplate voltage values for all Class 1E motors, MOVs, static loads, and 120 VAC components in the calculation. Specifically the team reviewed the manufacturer's data sheet for the Class 1E battery chargers which specified a rating of 480 VAC ± 10 percent and determined that the calculation acceptance criterion of 414 VAC (460 -10 percent) was lower than the battery charger minimum rated voltage (432 VAC). In addition, the team found the calculation did not consider voltage drops in 480V to 120V transformers to the associated downstream circuits and MOV motor terminals. Consequently, the team found there was not an adequate verification of the system capability to provide adequate voltage for the Class 1E AC load equipment.

Finally, the team reviewed the load flow calculation and determined that Exelon had not evaluated the TUR setpoint to ensure that adequate voltage was available at motor terminals for starting and running. The team found that the calculation did not model the worst-case design basis minimum source voltage condition of 3630 VAC as allowed by the TUR for the 4160 VAC Class 1E switchgear, as specified in TS SR 3.3.6.2. The team questioned whether the class 1E equipment would continue to operate at the degraded voltage condition allowed by the TS. Specifically, the team questioned whether equipment would trip on the overcurrent/thermal protective device.

Based on the observations and questions from the team, Exelon performed several calculations and analysis to address the adequacy of voltage to equipment at the various voltage levels and evaluated the overload conditions of the transformers identified during the inspection. Exelon's evaluation determined that there was reasonable assurance that equipment was operable. The team reviewed the work performed by Exelon and found the conclusions reasonable.

Analysis. The team determined that the failure to verify that all required Class 1E AC components would perform their safety functions during design basis events was a performance deficiency. The performance deficiency was determined to be more than minor because it was similar to IMC 0612, "Power Reactor Inspection Reports," Appendix E, Example 3j, because the failure to perform these evaluations resulted in a reasonable doubt on the operability of the offsite power supply. Additionally, the performance deficiency was associated with the Mitigating Systems Cornerstone attribute of Design Control, and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. The team evaluated the finding in accordance with Inspection Manual Chapter (IMC) 0609, Appendix A, "The Significance Determination Process (SDP) for Findings at Power, Exhibit 2 – Mitigating Systems Screening Questions," and determined that the finding was of very low safety significance (Green) because the finding was a design deficiency that did not result in the loss of operability or functionality. The team did not identify a cross-cutting aspect with this finding because it did not represent current performance. The inadequate calculation was developed outside of the timeframe that reflected current performance.

Enforcement. Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that design control measures provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use or alternate or simplified calculation methods, or by the performance of a suitable testing program. Contrary to the above, prior to November 23, 2015, Exelon did not verify that all required Class 1E AC components would perform their safety functions during design basis events. Specifically, the team found multiple examples where Exelon failed to ensure AC equipment operability and functionality at maximum postulated loading levels and minimum allowable voltage levels. Because this violation was of very low safety significance and because the issue was entered into Exelon's corrective action program (CR 02590231), this violation is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy. **(NCV 05000317/2015-02, 05000318/2015007-02 Failure to Verify AC Equipment Operability at Design Loading and Voltage Levels).**

.2.1.8 Unit 2, Motor-Driven Auxiliary Feedwater Pump (23MDAFW)

a. Inspection Scope

The team inspected the 23 motor-driven auxiliary feedwater (AFW), 23MDAFW, pump to determine if it was capable of meeting its design basis functions. Specifically, the team evaluated whether the pump was capable of providing adequate flow to the steam generators during postulated events. The team reviewed the AFW design basis hydraulic calculations to determine whether required total developed head, net positive suction head, and pump run-out conditions had been properly evaluated to bound the applicable design basis conditions during design basis events. The team reviewed system operating and emergency procedures to ensure they were consistent with the design requirements. The team also reviewed pump IST procedures, test results, and trends in test data to verify pump performance was consistent with design basis assumptions and verified IST acceptance criteria were appropriately correlated to accident analyses requirements. Additionally, the motor data, degraded voltage conditions, and voltage drop calculation results were reviewed to confirm that the pump motor would have sufficient voltage and power available to perform the intended safety function at degraded voltage conditions. The team also conducted a detailed walkdown of the pump and support systems to determine the material condition of the components and to ensure adequate configuration control. Finally, the team reviewed corrective action documents and system health reports to evaluate whether there were any adverse operating trends and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.9 Unit 2, Refueling Water Tank (2TKRWT21)

a. Inspection Scope

The team inspected the refueling water tank (RWT), 2TKRWT21, to determine if it was capable of meeting its design basis function. Specifically, the team evaluated whether the tank was adequately designed to provide the required quantity of water during design basis events. The team reviewed the design, testing, inspection, and operation of the RWT and associated tank level instruments to evaluate whether the tank could perform its design basis function as the water source for the emergency core cooling system pumps. Specifically, the team reviewed design calculations, drawings, and vendor specifications (including tank sizing and level uncertainty analyses, and pump vortex calculations) to evaluate the adequacy and appropriateness of design assumptions and operating limits. Seismic design documents were reviewed to evaluate whether RWT design assumptions were consistent with limiting seismic conditions. Additionally, the team reviewed test and inspection results to determine whether maintenance and testing was adequate to ensure reliable operation and evaluated whether maintenance and testing activities were performed in accordance with regulatory requirements, industry standards, and vendor recommendations. The team interviewed system and design engineers and conducted a walkdown of the tank area to assess the material condition of the RWT and associated equipment. Finally, the team reviewed corrective action documents and system health reports to determine whether there were any adverse operating trends and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.10 Unit 1, "B" Emergency Diesel Generator, Electrical (1B)

a. Inspection Scope

The team inspected the 1B EDG to determine whether it was capable of meeting its design basis function. Specifically, the team reviewed calculations for both static and transient loading to determine whether the EDG had sufficient capacity and capability to supply the required accident loads. The team reviewed one-line diagrams for the EDG, vendor manuals, nameplate rating data, and the EDG load study to ensure that the EDG was operated consistent with its rating and capable of operating under the worst case design basis loading conditions. The team also reviewed the generator electrical protective relaying scheme including drawings, calculations, calibration records, and procedures to determine whether the generator was adequately protected and to evaluate whether the output breaker was subject to spurious tripping. Additionally, the team reviewed maintenance schedules, procedures, and completed work records to determine whether the EDG was being properly maintained and reviewed completed surveillances to determine whether the diesel was being tested in accordance with the TS requirements. The team also interviewed station engineers and performed walkdowns of the EDG to assess the material condition of equipment. Finally, the team reviewed corrective action documents and system health reports to determine whether there were any adverse operating trends and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.11 Unit 1 Service Transformer (U440-14A)

a. Inspection Scope

The team inspected the 4160 VAC to 480 VAC service transformer, U440-14A, to determine whether it was capable of performing its design basis function. The team reviewed the system drawings, nameplate data, and design basis descriptions to verify that the loadings on the transformer and its input and output circuit breakers were within the corresponding transformer and switchgear design ratings. The team reviewed voltage calculations and operating procedures to determine whether transformer taps and administrative controls for switchyard and EDG voltage were adequate to assure the capability and capacity of the power supplies during normal and accident conditions. The team also reviewed input and output cable sizes to determine whether they had sufficient capacity to supply the current and voltage requirements of the 480 VAC distribution system during normal and accident conditions. Finally, the team reviewed corrective action documents and system health reports, and interviewed system and design engineers to determine whether there were any adverse operating trends or existing issues affecting bus reliability and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.1.12 Unit 1, High Pressure Safety Injection Pump Breaker and Disconnect (189-1310)

a. Inspection Scope

The team inspected the high pressure safety injection pump breaker and disconnect, 189-1310, to determine whether they could meet their design requirements. Specifically, the team reviewed the control schematic wiring diagrams for pump breaker and disconnect to evaluate whether the breakers operating schemes would perform as described in the DBDs. The team also reviewed the load flow analysis, short circuit calculations, and breaker and cables ratings to confirm that they could carry the design basis accident loads. The review included an evaluation of control power supply to ensure that adequate voltage would be available to the breakers for closing and opening in accordance with the design basis requirements. The team reviewed maintenance procedures and schedules to determine whether they were consistent with vendor recommendations. The team also reviewed selected corrective action documents and system health reports to evaluate whether there were any adverse operating trends and to assess Exelon's ability to evaluate and correct problems in a timely manner. Finally, the team performed a walkdown of the equipment to assess the material condition of the equipment and the presence of physical hazards that could impact breaker operation.

b. Findings

No findings were identified.

.2.1.13 Unit 1, ZG Cabinet 28V Relay (1yxzg-PS1/2B)

a. Inspection Scope

The team inspected the ZG cabinet 28v relays, 1yxzg-PS1/2B, to determine if they were capable of meeting their design basis requirements. Specifically, the team inspected the design, testing, and operation of the relays to determine if they could perform their design basis function to actuate the reactor trip breakers upon a valid reactor trip signal and actuate engineered safety features upon a valid initiation signal. The team reviewed functional logic diagrams, TSs, and vendor specifications to determine the performance requirements. The team reviewed maintenance, surveillance, and test procedures to determine whether the established acceptance limits were adequate to ensure reliable operation and that the equipment performed in accordance with design and licensing basis requirements, industry standards, and vendor recommendations. The team also compared as-found and as-left inspection and test results to the established acceptance criteria in order to determine if the relay test results met the established criteria. Additionally, the team interviewed system and design engineers and walked down accessible relays to independently assess the material condition of the system, and to determine if the system alignment and operating environment were consistent with design assumptions. Finally, the team reviewed corrective action documents and system health reports to determine if there were adverse trends associated with the relays and to assess Exelon's ability to evaluate and correct problems.

b. Findings

No findings were identified.

.2.2 Review of Industry Operating Experience and Generic Issues (1 sample)

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

.2.2.1 NRC Information Notice 98-25, Loss of Inventory from Safety Related Closed-Loop Cooling Water Systems

a. Inspection Scope

The team assessed Exelon's applicability review and disposition of NRC Information Notice (IN) 98-25. This IN discussed industry OE regarding leakage and make-up for closed-loop cooling water systems, as well as other closed-loop system performance issues including protection from high energy line breaks (HELBs) and seismic events. The team reviewed the Calvert Cliffs component cooling water (CCW) and SW system operating, fill and vent, and alarm response procedures to verify that procedures adequately addressed the concerns identified in the IN. In addition, the team performed several walkdowns of accessible piping and head tanks; reviewed system corrective action reports; reviewed the system design basis and modification history; and interviewed design engineers to independently verify that the CCW and SW systems were adequately designed to ensure protection from the design basis events postulated in the IN. Finally, the team reviewed Exelon procedures developed to respond to a loss of CCW inventory event, interviewed operators, and conducting a walkthrough of time-critical CCW and SW emergency makeup strategies to determine if the procedures and actions were adequate to mitigate the postulated loss of inventory and were consistent with licensing basis documents.

b. Findings

No findings were identified.

4. OTHER ACTIVITIES

4OA2 Identification and Resolution of Problems (IP 71152)

a. Inspection Scope

The team reviewed a sample of problems that Exelon had previously identified and entered into the 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 December 2, 2015, the team presented the inspection results to Mr. G. Gellrich, Site Vice President, and other members of the CCNPP staff. The team reviewed proprietary information, which was returned to Exelon at the end of the inspection. The team verified that no proprietary information was documented in the report.

ATTACHMENT

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Exelon Personnel

G. Gellrich, Site Vice President
R. Conley, Design Engineer
A. Drake, Senior Engineer
B. Lynch, System Engineer
B. Mahoney, Design Engineer
S. Reichard, Regulatory Assurance
L Smith, Regulatory Assurance Manager
C. Morgan, Design Engineer
M. Gahan, Design Engineering Supervisor
D. Lauver, Design Engineering Manager
K. Eiane, IST and App J Engineering
R. Gines, Senior Engineering
M. Herron, E&C Design Manager
S. Loeper, Diesel Generator System Manager
C. Shinafelt, AOV Programs Engineering

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Open and Closed

05000317/318/2015007-01	NCV	Inadequate Verification of Offsite Power Operability Limit
05000317/318/2015007-02	NCV	Failure to Verify AC Equipment Operability at Design Loading and Voltage Levels

LIST OF DOCUMENTS REVIEWED

Calculations and Engineering Evaluations
000-TH-9102, ADV Flow Capacity at SG Temperature of 340 degrees F, Revision 0
4B199800138, SME Evaluation of Industry Operating Experience Item IN 98-25, dated 10/15/98
Analysis of Diesel Fuel Oil Truck to 11 FOST, performed 9/3/2015
C-4014.2, Foundation and Mounting Qualification for the SWGR H Condensing Unit, Revision 1
CA03414, AFW Pumps, NPSH and Maximum Allowable Flows for Combinations of AFW Pumps, Revision 0
CA04750, Evaluation of Vortexing in the RWT and Resultant Void Fraction of Fluid Ingested by ECCS Pumps, Revision 2

CA00067, Emergency Diesel Generator Fuel Oil Consumption Rate and Tank Capacity Calculation, Revision 0
CA01028, Salt Water Pump Anchorage Evaluation, Revision 0
CA01206, Safety Related 4 kV Undervoltage Protection, Revision 4
CA03645, Parametric Calculation of CACS (Time to Boil), Revision 0
CA03716, 13 kV Voltage Regulator Control Settings, Revision 1
CA03727, Plant Transformer Models for Load Flow Analysis, Revision 1
CA04344, Evaluation of Sluice Gate Wire Rope for De-Rating, Revision 0
CA04511, Switchgear Room Transient Temperature Analysis Evaluating PRA Scenarios, Revision 0
CA04570, Heat-up of Units 1 and 2 Switchgear Rooms on a Loss of Ventilation, Revision 2
CA04658, Use of Outside Air to Cool Switchgear Rooms, Revision 0
CA04879, Salt Water Pump NPSH and Pressure Evaluation, Revision 0
CA04970, SWGR H Fan/Plenum Anchorage Evaluation, Revision 0
CA07771, Auxiliary Transformers Relay Settings, Revision 0
CA07772, AC Load Flow Study, Revision 1
CA08744, Salt Water Flow Indication Uncertainty, Revision 1
CC-AA-309-1001, 4 kV Bus 11 Protective Devices, Revision 5
DE 10250, AFW Pump Room High Ambient Temperatures and their Effect on the AFW Pump Operability, from 8/2005 - 9/2008
E-88-015, Diesel Generator Loading Calculation, Revision 4
E-90-022, Large Motor Data for Load Flow and Short Circuit, Revision 9
E-90-033, Master Fault Calculation, Revision 5
E-90-038, E&C Design Engineering Unit, Revision 10
E-90-059, Protective Relay Setpoint Calculation for 13.8 kV Breakers, Bus 12, Revision 8
E-90-065, Coordination Curves Using ETAP 12.5.0N, Revision 5
E-90-071, 4 kV Bus 14 Protective Devices, Revision 6
E-90-085, 480V Load Center 11A, Revision 3
E-90-086, Protective Relay Setpoint Calculation for 480V Breakers Bus 11B, Revision 1
E-90-71, Coordination Curves Using ETAP 12.5.0N Protective Devices, Revision 6
E-90-91, Protective Relay Setpoint Calculation for 480 V Bus 14A, Revision 5
E-92-010, Emergency Diesel Generator 12 Protective Relays, Revision 1
E-92-046, Diesel Generator LOCI and SD Sequence Voltage Profile, Revision 3
E-94-017, Plant Electrical AC Load Flow Analysis, Revision 2
ECP 13-000-210, Seismic Qualification of CAC Mounting, Revision 0
ECP-11-000373, Change from Low Sulfur to Ultra-Low Sulfur Diesel Fuel Oil (ULSDFO) for Calvert Cliffs Diesel Generators, Diesel Fire Pump and Auxiliary Boiler, Revision 0
ECP-14-000734/SE00537, 1B, 2A, 2B Diesel Generator Rooms Mixing Damper Control Air Modification, Revision 0
ECP-15-000641-309-101-01, Technical Evaluation of two cam surfaces on 2B EDG, Revision 0
ES 1998-01432, Vortexing Potential for AFW Pumps when Pumping from 12 CST, Revision 1
ES 2002-00063, Revise AFW Quarterly Surveillance Test STP-05A, Revision 0
ES 2007-00136, 2SV3938 Equivalent Change, Revision 0
ES 2008-00115, Evaluate Minimum Salt Water Flow to Service Water Heat Exchangers, Revision 0
FCR 79-1062, Design Criteria Document for AFW Modification, Revision C
M-83-18, #23 AFW Pump 48 Hour Endurance Test, dated 1/27/83
M-85-08, AFW Flow with Motor Driven Pump ARC Valve Function Removed, Revision 6

M-88-13, AFW and ECCS Recirculation, NRC Bulletin 88-04, dated 11/15/07
M-92-36, Containment Air Cooler Parametric Study, Revision 1
M-93-132, CCW and SRW Head Tank Levels vs. Volume, Revision 0
M-93-167, Units 1 and 2 CCW Pump NPSH and Max Discharge Header Pressure, Revision 0
M-93-188, Flow Rates for Temporary Fire Protection - AFW Connection, Revision 0
MPR-3643, Evaluation of Ultra Low Sulfur Diesel Fuel for CCNPP EDGs and SBO Diesel, Revision 0

Corrective Action Condition Reports

01700151	02579205	02590218*	2012-003396
01700171	02580356*	02590231*	2012-003588
01702035	02581637*	02590315*	2012-003933
01706319	02581673	02590405*	2012-008380
01831091	02582210*	2008-000669	2012-008558
01837897	02582609*	2008-000676	2013-000481
01842405	02585712*	2008-002833	2013-000518
01843128	02587958*	2009-003360	2013-004351
01844430	02588086	2009-003362	2013-005994
01844826	02588233	2009-003451	2013-006238
01848100	02589237*	2009-003452	2013-006792
01849465	02589251*	2009-003453	2013-008309
02457147	02589313*	2009-003660	2013-009462
02481527	02589642*	2009-006255	2014-005164
02484165	02589648*	2012-000854	2103-005994
02528673	02589729*	2012-001393	
02548999	02589874*	2012-001394	
02555331	02589895*	2012-001395	

* CR written as a result of this inspection

Design and Licensing Basis Documents
Baltimore Gas and Electric to NRC letter, Adequacy of Station Electric Distribution Systems Voltages, dated 10/8/79
Baltimore Gas and Electric to NRC letter, Adequacy of Station Electric Distribution Systems Voltages, dated 3/31/81
Baltimore Gas and Electric to NRC letter, Adequacy of Station Electric Distribution Systems Voltages, dated 11/24/81
Baltimore Gas and Electric to NRC letter, Electrical Distribution System Functional Inspection, dated 7/8/92
Baltimore Gas and Electric to NRC letter, Electrical Distribution System Functional Inspection, dated 8/14/92
Baltimore Gas and Electric to NRC letter, Electrical Distribution System Functional Inspection, dated 9/9/92
Constellation Energy to NRC letter, Generic Letter 2006-02, 60 Day Response, dated 4/3/06
Constellation Energy to NRC letter, Generic Letter 2006-02, Response to Request for Additional Information, dated 1/31/07
NRC to Baltimore Gas and Electric letter, Adequacy of Station Electric Distribution Voltages, dated 5/10/82

NRC to Baltimore Gas and Electric letter, EDSFI Inspection Report 50-317/92-80 & 50-318/92-80, dated 6/5/92
NRC to Baltimore Gas and Electric letter, Issuance of Amendments for Calvert Cliffs Nuclear Power Plant, dated 3/17/98
NRC to Calvert Cliffs letter, NRC Integrated Inspection Report, dated 3/9/04
SD-001, System Description, 500 kV Switchyard & Generator Step-Up Transformer, Revision 8
SD-003/007, System Description, 13.8 kV System, Revision 4
SD-004, System Description, 4160 Electrical Power Distribution, Revision 3
SD-024A, System Description, Fairbanks Morse Diesel Generators, Revision 7
Updated Final Safety Analysis Report, Revision 47

Drawings
12312-0002, Model D-100-100 OPER. 5" - 600 LB. USA STD Valve Assembly, Revision 6
12312-0008, F/D-100-60-100-160, 160-21/2 Diaphragm Operators Accessory Kit, Revision 2
12315-02, Assembly 24" F.G. 5712 Angle Flow Pump, F-M Drawing 99L24C-D, Revision 12
12329B-0003, Refueling Water Storage Tank, dated 12/2/71
12329C-12, Condensate Storage Tank, Revision D
12523-0158, Sht. 01, Power Supply System ESFAS, Revision 5
12523-0158, Sht. 02, Power Supply System ESFAS, Revision 7
1273-0157, Sht. 03, Parts List ZE, ZF, and ZG Sensor Cabinet ESFAS, Revision 0000D
1E-182, Sht. 01, Connection Diagram H.P. Safety Inj. Pump 13 4 kV Disc. Switches, Revision 3
1E-76, Sht. 05, Schematic Diagram High Press. Safety Injection Pump-13, Revision 6
53079, Sht. 054B, Schematic Diagram Auxiliary Feedwater Motor Driven Pump 23, Revision 8
60-485-E, RWST Piping, Revision 5
60583, Sht. 2, Auxiliary Feedwater (Condensate), Revision 6
60706, Sht. 1, Service Water Cooling System, Turbine Area, Revision 55
60706, Sht. 2, Service Water Cooling System, Auxiliary Building and Containment, Revision 79
60708, Circulating Salt Water Cooling System, Revision 43
60710, Shts. 1, 2 and 3, Component Cooling System, Revision 45, 42, and 45
60712, Sht. 3, Compressed Air System Instrument Air and Plant Air, Revision 113
60714, Sht. 03, Plant Fire Protection System, Turbine and Service Buildings and Intake Structure, Revision 32
60722, Sht. 1, Auxiliary Building Ventilation System, Revision 60
60722, Sht. 2, Auxiliary Building Ventilation System Details, Revision 47
60723, Ventilation Systems, Containment, Turbine and Penetration Rooms, Revision 63
60724, Sht. 1, Reactor Coolant and Waste Process Sample System, Revision 60
60727, Sht. 2, Diesel Generator Cooling Water, Starting Air, Fuel, and Lube Oil, Diesel No. 1B, Revision 64
60734, Sht. 4, Reactor Coolant Waste Processing Systems, Revision 31
60735, Sht. 2, Waste Gas and Miscellaneous Waste Processing Systems, Revision 46
60736, Sht. 1, Fuel Oil Storage System, Revision 53
60744, Sht. 1, Gas Analyzing System, Revision 18
61001, Sht. 1, Electrical Main Single Line Diagram, Revision 45
61004, Single Line Meter & Relay Diagram 13 kV System, Revision 26
61005, Meter and Relay Diagram 4 kV System Unit Buses 11 and 14, Revision 36
61009, Single Line Meter & Relay Diagram 480V Unit Buses 11A, 11B, 14A and 14B, Revision 41
61013, Sht. 04B, Reactor MCC 114R, Revision 55

61013, Sht. 04C, Reactor MCC 114R, Revision 43
61017, Sht. 02, Single Line Diagram Reactor 480V MCC 114R, Revision 45
61058, Logic Diagram Engineered Safety Features Actuation System Unit 1, Revision 36
61069, Schematic Diagram, Turbine Steam Dump and Bypass Controls, Revision 24
61076, Sht. 05, Schematic Diagram High Press Safety Injection Pump 13, Revision 6
61076, Sht. 11C, Schematic Diagram Containment Cooling Fan 11, Revision 3
61077, Sht. 0311, Block Diagram A.C. Schematic Diagram 480V Unit Bus 11B, Revision 6
61080, Sht. 7, Schematic Diagram Salt Water Pump 12, Revision 21
61085, Sht. 9C, Schematic Diagram Heating & Ventilating Swgr Room A/C Compressor 11 & 12, Revision 10
61085, Sht. 9L, Schematic Diagram Heating & Ventilating Switchgear H Unit 11 Fan, Revision 1
61182SH001, Connection Diagram High Pressure Safety Injection Pump 13 4 kV Disconnect Switches, Revision 3
61281, Trays & Conduits Auxiliary Building, Revision 38
61-841-E, Intake Structure Sluice Gates and Stop Logs, Revision 9
62700, Sht. 01, Main Steam and Reheat, Revision 54
62731, Sht. 1, and 3, Safety Injection and Containment Spray Systems, Revision 83, 49, and 28
63079, Sht. 054B, AFW Motor Driven Pump 23, Revision 8
65065, Sht. 01, Instrument Installation Detail for 1CV3938 and 1CV3939, Revision 4
82572, Sht. 01, Control Wiring Diagram Size 5 Started Assembly, Revision 0
87050, Sht. 01, Electrical ZE, ZF & ZG Sensor Cabinet ESFAS Wiring Diagram, Revision 3
C970124, Fan Mounting for Switchgear Room H Fans, Revision 0
E970034, SWGR Room Fan Assembly Drawing, Revision 0
FF11884, Series 2000 Axivane Fan, Revision 0
M-154, Ventilation System Containment Structure Unit 2, Revision 7
N-1348, No. 23 AFW Pump Curve, dated 4/26/82
SK2PI-059146, Setting Plan, Salt Water Pump, Revision 4

Functional, Surveillance and Modification Acceptance Testing
20140325-00034, "B" Train Integrated Engineered Safety Features Test, performed 3/9/14
20150501, Auxiliary Feedwater/Main Steam Check Valve Test, performed 3/11/15
23 AFW Motor Driven Pump, IST 4-Year Trend Data, dated 12/29/11 - 8/11/15
C92807872-100, Test of 1B DG and 14 4 kV Bus LOCI Sequencer, Monthly, performed 9/3/15
C92807874-100, Test of 1B DG and 14 4 kV Bus LOCI Sequencer, Quarterly, performed 9/3/15
ETP 93-064R, Unit 2 CAC Inlet CV Adjustment, performed 3/24/07
ETP 93-14, Unit 2 Containment Air Cooler Flow Test, performed 12/3/93
NC-014-1456, 1B DG Air Cooler, Lube Oil Cooler and Jacket Water Cooler Eddy Current Inspection Report, performed 10/14/14
NO-1-203, Operations Performance Evaluation of #11 and #12 SWGR Room H Units, performed May, July, and September 2015
STP O 73A-1, Salt Water Pump and Check Valve Quarterly Operability Test, performed 1/15/15, 4/14/15, and 7/15/15
STP O-4B-1, B Train Integrated Engineered Safety Features Test, performed 3/9/14
STP O-5A23-2, 23 Auxiliary Feedwater Pump Quarterly Surveillance Test, performed 8/11/15
STP O-67B-2, AFW/Main Steam Check Valve Test, performed 3/13/15
STP O-68-1, Miscellaneous Valve Position Indicator Test (1CV 3938), performed 3/16/15
STP O-71-2, Monthly Test of “B” Train Containment Cooling Units, performed 9/8/15
STP O-73H-2, Auxiliary Feedwater Pump Large Flow Test, performed 2/15/15

STP O-87-2, Borated Water Source 7-Day Operability Verification, performed 10/16/15
STP O-8B-1, Test of 1B DG and 14.4 kV Bus LOCI Sequencer, performed 9/4/15 and 10/5/15
STP O-9-2, AFAS Logic test, performed 7/18/15
STP O-9A-2, AFAS Equipment Response Time Test, performed 4/18/15

Miscellaneous
12 Salt Water Pump 4-year IST Trend Data, dated 2011-2015
12095-107-1015, Series 5600 Motor Control Centers Design and Application Guide, dated 9/9/85
15000-015-1002, Instruction Book Motor Equipment for Auxiliary Feed Water Modification Pumps, dated 2/10/84
152-1402, 1A04 Breaker 152-1402 Phase Overcurrent Relay 152/151T, dated 1/11/05
152-1405, Protective Relay Setting Sheets, Saltwater Pump 12, 5/9/961B04A/51G/T, 1B04A Load Center Transformer Ground Overcurrent Relay 51G/T, dated 2/18/97
1B Diesel Generator 24-hour Operating Logs, completed 10/4/15
1B Diesel Generator Maintenance Rule Basis Function Scope, Version 1.7.4, dated 7/25/15, 8/5/15, and 9/30/15
1C13-ALM, Unit 1 SRW and Miscellaneous Services Alarm Manual, Revision 54
1C40/251/ST-1, P-13000-1 Service Transformer Overcurrent Relay 251/ST-1, dated 4/2/96
1C40/251G/SB-11, 13 kV Bus 11 Breaker 252-1104 Ground Overcurrent Relay, dated 4/2/96
1C40/251G/ST-1, P-13000-1 Service Transformer Ground Overcurrent Relay 251G/ST-1, dated 4/2/96
23 AFW Pump and Motor Bearings Temperature Trend Graph, dated 11/4/15
251-1201/251G/B-12-1, No. 12 Service Bus Ground Overcurrent Relay 251G/B-12-1, dated 10/8/13
252-1201/251/B-12-1, No. 12 Service Bus Overcurrent Relay 251/B-12-1, dated 10/16/13
2C13-ALM, Unit 2 SRW and Miscellaneous Services Alarm Manual, Revision 55
52-1110, Protective Relay Setting Sheets, Switchgear Room H Unit 11, dated 10/7/03
52-11436, Protective Relay Setting Sheets, Switchgear Room H Unit 11 Fan, dated 3/11/99
52-1412, 1B04A Breaker 52-1412, dated 9/17/97
ASTM International D975-12a, Standard Specification for Diesel Fuel Oils, 11/1/12
C0-SY-004, 4 kV Service Transformer & Busses System Notebook, Revision 0
C0-SY-005, PRA 480 VAC Electrical Transformers & Buses System Notebook, Revision 0
C0-SY-006, PRA 480V MCCs, Revision 0
C0-SY-036, PRA Auxiliary Feedwater System Notebook, Revision 0
C0-SY-048, PRA Engineering Safety Features Actuation System Notebook (ESFAS), Revision 0
C0-SY-052, PRA Safety Injection System Notebook, Revision 0
Calvert Operational Assessment Related to Apparent Design Criteria Violations in E94-017, dated 2/19/12
Check Valve Data Sheet, 2-AFW-201, dated 6/6/91
Check Valve Data Sheet, 2-AFW-202, dated 5/31/91
CO-SY-032, PRA Aux H Cooling, Revision 0
CO-SY-060, PRA Primary Containment H System Notebook, Revision 0
CO-SY-OI2, PRA Salt Water Cooling System Notebook, Revision 0
ES-001, Flooding, Revision 4
ES199501715, Revise SP-0807 to Add 11 MCC Buckets, Revision 7
ESP 93-0203, Engineering Service Package, EDG Upgrade Project, Revision 0
Fairbanks Morse to W. Holston letter, BG&E; Salt Water Pump Minimum Flow, dated 11/29/88
Constellation to USNRC letter, Resolution of Generic Letter 96-06 Issues, dated 7/19/04

Machine Test Summary, #24 CAC, dated 11/6/15
Maintenance Rule Basis Document, 036A-01/03, Auxiliary Feedwater, dated 10/20/15
Maintenance Rule Basis Document, 083A-02, Main Steam, dated 10/20/15
NDE Report 07-U-CCNPP2-8098, Ultrasonic Thickness Measurement Record, HBC-19-2003-02FO, dated 11/15/07
P-13000-1, Transformer Tap Setting Sheet, dated 3/31/97
PR-SY-001, PRA 500 kV Switchyard System Notebook, Revision 0
PR-SY-003, PRA 13 kV Service Transformer and Busses System Notebook, Revision 0
Quality Assurance Topical Report, Revision 9
Reasonable Expectation of Continued Operability, RWT Air-Entrainment Void Fraction, dated 8/21/09
Seismic Screening Evaluation Worksheet, Salt Water Pump #12, dated 4/28/93
SGS Herguth Laboratories Crankcase Oil Analysis, 1B EDG, data from 5/6/13 through 10/5/15
SGS Herguth Laboratories Crankcase Oil Analysis, 2B EDG, performed 8/12/15, 9/9/15, and 10/11/15
Spec. No. 6750-M-66, Salt Water Pumps and Drivers, Revision 0
Steam Pressure Trace, Atmospheric Steam Dump Valve, dated 1/21/14
System Health Report, 023, 024A, 024C, Fairbanks EDG and Diesel Oil System, Q3-2015
U-440-14A, Transformer Tap Setting Sheet, dated 11/15/95
WC-CA-8003-1010, Calvert Cliffs Nuclear Power Plant Units 1 and 2 Nuclear Plant Interface Requirements (NPIRs), Revision 0

Operating Procedures
1C19-ALM, 13 kV & 4 kV Essential Feeder Bkrs Contr Board Alarm Manual, Revision 37
AOP-71, Loss of 4 kV, 480 Volt or 208/120 Volt Instrument Bus Power, Revision 29
AOP-7C, Loss of Component Cooling Water, Revision 4
AOP-7D-1, Unit 1 Loss of Instrument Air, Revision 15
AOP-7D-2, Unit 2 Loss of Instrument Air, Revision 13
AOP-7M, Major Grid Disturbances, Revision 2
AOP-7M-TB, Major Grid Disturbances Basis Document, Revision 2
CNG-CA-1.01-1005, Apparent Cause Evaluation, Revision 00200
CP-0226, Specifications and Surveillance – Diesel Fuel Oil, Revision 01600
CP-0503, Sampling of Oil, Revision 01201
E-10, Testing and Adjustment of Agastat Relays, Revision 00500
E-19, Clean and Inspect ITE Series 5600, Wyle Spectrum Technologies, and Nuclear Logistics Inc. Motor Control Center (MCC) Cubicles, Revision 01201
ER-AA-2011, Degraded Equipment Tracking in PLANTIQ, Revision 3
FTE-58, 480 Volt Motor Control Center (MCC) Cleaning and Inspection, Revision 500
FTE-59, Periodic Maintenance, Calibration and Functional Testing of Protective Relays, Revision 00700
FTE-61, 4KV Disconnect Switch Inspection, Revision 00401
FTE-89, Cutler Hammer DS-206 Circuit Breaker Inspection, Revision 400
FTM-03B, Rotating Equipment Alignment Using Laser Alignment Systems, Revision 00600
OAP 94-5, Guidelines for Nuclear Plant Operations (NPO) Support for Electric System Operation & Planning Department (ESO&PD) Transmission System Operations (TSO) Unit, Revision 24
OI-16, Unit 1 Component Cooling Water Valve Alignment, Revision 35
OI-21B, 2B Diesel Generator, Revision 22

OI-22H, Switchgear Ventilation and Air Conditioning, Revision 23
OI-27B, 13.8 kV System, Revision 20
OI-27C, 4.16 kV System, Revision 26
OI-27D-1, Station Power 480 Volt System, Revision 6
OI-27E, SMECO Offsite Power System, Revision 15
OI-28, Operation of 500 kV Switchyard, Revision 16
OI-32A, Auxiliary Feedwater System, Revision 02400
OI-34, Engineered Safety Features Actuation System, Revision 23
P-13000-1-ALM, 13.8 kV Transformer Alarm Manual, Revision 32
STP M-522B-1, 4 kV Bus 14 Undervoltage Relay Calibration and Response Time Check, Revision 00100
STP O-90-1, AC Sources and On Site Power Distribution Systems 7 Day Operability Verification, Revision 23
STP-M-220D-1, Engineered Safety Features Actuation System Channel ZG Functional Test, Revision 00600
TP Lube-02, General Lubrication Procedure, Revision 00900
TP Tube-01, Fabrication and Installation of Parker CPI and Swagelok Compression Fittings, Revision 00600
U-4000-11-ALM, Transformer Alarm Manual, Revision 32
WC-AA-101-1006, On-line Risk Management and Assessment, Revision 1
WC-AA-104, Integrated Risk Management, Revision 23

Procedures
2-102-54-O-SA, AOP/EOP Pre-staged Equipment, Revision 01904
AOP-9N, Safe Shutdown due to a Severe Fire, Revision 13
EOP Attachment 8, Maintain AFW Pump Suction Supply and CST Inventory, Revision 18
EOP-3, Loss of All Feedwater, Revision 21
ERPRP-611, Severe Accident Management Restorative Actions, Revision 00303
ES-022, Calculation Preparation, Revision 5
OI-32A, Auxiliary Feedwater System, Revision 02400
OI-3A, Safety Injection and Containment Spray, Revision 03200
OI-51, Operations Required Actions to Maintain PRA Equipment Availability, Revision 00100
OP-4, Plant Shutdown from Power Operation to Hot Standby, Revision 03406
OP-AA-108-115, Operability Determinations, Revision 16
PE 1-102-10-O-R, Remote Shutdown Panel Operation Verification, Revision 00503
STP M-522B-1, 4kV Bus 14 Undervoltage Relay Calibration and Response Time Check, Revision 1
STP O-67K-2, SRW Turbine Building Header Check Valve Test, Revision 104
VALVE-17, Atmospheric Dump Valve Inspection and Repair, Revision 01100

Vendor Technical Manuals
01-P13-37, Copes-Vulcan D-100 Valves, Installation, Operation and Maintenance Instructions, dated 8/10/84
12087-011-1046, P-13000-1 Service Transformer, Revision 1
12095-107-1001, General Instructions for Series 5600 Motor Control Center, dated 9/9/85
12095-107-1003, Series 5600 Typical Indoor Enclosure Dimensions, dated 9/9/85
12095-107-1015, Series 5600 Motor Control Centers Design and Application Guide, dated 9/9/85

12308-013-1001, Installation and Maintenance of Calvert Cliffs Containment Air Cooler, dated 4/9/96
12310-168, Emergency Diesel Generators, Fairbanks Morse 38TD8-1/8, Revision 184
12315-009-1000, Salt Water Pump Motor, Revision 2
12400-206-1006, Magne-Blast Circuit Breaker, dated 11/1/88
12410-097-1014, Power Center Transformers, dated 2/13/86
12421-017, Indoor/Outdoor Power Switching Center, dated 5/26/84
12723-217-1001, Operation Manual for Engineered Safety Features Actuation System, dated 7/31/84
12723-217-1002, Service Manual for Engineered Safety Features Actuation System, dated 7/31/84
AQR-67368, Component Replacement and Maintenance of ASCO Catalog NP-1 Valves, Revision 0
PES-5586, Procurement Engineering Specification, ASCO Solenoid Valves, dated 4/20/07
VTD J127-1013, Containment Air Cooler Tech Manual, dated 2/08/93
VTD 15000-015-1001, Ingersoll-Rand Vendor Manual, Auxiliary Feedwater Pump, dated 5/25/82

<u>Work Orders</u>

C220034544	C90945008	C92350125	C92644037
C220082106	C91348657	C92351305	C92655514
C90639792	C91660609	C92355472	C92718905
C90942190	C92139390	C92453339	
C92761993	C92788742	C92848271	
C92779110	C92794516		

LIST OF ACRONYMS

AC	Alternating Current
ADAMS	Agencywide Documents Access and Management System
ADV	Atmospheric Steam Dump Valve
AFW	Auxiliary Feedwater
CAC	Containment Air Cooler
CCW	Component Cooling Water
CCNPP	Calvert Cliffs Nuclear Power Plant
CDBI	Component Design Bases Inspection
CFR	Code of Federal Regulations
CR	Condition Report
DBD	Design Basis Document
DRS	Division of Reactor Safety
EDG	Emergency Diesel Generator
HELB	High Energy Line Break
H	Heating, Ventilation and Air Conditioning
IMC	Inspection Manual Chapter
IN	Information Notice
IP	Inspection Procedure
IST	In-Service Test
kV	Kilovolt

LERF	Large Early Release Frequency
LOCA	Loss-of-Coolant Accident
MCC	Motor Control Center
MOV	Motor Operator Valve
NCV	Non-cited Violation
NPIR	Nuclear Plant Interface Requirements
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
OE	Operating Experience
PM	Preventative Maintenance
PRA	Probabilistic Risk Assessment
RAW	Risk Achievement Worth
RRW	Risk Reduction Worth
RWT	Refueling Water Tank
SDP	Significance Determination Process
SPAR	Standardized Plant Analysis Report
SR	Safety Related
SUR	Steady State Degraded Voltage Relay
SW	Service Water
12SWP	12 Salt Water Pump
TDH	Total Dynamic Head
TS	Technical Specification
TSO	Transmission System Operator
TUR	Transient Degraded Voltage Relay
UFSAR	Updated Final Safety Analysis Report
VAC	Volts, Alternating Current