



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

February 10, 2017

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

**SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT – INTEGRATED INSPECTION  
REPORT 05000317/2016004 AND 05000318/2016004**

Dear Mr. Hanson:

On December 31, 2016, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Calvert Cliffs Nuclear Power Plant (CCNPP), Units 1 and 2. On January 24, 2017, the NRC inspectors discussed the results of this inspection with Mr. George Gellrich, Site Vice President, and other members of your staff. The results of this inspection are documented in the enclosed report.

NRC inspectors documented one finding of very low safety significance (Green) in this report. This finding involved 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 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 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 Resident Inspector at CCNPP. In addition, if you disagree with the cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region I, and the NRC Resident Inspector at CCNPP.

B. Hanson

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Sincerely,

*/RA/*

Anthony Dimitriadis, Chief  
Reactor Projects Branch 1  
Division of Reactor Projects

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

Enclosure:  
Inspection Report 05000317/2016004 and  
05000318/2016004  
w/Attachment: Supplementary Information

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SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT – INTEGRATED INSPECTION REPORT 05000317/2016004 AND 05000318/2016004 dated February 10, 2017

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U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket Nos. 50-317 and 50-318

License Nos. DPR-53 and DPR-69

Report Nos. 05000317/2016004 and 05000318/2016004

Licensee: Exelon Generation Company, LLC (Exelon)

Facility: Calvert Cliffs Nuclear Power Plant, Units 1 and 2

Location: Lusby, MD

Dates: October 1, 2016 through December 31, 2016

Inspectors: R. Clagg, Senior Resident Inspector  
E. Torres, Acting Senior Resident Inspector  
C. Roettgen, Resident Inspector  
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Approved by: Anthony Dimitriadis, Chief  
Reactor Projects Branch 1  
Division of Reactor Projects

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## SUMMARY

Inspection Report 05000317/2016004, 05000318/2016004; 10/01/2016 – 12/31/2016; Calvert Cliffs Nuclear Power Plant (CCNPP), Units 1 and 2; Operability Determinations and Functionality Assessments.

This report covers a three-month period of inspection by resident inspectors and announced baseline inspections performed by regional inspectors. The inspectors identified one non-cited violation (NCV) of very low safety significance (Green). The significance of most 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," 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 U.S. Nuclear Regulatory Commission (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.

### Cornerstone: Barrier Integrity

- Green. The inspectors identified a Green NCV of Title 10 of the *Code of Federal Regulations* (10 CFR), Appendix B, Criterion XVI, Corrective Action, for Exelon's failure to identify conditions adverse to quality at CCNPP. Specifically, several safety related auxiliary building caulking, seals, expansion joints, and penetration barriers were found by the inspectors or revealed themselves by water intrusion events to be degraded. The inspectors determined that Exelon's failure to identify degradation of several auxiliary building caulking, seals, and expansion joints was a performance deficiency that was reasonably within its ability to foresee and correct and should have been prevented. Exelon's immediate corrective actions included performing operability determinations on degraded barriers, and repair of the degraded barriers. Exelon entered these issues into its corrective action program (CAP) as action request (AR) 02715188, AR 02715199, AR 02716543, AR 02725901, and AR 02564655.

The inspectors reviewed IMC 0612, Appendix B, "Issue Screening," issued on May 6, 2016, and determined the issue is more than minor because it adversely affected the Human Performance attribute, of the Auxiliary Building Area, of the Barrier integrity cornerstone objective to provide reasonable assurance that physical design barriers protect the public from radionuclide releases caused by accidents or events. The inspectors also reviewed IMC 0612, Appendix E, "Examples of Minor Issues," and found it was sufficiently similar to Example 3.k, in that significant programmatic deficiencies were identified that could have led to worse outcomes. Specifically, several inspection programs designed to identify degraded barriers, caulking, seals, and expansion joints in safety related auxiliary building barriers, had not been performed, or had been performed inadequately. In accordance with IMC 0609, Attachment 4, "Initial Characterization of Findings," issued on October 7, 2016, and IMC 0609, Appendix A, "The Significance Determination Process for Findings at Power" issued on June 19, 2012, the inspectors determined that this finding is of very low safety significance (Green) since, the only safety related degradation represented by the finding is of the radiological barrier function provided for the auxiliary building. The inspectors determined that the cause of the finding has a cross-cutting aspect in the area of Human Performance, Procedure Adherence, because Exelon did not complete the baseline inspection required by AMBD-0026 within the 10 years preceding entry of Units 1 and 2 into

their respective periods of extended operation as specified in CNG-CM-6.01. Additionally, inspections conducted under AMBD-0052, and 0-013-49-O-18M were inadequate in that they failed to identify degradation of the barriers as described above. [H.8] (Section 1R15)

## REPORT DETAILS

### Summary of Plant Status

Unit 1 began the inspection period at 100 percent power. On December 10, 2016, operators reduced power to 83 percent for main turbine valve testing and restored the unit to 100 percent power the same day. The unit remained at or near 100 percent power for the remainder of the inspection period.

Unit 2 began the inspection period at 100 percent power. On December 3, 2016, the unit experienced an automatic loss of load reactor trip due to a leak in the electro-hydraulic control system from the Main Turbine 21 Governor Valve. Unit startup began on December 4 and the unit reached 100 percent power on December 5. The unit remained at or near 100 percent power for the remainder of the inspection period.

### 1. REACTOR SAFETY

#### **Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity**

#### 1R01 Adverse Weather Protection (71111.01 – 1 sample)

##### Readiness for Seasonal Extreme Weather Conditions

##### a. Inspection Scope

The inspectors performed a review of Exelon's readiness for the onset of seasonal cold temperatures. The review focused on the 12 condensate storage tank and Units 1 and 2 refueling water tank. The inspectors reviewed the Updated Final Safety Analysis Report (UFSAR), technical specifications (TS), control room logs, and the CAP to determine what temperatures or other seasonal weather could challenge these systems, and to ensure Exelon personnel had adequately prepared for these challenges. The inspectors reviewed station procedures, including Exelon's seasonal weather preparation procedure and applicable operating procedures. The inspectors performed walkdowns of the selected systems to ensure station personnel identified issues that could challenge the operability of the systems during cold weather conditions. Documents reviewed for each section of this inspection report (IR) are listed in the Attachment.

##### b. Findings

No findings were identified.

#### 1R04 Equipment Alignment

##### .1 Partial System Walkdowns (71111.04Q – 3 samples)

##### a. Inspection Scope

The inspectors performed partial walkdowns of the systems listed below. The inspectors selected these systems based on their risk-significance relative to the reactor safety cornerstones at the time they were inspected. The inspectors reviewed applicable procedures, system diagrams, the UFSAR, TS, work orders (WOs), ARs, and the impact of ongoing work activities on redundant trains of equipment in order to identify conditions



that could have impacted the system's performance of its intended safety functions. The inspectors also performed field walkdowns of accessible portions of the systems to verify system components and support equipment were aligned correctly and were operable. The inspectors examined the material condition of the components and observed operating parameters of equipment to verify that there were no deficiencies. The inspectors also reviewed whether Exelon staff had properly identified equipment issues and entered them into the CAP for resolution with the appropriate significance characterization.

- 22 emergency core cooling system (ECCS) train during 21 ECCS train out of service for motor operated valve (MOV) testing, October 5, 2016
- 1A emergency diesel generator (EDG) and associated equipment during 1B EDG out of service for maintenance, October 20, 2016
- 0C diesel generator and associated equipment during 1B EDG out of service for maintenance, November 8, 2016

b. Findings

No findings were identified.

.2 Full System Walkdown (71111.04S – 1 sample)

a. Inspection Scope

The inspectors performed a complete system walkdown of accessible portions of Unit 1 and Unit 2 auxiliary feedwater (AFW), to verify the existing equipment lineup was correct. The inspectors reviewed operating procedures, surveillance tests, drawings, equipment lineup check-off lists, and the UFSAR to verify the system was aligned to perform its required safety functions. The inspectors also reviewed electrical power availability, component lubrication and equipment cooling, hangar and support functionality, and operability of support systems. The inspectors performed field walkdowns of accessible portions of the systems to verify as-built system configuration matched plant documentation, and that system components and support equipment remained operable. The inspectors confirmed that systems and components were aligned correctly, free from interference from temporary services or isolation boundaries, environmentally qualified, and protected from external threats. The inspectors also examined the material condition of the components for degradation and observed operating parameters of equipment to verify that there were no deficiencies. Additionally, the inspectors reviewed a sample of related ARs and WOs to ensure Exelon had appropriately evaluated and resolved any deficiencies.

b. Findings

No findings were identified.

1R05 Fire ProtectionResident Inspector Quarterly Walkdowns (71111.05Q – 6 samples)a. Inspection Scope

The inspectors conducted a tour of the areas listed below to assess the material condition and operational status of fire protection features. The inspectors verified that Exelon controlled combustible materials and ignition sources in accordance with administrative procedures. The inspectors verified that fire protection and suppression equipment was available for use as specified in the area pre-fire plan, and passive fire barriers were maintained in good material condition. The inspectors also verified that station personnel implemented compensatory measures for out of service, degraded, or inoperable fire protection equipment, as applicable, in accordance with procedures.

- Unit 1, West Electrical Penetration Room, Fire Area 32, November 17, 2016
- Unit 1, East Electrical Penetration Room, Fire Area 33, November 17, 2016
- Unit 1, Cable Spreading Room and 1C Chase, Fire Area 16, December 2, 2016
- Unit 1, Battery Rooms, Fire Area 16A, December 2, 2016
- Hallway outside Cable Spreading Room, Fire Area 16B, December 2, 2016
- Control Room Complex, Fire Area 24, December 19, 2016

b. Findings

No findings were identified.

1R07 Heat Sink Performance (71111.07A – 1 sample)a. Inspection Scope

The inspectors reviewed the 11A service water (SRW) heat exchanger to determine its readiness and availability to perform its safety functions. The inspectors reviewed the design basis for the component and verified Exelon's commitments to NRC Generic Letter 89-13, "Service Water System Requirements Affecting Safety-Related Equipment." The inspectors reviewed the results of previous thermal performance tests and inspections of the 11A SRW heat exchanger and similar heat exchangers. The inspectors discussed the results of the most recent inspection with engineering staff and reviewed the as-found and as-left conditions. The inspectors verified that Exelon initiated appropriate corrective actions for identified deficiencies.

b. Findings

No findings were identified.

1R11 Licensed Operator Regualification Program and Licensed Operator Performance  
(71111.11Q – 2 samples; 71111.11A – 1 sample).1 Quarterly Review of Licensed Operator Regualification Testing and Traininga. Inspection Scope

The inspectors observed a licensed operator simulator training scenario on December 13-14, 2016, which involved a hypothetical steam generator tube rupture coincident with

a main steam line break inside of containment and a failure of select components to automatically start as required resulting in an Alert declaration. The inspectors evaluated operator performance during the simulated event and verified completion of risk significant operator actions, including the use of abnormal and emergency operating procedures (EOP). The inspectors assessed the clarity and effectiveness of communications, implementation of actions in response to alarms and degrading plant conditions, and the oversight and direction provided by the control room supervisor. The inspectors verified the accuracy and timeliness of the emergency classification made by, and the TS action statements entered by the shift manager. Additionally, the inspectors assessed the ability of the crew and training staff to identify and document crew performance problems.

b. Findings

No findings were identified.

.2 Quarterly Review of Licensed Operator Performance in the Main Control Room

a. Inspection Scope

On December 4, 2016, the inspectors observed licensed operators in the main control room during the Unit 2 reactor startup as well as infrequently performed test or evolution briefings, pre-shift briefings, and reactivity control briefings associated with the startup. The inspectors observed procedure use and adherence, crew communications, and coordination of activities between work groups and verified operator performance and briefings met the standards of Exelon procedure OP-AA-101-111-1001, "Operations Standards and Expectations," Revision 18.

b. Findings

No findings were identified.

.3 Licensed Operator Regualification Program (71111.11A)

a. Inspection Scope

On December 19, 2016, one NRC region-based inspector conducted an in-office review of results of the licensee-administered annual operating tests for 2016 for CCNPP Unit 1 and Unit 2 operators. The inspection assessed whether Pass/Fail rates were consistent with the guidance of NRC IMC 0609, Appendix I, "Licensed Operator Regualification Significance Determination Process (SDP)." The review verified that the failure rate (individual or crew) did not exceed 20 percent.

- None of the 75 operators failed any section of the annual exam. The overall individual failure rate was 0.0 percent
- None of the 14 crews failed the simulator test. The crew failure rate was 0.0 percent

a. Findings

No findings were identified.

1R12 Maintenance Effectiveness (71111.12Q – 2 samples)a. Inspection Scope

The inspectors reviewed the samples listed below to assess the effectiveness of maintenance activities on structure, system, and component (SSC) performance and reliability. The inspectors reviewed system health reports, CAP documents, maintenance WOs, and maintenance rule basis documents to ensure that Exelon was identifying and properly evaluating performance problems within the scope of the maintenance rule. For each sample selected, the inspectors verified that the SSC was properly scoped into the maintenance rule in accordance with 10 CFR 50.65 and verified that the (a)(2) performance criteria established by the Exelon staff was reasonable. As applicable, for SSCs classified as (a)(1), the inspectors assessed the adequacy of goals and corrective actions to return these SSCs to (a)(2). Additionally, the inspectors ensured that the Exelon staff was identifying and addressing common cause failures that occurred within and across maintenance rule system boundaries. Additionally the inspectors verified that quality control verifications were properly specified in accordance with the Quality Assurance Program, and were implemented as specified.

- Expansion joint degraded (AR02715188)
- C92145088, replace 0C AHU-2 air dampers per ECP-16-000067 (Augmented Quality), C93589938, CV causing 125VDC ground (Safety Related), C93590805, 1FT5209 11A saltwater flow indication is low (Safety Related), (Quality Control)

b. Findings

No findings were identified.

1R13 Maintenance Risk Assessments and Emergent Work Control (71111.13 – 3 samples)a. Inspection Scope

The inspectors reviewed station evaluation and management of plant risk for the maintenance and emergent work activities listed below to verify that Exelon performed the appropriate risk assessments prior to removing equipment for work. The inspectors selected these activities based on potential risk significance relative to the reactor safety cornerstones. As applicable for each activity, the inspectors verified that Exelon performed risk assessments as required by 10 CFR 50.65(a)(4) and that the assessments were accurate and complete. When Exelon performed emergent work, the inspectors verified that operations personnel promptly assessed and managed plant risk. The inspectors reviewed the scope of maintenance work and discussed the results of the assessment with the station's probabilistic risk analyst to verify that plant conditions were consistent with the risk assessment. The inspectors also reviewed the TS requirements and inspected portions of redundant safety systems, when applicable, to verify risk analysis assumptions were valid and applicable requirements were met.

- Unit 2, maintenance risk assessment for the week of October 3, 2016
- Unit 2, 21 switchgear heating, ventilation, and air conditioning out of service for maintenance, November 3, 2016
- Unit 1 and Unit 2, 22 Saltwater header and supported equipment out of service for maintenance, week of November 14, 2016

b. Findings

No findings were identified.

1R15 Operability Determinations and Functionality Assessments (71111.15 – 4 samples)

a. Inspection Scope

The inspectors reviewed operability determinations for the degraded or non-conforming conditions listed below based on the risk significance of the associated components and systems. The inspectors evaluated the technical adequacy of the operability determinations to assess whether TS operability was properly justified and the subject component or system remained available such that no unrecognized increase in risk occurred. The inspectors compared the operability and design criteria in the appropriate sections of the TS and UFSAR to Exelon staff's evaluations to determine whether the components or systems were operable. The inspectors confirmed, where appropriate, compliance with bounding limitations associated with the evaluations. Where compensatory measures were required to maintain operability, such as in the case of operator work arounds (OWA), the inspectors evaluated whether the measures in place would function as intended and were properly controlled by Exelon staff. The inspectors verified that Exelon staff identified OWAs at an appropriate threshold and addressed them in a manner that effectively managed OWA-related adverse effects on operators and SSCs.

- Lube oil leaking from top of lube oil filter (AR02738533)
- 1B EDG potential fuse is blown (AR02738523)
- Roof leak and water intrusion into 1K06 (AR02725901)
- 11 AFW turbine drains discharging slower than expected (AR02708355) (Operator Work Around)

b. Findings

Introduction. The inspectors identified a Green NCV of 10 CFR Part 50, Appendix B, Criterion XVI, Corrective Action, for Exelon's failure to identify conditions adverse to quality at CCNPP. Specifically, several safety related auxiliary building caulking, seals, expansion joints, and penetration barriers have been found by the inspectors or have revealed themselves by water intrusion events to be degraded.

Description. As part of the aging management monitoring program committed to as part of license renewal, Exelon developed programs and procedures requiring inspection of safety related auxiliary building caulking, seals, expansion joints, and penetration barriers. These programs were added to the operating licenses for Units 1 and 2 as issued on March 23, 2000. Procedures developed to satisfy this requirement included ER-AA-700, Aging Management Implementation, Revision 5, which superseded CNG-CM-6.01, License Renewal Implementation, Revision 0, their associated aging management basis documents (AMBD), AMBD-0026, Caulk and Seal Program, Revision 200, AMBD-0052, Structure and System Walkdowns, Revision 400, and 0-013-49-O-18M, Operations Performance Evaluation of Barriers for Non-Appendix R Fire Compartments, Revision, 401. The inspectors determined that some of these required inspections had been performed as recently as April, 2016, (e.g. 0-013-49-O-18M in April 2016, AMBD-0052 in 2009) while others had not been performed in accordance with timeframes and periodicities established in the licensee's procedures. Specifically CNG-CM-6.01, License Renewal Implementation, which was

active from June 29, 2007, to March 16, 2016, stated that except for the inspections that have been ongoing under existing aging management programs (e.g. inspections of Appendix 'R' and non-appendix 'R' fire seals, done every 18 months that are credited to perform a subset of the required AMBD-0026 inspections), inspections that occur up to 10 years prior to the period of extended operation can be credited for aging management. The inspectors determined that contrary to the above, some inspections required by AMBD-0026 were not performed in the 10 years preceding entry of Unit 1 in July of 2014 and Unit 2 in August of 2016 into their respective periods for extended operation and had not been performed during the period of extended operation as of the time of discovery of the degraded caulking, seals, or expansion joints.

The inspectors also determined that some of the barriers described above had been inappropriately excluded from the scope of the AMBD-0026 inspections at the last revision. While reviewing Exelon's CAP entries the inspectors further noted that an entry documenting barriers missing from the scope of AMBD-0026 (IR 02443423) had been closed out with no action taken due to the loss of the original list of missing barriers.

On September 13, 2016, the inspectors visually identified, and felt air flow through degradation of two expansion joints in the ceiling of room 517, the Unit 2 83' horizontal cable chase. The inspectors also noted evidence of past water intrusion through the degraded expansion joints onto safety related cables routed through the room. Upon notification by the inspectors, Exelon's immediate corrective actions included repairing the degraded expansion joints and inspecting the previously wetted safety related cables for evidence of degradation. No degradation was found to the cables and the issue was entered into the CAP as IR 02715188 and IR 02715199. During an extent of condition review, Exelon discovered and repaired two additional expansion joints in a degraded condition in room 518, the Unit 1 83' horizontal cable chase. This degradation was entered into the CAP as IR 02716546.

On October 8, 2016, degradation of an expansion joint in the ceiling of the 45' electrical penetration room, room 429, revealed itself when rain water entered the penetration room and entered the 1K06 alarm relay box causing control room annunciator J-02, "EAST PENET RM CANISTER PRESSURE LOW," to alarm. Exelon's immediate corrective action included securing electrical power to and drying the wetted relay, caulking a seam found to be open in the roof above the degraded expansion joint, and scheduling the repair of the degraded expansion joint. The issue was documented in the CAP as IR 02725901.

The inspectors reviewed entries in Exelon's CAP and determined that on October 2, 2015, an NRC inspector had identified degradation of an expansion joint in the ceiling of the Unit 2 Refueling Water Tank room, room 440 when rain water was identified to be entering the room. Exelon's immediate corrective actions included diverting the rain water entering the room to a floor drain, and repairing the roof above the degraded expansion joint. This issue was entered into Exelon's CAP as IR 02564655.

The inspectors determined that this program was clearly not being executed as designed and as a result was not effective in identifying and correcting actual degraded conditions. Water intrusion was a direct cause of the 2010 dual unit trip, when water from a leaking roof panel entered a conduit and collected in a break cubicle eventually causing fault. Thus plant history has shown undetected water intrusion can be an event initiator.

Analysis. The inspectors determined that Exelon's failure to identify degradation of several auxiliary building caulking, seals, and expansion joints was a performance

deficiency that was reasonably within Exelon's ability to foresee and correct and should have been prevented. The inspectors reviewed IMC 0612, Appendix B, "Issue Screening," issued on May 6, 2016, and determined the issue is more than minor because it adversely affected the Human Performance attribute, of the Auxiliary Building Area, of the Barrier integrity cornerstone objective to provide reasonable assurance that physical design barriers protect the public from radionuclide releases caused by accidents or events. The inspectors also reviewed IMC 0612, Appendix E, "Examples of Minor Issues," and found it was sufficiently similar to Example 3.k, in that significant programmatic deficiencies were identified that could have led to worse outcomes. Specifically, several inspection programs designed to identify degraded barriers, caulking, seals, and expansion joints in safety related auxiliary building barriers, had not been performed, or had been performed inadequately. In accordance with IMC 0609, Attachment 4, "Initial Characterization of Findings," issued on October 7, 2016, and IMC 0609, Appendix A, "The Significance Determination Process for Findings at Power" issued on June 19, 2012, the inspectors determined that this finding is of very low safety significance (Green) since, the only safety related degradation represented by the finding is of the radiological barrier function provided for the auxiliary building.

The inspectors determined that the cause of the finding has a cross-cutting aspect in the area of Human Performance, Procedure Adherence, because Exelon did not complete the baseline inspection required by AMBD-0026 within the 10 years preceding entry of Units 1 and 2 into its respective periods of extended operation as specified in CNG-CM-6.01. Additionally, inspections conducted under AMBD-0052, and 0-013-49-O-18M were inadequate in that they failed to identify degradation of the barriers as described above. [H.8]

Enforcement. Title 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," requires measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected.

Contrary to the above, in July of 2014, Exelon inadequately performed inspection procedures designed to identify degradation in barriers, caulking, seals, and expansion joints in the safety related auxiliary building, resulting in failure to promptly identify and correct conditions adverse to quality. Exelon's immediate corrective actions included performing operability determinations on degraded barriers, and repair of the degraded barriers. Because this violation is of very low safety significance (Green) and has been entered into Exelon's CAP (IR 02715188, IR 02715199, IR 02716543, IR 02725901, and IR 02564655), this violation is being treated as an NCV, consistent with Section 2.3.2.a of the NRC Enforcement Policy. **(NCV 05000317,318/2016004-01, Inadequate Inspection of Caulking, Seals, and Expansion Barriers in the Auxiliary Building).**

1R19 Post-Maintenance Testing (71111.19 – 2 samples)

a. Inspection Scope

The inspectors reviewed the post-maintenance tests for the maintenance activities listed below to verify that procedures and test activities ensured system operability and functional capability. The inspectors reviewed the test procedure to verify that the procedure adequately tested the safety functions that may have been affected by the maintenance activity, that the acceptance criteria in the procedure were consistent with information in the applicable licensing basis and/or design basis documents, and that the test results were properly reviewed and accepted, and problems were appropriately

documented. The inspectors also walked down the affected job site, observed the pre-job briefs and post-job critique where possible, and confirmed that work site cleanliness was maintained. Additionally, the inspectors witnessed the test or reviewed test data to determine if quality control hold points were performed and checked, and that results adequately demonstrated restoration of the affected safety functions.

- WO C93219810, EDG 1B post maintenance testing following preventative maintenance , October 20, 2016
- WO C93226015, verify pressure setting on main steam air regulator control 2PCV4071A, November 2, 2016

b. Findings

No findings were identified.

1R22 Surveillance Testing (71111.22 – 1 sample)

a. Inspection Scope

The inspectors observed performance of a surveillance test and reviewed test data of selected risk-significant SSCs to assess whether test results satisfied TS, the UFSAR, and Exelon procedure requirements. The inspectors verified that test acceptance criteria were clear, the test demonstrated operational readiness and was consistent with design documentation, test instrumentation had current calibrations and the range and accuracy for the application, the test was performed as written, and applicable test prerequisites were satisfied. Upon test completion, the inspectors considered whether the test results supported that equipment was capable of performing the required safety functions. The inspectors reviewed the surveillance test listed below.

- WO C92958227, perform as found diagnostic testing and visual inspection of 2CV4143, refueling water tank outlet MOV, October 5, 2016 (in-service testing)

b. Findings

No findings were identified.

**Cornerstone: Emergency Preparedness**

1EP4 Emergency Action Level and Emergency Plan Changes (71114.04 – 1 sample)

a. Inspection Scope

Exelon implemented various changes to the Calvert Cliffs emergency action levels (EALs), emergency plan, and implementing procedures. Exelon had determined that, in accordance with 10 CFR 50.54(q)(3), any change made to the EALs, emergency plan, and its lower-tier implementing procedures, had not resulted in any reduction in effectiveness of the plan, and that the revised plan continued to meet the standards in 50.47(b) and the requirements of 10 CFR Part 50, Appendix E.

The inspectors performed an in-office review of all EAL and emergency plan changes submitted by Exelon as required by 10 CFR 50.54(q)(5), including the changes to lower-tier emergency plan implementing procedures, to evaluate for any potential reductions in effectiveness of the emergency plan. This review by the inspectors was



not documented in an NRC Safety Evaluation Report and does not constitute formal NRC approval of the changes. Therefore, these changes remain subject to future NRC inspection in their entirety. The requirements in 10 CFR 50.54(q) were used as reference criteria.

b. Findings

No findings were identified.

**2. RADIATION SAFETY**

**Cornerstone: Public Radiation Safety and Occupational Radiation Safety**

2RS1 Radiological Hazard Assessment and Exposure Controls (71124.01) (6 samples)

a. Inspection Scope

The inspectors reviewed Exelon's performance in assessing and controlling radiological hazards in the workplace. The inspectors used the requirements contained in 10 CFR Part 20, "Standards for Protection Against Radiation," TS, Regulatory Guide (RG) 8.38, "Control of Access to High and Very High Radiation Areas of Nuclear Plants," Revision 1, and the procedures required by TS as criteria for determining compliance.

Inspection Planning

The inspectors reviewed the performance indicators (PIs) for the occupational exposure cornerstone, radiation protection (RP) program audits, and reports of operational occurrences in occupational radiation safety since the last inspection.

Radiological Hazard Assessment (1 sample)

The inspectors conducted independent radiation measurements during walkdowns of the facility and reviewed the radiological survey program, air sampling and analysis, continuous air monitor use, recent plant radiation surveys for radiological work activities, and any changes to plant operations since the last inspection to verify survey adequacy of any new radiological hazards for onsite workers or to members of the public.

Instructions to Workers (1 sample)

The inspectors reviewed high radiation area work permit controls and use, observed containers of radioactive materials and assessed whether the containers were labeled and controlled in accordance with requirements. The inspectors reviewed several occurrences where a worker's electronic personal dosimeter alarmed. The inspectors reviewed Exelon's evaluation of the incidents, documentation in the CAP, and whether compensatory dose evaluations were conducted when appropriate. The inspectors verified follow-up investigations of actual radiological conditions for unexpected radiological hazards were performed.

Contamination and Radioactive Material Control (1 sample)

The inspectors observed the monitoring of potentially contaminated material leaving the radiological controlled area and inspected the methods and radiation monitoring instrumentation used for control, survey, and release of that material. The inspectors

selected several sealed sources from inventory records and assessed whether the sources were accounted for and were tested for loose surface contamination. The inspectors evaluated whether any recent transactions involving nationally tracked sources were reported in accordance with requirements.

#### Radiological Hazards Control and Work Coverage (1 sample)

The inspectors evaluated in-plant radiological conditions and performed independent radiation measurements during facility walkdowns and observation of radiological work activities. The inspectors assessed whether posted surveys; radiation work permits; worker radiological briefings and RP job coverage; the use of continuous air monitoring, air sampling and engineering controls; and dosimetry monitoring were consistent with the present conditions. The inspectors examined the control of highly activated or contaminated materials stored within the spent fuel pools and the posting and physical controls for selected high radiation areas, locked high radiation areas and very high radiation areas to verify conformance with the occupational PI.

#### Radiation Worker Performance and Radiation Protection Technician Proficiency (1 sample)

The inspectors evaluated radiation worker performance with respect to RP work requirements. The inspectors evaluated RP technicians in performance of radiation surveys and in providing radiological job coverage.

#### Problem Identification and Resolution (1 sample)

The inspectors evaluated whether problems associated with radiation monitoring and exposure control (including operating experience) were identified at an appropriate threshold and properly addressed in the CAP.

#### b. Findings

No findings were identified.

### 2RS2 Occupational As Low As Is Reasonably Achievable Planning and Controls (71124.02) (4 samples)

#### a. Inspection Scope

The inspectors assessed Exelon's performance with respect to maintaining occupational individual and collective radiation exposures as low as is reasonably achievable (ALARA). The inspectors used the requirements contained in 10 CFR Part 20, RG 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be as Low as Is Reasonably Achievable," Revision 3, RG 8.10, "Operating Philosophy for Maintaining Occupational and Public Radiation Exposures as Low as Is Reasonably Achievable," Revision 2, TS, and procedures required by TS as criteria for determining compliance.

#### Inspection Planning

The inspectors conducted a review of the Calvert Cliffs collective dose history and trends; ongoing and planned radiological work activities; previous post-outage ALARA

reviews; radiological source term history and trends; and ALARA dose estimating and tracking procedures.

#### Radiological Work Planning (1 sample)

The inspectors selected the following radiological work activities based on exposure significance for review:

- ALARA Plan 16-0042, "DM Weld Inspections"
- ALARA Plan 16-0062, "Emergent Repair DM Weld in PZR Doghouse"
- ALARA Plan 16-0044, "U-1 Refueling Outage Scaffold Activities"
- ALARA Plan 16-0035, "Disassemble/Reassemble Reactor Vessel Closure Head"
- ALARA Plan 16-0043, "U-1 Refueling Outage Insulation Activities"

For each of these activities, the inspectors reviewed: ALARA work activity evaluations, exposure estimates, exposure reduction requirements, results achieved (dose rate reductions, actual dose), person-hour estimates and results achieved, and post-job reviews that were conducted to identify lessons learned.

#### Verification of Dose Estimates and Exposure Tracking Systems (1 sample)

The inspectors reviewed the current annual collective dose estimate; basis methodology; and measures to track, trend, and reduce occupational doses for ongoing work activities. The inspectors evaluated the adjustment of exposure estimates, or re-planning of work. The inspectors reviewed post-job ALARA evaluations of excessive exposure.

#### Source Term Reduction and Control (1 sample)

The inspectors reviewed the current plant radiological source term and historical trend, plans for plant source term reduction, and contingency plans for changes in the source term as the result of changes in plant fuel performance or changes in plant primary chemistry.

The inspectors observed radiological work activities and evaluated the use of shielding and other engineering work controls based on the radiological controls and ALARA plans for those activities.

#### Problem Identification and Resolution (1 sample)

The inspectors evaluated whether problems associated with ALARA planning and controls were identified at an appropriate threshold and properly addressed in the CAP.

#### b. Findings

No findings were identified.

#### 4. OTHER ACTIVITIES

##### 4OA1 Performance Indicator Verification (71151)

##### .1 Unplanned Scrams, Unplanned Power Changes, and Unplanned Scrams with Complications (6 samples)

###### a. Inspection Scope

The inspectors reviewed Exelon's submittals for the following Initiating Events Cornerstone PIs for the period of October 1, 2015, through September 30, 2016:

- Unit 1 unplanned scrams (IE01)
- Unit 2 unplanned scrams (IE01)
- Unit 1 unplanned power changes (IE03)
- Unit 2 unplanned power changes (IE03)
- Unit 1 unplanned scrams with complications (IE04)
- Unit 2 unplanned scrams with complications (IE04)

To determine the accuracy of the PI data reported during those periods, the inspectors used definitions and guidance contained in Nuclear Energy Institute (NEI) 99-02, "Regulatory Assessment of Performance Indicator Guideline," Revision 7. The inspectors reviewed Exelon's operator narrative logs, CRs, event reports, system health reports, and NRC integrated IRs to validate the accuracy of the submittals.

###### b. Findings

No findings were identified.

##### .2 Occupational Exposure Control Effectiveness (1 sample)

###### a. Inspection Scope

The inspectors reviewed Exelon submittals for the occupational radiological occurrences PI (OR01) for the third quarter 2015 through the third quarter 2016. The inspectors used PI definitions and guidance contained in NEI 99-02, Revision 7, "Regulatory Assessment of Performance Indicator Guidance," to determine the accuracy of the PI data reported. The inspectors reviewed electronic personal dosimetry accumulated dose alarms, dose reports, and dose assignments for any intakes that occurred during the time period reviewed to determine if there were potentially unrecognized PI occurrences. The inspectors conducted walkdowns of various locked high radiation area and very high radiation area entrances to determine the adequacy of the controls in place for these areas.

###### b. Findings

No findings were identified.

.3 Radiological Effluent TS/Offsite Dose Calculation Manual Radiological Effluent Occurrences (1 sample)

a. Inspection Scope

The inspectors reviewed Exelon submittals for the radiological effluent TS/Offsite Dose Calculation Manual radiological effluent occurrences PI (PR01) for the third quarter 2015 through the third quarter 2016. The inspectors used PI definitions and guidance contained in the NEI 99-02, "Regulatory Assessment of Performance Indicator Guidance," Revision 7, to determine if the PI data was reported properly. The inspectors reviewed the public dose assessments for the PI for public radiation safety to determine if related data was accurately calculated and reported.

The inspectors reviewed the CAP database to identify any potential occurrences such as unmonitored, uncontrolled, or improperly calculated effluent releases that may have impacted offsite dose. The inspectors reviewed gaseous and liquid effluent summary data and the results of associated offsite dose calculations to determine if indicator results were accurately reported.

b. Findings

No findings were identified.

4OA2 Problem Identification and Resolution (71152 – 3 samples)

.1 Routine Review of Problem Identification and Resolution Activities

a. Inspection Scope

As required by Inspection Procedure 71152, "Problem Identification and Resolution," the inspectors routinely reviewed issues during baseline inspection activities and plant status reviews to verify that Exelon entered issues into the CAP at an appropriate threshold, gave adequate attention to timely corrective actions, and identified and addressed adverse trends. In order to assist with the identification of repetitive equipment failures and specific human performance issues for follow-up, the inspectors performed a daily screening of items entered into the CAP and periodically attended AR screening meetings. The inspectors also confirmed, on a sampling basis, that, as applicable, for identified defects and non-conformances, Exelon staff performed an evaluation in accordance with 10 CFR Part 21.

b. Findings

No findings were identified.

.2 Semi-Annual Trend Review

a. Inspection Scope

The inspectors performed a semi-annual review of site issues, as required by Inspection Procedure 71152, "Problem Identification and Resolution," to identify trends that might indicate the existence of more significant safety issues. In this review, the inspectors included repetitive or closely-related issues that may have been documented by Exelon personnel outside of the CAP, such as trend reports, PIs, major equipment problem lists,

system health reports, maintenance rule assessments, and maintenance or CAP backlogs. The inspectors also reviewed Exelon's CAP database for the third and fourth quarters of 2016 to assess IRs written in various subject areas (equipment problems, human performance issues, etc.), as well as individual issues identified during the NRC's daily IR review (Section 40A2.1). The inspectors reviewed Exelon's quarterly trend report for the third quarter of 2016, conducted under PI-AA-125-1005, "Coding and Analysis Manual," Revision 0, to verify that Exelon personnel were appropriately evaluating and trending adverse conditions in accordance with applicable procedures.

b. Findings and Observations

No findings were identified.

The inspectors evaluated a sample of condition reports generated over the course of the past two quarters by departments that provide input to the quarterly trend reports. The inspectors determined that the issues were appropriately evaluated by Exelon staff for potential trends and resolved within the scope of the CAP. The inspectors reviewed self-assessments performed by Exelon outside of the CAP including quarterly performance assessment reports, Nuclear Oversight Audits, and others, and verified that trends identified were input into the CAP and appropriately evaluated.

3. Annual Sample: Unit 2 Repeat Rod Drop Events Due to Control Element Drive Mechanism Coil Stack Grounds

a. Inspection Scope

The inspectors performed an in-depth review of Exelon's evaluation and corrective actions associated with CCNPP, Unit 2 repetitive dropped control element assembly (CEAs) events into the core due to control element drive mechanism (CEDMs) lift coils grounding. Specifically, on September 5, 2013, Unit 2 dropped CEA No. 27 to the bottom of the core while conducting STP-O-029-2, CEA Free Movement Test, Revision 01501. On December 2, 2015, Unit 2 dropped CEAs No. 56 and No. 57 to the bottom of the core during a reactor start up.

The inspectors assessed Exelon's problem identification threshold, cause analyses, extent of condition reviews, compensatory actions, and the prioritization and timeliness of Exelon's corrective actions to determine whether Exelon was appropriately identifying, characterizing, and correcting problems associated with this issue and whether the planned or completed corrective actions were appropriate. The inspectors compared the actions taken to the requirements of Exelon's corrective action program and 10 CFR Part 50, Appendix B. In addition, the inspectors interviewed engineering personnel to assess the effectiveness of the implemented corrective actions.

b. Findings and Observations

No findings were identified

CCNPP UFSAR, Section 3.3.4, Control Element Drive Mechanism, describes the safety function of CEDMs for conditions requiring a rapid reactor shutdown. Under such conditions, the CEDM coils will deenergize, allowing the CEA to drop into the core by gravity. The secondary (and non-safety related) function is to allow for manual and automatic rod motion for plant operations such as plant startup and shutdown and reactor coolant system temperature control.

On September 5, 2013, during STP-O-029-2, CEA No. 27 dropped to the bottom of the core. A ground in the upper gripper coil assembly caused the upper gripper pawl to not engage during the manual rod withdrawal sequence thus allowing the rod to drop when the lower pawl released. CEA No. 27 was in the controlling group. CEDM 27 was replaced as an immediate corrective action prior to plant restart.

On December 2, 2015, during a reactor startup, CEAs No. 56 and No. 57 dropped into the core. CEAs No. 56 and 57 are in a scram group. By procedure, scram group rods are fully withdrawn at the beginning of the reactor startup when the reactor is in Mode 3 and has significant shutdown margin. CEDMs 56 and 57 were replaced as an immediate corrective action prior to plant restart.

Exelon determined the root cause for both events to be a manufacturing defect that resulted in circumferential displacement of the coil within the coil housing and the misalignment of the coil lead wire within the coil housing nipple. Exelon determined that a designed flaw left the coil stack lead wires susceptible to rubbing, chaffing, or cracking of the wire insulation due to service stress and hardening of the coil wire insulation due to thermal and radiation effects as contributing causes. Exelon determined that Unit 1 is not susceptible to the same failure mechanism because their CEDMs coil stacks were replaced with a new design that installed protective heat shrink wrap at the point the electrical conductors penetrate the housing as part of their vessel head replacement project in 2006.

In order to eliminate the cause of the rod drops, a plan was developed following the 2013 rod drop to replace all Unit 2 CEDMs in a phased approach over the next three refueling outages. All controlling group CEDMs were replaced in 2013. Half of the scram group CEDMs were replaced in 2015, and the remaining scram group CEDMs will be replaced in 2017. This was determined to be acceptable because the degraded condition would not affect the safety function of the CEDM, to release the CEA during a scram. Additionally since the scram group rods are withdrawn fully and not part of the automatic rod control system, a rod drop would not be expected to occur during normal operations at power from this group. If a rod drop occurred, the plant should be in a shutdown condition mitigating the potential transient, as was the case on December 2, 2015.

This degraded condition would be considered a condition adverse to quality (CAQ). A CAQ needs to be promptly identified and corrected in a manner commensurate with its safety significance. The inspectors concluded that the phased approach to replacement of the CEDM, which corrects the CAQ, was reasonable and timely given the number of CEDMs that needed to be changed out, the safety function was not impacted by the degraded condition, and the sequencing and compensatory actions would mitigate the impact if another rod drop occurred prior to all CEDMs being replaced. Compensatory actions such as pre evolution briefings and just in time training for operators were in place and observed by the inspectors. These mitigating actions were determined to have been effective on December 2, 2015.

The inspectors determined that Exelon's immediate and long term corrective actions were adequate to address the issue. All CEDM coil stacks will be upgraded to the newer design by the end of Unit 2's upcoming outage fully correcting the CAQ.

#### .4 Annual Sample: Review of Vibration and Bearing Failure of 12-CR-HVAC

##### a. Inspection Scope

The inspectors performed an in-depth review of Exelon's apparent cause evaluation and corrective actions associated with action request AR02542324, 12-CR-HVAC belts are loose. Specifically, this AR resulted in a Priority Level 2 request (C93162815) during which it was discovered the shaft had spun inside the inboard bearing nearest the sheave and belts causing the heating, ventilation, and air condition (HVAC) unit to become inoperable and causing entry into a TS limiting condition of operation with a duration of seven days.

The inspectors assessed Exelon's problem identification threshold, cause analyses, extent of condition reviews, compensatory actions, and the prioritization and timeliness of Exelon's corrective actions to determine whether Exelon was appropriately identifying, characterizing, and correcting problems associated with this issue and whether the planned or completed corrective actions were appropriate. The inspectors compared the actions taken to the requirements of Exelon's CAP and 10 CFR Part 50, Appendix B. In addition, the inspectors interviewed maintenance personnel to assess the effectiveness of the implemented corrective actions.

##### b. Findings

No findings were identified.

Exelon determined the most probable cause was a suboptimal application of a dimpled shaft and set screw which allowed the bearing to break loose and spin on the fan shaft. The failure analysis, contained in the apparent cause report, concluded that by dimpling the shaft, the inside diameter of the cupped portion of the set screw was not in contact with the shaft. The analysis states this "greatly reduced the surface area of contact between the screw and the shaft." This configuration caused the cupped surface to fail during a fan start.

The inspectors reviewed the referenced ARs and determined the identified problem was entered into the CAP in an accurate, complete, and timely fashion. The associated work assignments were completed in a timely fashion and the apparent cause evaluation (ACE) considered a broad array of related issues. The inspectors noted the extent of condition was considered both by review of all the site procedures that might include set screw guidance, and the CAP to determine if the problem might exist elsewhere. The ACE identified the root cause, apparent cause, and contributing causes of the problem and included a review of the revised procedures and processes to determine that they effectively corrected the problem. The corrective actions taken were comprehensively documented and were reported to appropriate levels of management.

The inspectors noted that operating experience was adequately evaluated for applicability, and applicable lessons learned were communicated to appropriate organizations and implemented by way of revision to fleet wide training materials. In addition, the ACE included comparison of the site methodology for set screw assembly with the methods used at other fleet wide sites. The Electric Power Research Institute was also consulted to determine best-practices.

Exelon Procedure, "Fastener-02," was revised (0300) to include a new Attachment 4, discussing "Common Set Screw Types and Uses." The technical procedure states a cupped set screw "can be used on flats or on shafts and does not require shaft to be



dimpled.” The inspectors noted this statement does not prohibit the use of a dimple and it did not give detail about the proper dimensions of a dimple if used. Exelon entered the need to revise the wording in Attachment 4 in order to clearly convey the limits of using a dimple when setting a cupped screw into their CAP (AR 02741780). However, the inspectors’ observation did not represent a violation of NRC requirements.

#### 4OA3 Follow-Up Events and Notices of Enforcement Discretion (71153 –3 samples)

##### .1 Plant Events

For the plant event listed below, the inspectors reviewed and/or observed plant parameters, reviewed personnel performance, and evaluated performance of mitigating systems. The inspectors communicated the plant events to appropriate regional personnel, and compared the event details with criteria contained in IMC 0309, “Reactive Inspection Decision Basis for Reactors,” for consideration of potential reactive inspection activities. As applicable, the inspectors verified that Exelon made appropriate emergency classification assessments and properly reported the event in accordance with 10 CFR 50.72 and 50.73. The inspectors reviewed Exelon follow-up actions related to the events to assure that Exelon implemented appropriate corrective actions commensurate with their safety significance.

- Unit 2 loss of load automatic reactor trip due to electrohydraulic control oil leak from the main turbine 21 governor valve emergency trip fluid check valve on December 3, 2016

##### .2 (Closed) Licensee Event Report (LER) 05000317/2016-001-00: Manual Reactor Trip Due to High Secondary Side Sodium Levels Due to a Condenser Tube Leak

At 0235, on January 25, 2016, operators received a condensate conductivity high level alarm. The chemistry department was notified and began to investigate the cause of the alarm. The chemistry technician reported that the condensate conductivity levels were rising. Concurrently, operators placed the condensate demineralizers in service in an attempt to reduce conductivity. Operators entered Exelon Abnormal Operating Procedure (AOP)-10, “Abnormal Secondary Chemistry Conditions,” Revision 1702. Operators secured the circulating water pump in the indicated condenser waterbox. At 0313, on January 25, 2016, operators manually tripped Unit 1 when feedwater and condensate sodium sample levels exceeded AOP-10 threshold limits that required a reactor trip. Following verification that Exelon EOP-0, “Post Trip Immediate Actions,” Revision 1300, safety functions were met, EOP-1, “Reactor Trip,” Revision 1400, was entered for an uncomplicated reactor trip. Subsequent investigation determined there was a condenser tube leak on one of the condenser tubes in 13A condenser waterbox. The cracked condenser tube and several surrounding condenser tubes were plugged and the site began preparations to start-up the unit. Unit 1 was returned to Mode 1 at 2220, on January 25, 2016, and the unit returned to full power at 2310, on January 26, 2016. During the 2016 Unit 1 refueling outage, eddy current testing confirmed a circumferential crack on the affected tube. A causal analysis revealed that the crack was vibration induced. As part of the extent of condition investigation the normal number of condenser tubes that were eddy current tested in 13A condenser during a refueling outage was expanded. As a result, four other condenser tubes in 13A condenser were found to have indications of wear at tube stake locations and were subsequently plugged. Radial stakes were then installed during the refueling outage to reduce movement in the X and Y direction. The site conducted the normal amount of eddy current testing on the remaining Unit 1 condensers with no similar issues detected.

The inspectors reviewed the LER and the causal analysis for the event. No findings or violations of NRC requirements were identified. This LER is closed.

.3 (Closed) LER 05000317/2016-004-00: High Energy Line Break Barrier Breached Due to Human Performance Error Causing Both Service Water Trains to be Inoperable

On October 19 and 21, 2015, the 11 SRW pump motor was replaced, which required opening of a high energy line break (HELB) barrier. This door separates the turbine building from the SRW pump room. During the SRW motor replacement activity, a new SRW motor was moved into the SRW room and the old SRW motor was moved out. The movement of the motors involved using a chain fall to move each motor from a cart stationed on one side of the door to a cart stationed on the other side of the door. The barrier was opened for approximately three and a half minutes for each movement. The HELB barrier was restored to its design configuration following each motor move. The WO which controlled the open barrier did not consider the barrier blocked by the chain fall and motor during motor movement. Additionally, compensatory actions for the barrier breach were not properly evaluated. The breach of this HELB barrier caused both trains of SRW to be inoperable because they are not qualified for the steam environment that is postulated to exist following a HELB in the turbine building. Both trains of SRW being inoperable results in a loss of safety function for a system needed to respond to a HELB to provide safe shutdown of the reactor, remove residual heat, and mitigate the consequence of an accident. In addition, this condition also results in an unanalyzed condition that significantly degrades plant safety and a common cause inoperability of independent trains. A single train of AFW was also affected, as were support equipment for other TS components.

An NCV of very low safety significance (Green) of CCNPP TS 5.4.1 for failure to implement procedures as required by RG 1.33, Appendix A, was previously documented as NCV 05000317/2015004-01: Failure to Implement Procedures for the Control of Hazard Barriers during Maintenance. The inspectors reviewed the LER. No additional findings or violations of NRC requirements were identified. This LER is closed.

4OA6 Meetings, Including Exit

Exit Meeting Summary

On January 24, 2017, the inspectors presented the inspection results to Mr. George Gellrich, Site Vice President, and other members of the Exelon staff. The inspectors verified that no proprietary information was retained by the inspectors or documented in this report.

ATTACHMENT: SUPPLEMENTARY INFORMATION

**SUPPLEMENTARY INFORMATION****KEY POINTS OF CONTACT**Licensee Personnel

G. Gellrich, Site Vice President  
 M. Flaherty, Plant General Manager  
 P. Amos, Manager, Site Emergency Preparedness  
 J. Beverly, Radiation Protection Technician  
 C. Blue, Manager, Radiological Engineering  
 B. Erdman, Manager, Radiation Protection Technical Support  
 M. Fick, Principal Engineer, Regulatory Assurance  
 K. Greene, Principal Engineer, Regulatory Assurance  
 A. Kelly, Operations Training Manager  
 R. Holland, Radiation Protection Technician  
 R. Ihnacik, Radwaste Chemist  
 R. Lopez, Senior Radiation Protection ALARA Specialist  
 J. Norris, Supervisor, Radiation Protection  
 S. Sanders, Manager - Site Radiation Protection  
 H. Simpson, Radiation Protection Technical Specialist  
 B. Wiley, Senior Radiation Protection ALARA Specialist

**LIST OF ITEMS OPENED, CLOSED AND DISCUSSED**Opened/Closed

05000317, 318/2016004-01	NCV	Inadequate Inspection of Caulking, Seals, and Expansion Barriers in the Auxiliary Building (Section 1R15)
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Closed

05000317/2016-001-00	LER	Manual Reactor Trip Due to High Secondary Side Sodium Levels Due to a Condenser Tube Leak (Section 4OA3.2)
05000317/2016-004-00	LER	High Energy Line Break Barrier Breached Due to Human Performance Error Causing Both Service Water Trains to be Inoperable (Section 4OA3.3)

**LIST OF DOCUMENTS REVIEWED****Section 1R01: Adverse Weather Protection**Procedures

WC-AA-107, Seasonal Readiness, Revision 17

Action Requests

AR02737192	AR02739374	AR02739377	AR03948684
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Drawings

15779-0290, Water System Tank Farm, Revision 6  
61017sh0002, Reactor 480V MCC 114R, Revision 45  
61096sh0001, Chemical Volume Control System Primary Boric Acid & Misc Heat Tracing,  
Revision 37  
61096sh0009, Heat Tracing for Condensate Storage Tank 12, Revision 0  
61387sh0003, Trays & Conduits Outdoor & Misc. Buildings Sections & Details, Revision 20  
63017sh0001, Reactor 480V MCC 204R, Revision 44  
63096sh0001A, Chemical Volume Control System Primary Boric Acid & Misc Heat Tracing,  
Revision 8  
63096sh0006, Cond. Stg. Tk. Lines Freeze Protection Panel 2P60, Revision 5

**Section 1R04: Equipment Alignment**

Procedures

AOP-9B-1, Safe Shutdown Due to a Severe Cable Spreading Room Fire, Revision 20  
AOP-9B-2, Safe Shutdown Due to a Severe Cable Spreading Room Fire, Revision 19  
OI-19-1, Instrument Air, Revision 03401  
OI-19-2, Instrument Air, Revision 03201  
OI-32B-2, AFAS System Operation, Revision 4  
MOV-12, Limitorque Motor Operated Valve Inspection and Preventative Maintenance,  
Revision 01201

Action Requests

AR02627753                      AR02628352                      AR03943146                      AR02728620

Drawings

60583sh0001, Unit 1 Auxilary Feedwater System (Steam), Revision 68  
60583sh0002, Unit 1 Auxilary Feedwater System (Condensate), Revision 7  
60712sh0003, Unit 1 Compressed Air System Instrument Air & Plant Air, Revision 115  
60712sh0005, Compressed Air System Instrument Air & Plant Air, Revision 9  
60910, Alternate Shutdown Related Circuit Unit No.1 AFWS Throttle and Misc. Control Valves,  
Revision 7  
620583sh002, Unit 2 Auxilary Feedwater System (Condensate), Revision 8  
62583sh0001, Unit 2 Auxilary Feedwater System (Steam), Revision 62  
62712sh0003, Unit 2 Compressed Air System Plant & Instrument Air, Revision 121  
65019sh0001, Instrument Installation Detail for 1-CV-4511, 1-CV-4512, 1-CV-4520, 1-CV-4521,  
1-CV-4522, 1-CV-4523, 1-CV-4525, 1-CV-4530, 1-CV-4531, 1-CV-4532, 1-CV-4533,  
1-CV4535 & 1-CV-4550, Revision 9  
65019sh0001A, Instrument Installation Detail for 1-CV4070, 1CV4071 & 1CV4071A, Revision 0  
62731sh0001, Safety Injection and Containment Spray, Revision 83

Miscellaneous

CCNPP NFPA-805-00006A, Safe shutdown Analysis Summary Fire Area 16, Revision 1  
ECP-14-000500, AOV Component Level Calculation – AFW Block Valves, AFW Cross Connect  
Valves, SDC Temp/Flow Control Valves  
M-90-56, AFW Steam Admission By-Pass (CV-4070A, 4071A) Valve Sizing Calculation  
Work Order C90953650  
Work Order C91504020  
Work Order C91504613  
Work Order C91953170  
Work Order C93347249  
CA-PRA-005.052, Safety Injection System Notebook, Revision 2

**Section 1R05: Fire Protection**

Procedures

FFSM TB45, Fire Fighting Strategies Manual Control 45' Elevation, Revision 00500  
FFSM AB27, Fire Fighting Strategies Manual Control 27' Elevation, Revision 00203

Drawings

62151SH0006, Barrier Segment Drawing For Plant Elevation 27'-0", Revision 0

Action Requests

AR03949003

**Section 1R07: Heat Sink Performance**

Procedures

ETP 98-041R, 12A & 12B SRW HX Thermal Performance Test, Revision 5

Action Requests

AR02740862

Miscellaneous

ECP-15-000671, Engineering Evaluation of 2015 12 SRW HX Thermal Performance Test, Revision 0  
CA03477, SRW Plate HX Thermal Performance Calculation, Revision 2

**Section 1R11: Licensed Operator Regualification Program**

Procedures

EOP-00-1, Post Trip Immediate Actions, Revision 01300  
EOP-06-1, Steam Generator Tube Rupture, Revision 01900  
EOP-08-1, Functional Recovery Procedure, Revision 04000

Miscellaneous

OP-29, Simulator Operating Examination for the Licensed Operator Training Program at the Calvert Cliffs Nuclear Power Plant, Revision 10

**Section 1R12: Maintenance Effectiveness**

Procedures

ER-AA-310, Implementation of the Maintenance Rule, Revision 9

Miscellaneous

Work Order C92145088  
Work Order C93589938  
Work Order C93590805

**Section 1R13: Maintenance Risk Assessments and Emergent Work Control**

Procedures

WC-AA-101, On-line Work Control Process, Revision 26

Action Requests

AR02724431

Miscellaneous

CA-PRA-004, PRA Human Reliability Analysis Notebook, Revision 4

**Section 1R15: Operability Determinations and Functionality Assessments**

Procedures

STP M-544A-1, #11 Penetration Exhaust Filter Test, Revision 8  
STP O-70-1, Monthly Test of "A" Train Containment Cooling Units, Iodine Removal Units, and Penetration Room Exhaust Filter, Revision 01505

Action Requests

AR02738523                      AR02725901                      CR-2012-000345

Drawings

12350-0009, Penetration Room Exhaust Fan 11, 12, 21 Performance Curves

Miscellaneous

Work Order C91762064  
QL00848, Barrier Function Table (Auxiliary Building 400 Series Barriers), Revision 0

**Section 1R19: Post Maintenance Testing**

Procedures

ER-AA-321-1007, Inservice Testing (IST) Program, Revision 1  
STP-O-5A22-2, 22 Auxiliary Feedwater Pump Quarterly Surveillance Test, Revision 3  
WC-AA-101-1002, On Line Scheduling Process, Revision 17

Action Requests

AR02736328                      AR02736514

Miscellaneous

Work Order C93226015

**Section 1R22: Surveillance Testing**

Procedures

MOV-009B, Operating the Crane Nuclear VOTES® Infinity or VIPER™ System, Revision 00600  
MOV-13 Limitorque MOV Limit Switch Compartment Inspection and PM, Revision 00403

Miscellaneous

CCNPP IST Program Component Basis Information Unit 2, Revision 8

**Section 1EP4: Emergency Action Level and Emergency Plan Changes**

Miscellaneous

EP-AA-1011, Addendum 3, Calvert Cliffs Nuclear Power Plant Emergency Action Levels, Revision 1

**Section 2RS1: Radiological Hazard Assessment and Exposure Controls**Procedures

RP-AA-300, "Radiological Survey Program," Revision 14  
 RP-AA-300-1001, "Discrete Radioactive Particle Controls," Revision 5  
 RP-AA-300-1005, "Removing Items from the Spent Fuel Pool, Reactor Cavity, and Equipment Pit," Revision 1  
 RP-AA-301, "Radiological Air Sampling Program," Revision 10  
 RP-AA-302, "Determination of Alpha Levels and Monitoring," Revision 7  
 RP-AA-350, "Personnel Contamination Monitoring, Decontamination and Reporting," Revision 16  
 RP-AA-376, "Radiological Postings, Labeling, and Markings," Revision 9  
 RP-AA-376-1001, "Radiological Posting, Labeling, and Marking Standard," Revision 14  
 RP-AA-460, "Control for High and Locked High Radiation Areas," Revision 28  
 RP-AA-460-001, "Controls for Very High Radiation Areas," Revision 6  
 RP-AA-500, "Radioactive Material (RAM) Control," Revision 17  
 RP-AA-503, "Unconditional Release Survey Method," Revision 14  
 RP-AA-503-F-01, "Unconditional Release Instructions Using the Small Articles Monitor (SAM) for Personal Items Used in the Radiologically Controlled Area (RCA) and in a Contaminated Area," Revision 4  
 RP-AA-700-1200, "Operation of the GM Detector Friskers," Revision 3  
 RP-AA-700-1239, "Operation and Calibration of the Model SAM-12 Small Articles Monitor," Revision 3  
 RP-AA-700-1249, "Operation of the Ludlum Model 3 with GM Frisker Probe," Revision 2  
 RP-AA-700-1301, "Calibration, Source Check, Operation and Set-Up of the Eberline Beta Air Monitor, Model AMS-4," Revision 3  
 RP-AA-700-1501, "Operation and Calibration of the Model SAM-9/11 Small Articles Monitor," Revision 4  
 RP-CA-300-1001, "Routine Surveys," Revision 3  
 RP-CA-700-1002, "Operation of CCNPP-Specific Radiation Protection Instruments," Revision 000

Action Requests

AR02594203	AR02611826	AR02677544
AR02605422	AR02627834	AR02705991
AR02605847	AR02628971	AR02735529

Miscellaneous

Airborne Radioactivity Calculation Sheet, dated 2/1/16 at 1030  
 Airborne Radioactivity Calculation Sheet, dated 2/1/16 at 1440  
 Airborne Radioactivity Calculation Sheet, dated 2/2/16 at 0921  
 Airborne Radioactivity Calculation Sheet, dated 2/3/16 at 1250  
 Confirmation Form, 2016 Annual Inventory Reconciliation, National Source Tracking System  
 Refueling Outage Readiness Review, Calvert Cliffs CCR22 T-3, AR2711603, dated 11/28/2016  
 Survey Form, Radiological, Map No. 3-2, dated 4/20/2015 at 1500  
 Survey Form, Radiological, Map No. 3-2, dated 4/26/2016 at 1008  
 Survey Form, Radiological, Map No. 4-2B, dated 10/4/2016 at 2100  
 Survey Form, Radiological, Map No. 4-2B, dated 11/6/2016 at 1400  
 Survey Form, Radiological, Map No. 5-3B, dated 2/2/2016 at 1900  
 Survey Form, Radiological, Map No. 5-3B, dated 7/21/2016 at 0900  
 Survey Form, Radiological, Map No. C1-9, dated 2/28/2016 at 0330

**Section 2RS2: Occupational ALARA Planning and Controls**Procedures

RP-AA-16, "ALARA Program Description," Revision 0  
 RP-AA-400-1002, "Dose Equalization," Revision 2  
 RP-AA-400-1003, "Work Group Radiological Excellence Plans," Revision 2  
 RP-AA-400-1004, "Emergent Dose Control and Authorization," Revision 8  
 RP-AA-400-1006, "Outage Exposure Estimating and Tracking," Revision 5  
 RP-AA-400-1007, "Elevated Dose Rate Response Planning," Revision 2  
 RP-AA-400-1008, "Exposure Goal Recovery Plans," Revision 2  
 RP-AA-400-2000, "Department Dose Advocate," Revision 2  
 RP-AA-551, "Cobalt Reduction Program," Revision 1  
 RP-AA-551-1004, "Elemental Cobalt Sampling Practice," Revision 3  
 RP-AA-552, "Guidelines for Installation and Control of Spot Shielding," Revision 0

Action Requests

AR02440687	AR02567349	AR02632607	AR02636269
AR02459168	AR02626322	AR02633234	AR02636495
AR02464604	AR02628447	AR02633245	AR02643237
AR02515803	AR02629217	AR02633972	AR02643773
AR02516866	AR02629405	AR02633988	AR02647423
AR02522581	AR02630662	AR02634555	AR02650667
AR02528298	AR02631347	AR02635333	AR02652748
AR02559323	AR02632085	AR02636259	AR02705437
AR02562385	AR02632124	AR02636263	AR02721748

Miscellaneous

ALARA Plan 16-0035  
 ALARA Plan 16-0042  
 ALARA Plan 16-0043  
 ALARA Plan 16-0044  
 ALARA Plan 16-0062  
 ALARA Plan Number 2015-QMAP-0078, "ISFSI DSC#77 Helium Leak UNSAT per ISFSI-03 Procedure"  
 ALARA Post-Job Review for ALARA Plan 16-0035  
 ALARA Post-Job Review for ALARA Plan 16-0042  
 ALARA Post-Job Review for ALARA Plan 16-0043  
 ALARA Post-Job Review for ALARA Plan 16-0044  
 ALARA Post-Job Review for ALARA Plan 16-0062  
 Apparent Cause Investigation Report, 02629217  
 Apparent Cause Investigation Report, 02725516  
 Check-In Self-Assessment, "CCNPP ALARA Program Assessment," AR0263932, dated 8/17/2016  
 EDE Dosimetry Evaluation Sheets for ISFSI Can #77  
 List of CC1R23 outage activities, by dose estimate  
 List of on-line activities with dose estimates > 1 rem  
 Meeting Minutes, Station ALARA Committee, January to July of 2016  
 Multiple Dosimetry Issue Log-sheets for ISFSI Can #77  
 NOSA-CAL-15-06, Audit Plan and Report, dated 6/8/2015  
 PIIM 2016-0259, "Outage Dose Performance"  
 Radiation Work Permit CC-1-16-00412, Revision 00 & 01  
 Radiation Work Permit CC-1-16-00502, Revision 00 & 01  
 Radiation Work Permit CC-1-16-00503, Revision 00 & 01



Radiation Work Permit CC-1-16-00505, Revision 00 & 01  
 Radiation Work Permit CC-1-16-00613, Revision 00 & 01  
 Radiological survey, SRMP Dose Rates, Unit-1, dated 3/4/2016  
 Radiological surveys for ISFSI Can #77  
 Radiological surveys, Initial Entry, Unit-1, dated 2/15/2016  
 Radiological surveys, Initial Entry, Unit-2, dated 2/16/2015  
 Report, "CC1R23 Radiation Protection Outage Report"  
 TEDE ALARA Evaluation for CC-1-16-00502  
 TEDE ALARA Evaluation for CC-1-16-00503  
 TEDE ALARA Evaluation for CC-1-16-00505  
 TEDE ALARA Evaluation for CC-1-16-00613  
 Work In-Progress Reviews for ALARA Plan 16-0035  
 Work In-Progress Reviews for ALARA Plan 16-0042  
 Work In-Progress Reviews for ALARA Plan 16-0043  
 Work In-Progress Reviews for ALARA Plan 16-0044  
 Work In-Progress Reviews for ALARA Plan 16-0062

**Section 4OA1: Performance Indicator Verification**

Procedure

NEI 99-02, Regulatory Assessment Performance Indicator Guideline, Revision 7

Action Requests

AR02556321	AR02596208	AR02671497	AR02725766
AR02570242	AR02605271	AR02699917	AR03953568
AR02582238	AR02615799	AR02700401	
AR02582828	AR02626895	AR02700750	
AR02592002	AR02639325	AR02705995	

Miscellaneous

Calvert Cliffs Unit 1 Unplanned Power Changes per 7000 critical hours performance indicator report, 3Q 2016  
 Calvert Cliffs Unit 1 Unplanned Scrams per 7000 critical hours performance indicator report, 3Q 2016  
 Calvert Cliffs Unit 1 Unplanned Scrams with Complications performance indicator report, 3Q 2016  
 Calvert Cliffs Unit 2 Unplanned Scrams per 7000 critical hours performance indicator report, 3Q 2016  
 Calvert Cliffs Unit 2 Unplanned Scrams with Complications performance indicator report, 3Q 2016  
 Calvert Cliffs Unit 2 Unplanned Power Changes per 7000 critical hours performance indicator report, 3Q 2016  
 List, RCA Exit Transactions > 100 mrem, as of 8/4/2016

**Section 4OA2: Problem Identification and Resolution**

Procedures

PI-AA-125-1005, Coding and Analysis Manual, Revision 00

Action Requests

AR02729179	AR02732184	AR03943164
AR02729777	AR02740113	AR03950810

Miscellaneous

Action Request 02549932, "IR to Investigate 12-CR-HVAC Failures – ACE to be performed,"  
09/02/2015

Apparent Cause Investigation Report 02549932, "12 HVAC Bearing Failure," 10/8/2015  
Calvert Cliffs Nuclear Power Plant Technical Procedure, Fastener-02, "Use of Lockwire,  
Safe-T-Cable, Cotter Pins and Special Washers," Revision 0300

Nuclear Event Report CC-15-005, "Loss of Control Room HVAC Due to Improper Set Screw  
Installation"

Calvert Cliffs Quarterly Assessment Report 3Q2016, October 26, 2016

NOSA-CAL-16-12, Calvert Cliffs Cyber Security Audit

**Section 4OA3: Followup of Events and Notices of Enforcement Discretion**

Procedures

LS-AA-106, Plant Operations Review Committee, Revision 10

OP-AA-104-114, Post Transient Review, Revision 12

Action Requests

AR03949100

AR03949318

Miscellaneous

Complex Troubleshooting Failure Mode Tree, IR 03949100: Determine cause of U2 Turbine trip  
on 12/3/2016 at 2224

Plant Computer Alarm Message Report

Post Transient Review – PWR Calvert Cliffs, Event Date 12/3/16

Reactivity Guidance for 12/4/16 Unit 2 Forced Outage Recovery

Calvert Cliffs, Unit 2 Condenser Tube Vibration Study Report, October 23, 2001

ECP-11-000261, Retube 11B, 12B, 13A, and 13B Condensers, Revision 0

Apparent Cause Evaluation Report 02616491, Revision 0

**LIST OF ACRONYMS**

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
12-CR-HVAC	number 12 Control Room, heating, ventilation, and air conditioning unit
ACE	apparent cause evaluation
ADAMS	Agencywide Documents Access and Management System
AFW	auxiliary feedwater
ALARA	as low as is reasonably achievable
AMBO	aging management basis documents
AOP	abnormal operating procedure
AR	action request
CAP	corrective action program
CAQ	condition adverse to policy
CCNPP	Calvert Cliffs Nuclear Power Plant
CEA	control element assembly
CEDM	control element drive mechanism
EAL	emergency action level
ECCS	emergency core cooling system
EDG	emergency diesel generator
EOP	emergency operating procedure
Exelon	Exelon Generation Company, LLC
HELB	high energy line break
HVAC	heating, ventilation, and air conditioning unit
IMC	Inspection Manual Chapter
IR	inspection report
LER	licensee event report
MOV	motor operated valve
NCV	non-cited violation
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
OWA	operator work around
PI	performance indicator
RG	Regulatory Guide
RP	radiation protection
SDP	significance determination process
SRW	service water
SSC	structure, system, and component
TS	technical specification
UFSAR	Updated Final Safety Analysis Report
WO	work order