UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 30, 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: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 - REPORT FOR THE AUDIT OF LICENSEE RESPONSES TO INTERIM STAFF EVALUATIONS OPEN ITEMS RELATED TO NRC ORDER EA-13-109 TO MODIFY LICENSES WITH REGARD TO RELIABLE HARDENED CONTAINMENT VENTS CAPABLE OF OPERATION UNDER SEVERE ACCIDENT CONDITIONS (CAC NOS. MF4416 AND MF4417; EPID L-2014-JLD-0053)

Dear Mr. Hanson:

On June 6, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13143A334), the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-13-109, "Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Condition," to all Boiling Water Reactor licensees with Mark I and Mark II primary containments. The order requirements are provided in Attachment 2 to the order and are divided into two parts to allow for a phased approach to implementation. The order required licensees to submit for review overall integrated plans (OIPs) that describe how compliance with the requirements for both phases of Order EA-13-109 will be achieved.

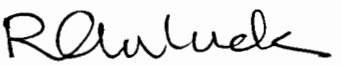
By letter dated June 30, 2014 (ADAMS Accession No. ML14181A301), Exelon Generation Company, LLC. (the licensee) submitted its Phase 1 OIP for Peach Bottom Atomic Power Station, Unit 2 and Unit 3 (Peach Bottom). By letters dated December 19, 2014, June 30, 2015, December 15, 2015 (which included the combined Phase 1 and Phase 2 OIP), June 30, 2016, December 15, 2016, and June 30, 2017 (ADAMS Accession Nos. ML14353A125, ML15181A018, ML15364A015, ML16182A012, ML16350A265, and ML17181A034, respectively), the licensee submitted its 6-month updates to the OIP. The NRC staff reviewed the information provided by the licensee and issued interim staff evaluations (ISEs) for Phase 1 and Phase 2 of Order EA-13-109 for Peach Bottom by letters dated February 12, 2015 (ADAMS Accession No. ML15026A469), and August 2, 2016 (ADAMS Accession No. ML16099A272), respectively. When developing the ISEs, the staff identified open items where the staff needed additional information to determine whether the licensee's plans would adequately meet the requirements of Order EA-13-109.

The NRC staff is using the audit process described in letters dated May 27, 2014 (ADAMS Accession No. ML14126A545), and August 10, 2017 (ADAMS Accession No. ML17220A328), to gain a better understanding of licensee activities as they come into compliance with the order. As part of the audit process, the staff reviewed the licensee's closeout of the ISE open items.

The NRC staff conducted teleconferences with the licensee on May 18, 2017, and November 2, 2017, respectively. The enclosed audit report provides a summary of that aspect of the audit.

If you have any questions, please contact me at 301-415-1025 or by electronic mail at Rajender.Auluck@nrc.gov.

Sincerely,



Rajender Auluck, Senior Project Manager
Beyond-Design-Basis Engineering Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosure:
Audit report

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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AUDIT REPORT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

AUDIT OF LICENSEE RESPONSES TO INTERIM STAFF EVALUATIONS OPEN ITEMS

RELATED TO ORDER EA-13-109 MODIFYING LICENSES

WITH REGARD TO RELIABLE HARDENED CONTAINMENT VENTS CAPABLE OF

OPERATION UNDER SEVERE ACCIDENT CONDITIONS

EXELON GENERATION COMPANY, LLC.

PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-277 AND 50-278

BACKGROUND

On June 6, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13143A334), the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-13-109, "Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Condition," to all Boiling Water Reactor (BWR) licensees with Mark I and Mark II primary containments. The order requirements are divided into two parts to allow for a phased approach to implementation.

Phase 1 of Order EA-13-109 requires license holders of BWRs with Mark I and Mark II primary containments to design and install a Hardened Containment Vent System (HCVS), using a vent path from the containment wetwell to remove decay heat, vent the containment atmosphere (including steam, hydrogen, carbon monoxide, non-condensable gases, aerosols, and fission products), and control containment pressure within acceptable limits. The HCVS shall be designed for those accident conditions (before and after core damage) for which containment venting is relied upon to reduce the probability of containment failure, including accident sequences that result in the loss of active containment heat removal capability or extended loss of alternating current power (ELAP). The order required all applicable licensees, by June 30, 2014, to submit to the Commission for review an overall integrated plan (OIP) that describes how compliance with the Phase 1 requirements described in Order EA-13-109 Attachment 2 will be achieved.

Phase 2 of Order EA-13-109 requires license holders of BWRs with Mark I and Mark II primary containments to design and install a system that provides venting capability from the containment drywell under severe accident conditions, or, alternatively, to develop and implement a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions. The order required all applicable licensees, by December 31, 2015, to submit to the Commission for

review an OIP that describes how compliance with the Phase 2 requirements described in Order EA-13-109 Attachment 2 will be achieved.

By letter dated June 30, 2014 (ADAMS Accession No. ML14181A301), Exelon Generation Company, LLC. (Exelon, the licensee) submitted its Phase 1 OIP for Peach Bottom Atomic Power Station, Unit 2 and Unit 3 (Peach Bottom). By letters dated December 19, 2014, June 30, 2015, December 15, 2015 (which included the combined Phase 1 and Phase 2 OIP), June 30, 2016, December 15, 2016, and June 30, 2017 (ADAMS Accession Nos. ML14353A125, ML15181A018, ML15364A015, ML16182A012, ML16350A265, and ML17181A034, respectively), the licensee submitted its 6-month updates to the OIP, as required by the order.

The staff reviewed the information provided by the licensee and issued interim staff evaluations (ISEs) for Phase 1 and Phase 2 for Peach Bottom by letters dated February 12, 2015 (ADAMS Accession No. ML15026A469), and August 2, 2016 (ADAMS Accession No. ML16099A272), respectively. When developing the ISEs, the staff identified open items where the staff needed additional information to determine whether the licensee's plans would adequately meet the requirements of Order EA-13-109.

The NRC staff is using the audit process in accordance with the letters dated May 27, 2014 (ADAMS Accession No. ML14126A545), and August 10, 2017 (ADAMS Accession No. ML17220A328), to gain a better understanding of licensee activities as they come into compliance with the order. The staff reviews submitted information, licensee documents (via ePortals), and preliminary Overall Program Documents (OPDs)/OIPs, while identifying areas where additional information is needed. As part of this process, the staff reviewed the licensee closeout of the ISE open items.

AUDIT SUMMARY

As part of the audit, the NRC staff conducted teleconferences with the licensee on May 18, 2017 and Novemeber 2, 2017, respectively. The purpose of the audit teleconferences was to continue the audit review and provide the NRC staff the opportunity to engage with the licensee regarding the closure of open items from the ISEs. As part of the preparation for these audit calls, the staff reviewed the information and/or references noted in the OIP updates to ensure that closure of ISE open items and the HCVS design are consistent with the guidance provided in Nuclear Energy Institute (NEI) 13-02, Rev. 1 and related documents (e.g. white papers (ADAMS Accession Nos. ML14126A374, ML14358A040, ML15040A038 and ML15240A072, respectively) and frequently asked questions (FAQs), (ADAMS Accession No. ML15271A148)) that were developed and reviewed as part of overall guidance development. The NRC staff audit members are listed in Table 1. Table 2 is a list of documents reviewed by the staff. Table 3 provides the status of the ISE open item closeout for Peach Bottom. The open items are taken from the Phase 1 and Phase 2 ISEs issued on February 12, 2015, and August 2, 2016, respectively.

FOLLOW UP ACTIVITY

The staff continues to audit the licensee's information as it becomes available. The staff will issue further audit reports for Peach Bottom, as appropriate.

Following the licensee's declarations of order compliance, the licensee will provide a final integrated plan (FIP) that describes how the order requirements are met. The NRC staff will

evaluate the FIPs, the resulting site-specific OPDs, as appropriate, and other licensee documents, prior to making a safety determination regarding order compliance.

CONCLUSION

This audit report documents the staff's understanding of the licensee's closeout of the ISE open items, based on the documents discussed above. The staff notes that several of these documents are still preliminary, and all documents are subject to change in accordance with the licensee's design process. In summary, the staff has no further questions on how the licensee has addressed the ISE open items, based on the preliminary information. The status of the NRC staff's review of these open items may change if the licensee changes its plans as part of final implementation. Changes in the NRC staff review will be communicated in the ongoing audit process.

Attachments:
1. Table 1 – NRC Staff Audit and Teleconference Participants
2. Table 2 – Audit Documents Reviewed
3. Table 3 – ISE Open Item Status Table

Table 1 - NRC Staff Audit and Teleconference Participants

Title	Team Member	Organization
Team Lead/Sr. Project Manager	Rajender Auluck	NRR/DLP
Project Manager Support/Technical Support – Containment / Ventilation	Brian Lee	NRR/DLP
Technical Support – Containment / Ventilation	Bruce Heida	NRR/DLP
Technical Support – Electrical	Kerby Scales	NRR/DLP
Technical Support – Balance of Plant	Kevin Roche	NRR/DLP
Technical Support – I&C	Steve Wyman	NRR/DLP
Technical Support – Dose	John Parillo	NRR/DRA

Table 2 – Audit Documents Reviewed

PM-0546, "Torus Hardened Vent-Flow Calculation"
PB-MISC-025, "MAAP Analysis to Support HCVS Design: Containment Vent Cycling"
ARA-002611, "Tornado Missile TORMIS Analysis"
PM-1190, "HCVS Dose Assessment"
PE-0301, "FLEX Electrical Loading and Voltage Drop"
PE-0308, "HCVS Battery Sizing and Selection"
PM-1207, "HCVS Phase II Dose Assessment"
2493544-28, "Temperature Profile for Areas During an ELAP"
PM-1034, "Temperature Profile for Cable Spreading Room and Computer Room During an ELAP"
PM-1174, "Temperature Profile for Refurl Floor Area During an ELAP"
BWROG-TP-008, "Severe Accident Water Addition Timing"
BWROG-TP-011, "Severe Accident Water Management Supporting Evaluations"
PB-MISC-023, "MAAP Analysis to Support HCVS Design"

Peach Bottom Atomic Power Station, Units 2 and 3
Vent Order Interim Staff Evaluation Open Items:

Table 3 - ISE Open Item Status Table

ISE Open Item Number Requested Action	Licensee Response – Information provided in 6 month updates and on the ePortal	NRC Staff Close-out notes	Safety Evaluation (SE) status Closed; Pending; Open (need additional information from licensee)
Phase 1 ISE OI 1 Make available for NRC staff audit guidelines and procedures for HCVS operation.	The guidelines and procedures for HCVS operation are complete and posted to the ePortal. A list of the guidelines and procedures for HCVS operation is provided below: - AO 56E.2-3, Rev 013, E134-T-B, E134-W-A, AND E-13A4-EC-A MOTOR CONTROL CENTERS OR E134 AND E13A4 EMERGENCY - AO 56E.4-2, Rev 019, E324-R-B, E324-R-D, E324-D-A, E324-T-B OR E324-0-A MOTOR CONTROLCENTERS OR E324 EMERGENC - CC-PB-118, Rev 003, PEACH BOTTOM IMPLEMENTATION OF DIVERSE AND FLEXIBLE COPING STRATEGIES (FLEX) AND SP - FSG-010-2, Rev 001, ALIGNING FLEX GENERATOR TO PANEL 2AS1061 AND FOR FUEL OIL TRANSFER - FSG-010-3, Rev 001, ALIGNING FLEX GENERATOR TO PANEL 3AS1061	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The guidelines and procedures for HCVS operation are complete and consistent with the guidance in NEI 13-02. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 5.1]

	- FSG-011-2, Rev 0000, ALIGNING FLEX GENERATOR TO PANEL 2BS1061 AND FOR FUEL OIL TRANSFER - FSG-011-3, Rev 001, ALIGNING FLEX GENERATOR TO PANEL 3BS1061 - FSG-013-2, Rev 0000, ELAP AC LOAD ALIGNMENT - FSG-013-3, Rev 001, ELAP AC LOAD ALIGNMENT - GP-2-2, Rev 008, NORMAL PLANT START-UP - OP-PB-108-103-2, Rev 007, LOCKED VALVE LIST- PBAPS UNIT 2 - PF-72H, Rev 007, RADWASTE BLDG RADWASTE COMPACTING AND STORAGE - ELEVATION 135'-0" - PF-75, Rev 006, RADWASTE BLDG RADWASTE CONTROL ROOM DEGON AND MEDICAL STATION ELEVATION 135'-0" - RT-M-07B-950-2, Rev 003, TORUS HARDENED VENT RUPTURE DISC INTEGRITY TEST - RT-0-07K-900-2, Rev 0000, CONTAINMENT EMERGENCY VENT SYSTEM BOTTLE PRESSURE VERIFICATION TEST - RT-0-57P-100-2, Rev 0000, CONTAINMENT EMERGENCY VENT		

	SYSTEM COMPONENT OPERATION TEST - RT-0-57P-745-2, Rev 0000, CONTAINMENT EMERGENCY VENT BATTERY MONTHLY INSPECTION - RT-0-57P-746-2, Rev 0000, CONTAINMENT EMERGENCY VENT BATTERY QUARTERLY INSPECTION RT-0-100-505-2, Rev 040, EMERGENCY OPERATING PROCEDURE TOOL INVENTORY - SE-4 BASES, Rev 031, FLOOD – BASES - SE-4 PROCEDURE, Rev 041, FLOOD – PROCEDURE - SE-11 BASES, Rev 022, LOSS OF OFF-SITE POWER – BASES - SO 7B.1 .A-2 COL, Rev 011, CONTAINMENT ATMOSPHERE INERTING - SO 7K.1.A-2 COL, Rev 0000, CONTAINMENT EMERGENCY VENT ARGON RUPTURE PURGE - SO 16C.1.A-2 COL, Rev 001, BACKUP INSTRUMENT NITROGEN TO HARDENED CONTAINMENT VENT SYSTEM - SO 57P.1 COL, Rev 0000, CONTAINMENT EMERGENCY VENT SYSTEM		

	- SO 57P.1, Rev 001, HARDENED CONTAINMENT VENT SYSTEM BATTERY CHARGER STARTUP AND NORMAL OPERATIONS - SO 58C.1.A COL, Rev 047, NORMAL 120 VAC SYSTEM COMMON PLANT - ST/LLRT 20.07B.11, Rev 003, TORUS 18 INCH VENT ISOLATION VALVES TO S.B.G.T. 0-RING SEALS OF A0-2-07B-2511 - ST-M-16B-250-2, Rev 019, SAFETY GRADE INSTRUMENT GAS SYSTEM FUNCTIONAL AND INSERVICE TEST - T-200-2, Rev 014, PRIMARY CONTAINMENT VENTING - T-200J-2, Rev 004, CONTAINMENT VENTING VIA THE TORUS HARDENED VENT - TQ-PB-201-0113, Rev 008, PEACH BOTTOM TRAINING DEPARTMENT SIMULATOR EXAMINATION SECURITY		
Phase 1 ISE OI 2 Make available for NRC staff audit the site specific controlling document for HCVS out of service and compensatory measures.	The NRC staff reviewed Procedure CC-PB-118, which contains the HCVS out of service requirements and is posted to the ePortal. The out of service requirements are described in the licensee's 5th Six-Month Status Report, dated December 15, 2016.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The site specific controlling document for HCVS out of service and compensatory measures is consistent with the guidance in NEI 13-02. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.13]

Phase 1 ISE OI 3 Make available for NRC staff audit a technical justification for the use of jumpers in the HCVS strategy.	The design of the HCVS includes a control switch in the MCR [main control room] for transferring power to the solenoid valve (SV) that does not include a PCIS [primary containment isolation system] isolation signal, eliminating the need for jumpers. Applicable Unit 2 drawings (M-1-S-23, Sheet 34B and E-403, Sheet 5) and Unit 2 ECR package 15-00148 have been uploaded to the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The licensee has changed its strategy and the use of jumpers is no longer needed. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.6]
Phase 1 ISE OI 4 Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit.	Calculation PM-0546, Torus Hardened Vent-Flow demonstrates that the HCVS has the capacity to vent the steam/energy equivalent of one percent licensed/rated thermal power. The primary containment design pressure is 56 psig [per square inch gauge] (UFSAR [updated final safety analysis report] [Section] 5.2.3.1). The primary containment pressure limit is 60 psig (UFSAR [Section] 5.2.3.6). PM-0546 shows that the HCVS capacity exceeds one percent of licensed/rated thermal power at the lower of these values. Calculation PM-0546 has been uploaded to the ePortal. Additionally, MAAP [modular accident analysis program] calculation PB-MISC-025 was developed using MAAP 4.0.6 to investigate the response of Peach Bottom Unit 2 and Unit 3 containment venting using the HCVS vent parameters and the use of RPV [reactor pressure vessel] alternate injection with assumed immediate RCIC failure. The MAAP analysis demonstrates that the	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. Calculation PM-0546 assumes the rated thermal power of both Units 2 and 3 is 3951 MWt [megawatt thermal]. The calculation shows a choked flow of 74,300 lbm/sec. The maximum required flow for 1% power is 40,700 lbm/sec. Calculation PM-0546 results show that at containment design pressure of 56 psig, the vent capacity has a 26% margin for Unit 2 and a 30% margin for Unit 3. Calculation PB-MISC-025 confirmed that the size of the wetwell portion of the HCVS provides adequate capacity to meet or exceed the order criteria. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.1]

	suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit. Calculation PBMISC-025 has been uploaded to the ePortal.		
Phase 1 ISE OI 5 Make available for NRC staff audit descriptions or diagrams of reactor building ventilation including exhaust dampers failure modes to support the licensee justification for the HVAC release point being below and 150 feet from the reactor building ventilation release point.	Reference drawing M-395: The Reactor Building Exhaust System. The RB Exhaust System Fans, including the Refuel Floor Exhaust Fans, RB Exhaust Fans, and RB Equipment Exhaust Fans, have Fail-Close dampers in exhaust ducts to prevent uncontrolled or unmonitored release from the RB in the event of loss of power to the solenoid valves associated with the dampers. Fail-Close dampers will eliminate pathway into the RB in the event of use of the HCVS in an ELAP. Drawing M-395 has been uploaded to the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.3]
Phase 1 ISE OI 6 Make available for NRC staff audit details to justify the deviation from the tornado protection standards provided in NEI 13-02 or make available a description of how the HCVS will comply with the tornado protection standards provided in NEI 13-02.	Exelon prepared a Tornado Missile TORMIS analysis (ARA-002611) which calculated probabilities of damage to the external piping that would crimp the pipe to a point of not being able to perform as expected under severe accident conditions following an ELAP event. The conclusions of the analysis are provided in a table in the 5th Six-Month Status Report. Frequencies for the Hardened Vent targets for each unit are lower than the threshold frequency of 1.0E-06 per year.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The licensee's "reasonable protection evaluation," which calculated the damage probabilities to the HCVS external piping to a point of not being able to perform as expected under severe accident conditions following an ELAP event are less than the numerical criterion stated in the NRC staff established	Closed [Staff evaluation to be included in SE Section 3.2.2]

	In addition, compensatory measures are available in the event the HCVS external piping does become crimped. This analysis has been reviewed by the NRC and determined to be acceptable based on the probability values provided in the analysis and the qualitative reasonable assurance argument provided. TORMIS analysis ARA-002611 has been posted to the ePortal.	position in the (TORMIS) SER dated May 7, 1983. The licensee also has established a "reasonable qualitative argument" to indicate defense-in-depth by having compensatory measures available in the event the HCVS does become crimped. No follow-up questions.	
Phase 1 ISE OI 7 Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions.	FLEX modification ECR 15-00126 improved the PBAPS communication system to be functional in the event of an ELAP. This modification provided equipment and connections to form a workable system to provide in-plant communications during and after an ELAP/BDBEE [beyond-design-basis external event]. The existing 3-way antenna coupler located in the northeast corner of the reactor building at El. 135'-0", was replaced with a 4-way coupler to accommodate a new connection installed from a new cabinet to power the existing plant antenna network. The new cabinet is located in the same area and was vendor supplied with all equipment as required. The cabinet houses an 8-hour rectifier power system and associated batteries, radio repeater that duplicates the frequency of the operations channel 1 (ops 1), a radio frequency duplexer to control the signals to and from the portable radio antenna and associated cabling that will be deployed after the event. The cabinet is powered from a division 1 power source which will be powered from the FLEX portable diesel during an ELAP. The permanently	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The communication methods are the same as accepted in Order EA-12-049. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.1.1]

	installed equipment in the reactor building along with all conduits for the cabling are seismically mounted. This system is deployed using procedure FSG-020. Operators in the remote HCVS operating location (Radwaste Building El. 135') will utilize this system to communicate with the Main Control Room staff. ECR 15-00126 and procedure FSG-020 have been uploaded to the ePortal.		
Phase 1 ISE OI 8 Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	Peach Bottom will utilize an Argon purge system to address combustible gases in the HCVS piping. A summary of the design features is included in the December 2015 OIP.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The licensee's design is consistent with Option 3 of the endorsed white paper HCVS-WP-03. The Argon purge system will have switches for the control valve in the MCR and will be operable from the Remote Operating Station (ROS), in case of a direct current power or control circuit failure. The Argon purge will only be utilized following severe accident conditions when hydrogen is being vented. The installed capacity for the Argon purge system will be sized for at least 8 purges within the first 24 hours of the ELAP. This number of vent cycles is the same value used for sizing the primary containment isolation valve (PCIV) pneumatic supply. The design will allow for Argon bottle	Closed [Staff evaluation to be included in SE Section 3.1.2.11]

		replacement for continued operation past 24 hours. The replacement bottles will be stored at the same location as the ROS. The Argon purge system can also be used to breach the rupture disc if venting is required before reaching the rupture disc set-point. No follow-up questions.	
Phase 1 ISE OI 9 Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.	Temperature and radiological conditions have been evaluated. The evaluated conditions support safe access and operation of control and supporting equipment by operating personnel. Temperature conditions are evaluated in Section 3.14 of ECR 15-00148 and radiological conditions are evaluated in Calculation PM-1190. Unit 2 ECR 15-00148 and Calculation PM-1190 have been posted to the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. ECR 15-00148 indicates that the ROS (Room #241) will be a maximum of 120°F and 90% relative humidity during an accident. The ECR notes that during the first 4-hours after the start of a severe accident access to the room will be unaffected due to the mass of concrete between the containment and the ROS. Operators will access the room for system alignment during that period. If ROS re-entry is required after the area heats up, operators will have ice vests and limited stay times per plant procedures. Access to other areas has been addressed under Order EA-12-049.	Closed [Staff evaluation to be included in SE Sections 3.1.1.2 and 3.1.1.3]

		Temperature and radiological conditions should not inhibit operator actions needed to initiate and operate the HCVS during an ELAP with severe accident conditions. No follow-up questions.	
Phase 1 ISE OI 10 Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	Descriptions of all instrumentation and controls necessary to implement this order including qualification methods are provided in ECR 15-00148, Section 3.2, 3.5, 3.14, 3.15 & 3.39. ECR 15-00148 has been posted to the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. ECR 15-00148, Sections 3.2, 3.5, 3.14, 3.15 & 3.39 discusses the environmental conditions during an accident at the locations containing I&C components. The staff's review indicated that the environmental qualification met the order requirements. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.8]
Phase 1 ISE OI 11 Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.	Final sizing evaluation for HCVS battery/battery charger is contained in Calculation PE-0308. Incorporation of HCVS loading to FLEX DG loading is contained in Calculation PE-0301. Calculations PE-0308 and PE-0301 have been posted to the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The licensee stated that all electrical power required for operation of HCVS components is provided by a dedicated HCVS battery charger and batteries. The battery sizing calculation (PE-0308) confirmed that the HCVS batteries have a minimum capacity capable of providing power for 24 hours without	Closed [Staff evaluation to be included in SE Section 3.1.2.6]

		recharging, and therefore is adequate. The licensee revised the FLEX Diesel Generator calculation (PE-0301) to add the loads for the HCVS. The NRC staff reviewed the revised calculation and confirmed that with the additional load added, it's still within the capacity and capability of the Peach Bottom FLEX diesel generator. No follow-up questions.	
Phase 1 ISE OI 12 Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	Descriptions of local conditions and confirmation that components required for HCVS venting are capable of performing their functions during ELAP and severe accident conditions are contained in ECR 15-00148, Sections 3.14 & 3.15. Unit 2 ECR 15-00148 has been posted to the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. ECR 15-00148, Sections 3.14 & 3.15 discuss the environmental conditions during an accident at the locations containing I&C components. The staff's review indicated that the environmental qualification met the order requirements. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.1.4]
Phase 1 ISE OI 13 Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the	Documentation that the existing containment isolation valves, which are relied upon for HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting (60 psig) is provided in	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. Data sheet DS-FP Sheet 1161A indicates a maximum operating	Closed [Staff evaluation to be included in SE Section 3.1.2.1]

HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.	specification M-00117 and valve data sheet DS-FP, Sheet 1161. Specification M-00117 requires that PCIV A0-2(3)-078-2(3)511 be able to operate with a 62 psig pressure differential and valve data sheet DSFP, Sheet 1161 states that the design pressure of PCIV A0-2(3)-07b-8(9)0290 is 150 psig. Specification M-00117 and valve data sheet DS-FP, Sheet 1161 have been posted to the ePortal.	differential pressure of 60 psid [per square inch differential] in the normal direction. The staff reviwed Specification M-00117, Addendum 1 for Primary Containment Isolation Butterfly Valves for the Peach Bottom Atomic Power Station Units 2 and 3, Calculation ME-0167, "Determine the Maximum Pressure Gradient Allowable Across the Containment Venting Valves (All Acceptable Vent Paths) While Maintaining Valve Integrity and Operability", and MOD 5236 PBAPS Torus Hard Vent Design Input Document. Licensee addressed the ability of the HCVS PCIVs to operate under maximum design differential pressure. No follow-up questions.	
Phase 1 ISE OI 14 Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings.	As described in the OIP, the HCVS torus vent path in each unit, starting at and including the downstream PCIV, will be a dedicated HCVS flow path. There are no interconnected systems downstream of the downstream, dedicated HCVS PCIV. Interconnected systems are upstream of the downstream HCVS PCIV and are isolated by normally shut, fail shut PCIVs which, if open, would shut on an ELAP. There is no shared HCVS piping between the two units.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The HCVS wetwell pipe in each each unit provides a dedicated HCVS flowpath from the wetwell penetration PCIVs to the outside with no interconnected downstream piping. The staff's review of the proposed system indicates that the licensee's design appears to maintain hydrogen below flammability limits.	Closed [Staff evaluation to be included in SE Section 3.1.2.12]

		No follow-up questions.	
Phase 1 ISE OI 15 Make available for NRC audit documentation confirming that HCVS will remain isolated from standby gas treatment system during ELAP and severe accident conditions.	The Hardened Containment Vent is isolated from the SGTS by valve A0-2-078-2512 (Unit 2) and A0-3-078-3512 (Unit 3). The boot seal of A0-2(3)-078-2(3)512 will be maintained inflated from the dedicated HCVS nitrogen supply to ensure that A0-2(3)-078-2(3)512 remains closed/isolated. Unit 2 ECR 15-00148 has been posted to the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.1]
Phase 2 ISE OI 1 Licensee to evaluate the SAWA [severe accident water addition] equipment and controls, as well as ingress and egress paths for the expected severe accident Conditions (temperature, humidity, radiation) for the sustained operating period.	<u>Equipment and Controls</u> Plant instrumentation for SAWM that is qualified to RG 1.97 or equivalent is considered qualified for the sustained operating period without further evaluation. The following plant instruments are qualified to RG 1.97: PR/TR-4805 (Unit 2) PR/TR-5805 (Unit 3) LI-8123A (Unit 2) LI-9123A (Unit 3) Not all components that are either in the PR/TR-4(5)805 instrument loops or that may affect the loops are RG 1.97 qualified. These components include PT-4805, PT-5805, 2DC834 and 3DC834, and are evaluated in EC 618957, Attachment 9A for the radiological, thermal and humidity conditions expected during a severe accident. These components are determined to be either acceptable or have no adverse effect on the PR/TR-4805 and PR/TR-5805 instrument loops if failure occurred. Passive components that do not need to change state after initially establishing	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. EC 618957 along with calculation PM-1207 shows that temperature and radiological conditions should not inhibit operator actions or SAWA equipment and controls needed to initiate and operate the HCVS during an ELAP with severe accident conditions. No follow-up questions.	Closed [Staff evaluation to be included in SE Sections 4.1.1.4 and 4.2.1.4]

	SAWA flow do not require evaluation beyond the first 8 hours, at which time they are expected to be installed and ready for use to support SAWA/SAWM. The following additional equipment performing an active SAWNSAWM function is considered: -SAWA/SAWM flow instrument -SAWA/SAWM pump (FLEX pump) -SAWA/SAWM generator (FLEX generator) -Active valves in SAWA flow path <u>Ingress and Egress</u> A quantitative evaluation of expected dose rates has been performed per HCVS-WP-02 in Calculation PM-1207 and found the dose rates at deployment locations including ingress/egress paths are acceptable. Calculation PM-1207 has been posted to the ePortal. Unit 3 EC 618957 will be posted to the ePortal upon approval of the EC.		
Phase 2 ISE OI 2 Licensee to demonstrate how instrumentation and equipment being used for SAWA and supporting equipment is capable to perform for the sustained operating period under the expected temperature and radiological conditions	<u>Equipment and Controls</u> Plant instrumentation for SAWM that is qualified to RG 1.97 or equivalent is considered qualified for the sustained operating period without further evaluation. The following plant instruments are qualified to RG 1.97: PR/TR-4805 (Unit 2) PR/TR-5805 (Unit 3) LI-8123A (Unit 2)	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. Technical Evaluation 2493544-28 along with calculation PM-1207 shows that temperature and radiological conditions should not inhibit operator actions or SAWA equipment and controls needed to initiate and operate the HCVS	Closed [Staff evaluation to be included in SE Sections 4.1.1.4 and 4.2.1.4]

	LI-9123A (Unit 3) See response to Phase 2 ISE-1 for discussion on components that are associated with the PR/TR-4(5)805 instrument loops that are not RG 1.97 qualified. Passive components that do not need to change state after initially establishing SAWA flow do not require evaluation beyond the first 8 hours, at which time they are expected to be installed and ready for use to support SAWA/SAWM. The following additional equipment performing an active SAWA/SAWM function is considered for temperature and radiation effects: -SAWA/SAWM flow instrument -SAWA/SAWM pump (FLEX pump) -SAWA/SAWM generator (FLEX generator) -Active valves in SAWA flow path <u>Temperature</u> The location of SAWA equipment and controls are the same or similar as FLEX with the exceptions noted below. The areas/rooms of PBAPS that require operator actions or passage to implement the SAWA/SAWM strategy are evaluated. The evaluation concluded that the expected thermal conditions associated with a severe accident are considered to be acceptable to accomplish the required SAWA/SAWM actions for HCVS Phase 2.	during an ELAP with severe accident conditions. No follow-up questions.	

	Details of the evaluation are contained in EC 618957, Attachment 9B. The SAWA/SAWM action time line is the same as the FLEX action time line with the exception of performing procedure FSG-043 "Defeating RCIC Interlocks" and FSG-032 "Establishing HPCI/RCIC/Sump Room Ventilation, Lighting and Water Removal". These procedures are not required to be performed as part of the SAWA/SAWM strategy since the actions performed in these procedures are to support RCIC/HPCI operation and RCIC and HPCI are assumed to fail for SAWA/SAWM. Technical Evaluation 2493544-28 established a temperature profile for areas of PBAPS during an ELAP that require operator actions or passage to implement the FLEX strategy. This evaluation considered loss of ventilation (until FLEX generators are deployed) combined with decay heat from the reactor and various subsystems and heat from plant equipment fed by station batteries such as relays, emergency lighting and other electrical components credited in the FLEX strategy. Active plant calculations involving loss of HVAC were evaluated to identify calculations where area temperatures would be bounding when compared to those temperatures anticipated during an ELAP. The following rooms were evaluated for FLEX in Technical Evaluation 2493544-28; however, they are not required to be accessed as part of the SAWA/SAWM strategy.		

	RCIC Pump Room and HPCI Pump Room Since RCIC and HPCI are assumed to fail immediately for SAWA/SAWM, there is no requirement to access the RCIC or HPCI pump rooms; however, operators will likely open the RCIC and HPCI pump room doors per procedure SE-11 and determine if the RCIC or HPCI pumps can be started. The temperatures listed for these rooms in Technical Evaluation 2493544-28 would remain bounding for the relatively short time operators would spend determining if the RCIC or HPCI pumps can be started since the heat load from the RCIC or HPCI pump operation would not contribute to the overall heat load of the room. Reactor Building Sump Room and Core Spray Pump Room The reactor building sump room and core spray pump room are required to be accessed as part of the FLEX strategy per procedure FSG-032; however, these rooms are not required to be accessed as part of the SAWA/SAWM strategy since FSG-032 is not required to be performed as stated above. South Isolation Valve Room (SIVR) Procedure FSG-044 aligns the backup instrument nitrogen bottles to the ADS valves as part of the FLEX and SAWA/SAWM strategy. This is achieved by bypassing the A and B backup instrument nitrogen solenoid valves via a		

	local bypass line. The B backup instrument nitrogen solenoid valve is located in the SIVA and cannot be bypassed using the local bypass line since the Unit 3 SIVA is uninhabitable during a Severe Accident. Therefore, the Engineering Change associated with SAWA/SAWM provides a new bypass line which is routed outside of the SIVA into the Control Rod Drive (CRD) Equipment Area which is evaluated below. The remaining areas identified in Technical Evaluation 2493544-28 are required to be accessed as part of the SAWA/SAWM strategy. The temperatures listed for the Stairwells, Reactor Building Closed Cooling Water (RBCCW) Rooms, CAD Equipment Areas, Corridors, and Operating Area are associated with a Loss of Coolant Accident (LOCA). As stated in Technical Evaluation 2493544-28, these area temperatures are greater than those anticipated in an ELAP. These LOCA temperatures are considered to be acceptable for application to SAWA/SAWM actions under a severe accident since these temperatures are conservative in nature under an ELAP, the SAWA/SAWM actions will be completed within 7 hours into the event where containment heat up is restricted to core damage prior to vessel breach, and the drywell shield wall provides restrictive heat transfer which will mitigate the propagation of the higher drywell temperature. The temperatures listed for		

	the Cable Spreading Room and Computer Room are from calculation PM-1034; these area temperatures are reasonable and would not be expected to have any notable increase due to location/proximity to primary containment. The Refuel Floor Area temperature is determined by calculation PM-1174, Rev. 0 and this temperature is also not expected to increase since the inputs and assumptions of the calculation remain the same. Per HCVS-FAQ-01, no evaluation is required for use of the MCR as the primary control station. Actions to open Reactor Building Railroad Doors and Refuel Floor Roof Hatch to establish natural circulation of the Secondary Containment atmosphere and establish MCR, Battery Room and Switchgear Room ventilation per FSG-030, FSG-031 and FSG-033 are maintained as part of the SAWA/SAWM strategy. Technical Evaluation 2493544-28 established area/room temperatures during an ELAP for PBAPS and determined that these temperatures are acceptable to implement FLEX actions. Based on the determination that the temperatures listed in Technical Evaluation 2493544-28 can be applied to SAWA/SAWM actions and that these temperatures are acceptable to accomplish the required FLEX actions, the expected thermal conditions associated with SAWA/SAWM are considered to be acceptable to accomplish the required SAWA/SAWM actions for HCVS Phase 2.		

	Radiation For equipment locations within the Reactor Building, a quantitative evaluation of expected normal operation and containment shine (vent line shine) total integrated dose has been performed per HCVS-FAQ-12 (HCVS-WP-02) in Calculation PM-1207 and found the total integrated dose at deployment locations is acceptable. For locations outside the Reactor Building between 7 hours and 7 days when SAWA is being utilized, a quantitative evaluation of expected dose rates has been performed per HCVS-WP-02 in Calculation PM-1207 and found the dose rates at deployment locations are acceptable. Calculation PM-1207 and Procedures FSG-030, FSG-031, FSG-032, FSG-033 and FSG-043 have been posted to the ePortal. The revised Procedure FSG-044 will be posted to the ePortal upon approval of the procedure revision. Unit 3 EC 618957 will be posted to the ePortal upon approval of the EC.		
Phase 2 ISE OI 3 Licensee to demonstrate that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.	The wetwell vent has been designed and installed to meet NEI 13-02, Rev. 1 guidance which will ensure that it is adequately sized to prevent containment overpressure under severe accident conditions. The SAWM strategy will ensure that the wetwell vent remains functional for the period of sustained operation.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. BWROG-TP-15-008 demonstrates adding water to the reactor vessel within 8-hours of the onset of the event will limit the peak containment drywell temperature significantly reducing	Closed [Staff evaluation to be included in SE Sections 4.1 and 4.2]

	PBAPS will follow the guidance (flow rate and timing) for SAWA/SAWM described in BWROG-TP-15-008 and BWROG-TP-15-011. These documents have been posted to the ePortal for NRC staff review. The wetwell vent will be opened prior to exceeding the PCPL value of 60 psig. Therefore, containment over pressurization is prevented without the need for a drywell vent.	the possibility of containment failure due to temperature. Drywell pressure can be controlled by venting the suppression chamber through the suppression pool. BWROG-TP-011 demonstrates that starting water addition at a high rate of flow and throttling after approximately 4-hours will not increase the suppression pool level to that which could block the suppression chamber HCVS. The suppression pool will be provided with sufficient makeup to maintain a heat sink for reactor decay heat, which will maintain containment within design limits. The SAWM strategy will ensure that the wetwell vent remains functional for the period of sustained operation. No follow-up questions.	
Phase 2 ISE OI 4 Licensee to demonstrate how the plant is bounded by the reference plant analysis that shows the SAWM strategy is successful in making it unlikely that a drywell vent is needed.	Peach Bottom will implement the initial SAWA flow rate of 500 GPM [gallons per minute] used in the reference plant evaluation. A site specific MAAP evaluation for determining an appropriate site specific initial SAWA flow rate is not required. Using Figure 2.1.C from the combined Phases 1 and 2 OIP, compare the reference plant parameters to the plant specific parameters. ***Reference Plant***	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. Peach Bottom was used as the reference plant. The staff concurs that it is unlikely the suppression chamber HCVS could become blocked leading to a successful SAWA/SAWM strategy. Therefore, it is unlikely a drywell vent would be required to maintain containment integrity.	Closed [Staff evaluation to be included in SE Section 4.2.1.1]

	Torus freeboard volume is 525,000 gallons, SAWA flow is 500 GPM at 8 hours followed by 100 GPM from 12 hours to 168 hours, ***Peach Bottom*** Torus freeboard volume is 525,000 gallons, SAWA flow is 500 GPM at 8 hours followed by 100 GPM from 12 hours to168 hours. The above parameters for Peach Bottom compared to the reference plant that determine success of the SAWM strategy demonstrate that the reference plant values are bounding. Therefore, the SAWM strategy implemented at Peach Bottom makes it unlikely that a drywell vent is needed to prevent containment overpressure related failure.	No follow-up questions.	
Phase 2 ISE OI 5 Licensee to demonstrate that there is adequate communication between the main control room (MCR) and the operator at the FLEX manual valve during severe accident conditions.	The SAWA/SAWM pump (FLEX pump) and SAWA manual valve location is adjacent to the 3 Startup Switchgear Building north of the Unit 3 Reactor Building. This location is shown in EC 618957, Attachment 12. Unit 3 EC 618957 will be posted to the ePortal upon approval of the EC. PBAPS [Peach Bottom Atomic Power Statio] utilizes radio communications to communicate between the MCR and the operator at the SAWA flow control location. This communication method is the same as accepted in Order EA-12-049. These items will be powered and remain powered using the same methods as evaluated under EA-12-049 for the period of sustained operation, which may be longer than identified for EA-12-049.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The communication methods are the same as accepted in Order EA-12-049. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 4.1]

Phase 2 ISE OI 6 Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions.	For locations outside the Reactor Building between 7 hours and 7 days when SAWA is being utilized, a quantitative evaluation of expected dose rates has been performed per HCVS-WP-02 in Calculation PM-1207 and found the dose rates at deployment locations are acceptable. The selected instrument is designed for the expected flow rate, temperature and pressure for SAWA over the period of sustained operation. **SAWA Flow Instrument** 3.3 to 1100 GPM, -4 to 140 °F, 740 PSI **Expected SAWA Parameter Qualification Range** 100 to 500 GPM, 10 to 95 °F, 300 PSI The SAWA flow instrument qualifications are contained in EC 618957, Attachment 4.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. EC 618957 discusses the SAWM flow instrumentation qualification. The NRC staff found through engineering judgement that the accuracy of the flow meter and the environmental qualifications related to the performance of the flow meter meet the intent of Order EA-13-109. No follow-up questions.	Closed [Staff evaluation to be included in SE Sections 4.1.1.3 and 4.2.1.3]

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNIT 2 AND 3 - REPORT FOR THE AUDIT OF LICENSEE RESPONSES TO INTERIM STAFF EVALUATIONS OPEN ITEMS RELATED TO NRC ORDER EA-13-109 TO MODIFY LICENSES WITH REGARD TO RELIABLE HARDENED CONTAINMENT VENTS CAPABLE OF OPERATION UNDER SEVERE ACCIDENT CONDITIONS DATED November 30, 2017

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