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

December 20, 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: DRESDEN NUCLEAR 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. MF4462 AND MF4463; EPID L-2014-JLD-0047)

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. ML14184A018), Exelon Generation Company, LLC. (the licensee) submitted its Phase 1 OIP for Dresden Nuclear Power Station, Units 2 and Unit 3 (Dresden). By letters dated December 17, 2014, June 30, 2015, December 16, 2015 (which included the combined Phase 1 and Phase 2 OIP), June 30, 2016, December 14, 2016, and June 27, 2017 (ADAMS Accession Nos. ML14351A442, ML15181A220, ML15352A027, ML16182A393, ML17353A045, and ML17178A078, 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 Dresden by letters dated February 11, 2015 (ADAMS Accession No. ML15007A491), and September 30, 2016 (ADAMS Accession No. ML16273A430), 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 June 1, 2017, and December 7, 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,

RAuluck

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

Docket Nos. 50-237 and 50-249

Enclosure:
Audit report

cc w/encl: Distribution via Listserv

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

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-237 AND 50-249

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. ML14184A018), Exelon Generation Company, LLC. (the licensee) submitted its Phase 1 OIP for Dresden Nuclear Power Station, Units 2 and Unit 3 (Dresden). By letters dated December 17, 2014, June 30, 2015, December 16, 2015 (which included the combined Phase 1 and Phase 2 OIP), June 30, 2016, December 14, 2016, and June 27, 2017 (ADAMS Accession Nos. ML14351A442, ML15181A220, ML15352A027, ML16182A393, ML17353A045, and ML17178A078, 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 Dresden by letters dated February 11, 2015 (ADAMS Accession No. ML15007A491), and September 30, 2016 (ADAMS Accession No. ML16273A430), 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 June 1, 2017, and December 7, 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 Dresden. The open items are taken from the Phase 1 and Phase 2 ISEs issued on February 11, 2015, and September 30, 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 Dresden, 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

Dresden Nuclear 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 documentation confirming that at least 6 hours battery coping time is available for instrumentation.	EC 391973 Rev. 0 was completed to evaluate proposed battery load shed to support FLEX events. The evaluation addressed both 125V and 250V battery systems. The evaluation identified that with the load shed, the 125V and 250V batteries will maintain acceptable capacity for a minimum of six (6) hours. This time supports the FLEX Strategy time line actions. EC 391973 is available for NRC review on the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. Each unit at Dresden has one 125 Volt (V) direct current (dc) safety-related main station battery and one 250 Vdc safety-related station battery. The battery coping time with load shedding evaluation (EC 391973) verified the capability of the dc system to supply power to the required loads during the first phase of the Dresden FLEX mitigation strategy plan for an ELAP as a result of a beyond-design-basis external event (BDBEE). The licensee's evaluation identified the required loads and their associated ratings (ampere (A) and minimum required voltage) and the non-essential loads that would be shed within 30 minutes to ensure battery operation for at least 6 hours.	Closed [Staff evaluation to be included in SE Section 3.1.2.6]

		No follow-up questions.	
Phase 1 ISE OI 2 Make available for NRC staff audit documentation that confirms the ability to operate HCVS following flooding around the suppression pool.	EC 391644 has been completed to provide flood barriers for the Reactor Building under a flood event prediction. The barriers will be installed to keep the flood waters from entering the suppression pool and challenging the functionality of the suppression pool vent. Additionally, an Engineering Evaluation (EC 407086) has been completed to ensure that any flood water in-leakage does not rise to a level where it can enter the suppression pool via the vacuum breakers. The 50.59 Evaluation for EC 391644 and EC 407086 have been uploaded to ePortal for NRC review.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The licensee has implemented the design and installation of deployable flood barriers and permanent penetration seals/closures in order to protect the critical structures (including the operability of the suppression pool vent) from the design-basis probable maximum flood. In addition, engineering evaluation EC 407086 indicates that any flood water in-leakage will not rise to a level where it can enter the suppression pool via the vacuum breakers. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.0]
Phase 1 ISE OI 3 Make available for NRC staff audit documentation of a method to disable HCVS during normal operation to provide assurances against inadvertent operation that also minimizes actions to enable HCVS operation following an ELAP.	HCVS design precludes inadvertent actuation of the system through passive design features. The HCVS vent pipe has been designed with two PCIVs [primary containment isolation valves], in series, in compliance with GDC-56. The PCIVs have independent actuation trains, thereby precluding inadvertent actuation by a single component failure or mis-alignment. Each PCIV isolates the vent line through its normally held closed actuator spring. A rupture disk in the vent line downstream of the PCIVs preserves the secondary containment boundary. Furthermore, to prevent inadvertent opening, the PCIVs are isolated from their	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The HCVS wetwell pipe in each unit contains two PCIVs, in series, which are isolated from their motive force supply by two locked closed manual valves and require remote manual operation of a key-lock on the control switch at the primary operating station. In addition, there are no interfacing systems downstream of the PCIVs, so inadvertent venting	Closed [Staff evaluation to be included in SE Section 3.1.2.7]

	motive force supply by two locked closed manual valves and require remote manual operation of a key-lock on the control switch at the primary operating station. Similarly, purge gas supply is isolated from the vent line by two locked closed manual valves and requires remote manual operation of a key-lock on the control switch at the primary operating station. Since there are no interfacing systems downstream of the PCIVs, no inadvertent venting cross flow can occur. Details on the configuration of the vent line PCIVs can be found in EC 401069, Design Considerations Summary (DCS). Sections 4.1.4.1, 4.1.4.1.5 and 4.1.27. Based on the details in the EC, NEI requirements 4.1.2.1 and 4.2.1, to prevent inadvertent actuation of the system, are met. EC 401069 is available for NRC review on the ePortal.	cross flow can not occur. The staff's review of the proposed system indicates that the licensee's design appears to preclude inadvertent actuation. No follow-up questions.	
Phase 1 ISE OI 4 Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.	Dresden does not require the consideration of contingencies discussed in Assumption No. 3 in HCVS white paper HCVS-WP-04. The Dresden HCVS vent pipes external to the missile-protected structure were installed greater than 30 feet above grade supported by a robust structural steel tower and have a target area less than ~300 ft2. The pipes are 10" diameter Schedule 40 steel pipes. Dresden's HCVS systems are enveloped by the assumptions in the generic evaluation in Section 3 of HCVS-WP-04 and it is, therefore, concluded that the HCVS is unlikely to be damaged in a manner that prevents containment venting by a wind-generated missile from the	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. EC400578 addresses the HCVS seismic qualification and tornado missile design. The licesee evaluated the entire HCVS system to Seismic Catergory I, which is consistent with the plant's seismic design-basis. For the tornado missile design, the licensee assumed the plant	Closed [Staff evaluation to be included in SE Section 3.2.2]

	same wind event that generates an ELAP or LUHS. In addition to the reasonable assurance evaluation in HCVS-WP-04; Dresden has two design basis missiles, the 1" diameter by 3 feet long steel rod (8 lbs.) and the 13.5" diameter by 35 feet long utility pole (1490 lbs.). Large mass tornado missiles are not considered credible above an elevation of 30 feet above grade, as discussed in HCVS-WP-04 and in the Design Considerations Summary (DCS) Section 4.1.38 of EC 400578. Therefore, only the 1" diameter steel rod missile is considered above 30 feet elevation. Dresden's HCVS pipe thickness is nominally 0.365" thick and the thickness of steel required to stop the 1" diameter steel rod missile is 1" thick steel. Therefore, the missile would penetrate the pipe section but is unlikely to crimp the pipe. This is discussed in the design criteria for the HCVS external piping and supporting structure in the DCS Section 4.1.38 of EC 400578. Ref. DRE 15-0038 and EC-400578, OIP Plant Specific Assumption #4.	licensing basis tornado missiles. The HCVS exits the plant structure approximately 50 feet above grade which is greater than the 30 feet assumed in the guidance for large tumbling wind generated missiles. Above 30 feet, the vent piping is enclosed within a large structural steel tower. The tower will provide some protection from large wind generated missiles. Smaller missiles may puncture the vent piping, but should not crimp the piping preventing flow. No follow-up questions.	
Phase 1 ISE OI 5 Make available for NRC staff audit documentation of the licensee design effort to confirm the diameter on the new common HCVS piping.	Calculation DRE15-0046 uses a RELAP5 model to determine that a 10-inch diameter vent is sufficient to remove 1% reactor thermal power. Calculation DRE15-0046 is available for NRC review on the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The licesee provided calculation DRE15-0046, which shows that the size of the wetwell portion of the HCVS (10 inch diameter) provides adequate capacity to meet or exceed the order criteria.	Closed [Staff evaluation to be included in SE Section 3.1.2.1]

		No follow-up questions.	
Phase 1 ISE OI 6 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 DRE15-0046 uses a RELAP5 model to determine that a 10-inch diameter vent is sufficient to remove 1% reactor thermal power. The steady state venting capacity of the Dresden HCVS was determined at a torus vapor space pressure of 47 psig [per square inch gauge], which corresponds to the PCPL for the torus filled with water. At a torus pressure of 47 psig, the HCVS can vent 111,071 lbm/hr of steam. At 1% reactor thermal power the required vent capacity is 110,381 lbm/hr. Calculation DRE15-0046 is available for NRC review on the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. Calculation DRE-15-0046 determined the mass flow rate of 110,381 lbm/hr to be the minimum flow to remove the equivalent of 1% rated thermal power. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.1]
Phase 1 ISE OI 7 Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	Dresden has designed and installed an argon purge system per EC 400578 to address hydrogen detonation and deflagration requirements of NEI 13-02 Rev. 1 for Unit 3 and will install for Unit 2. The design meets HCVS-WP-03 requirements. HCVS-WP-03 and the DCS Section of EC 400578 are available for NRC review on the ePortal.	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. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.11]
Phase 1 ISE OI 8 Make available for NRC staff audit documentation of a description of the final ROS location and a determination of	Calculation DRE16-0028 performed an evaluation for adequacy of the ROS location including seismic interaction of the structure above the ROS location. EC 403549 performed an evaluation for	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal.	Closed [Staff evaluation to be included in SE Section 3.2.2]

seismic adequacy for the ROS location.	seismic interaction of nearby SSCs in the ROS location. These documents are available for NRC review on the ePortal.	The ROS is in a location that is readily accessible and seismically adequate (based on calculation DRE16-0028), and appears to support operation of the HCVS. No follow-up questions.	
Phase 1 ISE OI 9 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.	FSG-39, FLEX Communications Options, discusses the available Onsite communications. Communications may be performed using the installed sound powered headset system within the power block and 800 Mhz [megahertz] radios in the talkaround mode. Public Address announcements are made by Nuclear Security Officers using hand-held bullhorns. Offsite communications will utilize hand-held satellite phones staged in the Control Room and Technical Support Center. Battery chargers for portable communications equipment are stored in a robust structure. Upon initiation of the ELAP, the FLEX Diesel Generator can power the battery chargers. FSG-39 is available for NRC review on the ePortal.	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]
Phase 1 ISE OI 10 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 Dresden unit, starting at and including the downstream Primary Containment Isolation Valve (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	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	Closed [Staff evaluation to be included in SE Section 3.1.2.12]

	ELAP. There is no shared HCVS piping between the two units. As a result, the potential for hydrogen gas migration and ingress into the reactor building or other buildings is minimized.	review of the proposed system indicates that the licensee's design appears to maintain hydrogen below flammability limits. No follow-up questions.	
Phase 1 ISE OI 11 Provide design details that minimize unintended cross flow of vented fluids within a unit and between units on the site.	As described in ISE item 10 response, Dresden's piping layout minimizes the possibility of cross flow of vented fluids within a unit and between the two units.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The licesee's design appears to minimize the unintended cross flow of vented fluids. No follow-up questions.	
Phase 1 ISE OI 12 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.	DRE16-0010 has been completed and documents dose assessment results for designated areas outside of primary containment that acceptably support the sustained operation of the wetwell containment system. The DCS section 4.1.14 for EC 400578 documents the environmental conditions. These documents are available for NRC review on the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. Main Control Room temperatures have been addressed as part of the FLEX order and were found to be acceptable by the NRC staff. EC 400578 Section 4.1.14 discusses the operability based on the environmental qualification for the new equipment and existing equipment. During the December 7, 2017, audit call the licensee indicated most HCVS actions will take place in the main control room. When manual actions are needed in ROS, an operator will be dispatched from MCR to perform	Closed [Staff evaluation to be included in SE Sections 3.1.1.2 and 3.1.1.3]

		the specific task. Stay time in ROS will be limited. Procedures identify requirements for hot area work. Ice vests will be available as needed. 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 13 Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG [diesel generator] loading calculation.	Calculation DRE15-0056 sizes the 125 VDC battery/battery charger required to power the Unit 2 and Unit 3 Hardened Containment Vent System (HCVS) components for 24 hours. The DCS section 4.1.35 for EC 400578 discusses re-powering of the HCVS battery charger using a FLEX portable DG. The calculation is available for NRC review on 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 the 125 VDC battery/battery charger. The battery sizing calculation (DRE15-0056) confirmed that the HCVS batteries have a minimum capacity capable of providing power for 24 hours without recharging, and therefore is adequate. The licensee provided DCS Section 4.1.35 for EC 400578, which discusses re-powering of the HCVS battery charger using a FLEX portable DG. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.6]

Phase 1 ISE OI 14 Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	The nitrogen pneumatic design is described in EC 400578 DCS section 4.1.33. For Unit 3, two nitrogen bottles are provided to operate 3-1601-60 and 3-1601-93 valves. The primary operating location for the nitrogen system is the MCR via solenoid operated valves. Additionally, the nitrogen system can be activated from the ROS by opening valves manually. EC 400578 DCS is available for NRC review on the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. EC 400578, DCS Section 4.1.33 and EC 401069 discussed the pneumatic design and sizing. Two N2 bottles are provided for operation of HCVS valves. The evaluation determined that 2640 psig in each N2 bottle, will have sufficient capacity to operate the HCVS for 24 hours.	Closed [Staff evaluation to be included in SE Section 3.1.2.6]
Phase 1 ISE OI 15 Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	Existing plant instruments that meet the requirements of RG 1.97 or equivalent are considered qualified for the sustained operating period without further evaluation. The following plant instruments required for HCVS that meet the requirements of RG 1.97: 2(3)-1641-5A (div I) and 2(3)-1641-58 (div II) Wetwell Level Instruments. 2(3)-1641-6A (div I) and 2(3)-1641-68 (div II) Drywell Pressure Instruments. New HCVS Instrumentation is discussed in detail within the DCS sections of EC 400578 and EC 401069. The HCVS instruments are either qualified by seismic shake table testing and/or analysis as discussed in the DCS of the ECs. These sections of the ECs are available for NRC review on the ePortal.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. The existing plant instuments required for HCVS (i.e. wetwell level instruments and drywell pressure instruments) meet the requirements of RG 1.97. EC 400578 and EC 401069 discusses the seismic qualifications for new HCVS I&C components. The staff's review indicated that the seismic 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 16 Make available for NRC staff audit the descriptions of local	The DCS of ECs 400578 and 401069 are available for NRC review on the ePortal. DCS section 4.1.14 provides detail on environmental conditions. The local	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal.	Closed

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.	environmental conditions do not impact the capability of the components to perform their intended functions.	EC 400578, Section 4.1.14 and EC 401069, 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.	[Staff evaluation to be included in SE Section 3.1.1.4]
Phase 1 ISE OI 17 Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.	DCS Sections 4.1.5 and 4.1.33 of EC 400578 and EC 401069 discuss the operations of the existing containment isolation valves relied upon for the HCVS. Appendix B of the DCS of EC 401069 describes the Primary Containment Pressure Limit (PCPL), which is conservatively expected to be the differential pressure during BDBEE and severe accident wetwell venting, being less than the maximum valve differential pressure limit. The PCPL is also less than the design pressure of the line containing the existing containment isolation valve.	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. EC 400578, DCS Section 4.1.5 and 4.1.33 and EC 401069 discusses the valve/actuator information for the PCIVs. The NRC staff verified the actuator can develop greater torque than PCIV's unseating torque. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 3.1.2.1]
Phase 1 ISE OI 18 Make available for NRC staff audit guidelines and procedures for HCVS operation.	The procedure for HCVS operation is FSG-15, "Hardened Containment Vent Operation." The procedure is available for NRC review on the ePortal.	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]

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: DW Pressure 2(3)-1640-11 A(B) Suppression Pool Level 2(3)-1640-10A(B) 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. SAWA/SAWM flow instrument: EC 617659 DCS section 4.1.36 describes details of SAWA flow meter. This flow meter will be attached to the SAWA manifold where flow rate will be measured and controlled. SAWA/SAWM Pump: SAWA/SAWM pump is a diesel driven and trailer mounted pump to be staged near the Cribhouse Intake. The pump is hydraulically driven with the hydraulic unit on the trailer and the pump head to be lowered in the Cribhouse Intake by the trailer mounted crane. Pump details are provided in EC 617659 DCS section 4.1.33 SAWA/SAWM Generator:	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. EC 617659, along with calculations DRE17-0013 and DRE16-0010 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]

	Two FLEX generators (800 KW each) are onsite. One generator is in robust FLEX Building A. The second generator is in FLEX Building C, which is not robust. For flooding scenario, these generators will be moved to the Turbine Deck at EL 561' as part of flood preparations. These generators will support SAWA/SAWM phases. <u>Ingress and Egress</u> For locations outside the Reactor Building between 7 hours and 7 days when SAWA is being utilized, a quantitative evaluation (DRE16-0010) of expected dose rates has been performed per HCVS-WP-02 and found the dose rates at deployment locations including ingress/egress paths are acceptable. DRE16-0010 is provided on ePortal for NRC Staff review.		
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	Actions taken within the first 1.3 hour (prior to start of core damage for Dresden) from the start of the ELAP are acceptable from an environmental and radiological perspective without further evaluation. Actions performed within the MCR are acceptable for the entire period of Sustained Operation per HCVS-FAQ-06., Assumption 049-21. For actions within the Reactor Building and between 1.3 and 7 hours, a quantitative evaluation of expected dose rates has been performed (DRE 16-0010)	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. EC 617659, along with calculations DRE17-0013 and DRE16-0010, 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.	Closed [Staff evaluation to be included in SE Sections 4.1.1.4 and 4.2.1.4]

	per HCVS-FAQ-12 and found the dose rates at deployment locations including ingress/egress paths are acceptable. For locations outside the Reactor Building between 7 hours and 7 days when SAWA is being utilized, a quantitative evaluation (DRE16-0010) of expected dose rates has been performed per HCVS-WP-02 and found the dose rates at deployment locations, including ingress/egress paths are acceptable. DRE16-0010 is provided on ePortal for NRC staff review.	No follow-up questions.	
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 SAWA strategy will ensure that the wetwell vent remains functional for the period of sustained operation. Dresden 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 as shown on Fig. D of the Dresden EOP procedures. Therefore, containment over pressurization is prevented without the need for a drywell vent. DEOP-100 is provided on the ePortal for NRC staff review.	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 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	Closed [Staff evaluation to be included in SE Sections 4.1 and 4.2]

		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.	From the combined Phases 1 and 2 OIP Attachment 2.1.C, Dresden parameters are compared to the reference plant parameters as shown below: ***Reference Plant*** Torus freeboard volume is 525,000 gallons, SAWA flow is 500 GPM [gallons per minute] at 8 hours followed by 100 GPM from 12 hours to 168 hours, ***Dresden*** Torus freeboard volume is 1,021,000 gallons, SAWA flow is 421 GPM at 8 hours followed by 85 GPM from 12 hours to 168 hours. The above parameters for Dresden 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 Dresden makes it unlikely that a drywell vent is needed to prevent containment overpressure related failure.	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. No follow-up questions.	Closed [Staff evaluation to be included in SE Section 4.2.1.1]
Phase 2 ISE OI 5 Licensee to demonstrate that there is adequate	Dresden utilizes FSG-39, "FLEX Communication Options" to communicate between the MCR and remote locations such as the intake structure (Cribhouse	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal.	Closed

communication between the main control room (MCR) and the operator at the FLEX manual valve during severe accident conditions.	Intake), FLEX pump in the RB basement level and SAWA flow control manifold. 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 forEA-12-049. FSG-39 is provided on ePortal for NRC staff review.	The communication methods are the same as accepted in Order EA-12-049. No follow-up questions.	[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.	The Design Consideration Summary of EC 617659, section 4.1.36 provides the following details of the SAWA/SAWM flow meter. For locations outside the Reactor Building between 7 hours and 7 days when SAWA is being utilized, Dresden performed a quantitative evaluation of he expected dose rates at deployment locations including ingress/egress paths 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** 80 to 2300 GPM, 0 to 125 °F (Operating) and 0 to 185 °F (Storage), 0 to 300 PSI **Expected SAWA Parameter Qualification Range** 85 to 421 GPM, -6 to 94 °F, 0 to 200 PSI	The NRC staff reviewed the information provided in the 6-month updates and on the ePortal. EC 617659, Section 4.1.36 discusses the SAWM flow instrumentation qualification. The NRC staff determined 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]

	The new flow meter is an FRC model FTA500. The unit is powered by an internal lead acid battery which will power the flow meter for 6 hours under normal expected operating conditions. Operating and storage temperatures of the flow meter are limited by the battery used. Colder ambient temperatures reduce the life expectancy and capacity of the internal battery. In order to conserve battery power, the flow meter will only be turned on when determining the flow required during a SAWA event. As a backup, the flow meter may be powered by a 120/240 VAC source, which can be provided from the FLEX diesel generator or other small portable generator available as part of the existing FLEX equipment inventory. The flow meter uses a paddle wheel to determine flow and is, therefore, not sensitive to the conductivity of the water. The flow meter is only used when changing the flow through the manifold and can be disconnected and brought to a warmer location such as a FLEX equipment deployment/refueling vehicle as a means to extend battery capacity when not required or powered from an external power source. The flow meter electronics including battery can be disconnected from and reconnected to the flow meter body without disruption of SAWA flow path. The body of the SAWA flow meter will remain at or near the process flow temperatures at or above 32°F due to the continuous SAWA flow. The SAWA flow meter is qualified for the expected environmental conditions that may exist over the period of Sustained Operation.		

	The instrument requires at least 10 ft. of 4" diameter hose upstream of the instrument for an accurate flow indication. Therefore, the 10 ft. of 4" diameter hose will be installed between the SAWA manifold and the flow meter. EC 617659, DCS is provided on ePortal for NEC staff review.		

SUBJECT: DRESDEN NUCLEAR 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 DATED December 20, 2017

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