



Order No. EA-13-109

RS-17-156

December 11, 2017

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-0001

Quad Cities Nuclear Power Station, Units 1 and 2  
Renewed Facility Operating License Nos. DPR-29 and DPR-30  
NRC Docket Nos. 50-254 and 50-265

Subject: Seventh Six-Month Status Report For Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)

References:

1. NRC Order Number EA-13-109, "Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," dated June 6, 2013
2. NRC Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions", Revision 0, dated November 14, 2013
3. NRC Interim Staff Guidance JLD-ISG-2015-01, "Compliance with Phase 2 Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions", Revision 0, dated April 2015
4. NEI 13-02, "Industry Guidance for Compliance With Order EA-13-109, BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions", Revision 1, dated April 2015
5. Exelon Generation Company, LLC's Answer to June 6, 2013, Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 26, 2013
6. Exelon Generation Company, LLC Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2014 (RS-14-063)
7. Exelon Generation Company, LLC First Six-Month Status Report Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 17, 2014 (RS-14-306)

8. Exelon Generation Company, LLC Second Six-Month Status Report Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2015 (RS-15-152)
9. Exelon Generation Company, LLC Phase 1 (Updated) and Phase 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 16, 2015 (RS-15-304)
10. Exelon Generation Company, LLC Fourth Six-Month Status Report For Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2016 (RS-16-110)
11. Exelon Generation Company, LLC Fifth Six-Month Status Report For Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated January 26, 2017 (RS-17-008)
12. Exelon Generation Company, LLC Sixth Six-Month Status Report For Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 27, 2017 (RS-17-069)
13. NRC letter to Exelon Generation Company, LLC, Quad Cities Nuclear Power Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4460 and MF4461), dated April 1, 2015
14. NRC letter to Exelon Generation Company, LLC, Quad Cities Nuclear Power Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 2 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4460 and MF4461), dated April 28, 2017

On June 6, 2013, the Nuclear Regulatory Commission (“NRC” or “Commission”) issued an Order (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directs EGC to require their BWRs with Mark I and Mark II containments to take certain actions to ensure that these facilities have a hardened containment vent system (HCVS) to remove decay heat from the containment, and maintain control of containment pressure within acceptable limits following events that result in loss of active containment heat removal capability while maintaining the capability to operate under severe accident (SA) conditions resulting from an Extended Loss of AC Power (ELAP). Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of an Overall Integrated Plan (OIP) by June 30, 2014 for Phase 1 of the Order, and an OIP by December 31, 2015 for Phase 2 of the Order. The interim staff guidance (References 2 and 3) provide direction regarding the content of the OIP for Phase 1 and Phase 2. Reference 3 endorses industry guidance document NEI 13-02, Revision 1 (Reference 4) with clarifications and exceptions identified in References 2 and 3. Reference 5 provided the EGC initial response regarding reliable hardened containment vents capable of

operation under severe accident conditions. Reference 6 provided the Quad Cities Nuclear Power Station, Units 1 and 2, Phase 1 OIP pursuant to Section IV, Condition D.1 of Reference 1. References 7 and 8 provided the first and second six-month status reports pursuant to Section IV, Condition D.3 of Reference 1 for Quad Cities Nuclear Power Station. Reference 9 provided the Quad Cities Nuclear Power Station, Units 1 and 2, Phase 1 updated and Phase 2 OIP pursuant to Section IV, Conditions D.2 and D.3 of Reference 1. References 10, 11, and 12 provided the fourth, fifth, and sixth six-month status reports pursuant to Section IV, Condition D.3 of Reference 1 for Quad Cities Nuclear Power Station.

The purpose of this letter is to provide the seventh six-month update report for Phases 1 and 2, pursuant to Section IV, Condition D.3 of Reference 1, that delineates progress made in implementing the requirements of Reference 1 for Quad Cities Nuclear Power Station, Units 1 and 2. The enclosed report provides an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief and the basis, if any. The enclosed report also addresses the NRC Interim Staff Evaluation open items contained in References 13 and 14.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David J. Distel at 610-765-5517.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 15<sup>th</sup> day of December 2017.

Respectfully,



Patrick R. Simpson  
Manager - Licensing  
Exelon Generation Company, LLC

Enclosure:

Quad Cities Nuclear Power Station, Units 1 and 2 Seventh Six-Month Status Report for Phases 1 and 2 Implementation of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions

cc: Director, Office of Nuclear Reactor Regulation  
NRC Regional Administrator - Region III  
NRC Senior Resident Inspector - Quad Cities Nuclear Power Station  
NRC Project Manager, NRR - Quad Cities Nuclear Power Station  
Mr. Raj Auluck, NRR/JLD/TSD/JCBB, NRC  
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Mr. John P. Boska, NRR/JLD/JOMB, NRC  
Illinois Emergency Management Agency - Division of Nuclear Safety

**Enclosure**

**Quad Cities Nuclear Power Station, Units 1 and 2**

**Seventh Six-Month Status Report for Phases 1 and 2 Implementation of Order EA-13-109,  
Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable  
of Operation Under Severe Accident Conditions**

(21 pages)

## Enclosure

### **Quad Cities Seventh Six Month Status Report for the Implementation of Order EA-13-109, “Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions”**

#### **1 Introduction**

Quad Cities developed an Overall Integrated Plan (Reference 1 in Section 8), documenting the installation of a Hardened Containment Vent System (HCVS) that provides a reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris, in response to Reference 2. Updates of milestone accomplishments will be based on the combined Phases 1 and 2 Overall Integrated Plan dated December 16, 2015.

Quad Cities developed an updated and combined Phases 1 and 2 Overall Integrated Plan (Reference 7 in Section 8), documenting:

1. The installation of a Hardened Containment Vent System (HCVS) that provides a reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris, in response to Reference 2.
2. An alternative venting strategy that makes it unlikely that a drywell vent is needed to protect the containment from overpressure related failure under severe accident conditions, including those that involve a breach of the reactor vessel by molten core debris, in response to Reference 2

This enclosure provides an update of milestone accomplishments since the Sixth Six-Month Update of the combined Phases 1 and 2 Overall Integrated Plan, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

In Reference 24, EGC requested an extension to comply with NRC Order EA-13-109 based on the earlier decision to permanently cease power operations at Quad Cities Nuclear Power Station, Units 1 and 2 by June 1, 2018, which caused engineering design and plant modification activities supporting Order implementation to be discontinued. As a result of the recent reversed cessation of operation decision, in Reference 25, EGC withdrew this request for extension to comply and provided a revised request for extension to comply with NRC Order EA-13-109 based on the continued operation of both units. EGC has now resumed work to complete full implementation of NRC Order EA-13-109 at Quad Cities Nuclear Power Station, Units 1 and 2 in accordance with this update to the Overall Integrated Plan, Section 3, Milestone Schedule, which is consistent with the requested extension letter (Reference 25), as approved by the NRC in Reference 33.

## 2 Milestone Accomplishments

The following milestone(s) have been completed since the Sixth Six-Month Update to the combined Phases 1 and 2 Overall Integrated Plan (Ref. 23), and are current as of December 1, 2017.

- Completed detailed design on Unit 2 Phase 1
- Completed detailed design on both Units Phase 2
- Started construction on both Units Phase 2

## 3 Milestone Schedule Status

The following provides an update to Attachment 2 of the combined Phases 1 and 2 Overall Integrated Plan. It provides the activity status of each item, and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

The revised milestone target completion dates do not impact the Order EA-13-109 implementation date.

<b>Phase 1 and Phase 2 HCVS Milestone Table</b>			
<b>Milestone</b>	<b>Target Completion Date</b>	<b>Activity Status</b>	<b>Comments {Include date changes in this column}</b>
Submit Overall Integrated Plan	<b>Jun 2014</b>	Complete	
<b>Submit 6 Month Updates:</b>			
Update 1	<b>Dec. 2014</b>	Complete	
Update 2	<b>Jun. 2015</b>	Complete	
Update 3	<b>Dec. 2015</b>	Complete	
Update 4	<b>Jun 2016</b>	Complete	
Update 5	<b>Jan 2017</b>	Complete	
Update 6	<b>Jun 2017</b>	Complete	
Update 7	<b>Dec 2017</b>	Complete with this submittal	
Update 8	<b>Jun 2018</b>	Not Started	
Update 9	<b>Dec 2018</b>	Not Started	

Phase 1 and Phase 2 HCVS Milestone Table			
Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
<b>Phase 1 Specific Milestones</b>			
<b>UNIT 1</b>			
<b>Phase 1 Unit 1 Modifications:</b>			
Complete Conceptual Design	Jun 2014	Complete	
Complete Detailed Design and Issue Modification Package	Mar 2016	Complete	
Begin Online Portion of the Installation	Jan 2016	Complete	
Complete Online Installation	Dec 2017	Complete	Schedule relief granted under Ref. 33.
Begin Outage Portion of the Installation	Mar 2017	Complete	Outage specific portion of installation completed during Q1R24.
Complete Outage Installation	Apr 2017	Complete	Outage specific portion of installation completed during Q1R24.
Installation Operational Acceptance	June 2018	Not Started	Schedule relief granted under Ref. 33.
<b>Phase 1 Unit 1 Procedure Changes</b>			
Operations Procedure Changes Developed	Dec 2017	Complete	Schedule relief granted under Ref. 33.
Site Specific Maintenance Procedure Developed	Dec 2017	Complete	Schedule relief granted under Ref. 33.
Procedure Changes Complete	Dec 2017	Complete	Schedule relief granted under Ref. 33.
<b>Procedure Final Validation and Implementation</b>	June 2018	Not Started	Schedule relief granted under Ref. 33.

<b>Phase 1 and Phase 2 HCVS Milestone Table</b>			
<b>Milestone</b>	<b>Target Completion Date</b>	<b>Activity Status</b>	<b>Comments {Include date changes in this column}</b>
<b>Phase 1 Unit 1 Training:</b>			
Simulator Upgrade Completion	<b>Dec 2017</b>	Started	Schedule relief granted under Ref. 33.
Training Complete	<b>April 2018</b>	Not Started	Schedule relief granted under Ref. 33.
<b>Phase 1 Unit 1 Completion</b>			
Phase 1 Unit 1 HCVS Implementation	<b>June 2018</b>	Not Started	Schedule relief granted under Ref. 33.
<b>UNIT 2</b>			
<b>Phase 1 Unit 2 Modifications:</b>			
Complete Conceptual Design	<b>Jun 2014</b>	Complete	
Complete Detailed Design and Issue Modification Package	<b>Jul 2017</b>	Complete	
Begin Online Portion of the Installation	<b>Nov 2016</b>	Complete	
Complete Online Installation	<b>Mar 2018</b>	Started	
Begin Outage Portion of the Installation	<b>Mar 2018</b>	Not Started	
Complete Outage Installation	<b>Apr 2018</b>	Not Started	
Installation Operational Acceptance	<b>June 2018</b>	Not Started	Schedule relief granted under Ref. 33.
<b>Phase 1 Unit 2 Procedure Changes</b>			
Operations Procedure Changes Developed	<b>Apr 2018</b>	Complete	
Site Specific Maintenance Procedure Developed	<b>Apr 2018</b>	Complete	
<b>Procedure Final Validation and Implementation</b>	<b>June 2018</b>	Not Started	Schedule relief granted under Ref. 33.
<b>Phase 1 Unit 2 Training:</b>			
Simulator Upgrade Completion	<b>Dec 2017</b>	N/A	Unit 1 only.
Training Complete	<b>Apr 2018</b>	Not Started	



<b>Phase 1 and Phase 2 HCVS Milestone Table</b>			
<b>Milestone</b>	<b>Target Completion Date</b>	<b>Activity Status</b>	<b>Comments {Include date changes in this column}</b>
<b>Phase 1 Unit 2 Completion</b>			
Phase 1 Unit 2 HCVS Implementation	<b>June 2018</b>	Not Started	Schedule relief granted under Ref. 33.
<b>Phase 2 Specific Milestones</b>			
<b>UNIT 1</b>			
<b>Phase 2 Unit 1 Modifications:</b>			
Begin Conceptual Design	<b>Apr 2016</b>	Complete	
Complete Conceptual Design	<b>Feb 2017</b>	Complete	Common design with Unit 2.
Begin Detailed Design	<b>Apr 2017</b>	Complete	Common design with Unit 2.
Complete Detailed Design and Issue Modification Package	<b>Jul 2017</b>	Complete	Common design with Unit 2.
Begin Online Portion of the Installation	<b>Sep 2017</b>	Complete	Common install with Unit 2.
Complete Online Installation	<b>Mar 2018</b>	Started	Common install with Unit 2.
Begin Outage Portion of the Installation	<b>N/A</b>	N/A	No outage scope
Complete Outage Installation	<b>N/A</b>	N/A	No outage scope
Installation Operational Acceptance	<b>April 2019</b>	Not Started	
<b>Phase 2 Unit 1 Procedure Changes Active</b>			
Operations Procedure Changes Developed	<b>Apr 2019</b>	Started	
Site Specific Maintenance Procedure Developed	<b>Apr 2019</b>	Not Started	
Procedure Changes Active	<b>Apr 2019</b>	Not Started	
<b>Phase 2 Unit 1 Training:</b>			

<b>Phase 1 and Phase 2 HCVS Milestone Table</b>			
<b>Milestone</b>	<b>Target Completion Date</b>	<b>Activity Status</b>	<b>Comments {Include date changes in this column}</b>
Training Complete	<b>Apr 2019</b>	Not Started	
<b>Phase 2 Unit 1 Completion</b>			
Phase 2 Unit 1 HCVS Implementation	<b>Apr 2019</b>	Not Started	
Submit Phases 1 and 2 Unit 1 Completion Report (60-day letter)	<b>Jun 2019</b>	Not Started	
<b>UNIT 2</b>			
<b>Phase 2 Unit 2 Modifications:</b>			
Begin Conceptual Design	<b>Apr 2016</b>	Complete	
Complete Conceptual Design	<b>Feb 2017</b>	Complete	Common design with Unit 1.
Begin Detailed Design	<b>Apr 2017</b>	Complete	Common design with Unit 1.
Complete Detailed Design and Issue Modification Package	<b>Jul 2017</b>	Complete	Common design with Unit 1. Formerly Mar 2017.
Begin Online Portion of the Installation	<b>Sep 2017</b>	Complete	Common install with Unit 1.
Complete Online Installation	<b>Mar 2018</b>	Started	Common install with Unit 1.
Begin Outage Portion of the Installation	<b>N/A</b>	N/A	No outage install
Complete Outage Installation	<b>N/A</b>	N/A	No outage install
Installation Operational Acceptance	<b>June 2018</b>	Not Started	Schedule relief granted under Ref. 33.
<b>Phase 2 Unit 2 Procedure Changes Active</b>			
Operations Procedure Changes Developed	<b>Apr 2018</b>	Started	
Site Specific Maintenance Procedure Developed	<b>Apr 2018</b>	Not Started	
Procedure Changes Active	<b>Apr 2018</b>	Not Started	

<b>Phase 1 and Phase 2 HCVS Milestone Table</b>			
<b>Milestone</b>	<b>Target Completion Date</b>	<b>Activity Status</b>	<b>Comments {Include date changes in this column}</b>
<b>Procedure Final Validation and Implementation</b>	<b>June 2018</b>	Not Started	Schedule relief granted under Ref. 33.
<b>Phase 2 Unit 2 Training:</b>			
Training Complete	<b>Apr 2018</b>	Started	
<b>Phase 2 Unit 2 Completion</b>			
Phase 2 Unit 2 HCVS Implementation	<b>June 2018</b>	Not Started	Schedule relief granted under Ref. 33.
Submit Phases 1 and 2 Unit 2 Completion Report (60-day letter)	<b>Aug 2018</b>	Not Started	

#### **4 Changes to Compliance Method**

##### Phase 1 Changes

None

##### Phase 2 Changes

No changes needed since Fifth Six-Month Update (Ref. 31).

#### **5 Need for Relief/Relaxation and Basis for the Relief/Relaxation**

Quad Cities has received schedule relaxation from the NRC via letter dated March 21, 2017 (Ref. 33).

No additional need for relief/relaxation relative to Order EA-13-109 (Ref 2), other than as described above, has been identified at this time.

## 6 Open Items from Combined Phase 1 and 2 Overall Integrated Plan and Interim Staff Evaluations

The following tables provide a summary of the open items documented in the combined Phases 1 and 2 Overall Integrated Plan or the Interim Staff Evaluation (ISE) and the status of each item.

Combined Phase 1 and 2 OIP Open Items		Status
<b>Phase 1 Open Items</b>		
OI-1	<i>Determine how Motive Power and/or HCVS Battery Power will be disabled during normal operation.</i>	<i>Complete – Per QDC detailed design, HCVS primary control panel will be provided with a key lock switch to activate the system. Normally system remains de-energized. This must be unlocked prior to performing any actuations of the DC powered components. With the panel being located in the MCR, unlocking and turning the switch can be performed in an ELAP with minimal operator action. Detailed in December 2015 OIP (Ref. 7).</i>
OI-2	<i>Confirm that the Remote Operating Station (ROS) will be in an accessible area following a Severe Accident (SA).</i>	<i>Closed to ISE Open Item number 4. Reference 16 has been provided in e-portal.</i>
OI-3	<i>Confirm diameter on new common HCVS Piping.</i>	<i>Closed to ISE Open Item number 5.</i>
OI-4	<i>Confirm suppression pool heat capacity.</i>	<i>Complete - The MAAP analysis verified that the vent is not required for at least 5 hours (Ref. 12). At 5 hours, the decay heat will be less than 1 %. Reference 12 has been provided in e-portal.</i>
OI-5	<i>Determine the approach for combustible gases.</i>	<i>Closed to ISE Open Items 10 and 11.</i>
OI-6	<i>Develop a procedure for HCVS out-of-service requirements and compensatory measures.</i>	<i>Started. Will be incorporated into QCAP 1500-07, Administrative Tracking Requirements for Unavailable FLEX Equipment.</i>
OI-7	<i>Provide procedures for HCVS Operation.</i>	<i>Closed to ISE Open Item No.14.</i>

<b>Combined Phase 1 and 2 OIP Open Items</b>		<b>Status</b>
<i>OI-8</i>	<i>Confirm 125 Volt DC Station Battery Life.</i>	<i>Complete per QDC calculation - QDC-8300-E-2100 (Ref. 13) confirms that the 125 VDC Station Battery will continue to supply necessary power during the 8-hour duration prior to aligning the FLEX diesel generator. Also, refer to NRC ISE Open Item No. 1. Reference 13 has been provided in e-portal.</i>
<b>Phase 2 Open Items</b>		
<i>OI-9</i>	<i>Supply Part 3 Drywell Boundary Condition.</i>	<i>Complete – The Phase 2 Alternate option (SAWA/SAWM) was added to the December 2015 OIP (Ref. 7).</i>
<i>OI-10</i>	<i>Determine deployment path for Discharge Bay booster pump with respect to HCVS dose.</i>	<i>Complete – Booster pump will be staged at the same location as the FLEX/SAWA pump, which has been evaluated for dose effects under Reference 6 as acceptable.</i>

<b>Phase 1 Interim Staff Evaluation Open Items (Reference 18)</b>		<b>Status</b>
<i>ISE-1</i>	<i>Make available for NRC staff audit the calculation (QDC-8300-E-2100) that confirms that Order EA-12-49 actions to restore power are sufficient to ensure continuous operation of non-dedicated containment instrumentation.</i>	<p><i>Complete - Supplied to NRC Audit team during onsite FLEX evaluation (Jan 2015). (Ref. 13).</i></p> <p><i>Calculation QDC-8300-E-2100 confirms that Order EA-12-49 actions to restore power are sufficient to ensure continuous operation of non-dedicated containment instrumentation.</i></p> <p><i>Reference 13 has been provided in e-portal.</i></p>
<i>ISE-2</i>	<i>Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.</i>	<p><i>Started - HCVS Battery design has been completed. (Refs. 14 and 17)</i></p> <p><i>Calculation QDC-1600-E-2200 evaluates the sizing of the HCVS battery. (Ref. 28)</i></p> <p><i>References have been provided in e-portal.</i></p> <p><i>Incorporation into FLEX DG loading calculations is in progress.</i></p>
<i>ISE-3</i>	<i>Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.</i>	<p><i>Started- Unit 1 nitrogen system installed. Calculation QDC-1600-M-2212 for sizing approved and applicable to both Units. Unit 2 system installation in progress. (Refs. 14 and 17)</i></p>
<i>ISE-4</i>	<i>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.</i>	<p><i>Complete- Temperature evaluation (Calculation 2014-02948) was made available to NRC Audit team during onsite FLEX evaluation (Jan 2015)(Ref. 21).</i></p> <p><i>Phase 1 Radiological evaluation has been completed. (Ref.16).</i></p> <p><i>Phase 2 Radiological evaluation has been completed (Ref. 6).</i></p> <p><i>Evaluations of temperature and radiological conditions ensure that operating personnel can safely access and operate controls and support equipment.</i></p> <p><i>References have been provided in e-portal.</i></p>

ISE-5	Make available for NRC staff review documentation that confirms the final design diameter of the HCVS piping.	Complete. Refer to the response to ISE open item 6.
ISE-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 primary containment pressure limit.	<p>Complete. Calculation QDC-1600-M-2188 for Unit 1 line sizing approved (Ref. 19). Calculation QDC-1600-M-2247 for Unit 2 line sizing approved. (Ref. 30)</p> <p>In addition, MAAP analyses (Ref. 12) are credited to verify that (1) venting can be delayed for at least three hours and (2) anticipatory venting sufficiently limits the suppression pool heat up to maintain RCIC functional.</p> <p>MAAP also confirms the HCVS is of sufficient size to prevent the Suppression Pool from reaching PCPL.</p> <p>References have been provided in e-portal.</p>
ISE-7	Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.	<p>Complete –The HCVS stack seismic design meets the Station’s design basis earthquake design criteria. (Ref. 20)</p> <p>Reference has been provided in e-portal.</p> <p>The information provided in December 2015 OIP (Ref. 7) demonstrates that the external piping meets the tornado missile protection criteria of HCVS-WP-04.</p>
ISE-8	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, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	<p>Complete – Component location design has been determined. The ROS, gas bottles, dedicated battery, and most equipment are in the Turbine Building. The HCVS primary control panel is in the MCR (Refs. 14, 15 and 17).</p> <p>Reactor Building temperatures are as noted in calculation 2014-02948 (Ref. 21).</p> <p>Turbine Building temperatures at the ROS are as noted in evaluation EC 402709 (Ref. 22).</p> <p>Limiting radiation conditions for equipment as per calculation QDC-0000-M-2199, HCVS 7-Day Dose Analysis (Ref. 16).</p> <p>References have been provided in e-portal.</p>

<p>ISE-9</p>	<p>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.</p>	<p>Complete – QCOP 0050-09 FLEX Response Instrumentation and Communication Equipment provides a detailed description of Communications equipment dedicated to FLEX response utilized for Severe Accident Response. This equipment includes radios programed for talk around mode with additional batteries and Sound powered phones which can be used for communications between the Main Control Room and local control stations. QCOS 0050-04 FLEX Sound Powered Phone Surveillance is being revised to test two additional connection points that can be utilized for Severe Accident response and control of SAWA/SAWM flow and local operation of the HCVS valves.</p> <p>References have been provided in e-portal.</p>
<p>ISE-10</p>	<p>Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.</p>	<p>Complete – As stated in the December 2015 OIP, Quad Cities will utilize Argon purge system to address combustible gases in the HCVS piping. A summary of the design features is included in the December 2015 OIP (Ref. 7).</p>
<p>ISE-11</p>	<p>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.</p>	<p>Complete - As described in the December 2015 OIP (Ref. 7), the HCVS torus vent path in each Quad Cities 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.</p> <p>The vent path will rely on Argon purge system to prevent the formation of a combustible gas mixture from forming within the line (Refs. 14, 15 and 17).</p> <p>References have been provided in e-portal.</p>
<p>ISE-12</p>	<p>Make available for NRC staff audit documentation of a determination of seismic qualification evaluation of the HCVS components.</p>	<p>Started – The Quad Cities seismic evaluation is based on the Quad Cities SSE, which is sufficient by Exelon Position Paper EXC-WP-15. A list of component</p>



		<i>evaluations is uploaded to ePortal. Due to the size of the evaluation, they are available upon request.</i>
<i>ISE-13</i>	<i>Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.</i>	<i>Complete. Instrument design is complete with approval of modifications for construction. (Refs. 14, 15 and 17).  References have been provided in e-portal.</i>
<i>ISE-14</i>	<i>Make available for NRC staff audit the procedures for HCVS operation.</i>	<i>Started. Procedures are under development by Operations.</i>

Phase 2 Interim Staff Evaluation Open Items (Reference 33)		Status
ISE-1	Licensee to demonstrate that the hydraulic analysis for the FLEX pump is capable to support the required 400 gpm SAWA flow rate.	<p>Complete. FLEX calculation QDC-0000-M-2097 (Ref. 11) is revised with hydraulic parameters for addition of SAWA scenarios.</p> <p>References have been provided in e-portal.</p>
ISE-2	Licensee to evaluate the SAWA equipment and controls, as well as the ingress and egress paths for the expected severe accident conditions (temperature, humidity, radiation) for the sustained operating period.	<p>Complete.</p> <p><b>Equipment and Controls</b></p> <p>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:</p> <p>DW Pressure                      PI 1(2)-1640-11A/B  Suppression Pool Level    LI 1(2)-1640-10A/B</p> <p>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.</p> <p>The following additional equipment performing an active SAWA/SAWM function is considered:</p> <p>SAWA/SAWM flow instrument.  SAWA/SAWM pump  SAWA/SAWM generator (the FLEX generator for the associated Unit)</p> <p><b>Ingress and Egress</b></p> <p>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 and found the dose rates at deployment locations including</p>

		<p>ingress/egress paths are acceptable. (QDC-0000-M-2223, Ref. 6)</p> <p>References have been provided in e-portal.</p>
<p>ISE-3</p>	<p><i>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.</i></p>	<p>Complete.</p> <p><b>Equipment and Controls</b>  <i>Plant instrumentation for SAWA 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:</i></p> <p><i>DW Pressure PI 1(2)-1640-11A/B</i>  <i>Suppression Pool Level LI 1(2)-1640-10A/B</i></p> <p><i>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.</i></p> <p><i>The following additional equipment performing an active SAWA/SAWM function is considered for temperature and radiation effects:</i></p> <p><i>SAWA/SAWM flow instrument.</i>  <i>SAWA/SAWM pump (may be the FLEX pump)</i>  <i>SAWA/SAWM generator (may be the FLEX generator)</i></p> <p><b>Temperature</b>  <i>The location of the distribution manifold is one floor below the ROS, and has similar or better temperature conditions as at the ROS. The location of the SAWA pump is similar to the FLEX pump, i.e. outside, but on the West side of the Site vs. east side.</i></p> <p><i>The location of SAWA equipment and controls are the same or similar as FLEX, and are bounded by the FLEX evaluations for temperature.</i></p>

		<p><b>Radiation</b></p> <p>For equipment 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 and found the dose rates at deployment locations are acceptable. (QDC-0000-M-2223, Ref. 6)</p> <p>References have been provided in e-portal.</p>
ISE-4	<p>Licensee to demonstrate that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.</p>	<p>Complete. 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.</p> <p>The SAWM strategy will ensure that the Wetwell vent remains functional for the period of sustained operation. Quad Cities 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 52 PSIG. Therefore, containment over pressurization is prevented without the need for a drywell vent.</p>

ISE-5	Licensee shall 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.	Complete.	
		<b>Reference Plant</b>	<b>Quad Cities</b>
		Torus freeboard volume is 525,000 <sup>1</sup> gallons	Torus freeboard volume is 619,190 <sup>2</sup> gallons
		SAWA flow is 500 GPM at 8 hours followed by 100 GPM from 12 hours to 168 hours	SAWA flow is 400 GPM at 8 hours followed by 80 GPM from 12 hours to 168 hours
		The above parameters for Quad Cities compared to the reference plant that determine success of the SAWM strategy demonstrate that the reference plant values are bounding. SAWA flow rates are based on RCIC design flow as allowed by NEI 13-02, Rev. 1, Section 4.1.1.2.2. Therefore, the SAWM strategy implemented at Quad Cities makes it unlikely that a DW vent is needed to prevent containment overpressure related failure.	
ISE-6	Licensee to demonstrate that there is adequate communication between the MCR and the SAWA/SAWM control location during severe accident conditions.	Complete. Quad Cities utilizes handheld radios to communicate between the MCR, the operator at the FLEX pump, 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.	

<sup>1</sup> Peach Bottom available freeboard volume in gallons is estimated from nominal water level of 14.7 feet to 21 feet. 21 feet is the upper range of the wide range torus level instrument and the assumed loss of wetwell vent function. The Peach Bottom torus is 31 feet in diameter.

<sup>2</sup> Quad Cities' freeboard volume is based on Torus water level from 14' to 22.5' in a torus with 30' minor diameter and 109' major diameter.

ISE-7	Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions.	<p>Complete. 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, and found the 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.</p> <table border="1" data-bbox="860 578 1488 791"> <thead> <tr> <th data-bbox="860 578 1163 687">SAWA Flow Instrument Qualification</th> <th data-bbox="1163 578 1488 687">Expected SAWA Parameter Range</th> </tr> </thead> <tbody> <tr> <td data-bbox="860 687 1163 725">2.21 to 736 GPM</td> <td data-bbox="1163 687 1488 725">80 to 400 GPM</td> </tr> <tr> <td data-bbox="860 725 1163 763">-4 to 140 °F</td> <td data-bbox="1163 725 1488 763">32 to 120 °F</td> </tr> <tr> <td data-bbox="860 763 1163 800">0 to 285 PSI</td> <td data-bbox="1163 763 1488 800">0 to 120 PSI</td> </tr> </tbody> </table>	SAWA Flow Instrument Qualification	Expected SAWA Parameter Range	2.21 to 736 GPM	80 to 400 GPM	-4 to 140 °F	32 to 120 °F	0 to 285 PSI	0 to 120 PSI
SAWA Flow Instrument Qualification	Expected SAWA Parameter Range									
2.21 to 736 GPM	80 to 400 GPM									
-4 to 140 °F	32 to 120 °F									
0 to 285 PSI	0 to 120 PSI									

## 7 Interim Staff Evaluation Impacts

There are no potential impacts to the Interim Staff Evaluation(s) identified at this time.

## 8 References

The following references support the updates to the combined Phases 1 and 2 Overall Integrated Plan described in this enclosure.

1. Quad Cities Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109),” dated June 30, 2014. (RS-14-063).
2. NRC Order Number EA-13-109, “Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions” dated June 6, 2013.
3. NEI 13-02, “Industry Guidance for Compliance with NRC Order EA-13-109, ‘To Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions,’ Revision 1, dated April 2015.
4. NRC Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated November 2013 (Accession No. ML13304B836).
5. NRC Endorsement of industry “Hardened Containment Venting System (HCVS) Phase 1 Overall Integrated Plan Template (EA-13-109) Rev 0” (Accession No. ML14128A219).
6. Calculation QDC-0000-M-2223, Revision 0, HCVS Phase II 7-Day Dose Analysis.
7. Quad Cities Combined Phase 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109),” dated December 16, 2015 (RS-15-304).
8. NRC Interim Staff Guidance JLD-ISG-2015-01, "Compliance with Phase 2 of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated April 2015 (Accession No. ML15104A118).
9. Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012.
10. Exelon Calculation LIP-QDC-001, Rev. 4A, Quad Cities Local Intense Precipitation Evaluation.
11. Exelon Calculation QDC-0000-M-2097, PIPE FLO Analysis of FLEX Strategy.
12. Exelon Calculation QC-MISC-015, Rev. 0, MAAP Analysis to Support HCVS Design.

13. Exelon Calculation QDC-8300-E-2100, Unit 1(2) 125 VDC Battery Coping Calculation for Beyond Design Basis FLEX Event.
14. EC 392256 - Unit 1 Hardened Containment Vent System (Non-Outage Portion) as Required by NRC Order EA-13-109, Rev. 001.
15. EC 392257 - Unit 1 Hardened Containment Vent System (Outage Portion) as Required by NRC Order EA-13-109, Rev. 000.
16. Exelon Calculation QDC-0000-M-2199, HCVS 7-Day Dose Analysis.
17. EC 400666 –Hardened Containment Vent System as Required by NRC Order EA-13-109 – Unit 2.
18. NRC Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase One of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC NOS. MF4460 and MF4461) (ML 15089A421), dated April 1, 2015.
19. Exelon Calculation QDC-1600-M-2188, HCVS Vent Line Sizing Calculation, Rev. 0.
20. Exelon Calculation QDC-0020-S-2192, HCVS Steel Tower Structural Calculation, Rev. 0.
21. Exelon Calculation 2014-02948, Reactor Building Temperature Analysis Resulting from Extended Loss of AC Power.
22. Exelon Evaluation EC 402709 – Temperature in Proposed Location of Remote Operating Station.
23. Quad Cities Units 1 and 2, Fourth Six-Month Status Report for Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2016 (RS-16-110).
24. Exelon Generation Company, LLC Request for Extension to Comply with NRC Order EA-13-109, “Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions” and NRC Order EA-12-049, “Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” dated November 16, 2016 (RS-16-210).
25. Exelon Generation Company, LLC Request for Extension to Comply with NRC Order EA-13-109, “Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions” and NRC Order EA-12-049, “Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” dated January 12, 2017 (RS-17-006).
26. Exelon Generation Company, LLC Letter to USNRC, Certification of Permanent Cessation of Power Operations at Quad Cities Nuclear Power Station, Units 1 and 2, dated June 20, 2016.



27. Exelon Generation Company, LLC Letter to USNRC, Withdrawal of Certification of Permanent Cessation of Power Operations for Quad Cities Nuclear Power Station, Units 1 and 2 and Previously Submitted Licensing Actions in Support of Decommissioning, dated December 14, 2016 (RS-16-253).
28. Exelon Calculation QDC-1600-E-2200, 125 VDC Battery Sizing Calculation for Hardened Containment Vent System for 24-Hour Duty Cycle, Rev. 0.
29. Exelon Calculation QDC-1600-M-2212, HCVS Nitrogen Bottle Sizing and Pressure Regulator Set Point Determination, Rev. 0.
30. Exelon Calculation QDC-1600-M-2247, Unit 2 HCVS Vent Line Sizing Calculation, Rev. 0.
31. Quad Cities Units 1 and 2, Fifth Six-Month Status Report for Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated January 26, 2016 (RS-17-008).
32. Quad Cities Nuclear Power Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan In Response to Phase 2 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (CAC Nos. MF4460 and MF 4461), dated April 28, 2017 (Accession No. ML17109A077).
33. Quad Cities Nuclear Power Station, Units 1 and 2 – Relaxation of Schedule Requirements for Order EA-12-049, “Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events” and Order EA-13-109, “Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions” (CAC Nos. MF1048, MF1049, MF4460, and MF 4461), dated March 21, 2017 (Accession No. ML17025A248).
34. Quad Cities Units 1 and 2, Sixth Six-Month Status Report for Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 27, 2017 (RS-17-069).