Exelon Generation

Order No. EA-13-109

RS-18-059

June 29, 2018

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

Limerick Generating Station, Unit 2
Renewed Facility Operating License No. NPF-85
NRC Docket No. 50-353

Subject: Eighth 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-14-060)
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-14-304)
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-15-150)

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 15, 2015 (RS-15-301)
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-16-108)
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 December 15, 2016 (RS-16-234)
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 30, 2017 (RS-17-066)
13. Exelon Generation Company, LLC 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), dated December 15, 2017 (RS-17-153)
14. NRC letter to Exelon Generation Company, LLC, Limerick Generating 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. MF4418 and MF4419), dated April 1, 2015
15. NRC letter to Exelon Generation Company, LLC, Limerick Generating 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. MF4418 and MF4419), dated August 2, 2016

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 Limerick Generating 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 Limerick Generating Station. Reference 9 provided the Limerick Generating 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, 12, and 13 provided the fourth, fifth, sixth, and seventh six-month status reports pursuant to Section IV, Condition D.3 of Reference 1 for Limerick Generating Station.

The purpose of this letter is to provide the eighth 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 Limerick Generating Station, Unit 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 14 and 15.

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 29th day of June 2018.

Respectfully submitted,

James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure:

Limerick Generating Station, Unit 2 Eighth 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
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Enclosure

Limerick Generating Station, Unit 2

Eighth 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

(22 pages)

Enclosure

Limerick Generating Station, Unit 2
Eighth 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"

1 Introduction

Limerick Generating Station (LGS) developed an Overall Integrated Plan (Reference 7) 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 15, 2015.

LGS developed an updated and combined Phases 1 and 2 Overall Integrated Plan (Reference 1), 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 submittal 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.

2 Milestone Accomplishments

The following milestone(s) have been completed since the December 15, 2017 status report (Reference 16) and are current as of June 1, 2018.

Eighth 6-Month Update Completed with this Submittal
Phase 1:
Unit 1 Modifications Evaluation
Unit 1 Design Engineering On-site/Complete
Unit 1 Implementation Outage
Unit 1 Walk Through Demonstration/Functional Test
Unit 1 Operations Procedure Changes Developed
Unit 1 Site Specific Maintenance Procedure Developed
Unit 1 Procedure Changes Active
Unit 1 Training Complete
Unit 1 HCVS Implementation
Phase 2:
Unit 1 Design Engineering On-site/Complete

Unit 1 Implementation Outage
Modifications Evaluation
Unit 1 Walk Through Demonstration/Functional Test
Unit 1 Operations Procedure Changes Developed
Unit 1 Site Specific Maintenance Procedure Developed
Unit 1 Procedure Changes Active
Unit 1 Training Complete
Unit 1 HCVS Implementation
Unit 2 Design Engineering On-site/Complete

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.

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
Phases 1 and 2 HCVS Milestone Table			
Submit Overall Integrated Plan	Jun 2014	Complete	Reference 7
Submit 6 Month Updates			
Update 1	Dec 2014	Complete	Reference 8
Update 2	Jun 2015	Complete	Reference 9
Update 3 [Simultaneous with Phase 2 OIP]	Dec 2015	Complete	Reference 1
Update 4	Jun 2016	Complete	Reference 12
Update 5	Dec 2016	Complete	Reference 14
Update 6	Jun 2017	Complete	Reference 15
Update 7	Dec 2017	Complete	Reference 16
Update 8	Jun 2018	Completed with this submittal	
Update 9	Dec 2018	Not Started	
Update 10	June 2019	Not Started	

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
Phases 1 and 2 HCVS Milestone Table			
Phase 1 Specific Milestones			
Phase 1 Modifications			
Hold preliminary/conceptual design meeting	Jun 2014	Complete	
Unit 1 Modifications Evaluation	Feb 2018	Complete	
Unit 2 Modifications Evaluation	Mar 2017	Complete	
Unit 1 Design Engineering On-site/Complete	Feb 2018	Complete	
Unit 1 Implementation Outage	Apr 2018	Complete	
Unit 1 Walk Through Demonstration/Functional Test	Apr 2018	Complete	
Unit 2 Design Engineering On-site/Complete	May 2017	Complete	
Unit 2 Walk Through Demonstration/Functional Test	May 2017	Complete	
Unit 2 Implementation Outage	May 2017	Complete	
Phase 1 Procedure Changes Active			
Unit 1 Operations Procedure Changes Developed	Feb 2018	Complete	
Unit 1 Site Specific Maintenance Procedure Developed	Feb 2018	Complete	
Unit 1 Procedure Changes Active	Apr 2018	Complete	
Unit 2 Operations Procedure Changes Developed	Feb 2017	Complete	
Unit 2 Site Specific Maintenance Procedure Developed	Feb 2017	Complete	

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
Phases 1 and 2 HCVS Milestone Table			
Unit 2 Procedure Changes Active	May 2017	Complete	
Phase 1 Training			
Unit 1 Training Complete	Feb 2018	Complete	
Unit 2 Training Complete	Feb 2017	Complete	
Phase 1 Completion			
Unit 1 HCVS Implementation	Apr 2018	Complete	
Unit 2 HCVS Implementation	May 2017	Complete	
Phase 2 Specific Milestones			
Phase 2 Modifications			
Hold preliminary/conceptual design meeting	Jun 2016	Complete	
Modifications Evaluation	Mar 2018	Complete	Moved to align with actual completion date
Unit 1 Design Engineering On-site/Complete	Feb 2018	Complete	
Unit 1 Implementation Outage	Apr 2018	Complete	
Unit 1 Walk Through Demonstration/Functional Test	Apr 2018	Complete	
Unit 2 Design Engineering On-site/Complete	Mar 2018	Complete	
Unit 2 Walk Through Demonstration/Functional Test	Apr 2019	Not Started	
Unit 2 Implementation Outage	May 2019	Not Started	
Phase 2 Procedure Changes Active			

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
Phases 1 and 2 HCVS Milestone Table			
Unit 1 Operations Procedure Changes Developed	Feb 2018	Complete	
Unit 1 Site Specific Maintenance Procedure Developed	Feb 2018	Complete	
Unit 1 Procedure Changes Active	Apr 2018	Complete	
Unit 2 Operations Procedure Changes Developed	Feb 2019	Not Started	
Unit 2 Site Specific Maintenance Procedure Developed	Feb 2019	Not Started	
Unit 2 Procedure Changes Active	May 2019	Not Started	
Phase 2 Training			
Unit 1 Training Complete	Feb 2018	Complete	
Unit 2 Training Complete	Feb 2019	Not Started	
Phase 2 Completion			
Unit 1 HCVS Implementation	Apr 2018	Complete	
Unit 2 HCVS Implementation	May 2019	Not Started	
Full Site HCVS Implementation	May 2019	Not Started	
Submit Unit 1, Phase 1 & Phase 2, Completion Report [60 days after Unit 1 compliance]	Jun 2018	Complete	
Submit Unit 2, Phase 1 & Phase 2, Completion Report [60 days after Unit 2 compliance]	Jul 2019	Not Started	

4 Changes to Compliance Method

LGS has completed site specific MAAP evaluations to determine the number of vent cycles required during initial 24 hours into the event. Based on the MAAP evaluations, less than 3 cycles are required. Based on MAAP evaluation input, LGS has designed and installed a volume of gases used for purge and PCIV motive force that are sized for a minimum of 24

hours of operation. The purge gas volume is sufficient for 4 purge cycles and the PCIV motive force (air) volume is sufficient for 8 open cycles. This is in compliance with NEI 13-02 Rev. 1, NRC endorsed HCVS-WP-02 guidance for determining number of vent cycles.

The Primary Containment Pressure Limit (PCPL) value of 60 psig is in Calculation MEL-0138. The design temperature for supports and piping components shall be at least 350°F to satisfy the recommendations of NEI 13-02. One exception is applied for the maximum operating temperature in relation to the piping and supports HBD-842-H003, H004 and H005. Instead of 350°F, 308°F is used as it corresponds to saturated steam at the PCPL pressure of 60 psig. This meets the design intent of the NEI guidance and provides design analysis margin. (Reference EC 422831 section 3.5.2.1) This exception applies to Unit 2 compliance.

LGS implemented operation, testing, and inspection requirements for the HCVS and SAWA that follows the existing plant procedures and process to ensure reliable operation of the systems. The existing plant maintenance program will be applied to the HCVS and SAWA valves, instead of the maintenance frequency that has been listed in NEI 13-02, Section 6.2.4. The maintenance program uses PCM (Performance Centered Maintenance) template which is currently used to maintain the plant's safety related and non-safety related systems.

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

LGS expects to comply with the order implementation date and no relief/relaxation is required at this time.

6 Open Items from Combined Phases 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 Phase 2 OIP Open Items		Status
Phase 1 Open Items		
OI-1	*Determine how Motive Power and/or HCVS Battery Power will be disabled during normal operation.*	*Closed to ISE -1*
OI-2	*Confirm that the Remote Operating Station (ROS) will be in an accessible area following a Severe Accident (SA).*	*Closed to ISE-3*
OI-3	*Determine wetwell line size to meet 1% venting criteria.*	*Closed to ISE- 4*
OI-4	*Confirm suppression pool heat capacity.*	*Closed to ISE-4*
OI-5	*Determine the approach for combustible gases.*	*Closed to ISE-9 and ISE-10*
OI-6	*Provide procedures for HCVS Operation.*	*Closed to ISE-13*

Combined Phase 1 and Phase 2 OIP Open Items		Status
Phase 1 Open Items		
OI-7	*Verify the external piping consists solely of large bore piping and its supports have less than 300 square feet of cross section.*	*Complete. (Reference EC 423331, Attachment 8 (formally known as ECR 16-00011)). EC 423331 is available in ePortal.*
OI-8	*Evaluate drywell pressure indication for environmental qualifications to ensure this instrument can survive for 7 days after an event.*	*Unit 1 - Complete.* *Unit 1 Pressure indicator will survive the environmental conditions for 7 days after the event. (See EC 423381 for replacement details).* *Unit 2 - Complete.* *(Reference EC 617568 section 3.2). EC 617568 and EC 423381 are available in ePortal.*
OI-9	*Determine Performance Criteria for Motive gas Cylinders, Argon Cylinders, FLEX Diesel Generator, and FLEX (SAWA) pump pressure at 500 gpm.*	*Unit 1 - Complete.* *The performance criteria for the Motive Gas Cylinders, Argon Cylinder has been defined and the system will meet the requirements of the order. (Reference EC 423381 Section 3.5 and 3.33 and EC 423382 Section 3.19)* *Unit 2 – Complete.* *The performance criteria for the Motive gas Cylinders, Argon Cylinder has been defined and the system will meet the requirements of the order. (Reference EC 423333 sections 3.5 and 3.33 and EC 423281 Section 3.19). EC 423333, EC 423281, EC 423381, and EC 423382 are available in ePortal.* *See ISEP2-6 for FLEX SAWA response.*
OI-10	*Perform radiological evaluation for Phase 1 vent line impact on ERO response actions.*	*Units 1 and 2 - Complete.* *The peak dose rates and 7-day integrated doses at operating stations, equipment locations, and along transit pathways required for sustained operation of the HCVS have been calculated. The peak dose rates along potential operator transit*

Combined Phase 1 and Phase 2 OIP Open Items		Status
Phase 1 Open Items		
		pathways external to the Reactor Building are bounded by the peak dose rate outside the FLEX storage building. (Reference Calculation LM-0721). Calculation LM-0721 is available in ePortal.
Phase 2 Open Items		
	None	

Phase 1 Interim Staff Evaluation Open Items		Status
ISE-1	*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.*	*Unit 1 – Complete. The system is designed to prevent inadvertent operation. The new control switch HS-057V-183 installed in the MCR panel 10-C689 is a key-lock switch. The switch is kept locked in "OFF" position (with key removed) to prevent inadvertent powering of the HCVS components from 125 Vdc HCVS battery source. Additionally, locked valves are used with the gas bottles to prevent inadvertent operation. (Reference EC 423381 section 3.19). Unit 2 - Complete. The system is designed to prevent inadvertent operation. The new control switch HS-057V-283 installed in the MCR panel 20-C689 is a key-lock switch. The switch is kept locked in "OFF" position (with key removed) to prevent inadvertent powering of the HCVS components from 125 Vdc HCVS battery source. Additionally, locked valves*

Phase 1 Interim Staff Evaluation Open Items		Status
		are used with the gas bottles to prevent inadvertent operation. (Reference EC 423333 section 3.19). EC 423333 and 423381 are available in ePortal.
ISE-2	*Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.*	*Unit 1 - Complete.* *The HCVS batteries have been sized to meet the requirements of the HCVS system and function for the initial 24 hours into the event. (Reference Calculation LE-0128).* *The FLEX diesel generator loading is acceptable and rated loading of the FLEX diesel generator will not be exceeded due to the additional HCVS loading. (Reference EC 423381 section 3.35).* *Unit 2 - Complete.* *The HCVS batteries have been sized to meet the requirements of the HCVS system and function for the initial 24 hours into the event. (Reference Calculation LE-0128).* *The FLEX diesel generator loading is acceptable and rated loading of the FLEX diesel generator will not be exceeded due to the additional HCVS loading. (Reference EC 423333 section 3.35). LE-0128 EC 423333, and EC 423381 are available in ePortal.*
ISE-3	*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.*	*Unit 1 - Complete.* *The primary operating station for HCVS operation is located in the Main Control Room. A remote operating station (ROS) is located in the EDG Corridor, EL. 217' (Room 313). The ROS location and*

Phase 1 Interim Staff Evaluation Open Items		Status
		travel path to ROS location were evaluated for habitability and accessibility during a severe accident. (Reference EC 423382 section 3.19). *Unit 2 - Complete.* *The primary operating station for HCVS operation is located in the Main Control Room. A remote operating station (ROS) is located in the EDG Corridor, EL. 217' (Room 317). The ROS location and travel path to ROS location were evaluated for habitability and accessibility during a severe accident. (Reference EC 423281 section 3.19). EC 423281 and 423382 are available in ePortal.* *See Note 1 on page 21 for ROS temperature discussion.*
ISE-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.*	*Unit 1 and Unit 2 – Complete.* *The required one percent capacity at the lower of Primary Containment Pressure Limit or containment design pressure is verified using Reactor Excursion and Leak Analysis Program (RELAP). In addition, Modular Accident Analysis Program (MAAP) analyses are credited to verify that venting can be delayed for at least three hours and that anticipatory venting can be credited to maintain Reactor Core Isolation Cooling (RCIC) functional* *Unit 1 (Reference EC 423382 section 3.33 and LM-709).* *Unit 2 (Reference EC 423281 section 3.33 and LM-709).*

Phase 1 Interim Staff Evaluation Open Items		Status
		EC 423281, EC 423382, and LM-709 are available in ePortal.
ISE-5	*Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.*	*Unit 1 and Unit 2 - Complete. (Reference EC 423331 section 3.2, 3.5, 3.9, and 3.38 (formally known as 16-00011) and EC 423332 section 3.38 (formally known as 16-00012), and EC 422831 section 3.24 (formally known as 13-264)) describe seismic and tornado missile design criteria for HCVS stack. EC pkgs 423331, 423332, and 422831 are available in ePortal for review.*
ISE-6	*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.*	*Unit 1 and Unit 2 - Complete. HCVS is designed to minimize the impact of elevated temperatures, due to the potential loss of ventilation, radiation and humidity impact on the ability of operators to initiate and maintain the functionality of the HCVS. The locations of system equipment that require operator action and the travel paths to reach the controls and indications are in mild environments. Unit 1 (Reference EC 423382 section 3.19 and 3.24). Unit 2 (Reference EC 423281 section 3.19 and 3.24) EC 423281 and EC 423382 are available in ePortal for review. The loss of all general area lighting, coincident with the ELAP, does not pose a threat to the operators' ability to access and operate HCVS, since self-contained emergency lights illuminate*

Phase 1 Interim Staff Evaluation Open Items		Status
		the travel paths and handheld or portable lighting is available to manipulate HCVS equipment.
ISE-7	*Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.*	*Unit 1 and Unit 2 - Complete. HCVS is designed to operate for first 24 hours with installed independent pneumatic air supply, thereby eliminating the reliance on portable equipment. HCVS is also designed for multiple venting and purge cycles during the first 24-hour period without the need to recharge pneumatic air supplies. The pneumatic air supply is located in the emergency diesel corridor.* *Unit 1 (Reference EC 423381 section 3.19 and Calculation LM-0723).* *Unit 2 (Reference EC 423333 section 3.19 and Calculation LM-0723). EC 423333, EC 423381 and Calculation LM-0723 are available in ePortal for review.*
ISE-8	*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.*	*Unit 1 and Unit 2 - Complete. 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.* *Communication will be via the plant radio system if available. If the radio system is not available, the Plant page system can be used. The page system was modified for FLEX to include a UPS that*

Phase 1 Interim Staff Evaluation Open Items		Status
		can be manually aligned to repower the system. (Reference AR 2492527-42). AR 2492527-42 is available in ePortal for review.
ISE-9	*Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.*	*Unit 1 and Unit 2-Complete. HCVS has been designed to ensure the flammability limits of gases passing through the system are not reached. A purge gas (argon) supply system has been provided to displace potentially flammable/ detonable mixtures of gases that may be present in the vent after system actuation. The purge gas supply system is designed for four purge cycles during the first 24-hour period without the need to recharge. Unit 1 (Reference EC 423381 section 3.19). Unit 2 (Reference EC 423333 section 3.19) EC 423333 and EC 423381 are available in ePortal for review.*
ISE-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.*	*Unit 1 – Complete. As discussed in the December 2015 OIP, the Limerick wetwell vent line for each unit has a dedicated HCVS flowpath from the wetwell penetration to the outside with no interconnected system. The discharge point meets the guidance of "HCVS Release Point", HCVS-FAQ-04 (Reference 11). Unit 2 – Complete. (Reference EC 423281 and Calculation LM-0709). EC 423281 and Calculation LM-0709 are available in ePortal for review.*
ISE-11	*Make available for NRC staff audit documentation of a seismic qualification evaluation of HCVS components.*	*Unit 1- Complete.*

Phase 1 Interim Staff Evaluation Open Items		Status
		Seismic documentation has been provided EC 423381, Section 3.4, EC 423382, Section 3.4, and AR 2492527-97. *Unit 2 - Complete.* *Seismic documentation has been provided in Reference EC 423331 section 3.4 and 3.38, EC 423333 section 3.4, 3.38 and attachment 45, and 617568 section 3.2. EC 423331, EC 423333, EC 617568, EC 423381, EC 423382, and AR 2492527-97 are available in ePortal for review.*
ISE-12	*Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.*	*Unit 1 - Complete.* *EC 423381 installed and qualified the following components in the MCR and in the plant:* *valve position indicating lights, power key-locked switch, temperature indicator displays, radiation monitoring system consisting of an element local to the HCVS vent pipe, and a monitor. (Reference EC 423381 section 3.19 and 3.36).* *Existing pressure instrument PI-042-170-1 will be used to monitor containment pressure in the drywell. The transmitter (PT-042-170) has been replaced with an RG 1.97 qualified component to ensure this will remain functioning during the event. See EC 423381 for replacement and EC 423382 section 3.19 for qualification of the component.* *Unit 2 - Complete.* *EC 423333 installed and qualified the following*

Phase 1 Interim Staff Evaluation Open Items		Status
		components in the MCR and in the plant: valve position indicating lights, power key-locked switch, temperature indicator displays, radiation monitoring system consisting of an element local to the HCVS vent pipe, and a monitor. (Reference EC 423333 section 3.19 and 3.36) Existing pressure instrument PI-042-270-1 will be used to monitor containment pressure in the drywell. See EC 617568 section 3.2 for qualification of the component. EC 423333, EC 617568, EC 423381 and EC 423382 are available in ePortal for review.
ISE-13	*Make available for NRC staff audit the procedures for HCVS operation.*	*Unit 1 and Unit 2 - Complete. Reference the following procedures. SAMP-1: RPV Control SAMP-2: Containment and Radioactivity Release Control T-101: RPV Control T-102: Primary Containment Control SP/T, SP/L, PC/P, DW/T, PC/H T-341: Primary Containment Venting Via Hardened Containment Vent System. These procedures are in ePortal for review.*

Phase 2 Interim Staff Evaluation Open Items		Status
ISEP2-1	*Licensee to demonstrate that the HCVS components meeting reasonable protection from tornado missiles is at least 30 feet above the highest grade within 300 yards.*	*Unit 1 and Unit 2 - Complete. Per Drawing HBD-842-01, HCVS pipe leaves the protected structure more than 120 feet above grade elevation, which is 217 feet MSL, as indicated on site*

Phase 2 Interim Staff Evaluation Open Items		Status
		topographical drawing C-0062 that shows grade elevation referenced to MSL within 300 yards of the HCVS components evaluated.
ISEP2-2	*Licensee to confirm through analysis the temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.*	*Unit 1 and Unit 2 - Complete. Actions taken within the first hour (prior to start of core damage) from the start of the ELAP are acceptable from an environmental and radiological perspective without further evaluation.* *Actions within the MCR are acceptable for the entire period of Sustained Operation per HCVS-FAQ-01.* *Actions within the Reactor Building and between 1 and 7 hours, evaluation of expected temperatures and dose rates has been performed and determined them to be acceptable. (Reference EC 622673, and calculations LM-0721 and LM-0725).* *For locations outside the Reactor Building between 7 hours and 7 days, Limerick performed evaluations for the temperature and radiological conditions for the equipment and deployment locations, including ingress/egress paths and determined them to be acceptable. (Reference EC 622673, and calculations LM-0721 and LM-0725). EC 622673, LM-0721 and LM-0725 are available in ePortal for review.* *See Note 1 on page 21 for ROS temperature discussion.*

Phase 2 Interim Staff Evaluation Open Items		Status
ISEP2-3	*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.*	*Unit 1 and Unit 2 - Complete.* *Equipment and Controls* *Plant instrumentation for SAWA/SAWM that is qualified to RG 1.97 or equivalent is considered qualified for the sustained operating period without further evaluation.* *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:* *SAWA/SAWM flow instrument* *SAWA/SAWM/FLEX pump* *SAWA/SAWM/FLEX generator* *Active valves in SAWA flow path.* *Ingress and Egress* *For locations outside the Reactor Building between 7 hours and 7 days when SAWA is being utilized, Limerick performed evaluations of expected temperatures, humidity and the dose rates and determined them to be acceptable. (Reference EC 622673, and calculations LM-0721 and LM-0725).* *EC 622673, LM-0721 and LM-0725 are available in ePortal for review.*

<table>
<tr><th colspan="2">Phase 2 Interim Staff Evaluation Open Items</th><th>Status</th></tr>
<tr><td>ISEP2-4</td><td>Licensee to demonstrate that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.</td><td>Unit 1 and Unit 2 - 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.

The SAWM strategy will ensure that the wetwell vent remains functional for the period of sustained operation. LGS 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.</td></tr>
<tr><td>ISEP2-5</td><td>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.</td><td>Unit 1 and Unit 2 - Complete. Using Figure 2.1.C from the combined Phases 1 and 2 OIP, compare the reference plant parameters to the plant specific parameters.
<table>
<tr><th>Reference Plant</th><th>LGS</th></tr>
<tr><td>Torus freeboard volume is 525,000 gallons</td><td>Suppression Pool freeboard volume is 147,670 ft3 (1,104,572 gallons)</td></tr>
<tr><td>SAWA flow is 500 GPM at 8 hours</td><td>SAWA flow is 500 GPM at 8 hours</td></tr>
</table></td></tr>
</table>

Phase 2 Interim Staff Evaluation Open Items		Status
		followed by 100 GPM from 12 hours to 168 hours | *followed by 100 GPM from 12 hours to 168 hours* *The above parameters for LGS 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 LGS makes it unlikely that a DW vent is needed to prevent containment overpressure related failure.*
ISEP2-6	*Licensee to demonstrate that there is adequate communication between the MCR and the operator at the FLEX pump during severe accident conditions.*	*Unit 1 and Unit 2 -Complete. 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. Communication will be via the plant radio system if available. If the radio system is not available, the Plant page system can be used. The page system was modified for FLEX to include a UPS that can be manually aligned to repower the system. (Reference AR 2492527-42)*
ISEP2-7	*Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions*	*Unit 1 and Unit 2 - Complete. For locations outside the Reactor Building between 7 hours and 7 days when SAWA is being utilized, Limerick Generating Station performed evaluation of expected temperatures, humidity and the*

<table>
<tr><th colspan="2">Phase 2 Interim Staff Evaluation Open Items</th><th>Status</th></tr>
<tr><td></td><td></td><td>dose rates and determined them to be acceptable. (Reference EC 622673).
<table>
<tr><td>SAWA Pump Flow Instrument Qualification</td><td>Expected SAWA Parameter Range</td></tr>
<tr><td>37 to 1246 GPM</td><td>100 to 500 GPM</td></tr>
<tr><td>32 to 140 °F fluid temperature 14 to 122 °F Instrument Electronics[2]</td><td>32 to 95 °F fluid temperature 0 to 100 °F Ambient air temperature</td></tr>
<tr><td>275 PSI maximum</td><td>239.7 PSI maximum</td></tr>
</table>
[2] Below 14 °F, the LCD may become sluggish or unresponsive; however, it will continue to measure and function to at least -4 °F. (Reference MS2500-DataSheet). MS2500-DataSheet and EC 622673 are available in ePortal for review.</td></tr>
</table>

Note 1:

For the location of the ROS in the DG corridor, there is a maximum expected temperature of 121 °F. This temperature is expected to occur due to a non-safety related heating steam pipe rupturing during a seismic event. To mitigate this issue, the heating steam pipe was analyzed and additional supports have been installed to ensure the piping will not rupture (EC 423333 and EC 423381). There are no additional process fluid piping or heat generating equipment that would add significant heat to this area. Therefore, the area will then be at outside ambient conditions which does not normally exceed 100 °F.

The performance validation for T-341 to align the HCVS for operation determined the longest duration of 16 minutes in the EDG corridor would be required to align the system. Activation of the system included opening the argon and air bottles and repositioning a three-way valve. This would be the longest duration of any operator at the ROS during the event. If required, operating personnel working in high temperature areas will be protected using SA-AA-111, Heat Stress Control. With the use of SA-AA-111 heat stress controls, it is reasonable to assume the operator actions required to implement the HCVS and

SAWA/SAWM strategies can be accomplished. SA-AA-111 and the validation study are available in ePortal.

7 Interim Staff Evaluation Impacts

There are no potential impacts to the Interim Staff Evaluations 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 attachment.

1. Limerick Generating Station, Units 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 15, 2015

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. 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)

7. 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

8. Exelon Generation Company, LLC, First Six-Month Status Report for 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

9. Exelon Generation Company, LLC, Second Six-Month Status Report for 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

10. Missile Evaluation for HCVS Components 30 feet Above Grade, HCVS-WP-04, Revision 0 (ML15244A923), August 8, 2015

11. HCVS Release Point, HCVS-FAQ-04, Revision 1, (ML14120A289), April 14, 2014

12. 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

13. Limerick Generating 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. MF4418 and MF4419), dated August 2, 2016

14. 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 December 15, 2016

15. 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 30, 2017

16. 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) dated December 15, 2017