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

April 1, 2015

Mr. Timothy S. Rausch
Senior Vice President
and Chief Nuclear Officer
PPL Susquehanna, LLC
769 Salem Boulevard
Berwick, PA 18063-0467

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION UNITS 1 AND 2 - 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. MF4364 AND MF4365)

Dear Mr. Rausch:

By letter dated June 6, 2013, 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 Conditions" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13143A334). By letter dated June 26, 2014 (ADAMS Accession Nos. ML14177A349, ML14177A364 and ML14177A731, respectively), PPL Susquehanna, LLC. (PPL) submitted its Overall Integrated Plan (OIP) for Susquehanna Steam Electric Station, Units 1 and 2 (Susquehanna) in response to Order EA-13-109. By letter dated December 23, 2014 (ADAMS Accession No. ML15040A155), PPL submitted its first six-month status report for Susquehanna in response to Order EA-13-109. Any changes to the compliance method described in the OIP will be reviewed as part of the ongoing audit process.

PPL's OIP for Susquehanna appears consistent with the guidance found in Nuclear Energy Institute 13-02, Revision 0, endorsed, in part, by the NRC's Japan Lessons-Learned Project Directorate (JLD) Interim Staff Guidance (ISG) JLD-ISG-2013-02, as an acceptable means for implementing the requirements of Phase 1 of Order EA-13-109. This conclusion is based on satisfactory resolution of the open items detailed in the enclosed Interim Staff Evaluation. This evaluation only addressed consistency with the guidance. Any plant modifications will need to be conducted in accordance with plant engineering change processes and consistent with the licensing basis.

If you have any questions, please contact Charles Norton, Project Manager, at 301-415-7818 or at Charles.Norton@nrc.gov.

Sincerely,

Mandy K Halter

Mandy K. Halter, Acting Chief
Orders Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosure:
Interim Staff Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
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INTERIM STAFF EVALUATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO ORDER EA-13-109 PHASE 1, MODIFYING LICENSES

WITH REGARD TO RELIABLE HARDENED

CONTAINMENT VENTS CAPABLE OF OPERATION UNDER

SEVERE ACCIDENT CONDITIONS

PPL SUSQUEHANNA, LLC

SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2

DOCKET NOS. 50-387 AND 50-388

1.0 INTRODUCTION

By letter dated June 6, 2013, the U.S. Nuclear Regulatory Commission (NRC or Commission) issued Order EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions" [Reference 1]. The order requires licensees to implement its requirements in two phases. In Phase 1, licensees of boiling-water reactors (BWRs) with Mark I and Mark II containments shall design and install a venting system that provides venting capability from the wetwell during severe accident conditions. In Phase 2, licensees of BWRs with Mark I and Mark II containments shall design and install a venting system that provides venting capability from the drywell under severe accident conditions, or, alternatively, those licensees shall 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.[1]

The purpose of the NRC staff's review, as documented in this interim staff evaluation (ISE) is to provide an interim evaluation of the Overall Integrated Plan (OIP) for Phase 1 of Order EA-13-109. Phase 1 of Order EA-13-109 requires that BWRs with Mark I and Mark II containments design and install a severe accident capable hardened containment vent system (HCVS) that provides venting capability from the wetwell during severe accident conditions, using a vent path

[1] This ISE only addresses the licensee's plans for implementing Phase 1 of Order EA-13-109. While the licensee's OIP makes reference to Phase 2 issues, those issues are not being considered in this evaluation. Issues related to Phase 2 of Order EA-13-109 will be considered in a separate interim staff evaluation at a later date.

Enclosure

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 (ac) power (ELAP).

By letter dated June 26, 2014 [Reference 2], PPL Susquehanna, LLC. (PPL, the licensee) provided the OIP for Susquehanna Steam Electric Station, Units 1 and 2 (Susquehanna) for compliance with Phase 1 of Order EA-13-109. By letter dated December 23, 2014, PPL submitted its first OIP six-month status report (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15040A155). The OIP, as updated, describes the licensee's currently proposed modifications to systems, structures, and components, new and revised guidance and strategies that it intends to implement in order to comply with the requirements of Order EA-13-109.

2.0 REGULATORY EVALUATION

Following the events at the Fukushima Dai-ichi nuclear power plant on March 11, 2011, the NRC established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF was tasked with conducting a systematic and methodical review of the NRC regulations and processes and determining if the agency should make improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a set of recommendations, documented in SECY-11-0093, "Recommendations For Enhancing Reactor Safety in The 21st Century – The Near-Term Task Force Review of Insights From The Fukushima Dai-Ichi Accident," dated July 12, 2011 [Reference 3]. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the NRC staff's efforts is contained in the Commission's Staff Requirements Memorandum (SRM) for SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011 [Reference 4] and SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011 [Reference 5].

As directed by the Commission's SRM for SECY-11-0093 [Reference 6], the NRC staff reviewed the NTTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. SECY-11-0124 and SECY-11-0137 established the NRC staff's prioritization of the recommendations based upon the potential safety enhancements.

On February 17, 2012, the NRC staff provided SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami" [Reference 7], to the Commission, including the proposed order to implement the installation of a reliable HCVS for Mark I and Mark II containments. As directed by SRM-SECY-12-0025 [Reference 8], the NRC staff issued Order EA-12-050, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents" [Reference 9], which required licensees to install a reliable HCVS for Mark I and Mark II containments.

While developing the requirements for Order EA-12-050, the NRC acknowledged that questions remained about maintaining containment integrity and limiting the release of radioactive materials if the venting systems were used during severe accident conditions. The NRC staff presented options to address these issues for Commission consideration in SECY-12-0157, "Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments" [Reference 10]. In the SRM for SECY-12-0157 [Reference 11], the Commission directed the staff to issue a modification to Order EA-12-050, requiring licensees with Mark I and Mark II containments to "upgrade or replace the reliable hardened vents required by Order EA-12-050 with a containment venting system designed and installed to remain functional during severe accident conditions." The NRC staff held a series of public meetings following issuance of SRM SECY-12-0157 to engage stakeholders on revising the order. Accordingly, by letter dated June 6, 2013, the NRC issued Order EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Performing under Severe Accident Conditions."

Order EA-13-109, Attachment 2, requires that BWRs with Mark I and Mark II containments have a reliable, severe-accident capable HCVS. This requirement shall be implemented in two phases. In Phase 1, licensees of BWRs with Mark I and Mark II containments shall design and install a venting system that provides venting capability from the wetwell during severe accident conditions. Severe accident conditions include the elevated temperatures, pressures, radiation levels, and combustible gas concentrations, such as hydrogen and carbon monoxide, associated with accidents involving extensive core damage, including accidents involving a breach of the reactor vessel by molten core debris. In Phase 2, licensees of BWRs with Mark I and Mark II containments shall design and install a venting system that provides venting capability from the drywell under severe accident conditions, or, alternatively, those licensees shall 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.

On November 12, 2013, the Nuclear Energy Institute (NEI) issued NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109," Revision 0 [Reference 12] to provide guidance to assist nuclear power reactor licensees with the identification of measures needed to comply with the requirements of Phase 1 of the HCVS order. On November 14, 2013, the NRC staff issued Japan Lessons-Learned Project Directorate (JLD) interim staff guidance (ISG) JLD-ISG-2013-02, "Compliance with Order EA-13-109, 'Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Performing under Severe Accident Conditions'" [Reference 13], endorsing, in part, NEI 13-02, Revision 0, as an acceptable means of meeting the requirements of Phase 1 of Order EA-13-109, and published a notice of its availability in the *Federal Register* (FR) [78 FR 70356]. Licensees are free to propose alternate methods for complying with the requirements of Phase 1 of Order EA-13-109.

By letter dated May 27, 2014 [Reference 14], the NRC notified all BWR Mark I and Mark II Licensees that the NRC staff will be conducting audits of the implementation of Order EA-13-109. This letter described the audit process to be used by the NRC staff in its review of the information contained in licensee's submittals in response to Phase 1 of Order EA-13-109.

3.0 TECHNICAL EVALUATION

Susquehanna is a two unit General Electric BWR site. Both units have Mark II primary containment systems. To implement Phase 1 of Order EA-13-109 on each unit, PPL intends to utilize a spare wetwell penetration from which an HCVS line will be attached and routed to an effluent release point approximately 3 feet above the reactor building roof. The HCVS will contain two primary containment isolation valves (PCIVs). The HCVS on each unit will be completely independent from the HCVS on the other unit. The OIP describes plant modifications, strategies and guidance under development for HCVS implementation.

3.1 GENERAL INTEGRATED PLAN ELEMENTS AND ASSUMPTIONS

3.1.1 Evaluation of Extreme External Hazards

Extreme external hazards for Susquehanna were evaluated in the Susquehanna OIP in response to Order EA 12-049 (Mitigation Strategies) [Reference 15]. In the Susquehanna ISE relating to Mitigation Strategies [Reference 16], NRC staff documented an analysis of PPL's extreme external hazards evaluation. The following extreme external hazards screened in: seismic, external flooding, severe storms with high winds (hurricanes and tornados), snow, ice, extreme cold and high temperature. No extreme external hazards screened out. Based on PPL not excluding any external hazard from consideration, the NRC staff determined that PPL appears to have identified the appropriate external hazards for consideration in the design of HCVS.

3.1.2 Assumptions

On page 5 of the OIP, PPL adopted a set of generic assumptions associated with Order EA-13-109 Phase 1 actions.

The NRC staff reviewed the Susquehanna plant-specific HCVS related assumption cited below:

PLT-1 All load stripping to support HCVS operation is accomplished within forty five (45) minutes of event initiation.

The NRC staff determined that the plant specific assumption for Susquehanna does not appear to deviate from the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable method to implement the requirements of Order EA-13-109. An evaluation that confirms that all load stripping to support HCVS operation can be accomplished within 45 minutes of event initiation is not available at this time; therefore the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit an evaluation that confirms that all load stripping to support HCVS operation can be accomplished within forty five minutes of event initiation.

3.1.3 Compliance Timeline and Deviations

Page 4 of the OIP states the following:

> Compliance will be attained for Susquehanna Units 1 and 2 with no known deviations to the guidelines in JLD-ISG-2013-02 and NEI 13-02 for each phase as follows:
>
> Unit 1:
>
> - Phase 1 (wetwell): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for Unit 1 2nd quarter 2018
>
> - Phase 2: by the startup from first refueling outage that begins after June 30, 2017, or June 30, 2019, whichever comes first. Currently scheduled for Unit 1 2nd quarter 2018
>
> Unit 2
>
> - Phase 1 (wetwell): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for Unit 2 2nd quarter 2017
>
> - Phase 2: by the startup from first refueling outage that begins after June 30, 2017, or June 30, 2019, whichever comes first. Currently scheduled for Unit 2 2nd quarter 2019.
>
> If deviations are identified at a later date, then the deviations will be communicated in a future 6-month update following identification.

PPL's implementation schedule for Phase 1 of Order EA-13-109 appears to comply with the requirements of Order EA-13-109.

Regarding other deviations, PPL did not identify any. However, the NRC staff has identified one deviation from the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable method to implement the requirements of Order EA-13-109. The deviation pertains to the Institute of Electrical and Electronic Engineers (IEEE) standard used by PPL for instrumentation seismic qualification and is discussed further in section 3.2.2.9, "Component Qualification," of this ISE.

<u>Summary, Section 3.1:</u>

The licensee's described approach to General Integrated Plan Elements and Assumptions, if implemented, as described in Section 3.1, and assuming acceptable resolution of any open items identified here or as a result of licensee alterations to their proposed plans, appears to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing Order EA-13-109.

3.2 BOUNDARY CONDITIONS FOR WETWELL VENT

3.2.1 Sequence of Events (SOE)

Order EA-13-109, Sections 1.1.1, 1.1.2, and 1.1.3 state that:

> 1.1.1 The HCVS shall be designed to minimize the reliance on operator actions.
>
> 1.1.2 The HCVS shall be designed to minimize plant operators' exposure to occupational hazards, such as extreme heat stress, while operating the HCVS system.
>
> 1.1.3 The HCVS shall also be designed to account for radiological conditions that would impede personnel actions needed for event response.

Page 8 of the integrated plan states the following:

> The operation of the HCVS will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1 [of the OIP]. Operator actions will be completed by plant personnel and will include the capability for remote manual initiation of HCVS valves from the HCVS control station. A list of the remote manual actions performed by plant personnel to open the HCVS vent path can be found in the following Table 2-1 [of the OIP]. A HCVS Extended Loss of AC Power (ELAP) Failure Evaluation table, which shows alternate actions that can be performed, is included in Attachment 4 [of the OIP].

The NRC staff reviewed the Remote Manual Actions (Table 2-1 of the OIP) and concluded that these actions appear to minimize the reliance on operator actions. The actions appear consistent with the types of actions described in the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. NRC staff reviewed the Wetwell HCVS Failure Evaluation Table (Attachment 4 of the OIP) and determined the actions described appear to adequately address all the failure modes listed in the guidance provided by NEI 13-02, which include: loss of all ac power, long term loss of batteries, long term loss of normal pneumatic supply, and solenoid operated valve failure.

The NRC staff reviewed the three cases contained in the SOE timeline (Attachment 2 of the OIP) and determined that the three cases appropriately bound the conditions for which the HCVS is required. These cases include: successful FLEX implementation with no failure of reactor core isolation cooling (RCIC); late failure of RCIC leading to core damage; and failure of RCIC to inject at the start of the event. The timelines accurately reflect the progression of events, as described in the Susquehanna FLEX OIP [Reference 17], SECY-12-0157 [Reference 10], and the State-of-the-Art Reactor Consequence Analyses (SOARCA) [Reference 18].

The NRC staff reviewed the licensee discussion of time constraints on page 9 of the OIP and confirmed that the time constraints identified appear to be appropriately derived from the time lines developed in Attachment 2 of the OIP, consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. The time constraints establish when the HCVS must be initiated and when supplemental compressed gas for motive power and supplemental electrical power (FLEX) must be supplied. The final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX diesel generator (DG) loading calculation [licensee identified] and documentation of the HCVS nitrogen pneumatic system design including sizing and location [licensee identified] are not available at this time; therefore the NRC staff has not completed its review.

The NRC staff reviewed the discussion of radiological and temperature constraints on page 9 of the OIP and determined that PPL considers radiological and temperature conditions at the locations identified to date where manual actions are necessary to operate HCVS. Evaluations of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and equipment outside the main control room (MCR) are not available at this time [licensee identified]; therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

Open Item: 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.

3.2.2 Vent Characteristics

3.2.2.1 Vent Size and Basis

Order EA-13-109, Section 1.2.1 states that:

> 1.2.1 The HCVS shall have the capacity to vent the steam/energy equivalent of one (1) percent of licensed/rated thermal power (unless a lower value is justified by analyses), and be able to restore and then maintain containment pressure below the primary containment design pressure and the primary containment pressure limit.

Page 13 of the OIP states the following:

> The HCVS wetwell path is designed for venting steam/energy at a minimum capacity of 1% of 3952 MW [megawatt] thermal power at pressure of 53 psig (Reference: FSAR [final safty analysis report], Section 6.2.1.1.3.1 and Plant Technical Specifications, Definitions- Rated Thermal Power). This pressure is

> the lower of the containment design pressure (53 psig) and the PCPL [Primary Containment Pressure Limit] value (65 psig). The size of the wetwell portion of the HCVS is nominally 12 inches in diameter, which provides adequate capacity to meet or exceed the order criteria.

The Susquehanna OIP describes a HCVS design that will be able to vent one percent of core thermal power following a 12.5 percent power uprate. 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 are not available at this time; therefore, the NRC staff has not completed its review.

Open Item: 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.

3.2.2.2 Vent Capacity

Order EA-13-109, Section 1.2.1 states that:

> 1.2.1 The HCVS shall have the capacity to vent the steam/energy equivalent of one (1) percent of licensed/rated thermal power (unless a lower value is justified by analyses), and be able to restore and then maintain containment pressure below the primary containment design pressure and the primary containment pressure limit.

Page 12 of the OIP states the following:

> The 1% value at SSES [Susquehanna Steam Electric Plant] Units 1 and 2 assumes that the suppression pool pressure suppression capacity is sufficient to absorb the decay heat generated during the first 3 hours. The vent would then be able to prevent containment pressure from increasing above the containment design pressure. As art of the detailed design, the duration of suppression pool decay heat absorption capability will be confirmed.

The Susquehanna OIP assumes that until decay heat is less than or equal to one percent, the suppression pool must absorb the decay heat generated and prevent containment pressure from increasing above the containment design pressure until HCVS is able to restore and maintain primary containment pressure below the primary containment design pressure. The licensee identified an open item to confirm suppression pool heat capacity. 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 are not available at this time; therefore, the NRC staff has not completed its review.

Open Item: 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.

3.2.2.3 Vent Path and Discharge

Order EA-13-109, Sections 1.1.4 and 1.2.2 state that:

> 1.1.4 The HCVS controls and indications shall be accessible and functional under a range of plant conditions, including severe accident conditions, extended loss of AC power, and inadequate containment cooling.
>
> 1.2.2 The HCVS shall discharge the effluent to a release point above main plant structures.

Page 14 of the OIP states the following:

> The Susquehanna Unit 1 and 2 HCVS vent path utilizes existing spare penetrations in the wetwell. Two PCIV s will be installed in this line outside of containment, in accordance with NEI 13-02, Section 4.1.2.1.1.1.1, and will be located as close as possible to the penetration. The new PCIVs will be manually operated with air actuators and will be either fully open or fully closed during HCVS operation. The valve operators will have an air to open and spring to close design feature (fail closed valves). The outboard PCIV will also serve as the primary method of establishing flow through the system (open or closed).
>
> The Susquehanna Unit 1 and Unit 2 HCVS discharge paths will be routed separately and will exit through each Reactor Building wall a minimum of 30 feet above ground elevation to a point approximately 3 feet above each units Reactor Building roof parapet, which is above any adjacent structure. It is noted that the cooling towers have a higher elevation but they are not adjacent to the Reactor Building. Missile protection for the HCVS external piping will be provided in accordance with guidelines established in HCVS-FAQ [frequently asked question] -04 (Reference 17 [of the OIP]).
>
> This HCVS discharge point is such that the release point will as far as practical away from emergency ventilation system intake and emergency ventilation system exhaust openings, main control room location, ROS [Remote Operating Station], storage location of HCVS portable equipment, access routes required

> following a ELAP and BDBEE [beyond-design-basis external event], and emergency response facilities; however, these must be considered in conjunction with other design criteria (e.g., flow capacity) and pipe routing limitations, to the degree practical. The vent pipe routing will satisfy the vent routing guidance provided in HCVS-FAQ-04.

The Susquehanna OIP describes the routing and discharge point of the HCVS that, pending resolution of open items, appear consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Design details not available at this time include: the HCVS seismic final design criteria, the HCVS stack tornado missile final design criteria [licensee identified], evaluations of the environmental and radiological effects on HCVS controls and indications, and documentation of an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.

Open Item: Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.

Open Item: 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.

3.2.2.4 Power and Pneumatic Supply Sources

Order EA-13-109, Sections 1.2.5 and 1.2.6 state that:

> 1.2.5 The HCVS shall, in addition to meeting the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.
>
> 1.2.6 The HCVS shall be capable of operating with dedicated and permanently installed equipment for at least 24 hours following the loss of normal power or loss of normal pneumatic supplies to air operated components during an extended loss of ac power.

Page 14 of the OIP states the following:

> All electrical supply required for operation of HCVS components will be routed through inverters. PCIV position indication in the control room will be normally energized during normal plant operation. The electrical supply to the other HCVS instruments/solenoid valves will be isolated during normal plant operation.
>
> Battery power will be provided by the existing station 250 VDC [volts direct current] system for the first 24 hours following the ELAP event (see Open Item #7 in Attachment 7 [in the OIP]). FLEX generators (4 kV) will be deployed to reenergize plant system components in accordance with FLEX Mitigation Strategy Integrated Plan (Ref. PLA-7137) within 6 hours of event initiation. This includes reenergizing the battery chargers associated with the 250 VDC supply system, which will support extended HCVS operation.
>
> Pneumatic power will be provided by a nitrogen gas bottle rack installed at the ROS. The gas bottles will supply the required motive force to those HCVS valves needed to maintain flow through the HCVS effluent piping. The gas supply will be sized to support HCVS operation for a minimum of 24 hours (a minimum of 12 valve cycles of valve operation is assumed, consistent with recommendations in HCVS-WP-02). This design assumption will require future validation in the design phase of this project (see Open Item #4 in Attachment 7 [of the OIP]). Backup gas bottles will be available at the FLEX storage facility to support extended HCVS operation.
>
> During normal plant operation, the gas supply to the PCIVs will be isolated to eliminate the potential for inadvertent operation of these valves. Following an ELAP event, simple operator actions will be required to unlock the ROS door and open a manual valve at the remote operating station to align the gas supply to the PCIVs.
>
> - The HCVS valves (inboard and outboard PCIVs) are air-operated valves (AOV) with air-to-open and spring-to-close. Opening the valves requires energizing an AC powered solenoid operated valve (SOV), which establishes a flow path for motive gas from the nitrogen bottles to open the HCVS valve. The system design will provide adequate power and motive gas supply to support 24 hours of operation with only simple operator actions required to initiate/operate the system, consistent with the guidance provided in HCVS-WP-0 1. The system design credits FLEX to sustain DC power for greater than 24 hours. The initial stored motive air/gas will allow for a minimum of 12 valve operating cycles for the HCVS valves for the first 24-hours (Ref. HCVS-FAQ-02).
>
> - All HCVS valves required to open the flow path will be designed for remote manual operation following an ELAP, such that the primary means of valve manipulation does not rely on use of a hand wheel, reach-rod or similar means that requires close proximity to the valve (reference FAQ HCVS-03). If the power supply to the solenoid valves were to fail, or if the

solenoid valve were to fail, manual valves will be provided at the remote operating station to bypass the solenoid and allow alignment of the nitrogen gas supply to the HCVS valves, to enable opening of the valves. Consequently, a vent flow path could be established, with no power available to the solenoid valves. In order to prevent inadvertent operation of the system from the remote operating station, a locked fence (or door) will be provided to prevent access to the station during normal plant operation.

- An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the remote operating station, based on time constraints listed in Attachment 2 (see Open Item #5 in Attachment 7 [of the OIP]).

- All permanently installed HCVS equipment, including any connections required to supplement the HCVS operation during an ELAP (i.e., electric power, N2/air) will be located in areas reasonably protected from defined hazards listed in Part 1 of this report [the OIP].

- Access to the locations described above will not require temporary ladders or scaffolding.

- During normal plant operation, position indication will be provided in the control room for the HCVS PCIV s.

The Susquehanna OIP contains system feature descriptions of power and pneumatic supply sources that, pending resolution of open items, appear to make the HCVS system reliable consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Design details not available at this time include: nitrogen pneumatic system design including sizing and location [licensee identified], the final sizing for HCVS battery/battery charger including documentation of incorporating HCVS electrical sources into the FLEX DG loading calculations [licensee identified], and documentation of an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment [licensee identified]; therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: 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.

3.2.2.5 Location of Control Panels

Order EA-13-109, Sections 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.2.4, and 1.2.5 state that:

1.1.1 The HCVS shall be designed to minimize the reliance on operator actions

1.1.2 The HCVS shall be designed to minimize plant operators' exposure to occupational hazards, such as extreme heat stress, while operating the HCVS system

1.1.3 The HCVS shall also be designed to account for radiological conditions that would impede personnel actions needed for event response

1.1.4 The HCVS controls and indications shall be accessible and functional under a range of plant conditions, including severe accident conditions, extended loss of AC power, and inadequate containment cooling.

1.2.4 The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.

1.2.5 The HCVS shall, in addition to meeting the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.

Page 16 of the OIP states the following:

> The HCVS design allows initiating and then operating and monitoring the HCVS from the Main Control Room (MCR) and Remote Operating Station (ROS) located on Elevation 686'- 6" in the Control Structure. The MCR location is protected from adverse natural phenomena and is the normal control point for Plant Emergency Response actions. The ROS is also protected from natural phenomena. ROS accessibility and habitability will be evaluated in accordance with HCVS-FAQ-01 (see Open Item #5 in Attachment 7 [of the OIP].)

The Susquehanna OIP describes HCVS control locations that, pending resolution of open items, appear to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Design details not available at this time include: documentation demonstrating adequate communication between remote HCVS operation locations and HCVS operational decision makers, evaluations of the environmental and radiological effects on HCVS controls and indications, and an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment [licensee identified]; therefore, the NRC staff has not completed its review.

Open Item: 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.

Open Item: Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.

Open Item: 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.

3.2.2.6 Hydrogen

Order EA-13-109, Sections 1.2.10, 1.2.11, and 1.2.12 state that:

> 1.2.10 The HCVS shall be designed to withstand and remain functional during severe accident conditions, including containment pressure, temperature, and radiation while venting steam, hydrogen, and other non-condensable gases and aerosols. The design is not required to exceed the current capability of the limiting containment components.
>
> 1.2.11 The HCVS shall be designed and operated to ensure the flammability limits of gases passing through the system are not reached; otherwise, the system shall be designed to withstand dynamic loading resulting from hydrogen deflagration and detonation.
>
> 1.2.12 The HCVS shall be designed to minimize the potential for hydrogen gas migration and ingress into the reactor building or other buildings.

Page 16 of the OIP states the following:

> As is required by EA-13-109, Section 1.2.11, the HCVS must be designed such that it is able to either provide assurance that oxygen cannot enter and mix with flammable gas in the HCVS (so as to form a combustible gas mixture), or it must be able to accommodate the dynamic loading resulting from a combustible gas detonation. Several configurations are available which will support the former (e.g., purge, mechanical isolation from outside air, etc.) or the latter (design of potentially affected portions of the system to withstand a detonation relative to pipe stress and support structures). Viable options available to meet the requirements of EA-13-109, Section 1.2.11 are provided in HCVS-WP-03. SSES will determine the method to be deployed once NRC review of HCVS-WP-03 is complete (see Open Item #6 in Attachment 7 [of the OIP]).

Design details for hydrogen control is not available at this time include a description of the final design of the HCVS to address hydrogen detonation and deflagration (licensee identified) and 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; therefore, the NRC staff has not completed its review.

Open Item: Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.

Open Item: 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.

3.2.2.7 Unintended Cross Flow of Vented Fluids

Order EA-13-109, Sections 1.2.3 and 1.2.12 state that:

> 1.2.3 The HCVS shall include design features to minimize unintended cross flow of vented fluids within a unit and between units on the site.
>
> 1.2.12 The HCVS shall be designed to minimize the potential for hydrogen gas migration and ingress into the reactor building or other buildings.

Page 16 of the OIP states the following:

> Since the Susquehanna Unit 1 and 2 HCVS design is not shared with any existing containment vent/purge systems and the vent path will be routed separately for each unit, cross flow of vented fluids is not a concern for the Susquehanna HCVS design.
>
> For Normal and Design Basis Accident (DBA) Conditions, the safety related position of the HCVS PCIVs is closed. During normal plant operation or DBA conditions, the motive force (gas pressure/electrical supply) required to open these valves will be isolated, thereby eliminating the possibility for inadvertent opening of these valves. Consequently, these valves are equivalent to manual containment isolation valves in the primary containment isolation system. No divisionalized electrical supplies are required to support operation of the two (2) HCVS PCIVs, since these normally closed, fail closed valves only safety function is to remain closed during normal plant operation and under DBA conditions. This design satisfies the existing containment Isolation System Requirements as required in NRC Order EA-13-109, Section 2.1.
>
> For beyond design basis ELAP conditions, the function of these valves is to open or close as required to support HCVS operation under either "anticipatory venting" or "severe accident" conditions. Procedures will be in place to manually align the system through simple operator actions to support HCVS operation under these conditions. In this mode of operation, the system is not required to meet the design requirements of the existing containment isolation system

> design, since this is a beyond design basis mode of operation, not subject to compliance with GDCs [General Design Criteria's]. The system is designed to satisfy NRC Order requirements.

The Susquehanna OIP describes a HCVS design with no interconnected systems and no sharing with the opposite unit. These features to minimize unintended cross flow of vented fluids appear consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.2.2.8 Prevention of Inadvertent Actuation

Order EA-13-109, Section 1.2.7 states that:

> 1.2.7 The HCVS shall include means to prevent inadvertent actuation.

Page 17 of the OIP states the following:

> Emergency operating procedures provide guidance that the HCVS is not to be used to defeat containment integrity during any design basis transients and accidents. The HCVS will be designed to provide features to prevent inadvertent actuation due to a design error, equipment malfunction, or operator error. Susquehanna does not rely on Containment Accident Pressure (CAP) to maintain NPSH [net positive suction head] for ECCS [emergency core cooling system] pumps. In addition, it is noted that initially, the ECCS pumps will not have normal power available because of the starting boundary conditions of an ELAP.
>
> The HCVS PCIVs serve a PCIV function to remain closed under normal operation and DBA conditions. The HCVS PCIVs do not have an active containment isolation system design function. The valves are air to open and spring to close and are normally closed. The features that prevent inadvertent actuation of the HCVS system during normal plant operation and design basis accident conditions include:
>
> - The gas supply to the HCVS PCIVs will be normally isolated to eliminate the potential for inadvertent operation of these valves (removes motive force to valves). Prior to initiation of the HCVS, a simple operator action will be required to open a manual valve at the remote operating station to align the gas supply to the PCIVs.
>
> - The electrical supply to the PCIV solenoid valves will be normally isolated to prevent inadvertent operation of the solenoid valves. A keylock switch will be provided on the HCVS control station to initiate/energize the HCVS control panel in the MCR. A separate keylock switch will also be provided for each PCIV. With the exception of PCIV position indication, the electrical supply to all HCVS components will be normally isolated.

- In order to prevent inadvertent operation of the system from the remote operating station, a locked door (or equivalent) will be provided to prevent access to the station during normal plant operation.

By isolating the electrical supply and gas supply to the HCVS PCIVs during normal plant operation, the PCIVs are effectively equivalent to a manual PCIV (no motive force available to inadvertently open the valves). This satisfies the containment isolation system design requirements with regard to inadvertent operation.

The Susquehanna OIP provides a description of methods to prevent inadvertent HCVS initiation that includes: key lock switches, valves in series that are air-to-open spring-to-close, isolated electrical and pneumatic supply during normal operations and physical. This appears to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.2.2.9 Component Qualifications

Order EA-13-109, Section 2.1 states that:

2.1 The HCVS vent path up to and including the second containment isolation barrier shall be designed consistent with the design basis of the plant. Items in this path include piping, piping supports, containment isolation valves, containment isolation valve actuators and containment isolation valve position indication components.

Page 18 of the OIP states the following:

The HCVS components downstream of the second containment isolation valve and components that interface with the HCVS are routed in seismically qualified structures, with the exception of the HCVS piping and check valve outside the Reactor building. These and any other exceptions identified during the final design phase of this project will be analyzed for seismic ruggedness to ensure that any potential failure would not adversely impact the function of the HCVS or other safety related structures or components (i.e. - seismic category II over category I criteria]. HCVS components that directly interface with the containment pressure boundary will be considered safety related, consistent with existing containment isolation system components. The containment system limits the leakage or release of radioactive materials to the environment to prevent offsite exposures from exceeding the guidelines of 10CFR100. During normal or design basis operations, this means serving as a pressure boundary to prevent release of radioactive material.

Likewise, any electrical or control component which interfaces with Class 1E power sources will be considered safety related up to and including appropriate isolation devices such as fuses or breakers, as their failure could adversely impact the safety-related power source. The remaining components will be considered augmented quality. Newly installed piping and valves will be seismically qualified to handle the forces associated with the new seismic hazards developed in response to Near Term Task Force (NTTF) Recommendation 2.1 - Seismic, back to their isolation boundaries. Electrical and control components will be seismically qualified and will include the ability to handle harsh environmental conditions (although they will not be considered part of the site Environmental Qualification (EQ) program).

HCVS instrumentation performance (e.g., accuracy and precision) need not exceed that of similar plant installed equipment. Additionally, radiation monitoring instrumentation accuracy and range will be sufficient to confirm flow of radionuclides through the HCVS.

The HCVS instruments, including valve position indication, process instrumentation, radiation monitoring, and support system monitoring, will be qualified by using one or more of the three methods described in the ISG, which includes:

- Purchase of instruments and supporting components with known operating principles from manufacturers with commercial quality assurance programs (e.g., ISO9001) where the procurement specifications include the applicable seismic requirements, design requirements, and applicable testing.
- Demonstration of seismic reliability via methods that predict performance described in IEEE 344-1975.
- Demonstration that instrumentation is substantially similar to the design of instrumentation previously qualified.

Instrument	**Qualification Method***
HCVS Process Temperature	ISO9001 / IEEE 344 / Demonstration
HCVS Process Radiation Monitor	ISO9001 / IEEE 344 / Demonstration
HCVS Process Valve Position	ISO9001 / IEEE 344 / Demonstration
HCVS Pneumatic Supply Pressure	ISO9001 / IEEE 344 / Demonstration
HCVS Electrical Power Supply Availability	ISO9001 / IEEE 344 / Demonstration

* The specific qualification method(s) used for each required HCVS instrument will be reported in future 6 month status reports.

In its description of component qualifications, the Susquehanna OIP deviates from the industry provided template that provides essential OIP information, as described in section 7.2.2.2 of NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109 by substituting IEEE 344-1975 for IEEE 344-2004 as the seismic qualification standard. In addition, descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions are not available at this time; therefore, the NRC staff has not completed its review.

Open Item: Provide a justification for deviating from the instrumentation seismic qualification guidance specified in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

Open Item: Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.

3.2.2.10 Monitoring of HCVS

Order EA-13-109, Sections 1.1.4, 1.2.8, and 1.2.9 state that:

> 1.1.1 The HCVS controls and indications shall be accessible and functional under a range of plant conditions, including severe accident conditions, extended loss of AC power, and inadequate containment cooling.
>
> 1.2.8 The HCVS shall include means to monitor the status of the vent system (e.g., valve position indication) from control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of AC power.
>
> 1.2.9 The HCVS shall include a means to monitor the effluent discharge for radioactivity that may be released from operation of the HCVS. The monitoring system shall provide indication from the control panel required by 1.2.4 and shall be designed for sustained operation during an extended loss of AC power.

Page 19 of the OIP states the following:

> The Susquehanna Unit 1 and 2 wetwell HCVS will be capable of being manually operated during sustained operations from a control panel located in the main control room (MCR) and will meet the requirements of Order element 1.2.4. The MCR is a readily accessible location with no further evaluation required. Control Room dose associated with HCVS operation conforms to GDC 19- Alternative Source Term (AST). Additionally, to meet the intent for a secondary control location of section 1.2.5 of the Order, a readily accessible Remote Operating Station (ROS) will also be incorporated into the HCVS design to facilitate remote manual operation of the HCVS. The controls and indications at the ROS location will be accessible and functional under a range of plant conditions, including severe accident conditions with due consideration to source term and dose impact on operator exposure, extended loss of AC power (ELAP), and inadequate containment cooling. For the proposed ROS, an evaluation will be

> performed to determine accessibility to the location, habitability, staffing sufficiency, and communication capability with Vent-use decision makers (see Open Item #5 in Attachment 7 [of the OIP]).
>
> The wetwell HCVS will include means to monitor the status of the vent system in the MCR and the ROS. The ability to open/close these valves multiple times during the event's first 24 hours will be provided by nitrogen bottles at the remote operating stations and will be supplemented by a portable gas supply, as required, to support extended HCVS operation beyond 24 hours.
>
> The wetwell HCVS will include indications for vent pipe temperature and effluent radiation levels at both the MCR and ROS. Other important information on the status of supporting systems, such as pneumatic supply pressure, will also be included in the design and located in the MCR and ROS to support HCVS operation.
>
> Other instrumentation that supports the HCVS function will be provided nearby in the MCR. This instrumentation is not required to validate HCVS function and is therefore not powered from the dedicated HCVS batteries. However, these instruments are expected to be available since the FLEX DG that supports HCVS operation after 24 hours also supplies the station battery charger for these instruments and will be installed prior to depletion of the station batteries (Reference 1 [of the OIP]).

The Susquehanna OIP provides a description of HCVS monitoring that, pending resolution of open items, appears to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Design details not available at this time include: documentation demonstrating adequate communication between remote HCVS operation locations and HCVS operational decision makers, descriptions of all instrumentation and controls (existing and planned) including qualification methods, descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions, and an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; therefore, the NRC staff has not completed its review.

Open Item: 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.

Open Item: Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.

Open Item: Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.

Open Item: 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.

3.2.2.11 Component Reliable and Rugged Performance

Order EA-13-109, Section 2.2 states that:

> 2.2 All other HCVS components shall be designed for reliable and rugged performance that is capable of ensuring HCVS functionality following a seismic event. These items include electrical power supply, valve actuator pneumatic supply and instrumentation (local and remote) components.

Page 20 of the OIP states the following:

> The HCVS downstream of the second containment isolation valve, including piping and supports, electrical supply, valve actuator pneumatic supply, and instrumentation (local and remote) components, will be designed/analyzed to conform to the requirements consistent with the applicable design codes (e.g., Non-safety, Seismic Category 1, B31.1, NEMA 4, etc.) for the plant and to ensure functionality following a design basis earthquake.
>
> Additional components required to meet the Order will be reliable temperature and radiation level instrumentation consistent with the vent pipe conditions for sustained operations. The instrumentation/electrical supplies/cables/connections (components) will be qualified for temperature, radiation level and total integrated dose radiation for the HCVS Pipe and at the HCVS ROS location.
>
> Conduit design will be installed to Seismic Class 1 criteria. Existing station barriers will be used to provide a level of protection from missiles, if equipment is located outside of seismically qualified structures. Augmented quality program will be applied to the components installed in response to this Order.
>
> If the instruments are purchased as commercial-grade equipment, they will be qualified to operate under severe accident environment as required by NRC Order EA-13-109 and the guidance of NEI 13-02. The equipment will be demonstrated suitable for the seismic, environmental, and EMI/RFI [electromagnetic interference/radio frequency interference] conditions anticipated for their location. These qualifications will be bounding conditions for Susquehanna Units 1 and 2.

For the instruments required after a potential seismic event, the following methods will be used to verify that the design and installation is reliable, rugged and thus capable of ensuring HCVS functionality following a seismic event. Applicable instruments are rated by the manufacturer (or otherwise tested) for seismic impact at levels commensurate with those of postulated severe accident event conditions in the area of the instrument component using one or more of the following methods:

- demonstration of seismic motion will be consistent with that of existing design basis loads at the installed location;
- substantial history of operational reliability in environments with significant vibration with a design envelope inclusive of the effects of seismic motion imparted to the instruments proposed at the location;
- adequacy of seismic design and installation is demonstrated based on the guidance in Sections 7, 8, 9, and 10 of IEEE Standard 344-1975, *IEEE Recommended Practice for Seismic Qualification of Class IE Equipment for Nuclear Power Generating Stations*, (Reference 27 [of the OIP]) or a substantially similar industrial standard;
- demonstration that proposed devices are substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges); or
- seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location.

The Susquehanna OIP provides descriptions for component reliable and rugged performance that appear to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD ISG 2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.2.3 Beyond-Design-Basis External Event Venting

3.2.3.1 First 24-Hour Coping

Order EA-13-109, Section 1.2.6 states that:

> 1.2.6 The HCVS shall be capable of operating with dedicated and permanently installed equipment for at least 24 hours following the loss of normal power or loss of normal pneumatic supplies to air operated components during an extended loss of AC power.

Page 21 of the OIP states the following:

> The operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and BDBEE hazards identified in part 1 of this OIP. Operator actions can be completed by Operators from the HCVS control stations and include remote-manual initiation. The operator actions required to open a vent path are as described in Table 2-1[of the OIP].
>
> Remote-manual is defined in this report [the OIP] as a non-automatic power operation of a component and does not require the operator to be at or in close proximity to the component. No other operator actions are required to initiate venting under the guiding procedural protocol.
>
> The HCVS will be designed to allow initiation, control, and monitoring of venting from the Main Control Room (MCR) or the ROS. These locations minimize plant operators' exposure to adverse temperature and radiological conditions and are protected from hazards assumed in Part 1 of this report [the OIP].
>
> Permanently installed electrical supply and motive air/gas capability will be available to support operation and monitoring of the HCVS for a minimum of 24 hours during an ELAP event (see Open Item #7 in Attachment 7 [of the OIP]). Permanently installed equipment will supply air and power to HCVS a minimum of 24 hours.
>
> *System control:*
>
> i. Active: PCIVs are operated in accordance with procedures to control containment pressure. The HCVS will be designed for 12 open/close cycles under ELAP conditions over the first 24 hours following an ELAP. Controlled venting will be permitted in the revised EPGs and associated implementing EOPs.
>
> ii. Passive: Inadvertent actuation protection is provided by isolating the gas supply to the HCVS PCIVs and the power supply to the PCIV solenoid valves during normal plant operation and design basis accident conditions. The PCIVs are air to open, spring to close valves, which are normally closed. By isolating the power/gas supply to the HCVS PCIVs during normal plant operation, the PCIVs are effectively equivalent to a normally closed manual valve with no motive force available to inadvertently open the valves, thereby effectively preventing inadvertent operation of the HCVS. In addition, keylock switches are used in the MCR to isolate the power supply to the PCIV solenoid valves. A locked door (or equivalent) will be used to prevent access to the ROS during normal plant operation.

The Susquehanna OIP describes a first 24 hour BDBEE coping strategy that, pending resolution of open items, appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of

Order EA-13-109. The final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation and the final nitrogen pneumatic system design including sizing and location are not available at this time; therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

3.2.3.2 Greater Than 24-Hour Coping

Order EA-13-109, Section 1.2.4 states that:

> 1.2.4 The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.

Page 22 of the OIP states the following:

> Within 24 hours, available personnel will be able to connect supplemental motive gas (e.g.- Nitrogen Bottles) to the HCVS. FLEX procedures will also be initiated to connect 4160 V FLEX generators to Class 1E 4 kV buses and supply the station 480 VAC system within approximately 6 hours following an ELAP. These generators will re-energize the battery chargers used to charge the HCVS batteries. The response to NRC EA-12-049 will demonstrate the capability for FLEX efforts to support this credited HCVS function. Connections for supplementing electrical power and motive air/gas required for HCVS will be located in accessible areas with reasonable protection per NEI 12-06 that minimize personnel exposure to adverse conditions for HCVS initiation and operation. Connections for the gas supply will be designed with connections to minimize manpower resources.
>
> These actions provide long term support for HCVS operation for the period beyond 24 hrs. to 7 days (sustained operation time period) because on-site and off-site personnel and resources will have access to the unit(s) to provide needed action and supplies.

The Susquehanna OIP describes a greater than 24 hour BDBEE coping strategy that, pending resolution of open items, appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. The final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation and the final nitrogen pneumatic system design including sizing and location are not available at this time; therefore, the staff has not completed its review.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

3.2.4 Severe Accident Event Venting

3.2.4.1 First 24 Hour Coping

Order EA-13-109, Section 1.2.6 states that:

> 1.2.6 The HCVS shall be capable of operating with dedicated and permanently installed equipment for at least 24 hours following the loss of normal power or loss of normal pneumatic supplies to air operated components during an extended loss of AC power.

Page 26 of the OIP states the following:

> The operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and severe accident (SA) events. Severe accident event assumes that specific core cooling actions from the FLEX strategies identified in the response to Order EA-12-049 were not successfully initiated. Access to the reactor building will be restricted as determined by the RPV [reactor pressure vessel] water level and core damage conditions. Immediate actions will be completed by Operators in the Main Control Room (MCR) or at the HCVS Remote Operating Station (ROS) and will include remote-manual actions. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this report [the OIP](Table 2-1 [of the OIP]).
>
> Permanently installed electrical supply and motive air/gas capable will be available to support operation and monitoring of the HCVS for 24 hours. Specifics are the same as for BDBEE Venting Part 2 [of the OIP].
>
> System control:
>
> i. Active: PCIVs will be manually operated in accordance with EOPs/SOPs [emergency operating procedures/standard operating procedures] to control containment pressure. For severe accident conditions (e.g.- Case 2 or 3 of Figure 2 [of the OIP]), vent operation will be in accordance with the EOPs and SAMGs [severe accident management guidelines]. It is anticipated that containment pressure will be maintained within a specified operating band by opening and closing the outboard PCIV in the HCVS. The HCVS will be designed for 12 open/close cycles under ELAP conditions over the first 24 hours following an ELAP. This assumption will require future validation during the design phase of this project, following

finalization of HCVS operating strategy under severe accident conditions (see Open Item #4 in Attachment 7 [of the OIP]).

ii. Passive: Same as for BDBEE Venting Part 2.

The Susquehanna OIP describes a first 24 hour severe accident coping strategy that, pending resolution of open items, appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Design details not available at this time include: the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation, the final nitrogen pneumatic system design including sizing and location, and an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment (licensee identified); therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

Open Item: 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.

3.2.4.2 Greater Than 24 Hour Coping

Order EA-13-109, Sections 1.2.4 and 1.2.8 state that:

1.2.4 The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.

1.2.8 The HCVS shall include means to monitor the status of the vent system (e.g., valve position indication) from the control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of AC power.

Page 27 of the OIP states the following:

Specifics are the same as for BDBEE Venting Part 2 [of the OIP] except the credited actions required to support HCVS system operation beyond 24 hours will be evaluated for SA environmental conditions resulting from the proposed damaged Reactor Core and resultant HCVS vent pathway.

Deployment of the FLEX generators under severe accident conditions will be confirmed (see Open Item #2, Attachment 7 [of the OIP]).

These actions provide long term support for HCVS operation for the period beyond 24 hrs. to 7 days (sustained operation time period) because on-site and off-site personnel and resources will have access to the unit(s) to provide needed action and supplies.

The Susquehanna OIP describes a greater than 24 hour severe accident coping strategy that pending resolution of open items, appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Specific details not available at this time include: the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation, the final nitrogen pneumatic system design including sizing and location, and an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment (licensee identified); therefore, the staff has not completed its review.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

Open Item: 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.

3.2.5 Support Equipment Functions

3.2.5.1 BDBEE

Order EA-13-109, Sections 1.2.8 and 1.2.9 state that:

1.2.8 The HCVS shall include means to monitor the status of the vent system (e.g., valve position indication) from control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of AC power.

1.2.9 The HCVS shall include a means to monitor the effluent discharge for radioactivity that may be released from operation of the HCVS. The monitoring system shall provide indication from the control panel required by 1.2.4 and shall be designed for sustained operation during an extended loss of AC power.

Page 28 of the OIP states the following:

> Containment integrity is initially maintained by permanently installed equipment. All containment venting functions will be performed from the MCR or ROS.
>
> Venting will require a nitrogen gas supply and DC power. Existing safety related station batteries will provide sufficient electrical supply for HCVS operation for greater than 24 hours. Before station batteries are depleted, portable FLEX generators, as detailed in the response to Order EA-12-049, will be credited to charge the station batteries and maintain DC bus voltage after 24 hours. Permanently installed N_2 bottles will provide sufficient motive force for HCVS valve operation up to 24 hours. Portable gas supply will provide the motive force required for HCVS valve operation beyond 24 hours.

The Susquehanna OIP describes BDBEE supporting equipment functions that, pending resolution of open items, appear to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. The final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation and the final nitrogen pneumatic system design including sizing and location are not available at this time; therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

3.2.5.2 Severe Accident Venting

Order EA-13-109, Sections 1.2.8 and 1.2.9 state that:

> 1.2.8 The HCVS shall include means to monitor the status of the vent system (e.g., valve position indication) from control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of AC power.
>
> 1.2.9 The HCVS shall include a means to monitor the effluent discharge for radioactivity that may be released from operation of the HCVS. The monitoring system shall provide indication from the control panel required by 1.2.4 and shall be designed for sustained operation during an extended loss of AC power.

Page 28 of the OIP states the following:

> Most of the equipment used in the HCVS is permanently installed. The key portable items are the FLEX Generators and the additional portable gas supply

needed to supplement the gas supply to the PCIVs after 24 hours. This equipment will be stored in a new FLEX Equipment Storage Building, which will be constructed to meet the requirements identified in NEI-12-06 section 11 for screened in hazards.

The Susquehanna OIP describes support equipment functions for severe accident venting that, pending resolution of open items, appear to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Design details not available at this time include: the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation, the final nitrogen pneumatic system design including sizing and location, and an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment (licensee identified); therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

Open Item: 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.

3.2.6 Venting Portable Equipment Deployment

Order EA-13-109, Section 3.1 states that:

> 3.1 The licensee shall develop, implement, and maintain procedures necessary for the safe operation of the HCVS. Procedures shall be established for system operations when normal and backup power is available, and during an extended loss of AC power.

Page 30 of the OIP states the following:

> Deployment pathways for compliance with Order EA-12-049 are acceptable without further evaluation needed except in areas around the Reactor Building or in the vicinity of the HCVS piping. Deployment in the areas around the Reactor Building or in the vicinity of the HCVS piping will allow access, operation and replenishment of consumables with the consideration that there is potential Reactor Core Damage and HCVS operation.(see Open Item #2 in Attachment 7 [of the OIP])

The Susquehanna OIP describes venting portable equipment deployment functions that, pending resolution of open items, appear to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Design details not available at this time include: the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation, the final nitrogen pneumatic system design including sizing and location, and an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.

Open Item: Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.

Open Item: 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.

<u>Summary, Section 3.2:</u>

The licensee's approach to Boundary Conditions for Wetwell Vent, if implemented as described in Section 3.2, and assuming acceptable resolution of any open items identified here or as a result of licensee alterations to their proposed plans, appears to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3 BOUNDARY CONDITIONS FOR DRY WELL VENT

<u>Summary, Section 3.3:</u>

Dry Well Vent will be evaluated during Phase 2 of Order EA-13-109. The ISG for Phase 2 will be provided by April 30, 2015. Licensees will submit an updated OIP to address Phase 2 of Order EA-13-109 by December 31, 2015.

3.4 PROGRAMMATIC CONTROLS, TRAINING, DRILLS AND MAINTENANCE

3.4.1 Programmatic Controls

Order EA-13-109, Sections 3.1 and 3.2 state that:

> 3.1 The licensee shall develop, implement, and maintain procedures necessary for the safe operation of the HCVS. Procedures shall be established for system operations when normal and backup power is available, and during an extended loss of AC power.
>
> 3.2 The licensee shall train appropriate personnel in the use of the HCVS. The training curricula shall include system operations when normal and backup power is available, and during an extended loss of AC power.

Page 33 of the OIP states the following:

Program Controls:

The HCVS venting actions will include:

- Site procedures and programs are being developed in accordance with NEI 13-02 to address use and storage of portable equipment relative to the Severe Accident defined in NRC Order EA-13-109 and the hazards applicable to the site per Part 1 of this OIP.
- Routes for transporting portable equipment from storage location(s) to deployment areas will be developed as the response details are identified and finalized. The identified paths and deployment areas will be accessible during all modes of operation and during Severe Accidents.

Procedures:
Procedures will be established for system operations when normal electrical supply is available, and during ELAP conditions.

The HCVS procedures will be developed and implemented following the plants process for initiating or revising procedures and contain the following details:

- appropriate conditions and criteria for use of the HCVS
- when and how to place the HCVS in operation,
- the location of system components,
- instrumentation available,
- normal electrical supplies,
- directions for sustained operation, including the storage location of portable equipment,
- training on operating the portable equipment, and
- testing of portable equipment

Susquehanna will establish and document provisions for out-of-service requirements of the HCVS and compensatory measures.

The provisions for out-of-service requirements for HCVS functionality are applicable in Modes 1, 2 and 3.

- If for up to 90 consecutive days, the primary or alternate means of HCVS operation are non-functional, no compensatory actions are necessary.

- If for up to 30 days, the primary and alternate means of HCVS operation are nonfunctional, no compensatory actions are necessary.

- If the out of service times exceed 30 or 90 days as described above, the following action will be performed:

  - The condition will entered into the corrective action system,

  - The HCVS functionality will be restored in a manner consistent with plant procedures,

  - A cause assessment will be performed to prevent future loss of function for similar causes.

  - Initiate action to implement appropriate compensatory actions

The Susquehanna OIP describes programmatic controls that, pending resolution of open items, appear to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. NRC staff determined that procedure development appears to be in accordance with existing industry protocols. The provisions for out-of-service requirements appear to reflect consideration of the probability of an ELAP requiring severe accident venting and the consequences of a failure to vent under such conditions. The licensee identified an open item to provide the procedures for HCVS operation.

3.4.2 Training

Order EA-13-109, Section 3.2 states that:

> 3.2 The licensee shall train appropriate personnel in the use of the HCVS. The training curricula shall include system operations when normal and backup power is available, and during an extended loss of AC power.

Page 34 of the OIP states the following:

> Personnel expected to perform direct execution of the HCVS will receive necessary training in the use of plant procedures for system operations. The training will be refreshed on a periodic basis and as any changes occur to the HCVS. Training content and frequency will be established using the Systematic Approach to Training (SAT) process.
>
> In addition, (reference NEI 12-06) all personnel on-site will be available to supplement trained personnel.

The Susquehanna OIP describes HCVS training requirements that appear to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. The systematic approach to training process has been accepted by the NRC as appropriate for developing training for nuclear plant personnel.

3.4.3 Drills

Order EA-13-109, Section 3.1 states that:

> 3.1 The licensee shall develop, implement, and maintain procedures necessary for the safe operation of the HCVS. Procedures shall be established for system operations when normal and backup power is available, and during an extended loss of AC power.

Page 35 of the OIP states the following:

> The site will utilize the guidance provided in NEI 13-06 and 14-01 for guidance related to drills, tabletops, or exercises for HCVS operation. In addition, the site will integrate these requirements with compliance to any rulemaking resulting from the NTTF Recommendations 8 and 9.

The Susquehanna OIP describes an approach to drills that appears to be in accordance with NEI 13-06, "Enhancements to Emergency Response Capabilities for Beyond Design Basis Accidents and Events" and NEI 14-01, "Emergency Response Procedures and Guidelines for Extreme Events and Severe Accidents." This approach appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.4.4 Maintenance

Order EA-13-109, Section 1.2.13 states that:

> 1.2.13 The HCVS shall include features and provisions for the operation, testing, inspection and maintenance adequate to ensure that reliable function and capability are maintained.

Page 36 of the OIP states the following:

> The site will utilize the standard EPRI [Electric Power Research Institute] industry PM process (Similar to the Preventive Maintenance Basis Database) for establishing the maintenance calibration and testing actions for HCVS components. The control program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines.

Susquehanna will implement the following operation, testing and inspection requirements for the HCVS to ensure reliable operation of the system.

Table 4-1: Testing and Inspection Requirements

Description	Frequency
Cycle the HCVS valves and the interfacing system valves not used to maintain containment integrity during operations.	Once per operating cycle
Perform visual inspections and a walk down of HCVS components	Once per operating cycle
Test and calibrate the HCVS radiation monitors.	Once per operating cycle
Leak test the HCVS.	(1) Prior to first declaring the system functional; (2) Once every three operating cycles thereafter; and (3) After restoration of any breach of system boundary within the buildings
Validate the HCVS operating procedures by conducting an open/close test of the HCVS control logic from its control panel and ensuring that all interfacing system valves move to their proper (intended) positions.	Once per every other operating cycle

The Susquehanna OIP describes an approach to maintenance that appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

<u>Summary, Section 3.4:</u>

The licensee's approach to Programmatic Controls Training, Drills and Maintenance, if implemented as described in Section 3.4, and assuming acceptable resolution of any open items identified here or as a result of licensee alterations to their proposed plans, appears to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

4.0 OPEN ITEMS

This section contains a summary of the open items identified to date as part of the technical evaluation. Open items, whether NRC or licensee identified, are topics for which there is insufficient information to fully resolve the issue, for which the NRC staff requires clarification to ensure the issue is on a path to resolution, or for which the actions to resolve the issue are not yet complete. The intent behind designating an issue as an open item is to highlight items that the NRC staff intends to review further.

The NRC staff has reviewed the licensee OIP for consistency with NRC policy and technical accuracy. NRC and licensee identified open items have been identified in Section 3.0 and are listed in the table below.

List of Open items

Open Item	Action	Comment
1.	Make available for NRC staff audit an evaluation that confirms that all load stripping to support HCVS operation can be accomplished within forty five minutes of event initiation.	Section 3.1.2
2.	Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.	Section 3.2.1 Section 3.2.2.4 Section 3.2.3.1 Section 3.2.3.2 Section 3.2.4.1 Section 3.2.4.2 Section 3.2.5.1 Section 3.2.5.2 Section 3.2.6
3.	Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	Section 3.2.1 Section 3.2.2.4 Section 3.2.3.1 Section 3.2.3.2 Section 3.2.4.1 Section 3.2.4.2 Section 3.2.5.1 Section 3.2.5.2 Section 3.2.6
4.	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.	Section 3.2.1 Section 3.2.2.3 Section 3.2.2.4 Section 3.2.2.5 Section 3.2.2.10 Section 3.2.4.1 Section 3.2.4.2 Section 3.2.5.2 Section 3.2.6
5.	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.	Section 3.2.2.1 Section 3.2.2.2
6.	Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.	Section 3.2.2.3

7.	Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	Section 3.2.2.3 Section 3.2.2.5 Section 3.2.2.9 Section 3.2.2.10
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.	Section 3.2.2.5 Section 3.2.2.10
9.	Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	Section 3.2.2.6
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.	Section 3.2.2.6
11.	Provide a justification for deviating from the instrumentation seismic qualification guidance specified in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.	Section 3.2.2.9
12.	Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	Section 3.2.2.10

5.0 SUMMARY

As required by Order EA-13-109, the licensee has provided an OIP for designing and installing Phase 1 of a severe accident capable HCVS that provides venting capability from the wetwell during severe accident conditions, 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 OIP describes a HCVS wetwell vent 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 ELAP.

The NRC staff finds that the licensee's OIP for Phase 1 of Order EA-13-109 describes: plan elements and assumptions; boundary conditions; provisions for programmatic controls, training, drills and maintenance; and an implementation schedule that appear consistent with the guidance found in NEI 13-02 endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing Phase 1 requirements of Order EA-13-109, subject to acceptable closure of the above open items.

6.0 REFERENCES

1. Order EA-13-109, "Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," June 6, 2013 (ADAMS Accession No. ML13143A321).

2. Letter from PPL to NRC, "Phase 1 Overall Integrated Plan for Susquehanna Steam Electric Station 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 26, 2014 (ADAMS Accession Nos. ML14177A349, ML14177A364, and ML14177A731).

3. SECY-11-0093, "Recommendations For Enhancing Reactor Safety in The 21st Century – The Near-Term Task Force Review of Insights From The Fukushima Dai-Ichi Accident," July 12, 2011 (ADAMS Accession No. ML111861807).

4. SRM-SECY-11-0124, "Staff Requirements - SECY-11-0124 - Recommended Actions to be Taken Without Delay From The Near-Term Task Force Report," September 9, 2011 (ADAMS Accession No. ML112911571).

5. SRM-SECY-11-0137, "Staff Requirements - SECY-11-0137 - Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," October 3, 2011 (ADAMS Accession No. ML113490055).

6. SRM-SECY-11-0093, "Staff Requirements – SECY-11-0093 – Near-Term Report and Recommendations for Agency Actions following the Events in Japan," August 19, 2011 (ADAMS Accession No. ML112310021)

7. SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," February 17, 2012 (ADAMS Accession No. ML12039A103).

8. SRM-SECY-12-0025, "Staff Requirements – SECY-12-0025 - Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," March 9, 2012 (ADAMS Accession No. ML120690347).

9. Order EA-12-050, "Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents," March 12, 2012 (ADAMS Accession No. ML12054A694).

10. SECY-12-0157, "Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments," November 26, 2012 (ADAMS Accession No. ML12325A704).

11. SRM-SECY-12-0157, "Staff Requirements - SECY-12-0157, Consideration Of Additional Requirements For Containment Venting Systems For Boiling Water Reactors With Mark I And Mark II Containments," March 19, 2013 (ADAMS Accession No. ML13078A017).

12. NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109," Revision 0, November 12, 2013 (ADAMS Accession No. ML13316A853).

13. 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," November 14, 2013 (ADAMS Accession No. ML13304B836).

14. NRC Letter dated May 27, 2014, "Nuclear Regulatory Commission Audits Of Licensee Responses To Phase 1 of Order EA-13-109 to Modify Licenses With Regard To Reliable Hardened Containment Vents Capable Of Operation Under Severe Accident Conditions," (ADAMS Accession No. ML14126A545).

15. Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012 (ADAMS Accession No. ML12054A735).

16. NRC Letter dated January 10, 2014, "Susquehanna Generating Station, Units 1 and 2 - Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC Nos. MF0888 and MF0889)" (ADAMS Accession No. ML13339A764).

17. Letter from PPL to NRC regarding Susquehanna, "Overall Integrated Plan in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 28, 2013 (ADAMS Accession No. ML130630052).

18. NUREG-1935, "State-of-the-Art Reactor Consequence Analyses (SOARCA) Final Report" (ADAMS Accession No. ML12332A053).

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Date: April 1, 2015

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Sincerely,

/RA/

Mandy K. Halter, Acting Chief
Orders Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

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