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

February 12, 2015

Mr. Thomas Joyce
President and Chief Nuclear Officer
PSEG Nuclear LLC – N09
P.O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: HOPE CREEK GENERATING STATION - INTERIM STAFF EVALUATION RELATING TO OVERALL INTEGRATED PLAN IN RESPONSE TO PHASE 1 OF ORDER EA-13-109 (SEVERE ACCIDENT CAPABLE HARDENED VENTS) (TAC NO. MF4458)

Dear Mr. Joyce:

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 25, 2014 (ADAMS Accession No. ML14177A508), PSEG Nuclear LLC (PSEG), submitted its Overall Integrated Plan (OIP) for Hope Creek Generating Station (Hope Creek) in response to Order EA-13-109. By letter dated December 19, 2014 (ADAMS Accession No. ML14353A076), PSEG submitted its first six-month status report for Hope Creek 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.

PSEG's OIP for Hope Creek appears consistent with the guidance found in Nuclear Energy Institute (NEI) 13-02, Revision 0, as 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 No. 50-354

Enclosure:
Interim Staff Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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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

PSEG NUCLEAR LLC

HOPE CREEK GENERATING STATION

DOCKET NO. 50-354

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 (SA) 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 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 shall design and install a severe accident capable hardened containment vent system (HCVS)

[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

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 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 25, 2014 [Reference 2], PSEG Nuclear LLC (PSEG, the licensee) provided the OIP for Hope Creek Generating Station (Hope Creek) for compliance with Phase 1 of Order EA-13-109. The OIP 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 Phase 1 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, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," 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* [78 FR 70356]. Licensees are free to propose alternative 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 staff will be conducting audits of the implementation of Order EA-13-109. This letter described the audit process to be used by the 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

Hope Creek is a single unit General Electric BWR with a Mark I primary containment that has an existing hardened torus vent (HTV) installed per the guidance found in Generic Letter (GL) 89-16 [Reference 15]. To Implement Phase 1 (HCVS) of Order EA-13-109, PSEG plans to upgrade the existing HTV. The OIP describes plant modifications, strategies and guidance under development for implementation by the licensee to upgrade the existing HCV to a HCVS. As part of its interim review of the submitted OIP, the NRC staff held clarifying discussions with PSEG in evaluating the licensee's plans for addressing wetwell venting during beyond-design-basis external events (BDBEEs) and severe accidents.

3.1 GENERAL INTEGRATED PLAN ELEMENTS AND ASSUMPTIONS

3.1.1 Evaluation of Extreme External Hazards

Extreme external hazards for Hope Creek were evaluated in the Hope Creek OIP in response to Order EA-12-049 (Mitigation Strategies) [Reference 18]. In the Hope Creek ISE relating to Mitigation Strategies [Reference 16], NRC staff documented an analysis of PSEG's extreme external hazards evaluation. The following extreme external hazards screen in: Seismic, External Flooding, Extreme Cold, High Wind, and Extreme High Temperature. No extreme external hazards screen out. Based on Hope Creek not excluding any external hazard from consideration, the NRC Staff determined that PSEG appears to have identified the appropriate external hazards for consideration in the design of HVCS.

3.1.2 Assumptions

On page 7 of the Hope Creek OIP, PSEG adopted, with one exception, a set of generic assumptions associated with Order EA-13-109 Phase 1 actions. The staff determined that the set of generic assumptions appear to establish a baseline for HCVS evaluation consistent with the guidance found in NEI 13-02, as endorsed, in part, by JLD-ISG-2013-02 as an acceptable method to implement the requirements of Order EA-13-109.

Hope Creek takes exception with the generic assumption which states:

> Under the postulated scenarios of order EA-13-109 the Control Room is adequately protected from excessive radiation dose due to its distance and shielding from the reactor (per General Design Criterion (GDC) 19 in 10CFR50 Appendix A) and no further evaluation of its use as the preferred HCVS control location is required. In addition, adequate protective clothing and respiratory protection is available if required to address contamination issues. (Reference HCVS-FAQ-01 [of the OIP]).

The staff confirmed that the Hope Creek Primary Operating Station (POS) and the Remote Operating Station (ROS) are outside the main control room (MCR) envelope and cannot be assumed to be shielded from radiation without evaluation during severe accident conditions. Open Items identified in later sections of this ISE track radiation protection considerations necessary for personnel operating HCVS equipment during a severe accident.

The staff reviewed the Hope Creek plant-specific HCVS related assumptions as stated by the licensee in the OIP:

PLT-1. The Hope Creek Reactor Building consists of a square building up to Elevation 132' (approximately 30 feet above ground level) and a concrete dome up to approximately Elevation 300' (ref. Attachment 3 Sketch 3).

PLT-2. The charger for the HCVS battery will be fed from a 1E Motor Control Center (MCC) that will be re-powered by the phase 2 FLEX diesel generator (FLEX DG). No actions outside of the FLEX strategy are required to align the HCVS battery charger to the FLEX DG for sustained operation beyond 24 hours.

PLT-3. Hope Creek has an existing HTV that is operated from the MCR. These controls interface with the field through the Bailey logic system, where containment isolation interlocks are implemented. The MCR controls include position indication and pushbuttons to bypass containment isolation signals but do not meet the order requirements relative to valve status indication. The MCR controls remain available for beyond design basis use until the 1E station batteries are depleted at approximately 5 hours, assuming load shedding per the Hope Creek FLEX strategy (Reference 31 [of the OIP]).

PLT-4. The Primary Operating Station (POS) as defined by Order EA-13-109 requirement 1.2.4 will be installed in the Lower Control Equipment Room (LCER), at a new control panel. This panel will contain vent status indications as outlined in this plan and will be permanently powered from the new HCVS inverter. Valve control and position indication will be transferred to this panel from the MCR in a similar fashion as a Remote Shutdown Panel, bypassing the Bailey control system and containment isolation interlocks.

PLT-5. The Remote Operating Position (ROS) as defined by Order EA-13-109 requirement 1.2.5 will be in the electrical chase on Elevation 102' [feet] of the Control/Diesel Building. The ROS will consist of backup nitrogen bottles with local pressure gauges, locked hand valves that can be used to bypass the HCVS solenoid valves, and the radiation monitor electronics for the HCVS.

PLT-6. Control will be transferred from the MCR to the POS after an ELAP event is declared, but before initiation of venting.

The staff determined that the plant specific assumptions for Hope Creek do not appear to create deviations from the guidance found in NEI 13-02, as endorsed, in part, by JLD-ISG-2013-02 as an acceptable method to implement the requirements of Order EA-13-109.

3.1.3 Compliance Timeline and Deviations

Page 6 of the OIP states the following:

Hope Creek will attain compliance with the guidelines in JLD-ISG-2013-02 and NEI 13-02, with alternatives delineated below, for each phase as follows:

- 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 fourth quarter 2016.

- Phase 2: Later

Hope Creek's planned alternatives to JLD-ISG-2013-02 and NEI 13-02 are:

1. Hope Creek is taking an alternative approach to vent monitoring. JLD-ISG-2013-02 requires temperature and pressure monitoring of the vent piping as an indication of flow. Hope Creek currently has a dual-element flow monitor (high/low range) as part of the existing Hardened Torus Vent (HTV) radiation monitoring system. The vent flow signal will be displayed at the POS in lieu of vent pipe temperature and pressure.

2. The HCVS discharge path is a dedicated 12-inch vent pipe with the release point of the vent piping located at elevation 250' (PSEG datum), about 150 feet above ground level and about 50 feet below the top of the Reactor Building Dome, where the Filtration, Recirculation, and Ventilation System (FRVS) Discharge Structure is located. The vent pipe is routed to a point above any adjacent structure, except for the Reactor Building Dome, and located such that the release point will vent away from ventilation system intake and exhaust openings, MCR location, and emergency response facilities. The location of the release was originally analyzed during the detailed design to ensure habitability of the control room (Reference 33 [of the OIP]).

If additional alternatives are identified at a later date, then the alternatives will be communicated in a future six-month update following identification.

Hope Creek's implementation schedule complies with the requirements of the order.

The Hope Creek OIP also describes a deviation from Order EA-13-109 provision 1.2.2, "The HCVS shall discharge the effluent to a release point above main plant structures." The staff notes that any deviation from the order requires a relaxation to the order signed by the Director, Office of Nuclear Reactor Regulation. The licensee must request this relaxation, and provide an evaluation of the expected radiological effects during severe accident conditions with the HCVS release point below that specified in the order in order to justify the relaxation.

Open Item: Submit a relaxation request as stated in the order for the deviation from Order EA-13-109 provision 1.2.2, "The HCVS shall discharge the effluent to a release point above the main plant structures," which includes a technical justification for the deviation.

Summary, Section 3.1:

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, generally 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, with the exception of the deviation from Order EA-13-109 provision 1.2.2, "The HCVS shall discharge the effluent to a release point above the main plant structures," which will require the licensee to obtain a relaxation from the order.

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 10 of the OIP 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; refer to section 3.1.1 of this ISE]. Immediate operator actions will be completed by plant personnel and will include the capability for remote-manual initiation from the HCVS control station. Remote-manual is defined in this report 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. 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]. Note that the HCVS may be operated from the MCR using existing controls for up to 5 hours following a loss of power. 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]. Time constraints and their bases will be finalized as part of the HCVS design process.

NRC staff reviewed the Remote Manual Actions (Table 2-1 of the OIP) and concluded that these actions appear to consider minimizing the reliance on operator actions. The actions appear consistent with the types of actions described in the guidance found in NEI 13-02, as 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 normal ac power, long term loss of batteries, loss of normal pneumatic supply, loss of alternate pneumatic supply, and solenoid operated valve (SOV) failure.

The 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 Hope Creek FLEX OIP [Reference 18], SECY-12-0157 [Reference 10], and State-of-the-Art Reactor Consequence Analyses (SOARCA) [Reference 19].

The NRC staff reviewed the licensee discussion of time constraints on page 12 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, as 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 licensee has identified the need to finalize the time constraints for operator actions.

The NRC reviewed the discussion of radiological and temperature constraints on page 12 of the OIP. The locations and approximate times of remote manual actions are identified. Specific evaluations of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and equipment are not available at this time; therefore, the staff has not completed its review.

Open Item: Make available for NRC staff audit the finalized time constraints for remote manual operations and their bases.

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 15 of the OIP states the following:

> The HCVS wetwell path is designed for venting steam/energy at a nominal capacity of at least 1 % of 3900 MWt [megawatt thermal] power at pressure of 62 psig [pounds per square inch gauge]. This power level assumes that Hope Creek implements a Margin Uncertainty Recovery (MUR) uprate. The thermal power assumes a power uprate of 1.56 % above the currently licensed thermal power of 3840 MWt. This pressure (62 psig) is the lower of the containment design pressure and the PCPL [Primary Containment Pressure Limit] value (Reference 34 [of the OIP]). The size of the wetwell portion of the HCVS is 12 inch Schedule 40 pipe which will be analyzed to ensure adequate capacity to meet or exceed the Order criteria. The existing vent piping is designed for a pressure rating of 65 psig, the higher of containment design pressure and PCPL (Reference 35 [of the OIP]).

The Hope Creek OIP describes that the vent is sized for venting steam/energy at nominal one percent of reactor thermal capacity assuming a future MUR power up rate. 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. Specific design details not available at this time include an 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; therefore, the 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 15 of the OIP states the following:

> The 1 % value at Hope Creek 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 part of the detailed design, the duration of suppression pool decay heat absorption capability will be confirmed.

The Hope Creek OIP assumes that until decay heat is less than the one percent capacity of the proposed HCVS, the suppression pool must absorb the decay heat generated until the HCVS is able to restore and maintain primary containment pressure below the primary containment design pressure and the primary containment pressure limit. Design analysis confirming 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 is not available at this time; therefore the 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:

> 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 15 of the OIP states the following:

> Existing HCVS vent path at Hope Creek consists of a wetwell vent. Vent path for the wetwell exits the reactor building at Elevation 132' (through the roof of the outer "square" of the reactor building). The pipe runs vertically up the side of the reactor building dome and exhausts at approximately Elevation 250'.
>
> The HCVS discharge path is routed to approximately 250' Elevation on the side of the Reactor Building dome. The top of the dome, approximate elevation 300', is higher than the HCVS discharge point. A preliminary analysis was performed to evaluate the existing discharge point versus a discharge point at the top of the

> dome using diffusion analysis, and the χ/Q values at the MCR ventilation intake approximately double if the vent release point is moved to the top of the dome. The existing release point will vent away from emergency ventilation system intake and exhaust openings, MCR location, location of HCVS portable equipment, access routes required following a ELAP and BDBEE, and emergency response facilities.

Hope Creek is upgrading the existing HTV, which discharges on the side of the reactor building 50 feet below the top of the reactor building dome. This is a deviation from order element 1.2.2 and the discharge height described in the ISG.

The Hope Creek OIP provides a description of an analysis performed when the existing HTV was installed to justify the existing effluent discharge point height as superior to an effluent discharge height as specified in the order. The staff determined that the existing analysis does not consider the full range of conditions and requirements that would be sufficient to justify the deviation. Any analysis submitted to justify this deviation should, at a minimum, assess the effects of the discharge height deviation on the temperature and radiological conditions on operating personnel accessing and operating controls and support equipment. Because PSEG has not fully addressed the impacts from this alternative effluent discharge point, the NRC staff will need additional justification for this deviation.

Open Item: Submit a relaxation request as stated in the order for the deviation from Order EA-13-109 provision 1.2.2, "The HCVS shall discharge the effluent to a release point above the main plant structures," which includes a technical justification for the deviation.

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, 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:

> 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 16 of the OIP states the following:

All electrical power required for operation of HCVS components will be routed through a dedicated HCVS inverter. The inverter will be sized for the connected loads and will convert DC [direct current] power from installed batteries into AC power for the end users (instruments, solenoid valves, etc.). Battery power will be provided by a dedicated HCVS battery. The HCVS battery charger is supplied 120VAC from the 'A' 1E inverter (1A-D-481). Once the FLEX DG is in place to recharge the station batteries, inverter 1A-D-481 will supply power to the HCVS battery charger with no further action.

Pneumatic power is normally provided by the non-interruptible air system with backup nitrogen provided from installed nitrogen supply bottles. Following an ELAP event, the station air system is lost, and normal backup is supplied from installed nitrogen bottles. These bottles will supply the required motive force to those HCVS valves needed to maintain flow through the HCVS effluent piping.

1. The HCVS flow path valves 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) and providing motive air/gas. The detailed design will provide a permanently installed power source and motive air/gas supply adequate for the first 24 hours. A FLEX DG is credited for maintaining electrical motive force beyond 24 hours. The FLEX activities required to install, operate, and refuel the generator are applicable under Order EA-13-109 Order requirements. The initial stored motive air/gas will allow for a minimum of 8 valve operating cycles for the HCVS valves for the first 24 hours (Reference 24 [in the OIP]).

2. An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the POS and ROS based on time constraints listed in Attachment 2 [of the OIP].

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

4. All 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 [frequently asked question] HCVS-03). Remote manual operation will be performed from the ROS in the Control/Diesel Building and will credit the Reactor Building-to-Aux Building shielding design. Toolbox actions

(reference FAQ HCVS-09) will be used to address area habitability. Any supplemental connections will be pre-engineered to minimize man-power resources and address environmental concerns. Required portable equipment will be reasonably protected from screened in hazards listed in Part 1 of this OIP.

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

6. Following the initial 24 hour period, additional motive force will be supplied from nitrogen bottles that will be staged with the FLEX equipment such that radiological impacts are not an issue. Additional bottles can be brought in as needed.

The Hope Creek OIP contains system feature descriptions that appear to make the system reliable consistent with the guidance found in NEI 13-02, as endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. The licensee identifies the need to perform the final sizing evaluation for HCVS pneumatic supply. Other specific design details not available at this time include the final sizing for HCVS battery/battery charger including documentation of incorporating HCVS electrical sources into the FLEX DG loading calculations 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 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, and 1.1.4, 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.

Order EA-13-109, Sections 1.2.4, and 1.2.5, 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.

1.2.5 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 POS in the LCER on Elevation 102' of the Control/Diesel Building and ROS in the electrical chase on Elevation 102' of the Control/Diesel Building. The POS and ROS are protected from adverse natural phenomena and have adequate communication to the MCR. A dose evaluation will be performed for both the POS and ROS areas. This evaluation is identified as an open item at this time.

The Hope Creek OIP describes HCVS control locations 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. Design details not available at this time include: documentation that demonstrates 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 environmental and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; therefore, the 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, 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 17 of the OIP states the following:

> As is required by Order 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.

A description of the final design for hydrogen control is not available at this time including 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 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, Section 1.2.3 states 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.

Order EA-13-109, Section 1.2.12 states:

> 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 17 of the OIP states the following:

> The HCVS uses the Containment Pre-purge Cleanup System (CPCS) outboard containment isolation valves (HV-4962 and HV-4963, Reference Attachment 3 Sketch 2[of the OIP]) for isolation between the HCVS and CPCS. These containment isolation valves are AOVs and they are air-to-open and spring-to-close. A SOV must be energized to allow the motive air to open the valve. These valves are not shared between the CPCS and the HCVS (i.e. they are not operated for HCVS venting).

The Hope Creek OIP describes features to minimize unintended cross flow of vented fluids 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 applicable requirements of Order EA-13-109. By review of the plant layout sketches and through clarification discussions with the licensee, the NRC staff notes that design features, such as air-to-open spring-to-close AOVs, and the need to provide power to solenoids in order to open the valves appear to provide protection against unintended cross flow.

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:

> The HCVS will be designed to provide features to prevent inadvertent actuation due to a design error, equipment malfunction, or operator error such that any credited containment accident pressure (CAP) that would provide net positive suction head to the emergency core cooling system (ECCS) pumps will be available (inclusive of a design basis loss-of-coolant accident (DBLOCA)). However the ECCS pumps will not have normal power available because of the starting boundary conditions of an ELAP. Hope Creek does not rely on CAP to maintain net positive suction head for ECCS pumps (Reference 32 [of the OIP]).
>
> The features that prevent inadvertent actuation are two PCIVs [primary containment isolation valves] in series powered from different divisions under normal conditions and key lock switches under BDBEE conditions. Procedures also provide clear guidance to not circumvent containment integrity by simultaneously opening torus and existing drywell vent valves. In addition, the

> HCVS will be designed to provide features to prevent inadvertent actuation due to a design error, equipment malfunction, or operator error.

The Hope Creek OIP provides a description of methods to prevent inadvertent HCVS initiation that includes: key lock switches, valves in series powered from separate power supplies and procedural guidance. 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 17 of the OIP states the following:

> The HCVS components downstream of the second containment isolation valve are routed in seismically qualified structures. Existing HCVS components that directly interface with the containment pressure boundary are safety-related. The containment system limits the leakage or release of radioactive materials to the environment to prevent offsite exposures from exceeding the guidelines of 10 CFR 100 [Title 10 of the *Code of Federal Regulations* Part 100]. During normal or design basis operations, this means serving as a pressure boundary to prevent release of radioactive material.
>
> Likewise, any electrical or controls 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 containment isolation and/or a 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 safe shutdown earthquake (SSE) back to their isolation boundaries. Electrical and controls 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 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:

1. Purchase of instruments and supporting components with known operating principles from manufacturers with commercial quality assurance programs (e.g., ISO 9001) where the procurement specifications include the applicable seismic requirements, design requirements, and applicable testing.

2. Demonstration of seismic reliability via methods that predict performance described in IEEE [Institute of Electrical and Electronics Engineers] 344-2004

3. Demonstration that instrumentation is substantially similar to the design of instrumentation previously qualified.

Instrument	Qualification Method*
HCVS Process Flow	ISO 9001 / IEEE 344-2004 / Demonstration
HCVS Process Radiation Monitor	ISO 9001 / IEEE 344-2004 / Demonstration
HCVS Process Valve Position	ISO 9001 / IEEE 344-2004 / Demonstration
HCVS Pneumatic Supply Pressure	ISO 9001 / IEEE 344-2004 / Demonstration
HCVS Electrical Power Supply Availability	ISO 9001 / IEEE 344-2004 / Demonstration

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

The Hope Creek OIP describes component qualification methods that appear to be consistent with the design-basis of the plant and 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: information regarding specific containment instrumentation, which will be used by operators to make containment venting decisions, descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions, and design details that confirm existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting; therefore, the NRC staff has not completed its review.

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, 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 documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.

3.2.2.10 Monitoring of HCVS

Order EA-13-109, Sections 1.1.4, 1.28, and 1.29, 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.
>
> 1.2.8 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.
>
> 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 18 of the OIP states the following:

> The Hope Creek wetwell HCVS will be capable of being manually operated during sustained operations from the POS located in the LCER and will meet Order requirement 1.2.4. Additionally, to meet the intent for a secondary control location of requirement 1.2.5 of the Order, a readily accessible ROS will also be incorporated into the HCVS design as described in NEI 13-02 section 4.2.2.1.2.1. 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, ELAP, and inadequate containment cooling. An evaluation will be performed to determine accessibility to the POS and ROS locations, habitability, staffing sufficiency, and communication capability with vent use decision makers.
>
> The wetwell HCVS will include means to monitor the status of the vent system at both the POS and the ROS. Included in the current design of the HTV are

control switches in the MCR with valve position indication. The existing HTV controls currently meet the environmental and seismic requirements of the Order for the plant severe accident and will be upgraded to address ELAP. The ability to open/close these valves multiple times during the first 24 hours of the event will be provided by nitrogen bottles and a dedicated HCVS battery. Beyond the first 24 hours, the ability to maintain these valves open or closed will be provided with replaceable nitrogen bottles and FLEX generators.

The wetwell HCVS will include indications for vent pipe flow and effluent radiation levels at both the POS and ROS. Other important information on the status of supporting systems, such as power source status and pneumatic supply pressure, will also be included in the design and located to support HCVS operation. The wetwell HCVS includes existing containment pressure and wetwell level indication in the MCR to monitor vent operation. This monitoring instrumentation provides the indication from the MCR as per Order requirement 1.2.4 and will be designed for sustained operation during an ELAP event.

The Hope Creek OIP provides a description of HCVS monitoring and control that 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. Specific details not available at this time include: descriptions of all instrumentation and controls (existing and planned) including qualification methods, evaluations of the environmental and radiological effects on HCVS controls and indications, and an evaluation of environmental and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; therefore, the staff has not completed its review.

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, 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 19 of the OIP states the following:

> The HCVS downstream of the second containment isolation valve, including piping and supports, electrical power supply, valve actuator pneumatic supply, and instrumentation (local and remote) components, has been designed/analyzed to conform to the requirements consistent with the applicable design codes (e.g., Non-safety, Cat 1, 300# ASME or B31.1, NEMA 4, etc.) for the plant and to ensure functionality following a design basis earthquake.
>
> A HTV system was installed to satisfy the requirements of Generic Letter 89-16. The modifications associated with the HTV were performed under the provisions of 10 CFR [Section] 50.59. The Hope Creek HTV was designed, analyzed, and implemented consistent with the design basis of the plant. The current design will be evaluated to confirm that the existing system, coupled with the planned modifications to upgrade the HTV to a hardened containment vent system (HCVS), will meet the requirements of Order EA-13-109, and remain functional following a severe accident.
>
> Additional modifications required to meet the Order will be reliably functional at the temperature, pressure, and radiation levels consistent with the vent pipe conditions for sustained operations. The instrumentation/power supplies/cables/connections (components) will be qualified for temperature, pressure, radiation level, and total integrated dose for the vent pipe.
>
> Conduit design will be installed to Seismic Class 1 criteria. Both existing and new barriers will be used to provide a level of protection from missiles when equipment is located outside of seismically qualified structures. Augmented quality requirements 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.
>
> 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 instrument component use 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 344-2004, *IEEE Recommended Practice for Seismic Qualification of Class 1E 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.

- Missile protection will be evaluated and described in a future 6-month update.

The Hope Creek 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. The seismic and tornado missile protection final design criteria for HCVS will be evaluated when the information is provided in future updates.

Open Item: Provide the seismic and tornado missile final design criteria for the HCVS stack.

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 20 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].

The HCVS will be designed to allow initiation, control, and monitoring of venting from the POS located in the LCER. This location minimizes plant operators' exposure to adverse temperature and radiological conditions and is protected from hazards assumed in Part 1 of this report.

Permanently installed power and motive air/gas capability will be available to support operation and monitoring of the HCVS for 24 hours.

System control:

i. Active: PCIVs are operated in accordance with EOPs/SOPs [Emergency Operating Procedures/System Operating Procedures] to control containment pressure. The HCVS will be designed for eight open/close cycles under ELAP conditions over the first 24 hours following an ELAP (reference 24 [of the OIP]). Controlled venting will be permitted in the revised EPGs [Emergency Procedure Guidelines] and associated implementing EOPs.

ii. Passive: Inadvertent actuation protection will be provided by key lock switches located at the POS and locked valves located at the ROS with keys controlled in accordance with applicable procedures.

The Hope Creek OIP describes a first 24 hour BDBEE coping strategy 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. Specific details not available at this time include: 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; 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.

3.2.3.2 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 20 of the OIP states the following:

At 24 hours, available personnel will be able to connect supplemental motive air/gas to the HCVS. Connections for supplementing electrical power and motive air/gas required for HCVS will be located in accessible areas with reasonable protection that will minimize personnel exposure to adverse conditions for HCVS initiation and operation. Connections will be pre-engineered quick disconnects to minimize manpower resources. Hope Creek is crediting FLEX to sustain electrical power for a BDBEE ELAP. The response to NRC Order EA-12-049 will demonstrate the capability for FLEX strategies to maintain the power source by repowering the 10B421 MCC as described above.

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

The Hope Creek OIP describes a greater than 24 hour BDBEE coping strategy 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. Specific details not available at this time include 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; 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 23 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 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. Actions will be completed by Operators at the POS or ROS and will include remote-manual actions from a gas cylinder station located at the ROS. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this report (Table 2-1 [of the OIP]).

Permanently installed power and motive air/gas will be available to support operation and monitoring of the HCVS for 24 hours. Specifics are the same as for BDBEE Venting Part 2.

System control:

i. Active: Same as for BDBEE Venting Part 2.

ii. Passive: Same as for BDBEE Venting Part 2, except the rupture disk has a burst set pressure which has been determined to be above the maximum inlet header pressure expected during a design basis event. In a severe accident scenario, the pressure from the wetwell will be able to burst the rupture disk unassisted, as it will be above the pressure expected during the worst case design basis event.

The Hope Creek OIP describes a first 24 hour severe accident coping strategy 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. 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 environmental and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; 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.

3.2.4.2 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.

Order EA-13-109, Section 1.2.8 states that:

> 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 23 of the OIP states the following:

> Specifics are the same as for BDBEE Venting Part 2 except the location and refueling actions for the FLEX DG and replacement nitrogen bottles will be evaluated for SA environmental conditions resulting from the proposed damaged Reactor Core and resultant HCVS vent pathway.
>
> These actions provide long term support for HCVS operation for the period beyond 24 hrs. and up to 7 days (sustained operation time period) because on-site and off-site personnel and resources will have access to the site to provide needed action and supplies.

The Hope Creek OIP describes greater than 24 hour severe accident coping strategy 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. 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 environmental 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 the 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 25 of the OIP states the following:

> Containment integrity is initially maintained by permanently installed equipment. All containment venting functions will be performed from the POS or ROS.
>
> Venting will require support from DC power as well as instrument air systems. Dedicated HCVS batteries will provide sufficient electrical power for HCVS operation for greater than 24 hours. Before the HCVS batteries are depleted, a FLEX DG, as detailed in the response to Order EA-12-049, will be credited to charge the HCVS batteries and maintain DC bus voltage after 24 hours. Permanently installed nitrogen bottles will provide sufficient motive force for all HCVS valve operation and will provide for multiple operations of the HV-11541 vent valve in the first 24 hours. Portable nitrogen bottles will be used to maintain valve motive force beyond the first 24 hours.

The Hope Creek OIP describes BDBEE supporting equipment functions 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. Specific details not available at this time include 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; 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.

3.2.5.2 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 25 of the OIP states the following:

> The same support functions that are used in the BDBEE scenario would be used for severe accident venting. To ensure power for at least 24 hours, a set of dedicated HCVS batteries will be available to feed HCVS loads via a manual transfer switch. At 24 hours, power will be restored to the 'A' 1E station battery via a FLEX DG evaluated for SA capability.
>
> Nitrogen bottles that will be located outside of the reactor building and in the immediate area of the ROS will be available to tie-in supplemental pneumatic sources.

The Hope Creek OIP describes support equipment functions for severe accident venting 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. 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 environmental 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.

3.2.6 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 27 of the OIP states the following:

> Deployment pathways for compliance with Order EA-12-049 are acceptable without further evaluation 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.

The Hope Creek OIP describes venting portable equipment deployment functions 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. 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 environmental and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; 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 documentation of an assessment of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.

Summary, Section 3.2:

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

Summary, Section 3.3:

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 30 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 the 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 and backup power is available, and during ELAP conditions.
>
> The HCVS procedures will be developed and implemented following the PSEG 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 and backup power supplies,
> - directions for sustained operation, including the storage location of portable equipment,
> - training on operating the portable equipment, and

- testing of portable equipment

Hope Creek will establish provisions for out-of-service requirements of the HCVS and compensatory measures. The following provisions will be documented in Operations department administrative controls:

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

- If for up to 90 consecutive days, the primary (POS) **OR** alternate (ROS) means of HCVS operation are non-functional, no compensatory actions are necessary.

- If for up to 30 consecutive days, the primary (POS) **AND** alternate (ROS) means of HCVS operation are non-functional, no compensatory actions are necessary.

- If the out of service times exceed 30 or 90 days as described above, the following actions 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 Hope Creek OIP describes programmatic controls 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. 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.

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 31 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 when normal and backup power is available and during ELAP conditions. 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 process.
>
> In addition, (reference NEI 12-06) all personnel on-site will be available to supplement trained personnel.

The Hope Creek 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 31 of the OIP states the following:

> Hope Creek 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 Hope Creek OIP describes an approach to drills that appear 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 32 of the OIP states the following:

> Hope Creek will utilize the standard EPRI [Electric Power Research Industry] 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.

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

Table 4-1 [of the OIP]: 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) Post-maintenance test 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

Notes: Table 4-1 is based on NEI 13-02 and OIP template guidance. Cycling of interfacing valves may be not applicable to Hope Creek testing based on the plant-specific design.

The Hope Creek 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 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 the finalized time constraints for remote manual operations and their bases.	Section 3.2.1
2.	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
3.	Provide the seismic and tornado missile final design criteria for the HCVS stack.	Section 3.2.2.11
4.	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
5.	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
6.	Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	Section 3.2.2.9 Section 3.2.2.10
7.	Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.	Section 3.2.2.4 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
8.	Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	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
9.	Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	Section 3.2.2.3 Section 3.2.2.5 Section 3.2.2.9 Section 3.2.2.10
10.	Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.	Section 3.2.2.9
11.	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
12.	Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	Section 3.2.2.6
13.	Submit a relaxation request as stated in the order for the deviation from Order EA-13-109 provision 1.2.2, "The HCVS shall discharge the effluent to a release point above the main plant structures," which includes a technical justification for the deviation.	Section 3.1.3 Section 3.2.2.3

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, as 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, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," June 6, 2013 (Agencywide Documents Access and Management System (ADAMS Accession No. ML13143A321).

2. Letter from PSEG to NRC, PSEG's Overall Integrated Plan for Hope Creek Generating 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 Phase 1 (Order EA-13-109), dated June 25, 2014 (ADAMS Accession No. ML14177A508).

3. SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan", (ADAMS Accession No. ML111861807).

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

5. SRM-SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned", (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, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents," March 9, 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. JLD-ISG-2013-02, "Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents," November 14, 2013 (ADAMS Accession No. ML13304B836)

14. 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. Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," September 1, 1989 (ADAMS Accession No. ML13017A234)

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

17. Hope Creek Generating Station-Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (ADAMS Accession No. ML13365A253)

18. Letter from PSEG to NRC, PSEG Nuclear LLC's Overall Integrated Plan for the Hope Creek Generating Station 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 27, 2013 (ADAMS Accession No. ML14177A508).

19. NUREG-1935, State-of-the-Art Reactor Consequence Analyses (SOARCA) Report (ADAMS Accession No. ML12332A057).

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Date: February 12, 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 No. 50-354

Enclosure:
Interim Staff Evaluation

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