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

February 11, 2015

Mr. Oscar A. Limpias
Vice President – Nuclear and CNO
Nebraska Public Power District
72676 648A Avenue
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR 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. MF4384)

Dear Mr. Limpias:

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 30, 2014 (ADAMS Accession No. ML14189A415), Nebraska Public Power District (NPPD), submitted its Overall Integrated Plan (OIP) for Cooper Nuclear Station (Cooper) in response to Phase I of Order EA-13-109. By letter dated December 19, 2014, NPPD submitted its first six month update to the OIP (ADAMS Accession No. ML14364A154) which included revision 1 to the OIP.

NPPD's OIP for Cooper 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. 50-298

Enclosure:
Interim Staff Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
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INTERIM STAFF EVALUATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

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

WITH REGARD TO RELIABLE HARDENED

CONTAINMENT VENTS CAPABLE OF OPERATION UNDER

SEVERE ACCIDENT CONDITIONS

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

DOCKET NO. 50-298

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 30, 2014 [Reference 2], Nebraska Public Power District (the licensee, NPPD) provided the OIP for Cooper Nuclear Station (CNS, Cooper) for compliance with Phase 1 of Order EA-13-109. The OIP described the licensee's previously proposed modifications to systems, structures, and components, new and revised guidance, and strategies that it intended to implement in order to comply with the requirements of Phase 1 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) 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 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 requires licensees to install a reliable HCVS for Mark I and Mark II containments.

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

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

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

By letter dated May, 27, 2014 [Reference 14], the NRC notified all BWR Mark I and Mark II Licensees that the 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

CNS is a single unit General Electric BWR with a Mark I containment system. CNS has an existing containment venting system that was installed in response to Generic Letter (GL) 89-16 [Reference 15]. The existing system has portions routed underground and discharges to the existing plant stack. On June 30, 2014, NPPD submitted an OIP that described NPPD's intension to upgrade the existing GL 89-16 containment vent to comply with Order EA-13-109.

On September 30, 2014 CNS informed the NRC that they intended to revise their HCVS OIP. Instead of upgrading the existing system, CNS will install a new HCVS that runs from the out board suppression pool vent valve to an effluent release point above the reactor building roof to comply with Phase 1 of Order EA-13-109. By letter dated December 19, 2014, NPPD submitted its first six month update to the OIP [Reference 16] which included revision 1 to the OIP. Revision 1 of 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 requirements Phase 1 of Order EA-13-109. All references to the licensee's OIP are to the revision. As part of its interim review of the submitted OIP, the NRC staff held clarifying discussions with NPPD 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 CNS were evaluated in the CNS OIP in response to Order EA-12-049 (Mitigation Strategies) [Reference 17]. NRC staff documented an analysis of the NPPD's extreme external hazards evaluation in the CNS ISE relating to the Mitigation Strategies OIP [Reference 18]. The following extreme external hazards screened in: Seismic, Extreme Cold, Snow, Ice, High Wind and Extreme High Temperature. External flooding screened out. Based on CNS not excluding any external hazard from consideration, the NRC staff determined that NPPD appears to have considered the appropriate external hazards in the design of the HCVS.

3.1.2 Assumptions

On page 6 of the CNS OIP, NPPD adopted 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 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.

The staff reviewed the CNS plant-specific HCVS related assumptions:

CNS-1 The plant layout of buildings and structures are depicted in the Figure 1-1 of the OIP (Cooper Nuclear Station Layout). Furthermore, the figure depicts the path of the vent piping, which exits the Reactor Building on the south wall and travels underground to the ERP [Elevated Release Point]. Note that CNS includes only one unit. The MCR [main control room] is located in the Control Building at elevation 932'-6" (ground level of the Control Building is 903'-6"), which is to the north of the Reactor Building (ground level is 903').

CNS-2 The existing THPV [torus hard pipe vent] line will not be used. A new HCVS vent line will be installed inside the Reactor Building.

CNS-3 The effluent will be released from the top of the Reactor Building.

CNS-4 A Mechanical ROS [remote operating system] (nitrogen station) will be installed to provide additional pneumatic supply to the HCVS air-operated valves after 24 hours. In addition, the nitrogen station will act as a remote operating station for the operation of the air-operated valves. The Mechanical ROS will be located against the south exterior wall of the Reactor Building.

The NRC staff determined that the plant specific assumptions for Cooper do not deviate 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 5 of the OIP states the following:

> Compliance will be attained for CNS with no known deviations to the guidelines in JLD-ISG-2013-02 and NEI 13-02 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 4th Quarter (November) of 2016.
>
> - Phase 2: No later than startup from the first refueling outage that begins after June 30, 2017, or June 30, 2019, whichever comes first. Currently scheduled for 4th Quarter (November) of 2018.
>
> If deviations are identified at a later date, then the deviations will be communicated in a future 6 month update following identification.

CNS's schedule for Phase 1 and Phase 2 of Order EA-13-109 complies with the requirements of the order without deviation. Regarding other deviations neither NPPD nor the NRC staff identified any at this time. Therefore, the staff concludes that it appears CNS will attain compliance with Phase 1 of Order EA-13-109 with no known deviations to the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 an acceptable means for implementing applicable requirements of Order EA-13-109.

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, 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 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 9 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]. Immediate operator actions will be completed by plant personnel and will include the capability for remote-manual initiation from the HCVS control station. A list of the remote manual actions performed by plant personnel to open the HCVS vent path can be found in the following Table 2-1 [of the OIP]. A HCVS ELAP Failure Evaluation Table, which shows alternate actions that can be performed, is included in Attachment 4 [of the OIP].

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 failure.

The staff reviewed the three cases contained in the sequence of events 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 time lines accurately reflect the progression of events as described in the CNS mitigation strategies OIP (Reference 19), SECY-12-0157 (Reference 3), and State-of-the-Art Reactor Consequence Analyses (SOARCA) (Reference 20).

The NRC staff reviewed the licensee discussion of time constraints on page 11 of the OIP and confirmed that: the time constraints identified appear to be appropriately derived from the timelines developed in Attachment 2 of the OIP; and the actions at the identified times appear appropriate for the sequences of events described and 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 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. NPPD however identified the need to determine the location of the nitrogen bottle connections before temperature and radiological considerations can be made.

The NRC staff reviewed the discussion of radiological and temperature constraints on page 12 of the OIP and determined that NPPD considers radiological and temperature conditions at the locations identified to date where manual actions are necessary to operate HCVS. Specific evaluations of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and equipment outside the MCR are not available at this time; 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 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 1% or greater of 2,419 MWt (which corresponds to the CLTP [Current Licensed Thermal Power]) at pressure of 56 psig. This pressure is the lower of the containment design pressure (56 psig) and the PCPL value (62.7 psig). The size of the wetwell portion of the HCVS goes from 20" to 24" until it combines

with the HCVS piping which will be sized at 16", which provides adequate capacity to meet or exceed the Order criteria. There are no plans for increases on licensed power.

The CNS OIP describes installation of a new vent sized to meet one percent CLTP. Specific design details are not available at this time include: a final vent path calculation for the HCVS piping confirming one percent CLTP minimum capacity, and an analysis that demonstrates 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:

> There are no exceptions to the 1% decay heat removal capacity. The 1% value at CNS 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 CNS OIP assumes that until decay heat is less than 1 percent, the suppression pool must absorb the decay heat generated and prevent containment pressure from increasing above the containment design pressure until the 1 percent containment vent is able to restore and maintain primary containment pressure below the primary containment design pressure and the primary containment pressure limit. Design analysis confirming the suppression pool has the capacity to absorb the decay heat generated until the decay heat rate within HCVS capacity 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 states 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.

Order EA-13-109 Section 1.2.2 states that:

> 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:

> The HCVS vent path at CNS consists of a wetwell vent. The HCVS will use the existing THPV piping between the wetwell penetration X-205 and PCIV [primary containment isolation valve] PC-AOV [air-operated valve]-237AV. Penetration X-205 is a 20" piping penetration located at the top of the torus, midway between ring girders in a vent pipe bay. The piping enlarges to a 24" pipe at a tee right beyond the penetration. This pipe contains two butterfly PCIVs, PC-MOV [Motor-Operated Valve]-233MV and PC-AOV-237AV. Currently, further downstream, the 24" pipe changes to a 24" piping/thin-walled piping. The portion of the thin-walled piping that is currently 14 gauge will be upgraded from 14 gauge to 10 gauge stainless steel (i.e., thicker gauge), and a new 16" line will be tied into this upgraded 24" line. The new control valve that replaces PC-AOV-AO32 (the venting valve) will be installed on the new 16" line in the torus room area. The pipe will then travel along the south wall of the Reactor Building, to the southwest corner room. The pipe will enter the corner room using a new penetration in the southwest diagonal wall. The pipe will then travel across the corner room to enter the southwest staircase "A2" below floor elevation 903'-6". Once in the staircase, the pipe will follow the underside of the staircase and penetrate the southwest corner of the stairwell landing (i.e., the first stairwell landing on the west wall above 903'-6"). The pipe will travel through the staircase all the way to the refueling floor (elevation 1001'-0"). It will penetrate the 1001' concrete floor slab in the southwest corner of the stairwell landing, and it will exit the top of the stairwell concrete structure (9' above elevation 1001') on the refuel floor. The vent line will then follow the south wall to a structural beam. The vent line will then go vertically out to the Reactor Building roof for the release point. The effluent will exit out of the Reactor Building.

Release Point:

The release point will be located at an elevation of at least 1056', i.e., more than 3' above the top of Reactor Building parapet walls (1052'-9") per NEI guidance contained in HCVS-FAQ-04, Revision 3 (Reference 17[of the OIP]). Protection from rain and snow is provided by a stack design with a goose-neck pipe fitting, or 180-degree bend, at the top of the vertical pipe above the Reactor Building roof. A screen and anti-roosting wire system, including narrow pins, will be installed on the top of the stack to repel birds. The stack design will also prevent ice formation. The pipe will have grating in order to satisfy security requirements.

Drains and Water-Hammer Prevention:

The system will be designed to prevent overflow in the vent line, or gas void, which could result in water hammer.

A loop seal will be utilized to drain condensation from the portion of the pipe in the torus area to the existing sump in the southwest Reactor Building corner room. The sump may be able to handle the condensation during the ELAP event, but the sump would need to be operated (i.e., powered) to remove any excess condensation.

Wind and Missile Protection:

The entire HCVS line, with the exception of the pipe section exiting the Reactor Building roof, is located inside the Reactor Building, which is a Seismic Class I building. The UPS [uninterruptible power supply] system powering PC-MOV-233MV is located in the Reactor Building as well. The main UPS system is located in the Control Building which is a Seismic Class I building. Seismic Class 1 buildings provide adequate wind and missile protection.

In summary, the location of the HCVS was evaluated against the guidance proposed in NEI HCVS-FAQ-04, Revision 3 (Reference 17[of the OIP]) with respect to missile protection, distance of the release point to the nearest structures, potential for damage due to deflagration/detonation in effluent plume, and the release point distance and elevation relative to emergency filtration intake and exhaust pathways.

1. The release point will be at least 3' above the roof and related structures of the building that it emanates from (such as roof parapets).

2. Missile protection evaluation is required for piping segments outside of Seismic Class I structures. This evaluation, referenced by NEI 13-02, section 5.1.1.6.2, can utilize: NRC Regulation Guide 1.76, Revision 1, Design-Basis Tornado And Tornado Missiles For Nuclear Power Plants, which limits automobile missile impact to "all altitudes less than 30 feet"; the plants current licensing bases; or other pertinent information. An evaluation will show that smaller missiles are very unlikely to hit the pipe exhaust at this height.

3. The ROS is the only structure located under the 25' horizontal limit. The radiological and environmental conditions at the ROS, and the impact of vent operations on accessibility of the ROS, will be evaluated as part of Open Item 2 [in the OIP].

4. No flammable or heat sensitive equipment is or will be located near the pipe exhaust.

5. Intakes are either located further than 100' horizontally and 20' vertically, or meet the 5:1 rule.

The CNS OIP describes the routing and discharge point of the HCVS 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 applicable requirements of Order EA-13-109. Design details not available at this time include: the seismic and tornado missile final design criteria for the HCVS stack, evaluations of the environmental and radiological effects on HCVS controls and indications, and documentation of an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; therefore, the staff has not completed its review.

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

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

Open Item: Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.

3.2.2.4 Power and Pneumatic Supply Sources

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

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

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

Page 17 of the OIP states the following:

<u>Electrical Power Supply:</u>

All electrical power required for operation of HCVS components (except PC-MOV-233MV), HCVS instrumentation, and indication in the MCR and at the Mechanical ROS will be routed through the CB [containment building] UPS system. The CB UPS will consist of a bank of 60 battery cells providing 120VDC powering a 4kW inverter, which supplies alternate HCVS 120VAC power, and a 120VAC Distribution Panel. The battery of choice is a sealed cell (or voltage regulated lead acid) due to its minimal hydrogen generation. The HCVS has no tie to the station batteries 125 DCA, 125 DCB, 250VDCA or 250VDCB. The only indicators at the UPS are the AC and DC [direct current] voltmeters, used to monitor HCVS battery power availability.

Note that PC-MOV-233MV will be powered by a separate alternate power supply. This alternate supply will consist of a UPS (charger, battery, and inverter) and transfer switch at or near MCC-RA. The transfer switch will provide proper separation of the safety-related control and power circuits for PC-MOV-233MV. The UPS will provide 480 VAC three phase power for PC-MOV-233MV, and will be sized to provide three operating cycles of the valve during the 24-hour period before FLEX power or offsite power is restored. See Sketch 1 of Attachment 3 for a 1-line sketch of the UPS systems (CB UPS and MOV UPS).

If the station power is not restored after 24 hours, power to the HCVS Distribution Panel will be provided directly by a FLEX DG [diesel generator] (bypassing the UPS battery charger) or by recharging the UPS batteries with a FLEX DG. The transfer switch will be aligned to supply normal AC power to the battery charger during normal operation. During the Beyond Design Basis event, cables will be connected to the receptacles installed on the transfer switch enclosure and connected to the cables from a FLEX DG that will be brought into the Auxiliary Relay Room.

The UPS will be located at the far end of the Control Building corridor at the 903'-6" level. At this location, the UPS will be easily and readily accessible from the MCR (located in the Control Building at elevation 932'-6"). This location was chosen based on the seismic class of the Control Building and being above the design basis flood level. The relative absence of safety-related equipment in that area is also a positive feature. Additionally, this location is in relatively close proximity to both the Control Room and anticipated connection points for FLEX power sources. The MOV UPS was sized to provide power for three opening/closing cycles of PC-MOV-233MV. The valve is expected to be open once and left open during venting operations. Therefore, the current size of the MOV UPS provides enough power supplies for more than 24 hours.

Radiological consequences resulting from the operation of the HCVS are not expected in the Control Building, as the HCVS will only be routed inside the Reactor Building (in addition to the shielding the Control Building provides). Heat loads seen during the severe accident, resulting from the undercooled containment, ELAP conditions, and operation of the equipment in the room where the CB UPS is located will be calculated as per Open Item 2. Equipment and instrumentation at the CB UPS is designed to withstand such conditions.

Pneumatic Power Supply:

Pneumatic power is normally provided by the non-interruptible air system with backup nitrogen provided from installed nitrogen supply tanks. Following an ELAP event, the station air system is lost, and normal backup from installed nitrogen supply tanks is isolated. Therefore, for the first 24 hours, pneumatic force will be supplied from existing and newly installed air accumulator tanks. These accumulators 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 a 24" MOV, AC power to open and close, followed by a 24" AOV, air-to-open and spring-to-shut. The vent control valve will be a 16" AOV with air-to-open and spring-to-shut. Opening the AOVs requires energizing an AC powered SOV [solenoid operated valve] and providing motive air/gas, while opening the MOV requires AC power. Power to energize the SOVs will be provided by the CB UPS. Power to operate the MOV will be provided by a separate, MOV-dedicated UPS. To prevent failure of the HCVS due to failure of the solenoid valves to actuate PC-AOV-237AV and PC-AOV-AO32, 4-way solenoids will be installed to allow these AOVs to accept nitrogen from the Mechanical ROS. Actuation of PC-AOV-237AV and PC-AOV-AO32 via nitrogen through the associated 4-way solenoids will be performed from the Mechanical ROS. The CB UPS, the MOV dedicated UPS, and the AOV accumulators provide permanently installed power source and motive air/gas supply adequate for the first 24 hours. Beyond the first 24 hours, FLEX generators will be used to maintain battery power to the HCVS components. The initial stored motive air/gas will allow for 8 valve operating cycles for the HCVS valves for the first 24 hours. This is conservative in regards to the results contained in the September 2014 MAAP [modular accident analysis program] analysis to support the CNS FLEX strategy (Reference 44 [of the OIP]). In this analysis, strategies with the vent continuously open (no cycle), or with one cycle or two cycles only, are sufficient to maintain Torus pressure between 15 and 30 psia and the suppression pool water temperature below 240°F.

2. An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the 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, N2/air) will be located in areas reasonably protected from defined hazards listed in Part 1 of this OIP.

4. All valves required to open the flow path or valves that require manual operation to be closed to prevent diversion or cross-flow into other systems/units 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 16 [of the OIP], FAQ [frequently asked question] HCVS-03). The remote manual operation of the valves will be performed from the Control Room. Only PC-AOV-237AV and PC-AOV-AO32 can additionally be operated from the ROS if the associated solenoids fail. Accessibility of the ROS during the event will be evaluated for radiological and environmental conditions, and strategies such as the use of ice vests or shielding will be implemented if deemed necessary. 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. A list of portable equipment can be found in Attachment 1.

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 pre-staged and pre-connected at the Mechanical ROS. Additional nitrogen bottles will also be available on-site for re-supply of the Mechanical ROS.

The CNS 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. Specific details not available at this time include the final sizing evaluation for HCVS pneumatic supply, 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 19 of the OIP states the following:

> The HCVS design allows initiating and then operating and monitoring the HCVS from the MCR and the ROS. The MCR location is protected from adverse natural phenomena and is the normal control point for Plant Emergency Response actions.
>
> The Mechanical ROS will be located as shown on Figure 1-1 on the exterior south wall of the Reactor Building, and will be several feet to the east of the current standby nitrogen injection station (and its barricaded door) just inside the security fence entrance to the transformer area. The Mechanical ROS will be a missile shielded structure. A door will be needed in order to allow operator access and to move additional nitrogen bottles into the Mechanical ROS to supply pneumatic motive force beyond the initial 24 hours of the event. The exterior and interior walls forming the door entrance will be constructed in order

to protect the equipment in the Mechanical ROS from tornado missiles. Therefore, the door does not need to be designed for missile protection itself.

[cf. OPEN ITEM 2: Evaluate accessibility of the Mechanical ROS for radiological and environmental conditions. Address dose and temperature items for the Mechanical ROS and non-MCR locations. FAQ HCVS-01 (Reference 14) will be used as guidance.]

The CNS 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. Specific 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, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.

Open Item: Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.

3.2.2.6 Hydrogen

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

1.2.10 The HCVS shall be designed to withstand and remain functional during severe accident conditions, including containment pressure, temperature, and radiation while venting steam, hydrogen, and other non-condensable gases and aerosols. The design is not required to exceed the current capability of the limiting containment components.

1.2.11 The HCVS shall be designed and operated to ensure the flammability limits of gases passing through the system are not reached; otherwise, the system shall be designed to withstand dynamic loading resulting from hydrogen deflagration and detonation.

1.2.12 The HCVS shall be designed to minimize the potential for hydrogen gas migration and ingress into the reactor building or other buildings.

Page 20 of the OIP states the following:

> As is required by EA-13-109, section 1.2.11, the HCVS must be designed such that it is able to either provide assurance that oxygen cannot enter and mix with flammable gas in the HCVS (so as to form a combustible gas mixture), or it must be able to accommodate the dynamic loading resulting from a combustible gas detonation. Several configurations are available which will support the former (e.g., purge, mechanical isolation from outside air, etc.) or the latter (design of potentially affected portions of the system to withstand a detonation relative to pipe stress and support structures).
>
> Hydrogen control will be addressed using a check valve combined with a purging system. A new check valve will be installed on the 1001' floor (refueling floor) of the Reactor Building. The function of this valve is twofold: first, the function of the valve is to eliminate air ingress further down the pipe when the venting stops and the steam condenses; second, the function of the check valve is to bottle up the steam and hydrogen in the pipe volume below this valve and above the upstream control valve. The check valve will be designed for the temperature, pressure, and radiological conditions seen at its location.
>
> Based on the run-up distance required for a DDT [Deflagration-to-Detonation] to occur (NEI HCVS-WP03, Reference 25 [in the OIP]), detonation loading cannot be ruled out for the section of piping downstream of the check valve (from check valve to exhaust point). Therefore, either the downstream pipe including the valve on the 1001' floor must be designed for detonation, or a purging system must be implemented to remove all hydrogen in this section before condensation draws in a substantial amount of air (oxygen). Argon purging has been selected for prevention of DDT in the HCVS at CNS. The HCVS piping will not be designed for detonation.
>
> As presented in NEI HCVS-WP-03 (Reference 25 [of the OIP]), argon is a relatively inexpensive inert gas of choice since its atomic mass (~40 amu) is higher than that of oxygen (~16 amu). Injecting argon in the line will create an argon "plug" between the hydrogen potentially below the check valve and the oxygen in the atmosphere above. Argon bottles will be located on the refueling floor and connected to the 16" vent line above the valve with ½" carbon steel lines. A flow diagram of the system is included in the overall HCVS flow diagram, in Attachment 3, Sketch 2 [of the OIP]. Purging is initiated just before the vent line is closed in order to exhaust the radiologically contaminated steam out of the pipe downstream of the check valve and prevent contaminated water condensation and water accumulation on top of the check valve.
>
> The argon station, located on the refueling floor, will consist of argon bottles, a PRV [pressure relief valve] installed downstream of the argon bottles (to prevent overpressurization of the argon bottles), and a pressure reducer (downstream of

the PRV) which will reduce the pressure of the argon coming from the bottles to the purging pressure. The purging pressure will be higher than the effluent pressure to prevent contaminated effluent from entering the purging line. Additionally, a check valve will be installed to prevent effluent backflow in the purging line. Finally, a two-way solenoid valve will be installed downstream of the pressure reducer, which will be energized from the Control Room to initiate purging.

The CNS OIP describes a check valve combined with a purging system to provide assurance that a combustible mixture will not occur in the HCVS. The system as described 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.

3.2.2.7 Unintended Cross Flow of Vented Fluids

Order EA-13-109, Section 1.2.3 states:

> 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 21 of the OIP states the following:

> The HCVS uses the Containment Purge System containment isolation valves for containment isolation. The inboard valve (PC-MOV-233MV) is an AC motor driven MOV and the outboard valve (PC-AOV-237AV) is an AOV with an AC powered SOV, and can be operated from switches in the MCR. An AC motor must be energized to open the MOV. An AC SOV must be energized to allow the motive air to open the AOV. Although these valves are shared between the Containment Purge System and the HCVS, key-locked override switches are provided to each valve to allow operators to override the containment isolation signal. Specifically:

- The Containment Purge System control circuit will be used during all "design basis" operating modes including all design basis transients and accidents.
- Suppression Chamber In/Outboard Isolation Valves PC-MOV-1304MV and PC-MOV-1303MV are normally closed and meet the requirements of 10CFR50 Appendix J, Type C Testing.
- Suppression Chamber Vacuum Relief Outboard Isolation Valves PC-13CV and PC-14CV are normally closed check-valves that automatically open on a differential pressure of 0.5 psid across the valve to ensure that the external design pressure of the torus will not be exceeded. The valve in its normally

closed position provides outboard primary containment isolation. The valves meet the requirements of 10CFR50 Appendix J, Type C Testing. PC-AOV-243AV and PC-AOV-244AV, which are the Inboard Isolation Valves for Suppression Chamber Vacuum Relief, meet the requirements of 10CFR50 Appendix J, Type C Testing.

- A new vacuum breaker will be installed for the HCVS, since vacuum breaker PC-CV-30CV will be removed along with the existing 10" THPV piping. The new vacuum breaker will meet the requirements of 10CFR50 Appendix J per NEI HCVS FAQ-05 (Reference 18 [of the OIP]). The vacuum breaker will be designed to withstand the temperature, pressure, and radiological conditions experienced during the accident. At minimum, the vacuum breaker will be designed for the pressure and temperature conditions of the Primary Containment, 56 psig and 281°F, respectively. Per its function, the vacuum breaker will be assumed closed during venting. Testing and maintenance will be performed to ensure that the valve remains leak-tight.

- The Suppression Chamber Valve PC-AOV-235AV, the Nitrogen Purge Supply Valve PC-AOV-239AV, and their support components will be replaced. Replacement valves will be leak-tight and will meet the requirements of 10CFR50, Appendix J. The replacement components will be designed to the environmental and radiological conditions seen at the location during a severe accident requiring the use of the HCVS. Testing and maintenance will be performed to ensure that the valves remain leak-tight.

- New local leak rate test connections will be added in order to individually test the leak-tightness of the new PC-AOV-235AV, PC-AOV-239AV, venting valve (replacing PC-AOV-AO32), and vacuum breaker.

- The HCVS vent path minimizes the number of auxiliary lines and interfacing ventilation systems. For example, the HCVS line will not interface with the SGT [standby gas treatment] system or ERP. All auxiliary lines are currently, or will be, isolated with boundary valves meeting the requirements of 10CFR50 Appendix J. Therefore, the risk of unintended cross flow of vented fluids will be minimized.

- CNS is a single unit. As such, interconnection through the common plant stack is not applicable.

- Pipe leakage to the Reactor Building and other buildings will be minimized:

    - Leak tightness of the vent pipe from PC-AOV-237AV to the exhaust will be tested in compliance with the requirements of USAS [United States of America Standards] B31.1.0, 1967 Edition.

    - Since the HCVS piping will be designed and installed per USAS B31.1.0, 1967 Edition, the HCVS piping will meet the Nondestructive Inspection and

> Examination requirements of power piping in USAS B31.1.0, 1967 Edition. This requires that all the pipe welds are visually inspected.

The CNS OIP describes design features to minimize unintended cross flow of NRC staff determined that CNS has addressed all the system interfaces that are depicted on Sketch 2 of the OIP, P&ID Layout of HCVS. This appears consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.2.2.8 Prevention of Inadvertent Actuation

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

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

Page 22 of the OIP states the following:

> EOP/EPG [emergency operating procedure/ emergency procedure guideline] operating procedures provide clear guidance that the HCVS is not to be used to defeat containment integrity during any design basis transients and accident. In addition, 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 CAP [Containment Accident Pressure] that would provide net positive suction head [NPSH] to the ECCS [Emergency Core Cooling System] pumps will be available (inclusive of a DBLOCA [Design-Basis Loss of Coolant Accident]. However, the ECCS pumps will not have normal power available because of the starting boundary conditions of an ELAP. CNS credits CAP to maintain sufficient NPSH for ECCS Pumps (Core Spray and RHR [Residual Heat Removal]). Therefore, it is essential to prevent inadvertent actuation of the HCVS to ensure that the CAP can be maintained.
>
> At CNS, the features that prevent inadvertent actuation are two containment isolation valves in series powered from different divisions and key-lock switches. With respect to the containment isolation valves, the inboard valve (PC-MOV-233MV) is an AC motor driven MOV fed from a Division I AC power source, and the outboard valve (PC-AOV-237AV) is an AOV with an AC powered SOV fed from a Division II AC power source. Hence, the containment isolation valves meet the requirements for redundant and diverse power sources. Furthermore, these valves can be operated from key-locked switches in the MCR. Although these valves are shared between the Containment Purge System and the HCVS, key-locked override switches are provided for each valve to allow operators to override the containment isolation signal. Specifically:
>
> - The Containment Purge System control circuit will be used during all "design basis" operating modes including all design basis transients and accidents. The containment isolation signal will cause the valves to shut.

- The HCVS control circuit will have a key-locked switch for each of the two in-series valves to address inadvertent operation. Turning the switch to "open" will energize the control circuit opening the valve. Both valves will use AC power for opening for the HCVS function. Also, separate control circuits including switches will be used for the two redundant valves to address single point vulnerabilities that may cause the flow path to inadvertently open.

Procedures also provide clear guidance to not circumvent containment integrity by simultaneously opening torus and drywell vent valves during any design basis transient or accident. 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 CNS OIP provides a description of methods to prevent inadvertent HCVS initiation that include: 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. Design details and procedures are not available at this time. Final compliance will be verified through the audit and inspection processes.

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 23 of the OIP states the following:

The HCVS components downstream of the second containment isolation valve, and components that interface with the HCVS, are routed in seismically qualified structures. The Mechanical ROS will be a seismically qualified structure. HCVS components that directly interface with the pressure boundary will be considered safety-related, as the existing system is 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 10CFR100. 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 CB UPS and MOV UPS are considered Balance of Plant. Where the UPS circuits interface with safety-related circuits, the appropriate separation will be provided by transfer switches, disconnects, or interposing relays between safety and non-safety-related circuits. The remaining components will be considered Augmented Quality. Newly installed piping and valves will be seismically qualified to handle the forces associated with the SME [seismic margin earthquake] 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 EQ [Environmental Qualification] program).

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

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

1. Purchase of instruments and supporting components with known operating principles from manufacturers with commercial quality assurance programs (e.g., ISO9001) where the procurement specifications include the applicable seismic requirements, design requirements, and applicable testing.

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.

Table 2-2, Qualification Method of HCVS instrumentation

Instrument	**Qualification Method***
HCVS Process Temperature	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Process Pressure	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Process Radiation Monitor	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Process Valve Position	ISO9001 / IEEE 344-2004 / Demonstration

HCVS Pneumatic Supply Pressure	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Electrical Power Supply Availability	ISO9001 / IEEE 344-2004 / Demonstration
Existing HCVS Containment Pressure	ISO9001 / IEEE 344-2004 / Demonstration
Existing Suppression Pool Level	ISO9001 / IEEE 344-2004 / Demonstration
Existing Suppression Pool Temperature	ISO9001 / IEEE 344-2004 / Demonstration
Nitrogen Bottles Pressure	ISO9001 / IEEE 344-2004 / Demonstration
Argon Purging Indicators	ISO9001 / IEEE 344-2004 / Demonstration

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

The CNS 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. Details not available at this time include: descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions, and documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under ELAP and severe accident conditions; therefore, the staff has not completed its review.

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

Open Item: Make available for NRC staff audit 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 states 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.

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:

> The CNS wetwell HCVS will be capable of being manually operated during sustained operations from a control panel located in the MCR and will meet the requirements of Order element 1.2.4. The MCR is a readily accessible location with no further evaluation required. Control Room dose associated with HCVS operation conforms to GDC 19/Alternate Source Term. Additionally, to meet the intent for a secondary control location of section 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 location, 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 in both the MCR and the ROS. Included in the current design of the THPV are control switches in the MCR with valve position indication (Reference 34). The existing THPV controls currently meet the environmental and seismic requirements of the Order for the plant severe accident and will be upgraded to address ELAP. At the ROS, a control panel will be included. Monitoring the status of the vent line will be made possible with indications of the pressure in the accumulators IA-ACC-237AV and IA-ACC-AO32, and a position indicator of PC-AOV-AO32 position.
>
> The ability to open/close these valves multiple times during the event's first 24 hours will be provided by air accumulator tanks and two UPS systems (i.e., the

CB UPS and MOV UPS) providing a backup battery power source. 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 pressure (already available in the MCR), temperature (to be installed), and effluent radiation levels (already available in the MCR) at the MCR. Other important information on the status of supporting systems, such as power source status (to be installed) and pneumatic supply pressure (already available in the MCR for PC-AOV-AO32 but will be replaced with the valve replacement, and to be installed for PC-AOV-237AV), 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 Requirement 1.2.4 and will be designed for sustained operation during an ELAP event.

The above description of the CNS OIP to upgrade the existing THPV to an HCVS was included in the revised OIP submitted with the first 6 month update. On page 26 of the revised OIP CNS provided the following description to summarize the changes to monitoring and control of the HCVS to meet Order EA-13-109 requirements, as well as industry recommendations:

Table 2-3 below summarizes the changes to the monitoring and control of the HCVS to meet the Order requirements and industry recommendations.

Table 2-3, HCVS Monitoring and Control Changes

NRC Requirements & Industry Recommendations	Existing I&C	Change
Order Requirement 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.	The primary controlling location of the existing THPV is the MCR. PCIVs valves can be manually operated from the MCR using key-locked override switches on Panel P2 and open/close switches on Vertical Board H (PC-SW-CS(233AV) and PC-SW-CS(237AV)). AOV-AO32 can be controlled from Panel P2 using key-locked switches.	The primary controlling location of the HCVS is the MCR. During a severe accident, controls will be powered from a HCVS-dedicated UPS. PC-MOV-233MV will be powered from a separate alternate power supply (MOV UPS). The supply of pneumatic motive force after 24 hours will be performed from the Mechanical ROS.

Table 2-3, HCVS Monitoring and Control Changes

NRC Requirements & Industry Recommendations	Existing I&C	Change
Order Reference 1.2.5: The HCVS shall, in addition to 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.	N/A	The installation of a HCVS dedicated source of power ensures operation of the HCVS from the MCR. The supply of pneumatic motive force after 24 hours will be operated from the Mechanical ROS. In case the SOV of PC-AOV-237AV and/or PC-AOV-AO32 fails, 4-way solenoids will allow actuation of the valves from the Mechanical ROS with pneumatic motive force.
Order Requirement 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. HCVS valve position indication should be available at the primary controlling location. (NEI 13-02, 4.2.2.1.5)	The position of the following valves is indicated in the MCR: MOV-233MV, AOV-237AV, AOV-AO32.	PC-AOV-AO32 will be replaced. The circuit indicating position lights for PC-AOV-AO32 on MCR Panel P2 will be modified accordingly to indicate the position of the new control AOV. An effluent pressure transmitter will be added to the line in the Torus Room to measure the effluent pressure and confirm the status of venting operations.

Table 2-3, HCVS Monitoring and Control Changes

NRC Requirements & Industry Recommendations	Existing I&C	Change
Order Requirement 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.	Currently, RMA-RE-27 measures radiation doses in the THPV. Indications are provided on MCR Panel 9-11.	The existing radiation monitor is located near the section of the THPV line which will be demolished. A new radiation monitor will be installed in the same area (Torus Room). The indication on Panel 9-11 will be modified to indicate the doses recorded on the new radiation monitor.
HCVS valve position indicators should be capable of operating under the temperature/radiation conditions existing at the valve locations. (NEI 13-02, 4.2.2.1.6)	N/A	Refer to Part 2, "Component Qualifications."
HCVS valve position indicators and indications should be powered from sources that will be available during the appropriate mission time of the HCVS system. (NEI 13-02, 4.2.2.1.7)	N/A	The position lights for the MOV will only be on when the MOV is energized from its temporary power supply. Once the valve is positioned open and the power supply is secured, the lights will be off. Position lights for PC-AOV-237AV and the new control valve (on MCR Vertical Board H) will be powered from the UPS.

Table 2-3, HCVS Monitoring and Control Changes

NRC Requirements & Industry Recommendations	Existing I&C	Change
HCVS system should include indications of effluent temperature. Permanently installed gauges that are at, or nearby, the HCVS control panel is an acceptable method to address this item. (NEI 13-02, 4.2.2.1.8) (also see Order Requirement 1.2.8)	There is currently no existing instrumentation to monitor effluent temperature.	An effluent temperature monitor will be installed in the new pipe path on the refueling floor. Effluent temperature indication will be provided in the MCR.
The HCVS system should include indications for the Containment Pressure and Wetwell level for determination of vent operation. Use of existing control room indications is adequate and these instruments do not need to be powered by the HCVS battery system. (NEI 13-02 4.2.2.1.9) (also see Order Requirement 1.2.8)	The following parameters are already recorded in the MCR: Drywell Pressure on PC-PT-512A, -B; PC-PT-4A1, -4B2 Torus Pressure on PC-PT-30A, -30B Suppression Pool Level on PC-DPT-3A1, -3B1	Although not required, these instruments and their indicators will be powered from the UPS to provide sustained indication during an ELAP.

Table 2-3, HCVS Monitoring and Control Changes

NRC Requirements & Industry Recommendations	Existing I&C	Change
Other important information includes the status of supporting systems, such as availability of electrical power and pneumatic supply pressure. (NEI 13-02, 4.2.4.1.3)	N/A	Voltmeters (AC and DC) will be installed at the CB UPS to monitor the power availability of the HCVS dedicated battery. Pneumatic supply pressure will be monitored as follows: Local nitrogen bottle pressure gauges will be installed on each back-up pre-installed nitrogen bottle to monitor their availability. Indication will only be available locally (at the bottle). The accumulators of AOV-237AV and the new control valve will be equipped with pressure monitors. Indications of these pressures will be available at both the MCR and the Mechanical ROS.

Table 2-4 below summarizes the locations (in the MCR, at the ROS, or at the UPS) of the instrumentation and controls (I&C) for HCVS operation.

Table 2-4, Summary of HCVS I&C Components and Indication

Location / I&C	MCR	CB UPS	Mechanical ROS
PCIV controls	Existing key-locked override switches on Panel P2 and open/close switches on Vertical Board H (PC-SW-CS(233AV) and PC-SW-CS(237AV)) Powered from CB UPS.	None	None, except piping to supply nitrogen to the new 4-way solenoid for PC-AOV-237AV.
PCIV position indicators	Existing indicating lights on VBD H Powered from CB UPS.	None	None

Table 2-4, Summary of HCVS I&C Components and Indication

Location / I&C	MCR	CB UPS	Mechanical ROS
Control valve controls	PC-AOV-AO32 key-locked switch on Panel P2 to be replaced, as AO32 will be replaced. Powered from CB UPS.	None	None, except piping to supply nitrogen to the new 4-way solenoid for PC-AOV-AO32.
Control valve position indication	PC-AOV-AO32 position indication (light on Panel P2) to be replaced. Powered from CB UPS.	None	New install. Powered from CB UPS.
Containment (DW and WW) pressure transmitters	Existing Drywell Pressure from PC-PT-512A, -B; PC-PT-4A1, -4B2; Torus Pressure on PC-PT-30A, -30B; Recorded on Panels 9-3 or 9-4. Powered from CB UPS.	None	None
Suppression Pool Level	Existing on PC-DPT-3A1, -3B1. Powered from CB UPS.	None	None
Effluent Temperature Monitor	New install. Powered from CB UPS.	None	None
Effluent Radiation Monitor	RMA-RE-27 indication on Panel 9-11 to be replaced. Powered from CB UPS.	None	None
Effluent Pressure Monitor	PC-PS-20 to be replaced by a pressure transmitter. Powered from CB UPS.	None	None
Accumulator pressure monitors	IA-PS-3 is replaced by a pressure transmitter. A new pressure transmitter is added to the AOV-237AV accumulators (in order to know when to use the Mechanical ROS). Powered from CB UPS.	None	New install. Accumulator pressure for valves PC-AOV-237AV and PC-AOV-AO32 to be indicated.
Pneumatic motive force controls for AOVs (manual ball valves)	None (located at the Mechanical ROS).	None	New install – not powered from UPS (mechanical system), normally not needed before 24 hours.

Table 2-4, Summary of HCVS I&C Components and Indication

I&C \ Location	MCR	CB UPS	Mechanical ROS
Nitrogen bottle availability (analog pressure gauges)	None (located at the Mechanical ROS).	None	New – not powered from UPS (mechanical system), normally not needed before 24 hours.
UPS Power availability status	None (located at the CB UPS).	New install	None
Power transfer switch for CB UPS	None (Transfer switch located at the CB UPS).	New install	None
Power transfer switch for MOV UPS	None (located at the MOV UPS which is at, or near, MCC-RA).	New install; at or near MCC-RA in Reactor Building	None
RPV Pressure	Currently available with RFC-PI-90A, B, C.	None	None
Suppression Pool Temperature	Existing PC-TE-1A to -1H and -2A to -2H. Recorded on PC-TR-24 and PC-TR-25 in MCR Vertical Board J. Powered from CB UPS.	None	None
Argon purging in process indicators (flow monitor and pressure transmitter)	New install. Powered from CB UPS.	None	None
Argon purging SOV	New install. Powered from CB UPS.	None	None

The revised OIP addresses the Order requirements for monitoring of HCVS and includes:

- Primary and secondary monitoring and control locations,
- Redundant electrical power supplies for monitoring and system control,
- Manual methods to operate HCVS,
- The means to monitor HCVS pressure, temperature, process radiation, pneumatic supply pressure, electrical power supply availability, suppression pool level, suppression pool temperature, nitrogen bottle pressure, argon purging mechanism and valve position indication.

The CNS OIP provides a description of monitoring and control that, pending resolution of open items, appears to be consistent with the guidance found in NEI 13-02, endorsed, in part, by

JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. 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, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.

Open Item: Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.

3.2.2.11 Component Reliable and Rugged Performance

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

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

Page 32 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, will be designed/analyzed to conform to the requirements consistent with the applicable design codes (e.g., Non-safety, Cat 1, SS and 300# ASME or B31.1, NEMA 4, etc.) for the plant and to ensure functionality following a design basis earthquake.
>
> A THPV system was originally installed to satisfy the requirements of Generic Letter 89-16. The modifications associated with the THPV system were performed under the provisions of 10CFR50.59, and thus the CNS THPV was designed, analyzed, and implemented consistent with the design basis of the plant. In addition, the THPV section upstream of the rupture disk was designed and installed per USAS B31.1.0 – 1967 Edition, as explained in DC 91-041

(Reference 34 [of the OIP]). Therefore, this code will be used for piping design and installation. HCVS piping located downstream of the PC-AOV-237AV will be classified for Seismic II/I requirements.

The current design will be evaluated to confirm that the existing system, coupled with the new HCVS line, 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, total integrated dose radiation for the Effluent Vent Pipe and HCVS ROS location.

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. The equipment will be qualified seismically (IEEE 344), environmentally (IEEE 323), and EMC (per RG 1.180). These qualifications will be bounding conditions for CNS.

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.

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

3.2.3 Beyond Design Basis External Event Venting

3.2.3.1 First 24-Hour Coping

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

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

Page 34 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. Immediate operator actions can be completed by operators from the MCR, except the transfer of power from Division I AC power to the MOV-dedicated UPS, which will be performed at or near the MCC-RA in the Reactor Building. If needed, supply of nitrogen to the AOVs' 4-way SOVs could be completed from the ROS. Actions will include remote-manual initiation, except the action of transferring MOV-233MV power. The operator actions required to open a vent path are as described in Table 2-1 [of the OIP].
>
> Remote-manual is defined in this report as a non-automatic power operation of a component and does not require the operator to be at or in close proximity to the component. No other operator actions are required to initiate venting under the guiding procedural protocol.
>
> The HCVS will be designed to allow initiation, control, and monitoring of venting from the MCR. Monitoring of the pneumatic supplies for the AOVs, monitoring of the position of the vent control valve, and control of AOVs PC-AOV-237AV and PC-AOV-AO32 will also be available at the Mechanical ROS as part of the response to this Order. Both locations minimize plant operators' exposure to adverse temperature and radiological conditions and are protected from hazards assumed in Part 1 of this OIP.

This scenario credits anticipatory venting at t=8 hours and anticipates cycling of the control valve PC-AOV-AO32. Therefore, PCIVs PC-MOV-233MV and PC-AOV-237AV are expected to be opened only once and left open during the first 24 hours of mitigation. Valve PC-AOV-237AV currently has two accumulators which provide sufficient back up air to operate the valve once and compensate for assumed leakage for 24 hours. Valve PC-AOV-AO32 will be cycled to control anticipatory venting. The new accumulator that will support operation of the new PC-AOV-AO32 will be sized for eight valve cycles. As per industry white paper HCVS-WP-02 "Hardened Containment Vent System Cyclic Operations Approach" (Reference 24[of the OIP]), a generic number of 8 wetwell cycles or 12 drywell cycles within the first 24 hours was deemed reasonable. Sizing the accumulator for 8 venting cycles is conservative in regards to the results contained in the September 2014 MAAP analysis to support the Cooper FLEX strategy (Reference 44 [of the OIP]). In this analysis, strategies with the vent continuously open (no cycle), or with one cycle or two cycles only, are sufficient to maintain Torus pressure between 15 and 30 psia and the suppression pool water temperature below 240°F. The detailed design of CNS HCVS will determine the final number of required valve cycles for the first 24 hours and the size of the initial stored motive air/gas that is required to support the number of valve cycles.

OPEN ITEM 10 [from the OIP]: Determine the number of required valve cycles during the first 24 hours. Size the electrical and pneumatic supplies accordingly.

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: Control valves and/or PCIVs are operated in accordance with EOPs/SOPs to control containment pressure. Controlled venting will be permitted in the revised EPGs and associated implementing EOPs. Anticipatory Venting will be permitted, and the vent line will be kept open (or cycled) until 24 hours in the event. A key-lock switch permissive circuit without any automatic controls will allow the containment isolation valves to be opened regardless of existing containment isolation signals.

ii. Passive: Inadvertent actuation protection is provided by the current circuitry associated with the containment isolation valves used to operate the HCVS. The containment isolation valves can be opened with key-lock switches in the MCR, as directed by applicable procedures.

The CNS 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. The licensee has identified the need to determine the number of required valve cycles during the first 24 hours. Other 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 a determination of the number of required valve cycles during the first 24 hours.

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 35 of the OIP states the following:

> After 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 per NEI 12-06 that minimize personnel exposure to adverse conditions for HCVS initiation and operation. Connections will be pre-engineered quick disconnects to minimize manpower resources.
>
> If the station power is not restored after 24 hours, power to the HCVS Distribution Panel will be provided directly by a FLEX DG (bypassing the UPS battery charger) or by recharging the UPS batteries with a FLEX DG. The transfer switch will be aligned to supply normal AC power to the battery charger during normal operation. During the Beyond Design Basis event, cables will be connected to the receptacles installed on the transfer switch enclosure and connected to the cables from a FLEX DG that will be brought into the Auxiliary Relay Room.
>
> Pneumatic supplies, in the form of portable nitrogen bottles, will be available for connection to provide motive gas to the HCVS.
>
> 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 unit to provide needed action and supplies.

The CNS 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 39 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 water level and core damage conditions. Immediate actions will be completed by operators in the MCR, except the transfer of power from Division I AC power to the MOV-dedicated UPS, which will be performed at or near the MCC-RA in the Reactor Building. Since this action will be performed at the very beginning of the event, water will still be covering the core and no additional radiological conditions will be present at the location. If needed, supply of nitrogen to the AOVs' 4-way SOVs could be completed from the HCVS ROS. Actions will include remote-manual actions, except the action of transferring MOV-233MV power. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this OIP (Table 2-1 [of the OIP]).
>
> As stated in the section on BDBEE Venting, the HCVS will be designed to allow initiation, control, and monitoring of venting from the MCR and will be capable of operation from an ROS to be installed as part of the response to this Order. Both

locations minimize plant operators' exposure to adverse temperature and radiological conditions and are protected from hazards assumed in Part 1 of this OIP. Travel pathways will be reviewed for dose and temperature, and alternate routes may need to be considered to minimize operator exposure to harsh environmental conditions.

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

Control of flammable gases will be performed from the MCR using argon purging, starting the purge toward the end of each cycling and stopping it once the HCVS control valve has been closed.

System control:

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

The CNS 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 the final sizing evaluation for pneumatic N2 supply.

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 40 of the OIP states the following:

> Specifics are the same as for BDBEE Venting Part 2 except:
>
> - A connection point will be provided on the AC side of the battery charger in the CB UPS to accept input from a FLEX DG to relieve the battery after the initial 24 hours period.
> - 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.
>
> OPEN ITEM 11 [in the OIP]: Evaluate the impact of SA environmental conditions for post-24 hour actions supporting the implementation of power and pneumatic supplies.
>
> 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 unit to provide needed action and supplies.

The CNS 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 the final sizing evaluation for pneumatic N2 supply.

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 42 of the OIP states the following:

<u>First 24 hours Pneumatic Power Supply:</u>

Existing and newly installed accumulator tanks with back-up portable N_2 bottles will provide sufficient motive force for all HCVS valve operation and will provide for multiple operations of the PC-AOV-AO32 vent valve.

The existing installed pneumatic supplies (accumulators) for PC-AOV-237AV are currently sized to support venting for 24 hours in a BDBEE with or without core damage. The accumulator to be installed for PC-AOV-AO32 will be sized to support venting for 24 hours in a BDBEE with or without core damage.

<u>First 24 hours Electric Power Supply:</u>

Containment integrity is initially maintained by permanently installed equipment. All containment venting functions will be performed from the MCR or ROS, except for transferring MOV-233MV power from Division I AC to the MOV-dedicated UPS located in the Reactor Building elevation 958'-3", at or near the MCC-RA. Venting will require support from the HCVS installed UPS batteries, UPS battery charger, and pneumatic supply. This installed equipment will provide a minimum of 24 hour operation. Connection points will be provided.

All DC and AC power to support HCVS venting will be provided by two dedicated UPS systems (i.e., the CB UPS and MOV-dedicated UPS) with dedicated UPS batteries to support 24 hours of operation. Existing safety-related station batteries will provide sufficient electrical power for RCIC operation. Before station batteries are depleted, portable FLEX diesel generators, as detailed in the response to Order EA-12-049, will be credited to charge the station batteries and maintain DC bus voltage.

The UPS to be installed will provide at least 24 hours of power supplies and support venting for 24 hours in a BDBEE with or without core damage. The proposed location for the UPS is the far end of the Control Building corridor at the 903'-6" level. This location is proposed based on the seismic class of the Control Building and being above the design basis flood level. The relative absence of other safety-related equipment in that area is also a positive feature. Additionally, this location is in relatively close proximity to both the Control Room and anticipated connection points for FLEX power sources. During the final design evaluation for NFPA 805 Fire PRA compatibility of this new design must be evaluated as well as the effects of an additional combustible and heat source to the area. Floor loading requires an engineered foundation to support the weight of the new equipment. As described in the section, "Power and Pneumatic Supply Sources," the Control Building UPS will consist of a bank of 60 battery cells providing 120VDC powering a 4kW inverter, which supplies alternate HCVS 120VAC power, and a 120VAC Distribution Panel. The battery of choice is a sealed cell (or voltage regulated lead acid - VRLA) due to its minimal hydrogen generation. The HCVS has no tie to the station batteries 125 DCA, 125 DCB, 250VDCA or 250VDCB.

Note that PC-MOV-233MV will be powered by a separate alternate power supply. This alternate supply will consist of a UPS (charger, battery, and inverter) and transfer switch at or near MCC-RA. The transfer switch will provide proper separation of the safety-related control and power circuits for PC-MOV-233MV. The UPS will provide 480 VAC three phase power for PC-MOV-233MV, and will be sized to provide three operating cycles of the valve during the 24 hour period before FLEX power or offsite power is restored.

See Sketch 1 of Attachment 3 for a 1-line sketch of the UPS system and PC-MOV-233MV alternate power system.

<u>Post-24 hours Pneumatic Power Supply:</u>

After 24 hours, pneumatic supply would be provided by portable nitrogen bottles. Pre-staged and pre-connected nitrogen bottles will be available for use in the Mechanical ROS. Additional nitrogen bottles will be stored on-site (potentially in the FLEX storage building) to substitute depleted bottles in the ROS and replenish pneumatic power supply if needed. FLEX storage buildings locations are defined in Reference 28 (FLEX OIP).

<u>Post-24 hours Electric Power Supply:</u>

If the station power is not restored after 24 hours, power to the HCVS Distribution Panel will be provided directly by a FLEX DG (bypassing the UPS battery charger) or by recharging the UPS batteries with a FLEX DG. The transfer switch will be aligned to supply normal AC power to the battery charger during normal operation. During the Beyond Design Basis event, cables will be connected to the receptacles installed on the transfer switch enclosure and connected to the cables from a FLEX DG that will be brought into the Auxiliary Relay Room.

New 4-way SOVs associated with AOVs:

In order to have pneumatic supply of nitrogen after 24 hours, and also to prevent failure of the HCVS due to failure of the solenoid valves to actuate PC-AOV-237AV and PC-AOV-AO32, 4-way SOVs will be newly installed for these AOVs. Failure of the solenoid valves means that alternate AC power and/or alternate pneumatic motive force has been lost. The 4-way solenoids allow these AOVs to be shifted by pneumatic motive force with the nitrogen from the Mechanical ROS, without power to the solenoid operator. The newly installed 4-way solenoids will be located in the torus area of the associated AOVs, and the piping for the nitrogen supply will go from the 4-way solenoids to the Mechanical ROS.

The CNS 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 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 44 of the OIP states the following:

> The same support functions that are used in the BDBEE scenario would be used for severe accident venting.
>
> Similar to the BDBEE scenario, the UPS will provide power for the first 24 hours. After 24 hours however, the power to the UPS battery chargers will either be switched to the FLEX generators evaluated for SA capability or a dedicated FLEX DG.
>
> Similar to the BDBEE scenario, nitrogen bottles that will be located outside of the Reactor Building in the FLEX storage building will be available to tie-in supplemental pneumatic sources if the nitrogen bottles located in the Mechanical ROS become depleted.
>
> Refer to "Part 2 - Hydrogen" [in the OIP] to find a description of the approaches used to prevent the accumulation of flammable gases to support venting operations.

The CNS 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 the final sizing evaluation for pneumatic N2 supply.

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 46 of the OIP states the following:

> Deployment pathways for compliance with Order EA-12-049 are acceptable without further evaluation needed except in areas around the Reactor Building or in the vicinity of the HCVS piping. Deployment in the areas around the Reactor Building or in the vicinity of the HCVS piping will allow access, operation and replenishment of consumables with the consideration that there is potential Reactor Core Damage and HCVS operation.
>
> Venting actions using portable equipment include the following:
>
> - Replenishment of pneumatic supplies: After the first 24 hours, the current strategy consists in using portable nitrogen bottles, pre-connected at the Mechanical ROS, in order to provide pneumatic motive force to PC-AOV-237AV and PC-AOV-AO32. Additional portable nitrogen bottles could be brought to the ROS as needed. The on-site location of these nitrogen bottles is an Open Item (Open Item 4 [in the OIP]). Most likely the additional nitrogen bottles would be stored in a FLEX storage building. If not, the nitrogen bottles would need to be stored in a rugged structure protected from all applicable screened-in hazards and located such that operator exposure to radiation and occupational hazards will be minimized, to meet the requirements identified in NEI-12-06 section 11 for screened in hazards. Off-site supplies would relieve the on-site supplies after about 72 hours in the event. The effect of the vent operation on deployment operations is an Open Item (Open Items 2 and 11 [in the OIP]).
>
> - Repowering the UPS system: After the first 24 hours, the HCVS Distribution Panel will be provided directly by a FLEX DG (bypassing the UPS battery charger) or by recharging the UPS batteries with a FLEX DG. The transfer switch will be aligned to supply normal AC power to the battery charger during normal operation. During the Beyond Design Basis event, cables will be connected to the receptacles installed on the transfer switch enclosure and connected to the cables from a FLEX DG that will be brought into the Auxiliary Relay Room. The connection would occur inside the Control Building far from the HCVS piping (on the opposite side of the plant site). Therefore, the connections of power sources should not be affected by the operation of the HCVS. The deployment of these power sources should take into account the operation of the HCVS and should preclude operators from coming in the vicinity of the Reactor Building or the HCVS piping.

The CNS 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: Provide 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 PROGRAMMTIC 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 50 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 SA defined in NRC Order EA-13-109 and the hazards applicable to the site per Part 1 of this OIP.
- Routes for transporting portable equipment from storage location(s) to deployment areas will be developed as the response details are identified and finalized. The identified paths and deployment areas will be accessible during all modes of operation and during SAs.

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 CNS' 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.

The procedures should state that "use of the vent may impact NPSH."

Licensees will establish provisions for out-of-service requirements of the HCVS and compensatory measures. The following provisions will be documented in a controlled document:

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

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

- If for up to 30 days, the primary and alternate means of HCVS operation are 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 be 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.

OPEN ITEM 12 [in the CNS OIP]: Determine the control document for HCVS out of service time criteria.

The CNS 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. The licensee identified the need to determine the control document for HCVS out of service time criteria.

Open Item: Make available for NRC audit the control document for HCVS out of service time criteria.

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 50 of the OIP states the following:

> Personnel expected to perform direct execution of the HVCS 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 (SAT) process.
>
> In addition, (per Reference 10 [of the OIP] (NEI 12-06)) all personnel on-site will be available to supplement trained personnel [applies only to FLEX].

The CNS 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 52 of the OIP states the following:

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

The CNS 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 52 of the OIP states the following:

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

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

Table 4-1 [from 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) After restoration of any breach of system boundary within the buildings
Validate the HCVS operating procedures by conducting an open/close test of the HCVS control logic from its control panel and ensuring that all interfacing system valves move to their proper (intended) positions.	Once per every other operating cycle

The CNS 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 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
2.	Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.	Section 3.2.2.3
3.	Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	Section 3.2.2.10
4.	Make available for NRC staff audit a determination of the number of required valve cycles during the first 24 hours.	Section 3.2.3.1
5.	Make available for NRC audit the control document for HCVS out of service time criteria	Section 3.4.1
6.	Make available for NRC staff to audit, an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during severe accident wetwell venting.	Section 3.2.2.9
7.	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
8.	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

9.	Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger and incorporate 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
10.	Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	Section 3.2.1 Section 3.2.2.4 Section 3.2.3.1 Section 3.2.3.2 Section 3.2.4.1 Section 3.2.4.2 Section 3.2.5.1 Section 3.2.5.2 Section 3.2.6
11.	Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	Section 3.2.2.3 Section 3.2.2.5 Section 3.2.2.9 Section 3.2.2.10

5.0 SUMMARY

As required by Order EA-13-109, the licensee has provided an OIP for designing and installing Phase 1 of a severe accident capable HCVS that provides venting capability from the wetwell during severe accident conditions, using a vent path from the containment wetwell to remove decay heat, vent the containment atmosphere (including steam, hydrogen, carbon monoxide, non-condensable gases, aerosols, and fission products), and control containment pressure within acceptable limits. The OIP describes a HCVS wetwell vent designed for those accident conditions (before and after core damage) for which containment venting is relied upon to reduce the probability of containment failure, including accident sequences that result in the loss of active containment heat removal capability or ELAP.

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

6.0 REFERENCES

1. Order EA-13-109, "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 NPPD to NRC, NPPD's Overall Integrated Plan for Cooper 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 30, 2014 (ADAMS Accession No. ML14189A415).

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, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," (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. 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. Letter from NPPD to NRC, "Nebraska Public Power District's First Six-Month Status Report for Cooper 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 December 19, 2014 (ADAMS Accession No. ML14364A154).

17. 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).

18. Cooper Nuclear Station Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (ADAMS Accession No. ML14007A650).

19. Letter from NPPD to NRC, "Overall Integrated Plan for the Cooper Nuclear 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 28, 2013 (ADAMS Accession No. ML130730488).

20. NUREG-1935, State-of-the-Art Reactor Consequence Analyses (SOARCA) Report (ADAMS Accession No. ML12332A058).

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Date: February 11, 2015

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Sincerely,

/RA/

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Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosure:
Interim Staff Evaluation

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