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

March 25, 2015

Mr. Mark E. Reddemann
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SUBJECT: COLUMBIA GENERATING STATION - INTERIM STAFF EVALUATION RELATING TO OVERALL INTEGRATED PLAN IN RESPONSE TO PHASE 1 OF ORDER EA-13-109 (SEVERE ACCIDENT CAPABLE HARDENED VENTS) (TAC NO. MF4383)

Dear Mr. Reddemann:

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. ML14191A688), Energy Northwest (EN, the licensee), submitted its Overall Integrated Plan (OIP) for Columbia Generating Station (Columbia) in response to Phase 1 of Order EA-13-109. By letter dated December 17, 2014 (ADAMS Accession No. ML14357A069), EN submitted its first six-month status report for Columbia in response to Order EA-13-109. Any changes to the compliance method will be reviewed as part of the ongoing audit process.

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

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

Sincerely,

Mandy K Halter

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

Docket No. 50-397

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

ENERGY NORTHWEST

COLUMBIA GENERATING STATION

DOCKET NO. 50-397

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 (WW) 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 NRC staff's review, as documented in this interim staff evaluation (ISE) is to provide an interim evaluation of the Overall Integrated Plan (OIP) for Phase 1 of Order EA-13-109. Phase 1 of Order EA-13-109 requires that BWRs with Mark I and Mark II containments 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.

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], Energy Northwest (EN, the licensee) provided the OIP for Columbia Generating Station (Columbia) for compliance with Order EA-13-109 Phase 1 for Columbia. The OIP describes the guidance and strategies under development for implementation by June 30, 2017, for the installation of reliable hardened wetwell vents that will not only assist in preventing core damage when containment heat-removal capability is lost, but will also function in severe accident conditions (i.e., when core damage has occurred), pursuant to Order EA-13-109.

2.0 REGULATORY EVALUATION

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

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

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

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

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

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

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

3.0 TECHNICAL EVALUATION

Columbia is a single unit BWR with a Mark II primary containment system. Energy Northwest's OIP describes an HCVS design that will use an existing wetwell penetration isolated by two primary containment isolation valves (PCIVs). A rupture disc will provide secondary containment isolation valve. The OIP describes the HCVS as an independent system with no interface with other systems. The HCVS effluent will be routed to a point above the reactor building roof.

3.1 GENERAL INTEGRATED PLAN ELEMENTS AND ASSUMPTIONS

3.1.1 Evaluation of Extreme External Hazards

Extreme external hazards were evaluated in the Columbia OIP in response to Order EA-12-049 (Mitigation Strategies) [Reference 15]. In the Columbia ISE relating to Mitigation Strategies [Reference 16], NRC staff documented an analysis of EN's extreme external hazards evaluation. The following extreme external hazards screened in:

- Seismic
- Extreme Cold- Ice Only
- Extreme High Temperature
- Volcanic Hazards

The following extreme external hazards screened out:

- Tornados and Hurricanes - NEI 12-06 Section 7.2.1 contains a screening process to identify whether sites should address high wind hazards as a result of hurricanes and tornados. FSAR 2.1.1.1 states that the reactor is located at 46° 28' 18"North latitude and 119° 19' 58"West longitude. Using NEI 12-06 Figures 7-1 and 7-2, Columbia screens out for both hurricanes and tornados. However, NEI 12-06, Figure 7-2 also indicates the recommended tornado design wind speed for Columbia is 127 mph. NEI 12-06, Section 7.2.1 indicates that plants with tornado wind speeds of less than 130 mph do not need to address tornado hazards (e.g. missile impact) impacting FLEX deployment. Therefore, Columbia screens out for tornado missile impact.

- External Flooding - The current licensing basis identifies Columbia as a dry site.

3.1.2 Assumptions

On page 8 of the Columbia OIP, EN adopted a set of generic assumptions associated with Order EA-13-109 Phase 1 actions. The NRC staff determined that the set of generic assumptions appear to establish a baseline for HCVS evaluation consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable method to implement the requirements of Order EA-13-109.

The NRC staff reviewed the Columbia plant-specific HCVS related assumptions:

PLT-1. The following building descriptions are taken from Columbia's Final Safety Analysis Report (FSAR).

Section 1.1

The containment consists of primary and secondary containment systems. The primary containment structure is a free-standing steel pressure vessel which contains both a drywell and a suppression chamber (wetwell). The secondary containment structure is composed of the reactor building, which completely encloses primary containment.

2.2.3.1 Determination of Design Basis Events

Energy Northwest has investigated the resistance of plant structures to explosions. The reactor building is a reinforced-concrete structure up to the refueling floor and is designed to withstand the worst probable combination of wind velocity and associated pressure drop due to a design-basis tornado. A differential pressure of 3 psi between the exterior and interior of the building is also considered in the design.

Section 3.2, Classification of Structures, Components, and Systems

Table 3.2-1Equipment Classification

46. Buildings	Safety Class	Quality Class	Seismic Category	notes
Reactor building	2	I	I	
Radwaste/control building	3/G	I/II	I/II	33
Diesel generator building	3	I	I	

Note 33. Those portions of the radwaste and control building that house systems or components necessary for safe shutdown of the reactor are designed to Quality Class I and Seismic Category I requirements. Those portions of the radwaste building housing equipment containing significant quantities of radioactive material are designed to Seismic Category I requirements.

Section 3.2.3.2.1 Definition of Safety Class 2

Safety Class 2 applies to those structures, systems, and components (SSC), other than service water systems that are not Safety Class 1, but are necessary to accomplish the safety function of:

a. Inserting negative reactivity to shut down the reactor,
b. Preventing rapid insertion of positive reactivity,
c. Maintaining core geometry appropriate to all plant process conditions,
d. Providing emergency core cooling,
e. Providing and maintaining containment, and
f. Removing residual heat from the reactor and reactor core.

Section 3.2.3.3.1 Definition of Safety Class 3

Safety Class 3 applies to those SSCs that are not Safety Class I or Safety Class 2 that is relied upon to accomplish a nuclear safety function.

Section 3.2.3.4 General Class G, Structures, Systems, and Components

3.2.3.4.1 Definition of General Class Structures, Systems, and Components

A boiling water reactor (BWR) has a number of SSCs in the power conversion or other portions of the facility which have no direct safety function but which may be connected to or influenced by the equipment within the safety classes defined above. Such SSCs are designated as General Class G. For example, portions of the service water systems, the turbine generator auxiliaries, and portions of the heating, ventilating, and air conditioning (HVAC) systems are designated as having no safety classification.

Section 3.3.2 TORNADO LOADINGS

3.3.2.3 Additional Design Features

Except for the steel superstructure atop the refueling floor, the reactor building remains sealed through the tornado event and a differential pressure of 0.9 psi across the exterior and interior is bounded by the design. All other Seismic Category I structures are provided with adequate openings to relieve a differential pressure of 0.9 psi in 3 seconds or are designed to withstand an external pressure drop of 0.9 psi.

The structural steel frame superstructure atop the refueling floor of the reactor building is designed to withstand the design-basis tornado. However, all the siding and roof decking enclosing the steel superstructure is designed for a maximum differential pressure of approximately 0.5 psi. The siding and girts are designed to blow off the steel frame when a differential pressure of approximately 0.5 psi is exceeded. The roof decking and roof purlins are designed to blow off the steel frame when a differential pressure of approximately 0.5 psi is exceeded. This value considers the dead weight loading from the roof membrane, roofing insulation, roof decking, and roof purlins. This is ensured by the use of controlled release type fasteners connecting the girts to the columns and roof purlins to the roof trusses.

The design of the reactor building crane and its support system considers tornado effects in addition to normal loads to eliminate the possibility of generating internal missiles which may endanger the primary and secondary containment structures.

Section 3.5.1.4.1

The reactor building exterior walls, up to the refueling floor at elevation 606 foot 10.5 inches are capable of withstanding the impact of the design-basis tornado- generated missiles. These exterior walls are constructed of 4 foot thick reinforced concrete to elevation 471 foot 0 inches which is 30 feet above plant finish grade. From elevation 471 foot 0 inches to the refueling floor at elevation 606 foot 10.5 inches, the exposed exterior walls are constructed of reinforced concrete, 18 inch minimum in thickness. The reactor building exterior wall thickness from plant grade to the refueling floor at elevation 606 foot 10.5 inches is adequate to prevent design- basis missile penetration and spalling of concrete. The reactor building walls and roof above elevation 606 foot 10.5 inches are constructed of insulated metal siding and insulated metal roof decking erected on a superstructure consisting of a structural steel frame.

The radwaste and control building exposed exterior concrete walls and roofs are designed to withstand the effects of the design-basis tornado-generated missiles. The exterior walls that house safety-related equipment have a minimum thickness of 2 feet.

The diesel generator building is designed to withstand the effects of tornado-generated missiles. The exposed exterior walls of the structure are constructed of reinforced concrete with a minimum thickness of 2 foot 8 inches. The roof has a minimum thickness of 1 foot 6 inches. The thicknesses of walls and roof are sufficient to withstand the effects of the design-basis tornado-generated missiles.

PLT-2. A Class IE, 24-V battery system dedicated to the HCVS electrical loads consisting of batteries, a battery charger, 24-V de distribution panels, wiring, cables and raceways will be installed. Sketch 1 in the OIP shows the preliminary layout of this system. The batteries will be located in Room C215, the Division 2 Battery Room and the charger will be located in Room C213, the Reactor Protection System Room. Both are located in the radwaste (RW) building and connected to power panel E-PP-SA (Division 2). The battery sizing will sustain operation for a minimum of 24 hours with no operator action. After 24 hours, supplemental power will be available. The hydrogen generation as a result of the addition of these batteries will be addressed.

PLT-3. A dedicated nitrogen bottle rack located in diesel generator (DG) building room D113 will provide the motive force for the air operated valves. The nitrogen supply will sustain operation for a minimum of 24 hours with no operator action and have a provision for the connection of a back-up pneumatic source. After 24 hours, a portable air compressor can be set-up outside the DG building and connected by hose to a fitting in the HCVS nitrogen bottle rack.

PLT-4. Instrumentation equipment will be purchased as Augmented Quality. The equipment will be capable of operating in the thermal and radiological environment for the location of the equipment for at least 7 days without significant operator actions.

PLT-5. Sketch 3 in the OIP shows the preliminary WW vent line. Valves HCV-V-1, 2 and 7 are pneumatically operated and are normally closed (NC), fail closed (FC) valves. These valves are primary and secondary containment isolation valves and categorized as locked closed (LC) valves. They will have a local hand wheel operator to be used during maintenance which will also be LC. As LC containment isolation valves, they are not required to receive automatic closure signals. The valves will be operated from the MCR [main control room] using key locked manual switches (NEI13-02, Section 4.2.1). The solenoid pilot valves (SPV) for these valves will be in a lockable cabinet or cage to control access and are part of the ROS [remote operating station].

The addition of this vent line introduces a potential for a secondary containment bypass leakage path. The resolution of this concern will be addressed in the first 6-month update of the HCVS OIP. ...

PLT -6. The HCVS batteries will be installed as Class 1 E in a Seismic Category I battery rack.

PLT -7. WW piping will be sized to vent 1% of rated thermal power with a 2% uprate to a power of 3556 MWt. The piping will also be sized to support anticipatory venting and pass 80,000 lbm/hr at a maximum pressure of 10 psig in the WW.

PLT-8. The WW vent will exit the reactor building (RB) at approximately 166 feet above plant grade level near the southeast comer of the RB and terminate above the parapet wall. The vent pipe is independent from the existing vent path and is located away from any ventilation system intake and exhaust openings or emergency response facilities.

PLT-9. The Columbia OIP for Mitigating Strategies, Revision I, dated February 28, 2014, Maintain Containment BWR Installed Equipment Phase 1, identifies that the following essential instrumentation will be available:

Drywell Pressure (CMS-PR-1)
Drywell Temperature (CMS-TI-5)
Suppression Pool (Wetwell) Pressure (CMS-PR-3)
Suppression Pool Level (CMS-LR-3)
Suppression Pool Temperature (SPI'M-TI-5)

This section also states that loads on the station batteries will be available for at least 10 hours (note 1).

PLT -10. The Columbia OIP for Mitigating Strategies, Revision 1, dated February 28, 2014, General Integrated Plan Elements states:

A MAPP analysis and resulting time line will establish the necessary actions that will be taken to protect containment. (O1-FLEX-09) GOTHIC calculations will evaluate the effects of a loss of HVAC on the plant response. Areas of the plant requiring access by personnel will be evaluated to ensure conditions will support the actions (O1-FLEX-10)

PLT -11. Sketch 2 [of the OIP], Plant Layout, shows the relationship of the venting equipment and pathways in regards to the ROS.

Notes:

1. The Columbia OIP for Mitigating Strategies, Revision I, dated February 28, 2014, General Integrated Plan Elements Open Items - sequence of Events states:

   The [station blackout] SBO/ELAP procedure will require all load shed actions to be completed in one-hour. These load shed actions will be validated to ensure they can be completed within this time limit. (0I-FLEX-12) (This 0I has been changed because the existing one-hour procedural limit will be maintained. This 0I has also been closed because the changed action has been completed.)

Page 4 of the first 6 month update to the OIP states the following:

PLT-5 Identified three valves, HCV-1, 2, and 7. HCV-V-7 has been replaced by a rupture disc. Energy Northwest is eliminating valve HCV-V-7 and adding a rupture disk HCV-RD-54 to prevent secondary containment bypass leakage. As a result a separate nitrogen supply will be added for use in rupturing the disk if anticipatory venting is to be performed. This will be a manual action in the area of the remote operating station. To prevent inadvertent operation of the WW HCV, instead of the solenoid pilot valves being located in a locked cabinet, the remote operating station will have lockable pneumatic supply valves. A new Sketch 3 is attached.

PLT-7 WW piping will be sized to vent 1% of rated thermal power with a 17% uprate to a power of 4079 MWt. The piping will also be sized to support anticipatory venting and pass 80,000 lbm/hr at a maximum pressure of 10 psig in the WW.

The NRC staff determined that the plant specific assumptions for Columbia do not appear to create deviations from the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable method to implement the requirements of Order EA-13-109. In association with assumption PLT-5, the licensee identified the potential for secondary containment bypass leakage because HCVS valves are not primary containment isolation valves with automatic closure signals. In the first six month update to the OIP [Reference 19], the licensee addressed the potential for secondary containment bypass leakage by replacing the third HCVS in-line valve, HCV-V7, with a rupture disk. This change in the compliance method appears to be in accordance with the guidance found in NEI 13-02.

3.1.3 Compliance Timeline and Deviations

Page 4 of the OIP states the following:

> Compliance will be attained for Columbia Generating Station (Columbia) with no known deviations to the guidelines in JLD-SG-2013-02 and NEI 13-02 for each phase as follows:
>
> - Phase 1 (WW): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for 2Q2017.
>
> - Phase 2 (DW): Information to be added by December 30, 2015.
>
> If deviations are identified at a later date, then the deviations will be communicated in a future 6-month update following identification.

Columbia's implementation schedule appears to be in accordance with the requirements of the Order at this time. Neither EN nor the NRC staff has identified any deviations. Therefore, the NRC staff concludes that it appears Columbia 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 as an acceptable method to implement the requirements of Order EA-13-109.

Regarding other deviations, EN did not identify any. However, the NRC staff has identified one deviation from the guidance found in NEI 13-02, endorsed, in part by JLD-ISG-2013-02 as an acceptable method to implement the requirements of Order EA-13-109. The deviation pertains to the leak testing frequency of the HCVS and is discussed further in section 3.4.4, "Maintenance," of this ISE.

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 11 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]. An HCVS ELAP failure evaluation table, which shows alternate actions that can be performed, is included in Attachment 4 [of the OIP].

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

The NRC staff reviewed the three cases contained in the SOE timeline [Attachment 2 of the OIP] and determined that the three cases appropriately bound the conditions for which the

HCVS is required. These cases include: successful FLEX implementation with no failure of reactor core isolation cooling (RCIC); late failure of RCIC leading to core damage; and failure of RCIC to inject at the start of the event. The timelines accurately reflect the progression of events as described in the Columbia Mitigation Strategies OIP [Reference 17], SECY-12-0157 [Reference 10], and State-of-the-Art Reactor Consequence Analyses (SOARCA) [Reference 18].

The NRC staff reviewed the licensee discussion of time constraints on page 12 of the OIP and confirmed that the time constraints identified appear to be appropriately derived from the time lines developed in Attachment 2 of the OIP, consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02. 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. Specific details not available at this time for NRC staff review include: the location of the ROSs (licensee identified), the location of portable air compressors (licensee identified), and the location of the portable diesel generators (licensee identified); therefore, the NRC staff has not completed its review.

The NRC staff reviewed the discussion of radiological and temperature constraints on page 12 of the OIP. The licensee identified that accessibility evaluations are required for specific HCVS locations outside the main control room. Until these locations are finalized, the licensee cannot complete evaluations of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment; therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit the location of the ROSs.

Open Item: Make available for NRC staff audit the location of the of the portable air compressor.

Open Item: Make available for NRC staff audit the location of the portable diesel generators.

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 14 of the OIP states the following:

> The following is based on the current design concept for the WW vent. Substantive changes in the current design will be included in future 6-month updates.
>
> The HCVS WW path is designed for venting steam/energy at a nominal capacity of 1% of 3556 MWt which accounts for a potential 2% power uprate above the current licensed thermal power of 3486 MWt thermal power at pressure of 45 psig. This pressure is the lower of the containment design pressure and the primary containment pressure limit (PCPL) value. The WW vent originates from a 12 inch penetration and is increased to a 16 inch pipe which provides adequate capacity to meet or exceed the Order criteria.

Page 4 of the first six month update states the following:

> WW piping will be sized to vent 1% of rated thermal power with a 17% uprate to a power of 4079 MWt. The piping will also be sized to support anticipatory venting and pass 80,000 lbm/hr at a maximum pressure of 10 psig in the WW.

The Columbia OIP describes a vent sized to meet or exceed 1 percent or greater licensed thermal power inclusive of a planned 17 percent power uprate. 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 is not available at this time (licensee identified); therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of uprated licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit.

3.2.2.2 Vent Capacity

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

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

Page 15 of the OIP states the following:

> The 1% value at Columbia assumes that the suppression pool pressure suppression capacity is sufficient to absorb the decay beat 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 Columbia OIP assumes that until decay heat is less than the one percent capacity of the proposed HCVS, the suppression pool must absorb the decay heat generated until the HCVS is able to restore and maintain primary containment pressure below the primary containment design pressure and the PCPL. Analyses confirming that HCVS has the capacity to vent the steam/energy equivalent of one percent of uprated licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit are not available at this time (licensee identified); therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of uprated 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, Section 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 WW vent will originate from 12 inch penetration X-58 at elevation 491 foot-0 inches which will increase to a 16 inch diameter pipe for the remainder of the vent line. The flow path will have three air-operated valves (AOV) that are air-to-open and spring-to-shut. Two of these valves are primary containment isolation valves (PCIV) and the third valve is the secondary containment isolation

valve (SCIV).

PCIVs will be installed as close to primary containment as possible. The line will be run in the abandoned stairwell in the southeast corner of the RB and exit the RB approximately 166 feet above plant grade level where it will penetrate through the RB, secondary containment, running up the south wall to release 3 feet above the parapet wall at approximately elevation 674 foot-2 inches. The vent release will be located near the southeast corner of the RB.

This discharge point is such that the release point will vent away from emergency ventilation system intake and exhaust openings, main control room location, location of HCVS portable equipment, access routes required following a ELAP and BDBEE [beyond-design-basis external event], and emergency response facilities; however, these must be considered in conjunction with other design criteria (e.g., flow capacity) and pipe routing limitations, to the degree practical.

Sketch 2 in the OIP shows the location of the HCVS components outside the MCR. A discussion of the construction of the buildings that contain these components is presented in PLT -1. The WW vent line exits the RB approximately 166 ft above plant grade level. As stated in PLT -1, the siding and girts of the upper portion of the RB are designed to blow off the steel frame when a differential pressure of approximately 0.5 psi is exceeded. The roof decking and roof purlins are designed to blow off the steel frame when a differential pressure of approximately 0.5 psi is exceeded.

The detailed design will address protection from external events as defined by NEI 12-06 and will address changes to this portion of the RB to assure the external portions of the vent line are protected from high wind hazards. (Reference 17, FAQ [frequently asked question] HCVS-04)

The Columbia OIP describes the routing and discharge point of the HCVS that, pending resolution of open items, appear consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions are not available at this time; therefore, the NRC 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, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.

3.2.2.4 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 16 of the OIP states the following:

> A Class 1E, 24-V dc [direct current] system will include a battery, battery charger, distribution panels, and associated wiring, cables and raceways. The battery rack will be Seismic Category I. The battery sizing will sustain operation for a minimum of 24 hours with no operator action. Beyond the first 24 hours, FLEX generators will be used to maintain battery power to the HCVS components.
>
> A dedicated nitrogen bottle rack, located in DG building room D113, will provide the pneumatic force for the air operated valves. An operator is required to line-up the system. The nitrogen supply will be sized to sustain operation for a minimum of 24 hours with no additional operator action. The initial stored motive gas will allow for a minimum of 12 valve operating cycles of the HCVS valves for the first 24 hours. Beyond 24 hours, FLEX portable air compressors will be used to supply pneumatics to the HCVS valves.
>
> 1. The HCVS flow path valves are AOVs which are air-to-open and spring-to-shut. Opening the valves requires energizing a SPV, powered from the dedicated 24-V dc system, to direct the pneumatics to the flow path valves.
>
> 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 report [of the OIP].
>
> 4. All valves that are required to open the flow path are 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 HCVS-03) To support remote manual operation of these valves,

pneumatics supplying the remote manual valves is required to be lined-up by an operator at the bottle rack in the DG building. Any supplemental connections will be pre-engineered to minimize man-power resources and address environmental concerns. Required portable equipment will be reasonably protected from screened in hazards listed in Part 1 of this OIP.

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

The Columbia OIP describes system features such as a dedicated battery and pneumatic supply that, pending resolution of open items, appear to make the system reliable. Specific design details not available at this time include: the final sizing evaluations for HCVS pneumatic supply (licensee identified), the final sizing for HCVS battery/battery charger including documentation of incorporating HCVS into the FLEX DG loading calculations (licensee identified), and documentation of an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment (licensee identified); therefore, the NRC staff has not completed its review.

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

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

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

3.2.2.5 Location of Control Panels

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

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

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

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

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

Order EA-13-109, Sections 1.2.4 and 1.2.5 state that:

> 1.2.4 The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.
>
> 1.2.5 The HCVS shall, in addition to meeting the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.

Page 16 of the OIP states the following:

> The HCVS design allows operating and monitoring the HCVS from the MCR or the ROS in the DG building, Room D113. The MCR location is protected from adverse natural phenomena and the normal control point for Plant Emergency Response actions. The ROS is located in the DG building which is separate from the RW building. As discussed in FAQ HCVS-01, DG building, Room D113, will be evaluated for accessibility, habitability (including environmental and radiological conditions) and communication capability.

The Columbia OIP describes two HCVS control locations for each unit, the ROS and the main control room. EN states that the control room is protected from normal adverse phenomena. However, design details are not available at this time including an assessment of communication between remote operation locations and HCVS operational decision makers (licensee identified), an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment (licensee identified), and descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions; therefore, the NRC staff has not completed its review.

Open Item: Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions.

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

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

3.2.2.6 Hydrogen

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

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

Page 16 of the OIP states the following:

> As is required by EA-13-109, Section 1.2.11, the HCVS must be designed such that it is able to either provide assurance that oxygen cannot enter and mix with flammable gas in the HCVS (so as to form a combustible gas mixture), or it must be able to accommodate the dynamic loading resulting from a combustible gas detonation. Several configurations are available which will support the former (e.g. purge, mechanical isolation from outside air, etc.) or the latter (design of potentially affected portions of the system to withstand a detonation relative to pipe stress and support structures).
>
> NEI White Paper, HCVS-WP-03, Hydrogen/Carbon Monoxide Control Measures, (Reference 25 [in the OIP]) provides several options for the design of an HCVS to address the hazards of combustible gasses. Energy Northwest will adopt one of these options and provide the details of how the Columbia design meets Order Elements 1.2.10 and 1.2.11 in a future 6-month update.

Page 4 of the first 6 month update to the OIP states the following:

> Energy Northwest will use Option number 5 of the NEI White Paper HCV-WP-03, Hydrogen/Carbon Monoxide Control Measures and add a check valve at the discharge end of the vent pipe to address the flammability of combustible gasses.

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, EN has chosen option 5 of NEI White Paper HCV-WP-03 to ensure that the flammability limits of gases passing through the system are not reached. EN has not described strategies to minimize the potential for hydrogen gas migration and ingress into the reactor building or other buildings; therefore, the NRC staff has not completed its review.

Open Item: Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings.

3.2.2.7 Unintended Cross Flow of Vented Fluids

Order EA-13-109, Section 1.2.3 states that:

> 1.2.3 The HCVS shall include design features to minimize unintended cross flow of vented fluids within a unit and between units on the site.

Order EA-13-109, Section 1.2.12 states that:

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

Page 17 of the OIP states the following:

> As seen in Sketch 3 [of the OIP], the HCVS WW vent is designed as a stand-alone system which does not interface with other plant mechanical systems and is independent from the existing vent path. This design eliminates the concern of cross flow of vented fluids. The system will only be used in a BDBEE.

The Columbia OIP describes the HCVS as a stand-alone system which does not interface with other plant systems. This design feature minimizes the potential for unintended cross flow within the unit. This 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.

3.2.2.8 Prevention of Inadvertent Actuation

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

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

Page 17 of the OIP states the following:

> EOP/SAG [emergency operating procedure/severe accident 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. Columbia does not rely on containment accident pressure to maintain NPSH [net positive suction head] for the RCIC pump.
>
> The features that prevent inadvertent actuation of the WW vent are the three vent path valves being operated by key lock switches in the MCR. The ROS, containing the SPVs, will have lockable covers/doors to limit access and inadvertent operation.

The Columbia OIP provides a description of methods to prevent inadvertent initiation that include: procedure controls, two PCIVs in series powered from different divisions, a rupture disk, and keylock switches. This 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.

3.2.2.9 Component Qualifications

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

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

Page 17 of the OIP states the following:

> The HCVS components downstream of the second containment isolation valve are routed in seismically qualified structures. HCVS components that directly interface with the containment pressure boundary will be considered safety-related. The containment system limits the leakage or release of radioactive materials to the environment to prevent offsite exposures from exceeding the guidelines of 10 CFR [Title 10 of the *Code of Federal Regulations*] 50.67. During normal or design basis operations, this means serving as a pressure boundary to prevent release of radioactive material.
>
> Likewise, any electrical or controls component which interfaces with Class 1E power sources will be considered safety-related up to and including appropriate isolation devices such as fuses or breakers, as their failure could adversely impact containment isolation and/or a safety-related power source. The remaining components will be considered Augmented Quality. Newly installed piping and valves will be seismically qualified to handle the forces associated with the safe shutdown earthquake back to their isolation boundaries. Electrical and controls components will be seismically qualified and will include the ability to handle harsh environmental conditions (although they will not be considered part of the site Environmental Qualification 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, and

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

Instrument	**Qualification Method***
HCVS Process Flow	To be added
HCVS Process Radiation Monitor	To be added
HCVS Process Valve Position	To be added
HCVS Pneumatic Supply Pressure	To be added
HCVS Electrical Power Supply Availability	To be added

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

The Columbia OIP describes component qualification methods that, pending resolution of open items, appear to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. Specific details not available at this time include: information regarding the pre-qualification methods of existing and planned instrumentation, which will be used by operators to make containment venting decisions, descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions and design details that confirm existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting; therefore, the NRC staff has not completed its review.

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

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

Open Item: Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.

3.2.2.10 Monitoring of HCVS

Order EA-13-109, Section 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 18 of the OIP states the following:

The HCVS WW vent 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 [General Design Criteria] 19, Control Room/Alternative Source Term (AST). Additionally, to meet the intent for a secondary control location of Section 1.2.5 of the Order, a readily accessible 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 HCVS WW vent will include means to monitor the status of the vent system in both the MCR and the ROS.

The HCVS WW vent will include indications for vent pipe pressure, temperature, and effluent radiation levels and valve position at the MCR. Other important information on the status of supporting systems, such as power source status

> and pneumatic supply pressure, will also be included in the design and located to support HCVS operation. The HCVS WW vent includes existing containment pressure and WW 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 Columbia OIP provides a description of HCVS 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 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 NRC 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, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.

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

3.2.2.11 Component Reliable and Rugged Performance

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

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

Page 19 of the OIP states the following:

> The HCVS downstream of the second containment isolation valve, including piping and supports, electrical power supply, valve actuator pneumatic supply, and instrumentation (local and remote) components, will be designed/analyzed to conform to the requirements consistent with the applicable design codes for the plant and to ensure functionality following a design basis earthquake.
>
> Additional modifications required to meet the Order will be reliably functional at the temperature, pressure, and radiation levels consistent with the vent pipe conditions for sustained operations. The instrumentation/power supplies/cables/connections (components) will be qualified for temperature,

pressure, radiation level, and total integrated dose radiation from the effluent vent pipe.

Conduit design will be installed to Seismic Class 1 criteria. Both existing and new barriers will be used to provide a level of protection from missiles when equipment is located outside of seismically qualified structures. Augmented quality requirements, will be applied to the components installed in response to this Order.

If the instruments are purchased as commercial-grade equipment, they will be qualified to operate under severe accident environment as required by NRC Order EA-13-109 and the guidance of NEI 13-02. The equipment will be qualified seismically (IEEE 344), environmentally (IEEE 323), and be electromagnetic compatible (RG 1.180). These qualifications will be consistent with the applicable design codes for Columbia.

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,/EEE Recommended Practice for Seismic Qualification of Class 1 E 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 Columbia OIP provides descriptions for component reliable and rugged performance 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.

3.2.3 Beyond-Design-Basis External Event Venting

3.2.3.1 First 24-Hour Coping

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

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

Page 21 of the OIP states the following:

> The operation of the HCVS will 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 action is required to line-up pneumatics at the bottle rack. All other operator actions can be completed by Operators from the HCVS control stations which include remote-manual venting. The operator actions required to open a vent path are as described in Table 2-1 [of the OIP].
>
> Remote-manual is defined in this report [the OIP] as a non-automatic power operation of a component and does not require the operator to be at or in close proximity to the component.
>
> Once the pneumatics is made available, the HCVS will be designed to allow initiation, control, and monitoring of venting from the MCR or ROS. These locations minimize plant operators' exposure to adverse temperature and radiological conditions and are protected from hazards assumed in Part 1 of this report [of the OIP].
>
> 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: The HCVS will be operated in accordance with the EOPs to control containment pressure. The HCVS will be designed for 12 open/close cycles under ELAP conditions over the first 24 hours following an ELAP. Controlled venting is permitted in the current EOPs.
>
> ii. Passive: Inadvertent actuation protection is provided by key-locked switches in the MCR and locked covers/doors at the ROS. Manual operators will be secured to prevent inadvertent operation (i.e., chain locked).

The Columbia 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.

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 21 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 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.
>
> Columbia's response to NRC Order EA-12-049 will demonstrate the capability of FLEX efforts to establish an electrical power source which will be used to recharge the HCVS batteries.
> 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 Columbia OIP describes a beyond 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.

3.3.4 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 24 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 RB will be restricted as determined by the RPV [reactor pressure vessel] water level and core damage conditions. Immediate actions will be completed by Operators in the MCR and at the ROS and will include local and remote-manual actions. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this report [of the OIP] (Table 2-1).
>
> Permanently installed power and motive air/gas will be available to support operation and monitoring of the HCVS for 24 hours. Specifics are the same as for BDBEE Venting Part 2.
>
> System control:
>
> i. Active: Same as for BDBEE Venting Part 2.
>
> ii. Passive: Same as for BDBEE Venting Part 2.

The Columbia OIP describes a first 24 hour severe accident coping strategy that, pending resolution of open items, appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. An evaluation of environmental and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment is not available at this time (licensee Identified); therefore, the NRC staff has not completed its review.

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 and 1.2.8 state that:

> 1.2.4 The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.
>
> 1.2.8 The HCVS shall include means to monitor the status of the vent system (e.g., valve position indication) from control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of AC power.

Page 24 of the OIP states the following:

> Specifics are the same as for BDBEE Venting Part 2 except the location and refueling actions for the FLEX DG and portable air compressor will be evaluated for severe accident environmental conditions resulting from the proposed damaged Reactor Core and resultant HCVS vent pathway.
>
> These actions provide long term support for HCVS operation for the period beyond 24 hrs. 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 Columbia OIP describes a greater than 24 hour severe accident coping strategy that, pending resolution of open items, appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. An evaluation of environmental and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment is not available at this time (licensee Identified); therefore, the NRC staff has not completed its review.

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

3.2.5 Support Equipment Functions

3.2.5.1 BDBEE

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

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

Page 26 of the OIP states the following:

> Containment integrity is initially maintained by permanently installed equipment. All containment venting functions will be performed from the MCR or ROS. Venting will not require support from the station's DC power or instrument air systems. A new dedicated battery system will provide sufficient electrical power for HCVS operation for at least 24 hours. Before these batteries are depleted,

> portable FLEX diesel generators, as detailed in the response to Order EA-12-049, will be credited to charge the batteries and maintain HCVS DC bus voltage after 24 hours. A newly installed pneumatic system will provide sufficient motive force for all HCVS valve operation for at least 24 hours and will provide for at least 12 operations of the HCVS valves. Portable air compressors will be available to tie into a fitting at the nitrogen bottle rack and provide the supplemental pneumatic source.

The Columbia OIP describes BDBEE support 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.

3.2.5.2 Severe Accident Venting

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

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

Page 26 of the OIP states the following:

> The same support functions that are used in the BDBEE scenario would be used for severe accident venting.
>
> The HCVS loads are supplied by a dedicated battery and pneumatic supply sized to provide operation for at least 24 hours without additional support. Before these batteries require recharging, a FLEX generator is expected to have been connected to the power supply for the HCVS battery charger. Portable air compressors will be available to tie into a fitting at the nitrogen bottle rack and provide the supplemental pneumatic source.

The Columbia OIP describes a severe accident support equipment functions that, pending resolution of open items, appears to be in accordance with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. An evaluation of environmental and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment is not available at this time (licensee Identified); therefore, the NRC staff has not completed its review.

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.

As described on page 28 of the OIP:

> Deployment pathways for compliance with Order EA-12-049 are acceptable without further evaluation needed except in areas around the RB or in the vicinity of the HCVS piping. Deployment in the areas around the RB or in the vicinity of the HCVS piping will allow access, operation, and replenishment of consumables with the consideration that there is potential reactor core damage and HCVS operation.

The Columbia OIP describes supporting 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 NRC staff has not completed its review.

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

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

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

Summary, Section 3.2:

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

3.3 BOUNDARY CONDITIONS FOR DRY WELL VENT

Summary, Section 3.3:

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

3.4 PROGRAMMATIC CONTROLS, TRAINING, DRILLS AND MAINTENANCE

3.4.1 Programmatic Controls

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

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

Page 31 of the OIP states the following:

> *Program Controls:*
>
> The HCVS venting actions will include:
>
> - Site procedures and programs are being developed in accordance with NEI 13-02 to address use and storage of portable equipment relative to the Severe Accident defined in NRC Order EA-13-109 and the hazards applicable to the site per Part 1 of this OIP.
> - Routes for transporting portable equipment from storage location(s) to deployment areas will be developed as the response details are identified and finalized. The identified paths and deployment areas will be accessible during all modes of operation and during Severe Accidents.
>
> *Procedures:*
>
> Procedures will be established for system operations when normal and backup power is available, and during ELAP conditions.
>
> The HCVS procedures will be developed and implemented following the plants process for initiating or revising procedures and contain the following details:
>
> - appropriate conditions and criteria for use of the HCVS

- when and how to place the HCVS in operation
- the location of system components
- instrumentation available
- normal 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

Licensees will establish provisions for out-of-service requirements of the HCVS and compensatory measures. The following provisions will be documented in Licensee Controlled Specifications (LCS):

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 consecutive 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 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, and
    - Actions initiated to implement appropriate compensatory actions.

The Columbia 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 has identified the need to provide site specific details of the EOPs when available [OIP Attachment 7, Open Item 10].

Open Item: Make available for NRC staff audit site specific details of the EOPs when available.

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 32 of the OIP states the following:

> Personnel expected to perform direct execution of the HCVS will receive necessary training in the use of plant procedures for system operations when normal and backup power is available and during ELAP conditions. The training will be refreshed on a periodic basis and as any changes occur to the HCVS. Training content and frequency will be established using the Systematic Approach to Training (SAT) process.
>
> In addition, (reference 10 [of the OIP]) all personnel on-site will be available to supplement trained personnel.

The Columbia 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 staff 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 32 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 Columbia 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 33 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.

Columbia 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.	Prior to first declaring the system functional
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

Page 6 of the first 6 month update to the OIP modified table 4-1 of the OIP as follows:

Table 4-1 Testing and Inspection Requirements

Description	Frequency	<u>Reason for Change</u>
~~Cycle the HCVS valves and the interfacing system valves not used to maintain containment integrity during operations.~~	~~Once per operating cycle~~	This testing has been deleted because HCV-V-7 has been replaced by a rupture disc to prevent secondary containment bypass

		leakage.
Perform visual inspections and a walk down of HCVS components	~~Once per operating cycle~~ Once every other operating cycle	The frequency of testing is being changed. The accessible components are routinely monitored during operator rounds and will be visually inspected as part of the validation testing every other operating cycle. The new discharge check valve and outside components will be inspected during the testing identified below.
Test the HCVS radiation monitors.	Once per operating cycle	Testing and calibration have been separated. Testing will be performed once per operating cycle.
Calibrate the HCVS radiation monitors.	Once per every other operating cycle	Calibration will be performed every other outage because this is a qualitative instrument.
Leak test the HCVS.	Prior to first declaring the system functional	NO CHANGE
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 validation of the HCVS operating procedures will be tested as specified. However, there are no interfacing valves in this system.
Leak test and stroke the discharge check valve.	Once per every three operating cycles	This testing is added to include the added discharge check valve.

The Columbia OIP describes an approach to maintenance that appears to deviate from 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. Specifically, table 4-1 of the OIP does not include leak testing the HCVS once every three operating cycles and after restoration of any breach of system boundary within the buildings as described in Section 6.2.4 of NEI 13-02.

Open Item: Provide justification for not leak testing the HCVS every three operating cycles and after restoration of any breach of system boundary within buildings.

Summary, Section 3.4:

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

4.0 OPEN ITEMS

This section contains a summary of the open items identified to date as part of the technical evaluation. Open items, whether NRC or licensee identified, are topics for which there is insufficient information to fully resolve the issue, for which the NRC staff requires clarification to ensure the issue is on a path to resolution, or for which the actions to resolve the issue are not yet complete. The intent behind designating an issue as an open item is to highlight items that the NRC staff intends to review further. The NRC staff has reviewed the licensee OIP for consistency with NRC policy and technical accuracy. NRC and licensee identified open items have been identified in Section 3.0 and are listed in the table below.

List of Open items

Open Item	Action	Comment
1.	Make available for NRC staff audit the location of the ROSs.	Section 3.2.1
2.	Make available for NRC staff audit the location of the of the portable air compressor.	Section 3.2.1
3.	Make available for NRC staff audit the location of the portable diesel generators.	Section 3.2.1
4.	Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.	Section 3.2.1 Section 3.2.2.4 Section 3.2.2.5 Section 3.2.2.10 Section 3.2.4.1 Section 3.2.4.2 Section 3.2.5.2 Section 3.2.6

5.	Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of uprated licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit.	Section 3.2.2.1 Section 3.2.2.2
6.	Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	Section 3.2.2.3 Section 3.2.2.5 Section 3.2.2.9 Section 3.2.2.10
7.	Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	Section 3.2.2.4 Section 3.2.6
8.	Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.	Section 3.2.2.4 Section 3.2.6
9.	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
10.	Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings.	Section 3.2.2.6
11.	Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	Section 3.2.2.9
12.	Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.	Section 3.2.2.9
13.	Make available for NRC staff audit site specific details of the EOPs when available.	Section 3.4.1
14.	Provide justification for not leak testing the HCVS every three operating cycles and after restoration of any breach of system boundary within buildings.	Section 3.4.4

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, assuming acceptable resolution of any open items identified here or as a result of licensee alterations to their proposed plans, 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 Energy Northwest to NRC, "Columbia Generating Station, Energy Northwest's Phase 1 Response to NRC Order EA-13-109, Overall Integrated Plan for Reliable Hardened Containment Vents Under Severe Accident Conditions", dated June 30, 2014 (ADAMS Accession No. ML14191A688).

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

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

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

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

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

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

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

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

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

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

13. Interim Staff Guidance 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. 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).

16. Columbia Generating Station - Interim Staff Evaluation And Audit Report Related to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC No. MF0796)(ADAMS Accession No. ML13337A266).

17. Letter from Energy Northwest to NRC, "Columbia Generating Station – Response to NRC Order EA-12-049, Overall Integrated Plan for Mitigating Strategies", dated February 28, 2013 (ADAMS Accession No. ML13071A614).

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

19. Letter from Energy Northwest to NRC, "Columbia - First Six-Month Status Update Report for the Implementation of NRC Order EA-13-109-Overall Integrated Plan for Reliable Hardened Containment Vents Under Severe Accident Conditions", dated December 17, 2014 (ADAMS Accession No. ML14357A069).

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13. Interim Staff Guidance 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. 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).

16. Columbia Generating Station - Interim Staff Evaluation And Audit Report Related to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC No. MF0796)(ADAMS Accession No. ML13337A266).

17. Letter from Energy Northwest to NRC, "Columbia Generating Station – Response to NRC Order EA-12-049, Overall Integrated Plan for Mitigating Strategies", dated February 28, 2013 (ADAMS Accession No. ML13071A614).

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

19. Letter from Energy Northwest to NRC, "Columbia - First Six-Month Status Update Report for the Implementation of NRC Order EA-13-109-Overall Integrated Plan for Reliable Hardened Containment Vents Under Severe Accident Conditions", dated December 17, 2014 (ADAMS Accession No. ML14357A069).

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Date: March 25, 2015

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Sincerely,

/RA/

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Docket No. 50-397

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Interim Staff Evaluation

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