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EA-13-109

December 16, 2015
GO2-15-175

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

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397 ENERGY NORTHWEST'S RESPONSE TO NRC ORDER EA-13-109 – OVERALL INTEGRATED PLAN FOR RELIABLE HARDENED CONTAINMENT VENTS UNDER SEVERE ACCIDENT CONDITIONS PHASES 1 AND 2, REVISION 1.**

References:
1. NRC Order EA-12-050, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents," March 12, 2012
2. NRC Order EA-13-109, "Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions," June 6, 2013
3. Letter GO2-14-107, dated June 30, 2014, from D. A. Swank (Energy Northwest) to the NRC "Energy Northwest's Phase 1 Response to NRC Order EA-13-109 - Overall Integrated Plan for Reliable Hardened Containment Vents under Severe Accident Conditions"

Dear Sir or Madam,

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-050, (Reference 1) which directed Energy Northwest's Columbia Generating Station (Columbia) to have a reliable hardened vent to remove decay heat and maintain control of containment pressure within acceptable limits following events that result in the loss of active containment heat removal capability or prolonged Station Blackout.

On June 6, 2013, the NRC issued Order EA-13-109; (Reference 2) which rescinded the requirements imposed in Section IV and Attachment 2 of Order EA-12-050 and replaced them with the requirements contained in Sections IV and Attachment 2 of Order EA-13-109. Order EA-13-109, Section IV, D.1 and D.2requires all licensees to submit an overall integrated plan (OIP) including a description of how compliance with the Phase 1 and Phase 2 requirements described in Attachment 1 of the Order will be achieved.

For the purpose of compliance with Phase 1 of NRC Order EA-13-109, Energy Northwest plans to install a severe accident capable wetwell vent at Columbia.

For the purpose of compliance with Phase 2 of NRC Order EA-13-109, Energy Northwest plans to utilize severe accident water addition and severe accident water management to inject water into the reactor pressure vessel and control suppression pool level to ensure the Phase 1 wetwell vent will remain functional for the removal of decay heat as described in Attachment 2, Section B.(2) of reference 2.

The attachment to this letter contains a synopsis of the significant changes made to the compliance method for the Phase 1 overall integrated plan (OIP) submitted on June 30, 2014, and updated on December 17, 2014, and June 30, 2015, as they relate to the current submittal contained in Enclosure 1. This attachment and the information provided in the Phase 1 portion of Enclosure 1 meets the requirement for a 6-month status report of Phase 1 activities due December 31, 2015.

Subsequent 6-month updates will be a combined Phase1 and Phase 2 submittal.

Enclosure 1 to this letter contains Energy Northwest's current OIP initially submitted in Reference 3 which has been updated to include Phase 2 information.

Enclosure 2 contains Energy Northwest's initial responses to the requests for additional information contained in the NRC's "Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents)," dated March 25, 2015.

Compliance with Reference 2 supersedes any and all actions or commitments associated with Reference 1. Any significant changes to the Phase 1 or Phase 2 portions of the OIP will be communicated to the NRC staff in subsequent combined six-month status reports.

There are no new or revised regulatory commitments contained in this letter. If you have any questions or require additional information, please contact Ms. L. L. Williams at (509) 377-8148.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on the 15th day of December, 2015

Respectfully,

A. L. Javorik
Vice President, Engineering

Attachment: Synopsis of the Changes Made to the Phase 1 Overall Integrated Plan and 6-month Update Reports for the Implementation of NRC Order Ea-13-109

Enclosures:
1. Phase 1 and Phase 2 Overall Integrated Plan for Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions
2. Response to the Phase 1 Request for Additional Information

cc: NRC Region IV Administrator
NRC NRR Project Manager
NRC Senior Resident Inspector/988C
CD Sonoda – BPA/1399 (email)

ENERGY NORTHWEST'S RESPONSE TO NRC ORDER EA-13-109 – OVERALL INTEGRATED PLAN FOR RELIABLE HARDENED CONTAINMENT VENTS UNDER SEVERE ACCIDENT CONDITIONS PHASES 1 AND 2, REVISION 1

ATTACHMENT

COLUMBIA GENERATING STATION, DOCKET NO. 50-397

SYNOPSIS OF THE CHANGES MADE TO THE PHASE 1 OVERALL INTEGRATED PLAN AND 6-MONTH UPDATE REPORTS FOR THE IMPLEMENTATION OF NRC ORDER EA-13-109

1.0 Introduction

As stated in the cover letter, Enclosure 1 provides an updated overall integrated plan (OIP) for Phases 1 and 2 of NRC Order EA-13-109. This attachment only contains a synopsis of the significant differences between the original Phase 1 OIP, the previous 6-month updates, and the current combined OIP.

2.0 Milestone Accomplishments

See Part 5 of the combined OIP.

3.0 Milestone Schedule Status

See Part 5 of the combined OIP.

4.0 Changes to Compliance Method

<u>First Change</u>

Original Phase 1 OIP Submittal

Part 1: General Integrated Plan Elements and Assumptions

Key Site assumptions to implement NEI 13-02 HCVS Actions.

Plant Specific HCVS Related Assumptions/Characteristics:

PLT-5 Sketch 3 shows the preliminary WW [wetwell] 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 (NEI 13-02, 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 [hardened containment vent system] OIP.

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.

The first 6-month update PLT-5 and PLT-7 were revised.

PLT-5 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 was 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.

In the second 6-month update Columbia stated that it will be moving the rupture disk to inside the secondary containment.

Current Combined OIP

PLT-5 and PLT-7 have been revised in the combined OIP as follows.

PLT-5 Sketch 2 of Attachment 3 shows the preliminary design of the WW vent line. Valves HCV-V-1 and 2 are pneumatically operated and are normally closed (NC), fail closed (FC) valves. These valves are PCIVs [primary containment isolation valves] and are categorized as locked closed (LC) valves. As LC containment isolation valves, they are not required to receive automatic closure signals. The valves will be operated from the MCR using key locked manual switches (NEI 13-02, Section 4.2.1). Inadvertent operation of the pneumatic supply to HCV-V-1 and 2 will be controlled by locked isolation valves. A rupture disc, HCV-RD-54, is added to prevent secondary containment bypass leakage. The rupture disc has a separate nitrogen supply in order to breach the disc for system operation.

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 system operation (anticipatory venting) and pass 80,000 lb/hr at a maximum pressure of 10 psig in the WW.

The order and of the sketches has changed in the combined OIP.

<u>Second Change</u>

Original Phase 1 OIP Submittal

Part 2: Boundary Conditions for Wetwell Vent

Provide Details on the Vent characteristics

Hydrogen (EA-13-109 Section 1.2.10. 1.2.11. 1.2.12 *I NEI 13-02 Section* 2.3.2.4.4.1.1. 4.1.6. 4.1.7. 5.1. & *Appendix H)*

No response was provided in the original submittal, however, in the first 6-month update it was identified that Energy Northwest will use Option 5 of NEI White Paper HCV-WP-03, Hydrogen/Carbon Monoxide Control Measures, and is adding a check valve at the discharge end of the vent pipe to address the flammability of combustible gasses.

Current Combined OIP

The combined OIP does not change the use of Option 5 to control combustible gasses.

<u>Third Change</u>

Original Phase 1 OIP Submittal

Part 4: Programmatic Controls, Training, Drills and Maintenance

Table 4-1: Testing and Inspection Requirements

Cycle the HCVS valves not used to maintain containment integrity during operations.	Once per operating cycle
Perform visual inspections and a walk down of RCVS 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

In the first 6-month update Table 4-1 was revised to the following:

Table 4-1 Testing and Inspection Requirements

Description	**Frequency**	**<u>Reason for Change</u>**
~~Cycle the HCVS 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.

Description	**Frequency**	**Reason for Change**
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 cycle	This testing is added to include the added discharge check valve.

Current Combined OIP

Columbia has adopted the current version of Table 4 as detailed in NEI 13-02 Section 5.4, 6.2 and as provided in the NRC endorsed template and detailed in Part 4 of Enclosure 1.

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

Energy Northwest expects to fully comply with the Order and its implementation date and does not anticipate a request for relief and/or relaxation of Order EA-13-109, Phase 1.

6.0 Open Items

See Attachment 7 of the combined OIP of a list of the OIP Open Items and Enclosure 2 for the status of Responses to the Phase 1 Request for Additional Information

7.0 Potential Safety Evaluation Impacts

Energy Northwest does not anticipate there are any potential impacts to the Interim Safety Evaluation.

ENCLOSURE 1

PHASE 1 AND PHASE 2 OVERALL INTEGRATED PLAN FOR RELIABLE HARDENED CONTAINMENT VENTS CAPABLE OF OPERATION UNDER SEVERE ACCIDENT CONDITIONS

ENERGY NORTHWEST

COLUMBIA GENERATING STATION
RICHLAND, WASHINGTON

Phase 1 and 2 Overall Integrated Plan for Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions

December 2015, Revision 0

Table of Contents:

Introduction

In 1989, the Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 89-16, "Installation of a Hardened Wetwell Vent," (Reference 1) to all licensees of BWRs with Mark I containments to encourage licensees to voluntarily install a hardened wetwell (WW) vent. In response, licensees installed a hardened vent pipe from the suppression pool to some point outside the secondary containment envelope (usually outside the reactor building (RB)). Some licensees also installed a hardened vent branch line from the drywell (DW). Columbia Generating Station's containment is a Mark II and was not affected by this GL.

On March 19, 2013, the NRC Commissioners directed the staff per Staff Requirements Memorandum (SRM) for SECY-12-0157 to require licensees with Mark I and Mark II containments to "upgrade or replace the reliable hardened vents required by Order EA-12-050 (Reference 3) with a containment venting system designed and installed to remain functional during severe accident conditions." In response, the NRC issued Order EA-13-109, *Issuance of Order to Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accidents*, June 6, 2013 (Reference 5). The Order (EA-13-109) requires that licensees of BWR facilities with Mark I and Mark II containment designs ensure that these facilities have a reliable hardened vent to remove decay heat from the containment, and maintain control of containment pressure within acceptable limits following events that result in the loss of active containment heat removal capability while maintaining the capability to operate under severe accident (SA) conditions resulting from an Extended Loss of AC Power (ELAP).

The Order requirements are applied in a phased approach where:

- "Phase 1 involves upgrading the venting capabilities from the containment WW to provide reliable, severe accident capable hardened vents to assist in preventing core damage and, if necessary, to provide venting capability during severe accident conditions." (Completed "no later than startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first.")
- "Phase 2 involves providing additional protections for severe accident conditions through installation of a reliable, severe accident capable drywell vent system or the development of a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions." (Completed "no later than startup from the first refueling outage that begins after June 30, 2017, or June 30, 2019, whichever comes first.")

The NRC provided an acceptable approach for complying with Order EA-13-109 through Interim Staff Guidance (ISG) JLD-ISG-2013-02 (Reference 8) issued in November 2013 and JLD-ISG-2015-01 (Reference 33) issued in April 2015. These ISGs endorse the compliance approach presented in NEI 13-02 Revision 0 and 1, *Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents*, with clarifications. Except in those cases in which a licensee proposes an acceptable alternative method for complying with Order EA-13-109, the NRC staff will use the methods described in the ISGs to evaluate licensee compliance as presented in submittals required in Order EA-13-109.

The Order also requires submittal of an overall integrated plan (OIP) which will provide a description of how the requirements of the Order will be achieved. This document provides the OIP for complying with Order EA-13-109 using the methods described in NEI 13-02 and endorsed by NRC JLD-ISG-2013-02 and JLD-ISG-2015-01. Combined 6-month progress reports will be provided consistent with the requirements of Order EA-13-109.

The submittals required are:

- OIP for Phase 1 of EA-13-109 was required to be submitted by Licensees to the NRC by June 30, 2014. The NRC requires periodic (6-month) updates for the hardened containment vent system (HCVS) actions being taken. The first update for Phase 1 was due December 2014, with the second due June 2015. All information was submitted as required.
- OIP for Phase 2 of EA-13-109 is required to be submitted by Licensees to the NRC by December 31, 2015. The December 2015, 6-month update for Phase 1 will be combined with the Phase 2 OIP submittal by means of a combined Phase 1 and 2 OIP.
- Thereafter, the 6-month updates will be for both the Phase 1 and Phase 2 actions until complete, consistent with the requirements of Order EA-13-109.

The Plant venting actions for the EA-13-109 Phase 1 severe accident capable venting scenario can be summarized by the following**:**

- The HCVS will be made operational by manual action from the remote operating station (ROS) at the appropriate time based on the start of the ELAP. Nitrogen will be manually lined-up to allow remote operation of the pneumatically operated primary containment isolation valves (PCIV). A separate nitrogen supply is also manually lined-up to breach the HCVS rupture disc.
- The HCVS will be initiated via manual action from either the main control room (MCR) or from the ROS at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms.
- The vent will utilize containment parameters of drywell pressure and suppression pool level from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation will be monitored by HCVS valve position, effluent temperature and radiation levels.
- The HCVS motive force will be monitored and have the capacity to operate for 24 hours with installed equipment. Replenishment of the motive force will be by use of portable equipment once the installed motive force is exhausted.
- Venting actions will be capable of being maintained for a sustained period of up to 7 days or a shorter time if justified.

The Phase 2 actions can be summarized as follows:

- Utilization of severe accident water addition (SAWA) to initially inject water into the reactor pressure vessel (RPV).
- Utilization of severe accident water management (SAWM) to control injection and suppression pool level to ensure the HCVS (Phase 1) WW vent will remain functional for the removal of the decay heat from containment.
- Ensure that the decay heat can be removed from the containment for seven (7) days using the HCVS (or until HCVS is no longer required due to the arrival of offsite equipment and the establishment of suitable residual heat removal (RHR) system functions to remove decay heat from containment).
- The SAWA and SAWM actions will be manually activated and controlled from areas that are accessible during severe accident conditions.
- Parameters measured are drywell pressure, suppression pool level, SAWA flowrate and the aforementioned HCVS parameters.

Part 1: General Integrated Plan Elements and Assumptions

Extent to which the guidance, JLD-ISG-2013-02, JLD-ISG-2015-01 and NEI 13-02 (Revision 1), are being followed. Identify any deviations.

Include a description of any alternatives to the guidance. A technical justification and basis for the alternative needs to be provided. This will likely require a pre-meeting with the NRC to review the alternative.

Ref: JLD-ISG-2013-02, JLD-ISG-2015-01

Compliance will be attained for Columbia Generating Station (Columbia) with no known deviations to the guidelines in JLD-ISG-2013-02, JLD-ISG-2015-01 and NEI 13-02 for each phase as follows:

- The HCVS will be comprised of installed and portable equipment and operating guidance:
    - Severe accident wetwell vent (SAWV) – Permanently installed vent from the suppression pool to the top of the RB.
    - Severe accident water addition (SAWA) – A combination of permanently installed and portable equipment to provide a means to add water to the RPV following a severe accident and monitor system and plant conditions.
    - Severe accident water management (SAWM) strategies and guidance for controlling the water addition to the RPV for the sustained operating period.
- 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 (alternate strategy): by the startup from the first refueling outage that begins after June 30, 2017 or June 30, 2019, whichever comes first. Currently scheduled for 2Q2019.

If deviations are identified at a later date, then the deviations will be communicated in a future 6 month update following identification.

State Applicable Extreme External Hazard from NEI 12-06, Section 4.0-9.0

List resultant determination of screened in hazards from the EA-12-049 Compliance.

Ref: NEI 13-02 Section 5.2.3 and D.1.2

Part 1: General Integrated Plan Elements and Assumptions

The following extreme external hazards screen-in for Columbia:

- Seismic, extreme cold, high wind, extreme high temperature, and volcanic hazards.

The following extreme external hazards screen out for Columbia:

- External flooding - The current licensing basis identifies Columbia as a dry site
- Tornados and Hurricanes.

Key Site assumptions to implement NEI 13-02 HCVS, Phase 1 and 2 Actions.

Provide key assumptions associated with implementation of HCVS Phase 1 and Phase 2 Actions

Ref: NEI 13-02, Revision 1, Section 2 NEI 12-06 Revision 0

Mark I/II Generic EA-13-109 Phase 1 and Phase 2 Related Assumptions:

Applicable EA-12-049 assumptions:

049-1 Assumed initial plant conditions are as identified in NEI 12-06 section 3.2.1.2 items 1 and 2.

049-2 Assumed initial conditions are as identified in NEI 12-06 section 3.2.1.3 items 1, 2, 4, 5, 6 and 8.

049-3 Assumed reactor transient boundary conditions are as identified in NEI 12-06 section 3.2.1.4 items 1, 2, 3 and 4.

049-4 No additional events or failures are assumed to occur immediately prior to or during the event, including security events except for failure of Reactor Core Isolation Cooling (RCIC). (Reference 10, NEI 12-06, 3.2.1.3 item 9)

049-5 At Time=0 the event is initiated and all rods insert and no other event beyond a common site ELAP is occurring. (Reference 10 NEI 12-06, Section 3.2.1.3 item 9 and 3.2.1.4 item 1-4)

049-6 At 45 minutes an ELAP is declared and actions begin as defined in EA-12-049 compliance. Power for the HCVS is independent of the station batteries. Therefore, this is not time critical for the HCVS.

049-7 The HCVS is independent from the DC power and distribution that can be credited for the duration determined per the EA-12-049, *Diverse and Flexible Coping Strategies (FLEX),* methodology for battery usage of 8 hours. This assumption applies to the water addition capability under SAWA/SAWM. The power supply scheme for the HCVS shall be in accordance with EA-13-109 and the applicable guidance. (Reference 10 NEI 12-06, Section 3.2.1.3 item 8)

049-8 Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.

049-9 All activities associated with plant specific EA-12-049 FLEX strategies that are not specific to implementation of the HCVS, including such items as debris removal, communication, notification, spent fuel pool (SFP) level and makeup, security response, opening doors for cooling, and initiating conditions for the event, can be credited as previously evaluated for FLEX. (Refer to assumption 109-02 below for clarity on SAWA)(HCVS-FAQ-11)

Applicable EA-13-109 generic assumptions:

109-01 Site response activities associated with EA-13-109 actions are considered to have no access limitations associated with radiological impacts while RPV level is above 2/3 core height (core damage is not expected). This is further addressed in Reference 41, HCVS-FAQ-12. Additionally, from HCVS-FAQ-12, the primary and secondary containment boundary provides substantial shielding such that the performance of actions outside the RB does not need to consider radiological dose from containment shine and further, that existing shielding components remain in place and intact following the initiating event that leads to severe accident conditions. Figure 1-2, Columbia Generating Station RB Elevation View, shows these substantial shielding boundaries of Columbia's Mark II containment.

109-02 Portable equipment can supplement the installed equipment after 24 hours provided the portable equipment credited meets the criteria applicable to the HCVS. An example is use of the FLEX portable air compressor that is credited to recharge air lines for HCVS components after 24 hours. The FLEX portable air compressor used must be demonstrated to meet the "Severe Accident Capable" criteria that are defined in NEI 13-02, Section 4.2.4.2 and Appendix D, Section D.1.3. This assumption does not apply to Phase 2 SAWA/SAWM because SAWA equipment needs to be connected and placed in service within 8 hours from the time of the loss of RPV injection. (Reference 41, HCVS-FAQ-12)

[OPEN ITEM – 11:] FLEX air compressors need to be credited to recharge air lines for HCVS components after 24 hours.

109-03 SFP level is maintained with either on-site or off-site resources such that the SFP does not contribute to the

	analyzed source term (Reference 20, HCVS-FAQ-07).
109-04	Existing containment components design and testing values are governed by existing plant primary containment criteria (e.g., Appendix J) and are not subject to the testing criteria from NEI 13-02 (Reference 18, HCVS-FAQ-05 and Reference 11, NEI 13-02 section 6.2.2).
109-05	Classical design basis evaluations and assumptions are not required when assessing the operation of the HCVS. The reason this is not required is that the order postulates an unsuccessful mitigation of an event such that an ELAP progresses to a severe accident with ex-vessel core debris which classical design basis evaluations are intended to prevent. (Reference 11, NEI 13-02 section 2.3.1).
109-06	HCVS manual actions that require minimal operator steps and can be performed in the postulated thermal and radiological environment at the location of the step(s) (e.g., load stripping, control switch manipulation, valving-in nitrogen bottles) are acceptable to obtain HCVS venting dedicated functionality (Reference 14, HCVS-FAQ-01). This assumption does not apply to Phase 2 SAWA/SAWM because SAWA equipment needs to be connected and placed in service within 8 hours from the time of the loss of RPV injection and will require more than minimal operator action.
109-07	HCVS dedicated equipment is defined as vent process elements that are required for the HCVS to function in an ELAP event that progresses to core melt ex-vessel (Reference 15, HCVS-FAQ-02 and Reference 23, White Paper HCVS-WP-01). This assumption does not apply to Phase 2 SAWA/SAWM because SAWA equipment is not dedicated to HCVS but shared to support FLEX functions. This is further addressed in Reference 40, HCVS-FAQ-11.
109-08	Use of MAAP Version 4 or higher provides adequate assurance of the plant conditions (e.g., RPV water level, temperatures, etc.) assumed for Order EA-13-109, beyond design basis external events (BDBEE) and severe accident HCVS operation (Reference 31, FLEX MAAP Endorsement ML13190A201). Additional analysis using RELAP5/MOD 3, GOTHIC, PCFLUD, LOCADOSE and SHIELD are acceptable methods for evaluating environmental conditions in areas of the plant provided the specific version utilized is documented in the analysis. MAAP Version 5 was used to develop Electric Power Research Institute (EPRI) Technical Report 3002003301 (Reference 31) to support drywell temperature response to SAWA under severe accident conditions.
109-09	Utilization of NRC Published Accident evaluations (e.g. SOARCA, SECY-12-0157, and NUREG 1465 as related to Order EA-13-109) conditions are acceptable as references. (Reference 11, NEI 13-02 Section 8).
109-10	Permanent modifications installed per EA-12-049 are assumed implemented and may be credited for use in EA-13-109 Order response.
109-11	This OIP is based on emergency operating procedure (EOP) changes consistent with the implementing Boiling Water Reactor Owner's Group (BWROG) Emergency Procedure Guidelines (EPG)/ Severe Accident Guidelines (SAG) Revision 3, in accordance with the EOP/ Severe Accident Management Guidelines (SAMG) procedure change process. This assumption does not apply to Phase 2 SAWM because SAWM is not part of Revision 3 (reference to Attachment 2.1.D of this OIP for SAWM SAMG Changes approved by the BWROG Emergency Procedures Committee).
109-12	Under the postulated scenarios of Order EA-13-109, the MCR is adequately protected from excessive radiation dose due to its distance and shielding from the reactor (per General Design Criterion (GDC) 19 in 10 CFR 50 Appendix A) and no further evaluation of its use as the preferred HCVS control location is required provided that the HCVS routing is a sufficient distance away from the MCR or is shielded to minimize impact to the MCR dose. In addition, adequate protective clothing and respiratory protection are available if required to address

contamination issues. (Reference 14, HCVS-FAQ-01 and Reference 22, HCVS-FAQ-09).

109-13 The suppression pool/WW of a BWR Mark I/II containment is considered to be bounded by assuming a saturated environment for the duration of the event response because of the water/steam interactions.

109-14 RPV depressurization is directed by the EPGs in all cases prior to entry into the SAGs (Reference 11, NEI 13-02 Rev 1, Section I.1.3).

109-15 The severe accident impacts are assumed on one unit only due to the site compliance with NRC Order EA-12-049. However, each BWR Mk I and II under the assumptions of NRC Order EA-13-109 ensure the capability to protect containment exists for each unit (HCVS-FAQ-1). This is further addressed in HCVS-FAQ-10. Columbia is a single unit station.

Columbia Generating Station Plant Specific HCVS Related Assumptions/Characteristics:

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 RB, which completely encloses primary containment.

Section 2.2.3.1 Determination of Design Basis Events

Energy Northwest has investigated the resistance of plant structures to explosions. The RB 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 3.2-1 Equipment 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 1 nor 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 RB 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 RB 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 RB 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 Tornado-Generated External Missiles

The RB 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 RB 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 RB 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 1E, 24-V battery system dedicated to the HCVS electrical loads consisting of batteries, a battery charger, 24-V DC distribution panels, wiring, cables and raceways will be installed. Sketch 1 of Attachment 3 shows the preliminary electrical 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-8A (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 has been addressed.

PLT-3 A dedicated nitrogen bottle rack located in Diesel Generator (DG) building room D113 (the ROS) will provide the motive force for the air operated valves. Once valved in by an operator, the nitrogen supply will sustain operation for a minimum of 24 hours with no operator action following manual valving in of the nitrogen bottles 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. **See [OPEN ITEM – 11].**

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 2 of Attachment 3 shows the preliminary design of the WW vent line. Valves HCV-V-1 and 2 are pneumatically operated and are normally closed (NC), fail closed (FC) valves. These valves are PCIVs and are categorized as locked closed (LC) valves. As LC containment isolation valves, they are not required to receive automatic closure signals. The valves will be operated from the MCR using key locked manual switches (NEI 13-02, Section 4.2.1). Inadvertent operation of the pneumatic supply to HCV-V-1 and 2 will be controlled by locked isolation valves. A rupture disc, HCV-RD-54, is added to prevent secondary containment bypass leakage. The rupture disc has a separate nitrogen supply in order to breach the disc for system operation.

PLT-6 The HCVS batteries will be installed as Class 1E 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 system operation and pass 80,000 lb/hr at a maximum pressure of 10 psig in the WW. (Reference 36, Columbia's First 6 Month Status Update Report, EN Letter GO2-14-175)

PLT-8 The WW vent will exit the RB at approximately 72 feet above plant grade level (E ~ 513' 0") near the southeast corner of the RB and terminate above the parapet wall. The vent pipe is independent of the RB elevated release point and is located away from any ventilation system intake and exhaust openings or emergency response facilities. Note grade elevation ~ 441'-0".

PLT-9 The Columbia OIP for Mitigating Strategies, Revision 1, 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 (SPTM-TI-5)

This section also states that loads on the station batteries will be available for at least 8 hours[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 has established the necessary actions that will be taken to protect containment. (OI-FLEX-09)

Calculations have evaluated 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 (OI-FLEX-10)

PLT-11 The plant layout of buildings and structures are depicted in the following Figures 1-1 and 1-2. Note the MCR is located in the northeast corner of the RW building. The MCR conforms to the requirements of GDC 19, *Alternative Source Term (AST)* as stated in HCV-FAQ-01, Reference 14. The HCVS vent routing external to the RB is indicated on Figure 1-1.

Notes:

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

   The SBO/ELAP procedure requires all load shed actions to be completed in one-hour. These load shed actions have been validated to ensure they can be completed within this time limit.

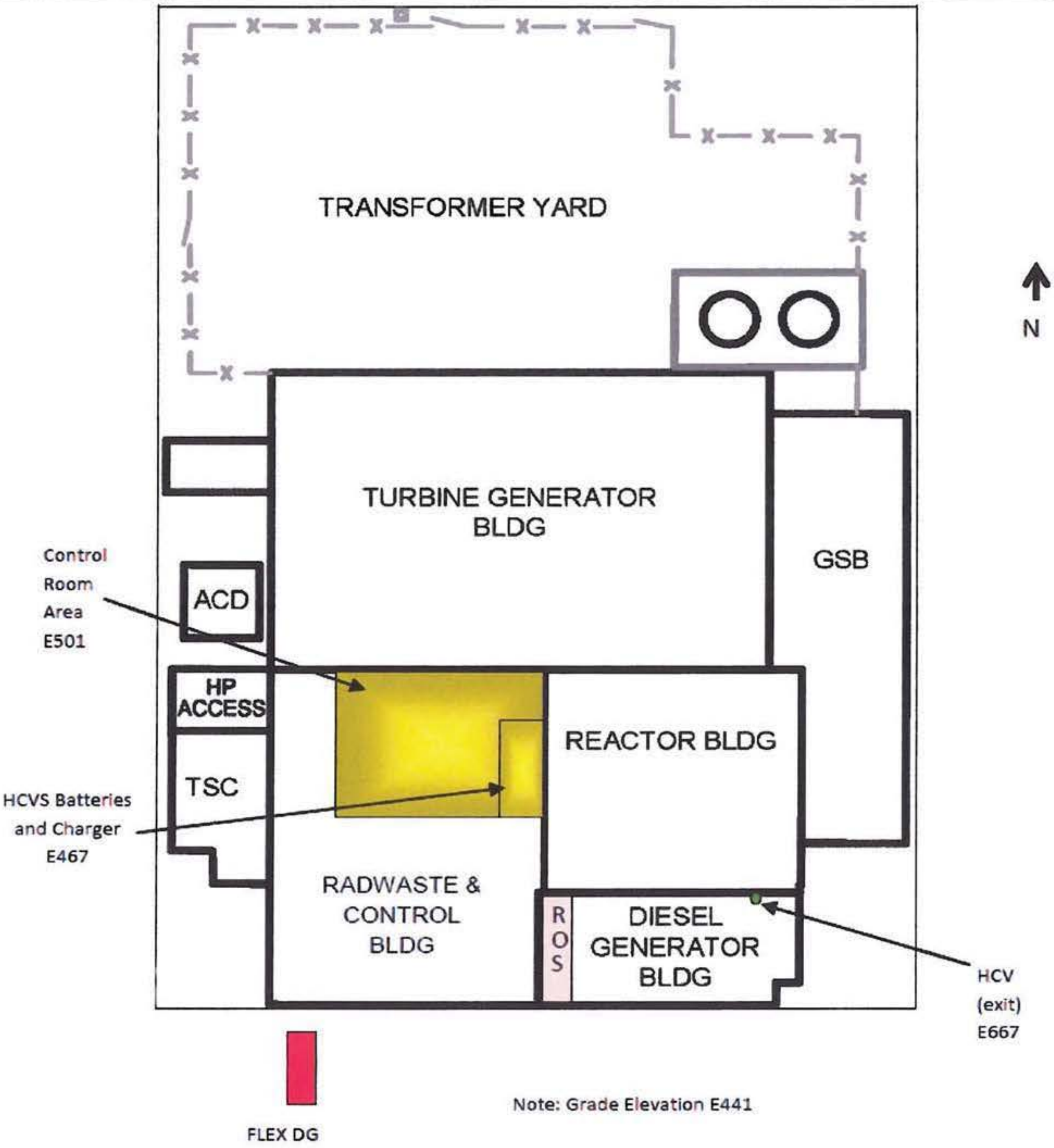


Figure 1-1
Columbia Generating Station General Site Layout

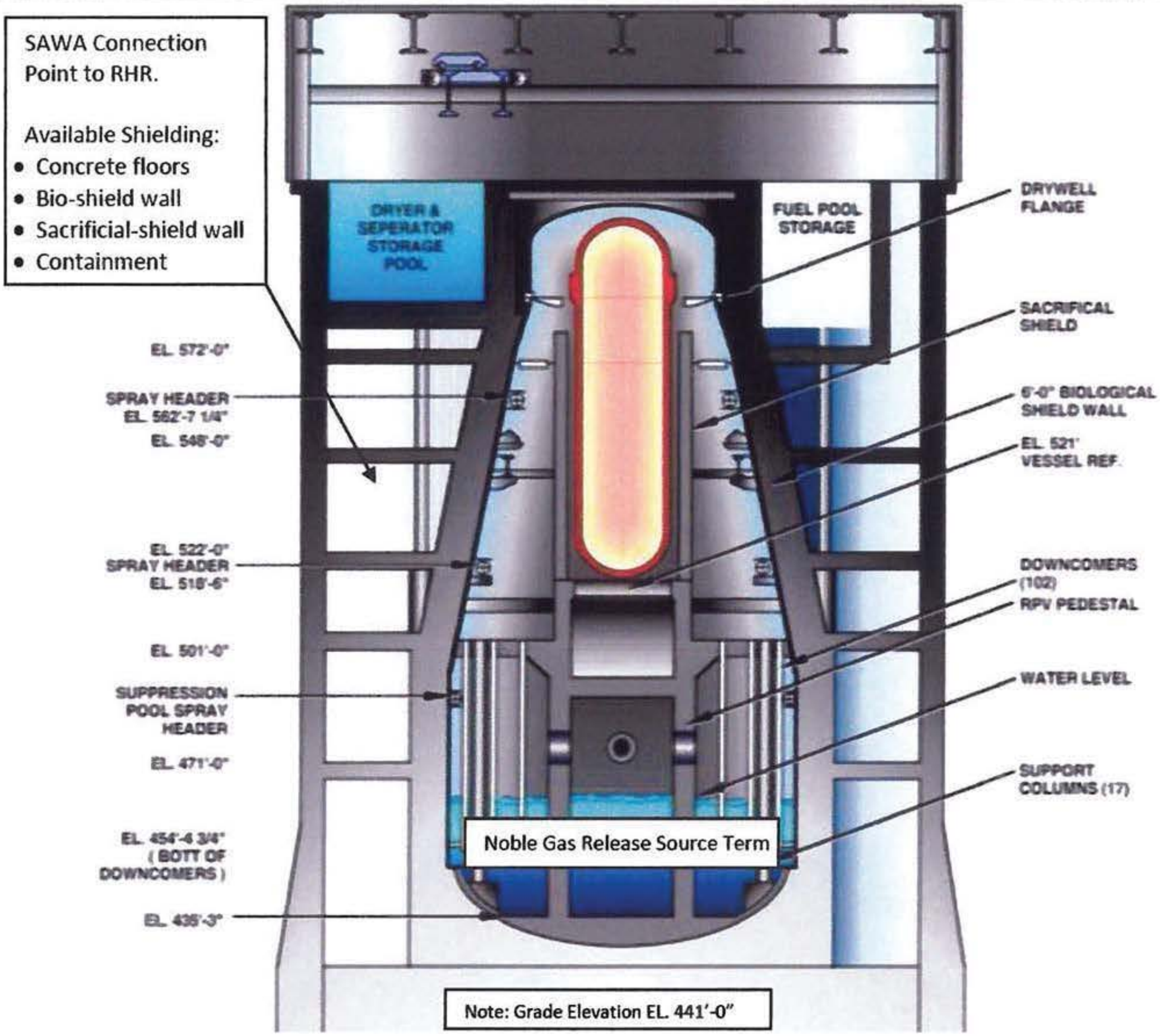


Figure 1-2
Columbia Generating Station Reactor Building Elevation View
(showing, in part, the substantial shielding boundaries of Columbia's Mark II Containment)

Part 2: Boundary Conditions for Wet Well Vent

Provide a sequence of events and identify any time or environmental constraint required for success including the basis for the constraint.

HCVS Actions that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, action to open vent valves).

HCVS Actions that have an environmental constraint (e.g. actions in areas of High Thermal stress or High Dose areas) should be evaluated per guidance.

Describe in detail in this section the technical basis for the constraints identified on the sequence of events timeline attachment.

See attached sequence of events timeline (Attachment 2A)

Ref: EA-13-109 Section 1.1.1, 1.1.2, 1.1.3 / NEI 13-02 Section 4.2.5, 4.2.6. 6.1.1

The operation of the HCVS will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1. Initial 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. A table showing HCVS WW failure evaluation is included in Attachment 4.

Table 2-1 HCVS Remote Manual Actions

Primary Action	Primary Location / Component	Notes
1. Line-up the nitrogen supply to the HCVS valves (HCV-V-1 and HCV-V-2) by opening nitrogen valve.	ROS /Nitrogen bottle isolation valve.	Nitrogen is lined up to the HCVS valves to make them operational.
2. Line-up the nitrogen supply to the HCVS Rupture Disc (HCV-RD-54) by opening nitrogen valve.	ROS /Nitrogen bottle isolation valve.	Nitrogen is lined up to the Rupture Disc in order to breach (rupture) it.
3. Open HCVS PCIVs HCV-V-1 and HCV-V-2 to control containment pressure.	MCR/Key locked hand switches ROS/override SPVs.	
4. Replenish pneumatics.	Near the ROS/Attach an airline from a FLEX portable air compressor to the installed fitting. See [OPEN ITEM–11]	Prior to depletion of the installed pneumatic sources actions will be required to connect back-up sources at a time greater than 24 hours.

Part 2: Boundary Conditions for Wet Well Vent

5. Lineup supplemental power to HCVS battery charger.	The HCVS battery charger can be powered from a supplemental 480 Volt AC source (FLEX DG).	Prior to depletion of the HCVS batteries, actions will be taken to repower the HCVS battery charger at a time greater than 24 hours.

Provide a sequence of events and identify any time or environmental constraint required for success including the basis for the constraint.

A HCVS timeline was developed to identify required operator response times and potential environmental constraints. This timeline is shown in Attachment 2A and is based upon the following three cases:

1. Case 1 is based upon the action response times developed for FLEX when utilizing anticipatory venting in a BDBEE without core damage.
2. Case 2 is based on a SECY-12-0157 long term station blackout (LTSBO) (or ELAP) with failure of RCIC after a black start where failure occurs because of subjectively assuming over injection.
3. Case 3 is based on NUREG-1935 (SOARCA) results for a prolonged SBO (or ELAP) with the loss of RCIC case without black start.

<u>The following is a discussion of time constraints identified in Attachment 2A for the 3 timeline cases identified above</u>

- Between 1-6 Hours, initiate use of the HCVS per site procedures to maintain containment parameters below design limits and within the limits that allow continued use of RCIC. The reliable operation of HCVS will be met because HCVS meets the seismic requirements identified in NEI 13-02 and will be powered by a dedicated 24-V battery with motive force supplied to the HCVS valves from a separate dedicated nitrogen bottle rack. Critical HCVS controls and instruments associated with containment will be DC powered and operated from the MCR or the ROS. The HCVS battery capacity will be designed for a minimum of 24 hours. In addition, a FLEX DG can provide power before battery life is exhausted (FLEX strategy timeline states within 8 hours). Thus initiation of the HCVS from the MCR or the ROS within 6 hours is acceptable because the actions can be performed any time after declaration of an ELAP until the venting is needed at approximately 6 hours for BDBEE venting. This action can also be performed for severe accident HCVS operation which occurs at a time further removed from an ELAP declaration as shown in Attachment 2A.
- The system pneumatics is a dedicated system of nitrogen bottles secured in a seismically qualified rack. Operator action is required to make it available and contains sufficient volume for at least 24 hours. Providing a supplemental pneumatic supply using an air fitting installed in the nitrogen supply line can be accomplished prior to depletion so there is no time constraint. **See [OPEN ITEM – 11].**
- Within 8 hours, a 480 volt FLEX DG will be installed and connected to supply power to a 480 volt vital bus which supplies the battery chargers for the station's batteries. The new HCVs battery charger will also be connected to the

Part 2: Boundary Conditions for Wet Well Vent

same bus and repowered at the same time, thus supplying the HCVS critical components/instruments. The FLEX DGs are maintained in either an on-site FLEX storage building or a pre-approved location. When needed, they can be transferred via haul routes to staging areas evaluated for impact from external hazards. Modifications have been implemented to facilitate the connections and operational actions required to supply power. This is acceptable because the actions can be performed any time after declaration of an ELAP and the repowering is needed at greater than 24 hours for HCVS operation.

<u>The following is a discussion of radiological and temperature constraints identified in Attachment 2A</u>

- At the start of the event, the nitrogen system is manually lined-up to supply motive force to the HCVS valves. The nitrogen isolation will be located in the DG building near the ROS. All other valve manipulations can be accomplished in the MCR or at the ROS. The ROS is accessible from several different pathways outside the RB which will be evaluated for habitability and radiological conditions to ensure operating personnel can safely access and operate the controls at the ROS.

[OPEN ITEM 2:] Evaluate the location of the ROS for accessibility.

- At >24 hours, a portable air compressor will be available to supplement the nitrogen supply as stated for the related time constraint item.

[OPEN ITEM 3:] Determine the location of the portable air compressor and evaluate for accessibility under Severe Accident HCVS use.

- At >24 Hours, the system battery charger can be powered from a supplemental 480 Volt AC source (FLEX DG).

[OPEN ITEM 4:] Evaluate the location of the FLEX DGs for accessibility under severe accident HCVS use.

Provide Details on the Vent characteristics

Provide Details on the Vent characteristics

Vent Size and Basis (EA-13-109 Section 1.2.1 / NEI 13-02 Section 4.1.1)

What is the plants licensed power? Discuss any plans for possible increases in licensed power (e.g. MUR, EPU).

What is the nominal diameter of the vent pipe in inches/ Is the basis determined by venting at containment design pressure, Primary Containment Pressure Limit (PCPL), or some other criteria (e.g. anticipatory venting)?

Vent Capacity (EA-13-109 Section 1.2.1 / NEI 13-02 Section 4.1.1)

Indicate any exceptions to the 1% decay heat removal criteria, including reasons for the exception. Provide the heat capacity of the suppression pool in terms of time versus pressurization capacity, assuming suppression pool is the injection source.

Vent Path and Discharge (EA-13-109 Section 1.1.4, 1.2.2 / NEI 13-02 Section 4.1.3, 4.1.5 and Appendix F/G)

Provides a description of Vent path, release path, and impact of vent path on other vent element items.

Power and Pneumatic Supply Sources (EA-13-109 Section 1.2.5 & 1.2.6 / NEI 13-02 Section 4.2.3, 2.5, 4.2.2, 4.2.6, 6.1)

Provide a discussion of electrical power requirements, including a description of dedicated 24 hour power supply from permanently installed sources. Include a similar discussion as above for the valve motive force requirements. Indicate the area in the plant from where the installed/dedicated power and pneumatic supply sources are coming

Indicate the areas where portable equipment will be staged after the 24 hour period, the dose fields in the area, and any shielding that would be necessary in that area. Any shielding that would be provided in those areas

Location of Control Panels (EA-13-109 Section 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.2.4, 1.2.5 / NEI 13-02 Section 4.1.3, 4.2.2, 4.2.3, 4.2.5, 4.2.6, 6.1.1 and Appendix F/G)

Indicate the location of the panels, and the dose fields in the area during severe accidents and any shielding that would be required in the area. This can be a qualitative assessment based on criteria in NEI 13-02.

Hydrogen (EA-13-109 Section 1.2.10, 1.2.11, 1.2.12 / NEI 13-02 Section 2.3,2.4, 4.1.1, 4.1.6, 4.1.7, 5.1, & Appendix H)

State which approach or combination of approaches the plant will take to address the control of flammable gases, clearly demarcating the segments of vent system to which an approach applies

Unintended Cross Flow of Vented Fluids (EA-13-109 Section 1.2.3, 1.2.12 / NEI 13-02 Section 4.1.2, 4.1.4, 4.1.6 and Appendix H)

Provide a description to eliminate/minimize unintended cross flow of vented fluids with emphasis on interfacing ventilation systems (e.g. SGTS). What design features are being included to limit leakage through interfacing valves or Appendix J type testing features?

Prevention of Inadvertent Actuation (EA-13-109 Section 1.2.7/NEI 13-02 Section 4.2.1)

The HCVS shall include means to prevent inadvertent actuation

Component Qualifications (EA-13-109 Section 2.1 / NEI 13-02 Section 5.1, 5.3)

State qualification criteria based on use of a combination of safety related and augmented quality dependent on the location, function and interconnected system requirements

Monitoring of HCVS (Order Elements 1.1.4, 1.2.8, 1.2.9/NEI 13-02 4.1.3, 4.2.2, 4.2.4, and Appendix F/G)

Provides a description of instruments used to monitor HCVS operation and effluent. Power for an instrument will require the intrinsically safe equipment installed as part of the power sourcing

Component reliable and rugged performance (EA-13-109 Section 2.2 / NEI 13-02 Section 5.2, 5.3)

HCVS components including instrumentation should be designed, as a minimum, to meet the seismic design requirements of the plant.

Components including instrumentation that are not required to be seismically designed by the design basis of the plant should be designed for reliable and rugged performance that is capable of ensuring HCVS functionality following a seismic event. (References ISG-JLD-2012-01 and ISG-JLD-2012-03 for seismic details.)

The components including instrumentation external to a seismic category 1 (or equivalent building or enclosure should be designed to meet the external hazards that screen-in for the plant as defined in guidance NEI 12-06 as endorsed by JLD-ISG-12-01 for Order EA-12-049.

Use of instruments and supporting components with known operating principles that are supplied by manufacturers with commercial quality assurance programs, such as ISO 9001. The procurement specifications shall include the seismic requirements and/or instrument design requirements, and specify the need for commercial design standards and testing under seismic loadings consistent with design basis values at the instrument locations.

Demonstration of the seismic reliability of the instrumentation through methods that predict performance by analysis, qualification testing under simulated seismic conditions, a combination of testing and analysis, or the use of experience data. Guidance for these is based on Sections 7, 8, 9, and 10 of IEEE Standard 344-2004, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," or a substantially similar industrial standard could be used.

Demonstration that the instrumentation is substantially similar in design to instrumentation that has been previously tested to seismic loading levels in accordance with the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges). Such testing and analysis should be similar to that performed for the plant licensing basis.

Vent Size and Basis

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% or greater of 3556 MWt which accounts for a potential 2% power uprate above the current licensed thermal power of 3486 MWt power at pressure of 45 psig. This pressure is the lower of the containment design pressure and the 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.

Vent Capacity

The 1% value at Columbia assumes that the suppression pool pressure suppression capacity is sufficient to absorb the decay heat generated during the first 3 hours. The vent would then be able to prevent containment pressure from increasing above the containment design pressure. As part of the detailed design, the Suppression Pool decay heat absorption capability has been confirmed.

Vent Path and Discharge

The HCVS suppression pool vent will originate from a 12 inch spare penetration (X-58) at elevation 491'-0" (located above the level of the suppression pool) which will increase to a 16 inch diameter pipe for the remainder of the vent line. The flow path will have two air (pneumatically)-operated valves (AOV) that are air-to-open and spring-to-shut (normally closed (NC), fail closed (FC) valves). These valves are PCIVs and categorized as locked closed (LC) valves. As LC PCIVs, they are not required to receive automatic closure signals. The valves (HCV-V-1 and HCV-V-2) will normally be operated from the MCR using key locked manual switches (NEI 13-02, Section 4.2.1).

The PCIVs will be installed outside the primary containment and as close to the primary containment as possible. Columbia's FSAR, Section 3.1.2.5.7, Criterion 56 -Primary Containment Isolation, provides the evaluation of Criterion 56 which provides an allowance for lines that connect to the suppression pool to have both PCIVs located outside containment to prevent an inside valve from being subjected to more severe environmental conditions including suppression pool dynamic loading and to make it easily accessible for inspection.

The lockable pneumatic supply to the PCIVs, HCV-V-1 and 2, is located in the ROS. A rupture disc (HCV-RD-54) is added to prevent secondary containment bypass leakage. The rupture disc is supplied with a separate nitrogen supply in order to breach the disc for system operation. A check valve will be installed at the discharge end of the HCV line near the release point.

The HCV line will be run in the abandoned stairwell in the southeast corner of the RB and exit the RB at approximately Elevation = 513'. The HCV Line will then run up the outside south wall of the RB to release greater than 3 feet above the parapet wall resulting in a discharge point of approximately Elevation = 677'. The HCVS path release point is independent of the RB elevated release path and release point (at Elevation = 674').

This discharge point is above the RB 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 an ELAP and BDBEE, 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.

As identified in Part 1, General Integrated Plan Elements and Assumptions, Columbia screened-in for high winds. Therefore, the detailed design will address missile protection from external events as defined by HCVS-WP-04 related to limited evaluation above 30 feet. (Reference 17, FAQ HCVS-04 and Reference 26, HCVS-WP-04)

Power and Pneumatic Supply Sources

The electrical power required for operation of the HCVS components is from a Class 1E, 24-V DC system that includes 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 DGs will be used to maintain DC 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 8 valve operating cycles of the HCVS valves during the first 24 hours. Beyond 24 hours, FLEX portable air compressors will be used to supply pneumatics to the HCVS valves.

- The HCVS PCIVs (flow path valves) are AOVs which are air-to-open and spring-to-shut. Opening the valves requires energizing a solenoid powered valve (SPV), powered from the dedicated 24-V DC system, to direct the pneumatics to the flow path valves. The SPVs at the ROS can be manually overridden to operate the PCIVs.
- 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 2A.
- 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.
- 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, 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 Nitrogen bottle rack in the ROS. 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.

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

Location of Control Panels

The HCVS design allows initiating and then 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. Existing sound powered phone systems are available for communication between the primary and secondary controls locations, since the controls and indications are not duplicated at both locations. A sound powered phone extension cable will be stored at the instrument rack E-IR-85 (in the ROS) to reach existing sound powered phone jacks in the adjacent diesel generator rooms. **[See OPEN ITEM 7]**

Hydrogen

As is required by EA-13-109, Attachment 2, 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) provides several options for the design of an HCVS to address the hazards of combustible gasses. Energy Northwest will incorporate Option 5 of Reference 25 by adding a check valve at the discharge end of the vent pipe to address the flammability of combustible gasses. (Reference 36, Columbia's First 6-Month Status Update Report, EN Letter GO2-14-175).

Unintended Cross Flow of Vented Fluids

As seen in Attachment 3, Sketch 2, the HCVS WW vent is designed as a stand-alone system which does not interface with other plant systems or use the RB elevated release point. The HCVS uses dedicated PCIVs for containment isolation which are not shared with other systems. These containment isolation valves are AOVs that are air-to-open and spring-to-shut. An SPV must be energized to allow the air to open the valve (valves are Normally Closed and Fail Closed.) This design eliminates the concern of cross flow of vented fluids. The system will only be used in a BDBEE.

Prevention of Inadvertent Actuation

EOP/SAG 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 net positive suction head for the RCIC pump.

The features that prevent inadvertent actuation of the WW vent are the two PCIVs which are operated by key lock switches in the MCR. The ROS, containing the SPVs, will have lockable covers/doors to limit access and inadvertent operation. Additionally, a rupture disc is located downstream of the PCIVs which will require additional manual action to breach.

Component Qualifications

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 100. During normal or design basis operations, this means serving as a pressure boundary to prevent release of radioactive material.

Likewise, any electrical or controls component which interfaces with Class 1E power sources will be considered safety related up to and including appropriate isolation devices such as fuses or breakers, as their failure could adversely impact containment isolation and/or safety-related power sources. 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 Equipment 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 344-2004, and
3. Demonstration that instrumentation is substantially similar to the design of instrumentation previously qualified.

Instrument	Qualification Method*
HCVS Process Temperature	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 used for each required HCVS instrument will be reported in future 6-month status

reports.

[OPEN ITEM 6:] Determine the method of qualification for each instrument listed.

Monitoring of HCVS

The Columbia 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 Attachment 2, Section 1.2.4. The MCR is a readily accessible location with no further evaluation required. Control room dose associated with HCVS operation conforms to GDC 19/*Alternative Source Term (AST)*. Additionally, to meet the intent for a secondary control location of Order Attachment 2, 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. Existing sound powered phone systems are available for communication between the primary and secondary controls locations, since the controls and indications are not duplicated at both locations. A sound powered phone extension cable will be stored at the instrument rack E-IR-85 (in the ROS) to reach existing sound powered phone jacks in the adjacent diesel generator rooms.

[OPEN ITEM 7:] Complete the evaluation to determine accessibility, habitability, staffing sufficiency, and communication capability of the ROS.

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 temperature and effluent radiation levels at the MCR and ROS. The PCIV position indication is located at the MCR (Full Open/Full Close indicators). 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 suppression pool level indication in the MCR to monitor vent operation. This monitoring instrumentation provides the indication for the MCR as per Order Attachment 2, Section 1.2.4 and is designed for sustained operation during an ELAP event.

Component Reliable and Rugged Performance

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.

[OPEN ITEM 8:] Identify design codes after design is finalized.

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

[OPEN ITEM 9:] Equipment qualifications will include temperature, pressure, radiation level, and total integrated dose radiation from the effluent vent pipe at local and remote locations.

Conduit 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 required (Reference 26, HCVS-WP-04). 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, *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations*, (Reference 27) 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 (e.g.-levels and frequency ranges); or
- seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location.

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: **BDBEE Venting**

Determine venting capability for BDBEE Venting, such as may be used in an ELAP scenario to mitigate core damage.

Ref: EA-13-109 Section 1.1.4 / NEI 13-02 Section 2.2

First 24 Hour Coping Detail
Provide a general description of the venting actions for first 24 hours using installed equipment including station modifications that are proposed. **Ref: EA-13-109 Section 1.2.6 / NEI 13-02 Section 2.5, 4.2.2**
The HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and BDBEE hazards identified in Part 1 of this OIP. Initial operator action is required to line-up pneumatics and can be completed by operators at the ROS. Once the pneumatics has been lined up and the rupture disk is breached, the vent line is available for use. The operator actions required to open a vent path are as described in Table 2-1. Remote-manual is defined in this OIP as a non-automatic power operation of a component and does not require the operator to be at or in close proximity to the component. No other operator actions are required to initiate venting under the guiding procedural protocol. The HCVS is 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 OIP. The equipment that will supply pneumatics and electrical power to HCVS will be permanently installed, independent of current plant equipment, and will sustain operation and monitoring of the HCVS for 24 hours. *System control:* i. Active: The HCVS PCIVs and SPVs will be operated in accordance with the EOPs to control containment pressure. The HCVS will be designed for a minimum of 8 open/close cycles under ELAP conditions over the first 24 hours following an ELAP. Controlled venting is permitted in the current EOPs. **[OPEN ITEM 10:]** Provide site-specific details of the EOPs when available. ii. Passive: Inadvertent actuation protection is provided by key-locked switches in the MCR and locked covers/doors at the ROS.
Greater Than 24 Hour Coping Detail
Provide a general description of the venting actions for greater than 24 hours using portable and installed equipment including station modifications that are proposed. **Ref: EA-13-109 Section 1.2.4, 1.2.8 / NEI 13-02 Section 4.2.2**
After 24 hours (or earlier), available personnel will be able to connect supplemental pneumatics to the HCVS. Connections for supplementing pneumatics 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 (FLEX strategy timeline states within 8 hours).

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.

Details:

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.

NEI 13-02, 6.1.2

PPM 5.2.1, *Primary Containment Control*, provides direction for protection and control of containment integrity.

- The primary containment control flowchart exists to direct operations in protection and control of containment integrity.

Other site procedures for venting containment using the HCVS include:*

PPM 5.5.14, *Emergency Wetwell Venting*

PPM 5.6.1, *Station Blackout (SBO)*

ABN-CONT-VENT, *Containment Vent without AC and DC Power Available*

*This list is not inclusive and the titles/numbers may change as the station develops its response.

Identify modifications:

List modifications and describe how they support the HCVS Actions.

<u>EA-12-049 Modifications</u>

- EC 12245, 480 volt AC Alternate Connection Points. Added the 480 volt AC connection points for the 480 volt AC FLEX DGs.
- EC 12229, Connection Points for NSRC 4.16 kV Generator. Adds two connection points for the RRC 4.16 kV generators to supply power to Division 1 or 2 loads.

<u>EA-13-109 Modifications</u>

- EC 13094, Addition of Wetwell Hardened Containment Vent. Adds the WW HCVS.
- EC 12511, Relocate Cables and Trays. Moves the electrical components to allow routing of WW vent piping.

- EC 13837, Secondary Containment Modification for Hardened Containment Vent.

Key Venting Parameters:

List instrumentation credited for this venting actions. Clearly indicate which of those already exist in the plant and what others will be newly installed (to comply with the vent order)

Initiation, operation and monitoring of the HCVS venting will rely on the following key parameters and indicators:

Key Parameter	Component Identifier	Indication Location
HCVS Valve Position Indication	HCV-V-1 / HCV-V-2 (PCIVs)	MCR (Full Open / Full Close indicators)
HCVS Effluent Radiation Level	HCV-RI-1/HCV-RIS-RAD1	MCR/ROS, respectively
HCVS Effluent Temperature	HCV-TI-1/HCV-TT-1	MCR/ROS, respectively
HCVS Nitrogen Supply Pressure (PCIVs)	HCV-PI-TK1 / TK2 / TK3 (bottle pressure) and HCV-PI-2 (header pressure)	ROS (Bottle Rack vicinity)
HCVS Nitrogen Supply Pressure (rupture disc)	HCV-PI-TK4 / TK5 (bottle pressure) and HCV-PI-3 (header pressure)	ROS (Bottle Rack vicinity)
HCVS Battery Voltage	Analog DC Voltmeter	Battery Charger (RPS Room 2)
HCVS Battery Current	Analog DC Ammeter	Battery Charger (RPS Room C215)

Initiation, operation and monitoring of the HCVS system will rely on several existing Main Control Room key parameters and indicators which are qualified or evaluated to Reg Guide 1.97 per the existing plant design:

Key Parameter	Component Identifier	Indication Location
Suppression Pool Pressure	CMS-PR-3	MCR
Suppression Pool level	CMS-LR-3	MCR
Suppression Pool Temperature	SPTM-TI-5	MCR
Drywell Temperature	CMS-TI-5	MCR
Drywell Pressure	CMS-PR-1	MCR

HCVS indications for HCVS valve position indication, HCVS radiation level, and HCVS effluent temperature will be installed in the MCR to comply with EA-13-109. Pneumatic supply pressure indication will be located near the ROS and the DC voltage and current indication will be located at the battery charger.

Notes: Existing sound powered phone system is available for communication between the primary and secondary controls locations, since the controls and indications are not duplicated at both locations. A sound powered phone extension cable will be stored at the instrument rack E-IR-85 (in the ROS) to reach existing sound powered phone jacks in the adjacent diesel generator rooms.

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: **Severe Accident Venting**

Determine venting capability for Severe Accident Venting, such as may be used in an ELAP scenario to mitigate core damage.

Ref: EA-13-109 Section 1.2.10 / NEI 13-02 Section 2.3

First 24 Hour Coping Detail

Provide a general description of the venting actions for first 24 hours using installed equipment including station modifications that are proposed.

Ref: EA-13-109 Section 1.2.6 / NEI 13-02 Section 2.5, 4.2.2

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 water level and core damage conditions. Initial 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 of this report (Table 2-1).

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

System control:

i. Active: Same as for Part 2, BDBEE Venting. In addition to the EOPs/SOPs, SAMGs may also direct actions needed for severe accident conditions.

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

Greater than 24 Hour Coping Detail

Provide a general description of the venting actions for greater than 24 hours using portable and installed equipment including station modifications that are proposed.

Ref: EA-13-109 Section 1.2.4, 1.2.8 / NEI 13-02 Section 4.2.2

Part 2: Boundary Conditions for Wet Well Vent
Part 2 Boundary Conditions for WW Vent**: Severe Accident Venting**
Specifics are the same as for Part 2, BDBEE Venting, 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. **[See OPEN ITEM 3]** 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.
Detail
Provide a brief description of Procedures / Guidelines: *Confirm that procedure/guidance exists or will be developed to support implementation.*
The operation of the HCVS is governed the same for SA conditions as for BDBEE conditions. Existing guidance in the SAMGs directs the plant staff to consider changing radiological conditions in a severe accident.
Identify modifications*:* *List modifications and describe how they support the HCVS Actions.*
The same as for BDBEE Venting Part 2.
Key Venting Parameters: *List instrumentation credited for the HCVS Actions. Clearly indicate which of those already exist in the plant and what others will be newly installed (to comply with the vent order)*
Initiation, operation and monitoring of the HCVS system will rely on several existing MCR key parameters and indicators that are the same as for Part 2, BDBEE Venting. HCVS indications for HCVS effluent temperature, HCVS effluent radiation, and HCVS vent valve position (Full Open / Full Close indicators) will be installed in the MCR to comply with EA-13-109.
Notes: None.

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: **HCVS Support Equipment Functions**

Determine venting capability support functions needed

Ref: EA-13-109 Section 1.2.8, 1.2.9 / NEI 13-02 Section 2.5, 4.2.4, 6.1.2

BDBEE Venting

Provide a general description of the BDBEE Venting actions support functions. Identify methods and strategy(ies) utilized to achieve venting results.

Ref: EA-13-109 Section 1.2.9 / NEI 13-02 Section 2.5, 4.2.2, 4.2.4, 6.1.2

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. However, some key parameters (as identified in the response to Order EA-12-049) are used to support the venting operation and rely on the station batteries. A new dedicated battery system will provide sufficient electrical power for HCVS operation for at least 24 hours. Before these batteries are depleted, a FLEX DG, as detailed in the response to Order EA-12-049, will be used to supply the AC battery charger and charge the batteries to maintain HCVS DC bus voltage after 24 hours (FLEX strategy timeline states within 8 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 a minimum of 8 operations of the HCVS valves. Portable air compressors will be available to tie into a fitting at the nitrogen bottle rack to provide the supplemental pneumatic source.

Severe Accident Venting

Provide a general description of the Severe Accident Venting actions support functions. Identify methods and strategy(ies) utilized to achieve venting results.

Ref: EA-13-109 Section 1.2.8, 1.2.9 / NEI 13-02 Section 2.5, 4.2.2, 4.2.4, 6.1.2

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 DG is expected to have been connected to supply power to the HCVS battery charger (FLEX strategy timeline states within 8 hours). Portable FLEX air compressors will be available to tie into a fitting at the nitrogen bottle rack and provide the supplemental pneumatic source.

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent**: HCVS Support Equipment Functions**

Details

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.

The equipment used during the first 24 hours will be permanently installed. No additional procedures, other than those previously identified, are currently required.

The supplemental equipment, used after the first 24 hours, will have procedures for installation, operation, and refueling.

Identify modifications*:*

List modifications and describe how they support the HCVS Actions.

As identified in Part 2, Boundary Conditions for WW Vent - BDBEE Venting, the following modifications are being made.

Flex modifications applicable to HCVS operation:

- EC 12245, 480 volt AC Alternate Connection Points. Added the 480 volt AC connection points for the 480 volt AC FLEX DGs.
- EC 12229, Connection Points for RCC 4.16 kV Generator. Adds two connection points for the RRC 4.16 kV generators to supply power to Division 1 or 2 loads.

HCVS Modifications:

- EC 13094, Addition of Wetwell Hardened Containment Vent. Adds the dedicated battery and pneumatics which includes a fitting for connection of a supplemental pneumatic supply
- EC 12511, Relocate Cables and Trays. Moves the electrical components to allow routing of WW vent piping.
- EC 13837, Secondary Containment Modification for Hardened Containment Vent.

HCVS connections required for portable equipment will be protected from all applicable screened-in hazards and located such that operator exposure to radiation and occupational hazards will be minimized. Structures to provide protection of the HCVS connections will be constructed to meet the requirements identified in NEI-12-06, Section 11 for screened in hazards.

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent**: HCVS Support Equipment Functions**

Key Support Equipment Parameters:

List instrumentation credited for the support equipment utilized in the venting operation.

Clearly indicate which of those already exist in the plant and what others will be newly installed (to comply with the vent order)

The support equipment has local instrumentation which is part of the equipment and not considered plant instrumentation.

Local control features of the FLEX DG electrical load and fuel supply.

Local control features of the portable air compressor and fuel supply.

Notes: None.

Part 2 Boundary Conditions for WW Vent**: HCVS Venting Portable Equipment Deployment**

Provide a general description of the venting actions using portable equipment including modifications that are proposed to maintain and/or support safety functions.

Ref: EA-13-109 Section 3.1 / NEI 13-02 Section 6.1.2, D.1.3.1

Portable equipment is only used to sustainability of the electrical and pneumatics requirements beyond 24 houts.

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.

Details:

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.

Operation of the portable equipment is the same as for compliance with Order EA-12-049 thus they are acceptable without further evaluation		
HCVS Actions	**Modifications**	**Protection of connections**
FLEX Air Compressor	The HCVSs ROS will contain a fitting for connection of the air compressor to support operations beyond 24 hours.	Connection will be inside the diesel generator building.
Notes: See [OPEN ITEM – 11].		

Part 3: Boundary Conditions for EA-13-109, Option B.2

General:

Licensees that use Option B.1 of EA-13-109 (SA Capable DW Vent without SAWA) must develop their own OIP. This template does not provide guidance for that option.

Licensees using Option B.2 of EA-13-109 ((SAWA and SAWM or 545°F SADW Vent (SADV) with SAWA)) may use this template for their OIP submittal. Both SAWM and SADV require the use of SAWA and may not be done independently. The HCVS actions under Part 2 apply to all of the following:

This Part is divided into the following parts:

3.1: Severe Accident Water Addition (SAWA)

3.1.A: Severe Accident Water Management (SAWM)

3.1.B: Severe Accident DW Vent (545 deg F)

Provide a sequence of events and identify any time constraint required for success including the basis for the time constraint.

SAWA and SAWM or SADV Actions supporting SA conditions that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, a walkthrough of deployment). Actions already identified under the HCVS part of this template need not be repeated here.

The time to establish the water addition capability into the RPV or DW should be less than 8 hours from the onset of the loss of all injection sources.

- *Electrical generators satisfying the requirements of EA-12-049 may be credited for powering components and instrumentation needed to establish a flow path.*
- *Time sensitive actions (TSAs) for the purpose of SAWA are those actions needed to transport, connect and start portable equipment needed to provide SAWA flow or provide power to SAWA components in the flow path between the connection point and the RPV or drywell. Actions needed to establish power to SAWA instrumentation should also be included as TSAs.*

Ref: NEI 13-02 Section 6.1.1.7.4.1, I.1.4, I.1.5

Part 3: Boundary Conditions for EA-13-109, Option B.2

The HCVS will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1 during SAWA and SAWM. Initial operator actions will be completed by plant personnel to line-up the nitrogen supply system to the HCVS from the ROS and will include the capability for remote-manual initiation either from the MCR using control switches or from the ROS (located in the DG building).

Timelines (see Attachment 2.1.A for SAWA/ SAWM) were developed to identify required operator response times and actions. The timelines are an expansion of Attachment 2A and begin either as core damage occurs (SAWA) or after initial SAWA injection is established and as flowrate is adjusted for option B.2 (SAWM). The timelines do not assume the core is ex-vessel and the actions taken are appropriate for both in-vessel and ex-vessel core damage conditions.

Access to the various SAWA/ SAWM locations for connection and control points will not require temporary ladders or scaffolding.

NOTE: Columbia will utilize Part 3.1.A, Severe Accident Water Management (SAWM) as outlined below.

Part 3.1: Boundary Conditions for SAWA

Table 3.1 – SAWA Manual Actions

Primary Action	Primary Location / Component	Notes
1. Establish HCVS capability in accordance with Part 2 of this guidance.	• MCR and/or ROS • MCR – HCVS vent valve position.	• Applicable to all SAWA/SAWM strategies.
2. Connect SAWA (FLEX) pump to water source.	• Remote - Spray Ponds	• SAWA Pump is FLEX Pump (EA-12-049 actions).
3. Connect SAWA (FLEX) pump discharge to injection piping	• Remote – hoses to RHR Valve V-63C.	• Use hose to connect to installed piping (RHR Valve) in RB (EA-12-049 actions).
4. Power SAWA/HCVS components with EA-12-049 (FLEX) generator	• Outside: RW Building via Truck Bay • Inside: RW Building Division I Switchgear Room	• FLEX DG staging and alignment per EA-12-049 actions.
5. Inject to RPV using SAWA (FLEX) pump	• Remote - Flow Elements installed in hose segments.	• Injection per EA-12-049 actions. • Initial SAWA injection rate at maximum, not to exceed 500 gpm.
6. Monitor SAWA indications	• Remote - Flow Elements installed in hose segments. • MCR - suppression pool level	• Mechanical Flow Elements in hoses installed per FLEX Actions (EA-12-049 actions).
7. Use SAWM to maintain availability of the WW vent (Part 3.1.A)	• MCR -suppression pool level • Remote - Spray Ponds SAWA (FLEX) pump. • Remote - Flow Elements installed in hose segments.	• Monitor DW Pressure and Suppression Pool Level in MCR • Control SAWA using hose installed valves and flow elements (100 gpm minimum capability is maintained for greater than 7 days).

[OPEN ITEM – 12:] SAWA/SAWM flow is controlled using hose installed valves and mechanical flow elements (EA-12-049 actions). Location of these valves and flow elements will need to be considered.

Discussion of timeline SAWA identified items
HCVS operations are discussed under Phase 1 of EA-13-109 (Part 2 of this OIP). • At ≤ 24 hours – Establish electrical power and other EA-12-049 actions needed to support the strategies for EA-13-109, Phase 1 and Phase 2 (FLEX strategy timeline states that within 8 hours FLEX equipment for battery charging will be established). • At ≤ 8 hours, establish flow paths for RPV make-up o Initiate SAWA flow to the RPV. Having the HCVS in service will assist in minimizing the peak DW pressure during the initial cooling conditions provided by SAWA. NOTES: o Action being taken within the RB under EA-12-049 conditions after RPV level lowers to 2/3 core height must be evaluated for radiological conditions assuming permanent containment shielding remains intact. (HCVS-FAQ-12, Reference 41) All other actions required are assumed to be in-line with the FLEX timeline submitted in accordance with the EA-12-049 requirements. o From HCVS-FAQ-12 (Reference 41), the primary and secondary containment boundary provides substantial shielding such that the performance of actions outside the RB does not need to consider radiological dose from containment shine and further, that existing shielding components remain in place and intact following the initiating event that leads to severe accident conditions. Figure 1-2, Columbia Generating Station RB Elevation View, shows these shielding boundaries.
Severe Accident Operation
Determine operating requirements for SAWA, such as may be used in an ELAP scenario to mitigate core damage. **Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section I.1.6, I.1.4.4**
It is anticipated that SAWA will only be used in Severe Accident Events based on presumed failure of injection systems or presumed failure to implement an injection system in a timely manner leading to core damage per direction by the plant SAMGs. This does not preclude the use of the SAWA system to supplement or replace the EA-12-049 injection systems if desired. SAWA will consist of both portable and installed equipment. The motive force equipment needed to support the SAWA strategy shall be available prior to T=8 hours from the loss of injection (assumed at T=0). The SAWA flow path includes methods to minimize exposure of personnel to radioactive liquids / gases and potentially flammable conditions by inclusion of backflow prevention. RHR LPCI injection line has installed ECCS backflow prevention devices qualified for accident scenarios. **Description of SAWA actions for first 24 hours:**

T<1 hr:

- No evaluation required for actions inside the RB for SAWA. From T=0 until T=1, there should be no adverse radiological conditions within the RB because this is the pre-core damage phase of the event (HCVS-FAQ-12, Reference 41). Expected actions are:
  - Commence EA-12-049 action in RB.

T=1 – 8 hr:

- Evaluation of noble gas and early in vessel release impact to RB access for SAWA actions is required. It is assumed that RB access is limited due to the source term at this time unless otherwise noted. (Refer to HCVS-FAQ-12 for actions in T=1-7 hr). Expected actions are:
  - Steps 1 and 2 of Table 3.1 are outside of the RB.
- Establish flow to the RPV using SAWA systems. Begin injection at a maximum rate, not to exceed 500 gpm.
  - Steps 3 and 5 of Table 3.1 (Step 4 is outside of the RB). **[OPEN ITEM -14]**

T≤8 –12 hr:

- Continue injection for 4 hours after SAWA injection begins at initial SAWA rate.
  - Step 6 of Table 3.1.

T≤ 12 hrs:

- Proceed to SAWM actions (Part 3.1.A)
  - Step 7 of Table 3.1.

Greater Than 24 Hour Coping Detail
Provide a general description of the SAWA actions for greater than 24 hours using portable and installed equipment including station modifications that are proposed. **Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3/ NEI 13-02 Section 4.2.2.4.1.3.1, I.1.4,**
SAWA Operation is the same for the full period of sustained operation. If SAWM is employed flow rates will be directed to preserve the availability of the HCVS wetwell vent (see 3.1.A).
Details:
Details of Design Characteristics/Performance Specifications *SAWA shall be capable of providing a RPV injection rate of 500 gpm within 8 hours of a loss of all RPV injection following an ELAP/Severe Accident. SAWA shall meet the design characteristics of the HCVS with the exception of the dedicated 24 hour power source. Hydrogen mitigation is provided by backflow prevention for SAWA.* **Ref: EA-13-109 Attachment 2, Section B.2.1, B.2.2, B.2.3/ NEI 13-02 Section I.1.4**
Equipment Locations/Controls/Instrumentation The locations of the SAWA equipment and controls, as well as ingress and egress paths will be evaluated for the expected severe accident conditions (temperature, humidity, radiation) for the sustained operating period to ensure the equipment remains operational throughout the sustained operating period. Personnel exposure and temperature/humidity conditions for operation of SAWA equipment will be evaluated to ensure the limits for ERO dose and plant safety guidelines for temperature and humidity are not exceeded. **See [OPEN ITEM – 14]** The electrical and mechanical equipment being used to support SAWA actions is the same equipment used for EA-12-049. The flow path makeup cooling water will be will be supplied from the spray ponds to the RPV. Implementation of the make-up function involves connecting hoses from the FLEX pump located near the spray ponds, across the yard area, and up the RB southwest stairwell. In the RB, the hose will supply the RHR piping at valve RHR-V-63C with a mechanical flow element installed. Flow into the RPV will go via the RHR LPCI injection valves. Valves will be manually aligned as necessary to direct the flow. Cross flow into other portions of the RHR system will be precluded by verifying various RHR valve positions (per FLEX procedure, EA-12-049 compliance document). DW pressure and Suppression Pool level will be monitored and SAWA/SAWM flow rate will be adjusted by use of the FLEX hose installed valve and mechanical flow element. Communication will be established between the MCR and the FLEX pump location.

The FLEX DG is connected in the RW building as described in the EA-12-049 compliance documents. The FLEX DG is located near the RW building which is significantly away from the discharge of the HCVS at the elevated HCVS release point on the RB. Refueling of the FLEX DG will be accomplished from portable diesel transport containers as described in the FLEX procedures (EA-12-049 compliance documents). The spray pond is a significant distance from the discharge of the HCVS release point on the RB.

Projected SA conditions indicate that personnel can complete the initial activities (HCVS-FAQ-12). Projected SA conditions (radiation / temperature) will be evaluated to show that personnel can complete the initial and support activities without exceeding the ERO-allowable dose for equipment operation or site safety standards.

See [OPEN ITEM – 3] and [OPEN ITEM – 4]

Electrical equipment and instrumentation will be powered from the existing station batteries and from AC distribution systems that are powered from the EA-12-049 generator(s). The HCVS battery chargers are also powered from the FLEX (EA-12-049) generator to maintain the battery capacities during the Sustained Operating period. The indications include (* are minimum):

Parameter	Instrument	Location	Power Source / Notes
*DW Pressure	CMS-PR-1 (Existing MCR Instrument)	MCR	Station batteries via EA-12-049 generator
*Suppression Pool Level	CMS-LR-3 (Existing MCR Instrument)	MCR	Station batteries via EA-12-049 generator
*SAWA Flow	FLEX Pump Flow indicator	Valve Position and Flow Elements installed in hose segments.	Mechanical Flow Elements in hoses installed per FLEX Actions (EA-12-049 actions).
SAWA pump instrumentation	Various: RPM and pressure (as minimum) on-board pump skid.	At SAWA (FLEX) Pump	EA-12-049, FLEX Pump

The instrumentation and equipment being used for SAWA and supporting equipment has been evaluated to perform for the Sustained Operating period under the expected radiological and temperature conditions.

Equipment Protection

Any SAWA component and connections external to protected buildings have been protected against the screened-in hazards of EA-12-049 for the station. The FLEX pump, FLEX DG, hoses, cables, connectors, and other equipment are stored in either the FLEX buildings, inside a Seismic Class I structure, or approved storage location. Thus, portable equipment used for SAWA implementation meets the protection requirements for storage in accordance with the criteria in NEI 12-06 Revision 0.

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section 5.1.1, 5.4.6, I.1.6

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.

Ref: EA-13-109 Attachment 2, Section A.3.1, B.2.3 / NEI 13-02 Section 1.3, 6.1.2

The following ABN-FSG procedures have been developed to support implementation of SAWA:

- ABN-FSG-002 provides water makeup strategies for RPV, SFP, DW, WW, CST during an Extended Loss of AC Power or other Beyond Design Basis Event.
- ABN-FSG-004 provides direction for DG5 crosstie to E-MC-7A and E-MC-8A

These FLEX procedures support SAWA by providing direction for many of the SAWA actions, including (briefly):

- Hook up FLEX pump to intake manifold at Spray Pond.
- Start FLEX pump for RPV injection via RHR (flow is monitored and adjusted using valves and mechanical flow elements installed in the FLEX hose segments).
- Hook-up and start FLEX DG to repower E-MC-7A and/or E-MC-8A

Identify modifications*:*

List modifications and describe how they support the SAWA Actions.

Ref: EA-13-109 Attachment 2, Section B.2.2, / NEI 13-02 Section 4.2.4.4, 7.2.1.8, Appendix I

None. No additional modifications are planned for SAWA. The electrical and mechanical equipment being used to support SAWA actions are the same equipment used for EA-12-049.

Component Qualifications:

State the qualification used for equipment supporting SAWA

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section I.1.6

Permanently installed plant equipment shall meet the same qualifications as described in Part 2 of this OIP. Temporary/Portable equipment shall be qualified and stored to the same requirements as FLEX equipment as specified in NEI 12-06 Rev 0. SAWA components are not required to meet NEI 13-02, Table 2-1 design conditions.

Notes: None

Part 3.1.A: Boundary Conditions for SAWA/SAWM

Time periods for the maintaining SAWM actions such that the WW vent remains available:

SAWM Actions supporting SA conditions that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, a walkthrough of deployment). Actions already identified under the HCVS part of this template need not be repeated here.

There are three time periods for the maintaining SAWM actions such that the WW vent remains available to remove decay heat from the containment:

- *SAWM can be maintained for >7 days without the need for a drywell vent to maintain pressure below PCPL or containment design pressure, whichever is lower.*
  - *Under this approach, no detail concerning plant modifications or procedures is necessary with respect to how alternate containment heat removal will be provided.*
- *SAWM can be maintained for at least 72 hours, but less than 7 days before DW pressure reaches PCPL or design pressure, whichever is lower.*
  - *Under this approach, a functional description is required of how alternate containment heat removal might be established before DW pressure reaches PCPL or design pressure whichever is lower. Under this approach, physical plant modifications and detailed procedures are not necessary, but written descriptions of possible approaches for achieving alternate containment heat removal and pressure control will be provided.*
- *SAWM can be maintained for <72 hours* SAWM strategy can be implemented but for less than 72 hours before DW pressure reaches PCPL or design pressure whichever is lower.
  - *Under this approach, a functional description is required of how alternate containment heat removal might be established before DW pressure reaches PCPL or design pressure whichever is lower. Under this approach, physical plant modifications and detailed procedures are required to be implemented to insure achieving alternate containment heat removal and pressure control will be provided for the sustained operating period.*

Ref: NEI 13-02 Appendix C.7

Columbia will utilize Part 3.1.A, Severe Accident Water Management (SAWM).

SAWM can be maintained for >7 days without the need for a drywell vent to maintain pressure below containment design pressure which is lower than PCPL. SAWM strategy can preserve Wetwell vent path for > 7 days.

Basis for SAWM time frame
SAWM can be maintained greater than or equal to 7 days (Option 1):   Columbia is bounded by the evaluations performed in BWROG TP-2015-008, Reference 43, and representative of the reference plant in NEI 13-02 Figures C-2 through C-6 (NEI 13-02 C.7.1.4.1). Columbia is performing MAAP evaluations to confirm applicability/similarity of the BWROG generic MAAP evaluations (for reference plant in NEI 13-02 figures C-2 through C-6). Specifically, Columbia's MAAP run reduced SAWM flowrates to a decreasing minimum flow rate which would dissipate core decay heat and maintain the suppression pool level constant (operator actions may prefer to keep suppression pool level constant). When using a constant reduced SAWM flowrate of 100 gpm, the suppression pool level response at Columbia would be expected to coincide with Figure C-3 of NEI 13-02 (given that level would decrease slightly and then gradually increase as decay heat decreases). **[OPEN ITEM-15]**   The instrumentation relied upon for SAWM operations is drywell pressure, suppression pool level, and SAWA flow.   Drywell pressure and suppression pool level indication are powered by the station batteries for a minimum of 8 hours and then by the FLEX generator which is placed in-service prior to core breach (expected to occur no earlier than approximately 8 hours following RCIC early failure). The FLEX DG will provide power throughout the sustained operation period (7 days). (NEI 13-02 C.7.1.4.2, C.8.3.1)   SAWA/SAWM flow instrumentation consists of mechanical flow elements in hoses installed per FLEX Actions (EA-12-049 actions).   Suppression pool level indication is maintained throughout the sustained operation period, so the HCVS remains in-service. The time to reach the level at which the WW vent must be secured is >7days using SAWM flowrates. SAWM strategy can preserve WW vent path for > 7 days. (NEI 13-02 C.6.3, C.7.1.4.3)

Table 3.1.B – SAWM Manual Actions

Primary Action	Primary Location / Component	Notes
1. Establish SAWA capability in accordance with Part 3.1 (Table 3.1) of this guidance	• MCR and/or ROS • Remote for SAWA – Spray pond, hoses, flow elements and flow control.	• See Table 3.1 for SAWA
2. Lower SAWA injection rate to control Suppression pool level and decay heat removal	• MCR • Remote - Spray Ponds SAWA (FLEX) pump. • Remote - Flow elements and flow control valve installed in hose segments.	• Reduce flow to maintain containment and WW parameters to ensure WW vent remains functional. • 100 gpm minimum capability is maintained for greater than 7 days
3. Control SAWM flowrate for containment control, decay heat removal, and maintain HCVS availability.	• MCR • Remote - Spray ponds SAWA (FLEX) pump. • Remote - Flow elements and flow control valve installed in hose segments.	• Monitor DW pressure and suppression pool level in MCR. • Control SAWA using hose installed valves and flow elements (100 gpm minimum capability is maintained for greater than 7 days).
4. Establish alternate source of decay heat removal	• MCR • Remote - Spray ponds SAWA (FLEX) pump. • Remote - Flow elements installed in hose segments.	• >7 days. SAWM strategy can preserve Wetwell vent path for > 7 days.
5. Secure SAWA / SAWM	• MCR • Remote - Spray ponds	• When reliable alternate containment decay heat removal is established. Follow FLEX procedures (EA-12-049 actions).

SAWM Time Sensitive Actions

Time Sensitive SAWM Actions:

12 Hours – Initiate actions to maintain the WW vent capability by lowering injection rate, while maintaining the cooling of the core debris (SAWM). Monitor SAWM critical parameters while ensuring the WW vent remains available.

[OPEN ITEM-15]

SAWM **Severe Accident Operation**
Determine operating requirements for SAWM, such as may be used in an ELAP scenario to mitigate core damage. **Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Appendix C**
It is anticipated that SAWM will only be used in severe accident events based on presumed failure of plant injection systems or presumed failure to implement an injection system in a timely manner leading to core damage per direction by the plant SAMGs. Refer to attachment 2.1.D for SAWM SAMG language additions.
First 24 Hour Coping Detail
Provide a general description of the SAWM actions for first 24 hours using installed equipment including station modifications that are proposed. *Given the initial conditions for EA-13-109:* • *BDBEE occurs with ELAP* • *Failure of all injection systems, including steam-powered injection systems* **Ref: EA-13-109 Section 1.2.6, Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 2.5, 4.2.2, Appendix C, Section C.7**
SAWA will be established as described as stated above. SAWM will use the installed instrumentation to monitor and adjust the flow from SAWA to control the pump discharge to deliver flowrates applicable to the SAWM strategy. Once the SAWA initial flow rate has been established for 4 hours, the flow will be reduced while monitoring DW pressure and suppression pool level. SAWM flowrate can be lowered to maintain containment parameters and preserve the WW vent path. SAWM will be capable of injection for the period of sustained operation.
Greater Than 24 Hour Coping Detail
Provide a general description of the SAWM actions for greater than 24 hours using portable and installed equipment including station modifications that are proposed. **Ref: EA-13-109 Section 1.2.4, 1.2.8, Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section 4.2.2, Appendix C, Section C.7**
<u>SAWM can be maintained >7 days</u>: The SAWM flow strategy will be the same as the first 24 hours until 'alternate reliable containment heat removal and pressure control' is reestablished. SAWM flow strategy uses the SAWA flow path. SAWM strategy can preserve WW vent path for > 7 days. No additional modifications are being made for SAWM.

Details:
Details of Design Characteristics/Performance Specifications **Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section Appendix C**
SAWM shall be capable of monitoring the containment parameters (DW pressure and suppression pool level) to provide guidance on when injection rates shall be reduced, until alternate containment decay heat/pressure control is established. SAWA will be capable of injection for the period of sustained operation.
Equipment Locations/Controls/Instrumentation *Describe location for SAWM monitoring and control.* **Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Appendix C, Section C.8, Appendix I**
The SAWM control location is the same as the SAWA control location. Makeup cooling water will be supplied from the spray ponds to the RPV. Implementation of the make-up function involves connecting hoses from the FLEX pump located near the spray ponds, across the yard area, and up the RB southwest stairwell. In the RB, the hose will supply the RHR piping at valve RHR-V-63C with the hose having a mechanical flow element and manual flow control valve qualified to operate under the expected environmental conditions. Flow into the RPV will be via the RHR LPCI injection valves. Valves will be manually aligned as necessary to direct the flow. Communications will be established between the SAWM control location and the MCR. Cross flow into other portions of the RHR system will be precluded by verifying various RHR valve positions (per FLEX procedure, EA-12-049 compliance document). DW pressure and suppression pool level will be monitored and SAWA/SAWM flow rate will be adjusted by use of the FLEX hose installed valves and mechanical flow elements. Communication will be established between the MCR and the FLEX pump location. Suppression pool level and DW pressure are read in the MCR using indicators powered by the station's batteries and by the FLEX DG installed under EA-12-049. These indications are used to control SAWA flowrate to the RPV. **See [OPEN ITEM – 12]**
Key Parameters: *List instrumentation credited for the SAWM Actions.*
Parameters used for SAWM are: • DW Pressure • Suppression Pool Level • SAWM Flowrate

The Drywell pressure and Suppression Pool level instruments are qualified to RG 1.97/equivalent and are the same as listed in Part 2 of this OIP. The SAWM flow instrumentation will be qualified for the expected environmental conditions expected when needed. **See [OPEN ITEM – 6]**
Notes: None

Part 3.1.B: Boundary Conditions for SAWA/SADV

Applicability of WW Design Considerations
Part 3.1.B is non-applicable for Columbia.
Table 3.1.C – SADV Manual Actions N/A
Timeline for SADV N/A
Severe Accident Venting N/A
First 24 Hour Coping Detail N/A
Greater Than 24 Hour Coping Detail N/A
Details:

Part 4: Programmatic Controls, Training, Drills and Maintenance

Programmatic Controls: Identify how the programmatic controls will be met.

Provide a description of the programmatic controls equipment protection, storage and deployment and equipment quality addressing the impact of temperature and environment

Ref: EA-13-109 Section 1.2.10, 3.1, 3.2 / NEI 13-02 Sections 5, 6.1.2, 6.1.3, 6.2

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 analyzed for radiation and temperature to ensure they are accessible during severe accidents.

See [OPEN ITEM – 2], [OPEN ITEM – 3], [OPEN ITEM – 4] and [OPEN ITEM-14].

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.

Part 4: Programmatic Controls, Training, Drills and Maintenance

Columbia will establish provisions for out-of-service requirements of the HCVS and compensatory measures. The following provisions will be documented in PPM 1.5.18, *Managing B.5.b and FLEX Equipment Unavailability*:

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

- If for up to 90 consecutive days, the primary or alternate means of HCVS/SAWA operation are non-functional, no compensatory actions are necessary.
- If for up to 30 days, the primary and alternate means of HCVS/SAWA 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 cause(s) of the non-functionality will be determined,
  - The actions to be taken and the schedule for restoring the system to functional status and prevent recurrence w be determined,
  - The actions to implement appropriate compensatory actions will be imitated, and
  - Restore full HCVS functionality at the earliest opportunity not to exceed one full operating cycle.

[OPEN ITEM – 13:] Reconcile the out-of-service provisions for HCVS/SAWA with the provisions documented in Columbia's PPM 1.5.18, Managing B.5.b and FLEX Equipment Unavailability.

Training: Describe training plan

List training plans for affected organizations or describe the plan for training development

Ref: EA-13-109 Section 3.2 / NEI 13-02 Section 6.1.3

Personnel expected to perform direct execution of the HCVS/SAWA/SAWM actions 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/SAWA/SAWM actions, systems or strategies. Training content and frequency will be established using the Systematic Approach to Training (SAT) process.

Drills: Identify how the drills and exercise parameters will be met.

Alignment with NEI 13-06 and 14-01 as codified in NTTF Recommendation 8 and 9 rulemaking

The Licensee should demonstrate use of the HCVS/SAWA/SAWM system in drills, tabletops, or exercises as follows:

- *Hardened containment vent operation on normal power sources (no ELAP).*
  - *During FLEX demonstrations (as required by EA-12-0490): Hardened containment vent operation on backup power and from primary or alternate location during conditions of ELAP/loss of UHS with no core damage. System use is for containment heat removal AND containment pressure control.*
  - *HCVS operation on backup power and from primary or alternate location during conditions of ELAP/loss of UHS with core damage. System use is for containment heat removal AND containment pressure control with potential for combustible gases (Demonstration may be in conjunction with SAG change).*
  - *Operation for sustained period with SAWA and SAWM to provide decay heat removal and containment pressure control.*

Ref: EA-13-109 Section 3.1 / NEI 13-02 Section 6.1.3

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.

Maintenance: Describe maintenance plan:

Describe the elements of the maintenance plan

- *The maintenance program should ensure that the HCVS/SAWA/SAWM equipment reliability is being achieved in a manner similar to that required for FLEX equipment. Standard industry templates (e.g., EPRI) and associated bases may be developed to define specific maintenance and testing.*
  - *Periodic testing and frequency should be determined based on equipment type, expected use and manufacturer's recommendations.*
  - *Testing should be done to verify design requirements and/or basis. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.*
  - *Preventive maintenance should be determined based on equipment type and expected use. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.*
  - *Existing work control processes may be used to control maintenance and testing.*
- *HCVS/SAWA/SAWM permanent installed equipment should be maintained in a manner that is consistent with assuring that it performs its function when required.*

- *HCVS/SAWA permanently installed equipment should be subject to maintenance and testing guidance provided to verify proper function.*

- *HCVS/SAWA/SAWM non-installed equipment should be stored and maintained in a manner that is consistent with assuring that it does not degrade over long periods of storage and that it is accessible for periodic maintenance and testing.*

Ref: EA-13-109 Section 1.2.13 / NEI 13-02 Section 5.4, 6.2

Columbia will utilize the standard EPRI industry PM process (Similar to the Preventive Maintenance Basis Database) for establishing the maintenance calibration and testing actions for HCVS/SAWA/SAWM 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 and SAWA to ensure reliable operation of the system.

Table 4-1: Testing and Inspection Requirements

Description	Frequency
Cycle the HCVS and installed SAWA valves[1] and the interfacing system boundary valves not used to maintain containment integrity during Mode 1, 2 and 3. For HCVS valves, this test may be performed concurrently with the control logic test described below.	Once per every[2] operating cycle
Cycle the HCVS and installed SAWA check valves not used to maintain containment integrity during unit operations[3]	Once per every other[4] operating cycle
Perform visual inspections and a walk down of HCVS and installed SAWA components	Once per every other[4] operating cycle
Functionally test the HCVS radiation monitors.	Once per operating cycle
Leak test the HCVS	1. Prior to first declaring the system functional; 2. Once every three operating cycles thereafter; and 3. After restoration of any breach of system boundary within the buildings
Validate the HCVS operating procedures by conducting an open/close test of the HCVS control function from its control location and ensuring that all HCVS vent path and interfacing system boundary valves[5] move to their proper (intended) positions.	Once per every other operating cycle

[1] Not required for HCVS and SAWA check valves.

[2] After two consecutive successful performances, the test frequency may be reduced to a maximum of once per every

other operating cycle. [3] Not required if integrity of check function (open and closed) is demonstrated by other plant testing requirements. [4] After two consecutive successful performances, the test frequency may be reduced by one operating cycle to a maximum of once per every fourth operating cycle. [5] Interfacing system boundary valves that are normally closed and fail closed under ELAP conditions (loss of power and/or air) do not require control function testing under this part. Performing existing plant design basis function testing or system operation that reposition the valve(s) to the HCVS required position will meet this requirement without the need for additional testing.
Notes: None.

Part 5: Milestone Schedule

Provide a milestone schedule

This schedule should include:

- **Modifications timeline**
- **Procedure guidance development complete**
  - **HCVS Actions**
  - **Maintenance**
- **Storage plan (reasonable protection)**
- **Staffing analysis completion**
- **Long term use equipment acquisition timeline**
- **Training completion for the HCVS Actions**

The dates specifically required by the order are obligated or committed dates. Other dates are planned dates subject to change. Updates will be provided in the periodic (six month) status reports.

Ref: EA-13-109 Section D.1, D.3 / NEI 13-02 Section 7.2.1

The following milestone schedules are provided. The dates are planning dates subject to change as design and implementation details are developed. Any changes to the following target dates will be reflected in the subsequent 6 month status reports.

Phase 1 Milestone Schedule:

Phase 1 Milestone Schedule:

Milestone	Target Completion Date	Activity Status	Comments *{Include date changes in this column}*
Hold preliminary/conceptual design meeting	June 2014	Complete	
Submit Overall Integrated Implementation Plan (Phase 1)	June 2014	Complete	GO2-14-107 6/30/2014
Submit 6-Month Status Report	Dec. 2014	Complete	GO2-14-175 12/17/2014
Submit 6-Month Status Report	June 2015	Complete	GO2-15-093 6/30/2015
WW Design Engineering Complete	May 2016		

Part 5: Milestone Schedule

Submit 6-Month Status Report (Phase 1)	Dec. 2015		Simultaneous with Phase 2 OIP
WW Operation Procedure Changes Developed	Mar 2017		
Site Specific WW Maintenance Procedure Developed	June 2017		
Submit 6 Month Status Report	June 2016		
Submit 6-Month Status Report	Dec. 2016		
WW Training Complete	Apr. 2017		
WW Installation Complete	May 2017		
WW Procedure Changes Active	May 2017		
WW Walk Through Demonstration/Functional Test	June 2017		
Submit WW Completion Report	Aug, 2017		

Phase 2 Milestone Schedule:

Phase 2 Milestone Schedule

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
Hold preliminary/conceptual design meeting	Jul 2016		
Submit Overall Integrated Implementation Plan	Dec 2015		
Submit 6 Month Status Report	Jun 2016		
Submit 6 Month Status Report	Dec 2016		
Submit 6 Month Status Report	Jun 2017		
Design Engineering On-site/Complete	Jul 2018		
Submit 6 Month Status Report	Dec. 2017		
Operations Procedure Changes Developed	Jan 2019		
Site Specific Maintenance Procedure Developed	Jan 2019		
Training Complete	Apr 2019		
Implementation Outage	May 2019		
Procedure Changes Active	May 2019		
Walk Through Demonstration/Functional Test	Jun 2019		

Part 5: Milestone Schedule

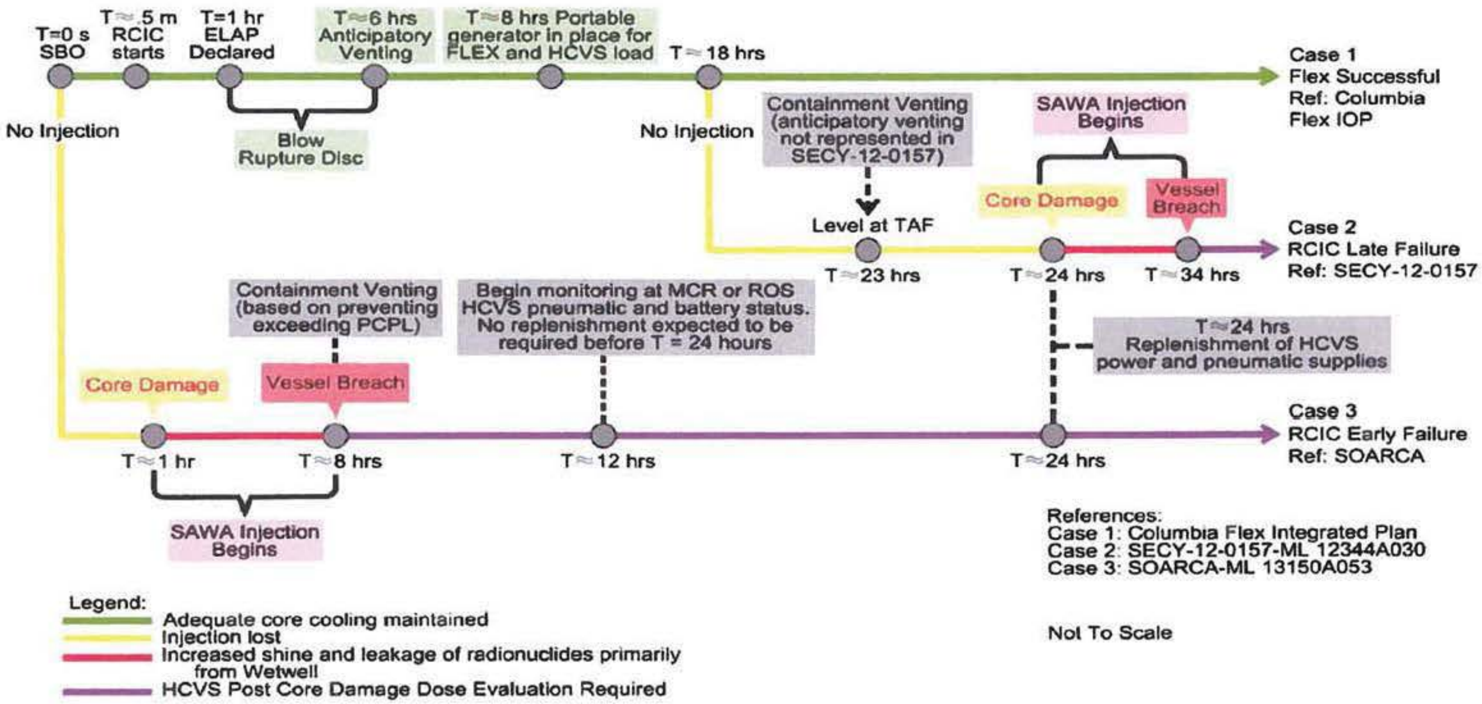
Submit 6 Month Status Report	June 2018		
Submit 6 Month Status Report	Dec 2018		
Submit Completion Report	Aug 2019		

Notes: None

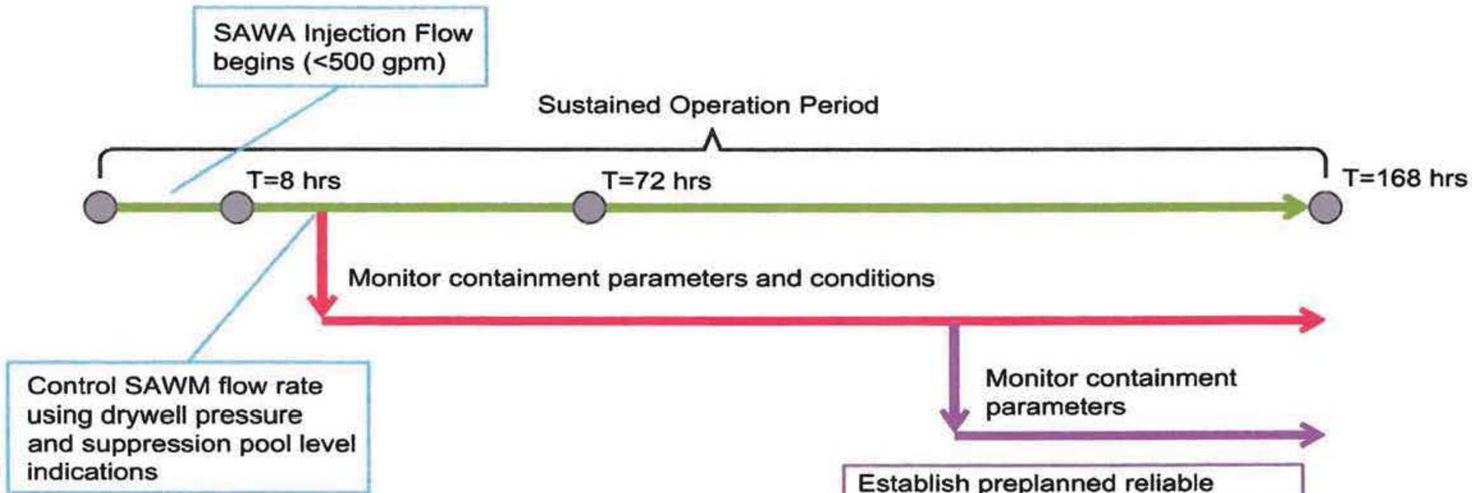
Attachment 1: HCVS Portable Equipment

List portable equipment	BDBEE Venting	Severe Accident Venting	Performance Criteria	Maintenance / PM requirements
FLEX DG (and associated equipment)	**X**	**X**	**Per Response to EA-12-049**	**Per Response to EA-12-049**
Portable Air Compressor	**X**	**X**	**Per Response to EA-12-049**	**Per Response to EA-12-049**
SAWA/SAWM Pump (and associated equipment)	**X**	**X**	**500 gpm for first 4 hours and 100 gpm for first 7 days**	**Per Response to EA-12-049 (SAWA/SAWM (FLEX) Pump (and associated equipment).**

See [OPEN ITEM – 11] for FLEX Portable Air Compressors



Attachment 2A: Sequence of Events Timeline – HCVS



Time	Action
T= 0 hours	Start of ELAP
T≤ 8 hours	Initiate SAWA flow at 500 gpm as soon as possible but no later than 8 hours
T≤ 12 hours	Throttle SAWM flow to 100 gpm, ~ 4 hours after initiation of SAWA flow
T= 168 hours	End of Sustained Operation

Attachment 2.1.A: Sequence of Events Timeline – SAWA / SAWM

Attachment 2.1.B: Sequence of Events Timeline – SADV

[If SAWA/SADV is chosen by a Plant Site then site specific detail to be provided in OIP]

Non Applicable to Columbia Generating Station

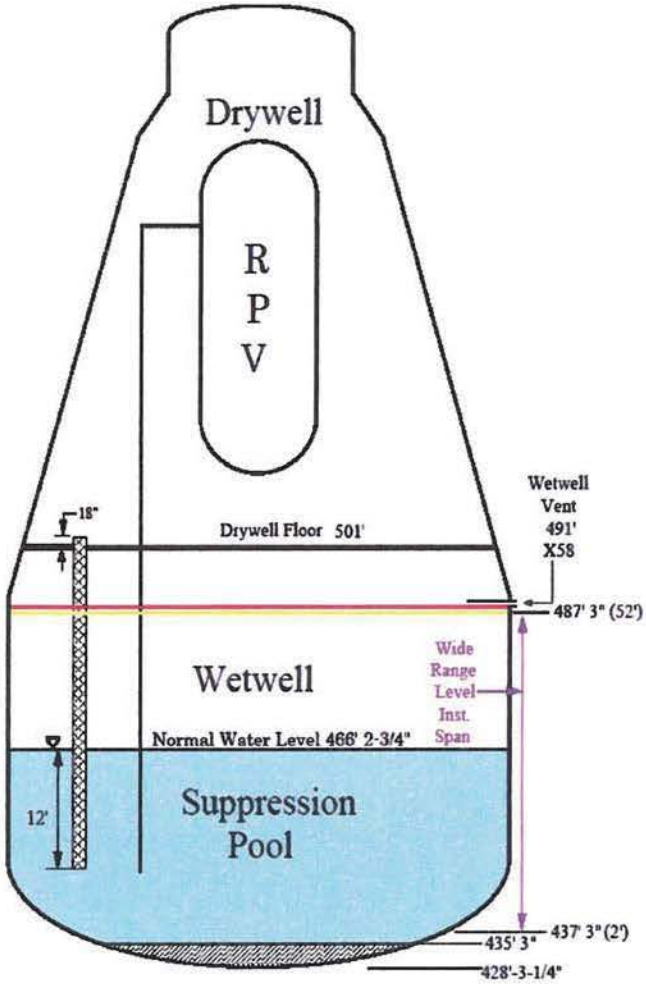
Attachment 2.1.C: SAWA / SAWM Plant-Specific Datum

Drywell Net Free Volume = 200,540 ft^3.
Wetwell Free Volume = 142,500 ft^3.
Suppression Pool Water Volume at Normal Water Level = 127,197 ft^3 = 952,000 gal.
Approximate Suppression Pool volume per foot = 30,700 gal/ft.
Estimated rate of level change* in Suppression Pool at:
500 gpm = 1 ft/hr [500 gpm * 60min/hr * 1/30700 gal/ft]
100 gpm = 0.2 ft/hr [100 gpm * 60min/hr * 1/30700 gal/ft]

***NOTE:** the estimated rate of level change in the Suppression Pool does not consider water mass loss rates of steam leaving containment through the HCVS vent.

(red line) = Elev. 490' 6" = Loss of Wetwell Vent Function (Bottom of 12" Vent Penetration at Elev 491'), Suppression Pool Water Volume = 1,697,000 gal.

(yellow line) = Elev. 487' 3" = Top of Wetwell Level Instrumentation, Suppression Pool Water Volume = 1,597,000 gal.



Attachment 2.1.D: SAWM SAMG Approved Language

The following general cautions, priorities and methods will be evaluated for plant specific applicability and incorporated as appropriate into the plant specific SAMGs using administrative procedures for EPG/SAG change control process and implementation. SAMGs are symptom based guidelines and therefore address a wide variety of possible plant conditions and capabilities while these changes are intended to accommodate those specific conditions assumed in Order EA-13-109. The changes will be made in a way that maintains the use of SAMGs in a symptom based mode while at the same time addressing those conditions that may exist under extended loss of AC power (ELAP) conditions with significant core damage including ex-vessel core debris.

Actual Approved Language that will be incorporated into site SAMG*

Cautions:

- Addressing the possible plant response associated with adding water to hot core debris and the resulting pressurization of the primary containment by rapid steam generation.
- Addressing the plant impact that raising suppression pool water level above the elevation of the suppression chamber vent opening elevation will flood the suppression chamber vent path.

Priorities:

With significant core damage and RPV breach, SAMGs prioritize the preservation of primary containment integrity while limiting radioactivity releases as follows:

- Core debris in the primary containment is stabilized by water addition (SAWA)
- Primary containment pressure is controlled below the Primary Containment Pressure Limit (Wetwell venting)
- Water addition is managed to preserve the Mark I/II suppression chamber vent paths, thereby retaining the benefits of suppression pool scrubbing and minimizing the likelihood of radioactivity and hydrogen release into the secondary containment (SAWM)

Methods:

Identify systems and capabilities to add water to the RPV or drywell, with the following generic guidance:

- Use controlled injection if possible.
- Inject into the RPV if possible.
- Maintain injection from external sources of water as low as possible to preserve suppression chamber vent capability.

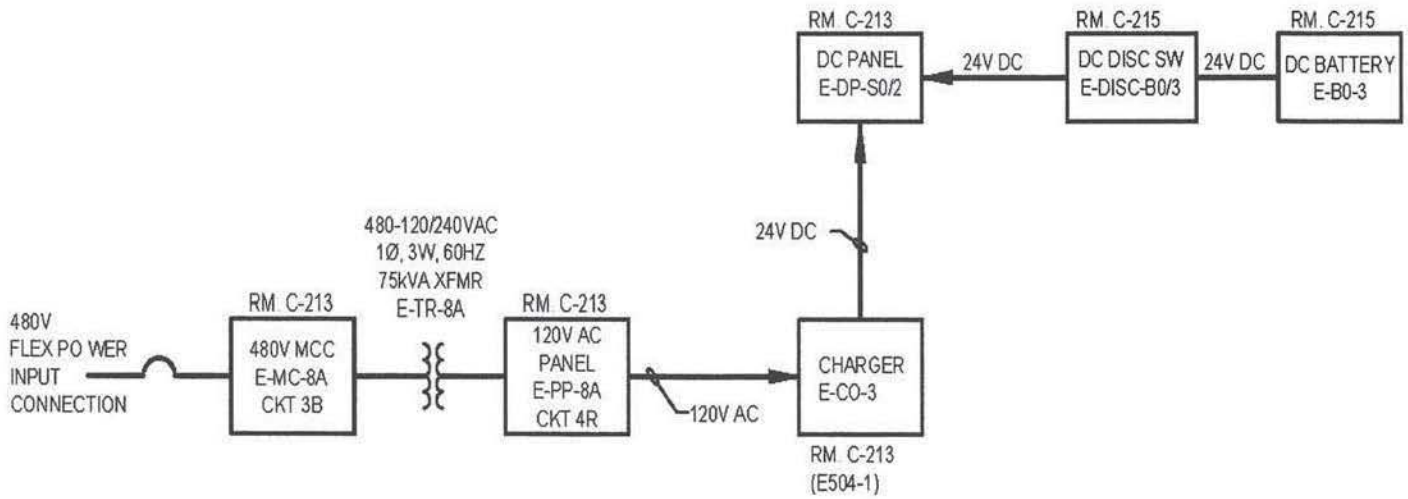
* Actual language may vary by acceptable site procedure standards, but intent and structure should follow this guidance.

Attachment 3: Conceptual Sketches

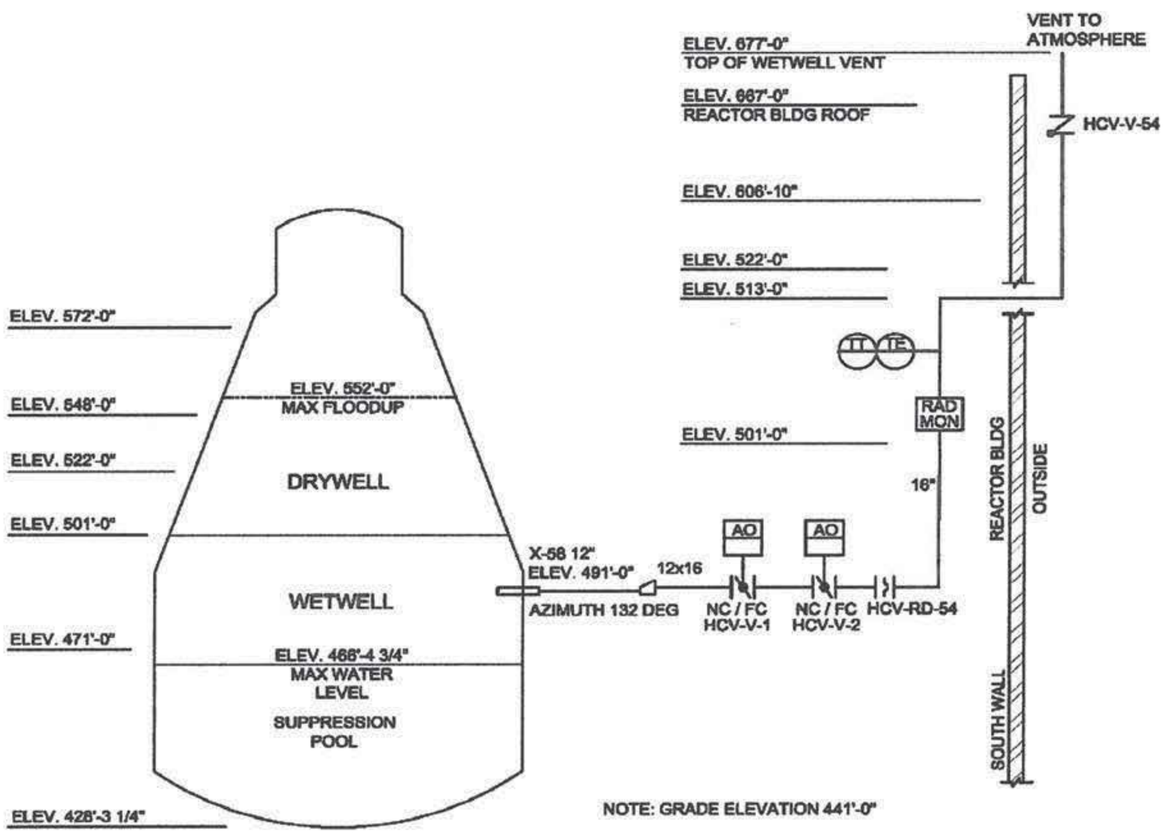
Sketch 1: Electrical Layout of System *(preliminary)*

Sketch 2: Flow Diagram *(preliminary)*

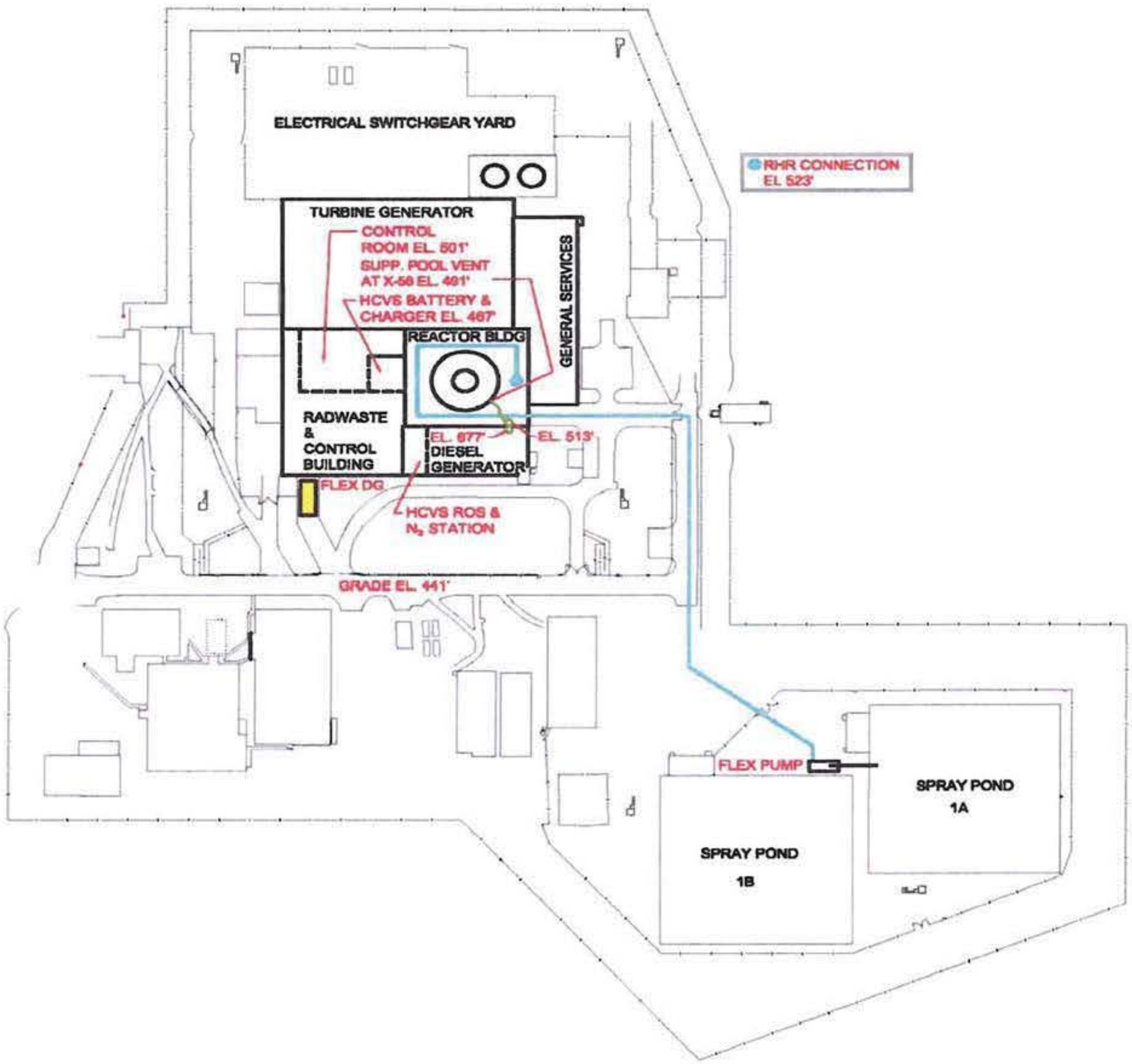
Sketch 3: P&ID Layout of HCVS *(preliminary)*
• Egress and Ingress Pathways to ROS
• Site layout sketch to show location/routing of HCVS piping and associated components.



Sketch 1: Electrical Layout of System
(<u>Preliminary</u>)



Sketch 2 – Flow Diagram
(Pipe Routing Layout, HCVS WW Vent)
(Preliminary)



Sketch 3: P&ID Layout of HCVS and SAWA/SAWM
(Site Layout and SAWA Routing of current HCVS and SAWA)
(*Preliminary*)

Attachment 4: HCVS Wetwell Failure Evaluation Table

Functional Failure Mode	Failure Cause	Alternate Action	Failure with Alternate Action Impact on Containment Venting?
Failure of Vent Valve to Open on Demand	Valves fail to open due to complete loss of batteries (long term)	Open valves by local manual operation of the SPV at the remote operating station (ROS). Recharge HCVS batteries with FLEX provided generators, considering severe accident conditions.	No
Failure of Vent Valve to Open on Demand	Valves fail to open due to loss of normal pneumatic air supply (short term)	No action needed, nitrogen is supplied by dedicated nitrogen bottles which is sufficient for at least 8 cycles each of valves HCV-V-1 and 2 over first 24 hours.	No
Failure of Vent Valve to Open on Demand	Valves fail to open due to loss of normal pneumatic air supply (long term)	Replace bottles or provide pneumatic supply via FLEX portable air compressor. An air fitting is supplied for a FLEX air compressor connection.	No
Failure of Vent Valve to Open on Demand	Valves fail to open due to SPV electrical coil failure	Open valves by local manual operation of the SPV at the ROS.	No
Failure of Vent to Open on Demand	Valves fail to open/close due to SPV failure	Heroic action needed	Yes
Failure to stop venting on demand	The two valves in the vent flow path fail open	Not credible as there is no common mode failure that would prevent at least 1 of the 2 valves to close. Valves fail closed by spring action.	No

Functional Failure Mode	Failure Cause	Alternate Action	Failure with Alternate Action Impact on Containment Venting?
Spurious Opening of Vent Valves	Not credible as key locked switches prevent miss-positioning of the HCVS vent valves. Manual SPV operation is precluded by preventing access to the SPVs by key locked physical barrier. Additionally, a rupture disc is located downstream of the HCVS vent valves which would require additional manual action to breach.	N/A	No
Spurious Closure of Vent Valves	Valve fails to stay open due to failure of SPV electrical coil.	Reopen valves by local manual operation of the SPV at the ROS.	No
Spurious Vent Valve operation	Valve fails to stay open/closed due to complete loss of DC batteries (long term)	Not credible as SPVs latch in the open or closed position and do not require power to hold that position. SPV will remain in position for any length of time without DC power. No action required.	No
Spurious Vent Valve closure	Valve fails to stay open due to loss of pneumatic supply.	Replace bottles or provide pneumatic supply via FLEX portable air compressor.	No

Attachment 5: References

1. Generic Letter 89-16, Installation of a Hardened Wetwell Vent, dated September 1, 1989
2. Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012 (ML12054A735)
3. Order EA-12-050, Reliable Hardened Containment Vents, dated March 12, 2012 (ML12054A696)
4. Order EA-12-051, Reliable SFP Level Instrumentation, dated March 12, 2012
5. Order EA-13-109, Severe Accident Reliable Hardened Containment Vents, dated June 6, 2013 (ML13143A321)
6. JLD-ISG-2012-01, Compliance with Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated August 29, 2012 (ML 12229A174).
7. JLD-ISG-2012-02, Compliance with Order EA-12-050, Reliable Hardened Containment Vents, dated August 29, 2012 (ML12229A475).
8. JLD-ISG-2013-02, Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents, dated November 14, 2013 (ML13304B836).
9. NRC Responses to Public Comments, Japan Lessons-Learned Project Directorate Interim Staff Guidance JLD-ISG-2012-02: Compliance with Order EA-12-050, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents, dated August 29, 2012 (ML12229A477)
10. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012
11. NEI 13-02 Rev. 1, Industry Guidance for Compliance with Order EA–13–109, Revision 1, Dated April 2014 (ML15113B318)
12. NEI 13-06, Enhancements to Emergency Response Capabilities for Beyond Design Basis Accidents and Events, Revision 0, dated March 2014
13. NEI 14-01, Emergency Response Procedures and Guidelines for Extreme Events and Severe Accidents, Revision 0, dated March 2014
14. NEI FAQ HCVS-01, HCVS Primary Controls and Alternate Controls and Monitoring Locations
15. NEI FAQ HCVS-02, HCVS Dedicated Equipment
16. NEI FAQ HCVS-03, HCVS Alternate Control Operating Mechanisms
17. NEI FAQ HCVS-04, HCVS Release Point
18. NEI FAQ HCVS-05, HCVS Control and 'Boundary Valves'
19. NEI FAQ HCVS-06, FLEX Assumptions/HCVS Generic Assumptions
20. NEI FAQ HCVS-07, Consideration of Release from Spent Fuel Pool Anomalies

21. NEI FAQ HCVS-08, HCVS Instrument Qualifications

22. NEI FAQ HCVS-09, Use of Toolbox Actions for Personnel

23. NEI White Paper HCVS-WP-01, HCVS Dedicated Power and Motive Force (ML14120A295)

24. NEI White Paper HCVS-WP-02, HCVS Cyclic Operations Approach (ML14309A588)

25. NEI White Paper HCVS-WP-03, Hydrogen/CO Control Measures (ML14295A442)

26. HCVS-WP-04, Missile Evaluation for HCVS Components 30 Feet Above Grade, Revision 0, August 17, 2015 (ML15244A923)

27. IEEE Standard 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

28. EN Letter GO2-13-034 to NRC Columbia's EA-12-049 (FLEX) Overall Integrated Implementation Plan, Rev 1, February 2013

29. EN Letter GO2-13-035 to NRC Columbia's EA-12-050 (HCVS) Overall Integrated Implementation Plan, Rev 0, February 2013

30. EN Letter GO2-13-036 to NRC Columbia's EA-12-051 (SFP LI) Overall Integrated Implementation Plan, Rev 0, February 2013

31. EPRI Technical Report 3002001785, "Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications," June 2013 (ML13190A201)

32. JLD-ISG-2012-03, Revision 0, -Compliance with Order EA-12-51, Reliable Spent Fuel Pool Instrumentation, Interim Staff Guidance, August 29, 2012 (ML 12221A339)

33. JLD-ISG-2015-01, Compliance with Phase 2 of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions, dated April 2015

34. EN Letter GO2-13-087 to NRC, Columbia's Response to EA-13-109 Reliable HCVS Capable of Operation Under Severe Accident Conditions, Rev 0, June 24, 2013.

35. EN Letter GO2-14-107 to NRC, Columbia's Response to EA-13-109, Overall Integrated Plan (OIP) Phase 1 of Reliable HCV Under Severe Accident Conditions, Rev 0, June 30, 2014 (ML 14191A688).

36. EN Letter GO2-14-175 to NRC, Columbia's First 6 Month Status Update Report for the Implementation of NRC Order EA-13-109 - Overall Integrated Plan (OIP) for Reliable HCV Under Severe Accident Conditions, Rev 0, December 17, 2014 (ML 14191A688).

37. EN Letter GO2-15-093 to NRC, Columbia's Second 6 Month Status Update Report for the Implementation of NRC Order EA-13-109 - Overall Integrated Plan (OIP) for Reliable HCV Under Severe Accident Conditions, Rev 0, June 30, 2015.

38. NRC Letter to EN dated March 25, 2015, Interim Staff Evaluation Relating to Columbia's OIP Phase 1 of Reliable HCV Under Severe Accident Conditions (ML 14335A158).

39. NEI FAQ HCVS-10, Severe accident Multi-unit capability

40. NEI FAQ HCVS-11, Plant Response During a Severe Accident.

41. NEI FAQ HCVS-12, Radiological Evaluations on plant actions prior to HCVS initial use.

42. NEI FAQ HCVS-13, Severe Accident Venting Actions Validation.

43. BWROG TP-2015-008 FRC SAWA Rev 0 (BWROG-15034)

44. EN letter GO2-14-031, Columbia's Second 6-Month Update Report for the Implementation of NRC Order EA-12-049, Mitigation Strategies for Beyond Design Basis External Events

Attachment 6: Changes/Updates to this Overall Integrated Implementation Plan

Any significant changes to this plan will be communicated to the NRC staff in the 6-Month Status Reports

Attachment 7: List of Overall Integrated Plan Open Items

Open Item	Action	Status	Comment
1	Provide resolution of the potential secondary containment bypass leakage path in the first 6-month update of the HCVS OIP	Closed	Closed per EN Letter GO2-14-175 (Reference 36). Columbia will use a rupture disk to prevent secondary containment bypass leakage.
2	Evaluate the location of the ROS for accessibility.		
3	Determine the location of the portable air compressor and evaluate for accessibility under Severe Accident HCVS use.		
4	Evaluate the location of the FLEX DG for accessibility under Severe Accident HCVS use.		
5	Confirm suppression pool heat capacity	Closed	Closed per EN Letter GO2-14-175 (Reference 36). Calculation ME-02-14-02, Revision 0, Appendix C confirms that there is sufficient heat capacity in the suppression pool water when at a minimum Technical Specification level to control pressure in containment before venting commences.
6	Determine the method of qualification for each instrument		
7	Complete the evaluation to determine accessibility, habitability, staffing sufficiency, and communication capability of the ROS.		
8	Identify design codes after design is finalized.		
9	Equipment qualifications will include temperature, pressure, radiation level, and total integrated dose radiation from the effluent vent pipe at local and remote locations.		

10	Provide site-specific details of the EOPs when available.		
11	FLEX air compressors need to be credited to recharge air lines for HCVS components after 24 hours.		
12	SAWA/SAWM flow is controlled using hose installed valves and mechanical flow elements (EA-12-049 actions). Location of these valves and flow elements will need to be considered per HCVS-FAQ-12.		
13	Reconcile the out-of-service provisions for HCVS/SAWA with the provisions documented in Columbia's PPM 1.5.18, Managing B.5.b and FLEX Equipment Unavailability.		
14	Complete the evaluation to determine accessibility, habitability, staffing sufficiency, and communication capability during SAWA/SAWM		
15	Perform MAPP analysis for NEI 13-02 figures C-2 through C-6 and determine the time sensitive SAWM actions		

Attachment 8: List of Acronyms

AC	Alternating Current
ASME	The American Society of Mechanical Engineers
AST	Alternative Source Term
BDBEE	Beyond Design Bases External Event
BWR	Boiling Water Reactor
Columbia	Columbia Generating Station
CST	Condensate Storage Tank
DC	Direct Current
DG	Diesel Generator
DW	Drywell
EC	Engineering Change
ELAP	Extended Loss of AC Power
EOP	Emergency Operating Procedure
EPG	Emergency Procedure Guideline
FAQ	Frequently Asked Question
FAI	Fail As-Is
FC	Fail Closed
FLEX	Diverse and Flexible Coping Strategies
FO	Fail Open
GDC	General Design Criteria
HCVS	Hardened Containment Vent System
IEEE	The Institute of Electrical and Electronics Engineers, Inc.
ISG	Interim Staff Guidance
LC	Locked Closed
LED	Light Emitting Diode
MAAP	Modular Accident Analysis Program
MCR	Main Control Room
NC	Normally Closed
NEI	Nuclear Energy Institute
NEMA	The National Electrical Manufacturers Association
NO	Normally Open
NRC	Nuclear Regulatory Commission
NTTF	Near-Term Task Force
OIP	Overall Integrated Plan
PCIV	Primary Containment Isolation Valve
PCPL	Primary Containment Pressure Limit
RB	Reactor Building
RCIC	Reactor Core Isolation Cooling
RG	Regulatory Guide
RHR	Residual Heat Removal
ROS	Remote Operating Station
RPV	Reactor Pressure Vessel
RRC	Regional Response Center
RW	Radioactive Waste Building
SA	Severe Accident
SAG	Severe Accident Guidance
SAMG	Severe Accident Management Guidelines
SAWA	Severe Accident Water Addition
SAWM	Severe Accident Water Management
SBO	Station Blackout
SFP	Spent Fuel Pool
SOP	System Operating Procedure
SOARCA	State-of-the-Art Reactor Consequence Analyses
SPV	Solenoid Powered Valve
SSC	Structures, Systems, and Components
WW	Wetwell

ENERGY NORTHWEST'S RESPONSE TO NRC ORDER EA-13-109 - OVERALL INTGRATED PLAN FOR RELIABLE HARDENED CONTAINMENT VENTS UNDER SEVERE ACCIDENT CONDITIONS PHASES 1 AND 2, REVISION 0

ENCLOSURE 2

Response to the Phase 1 Request for Additional Information

Response to the Phase 1 Request for Additional Information				
RAI	**Action**	**ISE Report Section**	**Status**	**Comment**
1	Make available for NRC staff audit the location of the ROSs.	Section 3.2.1	OPEN	
2	Make available for NRC staff audit the location of the portable air compressor.	Section 3.2.1	OPEN	
3	Make available for NRC staff audit the location of the portable diesel generators.	Section 3.2.1	OPEN	
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	OPEN	
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	OPEN	
6	Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and	Section 3.2.2.3	OPEN	

	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 3.2.2.5 Section 3.2.2.9 Section 3.2.2.10		
7	Make available for N RC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	Section 3.2.2.4 Section 3.2.6	OPEN	
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	OPEN	
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	OPEN	
10	Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the RB or other buildings.	Section 3.2.2.6	CLOSED	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.
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	OPEN	
12	Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will	Section 3.2.2.9	CLOSED	Columbia will be using an unused containment penetration and will be

	open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.			installing new containment isolation valves.
13	Make available for NRC staff audit site specific details of the EOPs when available.	Section 3.4.1	OPEN	
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	CLOSED	Columbia has adopted the current NEI guidance on testing and Inspection requirements as shown in Table 4-1