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Serial: BSEP 15-0100

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

Subject: Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-71 and DPR-62
NRC Docket Nos. 50-325 and 50-324
Phase 1 and Phase 2 Overall Integrated Plan in Response to June 6, 2013, Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)

References:

1. Nuclear Regulatory Commission (NRC) Order Number EA-13-109, *Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions*, dated June 6, 2013, Agencywide Documents Access and Management System (ADAMS) Accession Number ML13143A321.
2. NRC Interim Staff Guidance JLD-ISG-2013-02, *Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions*, Revision 0, dated November 14, 2013, ADAMS Accession Number ML13304B836.
3. NRC Interim Staff Guidance 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*, Revision 0, dated April 30, 2015, ADAMS Accession Number ML15104A118.
4. NEI 13-02, *Industry Guidance for Compliance With Order EA-13-109, BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions*, Revision 1, dated April 2015, ADAMS Accession Number ML15113B318.
5. Duke Energy Letter, BSEP, Unit Nos. 1 and 2, *Duke Energy's Response to June 6, 2013, Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)*, dated June 17, 2013, ADAMS Accession Number ML13191A567.
6. Duke Energy Letter, BSEP, Unit Nos. 1 and 2, *Phase 1 Overall Integrated Plan in Response to June 6, 2013, Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)*, dated June 26, 2014, ADAMS Accession Number ML14191A687.
7. Duke Energy Letter, BSEP, Unit Nos. 1 and 2, *First Six Month Status Report in Response to June 6, 2013, Commission Order Modifying Licenses with Regard to Reliable Hardened*

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Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 17, 2014, ADAMS Accession Number ML14364A029.

8. Duke Energy Letter, BSEP, Unit Nos. 1 and 2, *Second Six Month Status Report in Response to June 6, 2013, Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)*, dated June 25, 2015, ADAMS Accession Number ML15196A035.
9. NRC Letter, *Brunswick Steam Electric Plant, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4467 and MF4468)*, dated March 10, 2015, ADAMS Accession Number ML15049A266.
10. Letter from Jack R. Davis, Office of Nuclear Reactor Regulation, to Joseph E. Pollock, Nuclear Energy Institute, Endorsement of the document entitled *Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan Template,* Revision 1, dated October 8, 2015, ADAMS Accession Number ML15271A148.
11. Nuclear Energy Institute Document entitled *Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan Template,* Revision 1, dated September 22, 2015, ADAMS Accession Number ML15272A336.

Ladies and Gentlemen:

On June 6, 2013, the Nuclear Regulatory Commission (NRC) issued an order (i.e., Reference 1) to Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. Reference 1 was immediately effective and directs all boiling water reactors (BWRs) with Mark I and Mark II containments to take certain actions to ensure that these facilities have a hardened containment venting system (HCVS) to support strategies for controlling containment pressure and preventing core damage following an event that causes a loss of heat removal systems, such as an Extended Loss of AC Power (ELAP), while ensuring the venting functions are also available during severe accident (SA) conditions. BSEP, Unit Nos. 1 and 2, have Mark I containments. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 requires submission of an Overall Integrated Plan (OIP) by June 30, 2014, for Phase 1 of the Order, and an OIP by December 31, 2015, for Phase 2 of the Order. The interim staff guidance (i.e., References 2 and 3) provides direction regarding the content of the OIP for Phase 1 and Phase 2. Reference 3 endorses industry guidance document NEI 13-02, Revision 1 (i.e., Reference 4), with clarifications and exceptions identified in Reference 3. Reference 5 provided the Duke Energy initial status report regarding reliable hardened containment vents capable of operation under severe accident conditions. Reference 6 provided the BSEP, Units 1 and 2, Phase 1 OIP. References 7 and 8 provided the first and second six month status reports pursuant to Section IV, Condition D.3 of Reference 1 for BSEP, Units 1 and 2.

The purpose of this letter is to provide both the third six month update for Phase 1 of the Order pursuant to Section IV, Condition D.3, of Reference 1, and the OIP for Phase 2 of the Order pursuant to Section IV, Condition D.2 of Reference 1, for BSEP, Units 1 and 2. The third six month update for Phase 1 of the Order is incorporated into the HCVS Phase 1 and Phase 2 OIP document, which provides a complete updated Phase 1 OIP, a list of the Phase 1 OIP open items, and addresses the NRC Interim Staff Evaluation open items for Phase 1 contained in

Reference 9. Future six month status reports will provide the updates for both Phase 1 and Phase 2 OIP implementation in a single status report.

This letter contains no new regulatory commitments.

If you have any questions regarding this submittal, please contact Mr. Lee Grzeck, Manager - Regulatory Affairs, at (910) 457-2487.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on December 11, 2015.

Sincerely,

William R. Gideon

Enclosure:
Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2, Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan – December 2015

cc (with enclosure):

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Enclosure

Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2

Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan – December 2015

(58 Pages)

Table of Contents:

Introduction

In 1989, the NRC issued Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," to all licensees of BWRs with Mark I containments to encourage licensees to voluntarily install a hardened wetwell 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). Some licensees also installed a hardened vent branch line from the drywell.

On March 19, 2013, the Nuclear Regulatory Commission (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 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 Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions*, on June 6, 2013. 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 wetwell 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 (JLD-ISG-2013-02 issued in November 2013 and JLD-ISG-2015-01 issued in April 2015). The ISG endorses the compliance approach presented in NEI 13-02, Revision 0 and 1, *Industry Guidance for Compliance with Order EA-13-109, BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions*, 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 which will provide a description of how the requirements of the Order will be achieved. This document provides the Overall Integrated Plan (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. Six month progress reports will be provided consistent with the requirements of Order EA13-109. 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 HCVS actions being taken. The first update for Phase 1, was due December 2014, with the second due June 2015.

- OIP for Phase 2 of EA-13-109 is required to be submitted by Licensees to the NRC by December 31, 2015. It is expected the December 2015 six 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 initiated via manual action from the either the Main Control Room (MCR) or from a Remote Operating Station (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 Pressure and Level from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation will be monitored by HCVS valve position, temperature, and effluent 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) or Drywell.
- Utilization of Severe Accident Water Management (SAWM) to control injection and Suppression Pool level to ensure the HCVS (Phase 1) wetwell vent (SAWV) will remain functional for the removal of decay heat from containment.
- Ensure that the decay heat can be removed from the containment for seven (7) days using the HCVS or describe the alternate method(s) to remove decay heat from the containment from the time the HCVS is no longer functional until alternate means of decay heat removal are established that make it unlikely the drywell vent will be required for DW pressure control.
- The SAWA and SAWM actions will be manually activated and controlled from areas that are accessible during severe accident conditions.
- Parameters measured should be Drywell pressure, Suppression Pool level, SAWA flowrate and the HCVS parameters listed above.
- Alternatively SAWA and a Severe Accident Capable Drywell Vent (SADV) strategy may be implemented to meet Phase 2 of Order EA-13-109.

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 Brunswick Steam Electric Plant (BSEP) 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 Hardened Containment Vent System (HCVS) will be comprised of installed and portable equipment and operating guidance:
  - Severe Accident Wetwell Vent (SAWV) – Permanently installed vent from the Unit Suppression Pool to the top of the Unit Reactor Building
  - 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. (reference attachment 2.1.C)
- Phase 1 (wetwell): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for *1st quarter of 2018 for Unit 1 and 1st quarter of 2017 for Unit 2.*
- 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 *1st quarter of 2018 for Unit 1 and 1st quarter of 2019 for Unit 2.*

BSEP is taking no alternative approaches to the guidelines in JLD-ISG-2013-02 and JLD-ISG-2015-01.

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

The following extreme external hazards screen-in for BSEP.

- Seismic, External Flooding, Extreme Cold – Ice only, High Wind, Extreme High Temperature

The following extreme external hazards screen out for BSEP

- Extreme Cold except for Ice

Part 1: General Integrated Plan Elements and Assumptions

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 RCIC or HPCI. (Reference 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 at any or all of the units. (NEI 12-06, section 3.2.1.3 item 9 and 3.2.1.4 item 1-4)

049-6. At one hour an ELAP is declared and actions begin as defined in EA-12-049 compliance

049-7. DC power and distribution can be credited for the duration determined per the EA-12-049 (FLEX) methodology for battery usage, 168 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. (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, 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 HCVS-FAQ-12

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 FLEX portable air supply equipment that is credited to recharge air lines for HCVS components after 24 hours. The FLEX portable air supply used must be demonstrated to meet the "SA 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 HCVS-FAQ-12)

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 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 HCVS-FAQ-05 and 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.

Part 1: General Integrated Plan Elements and Assumptions

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 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 HCV-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 HCVS-FAQ-02 and 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 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 BDBEE and SA HCVS operation. (reference 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 EPRI Technical Report 3002003301 to support drywell temperature response to SAWA under severe accident conditions.

109-09. 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 NEI 13-02 section 8).

109-10. Permanent modifications installed or planned per EA-12-049 are assumed implemented and may be credited for use in EA-13-109 Order response.

109-11. This Overall Integrated Plan is based on Emergency Operating Procedure changes consistent with EPG/SAGs Revision 3 as incorporated per the sites EOP/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.C for SAWM SAMG Changes approved by the BWROG Emergency Procedures Committee)

109-12. Under the postulated scenarios of Order EA-13-109 the Control Room is adequately protected from excessive radiation dose due to its distance and shielding from the reactor (per General Design Criterion (GDC) 19 in 10CFR50 Appendix A) and no further evaluation of its use as the preferred HCVS control location is required 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 HCVS-FAQ-01 and HCVS-FAQ-09)

109-13. The suppression pool/wetwell 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 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.

Plant Specific HCVS Related Assumptions/Characteristics:

BSEP-1 FLEX Diesel Generators (DGs) will be aligned to repower the 24/48VDC battery charger and recharge the

Part 1: General Integrated Plan Elements and Assumptions

batteries to support operation of the HCVS at 24 hours from event initiation.

BSEP-2 A connection to supply supplemental pneumatics via the FLEX pneumatic connection and from the FLEX air compressor will be made prior to venting start at approximately 8 hours.

BSEP-3 The Control Building (CB) 49' elevation rooms adjacent to the Main Control Room (MCR) are inside the MCR boundary and are protected from hazards similarly to the MCR and are acceptable for HCVS actions during a severe accident.

Part 2: Boundary Conditions for Wetwell 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 HCVS Extended Loss of AC Power (ELAP) Failure Evaluation table, which shows alternate actions that can be performed, is included in Attachment 4.

Table 2-1 HCVS Remote Manual Actions

Primary Action	Primary Location / Component	Notes
1. Close normally open breakers in Distribution Panels to supply 48VDC to the HCVS inverters.	Close breakers in the 24/48VDC Distribution Panels located in the Unit 1 and 2 Battery Rooms on EL. 23' of the Control Building.	None
2. Transfer HCVS electrical loads to 24/48VDC Distribution Panels.	Key-locked transfer switches located on EL. 49' of the Control Building adjacent to the MCR.	None

Part 2: Boundary Conditions for Wetwell Vent

3. Manually bypass Group 6 isolation and isolation override contacts for valves 1/2-CAC-V7 and 1/2-CAC-V216	Key-locked bypass switches on the HCVS Control Panel located on EL. 49' of the Control Building adjacent to the MCR.	None
4. Open Inboard Wetwell Purge Exhaust Valve 1/2-CAC-V7.	Control switch located in the MCR or via manual valve located at the ROS.	None
5. Open Hardened Wetwell Vent Valve 1/2-CAC-V216.	Key-locked control switch located in the MCR or via manual valve located at the ROS.	None
6. Run hose to FLEX pneumatic makeup connection to provide a pneumatic supply for sustained operations (post-24 hours).	FLEX pneumatic makeup connections are located outside the RB in the vicinity of the HCVS vent pipe. The long term FLEX air compressor will be located in the alleyway adjacent to the RB.	Action performed prior to start of venting.
7. Re-power the 24/48VDC battery chargers for sustained operations (post-24 hours).	FLEX DGs are located in areas that meet the requirements of EA-12-049 and are accessible to operators during a severe accident. **[Open item #4]**	Action required to provide power to HCVS equipment after 24 hours.

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

A timeline was developed to identify required operator response times and potential environmental constraints. This timeline 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.

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

- Approximately 17 Hours: Initiate use of Hardened Containment Vent System (HCVS) per site procedures to maintain containment parameters below design limits.- The reliable operation of HCVS will be met because HCVS meets the seismic requirements identified in NEI 13-02 and will be powered by DC buses with motive force supplied to HCVS valves from installed backup nitrogen storage bottles via the N2 backup system. Critical HCVS controls and instruments associated with containment will be DC powered and operated from the MCR or a Remote

Part 2: Boundary Conditions for Wetwell Vent

Operating Station on each unit. The DC power for HCVS will be available as long as the HCVS is required. HCVS battery capacity will be available to extend past 24 hours. In addition, when available, Phase 2 FLEX DGs can provide power before battery life is exhausted. Thus initiation of the HCVS from the MCR or the Remote Operating Station within 17 hours which is acceptable because the actions can be performed any time after declaration of an ELAP until the venting is needed for BDBEE venting. This action can also be performed for SA HCVS operation which occurs at a time further removed from an ELAP declaration as shown in Attachment 2A.

- 24 Hours (greater than 24 hours): FLEX air compressor will be aligned to supplement the N2 backup system.
- 24 Hours (greater than 24 hours): Permanently staged FLEX DGs will be connected to power up 24/48VDC batteries to supply power to HCVS critical components/instruments; time sensitive after 24 hours as 24/48VDC batteries have sufficient capacity for 24 hour operation without recharging. The FLEX DGs will be available to be placed in service prior to 24 hours as required per the BSEP EA-12-049 overall integrated plan.

<u>Discussion of radiological and temperature constraints identified in Attachment 2A</u>

- Primary control of the HCVS is accomplished from the main control room. Under the postulated scenarios of order EA-13-109 the control room is adequately protected from excessive radiation dose per General Design Criterion (GDC) 19 in 10CFR50 Appendix A and no further evaluation of its use is required. (Ref. HCVS-FAQ-01)
- Alternate control of the HCVS is accomplished from the ROS. The ROS will be in an area that has been evaluated to be accessible before and during a severe accident. **[Open item #2 and ISE open item #10]**
- Other actions required to support HCVS operation are performed in the Control Building, outside the MCR boundary (i.e., battery rooms), will be performed in an area that has been evaluated to be accessible before and during a severe accident. (Ref. Attachment 2 and **ISE open item #10**)
- When an ELAP is declared, the HCVS components will be transferred from normal 120VAC distribution panels to the 24/48VDC dedicated HCVS batteries to ensure power to the inverters. Access to the transfer switches will be in the room just outside the main control room.
- For sustained operations (>24 hours), the FLEX air compressor will be used to supplement the N2 backup system. Hoses stored in the FLEX building will be used to provide supplemental air to HCVS equipment via the pneumatic makeup connection prior to containment venting resulting from early RCIC failure (Ref. Attachment 2). **[Open item #7]**
- For sustained operations (>24 Hours), FLEX DGs will be connected to installed switchgear to supply power to HCVS critical components/instruments. The connections, location of the FLEX DGs and access for refueling are located in an area that is accessible to operators during a severe accident. **[Open item #4]**

Provide Details on the Vent characteristics

Provide Details on the Vent characteristics

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

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)?

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

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

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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. (reference ISG-JLD-201201 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

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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 ISO9001. 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 HCVS wetwell path is designed for venting steam/energy at a nominal capacity of 1% or greater of 2923 MWt thermal power (Current Licensed Thermal Power) at a pressure of 62 psig. This pressure is the lower of the containment design pressure (62 psig) and the PCPL value (70 psig). The size of the existing wetwell portion of the HCVS is ≥ 8 inches in diameter. The vent has adequate capacity to meet or exceed the Order criteria at the containment design pressure (62 psig). **[Open item #9].**

Vent Capacity

The 1% value at BSEP assumes that the suppression pool pressure suppression capacity is sufficient to absorb the decay heat generated during the first 3 hours. The vent would then be able to prevent containment pressure from increasing above the containment design pressure. As part of the detailed design, the duration of suppression pool decay heat absorption capability will be confirmed. **[Open item #6]**

Vent Path and Discharge

The existing HCVS vent path at BSEP consists of a wetwell vent on each unit. The wetwell vent exits the Primary Containment through the wetwell purge exhaust piping and associated inboard wetwell purge exhaust valve. Between the inboard and outboard wetwell purge exhaust valves, the wetwell vent isolation valve is installed. Downstream of the wetwell vent isolation valve, the vent piping exits the Reactor Building through the west wall and into the space between the Reactor Building and Turbine Building. The vent traverses up the exterior of the building and re-enters the Reactor Building through the metal siding on the refuel floor, then rises along the west side where it exits the Reactor Building through the roof. All effluents are exhausted above each unit's Reactor Building.

The HCVS discharge path will be routed to a point above any adjacent structure. This discharge point is just above that unit's Reactor Building such that the release point will vent away from emergency ventilation system intake and exhaust openings, main control room location, location of HCVS portable equipment, access routes required following a ELAP and BDBEE, and emergency response facilities; however, these must be considered in conjunctions with other design criteria (e.g. flow capacity) and pipe routing limitations, to the degree practical.

Missile protection from external events as defined by NEI 12-06 for the vent pipe has been evaluated and found to be acceptable. (Ref. HCVS-FAQ-04; HCVS-WP-04) **[Open item #1; ISE Open item #7]**

Power and Pneumatic Supply Sources

All electrical power required to sustain HCVS operation for 24 hours will be supplied by the unit's 24/48VDC battery.

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Instruments that require 24VDC input will receive it directly from the battery through an HCVS transfer switch. HCVS loads that require 120VAC power will receive it from an HCVS 48VDC to 120VAC inverter fed from the unit's 24/48VDC battery. All electrical components are located in the mild environment of the Control Building on either the 23' or 49' level and are seismically qualified. The 24/48VDC battery has the capacity to power these loads for 24 hours without recharging. After 24 hours the FLEX DGs will re-power the 24/48VDC battery chargers for sustained operation.

Pneumatic power is normally provided by the non-interruptible instrument air system (for the Reactor Building) and the pneumatic nitrogen system (for the Drywell) with backup nitrogen provided from the safety-related nitrogen backup system. Following an ELAP event, and the loss of non-interruptible instrument air and pneumatic nitrogen, the nitrogen backup system automatically provides operating pneumatics to the SRV accumulators and hardened wetwell vent valves. Therefore, for the first 24 hours post-ELAP initiation, pneumatic force will be supplied from the existing nitrogen backup system bottle racks located on the EL. 50'-0" of the Reactor Building. These installed bottles will supply the required motive force to those HCVS valves needed to maintain flow through the HCVS effluent piping.

1. The HCVS flow path valves are air-operated valves (AOV) with air-to-open and spring-to-close actuators. Opening the valves from the primary control station requires energizing an AC-powered solenoid-operated valve (SOV) and providing motive air/gas. The systems described above will provide a permanently installed power source and motive air/gas supply adequate for the first 24 hours. Beyond the first 24 hours, FLEX DGs will be used to maintain battery power to the HCVS components. The initial stored motive air/gas will allow for a minimum of eight valve operating cycles for the HCVS valves for the first 24 hours. Additional motive force will be supplied from the FLEX air compressor that will be located such that radiological impacts are not a concern. **[Open item #7]** The location of the FLEX DGs, FLEX air compressors, and their connections will be evaluated as acceptable for use during a severe accident. **[Open items #4 & #7]**
2. The ROS will provide valves that supply pneumatics to the HCVS valve actuators so that these may be opened without power to the valve actuator solenoids. This will provide a diverse method of valve operation improving system reliability.
3. An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the Remote Operating Station based on time constraints listed in Attachment 2A. **[ISE Open item #10]**
4. 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.
5. All valves 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 FAQ HCVS-03). 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.
6. Access to the locations described above will not require temporary ladders or scaffolding.

Location of Control Panels

The BSEP wetwell HCVS will allow initiating and then operating and monitoring the HCVS from a control panel located in the main control room (MCR) and will meet the requirements of Order element 1.2.4. The MCR functions as the normal control point for Plant Emergency Response actions and is a readily accessible location with no further evaluation required. Control Room dose associated with HCVS operation conforms to GDC 19/Alternative Source Term (AST). Additionally, to meet the intent for a secondary control location of section 1.2.5 of the Order, a readily accessible alternate location, called the Remote Operating Station (ROS), will also be incorporated into the HCVS design as described in NEI 13-02 section 4.2.2.1.2.1. Means to manually operate the wetwell vent will be provided at the ROS.

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The planned location for the ROS is in the southeast corner of the RB 50'-0" for Unit 1, and the northeast corner of the RB 50'-0" elevation for Unit 2. The ROS will be located within the RB, in an area shielded from the HCVS vent pipe, with a direct egress path to the MCR. Refer to the sketches provided in Attachment 3 for the BSEP site layout. The controls available at the ROS location will be accessible and functional under a range of plant conditions, including severe accident conditions with due consideration to source term and dose impact on operator exposure, extended loss of AC power (ELAP), inadequate containment cooling, and loss of reactor building ventilation. As part of the detailed design, an evaluation will be performed to verify accessibility to the location, habitability, staffing sufficiency, and communication capability with vent-use decision makers. **[Open item #2]**

Hydrogen

As is required by EA-13-109, Section 1.2.11, the HCVS must be designed such that it is able to either provide assurance that oxygen cannot enter and mix with flammable gas in the HCVS (so as to form a combustible gas mixture), or it must be able to accommodate the dynamic loading resulting from a combustible gas detonation. Several configurations are available which will support the former (e.g., purge, mechanical isolation from outside air, etc.) or the latter (design of potentially affected portions of the system to withstand a detonation relative to pipe stress and support structures).

BSEP will install a check valve at the top of the HCVS pipe above the RB roof. This check valve will prevent air from being drawn back into the vent pipe after a venting evolution. In this manner, an explosive mixture is prevented from forming in the vent pipe. **[Open item #3]**

Unintended Cross Flow of Vented Fluids

The HCVS utilizes Containment Atmospheric Control (CAC) system valves CAC-V7 and CAC-V216 for containment isolation. CAC-V7 and CAC-V216 are AOVs and they are air-to-open and spring-to-shut. An SOV must be energized to allow the motive air to open the valve from the MCR location. CAC-V7 and CAC-V216 have a safety related function to maintain the containment pressure boundary during a design basis accident and are tested as required by 10CFR50, Appendix J. Although these valves are shared between the CAC and the HCVS, separate control circuits are provided to each valve. Specifically, the CAC control circuit will be used during all "design basis" operating modes including all design basis transients and accidents.

Cross flow potential exists between the HCVS and the Standby Gas Treatment System (SBGT). CAC system valves CAC-V8 and CAC-V172 function as boundary valves with the SBGT system. Valves CAC-V8 and V-172 are containment isolation valves with a safety related function to maintain the containment pressure boundary during a design basis accident. These valves are tested, and will continue to be tested, for leakage under 10CFR50 Appendix J as part of the containment boundary IAW HCVS-FAQ-05. See Sketch 1 of Attachment 3 for a P&ID diagram of the system. These valves therefore prevent cross-flow from the SAWV pipe to the SBGT system.

Prevention of Inadvertent Actuation

EOP/ERG operating procedures provide guidance that the HCVS is not to be used to defeat containment integrity during any design basis transients and accident. In addition, the HCVS will be designed to provide features to prevent inadvertent actuation due to a design error, equipment malfunction, or operator error such that any credited containment accident pressure (CAP) that would provide net positive suction head to the emergency core cooling system (ECCS) pumps will be available (inclusive of a design basis loss-of-coolant accident (DBLOCA)). As part of BSEP's 120 percent power uprate, a 5 psig credit for containment overpressure was established for evaluating low pressure ECCS pump NPSH (Ref. 38, Section 6.3.2.2.5). However the ECCS pumps will not have power available because of the starting boundary conditions of an ELAP.

- The features that prevent inadvertent actuation are key lock switches at the primary control station and locked closed valves at the ROS. Procedures also provide clear guidance to not circumvent containment integrity by opening CAC purge exhaust and SAWV wetwell vent valves during any design basis transient or accident.

Component Qualifications

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The HCVS components downstream of the second containment isolation valve (and components that interface with the HCVS) that are not routed in seismically qualified structures will be designed for reliable and rugged performance that is capable of ensuring HCVS functionality following a seismic event. HCVS components that directly interface with the pressure boundary will be considered safety related, as the existing system is safety related. The containment system limits the leakage or release of radioactive materials to the environment to prevent offsite exposures from exceeding the guidelines of 10CFR100. During normal or design basis operations, this means serving as a pressure boundary to prevent release of radioactive material.

Likewise, any electrical or controls component which interfaces with Class 1E power sources will be considered safety related up to and including appropriate isolation devices such as fuses or breakers, as their failure could adversely impact containment isolation and/or a safety-related power source. The remaining components will be considered Augmented Quality. Newly installed piping and valves will be seismically qualified to handle the forces associated with the seismic margin earthquake (SME) back to their isolation boundaries. Electrical and controls components will be seismically qualified and will include the ability to handle harsh environmental conditions (although they will not be considered part of the site Environmental Qualification (EQ) program).

HCVS instrumentation performance (e.g., accuracy and precision) need not exceed that of similar plant installed equipment. Additionally, radiation monitoring instrumentation accuracy and range will be sufficient to confirm flow 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 344-1975
3. Demonstration that instrumentation is substantially similar to the design of instrumentation previously qualified.

Instrument	**Qualification Method***
HCVS Process Temperature	To Be Determined
HCVS Process Radiation Monitor	To Be Determined
HCVS Process Valve Position CAC-V7, CAC-V216	IEEE 323-1974, IEEE-344-1975 (Ref. QDP-49)
HCVS Pneumatic Supply Pressure RNA-PT-5268	IEEE 323-1974, IEEE 344-1975 (Ref. QDP-36; FP-70262)
HCVS Electrical Power Supply Availability	TBD
Drywell Pressure CAC-PT-1230	IEEE 323-1974, IEEE 344-1975 (Ref. QDP-36; FP-70262)
Wetwell Level CAC-LT-2601	IEEE 323-1974, IEEE 344-1975 (Ref. QDP-36; FP-70262)

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

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Monitoring of HCVS

The BSEP wetwell HCVS will be capable of being manually operated during sustained operations from a control panel located in the main control room (MCR) and will meet the requirements of Order element 1.2.4. The MCR is a readily accessible location with no further evaluation required. Control Room dose associated with HCVS operation conforms to GDC 19/Alternate Source Term (AST). Additionally, to meet the intent for a secondary control location of section 1.2.5 of the Order, a readily accessible Remote Operating Station (ROS) will also be incorporated into the HCVS design 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, extended loss of AC power (ELAP), and inadequate containment cooling. An evaluation has been performed to determine accessibility to the location, habitability, staffing sufficiency, and communication capability with vent-use decision makers.

The wetwell HCVS will include means to monitor the status of the vent system in both the MCR and the ROS. The wetwell HCVS will include indications for HCVS valve position, vent pipe temperature and effluent radiation levels in the MCR, as well as information on the status of supporting systems, such as battery voltage and pneumatic supply pressure. Indication of pneumatic supply pressure is available from the MCR, while battery voltage will be indicated on the inverter.

The wetwell HCVS will also include containment pressure and wetwell level indication in the MCR to monitor vent operation. This monitoring instrumentation provides the indication from the MCR as per Requirement 1.2.4. The wetwell HCVS will be supplied by existing 24/48VDC batteries for at least 24 hours, then by normal station power or the FLEX DGs.

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 (e.g., Non-safety, Cat 1, SS and 300# ASME or B31.1, NEMA 4, etc.) for the plant and to ensure functionality following a design basis earthquake.

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, total integrated dose radiation for the Effluent Vent Pipe.

Conduit design will be installed to Seismic Class 1 criteria. Both existing and new barriers will be used to provide a level of protection from missiles when required. (reference 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 EMI/RFIC (per RG 1.180). These qualifications will be bounding conditions for BSEP.

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:

1. Demonstration of seismic motion will be consistent with that of existing design basis loads at the installed location;
2. 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;

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3. Adequacy of seismic design and installation is demonstrated based on the guidance in Sections 7, 8, 9, and 10 of IEEE Standard 344-1975, *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations,* (Reference 27) or a substantially similar industrial standard;
4. Demonstration that proposed devices are substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges); or
5. Seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location

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 operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and BDBEE hazards identified in part 1 of this OIP.

Initial operator actions can be completed by Operators from the HCVS control station(s) and include remote-manual initiation. The operator actions required to open a vent path are as described in table 2-1.

Remote-manual is defined in this report as a non-automatic power operation of a component and does not require the operator to be at or in close proximity to the component. No other operator actions are required to initiate venting under the guiding procedure protocol.

The HCVS will be designed to allow initiation, control, and monitoring of venting from the MCR. In addition, operators will be able to operate the HCVS valves from an installed ROS as part of the response to EA-13-109. Both locations minimize plant operators' exposure to adverse temperature and radiological conditions and are protected from hazards assumed in Part 1 of this report.

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

System control:

i. Active: PCIVs are operated in accordance with EOPs/SOPs to control DW pressure. The HCVS is designed for a minimum 8 open/close cycles under ELAP conditions over the first 24 hours following an ELAP. Controlled venting will be permitted in the revised EPGs and associated implementing EOPs.
ii. Passive: Inadvertent actuation protection is provided by key lock switches located in the MCR and locked valves at the ROS. The HCVS isolation valve is key-locked and closed. Actuation of the HCVS vent path valves from the ROS will require manual operation of normally locked closed isolation valves.

Greater Than 24 Hour Coping Detail

Part 2: Boundary Conditions for Wetwell Vent

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, available personnel will be able to connect supplemental motive air/gas to the HCVS. Connections for supplementing electrical power and motive air/gas required for HCVS are located in accessible areas with reasonable protection per NEI 12-06 that minimize personnel exposure to adverse conditions for HCVS initiation and operation. Connections are pre-engineered quick disconnects to minimize manpower resources. The equipment provided in response to NRC EA-12-049 will provide pneumatic and electrical makeup for the sustained operating period. Response to EA-12-049 has demonstrated the capability for long-term power supply.

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

Details:

Provide a brief description of Procedures / Guidelines:

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

NEI 13-02 Section 6.1.2

Primary Containment Control Flowchart (0EOP-02-PCCP) exists to direct operations in protection and control of containment integrity, including use of the existing Hardened Wetwell Vent System. Other site procedures for venting containment using the HCVS include: Primary Containment Venting (0EOP-01-SEP-01), SAMG Primary Containment Venting (0SAMG-12), and Containment Venting Under Conditions of Extreme Damage (0EDMG-003). These procedures will be updated for SAWV operation per EA-13-109, as applicable. **[Open item #5]**

Identify modifications:

List modifications and describe how they support the HCVS Actions.

EA-12-049 Modifications

- EC 290398 (common) provides a method to transfer fuel oil from the Emergency Diesel Generator (EDG) 4-day tanks to the FLEX DGs in order to power the 24/48VDC battery chargers. This modification is complete.
- EC 292799 (Unit 1) and EC 290387 (Unit 2) will provide a connection to supply pneumatic makeup to the N2 backup system using FLEX equipment.
- EC 290388, EC 290389, and EC 290390 will install the FLEX DGs and provide the necessary 480V tie-ins to unit substations in order to power the 24/48VDC battery chargers

EA-13-109 Modifications

- A modification will be required to provide new HCVS power distribution panel, manual transfer switch, 48VDC to 120VAC inverters and 24VDC instrument power supplies needed to supply power to HCVS equipment for 24 hours post-ELAP.
- A modification will be required to install key-lock switches and additional control circuitry to allow bypass of the containment isolation signal contacts for the existing SAWV vent path AOVs to enable venting during an ELAP

Part 2: Boundary Conditions for Wetwell Vent

condition.

- A modification will be required to install a Remote Operation Station, and associated tubing and valves to allow for manual operation of the SAWV vent path AOVs, for both units.
- A modification will be required to install new vent pipe temperature instrumentation and indication.
- A modification will be required to modify the existing wetwell vent pipe radiation monitor, as necessary, to comply with the requirements of EA-13-109.
- A modification will be required to modify the existing hardened wetwell vent piping, as necessary, to comply with the requirements of EA-13-109.
- A modification will be required to add capacity to the nitrogen backup system to support pneumatic loads associated with HCVS operation for 24 hours post ELAP. This modification is complete. (EC 290410 and EC 292338).

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:

New Instrumentation

Key Parameter	Component Identifier	Indication Location
HCVS Effluent temperature	To Be Determined	Control Building
24/48 VDC Battery Voltage	To Be Determined	Control Building
Wetwell Vent Radiation Monitor	To Be Determined	Control Building

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:

Existing Instrumentation

Key Parameter	Component Identifier	Indication Location
Div. II N2 Backup supply pressure	RNA-PT-5268	MCR
Inboard wetwell purge exhaust valve position	CAC-V7	MCR
Hardened wetwell vent isolation valve position	CAC-V216	MCR
Drywell pressure	CAC-PT-1230	MCR
Wetwell Level	CAC-LT-2601	MCR

Notes:

Part 2: Boundary Conditions for Wetwell 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 operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and severe accident events. Severe accident event assumes that specific core cooling actions from the FLEX strategies identified in the response to Order EA12-049 were not successfully initiated. Access to the reactor building will be restricted as determined by the RPV water level and core damage conditions. Initial actions will be completed by Operators in the Main Control Room (MCR) or at the HCVS Remote Operating Station (ROS) and will include remote manual actions. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this report (Table 2-1).

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

System control:

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

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

Details:

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

Specifics are the same as for BDBEE Venting Part 2 except the location and refueling actions for the FLEX DGs and air compressors will be evaluated for SA environmental conditions resulting from the proposed damaged Reactor Core and resultant SAWV pathway. **[Open Items #4 and #7]**

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

First 24 Hour Coping 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.

Part 2: Boundary Conditions for Wetwell Vent
Part 2 Boundary Conditions for WW Vent: **Severe Accident Venting**
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)*
The same as for DBDEE Venting Part 2.
Notes:

Part 2: Boundary Conditions for Wetwell 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 require support from DC power as well as pneumatic systems as detailed in the response to Order EA-12-049. Existing 24/48VDC batteries will provide sufficient electrical power for HCVS operation for 24 hours. Before battery power is depleted, FLEX DGs, as detailed in the response to Order EA-12-049, will be credited to charge the 24/48VDC batteries and maintain DC bus voltage after 24 hours. The nitrogen backup system will provide sufficient motive force for all SAWV valve operation for the first 24 hours and will provide for multiple operations of the hardened wetwell vent valve. Post 24 hours, the FLEX air compressor will be aligned to supplement the nitrogen backup system.

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. Existing 24/48VDC batteries will provide sufficient electrical power for HCVS operation for 24 hours. At 24 hours, FLEX DGs, as detailed in the response to Order EA-12-049, will be credited to charge the 24/48VDC batteries and maintain DC bus voltage

The nitrogen backup system will provide sufficient motive force for all wetwell HCVS valve operation for the first 24 hours. Post 24 hours, the FLEX air compressor will be aligned to supplement the nitrogen backup system.

Details

Provide a brief description of Procedures / Guidelines:

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

All of the equipment credited for HCVS operation during the first 24 hours will be permanently installed. Post 24 hours, the key portable items are the FLEX DGs and the FLEX air compressors needed to supplement the pneumatic supply to the AOVs. FLEX Support Guidelines (FSG) are being developed to address all HCVS operating strategies, including deployment of portable equipment. Direction to enter the FSGs for HCVS operation will be given in the EOPs, the site ELAP procedure, and the SAMGs. **[Open item #5]**

Identify modifications:
List modifications and describe how they support the HCVS Actions.

Part 2: Boundary Conditions for Wetwell Vent

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

Flex modifications applicable to HCVS operation:

- EC 290398 (common) provides a method to transfer fuel oil from the Emergency Diesel Generator (EDG) 4-day tanks to the FLEX DGs in order to power the 24/48VDC battery chargers. This modification is complete.
- EC 292799 (Unit 1) and EC 290387 (Unit 2) will provide a connection to supply pneumatic makeup to the N2 backup system using FLEX equipment.
- EC 290388, EC 290389, and EC 290390 will install the FLEX DGs and provide the necessary 480V tie-ins to unit substations in order to power the 24/48VDC battery chargers.
- EC 290400 (common) provides the FLEX storage building for storage of FLEX and HCVS equipment.

HCVS modification:

- A modification will be required to provide new HCVS power distribution panel, manual transfer switch, 48VDC to 120VAC inverters and 24VDC instrument power supplies needed to supply power to HCVS equipment for 24 hours post-ELAP.
- A modification will be required to install key-lock switches and additional control circuitry to allow bypass of the containment isolation signal contacts for the existing SAWV vent path AOVs to enable venting during an ELAP condition.
- A modification will be required to install a Remote Operation Station, and associated tubing and valves to allow for manual operation of the SAWV vent path AOVs, for both units.
- A modification will be required to install new vent pipe temperature instrumentation and indication.
- A modification will be required to modify the existing wetwell vent pipe radiation monitor, as necessary, to comply with the requirements of EA-13-109.
- A modification will be required to modify the existing hardened wetwell vent piping, as necessary, to comply with the requirements of EA-13-109.
- A modification will be required to add capacity to the nitrogen backup system to support pneumatic loads associated with HCVS operation for 24 hours post ELAP. This modification is complete. (EC 290410 and EC292338)

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 have been constructed to meet the requirements identified in NEI-12-06 section 11 for screened in hazards.

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)

Local control features of the FLEX DG electrical load and fuel supply have been supplied as part of FLEX modifications.

Notes:

Part 2: Boundary Conditions for Wetwell Vent

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

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

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 that for compliance with Order EA-12-049 thus they are acceptable without further evaluation

HCVS Actions	Modifications	Protection of connections
Identify Actions including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection is protected*
Per compliance with Order EA-12-049 (FLEX)	N/A	Per compliance with Order EA12-049 (FLEX)

Notes:

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 sections:

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) (NOT APPLICABLE)

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

The operation of the HCVS using SAWA and SAWM/SADV 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 outside the RB in an area far from the HCVS vent pipe.

Timelines (see attachments 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.

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 (MCR or ROS)	Applicable to SAWA/SAWM strategy
2. Connect the FLEX (SAWA) pump to the Condensate Storage Tank (CST)	East of the RB, near the CST	Opposite of the HCVS vent pipe which is west of the RB.
3. Connect the FLEX (SAWA) pump discharge hose to the RB core bore connection to installed injection piping).	Outside the RB	North RB wall for U-1, South RB wall for U-2. This is the primary FLEX RPV injection path for the units.
4. Open SAWA manual valves inside the RB	20' level prior to 8 hours.	Conditions at 20' level will be evaluated as satisfactory for temperature and radiation.
5. Inject to RPV using FLEX (SAWA) pump	FLEX (SAWA) pump outside the RB.	Initial SAWA injection rate is 300 gpm based on FLEX flow rate .
6. Monitor SAWA indications	MCR and FLEX (SAWA) pump outside the RB.	Indications used/required: o Pump Flow o SAWA flow o Containment pressure o Wetwell level
7. Use SAWM to maintain availability of the WW vent (Part 3.1.A)	MCR and FLEX (SAWA) pump outside the RB.	• Monitor DW Pressure and Suppression Pool Level in MCR • Control SAWA at pump skid
8. Refill CST from alternate sources a. Demin Water Storage Tank b. Fire water tank c. Discharge canal	Determined by the water sources available and prioritization per the FLEX strategy. Ultimate supply is the Cape Fear River from the discharge canal using NSRC pumps.	Analysis done for FLEX demonstrates that makeup is required in approximately 52 hours, and the NSRC pumps have the capacity to replenish the CST from the discharge canal (head and flow rate).

Discussion of timeline SAWA identified items

HCVS operations are discussed under Phase 1 of EA-13-109 (Part 2 of this OIP).

- 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. Action being taken within the reactor building will be evaluated for temperature and dose concerns. All other actions are outside the RB and removed from the SAWV vent pipe so that there are no radiological concerns.
  - Less than 8 Hours – 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

Part 3.1: Boundary Conditions for SAWA

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 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. 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. The SAWA injection path flows to the Reactor Water Cleanup System then through the main feed system to the RPV. The main feedwater containment isolation check valves prevent any backflow from the RPV to the SAWA connection.

Description of SAWA actions for first 24 hours:

T<1 hr:

- No evaluation required for actions inside the reactor building for SAWA. No expected actions.

T=1 – 8 hr:

- Evaluation of core gap and early in vessel release impact to reactor building access for SAWA actions is required. It is assumed that reactor building 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:
  - Open the three SAWA manual valves that align SAWA inside the RB, one at the core bore and two at the RWCU connection. If the event is seismic, close one additional valve in the RB.
- Establish electrical power for SAWA indications (containment parameters) using the EA-12-049 FLEX DGs in addition to the indications provided by the HCVS backup power (Section 2).
- Establish flow to the RPV using SAWA systems. Begin injection at 300 gpm

T≤8 –12 hr:

- Continue injection for 4 hours after SAWA injection begins at initial SAWA rate.

T≤12 hrs:

- Proceed to SAWM actions (Part 3.1.A) to reduce SAWA flow and maintain the HCVS vent in service.

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:

Part 3.1: Boundary Conditions for SAWA

Details of Design Characteristics/Performance Specifications

SAWA shall be capable of providing an RPV *injection rate of 300 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, have been evaluated for the expected severe accident conditions (temperature, humidity, radiation) for the Sustained Operating period. Personnel exposure and temperature / humidity conditions for operation of SAWA equipment will not exceed the limits for ERO dose and plant safety guidelines for temperature and humidity.

The SAWA flow path will use the same path and equipment as the FLEX primary injection flow path, but without the need to run any hoses inside the RB. All equipment and connections are remote from the HCVS vent pipe and so are protected by intervening structures and distance from the radiation from the vent pipe. The path is as follows:

- Hose connection at the Condensate Storage Tank (CST) that is protected from all applicable external hazards
- FLEX suction hose from the CST to the FLEX (SAWA) pump that is stored in the FLEX storage building
- FLEX (SAWA) pump that is stored in the FLEX storage building
- FLEX discharge hose from the FLEX (SAWA) pump to the RB core bore connection at the RB wall and reachable at ground level
- Through the core bore to a manual valve located inside the RB
- Through a pipe, two manual valves and a check valve to the Reactor Water Cleanup (RWCU) return line
- Via RWCU return, Reactor Core Isolation Cooling (RCIC) and Main Feed to the RPV
- SAWA flow rate will be monitored via a flow meter mounted on the FLEX (SAWA) pump skid.
- SAWA flow rate can be controlled by throttling valves on the FLEX (SAWA) pump skid

Preliminary evaluations for projected SA conditions (radiation / temperature) indicate that personnel can complete the initial and support activities without exceeding the ERO-allowable dose for equipment operation or site safety standards. (reference HCVS-WP-02, Plant-Specific Dose Analysis for the Venting of Containment during the SA Conditions and HCVS-FAQ-12)

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 battery chargers are also powered from the EA-12-049 generator(s) to maintain the battery capacities during the Sustained Operating period. The indications include (* are minimum):

Parameter	Instrument	Location	Power Source / Notes
*DW Pressure	*Same as Section 2.*	*MCR*	HCVS power supply; FLEX DG
*Suppression Pool Level	*Same as Section 2.*	*MCR*	HCVS power supply; FLEX DG
*SAWA Flow	FLEX (SAWA) pump Flow indicator	FLEX (SAWA) pump Skid	FLEX (SAWA) pump (skid mounted device)

Part 3.1: Boundary Conditions for SAWA

The instrumentation and equipment being used for SAWA and supporting equipment will be 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 CST has been evaluated for all hazards other than wind-driven missiles, for which it has been protected per EA-12-049. The FLEX/SAWA core bore external to the RB has been protected per EA-12-049 response and evaluated for all external hazards. The FLEX DGs are protected for all applicable hazards. The portable FLEX/SAWA equipment is stored in the FLEX storage building which has been designed and constructed to protect against all applicable hazards 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

Procedures / Guidelines:

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

SAWA initiation is directed by the EOP network as a means of water injection to the RPV when RPV level is not being maintained by other systems. 0EOP-01-FSG-07 contains guidance for deployment and connection of the FLEX (SAWA) pump. 0EOP-01-FSG-02 contains the specific instructions for FLEX (SAWA) pump operation to inject water into the RPV. These procedures are the same as for FLEX, with the exception that, rather than run a hose in the RB from the core bore to the RWCU connection, three valves are opened to align the FLEX (SAWA) pump for injection. (See sketch 3.A)

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

A new pipe will be routed from the RB core bore inside connection to the RWCU connection at the RB 20' level. The modification replaces a FLEX hose run inside the RB with pipe. This modification reduces the required operator actions inside the RB for RPV injection to opening three valves.

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. The FLEX (SAWA) pumps and hoses are qualified per NEI 12-06 and are stored in the FLEX Storage Building which is protected from all the screened-in external hazards. The pipe connecting the RB core bore and the RWCU connection will be qualified per NEI 13-02 and 12-06 as applicable.

Notes:

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

BSEP meets the requirements for Option 1 above; SAWM can be maintained for greater than 7 days without the need for a drywell vent to maintain pressure below containment design pressure.

Basis for SAWM time frame

<u>Option 1 - SAWM can be maintained greater than or equal to 7 days</u>:

Preliminary BSEP site-specific MAAP 5.02 analysis demonstrates the containment will be protected for a minimum of 7 days without the use of a drywell vent by SAWM in conjunction with the SAWV. (C.7.1.4.1)

Instrumentation relied upon for SAWM operations is Drywell Pressure, Suppression Pool level and SAWA flow. Planned modifications are that all of these will be powered by the HCVS panel from the 24/48VDC batteries, and then by the FLEX DGs. The FLEX DGs will provide power throughout the Sustained Operation period (7 days). (C.7.1.4.2, C.8.3.1)

MAAP analysis shows that 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 (C.6.3, C.7.1.4.3)

Table 3.1.B – SAWM Manual Actions

Part 3.1.A: Boundary Conditions for SAWA/SAWM

Primary Action	Primary Location / Component	Notes
1. Lower SAWA injection rate to control Suppression Pool Level and decay heat removal	Manual flow control valve at the FLEX (SAWA) pump.	• Control to maintain containment and WW parameters to ensure WW vent remains functional. • 100 gpm minimum capability is maintained for greater than 7 days
2. Control to SAWM flowrate for containment control / decay heat removal	Flow control is local to pump; suppression pool level and DW pressure are available from the MCR.	• SAWM flow rates will be monitored using the following instrumentation o SAWA Flow o Suppression Pool Level o DW pressure • SAWM flow rates will be controlled using the manual flow control valve at the FLEX (SAWA) pump
3. Establish alternate source of decay heat removal	Determined by Emergency Response Organization.	• >7 days
4. Secure SAWA / SAWM	At the CST.	• When reliable alternate containment decay heat removal is established.

SAWM Time Sensitive Actions

Time Sensitive SAWM Actions:

12 Hours – Initiate actions to maintain the Wetwell (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.

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 per direction by the plant SAMGs. Refer to attachment 2.1.C 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*

Part 3.1.A: Boundary Conditions for SAWA/SAWM

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

SAWM can be maintained >7 days:

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. 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. Local indication of SAWM flow rate will be provided at the pump trailer by an installed flow instrument qualified to operate under the expected environmental conditions. The SAWA flow instrument will be powered by the FLEX (SAWA) pump skid diesel engine alternator. Communications will be established between the SAWM control location and the MCR using ERO radios.

Injection flowrate will be controlled by a manual valve located on the FLEX (SAWA) pump skid.

Suppression Pool level and DW pressure will be read in the control room using indicators powered by the HCVS power supply and FLEX DGs installed under EA-12-049. These indications are used to control SAWM flowrate to the RPV.

Key Parameters:

List instrumentation credited for the SAWM Actions.

Part 3.1.A: Boundary Conditions for SAWA/SAWM

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* 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.

Notes:

Part 3.1.B: Boundary Conditions for SAWA/SADV
Applicability of WW Design Considerations
Not Applicable.
Table 3.1.C – SADV Manual Actions
Timeline for SADV
Severe Accident Venting
First 24 Hour Coping Detail
Greater Than 24 Hour Coping Detail
Details:

Part 4: Programmatic Controls, Training, Drills and Maintenance

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.

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 including consideration for Emergency Core Cooling Pumps net positive suction head
- 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

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

The provisions for out-of-service requirements for HCVS/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 nonfunctional, 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 through the sites corrective action program:
    - The cause(s) of the non-functionality

Part 4: Programmatic Controls, Training, Drills and Maintenance

- The actions to be taken and the schedule for restoring the system to functional status and prevent recurrence
- Initiate action to implement appropriate compensatory actions, and
- Restore full HCVS functionality at the earliest opportunity not to exceed one full operating cycle.

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.

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-12-049: 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.

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 (further details are provided in Part 6 of this document).*
  - *Testing should be done to verify design requirements and/or basis. The basis should be documented and*

Part 4: Programmatic Controls, Training, Drills and Maintenance

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 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 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

BSEP 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.

BSEP 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

Part 4: Programmatic Controls, Training, Drills and Maintenance

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:

Part 5: Implementation Schedule Milestones

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:

Milestone	Target Completion Date	Activity Status	Comments *{Include date changes in this column}*
Hold preliminary/conceptual design meeting	Jun 2014	Complete	
Submit Overall Integrated Implementation Plan	Jun 2014	Complete	
Submit 6 Month Status Report	Dec 2014	Complete	
Submit 6 Month Status Report	Jun 2015	Complete	
Submit 6 Month Status Report	Dec 2015	Started	Simultaneous with Phase 2 OIP
U2 Design Engineering On-site/Complete	Mar 2016	Started	
Submit 6 Month Status Report	Jun 2016	Not Started	
Operations Procedure Changes Developed	Dec 2016	Not Started	
Site Specific Maintenance Procedure Developed	Dec 2016	Not Started	
Submit 6 Month Status Report	Dec 2016	Not Started	
Training Complete	Feb 2017	Not Started	
U2 Implementation Outage	Feb 2017	Not Started	
Procedure Changes Active	Mar 2017	Not Started	
U2 Walk Through Demonstration/Functional Test	Mar 2017	Not Started	
U1 Design Engineering On-site/Complete	Mar 2017	Not Started	
Submit 6 Month Status Report	Jun 2017	Not Started	

Part 5: Implementation Schedule Milestones

Submit 6 Month Status Report	Dec 2017	Not Started	
U1 Implementation Outage	Feb 2018	Not Started	
U1 Walk Through Demonstration/Functional Test	Mar 2018	Not Started	
Submit Completion Report	May 2018	Not Started	

Phase 2 Milestone Schedule:

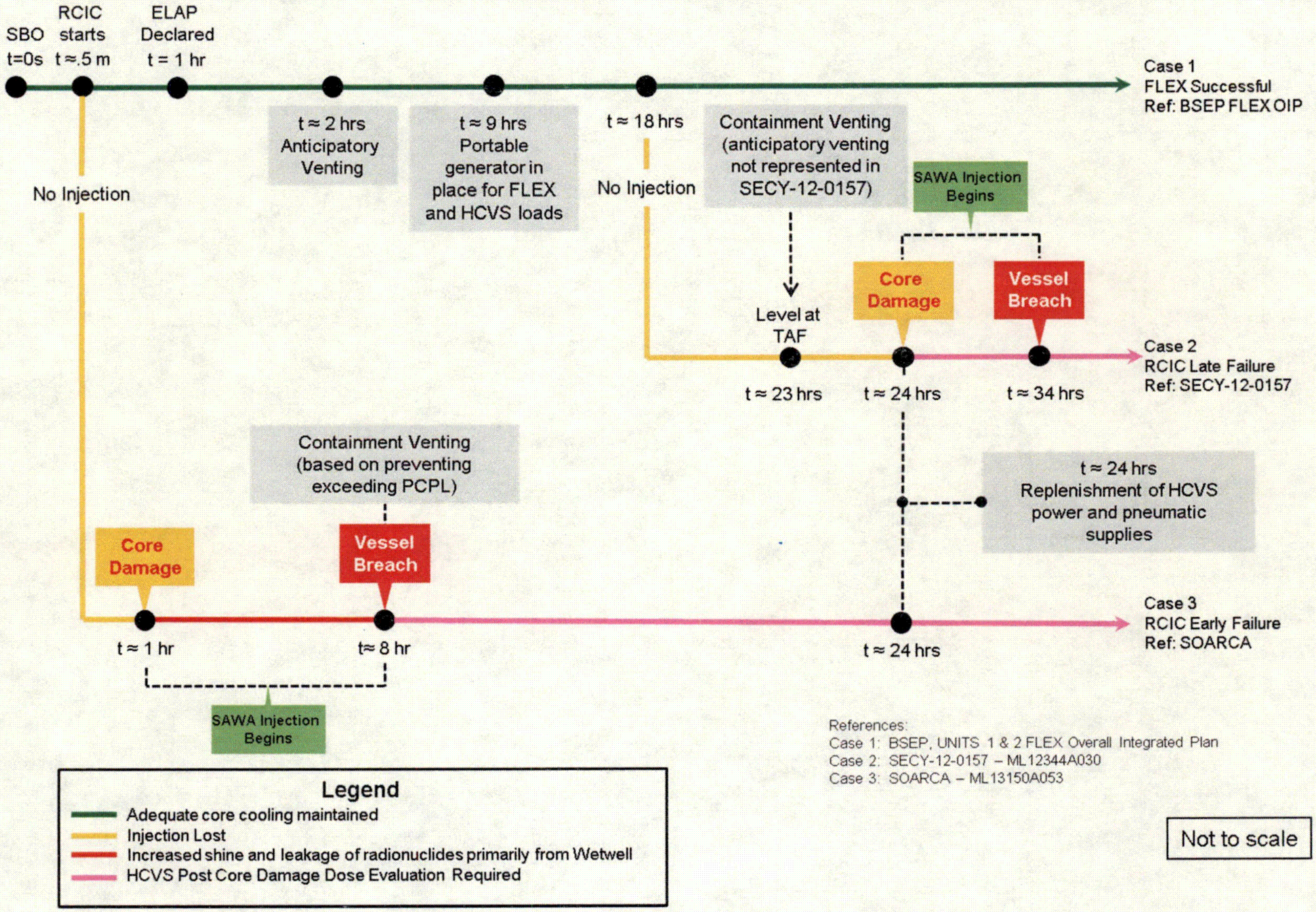
Milestone	Target Completion Date	Activity Status	Comments *{Include date changes in this column}*
Hold preliminary/conceptual design meeting	Oct 2015	Complete	
Submit Overall Integrated Implementation Plan	Dec 2015	Started	
Submit 6 Month Status Report	June 2016	Not Started	
Submit 6 Month Status Report	Dec 2016	Not Started	
Submit 6 Month Status Report	June 2017	Not Started	
U1 Design Engineering On-site/Complete	Mar 2017	Not Started	
Submit 6 Month Status Report	Dec 2017	Not Started	
Operations Procedure Changes Developed	Sep 2017	Not Started	
Site Specific Maintenance Procedure Developed	Sep 2017	Not Started	
Training Complete	Dec 2017	Not Started	
U1 Implementation Outage	Mar 2018	Not Started	
Procedure Changes Active	Mar 2018	Not Started	
U1 Walk Through Demonstration/Functional Test	Mar 2018	Not Started	
U2 Design Engineering On-site/Complete	Mar 2018	Not Started	
Submit 6 Month Status Report	June 2018	Not Started	
Submit 6 Month Status Report	Dec 2018	Not Started	
U2 Implementation Outage	Mar 2019	Not Started	
U2 Walk Through Demonstration/Functional Test	Mar 2019	Not Started	
Submit Completion Report	July 2019	Not Started	

Notes:

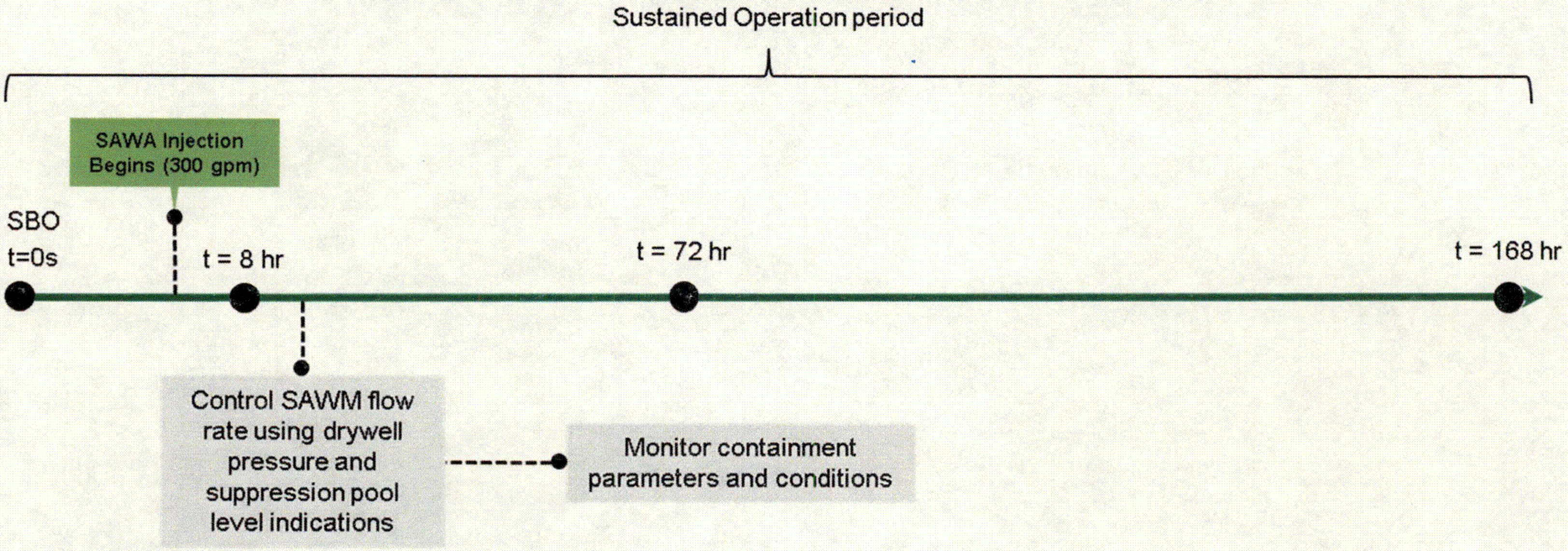
Attachment 1: HCVS/SAWA Portable Equipment

List portable equipment	**BDBEE Venting**	**Severe Accident Venting**	**Performance Criteria**	**Maintenance / PM requirements**
FLEX Air Compressor	X	X	300 SCFM at 200 psig	Per Response to EA-12-049.
FLEX DG	X	X	500 kW	Per Response to EA-12-049
FLEX (SAWA) pump	N/A	N/A	300 gpm	Per Response to EA-12-049
SAWA hoses (outside the RB)	N/A	N/A	200 psig	Per Response to EA-12-049

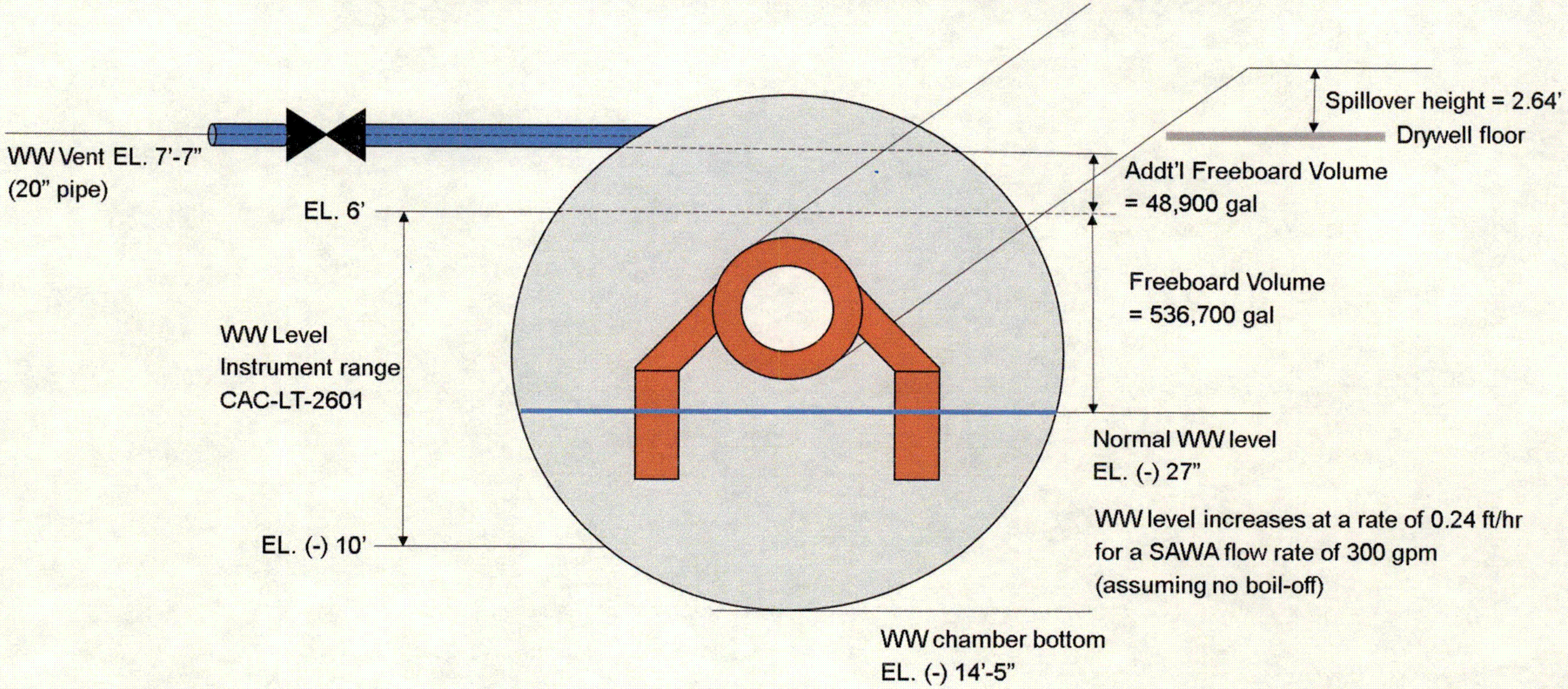
Attachment 2A: Sequence of Events Timelines – HCVS



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



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



Attachment 2.1.C: 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

(Conceptual sketches, as necessary to indicate equipment which is installed or equipment hookups necessary for the HCVS Actions)

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

- Instrumentation Process Flow
- Electrical Connections

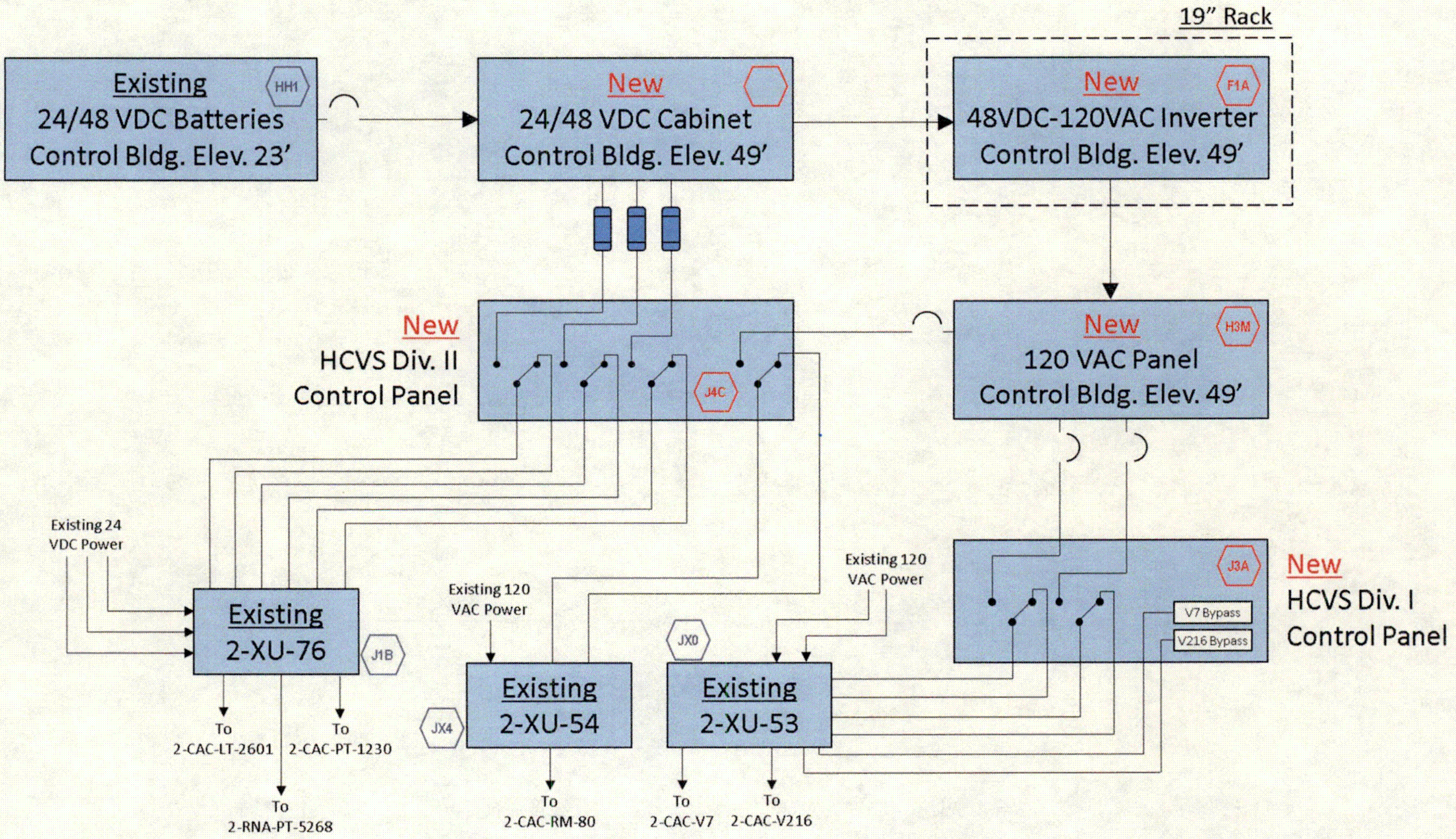
Sketch 2: P&ID Layout of WW Vent *(preliminary)*

- Piping routing for vent path – WW Vent
  - Demarcate the valves (in the vent piping) between the currently existing and new ones
  - WW Vent Instrumentation Process Flow Diagram
  - Egress and Ingress Pathways to ROS, Battery Transfer Switch, DG Connections and Deployment location
  - Site layout sketch to show location/routing of WW vent piping and associated components. This should include relative locations both horizontally and vertically

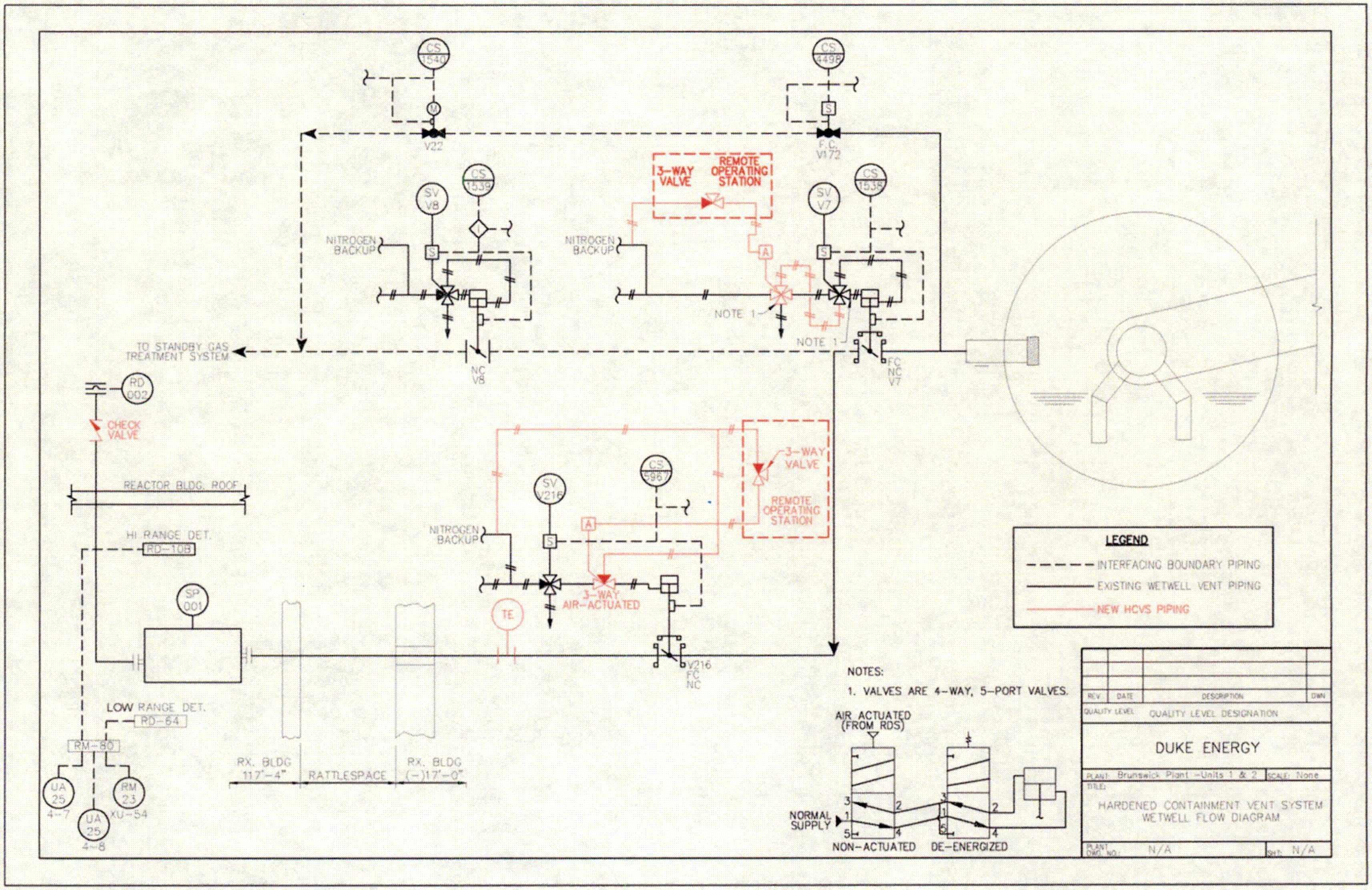
Sketch 3: P&ID Layout of SAWA *(preliminary)*

- Piping routing for SAWA path
  - SAWA instrumentation process paths
  - SAWA connections
  - Include a piping and instrumentation diagram of the vent system. Demarcate the valves (in the vent piping) between the currently existing and new ones.
  - Ingress and egress paths to and from control locations and manual action locations
  - Site layout sketch to show locations of piping and associated components. This should include relative locations both horizontally and vertically

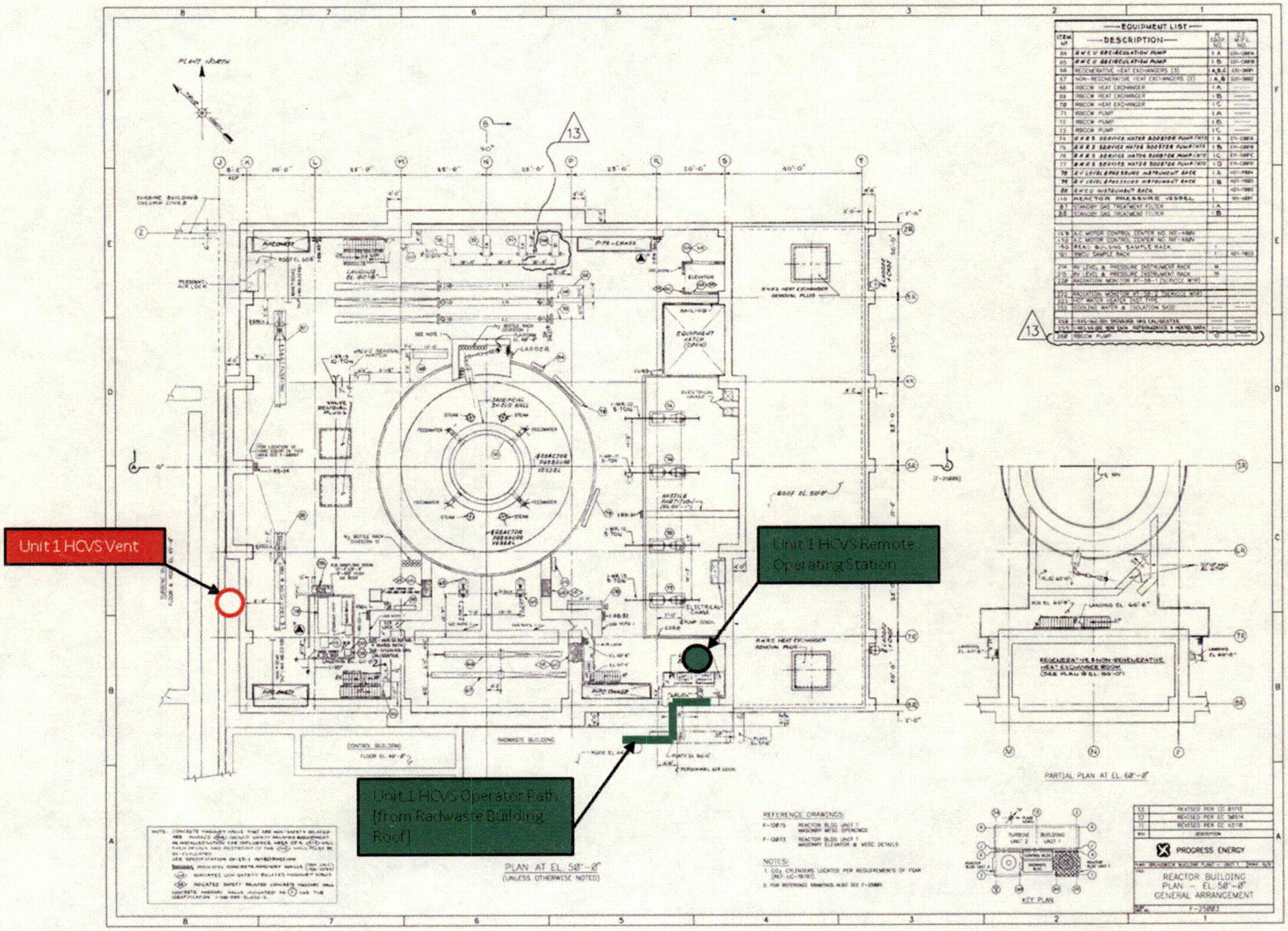
Sketch 1: Electrical Layout of System



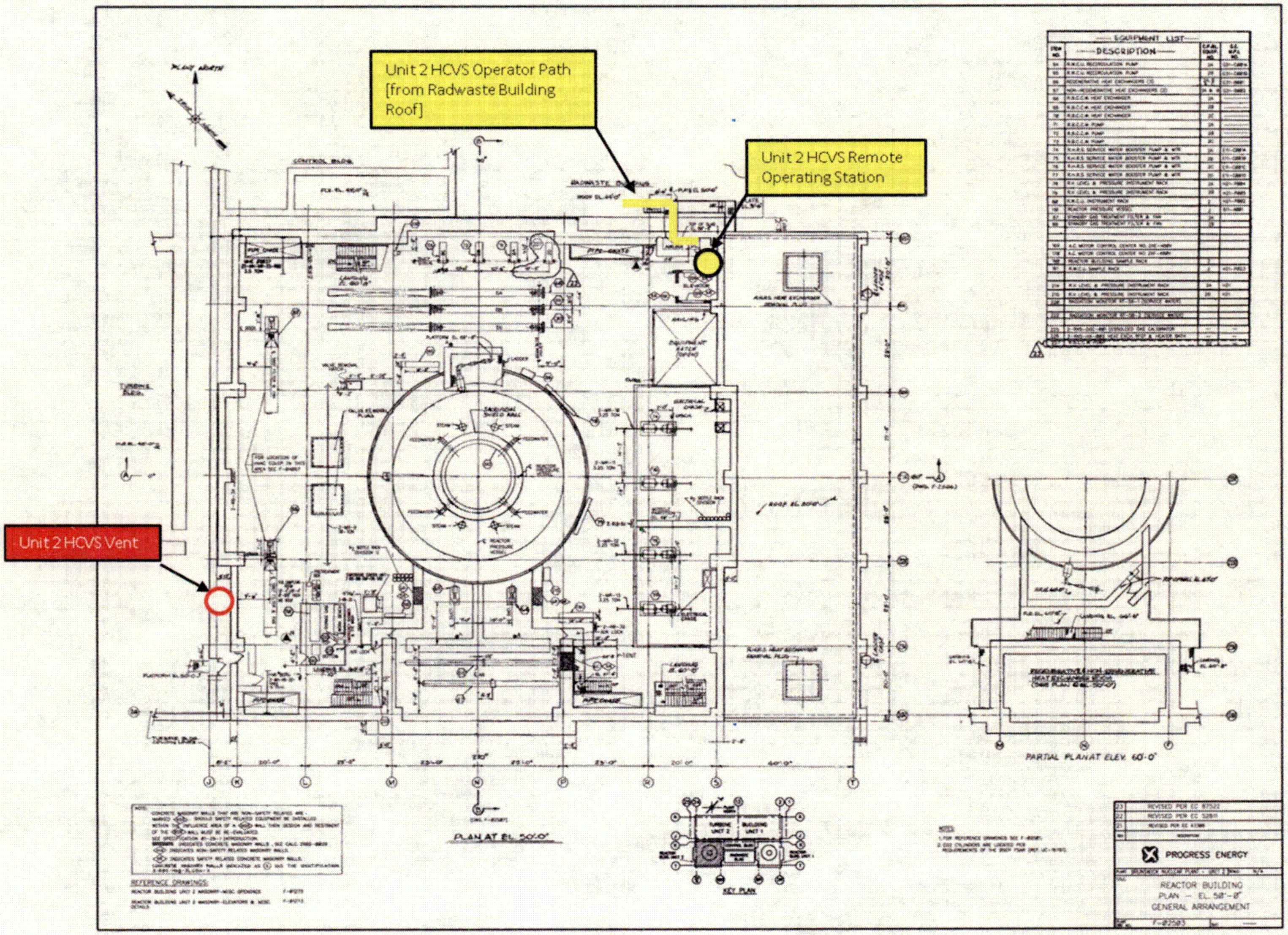
Sketch 2.A: Layout of HCVS



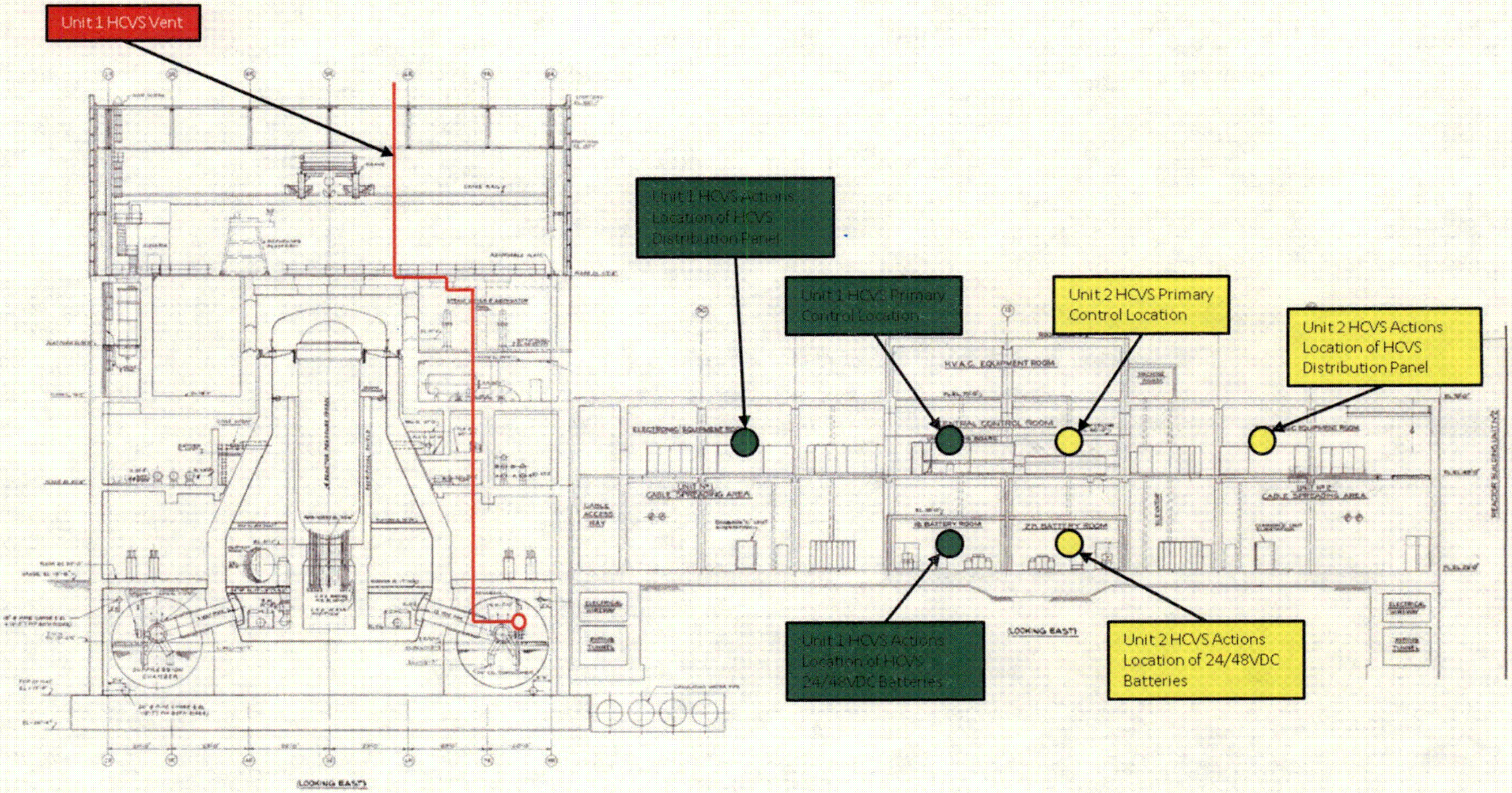
Sketch 2.B: ROS Location – Unit 1



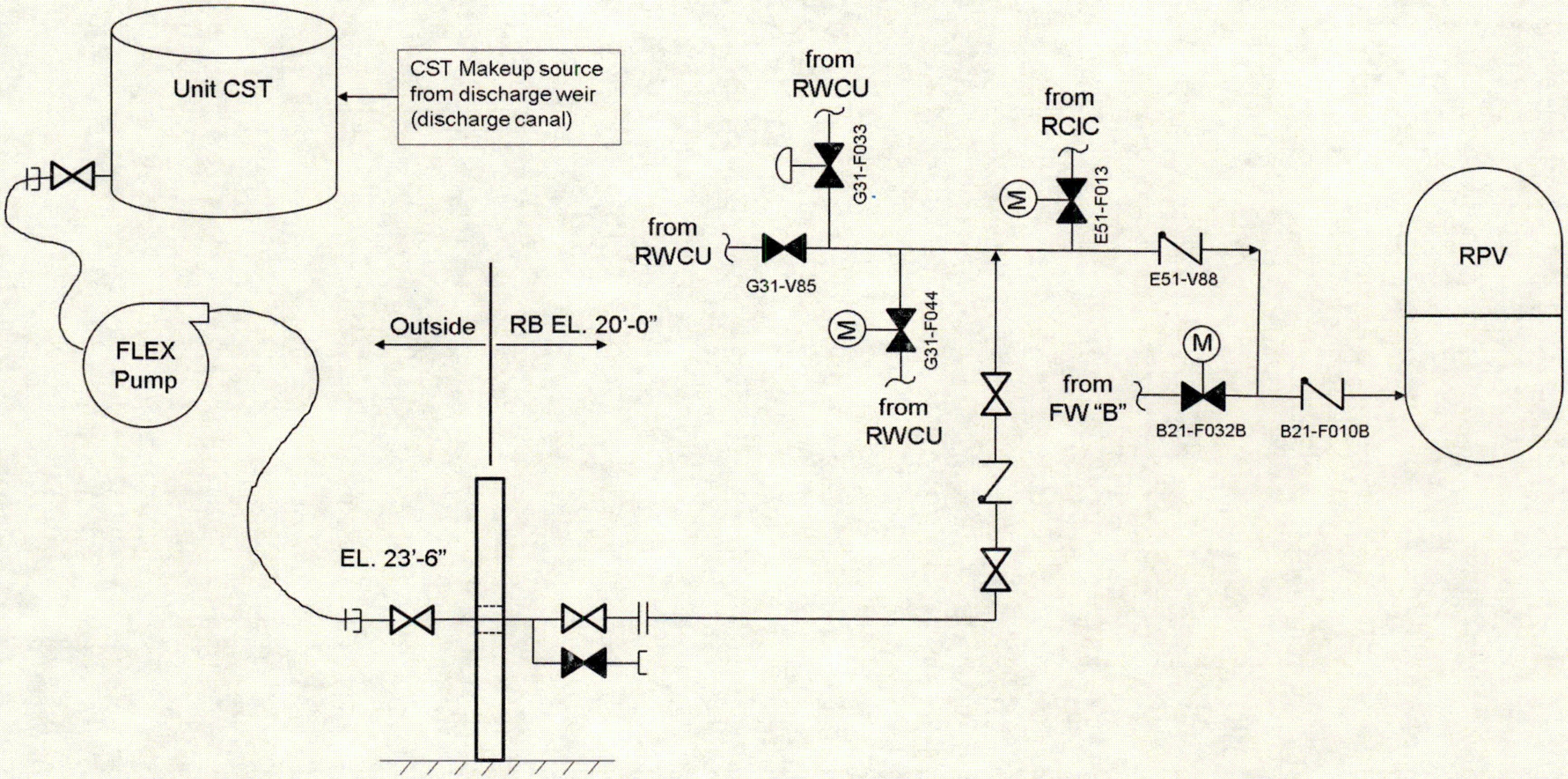
Sketch 2.C: ROS Location – Unit 2



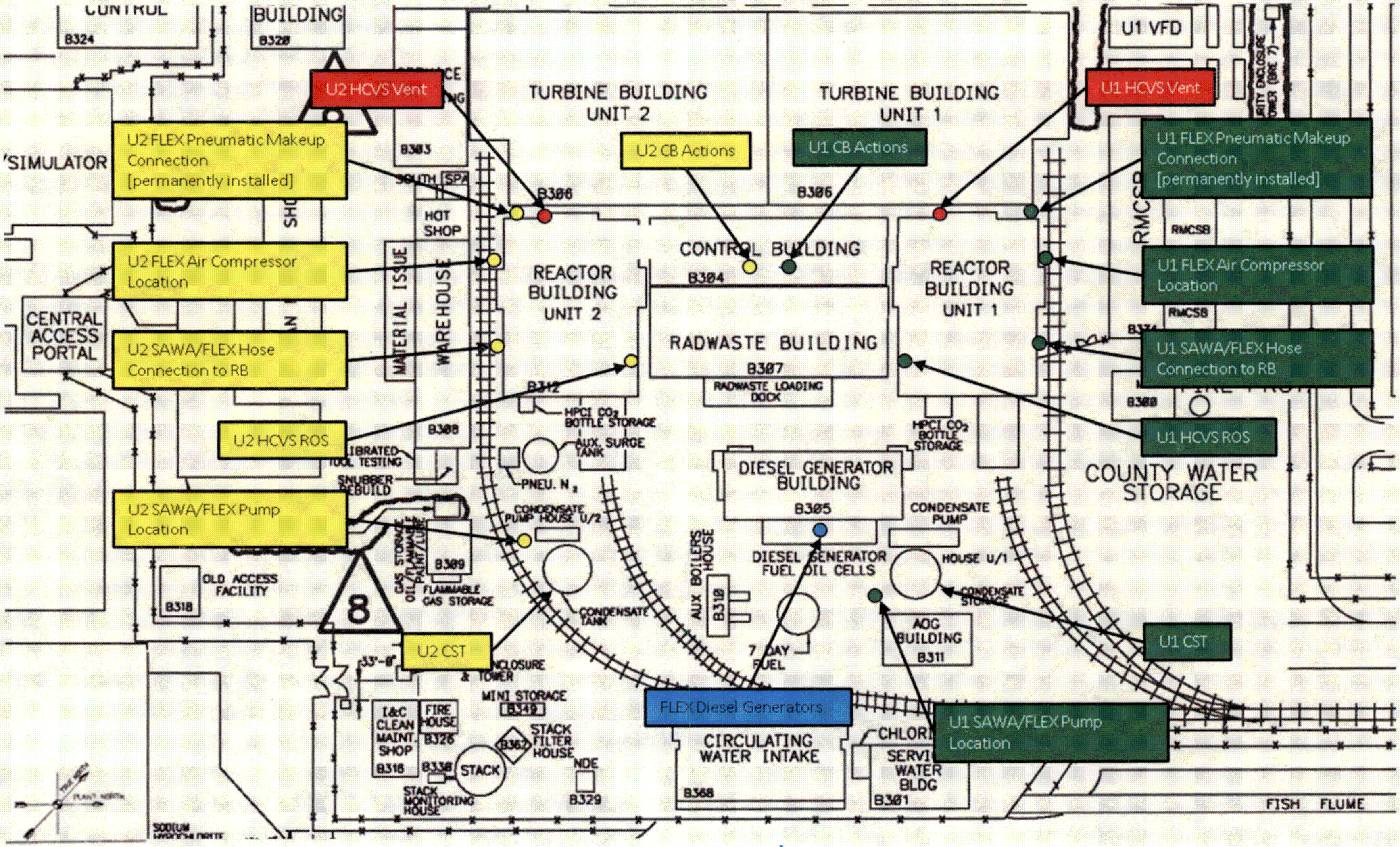
Sketch 2.D: HCVS Actions



Sketch 3.A: SAWA Flow Path



Sketch 3.B: HCVS and SAWA Equipment



Attachment 4: Failure Evaluation Table

Functional Failure Mode	**Failure Cause**	**Alternate Action**	**Failure with Alternate Action Impact on Containment Venting?**
Fail to Vent (Open on Demand)	Valves fail to open/close due to loss of normal AC power	Swap power to 24/48VDC batteries and inverters	No
Fail to Vent (Open on Demand)	Valves fail to open/close due to loss of alternate AC power (long term)	Operate valves from the ROS.	No
Fail to Vent (Open on Demand)	Valves fail to open/close due to complete loss of batteries (long term)	Recharge station service batteries with FLEX provided generators, considering severe accident conditions or operate valves from ROS.	No
Fail to Vent (Open on Demand)	Valves fail to open/close due to loss of normal pneumatic air supply	Valves will be supplied from safety-related nitrogen backup system.	No
Fail to Vent (Open on Demand)	Valves fail to open/close due to loss of alternate pneumatic air supply (long term)	If nitrogen backup system is depleted, connect portable FLEX air compressor to the nitrogen backup system.	No
Fail to Vent (Open on Demand)	Valves fail to open/close due to SOV failure	Operate valves from the ROS.	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
3. Order EA-12-050, Reliable Hardened Containment Vents, dated March 12, 2012
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
6. JLD-ISG-2012-01, Compliance with Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated August 29, 2012
7. JLD-ISG-2012-02, Compliance with Order EA-12-050, Reliable Hardened Containment Vents, dated August 29, 2012
8. JLD-ISG-2013-02, Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents, dated November 14, 2013
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, ADAMS Accession No. ML12229A477, dated August 29, 2012
10. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012
11. NEI 13-02, Industry Guidance for Compliance with Order EA–13–109, Revision 1, Dated April 2015
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 HCVS-FAQ-01, HCVS Primary Controls and Alternate Controls and Monitoring Locations
15. NEI HCVS-FAQ-02, HCVS Dedicated Equipment
16. NEI HCVS-FAQ-03, HCVS Alternate Control Operating Mechanisms
17. NEI HCVS-FAQ-04, HCVS Release Point
18. NEI HCVS-FAQ-05, HCVS Control and 'Boundary Valves'
19. NEI HCVS-FAQ-06, FLEX Assumptions/HCVS Generic Assumptions
20. NEI HCVS-FAQ-07, Consideration of Release from Spent Fuel Pool Anomalies
21. NEI HCVS-FAQ-08, HCVS Instrument Qualifications
22. NEI HCVS-FAQ-09, Use of Toolbox Actions for Personnel
23. NEI White Paper HCVS-WP-01, HCVS Dedicated Power and Motive Force
24. NEI White Paper HCVS-WP-02, HCVS Cyclic Operations Approach

25. NEI White Paper HCVS-WP-03, Hydrogen/CO Control Measures
26. NEI White Paper HCVS-WP-04, Missile Evaluation for HCVS Components 30 Feet Above Grade
27. IEEE Standard 344-1975, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power *Generating Stations*,
28. BSEP EA-12-049 (FLEX) Overall Integrated Implementation Plan, Rev 0, February 2013
29. BSEP EA-12-050 (HCVS) Overall Integrated Implementation Plan, Rev 1, February 2013
30. BSEP EA-12-051 (SFP LI) Overall Integrated Implementation Plan, Rev 1, February 2013
31. 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 March 2015
32. Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments, SECY-12-0157, ML12344A030
33. NUREG/CR-7110, V1, R1, State-of-the-Art Reactor Consequence Analyses (SOARCA) Project: Peach Bottom Integrated Analysis, ML13150A053
34. NEI HCVS-FAQ-10, Severe Accident Multiple Unit Response
35. NEI HCVS-FAQ-11, Plant Response During a Severe Accident
36. NEI HCVS-FAQ-12, Radiological Evaluations on Plant Actions Prior to HCVS Initial Use
37. NEI HCVS-FAQ-13, Severe Accident Venting Actions Validation
38. Updated FSAR (UFSAR) Brunswick Steam Electric Plant, Units 1 and 2, Rev. 24
39. EC 289233, Fukushima: Hardened Vents at BNP NRC Order EA-13-109

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

This Overall Integrated Plan has been updated in format and content to encompass both Phase 1 and Phase 2 of Order EA-13-109. Any significant changes to this plan will be communicated to the NRC staff in the 6 Month Status Reports.

1. FLEX Air compressor will be used versus nitrogen bottles for long-term pneumatic makeup.
2. Revised the electrical backup supply. The HCVS electrical panels do not supply power under normal conditions, only upon the ELAP.
3. Radiation monitor and detector are being replaced with a qualified system, rather than being upgraded as previously reported.

Attachment 7: List of Overall Integrated Plan Open Items

OIP Open Item	Action	Comment
1	Evaluate, design, and implement missile protection as required for the SAWV piping external to the reactor building.	N/A
2	Finalize location of the Remote Operating Station.	N/A
3	Finalize and design means to address flammable gases in the SAWV.	N/A
4	Evaluate location of FLEX DG for accessibility under Severe Accident conditions.	N/A
5	Develop procedures for BDBEE and Severe Accident vent operation (load shedding, power supply transfer, and vent valve operation from the MCR and ROS), vent support functions for sustained operation and portable equipment deployment (FLEX DG supply to the 24/48VDC battery system, and makeup to the nitrogen backup system). 24/48VDC.	N/A
6	Confirm suppression pool heat capacity. Initial results from GE report 0000-0165-0656-R0 for BSEP indicate the suppression pool reaches the heat capacity temperature limit (HCTL) in 2.11 hours.	N/A
7	Finalize location of supplemental N2 bottle connection.	N/A
8	Establish programs and processes for control of HCVS equipment functionality, out-of-service time, and testing.	N/A
9	Confirm wetwell vent capacity is sufficient at the containment design pressure (62 psig). Existing calculation 0D12-0009 calculates a wetwell vent capacity at PCPL (70 psig).	N/A
ISE Open Items	**Action (OIP section reference)**	
1	Make available for NRC staff audit the site specific controlling document for HCVS out of service and compensatory measures.	N/A
2	Make available for NRC staff audit analyses demonstrating that SAWV has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the SAWV 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.	N/A
3	Make available for NRC staff audit confirmation of the time it take the suppression pool to reach the heat capacity temperature limit during ELAP with RCIC in operation.	N/A

4	Make available for NRC staff audit a description of the final ROS location	N/A
5	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.	N/A
6	Provide a description of the final design of the SAWV to address hydrogen detonation and deflagration	N/A
7	Make available for NRC staff audit the seismic and tornado missile final design criteria for the SAWV stack.	N/A
8	Make available for NRC staff audit documentation of the SAWV nitrogen pneumatic system design including sizing and location.	N/A
9	Make available for NRC staff audit documentation of SAWV incorporation into the FLEX diesel generator loading calculation.	N/A
10	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.	N/A
11	Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	N/A
12	Clarify whether the seismic reliability demonstration of instruments, including valve position indication, vent pipe temperature instrumentation, radiation monitoring, and support system monitoring will via methods that predict performance described in IEEE 344-2004 or provide justification for using a different revision of the standard	N/A
13	Make available for NRC staff audit a justification for not monitoring SAWV system pressure as described in NEI 13- 02.	N/A
14	Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for SAWV venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	N/A
15	Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the SAWV, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.	N/A
16	Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings.	N/A