Nebraska Public Power District

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NLS2015137
December 21, 2015

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

Subject: Nebraska Public Power District's 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)
Cooper Nuclear Station, Docket No 50-298, DPR-46

References:

1. NRC Order Number EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," dated June 6, 2013

2. NPPD letter to NRC, "Nebraska Public Power District's 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 30, 2014 (NLS2014057)

3. NPPD letter to NRC, "Nebraska Public Power District's First 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 December 19, 2014 (NLS2014101)

4. NRC letter to NPPD, "Cooper Nuclear Station - Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC NO. MF4384)," dated February 11, 2015

Dear Sir or Madam:

On June 6, 2013, the Nuclear Regulatory Commission (NRC) issued Order EA-13-109 (Reference 1) to Nebraska Public Power District (NPPD). Reference 1 was immediately effective and directs NPPD to take certain actions to ensure that Cooper Nuclear Station (CNS) has a hardened containment vent system (HCVS) to remove decay heat from the containment, and maintain control of containment pressure within acceptable limits following events that result in loss of active containment heat removal capability while maintaining the capability to operate under severe accident conditions resulting from an Extended Loss of AC Power. Specific requirements are outlined in Attachment 2 of Reference 1.

A153
NRR

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Reference 1 required submission of a Phase 1 overall integrated plan (OIP) pursuant to Section IV, Condition D, and status reports at six-month intervals thereafter. NPPD submitted an initial OIP for CNS by letter dated June 30, 2014 (Reference 2) and a revised OIP by letter dated December 19, 2014 (Reference 3).

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. The third six-month update for Phase 1 of the Order is incorporated into the attached HCVS overall integrated plan 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 4. 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. Should you have any questions concerning the content of this letter, please contact Jim Shaw, Licensing Manager, (402) 825-2788.

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

Executed on: 12/21/15

Sincerely,

Oscar A. Limpias
Vice President - Nuclear and
Chief Nuclear Officer

/bk

Attachment: Cooper Nuclear Station Hardened Containment Venting System Overall Integrated Plan, Revision 2

cc: Regional Administrator, w/attachment
USNRC - Region IV

Director, w/attachment
USNRC - Office of Nuclear Reactor Regulation

Cooper Project Manager, w/attachment
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector, w/attachment
USNRC - CNS

NPG Distribution, w/o attachment

CNS Records, w/attachment

Attachment to
NLS2015137

Cooper Nuclear Station Hardened Containment Venting System
Overall Integrated Plan, Revision 2

Cooper Nuclear Station

Hardened Containment Venting System

Overall Integrated Plan

Revision Summary

Revision	Date	Description of Change
0	6/30/2014	Initial submittal.
1	12/15/2014	First Status Update. New Hardened Containment Venting Path (major rewrite).

2	12/15/2015	• Incorporated Phase 2 actions into one comprehensive Overall Integrated Plan
		• Finalizing the design resulted in:
		  o Vent pipe size changed to 12"
		  o Changed method of hydrogen control to no longer require a purge system
		  o Changed method of rain/snow protection for release point
		  o Removed need for a vacuum breaker
		• Minor editorial and formatting changes

Table of Contents:

Introduction

In 1989, the Nuclear Regulatory Commission (NRC) issued Generic Letter 89-16, *Installation of a Hardened Wetwell Vent*, to all licensees of boiling water reactors (BWR) 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 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 Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accidents*, 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 (ISG) (JLD-ISG-2013-02 issued in November 2013 and JLD-ISG-2015-01 issued in April 2015). The ISGs endorse the compliance approach presented in NEI 13-02 Revision 0 and 1, *Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents*, with clarifications. Except in those cases in which a licensee proposes an acceptable alternative method for complying with Order EA-13-109, the NRC staff will use the methods described in the ISGs to evaluate licensee compliance as presented in submittals required in Order EA-13-109.

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

Six month progress reports will be provided consistent with the requirements of Order EA-13-109.

The submittals required are:

- OIP for Phase 1 of EA-13-109 was required to be submitted by Licensees to the NRC by June 30, 2014. The NRC requires periodic (6 month) updates for the Hardened Containment Vent System (HCVS) actions being taken. The first update for Phase 1, was due December 2014, with the second due June 2015.

- 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.

  Note: At the Licensee's option, the December 2015 six month update for Phase 1 may be independent of the Phase 2 OIP submittal, but will require separate six month updates for Phase 1 and 2 until each phase is in compliance.

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) (some plants have a designated Primary Operating Station (POS) that will be treated as the main operating location for this order) 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).

- 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 Drywell 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 CNS with no known deviations to the guidelines in JLD-ISG-2013-02, JLD-ISG-2015-01 and NEI 13-02 for each phase as follows:

- The HCVS will be comprised of installed and portable equipment and operating guidance:
    - Severe Accident Wetwell Vent (SAWV) – Permanently installed vent from the Suppression Pool to the top of the 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.D)
- Phase 1 (wetwell): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for 4th Quarter (November) of 2016.
- Phase 2 (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 4th Quarter (November) of 2018.

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

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 CNS:

- Seismic, Extreme Cold, High Wind, Extreme High Temperature

The following extreme external hazards screen out for CNS:

- External Flooding

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 (Reference 10).
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 (Reference 10).
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 (Reference 10).
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 10, NEI 12-06, Section 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 (Reference 10, NEI 12-06, Section 3.2.1.3, item 9 and 3.2.1.4 items 1-4).
049-6. At 1 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, (greater than 8 hours with a calculation limiting value of 9 hours). This assumption applies to the water addition capability under SAWA/SAWM. The power supply scheme for the HCVS shall be in accordance with EA-13-109 and the applicable guidance (Reference 10, NEI 12-06, Section 3.2.1.3, item 8).
049-8. Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.
049-9. All activities associated with plant specific EA-12-049 FLEX strategies that are not specific to implementation of the HCVS, including such items as debris removal, communication, notification, 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 51, 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 20, HCVS-FAQ-07).

Part 1: General Integrated Plan Elements and Assumptions

109-04. Existing containment components design and testing values are governed by existing plant primary containment criteria (e.g., Appendix J) and are not subject to the testing criteria from NEI 13-02 (Reference 18, HCVS-FAQ-05 and Reference 11, NEI 13-02, Section 6.2.2).

109-05. Classical design basis evaluations and assumptions are not required when assessing the operation of the HCVS. The reason this is not required is that the order postulates an unsuccessful mitigation of an event such that an ELAP progresses to a severe accident with ex-vessel core debris which classical design basis evaluations are intended to prevent (Reference 11, NEI 13-02, Section 2.3.1).

109-06. HCVS manual actions that require minimal operator steps and can be performed in the postulated thermal and radiological environment at the location of the step(s) (e.g., load stripping, control switch manipulation, valving-in nitrogen bottles) are acceptable to obtain HCVS venting dedicated functionality (Reference 14, HCVS-FAQ-01). This assumption does not apply to Phase 2 SAWA/SAWM because SAWA equipment needs to be connected and placed in service within 8 hours from the time of the loss of RPV injection and will require more than minimal operator action.

109-07. HCVS dedicated equipment is defined as vent process elements that are required for the HCVS to function in an ELAP event that progresses to core melt ex-vessel (Reference 15, HCVS-FAQ-02 and Reference 23, White Paper HCVS-WP-01). This assumption does not apply to Phase 2 SAWA/SAWM because SAWA equipment is not dedicated to HCVS but shared to support FLEX functions. This is further addressed in Reference 50, 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 31, FLEX MAAP Endorsement ML13190A201). Additional analysis using RELAP5/MOD 3, GOTHIC, PCFLUD, LOCADOSE and SHIELD are acceptable methods for evaluating environmental conditions in areas of the plant provided the specific version utilized is documented in the analysis. MAAP Version 5 was used to develop 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 11, 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 OIP is based on EOP 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 Attachment 2.1.D 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 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 14, HCVS-FAQ-01 and Reference 22, 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 11, NEI 13-02 Rev 1, §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 Mark I and II under the assumptions of NRC Order EA-13-109 ensures the capability to protect containment exists for each unit (Reference 14, HCVS-FAQ-01). This is further addressed in Reference 49, HCVS-FAQ-10.

Part 1: General Integrated Plan Elements and Assumptions

Plant Specific HCVS Related Assumptions/Characteristics:

CNS-1 The plant layout of buildings and structures are depicted in the following Figure 1-1 (Cooper Nuclear Station Layout). Note that CNS includes only one unit. The MCR is located in the Control Building at elevation 932'-6" (ground level of the Control Building is 903'-6"), which is to the north of the Reactor Building (ground level is 903').

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

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

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

CNS-5 The CNS HCVS includes a UPS which is sized to provide power for at least 24 hours for the HCVS components and the HCVS instrumentation and indication in the MCR and at the Mechanical ROS. The UPS will be located at the far end of the Control Building corridor at the 903'-6" level.

CNS-6 An additional UPS system will be installed in the Reactor Building to provide power to the inboard PCIV.

CNS-7 Hydrogen control will be addressed using a check valve combined with limiting the run-up distance of the piping downstream of the check valve.

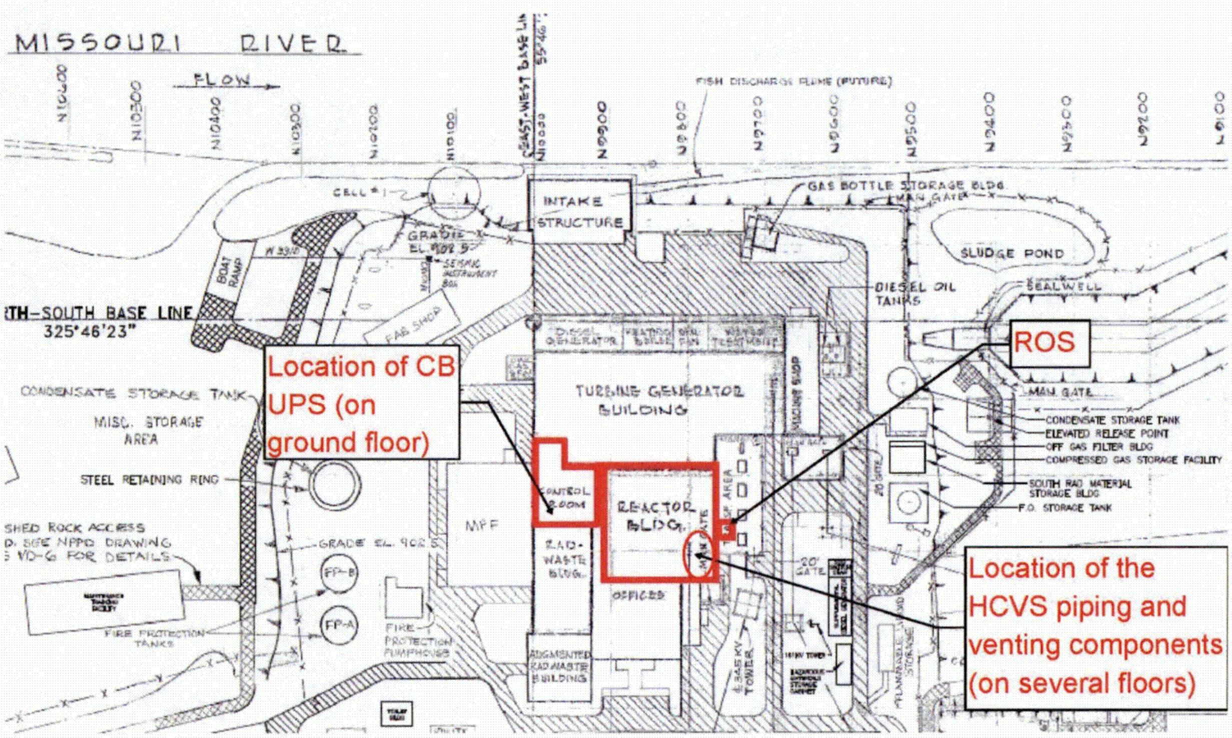

Figure 1-1, Cooper Nuclear Station Layout

Part 2: Boundary Conditions for Wet Well Vent

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

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

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

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

See attached sequence of events timeline (Attachment 2A).

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

The operation of the HCVS will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1. Initial operator actions will be completed by plant personnel and will include the capability for remote-manual initiation from the HCVS control station. A list of the remote manual actions performed by plant personnel to open the HCVS vent path can be found in the following table (2-1). An HCVS 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 Actions	Primary Location / Component	Notes
Switch power	1. Manually switch PC-MOV-233MV power from Division I AC to dedicated PC233MV UPS.	Reactor Building, elevation 958'-3", at or near MCC-RA	This dedicated UPS provides three operating cycles of PC-MOV-233MV. This valve is expected to be opened once.
Isolate torus purge	2. Ensure N_2 purge to torus valve AO-239 is closed.	MCR Vertical Board H	This valve is normally closed, fails-closed.
	3. Ensure torus inlet purge shutoff valve AO-235 is closed.	MCR Vertical Board H	This valve is normally closed, fails-closed.
Prepare Hardened Pipe Venting	4. Place PC-MO-233 ISOLATION OVERRIDE to OVERRIDE.	MCR Key PA2235 Panel P2	
	5. Place PC-AO-237 ISOLATION OVERRIDE to OVERRIDE.	MCR Key PA2235 Panel P2	
	6. Open torus inlet outboard isolation valve PC-AO-237AV.	MCR Vertical Board H	This valve is normally closed, and fails-closed on loss of air or electricity. Controlled from ROS panel, as well.

Part 2: Boundary Conditions for Wet Well Vent

	7. Open torus inlet inboard isolation valve PC-MO-233MV.	MCR Vertical Board H	This valve is normally closed.
	8. Open torus HCVS valve PC-AO-32.	MCR Key PA2235 Panel P2	AO-32 is the venting valve. This valve is normally closed, and fails-closed on loss of air and electricity. Controlled from ROS panel, as well.
Post-24 hours actions	9. Connect FLEX DG to emergency connection of the UPS system.	HCVS UPS in Control Building Corridor	Prior to depletion of the HCVS dedicated power supply (the UPS battery); actions will be required to connect back-up sources at a time greater than 24 hours.
	10. Switch UPS power from 120 VDC battery to bypass source.	HCVS UPS in Control Building Corridor	Prior to depletion of the HCVS dedicated power supply (the UPS battery), actions will be required to connect back-up sources at a time greater than 24 hours.
	11. Replenish pneumatics with replaceable nitrogen bottles to pre-installed connections.	Mechanical ROS N_2 bottles will be located in an area accessible to operators (by ROS).	Nitrogen bottles will be pre-connected at the Mechanical ROS. Prior to depletion of the pneumatic sources, actions will be required to connect back-up sources at a time greater than 24 hours.

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

A 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 a 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.

Part 2: Boundary Conditions for Wet Well Vent

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

- 8 hours: Initiate use of HCVS per site procedures to maintain containment parameters below design limits and within the limits that allow continued use of RCIC. The reliable operation of HCVS will be met because HCVS meets the seismic requirements identified in NEI 13-02 and will be powered by a dedicated HCVS DC powered UPS (the "UPS" system mentioned below) with motive force supplied to HCVS valves from installed accumulators and portable nitrogen storage bottles. Critical HCVS controls and instruments associated with containment will be powered by two UPS systems described below and in "Part 2 – HCVS Support Equipment Functions" of this document, and operated from the MCR. HCVS battery capacity will be available to extend to 24 hours. In addition, when available, Phase 2 FLEX DG can provide power before battery life is exhausted. Thus, initiation of the HCVS from the MCR within 8 hours is acceptable because the actions can be performed any time after declaration of an ELAP until the venting is needed at 8 hours 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.

- Dedicated HCVS battery capacity will be available from two UPS systems (Sketch 1 in Attachment 3) to provide power for at least 24 hours. The HCVS UPS will provide power to the HCVS components and the HCVS instrumentation and indication in the MCR and at the Mechanical ROS until the FLEX DG is ready to be put in service. This system will consist of a bank of battery cells providing 120VDC powering an inverter, which supplies alternate HCVS 120VAC power, and a 120VAC Distribution Panel. The inboard PCIV (PC-MOV-233MV) will be powered by a separate, dedicated UPS (PC233MV UPS). Therefore, providing power to the UPS is under no time constraint until at least 24 hours.

- 24 hours: If station power is not restored after 24 hours, power to the HCVS Distribution Panel will be provided directly by a FLEX DG (bypassing the UPS battery charger) or by recharging the UPS batteries with a FLEX DG. The transfer switch will be aligned to supply normal AC power to the battery charger during normal operation. During the beyond design basis event, cables will be connected to the receptacles installed on the transfer switch enclosure and connected to the cables from a FLEX DG.

- 24 hours: AOVs PC-AOV-237AV and PC-AOV-AO32 will be supplied pneumatic motive force using portable nitrogen bottles pre-staged and pre-connected in the Mechanical ROS. Although the valves can be supplied pneumatic motive force from the Mechanical ROS at any time prior to 24 hours, the accumulators of PC-AOV-237AV and PC-AOV-AO32 will be sized to provide enough pneumatic supplies for 24 hours. Hence, this time constraint is not limiting.

Discussion of radiological and temperature constraints identified in Attachment 2A:

- Actions to initiate HCVS operation are taken from the MCR, or from the ROS if operation of PC-AOV-237AV and PC-AOV-AO32 require nitrogen from the Mechanical ROS. As per assumption 109-12, the Control Room is adequately protected from excessive radiation dose per GDC 19 in 10CFR50 Appendix A. Non-radiological habitability for the MCR is being addressed as part of the FLEX response (Reference 28).

- The Mechanical ROS will be located against the South wall of the Reactor Building, on the exterior side.

- To transfer power to the PC-MOV-233MV dedicated PC233MV UPS, operators will be required to travel to the transfer switch located in the Reactor Building near the MCC-RA (floor elevation 958'-3").

Part 2: Boundary Conditions for Wet Well Vent

This operation will be performed after an ELAP is declared, but before venting of the HCVS is initiated. The core will still be covered and no additional radiological conditions will be experienced at the location of the connection.

- A formal calculation to evaluate the accessibility of the Mechanical ROS and other non-MCR locations (e.g., Control Building, and Reactor Building 958'-3" near MCC-RA) for radiological and environmental conditions will be performed. This calculation will also confirm travel pathways accessibility to the Mechanical ROS and other non-MCR locations in order to minimize operator exposure to adverse environmental conditions.

OPEN ITEM 1: Determine the location of the HCVS ROS. **(COMPLETE)**

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

- At 24 hours, based on battery depletion, power supply will be swapped from the dedicated HCVS batteries to the FLEX DG to ensure power to the inverters. The HCVS UPS transfer switch will be located in the Control Building corridor. To access the transfer switch, operators will only be required to travel in the Control Building. Radiological consequences resulting from the operation of the HCVS are not expected in the Control Building, as the HCVS will only be routed inside the Reactor Building. In addition, the Control Building provides shielding.

OPEN ITEM 3: Determine the location of the dedicated HCVS battery transfer switch. **(COMPLETE)**

- At >24 hours, installed nitrogen bottles will be valved-in to supplement the air accumulator supply for PC-AOV-237AV and PC-AOV-AO32 as stated for the related time constraint item. Nitrogen bottles will be pre-staged and pre-connected in the Mechanical ROS. The Mechanical ROS will be evaluated for radiological and environmental conditions as stated in Open Item 2.

OPEN ITEM 4: Determine the location of backup nitrogen bottles and evaluate the effects of radiological and temperature constraints on their deployment.

- At >24 hours, actions to connect the UPS battery to a power supply will occur on the north side of the CNS Control Building and within the Control Building itself. The Control Building is located on the north side of the Reactor Building. The locations for installation (and control) of the DG are therefore shielded from HCVS piping by the Reactor Building and is greater than 100' away from the piping and the stack. Although there is no radiological and temperature constraints associated with the connection of the UPS batteries to its backup power supply, there may be radiological and temperature constraints related to the deployment of the backup supply itself, such as the deployment of the FLEX DG dedicated to recharge the UPS battery.

OPEN ITEM 5: Evaluate location of the portable DG for accessibility under SA HCVS use.

Provide details on the vent characteristics.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The HCVS shall include means to prevent inadvertent actuation.

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

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

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

Provide 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

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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 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 2,419 MWt (which corresponds to the CLTP) at pressure of 56 psig. This pressure is the lower of the containment design pressure (56 psig) and the PCPL value (62.7 psig). The size of the wetwell portion of the HCVS goes from 20" to 24" until it combines with the HCVS piping which will be sized at 12", which provides adequate capacity to meet or exceed the Order criteria. There are no plans for increases on licensed power.

Vent Capacity:

There are no exceptions to the 1% decay heat removal capacity. The 1% value at CNS assumes that the suppression pool pressure suppression capacity is sufficient to absorb the decay heat generated during the first 3 hours. The vent would then be able to prevent containment pressure from increasing above the containment design pressure. As part of the detailed design, the duration of suppression pool decay heat absorption capability will be confirmed.

OPEN ITEM 6: Confirm suppression pool heat capacity.

Vent Path and Discharge:

The HCVS vent path at CNS consists of a wetwell vent. The HCVS will use the existing THPV piping between the wetwell penetration X-205 and PCIV PC-AOV-237AV. Penetration X-205 is a 20" piping penetration located at the top of the torus, midway between ring girders in a vent pipe bay. The piping enlarges to a 24" pipe right beyond the penetration. This pipe contains two butterfly PCIVs, PC-MOV-233MV and PC-AOV-237AV.

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Currently, further downstream, the 24" pipe changes to a 24" piping/thin-walled piping. This thin-walled piping has been evaluated (calculation NEDC 92-054) and determined to meet the design requirements of the HCVS, and a new 12" line will be tied into this 24" line. The new control valve that replaces PC-AOV-AO32 (the venting valve) will be installed on the new 12" line in the torus room area. The pipe will then travel along the south wall of the Reactor Building, to the southwest corner room. The pipe will enter the corner room using a new penetration in the southwest diagonal wall. The pipe will then travel across the corner room to enter the southwest staircase "A2" below floor elevation 903'-6". Once in the staircase, the pipe will follow the underside of the staircase and penetrate the southwest corner of the stairwell landing (i.e., the first stairwell landing on the west wall above 903'-6"). The pipe will travel through the staircase all the way to the refueling floor (elevation 1001'-0"). It will penetrate the 1001' concrete floor slab in the southwest corner of the stairwell landing, and it will exit the top of the stairwell concrete structure (9' above elevation 1001') on the refuel floor. The vent line will then follow the south wall to a structural beam. The vent line will then go vertically out to the Reactor Building roof for the release point. The effluent will exit out of the Reactor Building.

Release Point:

The release point will be located at an elevation of at least 1056', i.e., more than 3' above the top of Reactor Building parapet walls (1052'-9") per NEI guidance contained in HCVS-FAQ-04, Revision 3 (Reference 17). Protection from rain and snow is provided by a weather cap secured in place by breakaway bolts. The stack design is a vertical release point above the Reactor Building roof, in order to release the effluent directly up into the atmosphere. The weather cap is designed to blow off such that anticipatory venting naturally removes the cap during venting operations. Similarly, the check-valve is designed to open at a maximum of 2 psig for anticipatory venting. The weather cap repels birds, prevents ice formation, and protects the HCVS pipe from water and other debris. The weather cap, pipe size, and check valve satisfy security requirements.

Drains and Water-Hammer Prevention:

Water hammer does not occur in the HCVS line during operation as a result of condensation of the steam, or during the opening/closing of the control valve PC-AOV-AO32. Additionally, the HCVS does not require a drainage system due to entrainment of condensation in the high velocity flow and the low amount of condensation produced during venting or accumulated after HCVS venting.

Wind and Missile Protection:

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

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

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

2. Missile protection evaluation is required for piping segments outside of Seismic Class I structures.

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

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

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

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

Power and Pneumatic Supply Sources:

Electrical Power Supply:

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

Note that PC-MOV-233MV will be powered by a separate alternate power supply. This alternate supply will consist of a UPS (charger, battery, and inverter) and transfer switch at or near MCC-RA. The transfer switch will provide proper separation of the safety-related control and power circuits for PC-MOV-233MV. The UPS will provide 480 VAC three phase power for PC-MOV-233MV, and will be sized to provide three operating cycles of the valve during the 24-hour period before FLEX power or offsite power is restored. See Sketch 1 of Attachment 3 for a 1-line sketch of the UPS systems (HCVS UPS and PC233MV UPS).

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

The UPS will be located at the far end of the Control Building corridor at the 903'-6" level. At this location, the UPS will be easily and readily accessible from the MCR (located in the Control Building at elevation 932'-6"). This location was chosen based on the seismic class of the Control Building and being above the design basis flood level. The relative absence of safety-related equipment in that area is also a positive feature. Additionally, this location is in relatively close proximity to both the Control Room and anticipated connection points for FLEX power sources. The PC233MV UPS was sized to provide power for three opening/closing cycles of PC-MOV-233MV. The valve is expected to be open once and left open during venting operations. Therefore, the current size of the PC233MV UPS provides enough power supplies for more than 24 hours.

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

Pneumatic Power Supply:

Pneumatic power is normally provided by the non-interruptible air system with backup nitrogen provided from installed nitrogen supply tanks. Following an ELAP event, the station air system is lost, and normal backup from installed nitrogen supply tanks is isolated. Therefore, for the first 24 hours, pneumatic force will be supplied from existing and newly installed air accumulator tanks. These accumulators will supply the required motive force to those HCVS valves needed to maintain flow through the HCVS effluent piping.

1. The HCVS flow path valves are a 24" MOV, AC power to open and close, followed by a 24" AOV, air-to-open and spring-to-shut. The vent control valve will be a 12" AOV with air-to-open and spring-to-shut. Opening the AOVs requires energizing an AC powered SOV and providing motive air/gas, while opening the MOV requires AC power. Power to energize the SOVs will be provided by the HCVS UPS. Power to operate the MOV will be provided by a separate, PC233MV UPS. To prevent failure of the HCVS due to failure of the solenoid valves to actuate PC-AOV-237AV and PC-AOV-AO32, shuttle valves will be installed to allow these AOVs to accept nitrogen from the Mechanical ROS. Actuation of PC-AOV-237AV and PC-AOV-AO32 via nitrogen through the associated shuttle valves will be performed from the Mechanical ROS. The HCVS UPS, the PC233MV UPS, and the AOV accumulators provide permanently installed power source and motive air/gas supply adequate for the first 24 hours. Beyond the first 24 hours, FLEX generators will be used to maintain battery power to the HCVS components. The initial stored motive air/gas will allow for 8 valve operating cycles for PC-AOV-AO32 and one cycle of PC-AOV-237AV for the first 24 hours. This is conservative in regards to the results contained in the September 2014 MAAP analysis to support the CNS FLEX strategy (Reference 44). In this analysis, strategies with the vent continuously open (no cycle), or with one cycle or two cycles only, are sufficient to maintain Torus pressure between 15 and 30 psia and the suppression pool water temperature below 240°F.

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

3. All permanently installed HCVS equipment, including any connections required to supplement the HCVS operation during an ELAP (i.e., electric power, N_2/air) will be located in areas reasonably protected from defined hazards listed in Part 1 of this OIP.

4. All valves required to open the flow path or valves that require manual operation to be closed to prevent diversion or cross-flow into other systems/units will be designed for remote manual operation following an ELAP, such that the primary means of valve manipulation does not rely on use of a hand wheel, reach–rod or similar means that requires close proximity to the valve (Reference 16, FAQ HCVS-03). The remote manual operation of the valves will be performed from the Control Room. Only PC-AOV-237AV and PC-AOV-AO32 can additionally be operated from the ROS if the associated solenoids fail. Accessibility of the ROS during the event will be evaluated for radiological and environmental conditions, and strategies such as the use of ice vests or shielding will be implemented if deemed necessary. Any supplemental connections will be pre-engineered to minimize man-power resources and address environmental concerns.

Part 2: Boundary Conditions for Wet Well Vent

Required portable equipment will be reasonably protected from screened in hazards listed in Part 1 of this OIP. A list of portable equipment can be found in Attachment 1.

5. Access to the locations described above will not require temporary ladders or scaffolding.
6. Following the initial 24-hour period, additional motive force will be supplied from nitrogen bottles that will be pre-staged and pre-connected at the Mechanical ROS. Additional nitrogen bottles will also be available on-site for re-supply of the Mechanical ROS.

Location of Control Panels:

The HCVS design allows initiating and then operating and monitoring the HCVS from the MCR and the ROS. The MCR location is protected from adverse natural phenomena and is the normal control point for Plant Emergency Response actions.

The Mechanical ROS will be located as shown on Figure 1-1 on the exterior south wall of the Reactor Building, and will be several feet to the east of the current standby nitrogen injection station (and its barricaded door) just inside the security fence entrance to the transformer area. The Mechanical ROS will be a missile shielded structure. A door will be needed in order to allow operator access and to move additional nitrogen bottles into the Mechanical ROS to supply pneumatic motive force beyond the initial 24 hours of the event. The exterior and interior walls forming the door entrance will be constructed in order to protect the equipment in the Mechanical ROS from tornado missiles. Therefore, the door does not need to be designed for missile protection itself.

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

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).

Hydrogen control will be addressed using a check valve in the discharge pipe placed such that the remaining length of piping is less than the minimum run-up distance required for a DDT to occur (NEI HCVS-WP-03, Reference 25). A new check valve will be installed on the 1001' floor (refueling floor) of the Reactor Building. The function of this valve is twofold: first, the function of the valve is to eliminate air ingress further down the pipe when the venting stops and the steam condenses; second, the function of the check valve is to bottle up the steam and hydrogen in the pipe volume below this valve and above the upstream control valve. The check valve will be designed for the temperature, pressure, and radiological conditions seen at its location.

OPEN ITEM 7: Determine which approach or combination of approaches CNS will take to address the control of flammable gases, clearly demarcating the segments of vent system to which an approach applies. **(COMPLETE)**

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Unintended Cross Flow of Vented Fluids:

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

- The Containment Purge System control circuit will be used during all "design basis" operating modes including all design basis transients and accidents.
- Suppression Chamber In/Outboard Isolation Valves PC-MOV-1304MV and PC-MOV-1303MV are normally closed and meet the requirements of 10CFR50 Appendix J, Type C Testing.
- Suppression Chamber Vacuum Relief Outboard Isolation Valves PC-13CV and PC-14CV are normally closed check-valves that automatically open on a differential pressure of 0.5 psid across the valve to ensure that the external design pressure of the torus will not be exceeded. The valve in its normally closed position provides outboard primary containment isolation. The valves meet the requirements of 10CFR50 Appendix J, Type C Testing. PC-AOV-243AV and PC-AOV-244AV, which are the Inboard Isolation Valves for Suppression Chamber Vacuum Relief, meet the requirements of 10CFR50 Appendix J, Type C Testing.
- Vacuum breaker PC-30CV is currently installed on the 10" THPV piping upstream of PC-AOV-AO32 to prevent collapse of the 24" Torus Purge and Vent Supply thin wall pipe after a venting operation. Since the 10" line is removed, this vacuum breaker is removed. Vacuum breaker PC-30CV is not replaced in the HCVS. During an event which requires venting through the HCVS, PC-MOV-233MV and PC-AOV-237AV remain open. This allows the existing Suppression Chamber Relief System (PC-AOV-243AV and PC-AOV-244AV) to provide relief of vacuum conditions within the piping from the Torus to PC-AOV-AO32. Therefore, replacing the THPV vacuum breaker PC-30CV is not necessary.
- The Suppression Chamber Valve PC-AOV-235AV, the Nitrogen Purge Supply Valve PC-AOV-239AV, and their support components will be replaced. Replacement valves will be leak-tight and will meet the requirements of 10CFR50, Appendix J. The replacement components will be designed to the environmental and radiological conditions seen at the location during a severe accident requiring the use of the HCVS. Testing and maintenance will be performed to ensure that the valves remain leak-tight.
- New local leak rate test connections will be added in order to individually test the leak-tightness of the new PC-AOV-235AV, PC-AOV-239AV, venting valve (replacing PC-AOV-AO32), and vacuum breaker.
- The HCVS vent path minimizes the number of auxiliary lines and interfacing ventilation systems. For example, the HCVS line will not interface with the SGT system or ERP. All auxiliary lines are currently, or will be, isolated with boundary valves meeting the requirements of 10CFR50 Appendix J. Therefore, the risk of unintended cross flow of vented fluids will be minimized.
- CNS is a single unit. As such, interconnection through the common plant stack is not applicable.
- Pipe leakage to the Reactor Building and other buildings will be minimized:

Part 2: Boundary Conditions for Wet Well Vent

- Leak tightness of the vent pipe from PC-AOV-237AV to the exhaust will be tested in compliance with the requirements of USAS B31.1.0, 1967 Edition.
- Since the HCVS piping will be designed and installed per USAS B31.1.0, 1967 Edition, the HCVS piping will meet the Nondestructive Inspection and Examination requirements of power piping in USAS B31.1.0, 1967 Edition. This requires that all the pipe welds are visually inspected.

Prevention of Inadvertent Actuation:

EOP/EPG operating procedures provide clear guidance that the HCVS is not to be used to defeat containment integrity during any design basis transients and accident. In addition, the HCVS will be designed to provide features to prevent inadvertent actuation due to a design error, equipment malfunction, or operator error such that any credited CAP that would provide net positive suction head to the ECCS pumps will be available (inclusive of a DBLOCA). However, the ECCS pumps will not have normal power available because of the starting boundary conditions of an ELAP. CNS credits CAP to maintain sufficient NPSH for ECCS Pumps (Core Spray and RHR). Therefore, it is essential to prevent inadvertent actuation of the HCVS to ensure that the CAP can be maintained.

At CNS, the features that prevent inadvertent actuation are two containment isolation valves in series powered from different divisions and key-lock switches. With respect to the containment isolation valves, the inboard valve (PC-MOV-233MV) is an AC motor driven MOV fed from a Division I AC power source, and the outboard valve (PC-AOV-237AV) is an AOV with an AC powered SOV fed from a Division II AC power source. Hence, the containment isolation valves meet the requirements for redundant and diverse power sources. Furthermore, these valves can be operated from key-locked switches in the MCR. Although these valves are shared between the Containment Purge System and the HCVS, key-locked override switches are provided for each valve to allow operators to override the containment isolation signal. Specifically:

- The Containment Purge System control circuit will be used during all "design basis" operating modes including all design basis transients and accidents. The containment isolation signal will cause the valves to shut.
- The HCVS control circuit will have a key-locked switch for each of the two in-series valves to address inadvertent operation. Turning the switch to "open" will energize the control circuit opening the valve. Both valves will use AC power for opening for the HCVS function. Also, separate control circuits including switches will be used for the two redundant valves to address single point vulnerabilities that may cause the flow path to inadvertently open.

Procedures also provide clear guidance to not circumvent containment integrity by simultaneously opening torus and drywell vent valves during any design basis transient or accident. In addition, the HCVS will be designed to provide features to prevent inadvertent actuation due to a design error, equipment malfunction, or operator error.

Component Qualifications:

The HCVS components downstream of the second containment isolation valve, and components that interface with the HCVS, are routed in seismically qualified structures. The Mechanical ROS will be a seismically qualified structure. HCVS components that directly interface with the pressure boundary will be considered safety-related, as the existing system is safety-related. The containment system limits the leakage or release of radioactive materials to the environment to prevent offsite exposures from exceeding the guidelines of 10CFR100. During normal or design basis operations, this means serving as a pressure boundary to prevent release of radioactive material.

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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 HCVS UPS and PC233MV UPS are considered Balance of Plant. Where the UPS circuits interface with safety-related circuits, the appropriate separation will be provided by transfer switches, disconnects, or interposing relays between safety and non-safety-related circuits. The remaining components will be considered Augmented Quality. Newly installed piping and valves will be seismically qualified to handle the forces associated with the SME back to their isolation boundaries. Electrical and controls components will be seismically qualified and will include the ability to handle harsh environmental conditions (although they will not be considered part of the site EQ program).

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

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

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

2. Demonstration of seismic reliability via methods that predict performance described in IEEE 344-2004.

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

Table 2-2, Qualification Method of HCVS instrumentation

Instrument	Qualification Method*
HCVS Process Temperature	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Process Pressure	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Process Radiation Monitor	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Process Valve Position	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Pneumatic Supply Pressure	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Electrical Power Supply Availability	ISO9001 / IEEE 344-2004 / Demonstration
Existing HCVS Containment Pressure	ISO9001 / IEEE 344-2004 / Demonstration
Existing Suppression Pool Level	ISO9001 / IEEE 344-2004 / Demonstration
Existing Suppression Pool Temperature	ISO9001 / IEEE 344-2004 / Demonstration
Nitrogen Bottles Pressure	ISO9001 / IEEE 344-2004 / Demonstration

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

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OPEN ITEM 8: Identify qualification method used for HCVS instruments.

The instrumentation is listed in Table 2-4 of the OIP.

Monitoring of HCVS:

The CNS wetwell HCVS will be capable of being manually operated during sustained operations from a control panel located in the MCR and will meet the requirements of Order element 1.2.4. The MCR is a readily accessible location with no further evaluation required. Control Room dose associated with HCVS operation conforms to GDC 19/Alternate Source Term. Additionally, to meet the intent for a secondary control location of Section 1.2.5 of the Order, a readily accessible ROS will also be incorporated into the HCVS design as described in NEI 13-02, Section 4.2.2.1.2.1. The controls and indications at the ROS location will be accessible and functional under a range of plant conditions, including severe accident conditions with due consideration to source term and dose impact on operator exposure, ELAP, and inadequate containment cooling. An evaluation will be performed to determine accessibility to the location, habitability, staffing sufficiency, and communication capability with vent-use decision makers.

OPEN ITEM 9: Evaluate HCVS monitoring location for accessibility, habitability, staffing sufficiency, and communication capability with vent-use decision makers.

The wetwell HCVS will include means to monitor the status of the vent system in both the MCR and the ROS. Included in the current design of the THPV are control switches in the MCR with valve position indication (Reference 34). The existing THPV controls currently meet the environmental and seismic requirements of the Order for the plant severe accident and will be upgraded to address ELAP. At the ROS, a control panel will be included. Monitoring the status of the vent line will be made possible with indications of the pressure in the accumulators IA-ACC-237AV and IA-ACC-AO32, and a position indicator of PC-AOV-AO32 position.

The ability to open/close these valves multiple times during the event's first 24 hours will be provided by air accumulator tanks and two UPS systems (i.e., the HCVS UPS and PC233MV UPS) providing a backup battery power source. Beyond the first 24 hours, the ability to maintain these valves open or closed will be provided with replaceable nitrogen bottles and FLEX generators.

The wetwell HCVS will include indications for vent pipe pressure (already available in the MCR), temperature (to be installed), and effluent radiation levels (already available in the MCR) at the MCR. Other important information on the status of supporting systems, such as power source status (to be installed) and pneumatic supply pressure (already available in the MCR for PC-AOV-AO32 but will be replaced with the valve replacement, and to be installed for PC-AOV-237AV), will also be included in the design and located to support HCVS operation. The wetwell HCVS includes existing containment pressure and wetwell level indication in the MCR to monitor vent operation. This monitoring instrumentation provides the indication from the MCR as per Requirement 1.2.4 and will be designed for sustained operation during an ELAP event.

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

Part 2: Boundary Conditions for Wet Well Vent

Table 2-3, HCVS Monitoring and Control Changes

NRC Requirements & Industry Recommendations	Existing I&C	Change
Order Requirement 1.2.4: The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the MCR or a remote but readily accessible location.	The primary controlling location of the existing THPV is the MCR. PCIVs valves can be manually operated from the MCR using key-locked override switches on Panel P2 and open/close switches on Vertical Board H (PC-SW-CS (233AV) and PC-SW-CS (237AV)). AOV-AO32 can be controlled from Panel P2 using key-locked switches.	The primary controlling location of the HCVS is the MCR. During a severe accident, controls will be powered from a HCVS-dedicated UPS. PC-MOV-233MV will be powered from a separate alternate power supply (PC233MV UPS). The supply of pneumatic motive force after 24 hours will be performed from the Mechanical ROS.
Order Requirement 1.2.5: The HCVS shall, in addition to the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.	N/A	The installation of a HCVS dedicated source of power ensures operation of the HCVS from the MCR. The supply of pneumatic motive force after 24 hours will be operated from the Mechanical ROS. In case the SOV of PC-AOV-237AV and/or PC-AOV-AO32 fails, shuttle valves will allow actuation of the valves from the Mechanical ROS with pneumatic motive force.

Part 2: Boundary Conditions for Wet Well Vent

Order Requirement 1.2.8: The HCVS shall include means to monitor the status of the vent system (e.g., valve position indication) from the control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of AC power. HCVS valve position indication should be available at the primary controlling location. (NEI 13-02, 4.2.2.1.5)	The position of the following valves is indicated in the MCR: MOV-233MV, AOV-237AV, AOV-AO32.	PC-AOV-AO32 will be replaced. The circuit indicating position lights for PC-AOV-AO32 on MCR Panel P2 will be modified accordingly to indicate the position of the new control AOV. An effluent pressure transmitter will be added to the line in the Torus Room to measure the effluent pressure and confirm the status of venting operations.
Order Requirement 1.2.9: The HCVS shall include a means to monitor the effluent discharge for radioactivity that may be released from operation of the HCVS. The monitoring system shall provide indication from the control panel required by 1.2.4 and shall be designed for sustained operation during an extended loss of AC power.	Currently, RMA-RE-27 measures radiation doses in the THPV. Indications are provided on MCR Panel 9-11.	The existing radiation monitor is located near the section of the THPV line which will be demolished. A new radiation monitor will be installed in the same area (Torus Room). The indication on Panel 9-11 will be modified to indicate the doses recorded on the new radiation monitor.
HCVS valve position indicators should be capable of operating under the temperature/radiation conditions existing at the valve locations. (NEI 13-02, 4.2.2.1.6)	N/A	Refer to Part 2, "Component Qualifications."

Part 2: Boundary Conditions for Wet Well Vent

HCVS valve position indicators and indications should be powered from sources that will be available during the appropriate mission time of the HCVS system. (NEI 13-02, 4.2.2.1.7)	N/A	The position lights for the MOV will only be on when the MOV is energized from its temporary power supply. Once the valve is positioned open and the power supply is secured, the lights will be off. Position lights for PC-AOV-237AV and the new control valve (on MCR Vertical Board H) will be powered from the UPS.
HCVS system should include indications of effluent temperature. Permanently installed gauges that are at, or nearby, the HCVS control panel is an acceptable method to address this item. (NEI 13-02, 4.2.2.1.8) (also see Order Requirement 1.2.8)	There is currently no existing instrumentation to monitor effluent temperature.	An effluent temperature monitor will be installed in the new pipe path on the refueling floor. Effluent temperature indication will be provided in the MCR.
The HCVS system should include indications for the Containment Pressure and Wetwell level for determination of vent operation. Use of existing control room indications is adequate and these instruments do not need to be powered by the HCVS battery system. (NEI 13-02 4.2.2.1.9) (also see Order Requirement 1.2.8)	The following parameters are already recorded in the MCR: Drywell Pressure on PC-PT-512A, -B; PC-PT-4A1, -4B2 Torus Pressure on PC-PT-30A, -30B Suppression Pool Level on PC-DPT-3A1, -3B1	Although not required, these instruments and their indicators will be powered from the UPS to provide sustained indication during an ELAP.

Part 2: Boundary Conditions for Wet Well Vent

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

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

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

Location / I&C	MCR	HCVS UPS	Mechanical ROS
PCIV controls	Existing key-locked override switches on Panel P2 and open/close switches on Vertical Board H (PC-SW-CS(233AV) and PC-SW-CS(237AV)). Powered from HCVS UPS.	None	None, except piping to supply nitrogen to the new shuttle valve for PC-AOV-237AV.
PCIV position indicators	Existing indicating lights on VBD H Powered from HCVS UPS.	None	None
Control valve controls	PC-AOV-AO32 key-locked switch on Panel P2 to be replaced, as AO32 will be replaced. Powered from HCVS UPS.	None	None, except piping to supply nitrogen to the new shuttle valve for PC-AOV-AO32.
Control valve position indication	PC-AOV-AO32 position indication (light on Panel P2) to be replaced. Powered from HCVS UPS.	None	New install. Powered from HCVS UPS.

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Containment (DW and WW) pressure transmitters	Existing Drywell Pressure from PC-PT-512A, -B; PC-PT-4A1, -4B2; Torus Pressure on PC-PT-30A, -30B; Recorded on Panels 9-3 or 9-4. Powered from HCVS UPS.	None	None
Suppression Pool Level	Existing on PC-DPT-3A1, -3B1. Powered from HCVS UPS.	None	None
Effluent Temperature Monitor	New install. Powered from HCVS UPS.	None	None
Effluent Radiation Monitor	RMA-RE-27 indication on Panel 9-11 to be replaced. Powered from HCVS UPS.	None	None
Effluent Pressure Monitor	PC-PS-20 to be replaced by a pressure transmitter. Powered from HCVS UPS.	None	None
Accumulator pressure monitors	IA-PS-3 is replaced by a pressure transmitter. A new pressure transmitter is added to the AOV-237AV accumulators (in order to know when to use the Mechanical ROS). Powered from HCVS UPS.	None	New install. Accumulator pressure for valves PC-AOV-237AV and PC-AOV-AO32 to be indicated.
Pneumatic motive force controls for AOVs (manual ball valves)	None (located at the Mechanical ROS).	None	New install – not powered from UPS (mechanical system), normally not needed before 24 hours.
Nitrogen bottle availability (analog pressure gauges)	None (located at the Mechanical ROS).	None	New – not powered from UPS (mechanical system), normally not needed before 24 hours.
UPS Power availability status	None (located at the HCVS UPS).	New install	None
Power transfer switch for HCVS UPS	None (Transfer switch located at the HCVS UPS).	New install	None

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Power transfer switch for PC233MV UPS	None (located at the PC233MV UPS which is at, or near, MCC-RA).	New install; at or near MCC-RA in Reactor Building	None
RPV Pressure	Currently available with RFC-PI-90A, B, C.	None	None
Suppression Pool Temperature	Existing PC-TE-1A to -1H and -2A to -2H. Recorded on PC-TR-24 and PC-TR-25 in MCR Vertical Board J. Powered from HCVS UPS.	None	None

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.

A THPV system was originally installed to satisfy the requirements of Generic Letter 89-16. The modifications associated with the THPV system were performed under the provisions of 10CFR50.59, and thus the CNS THPV was designed, analyzed, and implemented consistent with the design basis of the plant. In addition, the THPV section upstream of the rupture disk was designed and installed per USAS B31.1.0 – 1967 Edition, as explained in DC 91-041 (Reference 34). Therefore, this code will be used for piping design and installation. HCVS piping located downstream of the PC-AOV-237AV will be classified for Seismic II/I requirements.

The current design will be evaluated to confirm that the existing system, coupled with the new HCVS line, will meet the requirements of Order EA-13-109 and remain functional following a severe accident.

Additional modifications required to meet the Order will be reliably functional at the temperature, pressure, and radiation levels consistent with the vent pipe conditions for sustained operations. The instrumentation/power supplies/cables/connections (components) will be qualified for temperature, pressure, radiation level, total integrated dose radiation for the Effluent Vent Pipe, and HCVS ROS location.

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

If the instruments are purchased as commercial-grade equipment, they will be qualified to operate under severe accident environment as required by NRC Order EA-13-109 and the guidance of NEI 13-02. The equipment will be qualified seismically (IEEE 344), environmentally (IEEE 323), and EMC (per RG 1.180). These qualifications will be bounding conditions for CNS.

Part 2: Boundary Conditions for Wet Well Vent

For the instruments required after a potential seismic event, the following methods will be used to verify that the design and installation is reliable / rugged and thus capable of ensuring HCVS functionality following a seismic event. Applicable instruments are rated by the manufacturer (or otherwise tested) for seismic impact at levels commensurate with those of postulated severe accident event conditions in the area of instrument component use using one or more of the following methods:

- demonstration of seismic motion will be consistent with that of existing design basis loads at the installed location;
- substantial history of operational reliability in environments with significant vibration with a design envelope inclusive of the effects of seismic motion imparted to the instruments proposed at the location;
- adequacy of seismic design and installation is demonstrated based on the guidance in Sections 7, 8, 9, and 10 of IEEE Standard 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations, (Reference 27) or a substantially similar industrial standard;
- demonstration that proposed devices are substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges); or
- seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location.

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

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

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

First 24 Hour Coping Detail

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

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

The operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and BDBEE hazards identified in Part 1 of this OIP. Immediate operator actions can be completed by operators from the MCR, except the transfer of power from Division I AC power to the PC233MV UPS, which will be performed at or near the MCC-RA in the Reactor Building. If needed, supply of nitrogen to the AOVs' shuttle valves could be completed from the ROS. Actions will include remote-manual initiation, except the action of transferring MOV-233MV power. The operator actions required to open a vent path are as described in Table 2-1.

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

The HCVS will be designed to allow initiation, control, and monitoring of venting from the MCR. Monitoring of the pneumatic supplies for the AOVs, monitoring of the position of the vent control valve, and control of AOVs PC-AOV-237AV and PC-AOV-AO32 will also be available at the Mechanical ROS as part of the response to this Order. Both locations minimize plant operators' exposure to adverse temperature and radiological conditions and are protected from hazards assumed in Part 1 of this OIP.

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

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

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

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

System control:

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

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

Greater Than 24 Hour Coping Detail

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

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

After 24 hours, available personnel will be able to connect supplemental motive air/gas to the HCVS. Connections for supplementing electrical power and motive air/gas required for HCVS will be located in accessible areas with reasonable protection per NEI 12-06 that minimize personnel exposure to adverse conditions for HCVS initiation and operation. Connections will be pre-engineered quick disconnects to minimize manpower resources.

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

Pneumatic supplies, in the form of portable nitrogen bottles, will be available for connection to provide motive gas to the HCVS.

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

Details

Provide a brief description of Procedures / Guidelines:

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

NEI 13-02 §6.1.2

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

Primary Containment Control Flowchart exists to direct operations in protection and control of containment integrity, including use of the existing Hardened Vent System. Other site procedures for venting containment using the HCVS include: EOP 5.8.18, Primary Containment Venting for PCPL, PSP, or Primary Containment Flooding (Reference 39); EOP 5.8.21, PC Venting and Hydrogen Control (Less than Combustible Limits) (Reference 35); EOP 5.8.22, PC Venting and Hydrogen Control (Greater than Combustible Limits) (Reference 36); Emergency Procedure 5.3ALT-STRATEGY, Alternate Core Cooling Mitigating Strategies (Reference 37).

Identify modifications:

List modifications and describe how they support the HCVS Actions.

EA-12-049 Modifications:

- Upgrade power supply and indicators for torus level.
- New connections to the FLEX DG may be required.

EA-13-109 Modifications:

- A modification will be required to remove the existing 10" THPV line from the 24" thin-walled pipe to the SGT system connection. This modification will include removal of PC-AOV-AO32, vacuum breaker PC-30CV, the pressure switch PC-PS-20, and the radiation monitor RMA-RE-27.
- A modification will be required to cap the existing THPV connection at the SGT system. This cap will provide isolation of the SGT.
- A modification will be required to remove the existing PC-AOV-235AV, PC-AOV-239AV, and support components, and install new valves and components capable of being qualified to 10CFR50 Appendix J.
- A modification will be required to install the new 12" HCVS line from the upgraded 10 gauge thin-walled pipe to the top of the Reactor Building. The modification will include tasks such as anchoring the new line, and drilling new penetrations.
- A modification will be required to add pneumatic supply piping to provide nitrogen to the new shuttle valves from the Mechanical ROS, for PC-AOV-237AV and the new PC-AOV-AO32.
- A modification will be required to install a larger accumulator for the venting valve (PC-AOV-AO32) to accommodate 8 venting cycles.
- A modification will be required to install nitrogen bottles to provide pneumatic supply after 24 hours.
- A modification will be required to install a dedicated battery, charger, and UPS system (i.e., the HCVS UPS) to maintain power for the HCVS for 24 hours following the ELAP event.
- A modification will be required to provide power at the MCC-RA for PC-MOV-233MV, by installing the PC233MV UPS.
- A modification will be required to route cables from UPS to the equipment and instrumentation it supplies.
- A modification will be required to install and build a missile-shielded ROS.
- A modification may be required to ensure accessibility and habitability of the ROS during a BDBEE without core damage.
- A modification will be required to install an HCVS Rad Monitor and power supply.
- A modification will be required for installation of required HCVS instrumentation and controls in the MCR, such as indication of pneumatic supply availability, effluent temperature, and accumulator pressure.
- Modifications may be needed to add connection points and valves to the HCVS to facilitate Appendix J type testing of the boundary valves.
- Additional modifications may be required to system isolation valves, and existing HCVS piping.

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

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:

Table 2-5

Key Parameter	Component Identifier	Indication Location
HCVS Effluent temperature	PC-TT-520	MCR
HCVS Pneumatic supply pressure	IA-PS-3 to be replaced with pressure transmitter. New pressure transmitter to be added to PC-AOV-237AV accumulators.	MCR (Annunciator P-2/C-2 point 4992) / ROS (add to ROS)
HCVS valve position indication	Limit switch	MCR / ROS (add to ROS)
HCVS system pressure indication	Pressure switch PC-PS-20 to be replaced.	MCR (Annunciator P-2/B-2 point 4991) / ROS (add to ROS)
HCVS electrical power supply availability (voltmeter)	TBD	HCVS UPS
HCVS process radiation monitor	RMP-RE-520	MCR (Panel 9-11 and Annunciator P-2/A-2 on Panel P2) / ROS (add to ROS)

Initiation and operation of the HCVS system will rely on several existing MCR key parameters and indicators which are qualified or evaluated to the existing plant design (Reference 11, NEI 13-02 Section 4.2.2.1.9):

Table 2-6

Key Parameter	Component Identifier	Indication Location
Drywell pressure	Transmitter PC-PT-512A (-5 to 70 psig) recorded on PC-LRPR-1A CH6	MCR Panel 9-3
	Transmitter PC-PT-512B (-5 to 70 psig) recorded on PC-LRPR-1B CH6	MCR Panel 9-4
	Transmitter PC-PT-4A1 (0 to 250psig) recorded on PC-LRPR-1A CH3	MCR Panel 9-3
	Transmitter PC-PT-4B2 (0 to 250psig) recorded on PC-LRPR-1B CH3	MCR Panel 9-4

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

Torus pressure	Transmitter PC-PT-30A (-5 to 70 psig) recorded on PC-LRPR-1A CH5	MCR Panel 9-3
	Transmitter PC-PT-30B (-5 to 70 psig) recorded on PC-LRPR-1A CH5	MCR Panel 9-4
Torus water temperature	Elements PC-TE-1A through 1H (0 to 250F) recorded on PC-TR-24, -25	MCR Annunciator window J-1/A-1, J-1/A-2
	Elements PC-TE-2A through 2H (0 to 250F), recorded on PC-TR-24, -25	MCR Annunciator window J-1/A-1, J-1/A-2
Torus level	Transmitter PC-DPT-3A1	MCR Panel 9-3 [PC-LRPR-1A]
	Transmitter PC-DPT-3B2	MCR Panel 9-4 [PC-LRPR-1B]
Reactor pressure	RFC-PI-90A, B and C (0 to 1200 psig)	MCR Panel 9-5
HCVS Process Radiation Monitor	RMA-RE-27 recorded on RMA-RA-27 to be replaced.	MCR Panel 9-11 and Annunciator P-2/A-2 on Panel P2
HCVS system pressure indication	Pressure switch PC-PS-20 to be replaced.	MCR (Annunciator P-2/B-2 point 4991)
HCVS pneumatic supply pressure	IA-PS-3 to be replaced with pressure transmitter. New pressure transmitter to be added to PC-AOV-237AV accumulators.	MCR (Annunciator P-2/C-2 point 4992)
HCVS valve position indication	Limit switch (for PC-MOV-233MV)	Indicating lights in MCR (Vertical Panel 9-3) Vertical Board H
HCVS valve position indication	Limit switch (for PC-AOV-237AV)	Indicating lights in MCR (Vertical Panel H)
HCVS valve position indication	Limit switch (for PC-AOV-AO32) to be replaced.	Indicating lights in MCR (Panel P2)

HCVS indications for HCVS valve position indication, HCVS pneumatic supply pressure, HCVS effluent temperature, and HCVS system pressure will be installed in the MCR to comply with Order EA-13-109.

Notes: None.

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: Severe Accident Venting

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

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

First 24 Hour Coping Detail

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

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

The operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and severe accident events. Severe accident event assumes that specific core cooling actions from the FLEX strategies identified in the response to Order EA-12-049 were not successfully initiated.

Access to the Reactor Building will be restricted as determined by the RPV water level and core damage conditions. Immediate actions will be completed by operators in the MCR, except the transfer of power from Division I AC power to the PC233MV UPS, which will be performed at or near the MCC-RA in the Reactor Building. Since this action will be performed at the very beginning of the event, water will still be covering the core and no additional radiological conditions will be present at the location. If needed, supply of nitrogen to the AOVs' shuttle valves could be completed from the HCVS ROS. Actions will include remote-manual actions, except the action of transferring MOV-233MV power. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this OIP (Table 2-1).

As stated in the section on BDBEE Venting, the HCVS will be designed to allow initiation, control, and monitoring of venting from the MCR and will be capable of operation from an ROS to be installed as part of the response to this Order. Both locations minimize plant operators' exposure to adverse temperature and radiological conditions and are protected from hazards assumed in Part 1 of this OIP. Travel pathways will be reviewed for dose and temperature, and alternate routes may need to be considered to minimize operator exposure to harsh environmental conditions.

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

System control:

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

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW Vent: Severe Accident Venting

Specifics are the same as for BDBEE Venting Part 2 except:

- A connection point will be provided on the AC side of the battery charger in the HCVS UPS to accept input from a FLEX DG to relieve the battery after the initial 24 hours period.
- The location and refueling actions for the FLEX DG and replacement nitrogen bottles will be evaluated for SA environmental conditions resulting from the proposed damaged Reactor Core and resultant HCVS vent pathway.

OPEN ITEM 11: Evaluate the impact of SA environmental conditions for post-24 hour actions supporting the implementation of power and pneumatic supplies.

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

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.

Identify modifications:

List modifications and describe how they support the HCVS Actions.

The same as for BDBEE Venting Part 2, except:

- A modification may be required to ensure accessibility and habitability of the ROS during SA conditions.
- A modification will be required to ensure the flammability limits of gases passing through the system are not reached. This modification will install a check valve on the last segment (from the refueling floor to the exhaust) of the new HCVS line.

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 BDBEE Venting Part 2.

Notes: None.

Part 2: Boundary Conditions for Wet Well Vent

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

Determine venting capability support functions needed.

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

BDBEE Venting

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

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

First 24 hours Pneumatic Power Supply:

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

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

First 24 hours Electric Power Supply:

Containment integrity is initially maintained by permanently installed equipment. All containment venting functions will be performed from the MCR or ROS, except for transferring MOV-233MV power from Division I AC to the PC233MV UPS located in the Reactor Building elevation 958'-3", at or near the MCC-RA. Venting will require support from the HCVS installed UPS batteries, UPS battery charger, and pneumatic supply. This installed equipment will provide a minimum of 24 hour operation. Connection points will be provided.

All DC and AC power to support HCVS venting will be provided by two dedicated UPS systems (i.e., the HCVS UPS and PC233MV UPS) with dedicated UPS batteries to support 24 hours of operation. Existing safety-related station batteries will provide sufficient electrical power for RCIC operation. Before station batteries are depleted, portable FLEX diesel generators, as detailed in the response to Order EA-12-049, will be credited to charge the station batteries and maintain DC bus voltage.

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

Part 2: Boundary Conditions for Wet Well Vent

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

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

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

Post-24 hours Pneumatic Power Supply:

After 24 hours, pneumatic supply would be provided by portable nitrogen bottles. Pre-staged and pre-connected nitrogen bottles will be available for use in the Mechanical ROS.

Post-24 hours Electric Power Supply:

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

New shuttle valves associated with AOVs:

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

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.

Similar to the BDBEE scenario, the UPS will provide power for the first 24 hours. After 24 hours however, the power to the UPS battery chargers will either be switched to the FLEX generators evaluated for SA capability or a dedicated FLEX DG.

Refer to "Part 2 - Hydrogen" to find a description of the approaches used to prevent the accumulation of flammable gases to support venting operations.

Part 2: Boundary Conditions for Wet Well Vent

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

Details

Provide a brief description of Procedures / Guidelines:

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

Most of the equipment used in the HCVS is permanently installed. The key portable items are the FLEX DGs, and the nitrogen bottles needed to supplement the air supply to the AOVs after 24 hours. The nitrogen bottles will be permanently staged in the plant for use post-event. The DGs once deployed post-event will remain in position for the duration of the event. The staging and deployment of this equipment will be incorporated into new or existing procedures as part of the BDBEE/severe accident response.

Identify modifications:

List modifications and describe how they support the HCVS Actions.

FLEX modifications applicable to HCVS operation: installation of an emergency connection point for a FLEX DG to repower the battery charger of the UPS.

HCVS modification:

- Add piping from the AOVs to the Mechanical ROS and connection points in the Mechanical ROS to connect portable N_2 bottles for motive force to HCVS components after 24 hours. The piping will supply nitrogen from the Mechanical ROS to the new shuttle valves associated with AOVs PC-AOV-237AV and PC-AOV-AO32.

- Install the two UPS systems to deliver power to the HCVS equipment and I&C: the HCVS UPS system will consist of battery cells, an inverter, and a 120VAC distribution panel; the PC233MV UPS will consist of a charger, battery and inverter delivering 480VAC three phase power. Install cables from the UPS to the equipment and I&C it powers.

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

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).

New equipment:
- Pressure gauge on supplemental nitrogen bottles.
- Pressure transmitters on the accumulators of air-operated valves.
- Indication of UPS electrical power supply availability.

Notes: None.

Part 2: Boundary Conditions for Wet Well 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.

Venting actions using portable equipment include the following:

- Replenishment of pneumatic supplies: After the first 24 hours, the current strategy consists in using portable nitrogen bottles, pre-connected at the Mechanical ROS, in order to provide pneumatic motive force to PC-AOV-237AV and PC-AOV-AO32. Additional portable nitrogen bottles could be brought to the ROS as needed. The on-site location of these nitrogen bottles is an Open Item (Open Item 4). Off-site supplies would relieve the on-site supplies after about 72 hours in the event. The effect of the vent operation on deployment operations is an Open Item (Open Items 2 and 11).

- Repowering the UPS system: After the first 24 hours, the HCVS Distribution Panel will be provided directly by a FLEX DG (bypassing the UPS battery charger) or by recharging the UPS batteries with a FLEX DG. The transfer switch will be aligned to supply normal AC power to the battery charger during normal operation. During the Beyond Design Basis event, cables will be connected to the receptacles installed on the transfer switch enclosure and connected to the cables from a FLEX DG. The connection would occur inside the Control Building far from the HCVS piping (on the opposite side of the plant site). Therefore, the connections of power sources should not be affected by the operation of the HCVS. The deployment of these power sources should take into account the operation of the HCVS and should preclude operators from coming in the vicinity of the Reactor Building or the HCVS piping.

Details

Provide a brief description of Procedures / Guidelines:

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

Operation of the portable equipment is the same as for compliance with Order EA-12-049, thus they are acceptable without further evaluation.

The HCVS effluent will exit from the roof of the Reactor Building. The HCVS UPS and equipment connections will be in and around the Control Building north of the Reactor Building. The Mechanical ROS is on the south side of the Reactor Building at ground level. Therefore, the procedures/guidelines for HCVS actions are the same as for the support equipment section.

[cf. OPEN ITEM 11: Evaluate the impact of SA environmental conditions for post-24 hour actions supporting the implementation of power and pneumatic supplies.]

Implementation procedures are being developed to address all HCVS operating strategies, including deployment of portable equipment. Direction to enter the procedure for HCVS operation will be given in the EOPs, the ELAP procedure, and the SAMGs (refer to Part 4 for general information on procedures).

Part 2: Boundary Conditions for Wet Well Vent

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 EA-12-049 (FLEX)

Notes: Additional nitrogen bottles can be brought in after 72 hours for the valve motive force.

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)

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 the HCVS control station in the MCR. A list of the remote manual actions performed by plant personnel to open the HCVS vent path can be found in Table 2-1. In addition, HCVS operation may occur at the ROS.

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 Vertical Board H.	Applicable to SAWA/SAWM strategy.
2. Connect SAWA pump (FLEX Pump (Godwin)) to water source.	Southeast of the Turbine Building adjacent to the "A" CST. or Northeast of the Turbine Building adjacent to the Missouri River.	The SAWA pump (FLEX Pump (Godwin)) to be located either South or North of the Turbine Building.
3. Route 5-inch flexible hose(s) (up to three (3)) from the valved connections on the 882'-6" Elevation of the Control Building to the RHR/SW FLEX connections.	882'-6" Elevation of the Control Building.	The Emergency Core Flooding Crosstie which provides water injection into the RPV via the "A" LPCI injection line which runs from the outlet side of the "A" RHR Heat Exchanger to the recirculation system piping and then into the reactor vessel.
4. Route 5-inch flexible hose(s) (up to three (3)) from the SAWA pump (FLEX Pump (Godwin)) to the connections in the Control Building Elevation 903' corridor.	From SAWA pump (FLEX Pump (Godwin)) located Southeast of the Turbine Building adjacent to the "A" CST to the connections within the Control Building Elevation 903' corridor.	
5. Prior to battery expenditure, open 24" RHR-MO-25A from the MCR and/or connect the portable FLEX diesel generators to the load side of the 'C' Battery Charger manual transfer switches EE-SW-LXTX(250) and EE-SW-LXTX(125).	RHR valves may be operated from the MCR. The flexible hose connection point manual valves will be operated at the 882'-6" Elevation of the Control Building.	
6. Inject to RPV using the diesel driven SAWA pump (FLEX Pump (Godwin)).	N/A	Initial SAWA injection rate is greater than 400 gpm. 400 gpm is the equivalent to the RCIC pump flow and greater than 400 gpm can be provided by the SAWA pump (FLEX Pump (Godwin)).

Part 3.1: Boundary Conditions for SAWA

7. Monitor SAWA indications.	N/A	Injection flow indication from the FLEX Pump (Godwin) will be obtained with a flow meter package supplied from the pump manufacturer (Godwin). 24" RHR-MO-25A valve position will be verified from the MCR.
8. Use SAWM to maintain availability of the WW vent (Part 3.1.A).	FLEX Pump (Godwin) pump performance and flow rate local to the pump.	Monitor DW Pressure and Suppression Pool Level in MCR. Control SAWA at pump skid.

Discussion of timeline SAWA identified items

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

- Less than 8 Hours – Establish electrical power to the load side of the 'C' Battery Charger manual transfer switches EE-SW-LXTX (250) and EE-SW-LXTX (125) or to Critical Switchgear 1F & 1G located in the 932' Reactor Building needed to support the strategies for EA-13-109, Phase 1 and Phase 2. Action being taken within the Reactor Building after RPV level lowers to 2/3 core height must be evaluated for radiological conditions assuming permanent containment shielding remains intact. (HCVS-FAQ-12) All other actions required are assumed to be in-line with the FLEX timeline submitted in accordance with the EA-12-049 requirements. The connections necessary to support the SAWA/SAWM are located within the Control Building.

- 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.

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. Check valve 24" RHR-26CV is included in the Low Pressure Coolant Injection flowpath to prevent backflow from the RPV to the connection point at the 882'-6" Elevation of the Control Building.

Part 3.1: Boundary Conditions for SAWA

Description of SAWA actions for first 24 hours:

T < 1 hr:

- No evaluation required for actions inside the Reactor Building for SAWA.

T = 1 – 7 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:
  - No actions are required in the Reactor Building.
- Establish backup electrical power for SAWA systems and indications using EA-12-049, or other systems.
  - Prior to battery expenditure, open 24" RHR-MO-25A from the MCR and/or connect the portable FLEX diesel generators to the load side of the 'C' Battery Charger manual transfer switches EE-SW-LXTX(250) and EE-SW-LXTX(125).
- Establish flow to RPV using SAWA systems. Begin injection at a maximum rate, greater than 400 gpm.
  - Connect SAWA pump (FLEX Pump (Godwin)) to water source.
  - Route 5-inch flexible hose(s) (up to three (3)) from the valved connections on the 882'-6" Elevation of the Control Building to the RHR/SW FLEX connections.
  - Route 5-inch flexible hose(s) (up to three (3)) from the SAWA pump (FLEX Pump (Godwin)) to the connections in the Control Building Elevation 903' corridor.
  - Connect flow meter(s) on the discharges of the SAWA pump (FLEX Pump (Godwin)).
  - Inject to RPV using the diesel driven SAWA pump (FLEX Pump (Godwin)).

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)
  - Reduce the SAWA injection flow rate from greater than 400 gpm to approximately 80 gpm.
  - Monitor Suppression Pool level (Ch 2 PC-LRPR-1B – Level Recorder Pressure Recorder 1B) Torus Level (input: PC-DPT-3B2).
  - Monitor Suppression Pool pressure (Ch 5 PC-LRPR-1B – Level Recorder Pressure Recorder 1B) Torus Pressure (input: PC-PT-30B).
  - Monitor SAWA pump (FLEX Pump (Godwin)) operation and flow rate locally at the pump instrumentation.
  - Based on the information obtained above, adjust the output of the FLEX Pump (Godwin) such that the Suppression Pool level remains constant or slowly raises.
  - Continue to monitor the above parameters and adjust the discharge flow rate of the FLEX Pump (Godwin) to maintain Suppression Pool level throughout the remainder of the event or until a means of reliable Alternate Decay Heat Removal and pressure control is established.

Part 3.1: Boundary Conditions for SAWA

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 Part 3.1.A).

Details

Details of Design Characteristics/Performance Specifications

SAWA shall be capable of providing a RPV injection rate of greater than 400 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. Equipment has been evaluated to remain operational throughout 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 flow path will be from the FLEX pump suction at the drain connection of the "A" CST through the FLEX pump with multiple outlets with individual flow indicators. To provide the required flow control with the selected pump (Godwin), a recirculation path will be provided to ensure the pump flow is within the normal operating range of the pump. As required, flow indicator(s) will be dedicated to the unit in a Severe Accident, and the flow that is provided to the RHR service water FLEX header will be monitored. The monitored water flow rate will pass through the RHRSW piping to the RHR System Injection Flow Path Crosstie (Upstream of SW-V-120) inside the Control Building where it will connect with the RHR system in the Reactor Building by manually opening SW-V-120 and the 10" butterfly valve that interconnect the systems. The flow will then be directed into the RPV via the LPCI injection valve (24" RHR-MO-25A) from the MCR. DW pressure and Suppression Pool level will be monitored and flow rate will be manually adjusted by use of the FLEX pump control valve local to the pump. Communication will be established between the MCR and the FLEX pump location.

RHR-MOV-MO25A is the only MOV that has to be opened to support SAWA. This is a DC powered MOV and is already supplied power via the station batteries. The FLEX DG is located near the Control Building which is significant distance from the discharge of the HCVS at the top of the Reactor Building. Refueling of the FLEX DG will be accomplished from the various diesel fueled items or from the DG fuel oil tanks as described in the EA-12-049 compliance documents. The "A" CST or the Missouri River are both a significant distance from the discharge of the HCVS at the top of the Reactor Building.

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 24, HCVS-WP-02)

Part 3.1: Boundary Conditions for SAWA

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

Parameter	Instrument	Location	Power Source / Notes
*DW Pressure	PC-PT-4B2 and PC-PT-5B2 (PC-LRPR-1A Ch 3 and PC-LRPR-1A Ch 4)	MCR	Station batteries via EA-12-049 generator
*Suppression Pool Level	PC-DPT-3B2 (PC-LRPR-1A Ch 2)	MCR	Station batteries via EA-12-049 generator
*SAWA Flow	FLEX Pump Flow indicator	FLEX Pump Skid	FLEX pump (skid powered device)
SAWA pump instrumentation	On-Board Generator	FLEX Pump Skid	EA-12-049 generator
Valve controls and indication	MCR Panels	MCR and Control Building	Station batteries via EA-12-049 generator

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

Equipment Protection:

Any SAWA component and connections external to protected buildings have been protected against the screened-in hazards of EA-12-049 for the station.

There are no external SAWA connections or components.

Portable equipment used for SAWA implementation will meet the protection requirements for storage in accordance with the criteria in NEI 12-06 Revision 0.

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

Provide a brief description of Procedures / Guidelines:
Confirm that procedure/guidance exists or will be developed to support implementation.

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

- Hook up FLEX pump to water source at either the "A" CST drain connection or to the Missouri River and to the connections in the Control Building corridor at Elevation 903' per FLEX Support Guidelines. Connect the valved outlets in the 882'-6" Elevation of the Control Building to the RHR System Injection Flow Path Crosstie (Upstream of SW-V-120).
- Hook-up and start FLEX DG to repower 125VDC "1C" Battery Charger and 250VDC "1C" Battery Charger.
- Manually open SW-V-120 and the 10" interconnect butterfly valve to cross tie RHR with RHRSW.

Part 3.1: Boundary Conditions for SAWA
• Open 24" RHR-MO-25A using MCR Switches for RHR LPCI injection pathway. • Start FLEX pump. • Adjust flow rate using local flow indicator and manual control valve.
Identify modifications: *List modifications and describe how they support the SAWA Actions.* **Ref: EA-13-109 Attachment 2, Section B.2.2, / NEI 13-02 Section 4.2.4.4, 7.2.1.8, Appendix I**
None.
Component Qualifications: *State the qualification used for equipment supporting SAWA.* **Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section I.1.6**
Permanently installed plant equipment shall meet the same qualifications as described in Part 2 of this OIP. Temporary/portable equipment shall be qualified and stored to the same requirements as FLEX equipment as specified in NEI 12-06 Rev 0. SAWA components are not required to meet NEI 13-02, Table 2-1 design conditions.
Notes: None.

Part 3.1.A: Boundary Conditions for SAWA/SAWM

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

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

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

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

Ref: NEI 13-02 Appendix C.7

SAWM can be maintained for >7 days without the need for a drywell vent to maintain pressure below PCPL.

Basis for SAWM time frame

Option 1 - SAWM can be maintained greater than or equal to 7 days:

CNS is bounded by the evaluations performed in BWROG TP-2015-008 and representative of the reference plant in NEI 13-02 figures C-2 through C-6. CNS has a Rated Thermal Power of 2419 MWt. The Reference Plant (Peach Bottom) had a Rated Thermal Power of 3514 MWt at the time of the evaluations. Therefore, the ratio of plant powers is 1.45 (3514/2419). The ratio of the core power to the containment free volume is a standard indication of the capacity of the plant to cope with an accident involving loss of containment heat removal. Peach Bottom has a ratio of approximately 12.5 (3514 MWt/281,500 ft^3), while the ratio for CNS is approximately 10 (2419 MWt/239,100 ft^3). Both Peach Bottom and CNS have approximately the same pressure suppression chamber free volume at 112,000 ft^3. Based on these ratios and parameters, the heat capacity at CNS is bounded by that at the Reference Plant (Peach Bottom).

Instrumentation relied upon for SAWM operations is DW pressure, Suppression Pool level and SAWA flow. DW pressure, Suppression Pool level are initially powered by the HCVS UPS (first 24 hours) and then by the FLEX (EA-12-049) generator. SAWA flow indication is powered by the integral generator supplied with the FLEX Pump (Godwin). The DG will provide power throughout the Sustained Operation period (7 days).

Part 3.1.A: Boundary Conditions for SAWA/SAWM

DW Temperature monitoring is not a requirement for compliance with Phase 2 of the Order, but some knowledge of temperature characteristics provides information for the operation staff to evaluate plant conditions under a severe accident and provide confirmation to adjust SAWA flow rates. (C.7.1.4.2, C.8.3.1)

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)

Procedures will be developed that control the Suppression Pool level, while ensuring the DW pressure indicates the core is being cooled, whether in-vessel or ex-vessel. Procedures will dictate conditions during which SAWM flowrate should be adjusted (up or down) using suppression pool level and DW pressure as controlling parameters to remove the decay heat from the containment. (This is similar to the guidance currently provided in the BWROG SAMGs) (C.7.1.4.3)

Attachment 2.1.A shows the timeline of events for SAWA / SAWM. (C.7.1.4.4)

Table 3.1.B – SAWM Manual Actions

Primary Action	Primary Location / Component	Notes
1. Lower SAWA injection rate to control Suppression Pool level and decay heat removal.	Southeast of the Turbine Building adjacent to the "A" CST. or Northeast of the Turbine Building adjacent to the Missouri River.	Control to maintain containment and WW parameters to ensure WW vent remains functional. 80.4 gpm minimum capability is maintained for greater than 7 days.
2. Control to SAWM flowrate for containment control / decay heat removal.	Southeast of the Turbine Building adjacent to the "A" CST and MCR. or Northeast of the Turbine Building adjacent to the Missouri River and MCR.	SAWM flow rates will be monitored using the following instrumentation: o FLEX pump flow o Suppression Pool level o DW pressure SAWM flow rates will be controlled using the manual flow control valve at the FLEX pump.
3. Establish alternate source of decay heat removal.	Yard	>7 days
4. Secure SAWA / SAWM.	Southeast of the Turbine Building adjacent to the "A" CST. or Northeast of the Turbine Building adjacent to the Missouri River.	When reliable alternate containment decay heat removal is established.

Part 3.1.A: Boundary Conditions for SAWA/SAWM

SAWM Time Sensitive Actions

Time Sensitive SAWM Actions:

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

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.D for SAWM SAMG language additions.

First 24 Hour Coping Detail

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

Given the initial conditions for EA-13-109:

- *BDBEE occurs with ELAP*
- *Failure of all injection systems, including steam-powered injection systems*

Ref: EA-13-109 Section 1.2.6, Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 2.5, 4.2.2, Appendix C, Section C.7

SAWA will be established as described 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 low 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.

Part 3.1.A: Boundary Conditions for SAWA/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 is provided at the pump skid by pump vendor provided flow instrument qualified to operate under the expected environmental conditions. The SAWA flow instrument is powered by the SAWA pump skid diesel engine alternator. Communications will be established between the SAWM control location and the MCR.

Injection flowrate will be controlled by a FLEX manual valve located on the FLEX pump.

Suppression Pool level and DW pressure are read in the control room using indicators powered by the FLEX DG 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.

Parameters used for SAWM are:

- DW Pressure
- Suppression Pool Level
- SAWM Flowrate

The DW 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: None.

Part 3.1.B: Boundary Conditions for SAWA/SADV
Applicability of WW Design Considerations
CNS will not be using SAWA/SADV.
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 will contain the following details:

- appropriate conditions and criteria for use of the HCVS,
- when and how to place the HCVS in operation,
- the location of system components,
- instrumentation available,
- normal and backup power supplies,
- directions for sustained operation, including the storage location of portable equipment,
- training on operating the portable equipment, and
- testing of portable equipment

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

CNS 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.

Part 4: Programmatic Controls, Training, Drills and Maintenance

- If the out of service times exceed 30 or 90 days as described above, the following actions will be performed through the corrective action program:
  - The cause(s) of the non-functionality,
  - 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.

OPEN ITEM 12: Determine the control document for HCVS out of service time criteria.

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 process.

In addition, (per Reference 10 (NEI 12-06)) all personnel on-site will be available to supplement trained personnel.

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*

Part 4: Programmatic Controls, Training, Drills and Maintenance

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 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

The site 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.

CNS 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 Modes 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.

Part 4: Programmatic Controls, Training, Drills and Maintenance

Test and calibrate the HCVS radiation monitors.	Once per operating cycle.
Leak test the HCVS.	1. Prior to first declaring the system functional; 2. Once every three operating cycles thereafter; and 3. After restoration of any breach of system boundary within the buildings.
Validate the HCVS operating procedures by conducting an open/close test of the HCVS control function from its control location and ensuring that all HCVS vent path and interfacing system boundary valves[5] move to their proper (intended) positions.	Once per every other operating cycle.

1 Not required for HCVS and SAWA check valves.
2 After two consecutive successful performances, the test frequency may be reduced to a maximum of once per every other operating cycle.
3 Not required if integrity of check function (open and closed) is demonstrated by other plant testing requirements.
4 After two consecutive successful performances, the test frequency may be reduced by one operating cycle to a maximum of once per every fourth operating cycle.
5 Interfacing system boundary valves that are normally closed and fail closed under ELAP conditions (loss of power and/or air) do not require control function testing under this part. Performing existing plant design basis function testing or system operation that reposition the valve(s) to the HCVS required position will meet this requirement without the need for additional testing.

Notes: None.

Part 5: Milestone Schedule

Provide a milestone schedule

This schedule should include:

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

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

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

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

Phase 1 Milestone Schedule:

Phase 1 Milestone Schedule

Milestone	Target Completion Date	Activity Status	Comments *{Include date changes in this column}*
Hold preliminary/conceptual design meeting	June 2014	Complete	
Submit Overall Integrated Implementation Plan	June 2014	Complete	
Submit 6 Month Status Report	December 2014	Complete	
Submit 6 Month Status Report	June 2015	Complete	
Design Engineering On-site/Complete	September 2015	Complete	
Submit 6 Month Status Report	December 2015	Complete	Simultaneous with Phase 2 OIP
Submit 6 Month Status Report	June 2016	Not Started	
Operations Procedure Changes Developed	August 2016	Not Started	
Site Specific Maintenance Procedure Developed	August 2016	Not Started	
Training Complete	September 2016	Not Started	

Part 5: Milestone Schedule

Implementation Outage	October 2016	Not Started	
Procedure Changes Active	November 2016	Not Started	
Walk Through Demonstration/Functional Test	November 2016	Not Started	

Phase 2 Milestone Schedule:

Phase 2 Milestone Schedule

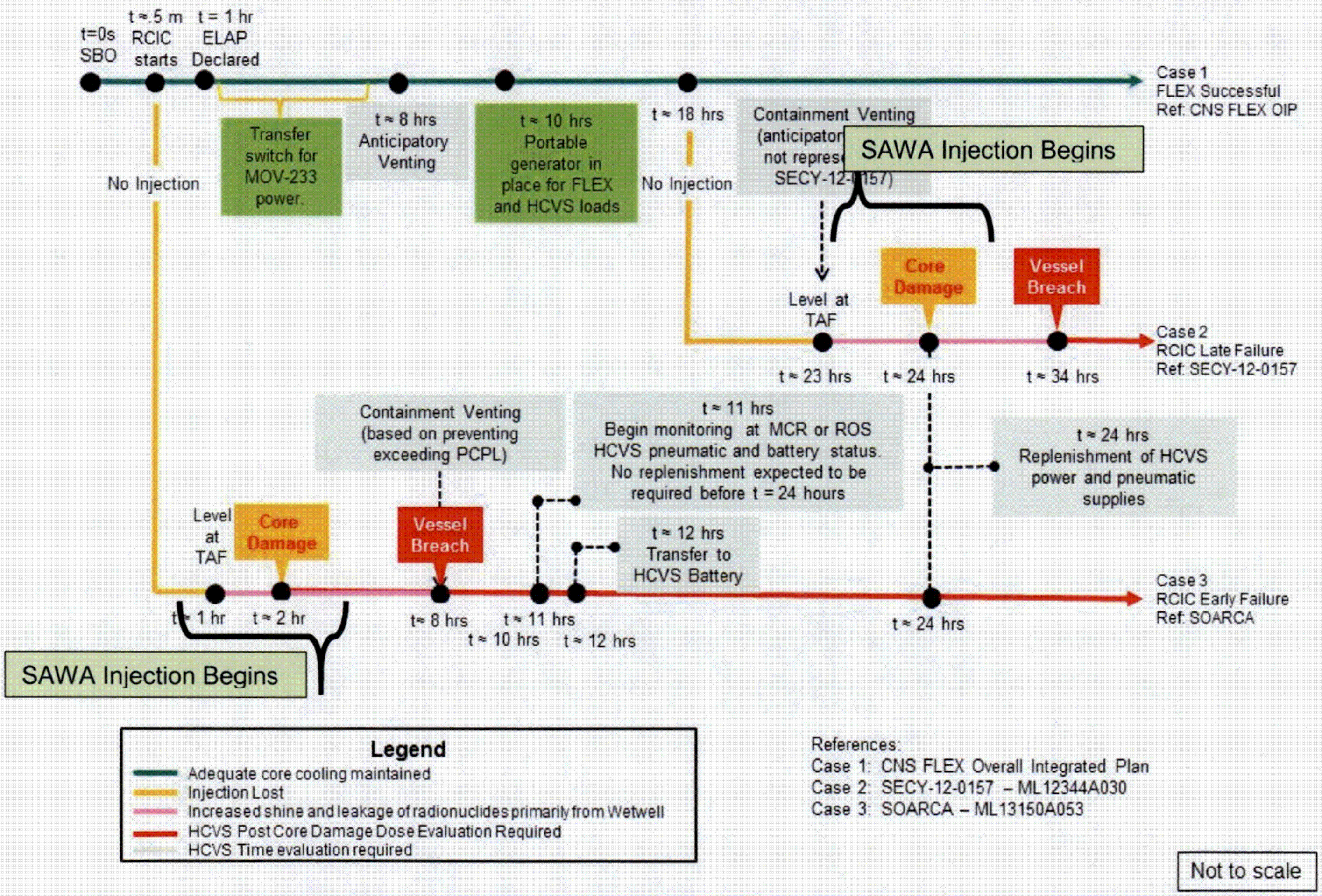
Milestone	Target Completion Date	Activity Status	Comments *{Include date changes in this column}*
Hold preliminary/conceptual design meeting		Complete	
Submit Overall Integrated Implementation Plan	December 2015	Complete	
Submit 6 Month Status Report	June 2016		
Submit 6 Month Status Report	December 2016		
Submit 6 Month Status Report	June 2017		
Design Engineering On-site/Complete	October 2017	Started	
Submit 6 Month Status Report	December 2017		
Operations Procedure Changes Developed	May 2018		
Site Specific Maintenance Procedure Developed	May 2018		
Training Complete	June 2018		
Submit 6 Month Status Report	June 2018		
Submit 6 Month Status Report	June 2018		
Implementation Outage	October 2018		
Walk Through Demonstration/Functional Test	October 2018		
Procedure Changes Active	October 2018		
Submit Completion Report	January 2019 (60 days after full compliance)		

Notes: None.

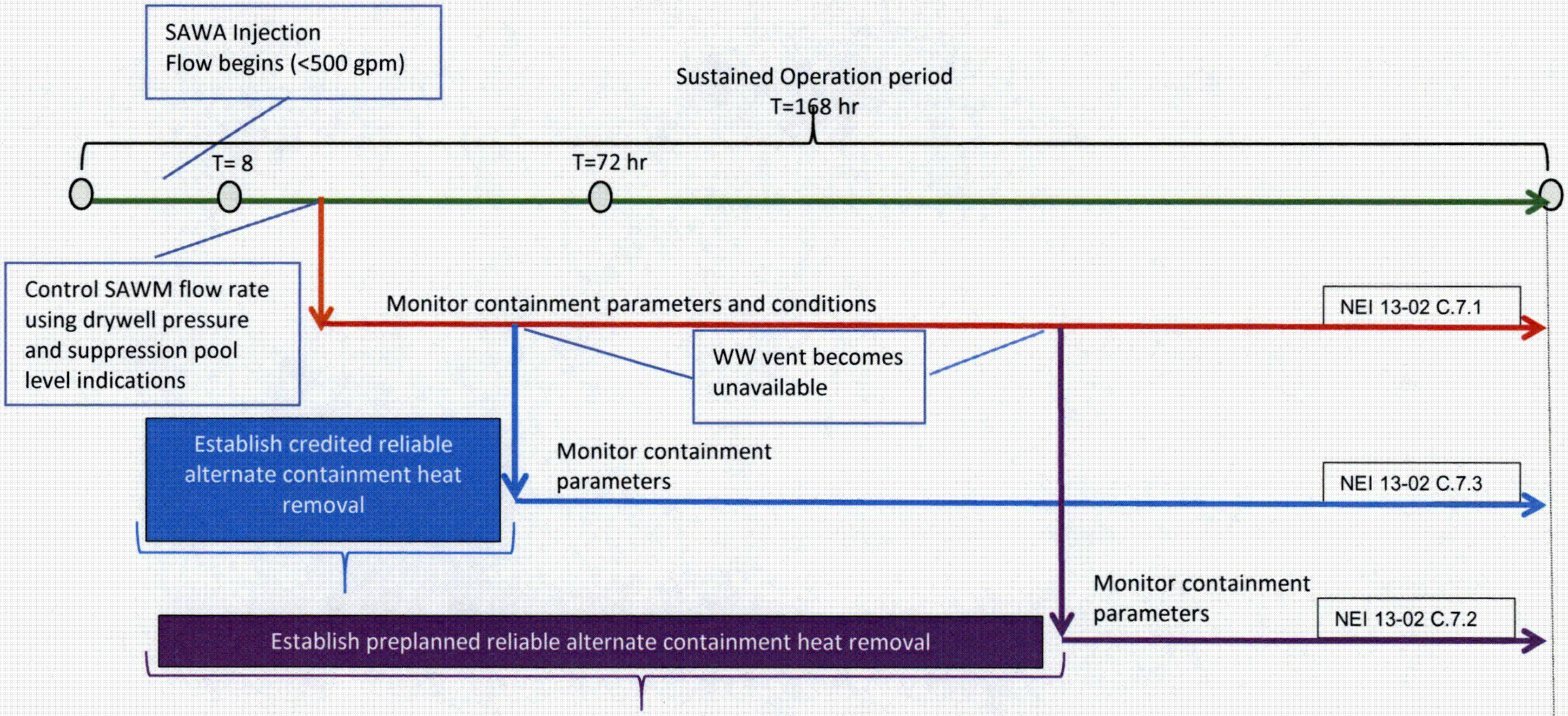
Attachment 1: HCVS/SAWA Portable Equipment

List portable equipment	*BDBEE Venting*	*Severe Accident Venting*	*Performance Criteria*	*Maintenance / PM Requirements*
Nitrogen Cylinders	X	X	X	Check periodically for pressure, replace or replenish as needed
FLEX DG (and associated equipment)	X	X	TBD	Per Response to EA-12-049
SAWA Pump (and associated equipment)	X	X	≥400 gpm for first 4 hours and 80.4 gpm for first 7 days	Per Response to EA-13-109

Attachment 2A: Sequence of Events Timeline – HCVS



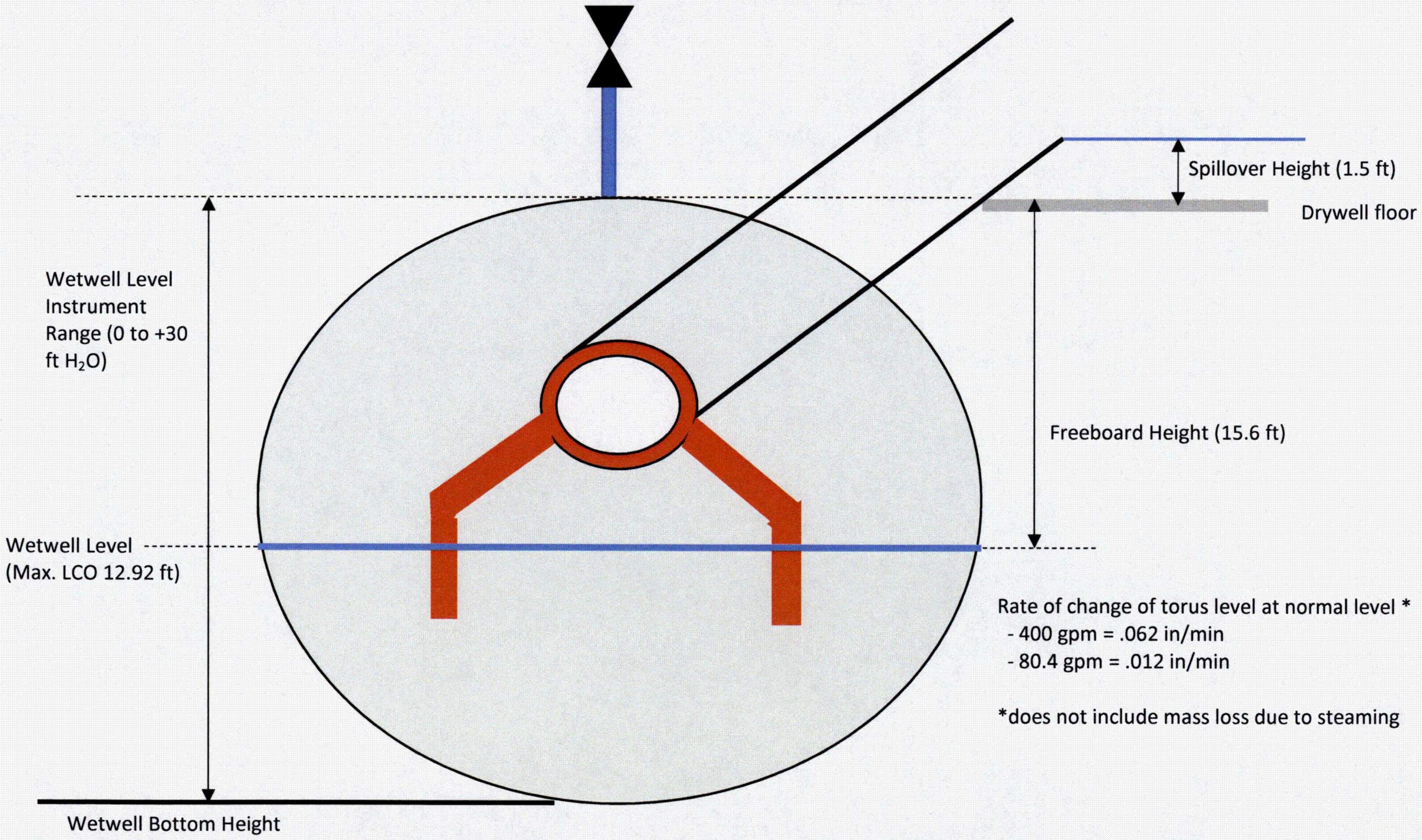
Attachment 2.1.A: Sequence of Events Timeline – SAWA / SAWM



Attachment 2.1.B: Sequence of Events Timeline – SADV

CNS will not install a Severe Accident Drywell Vent

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



Attachment 2.1.D: SAWM SAMG Approved Language

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

Actual Approved Language that will be incorporated into site SAMG*

Cautions:

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

Priorities:

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

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

Methods:

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

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

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

Attachment 3: Conceptual/Final Sketches

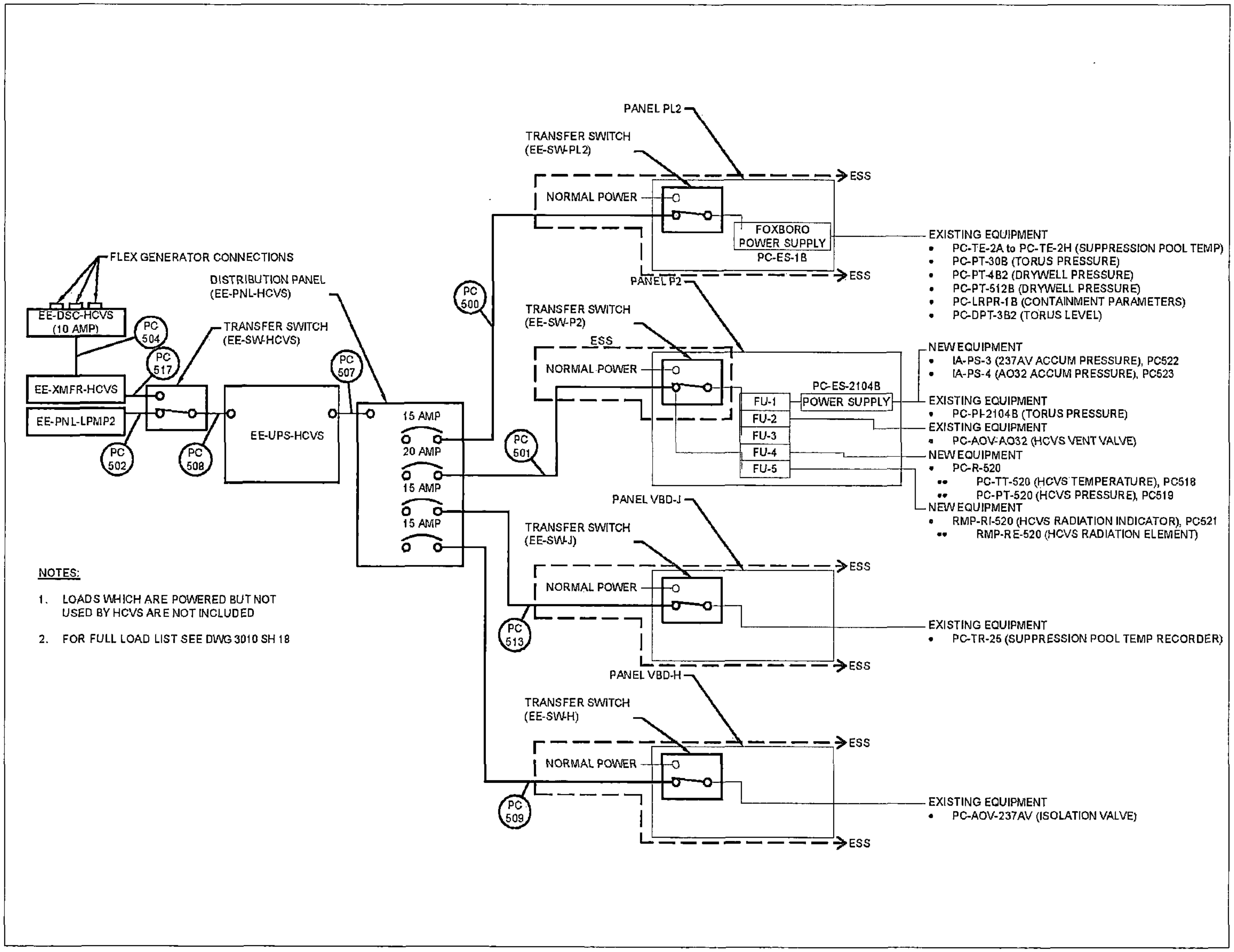
(Conceptual sketches, as necessary to indicate equipment which is installed or equipment hookups necessary for the HCVS Actions)

Sketch 1: Electrical Layout of UPS Systems (final design)

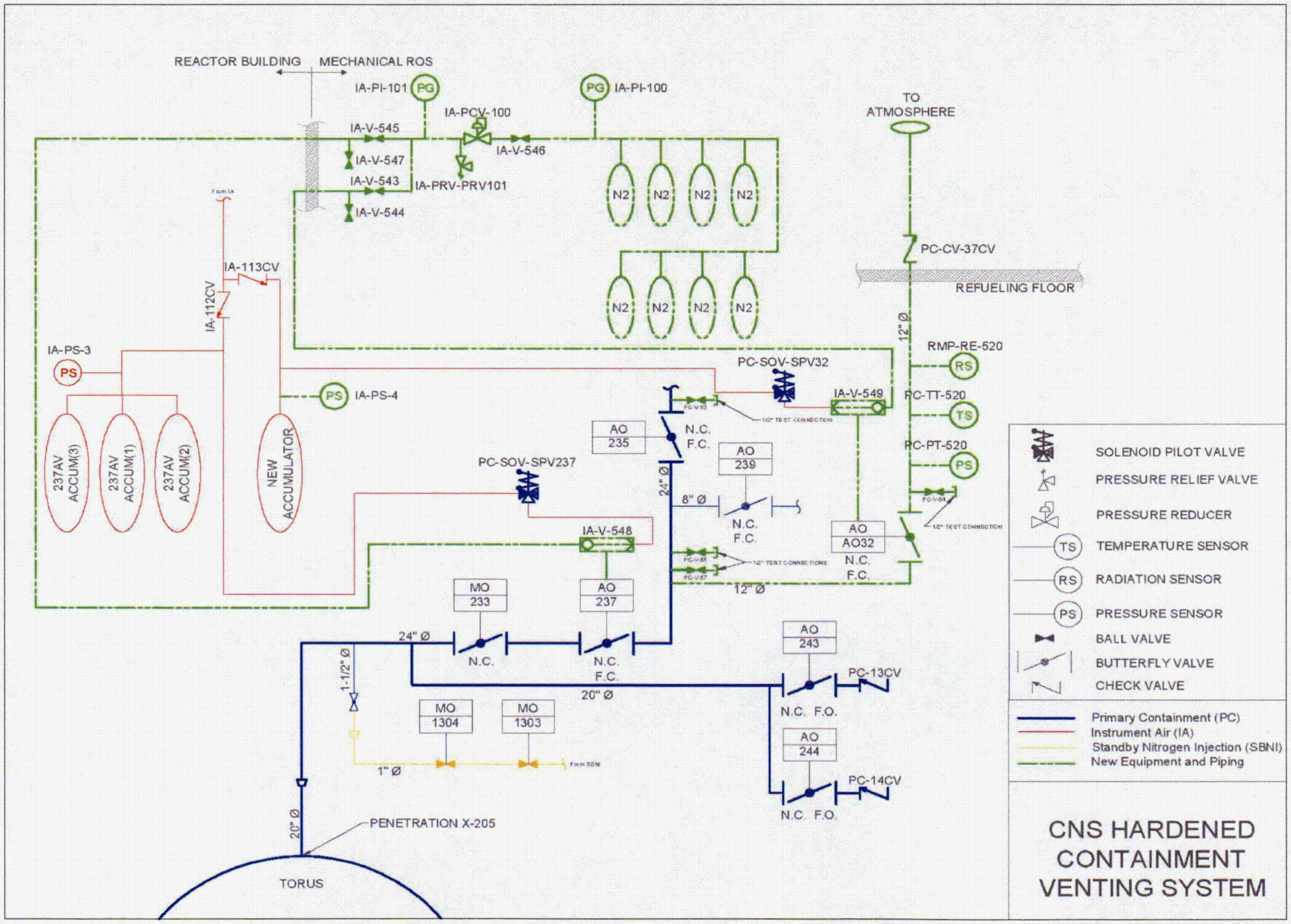
Sketch 2: P&ID Layout of HCVS (final design)

Sketch 3: Control Building UPS Location (final design)

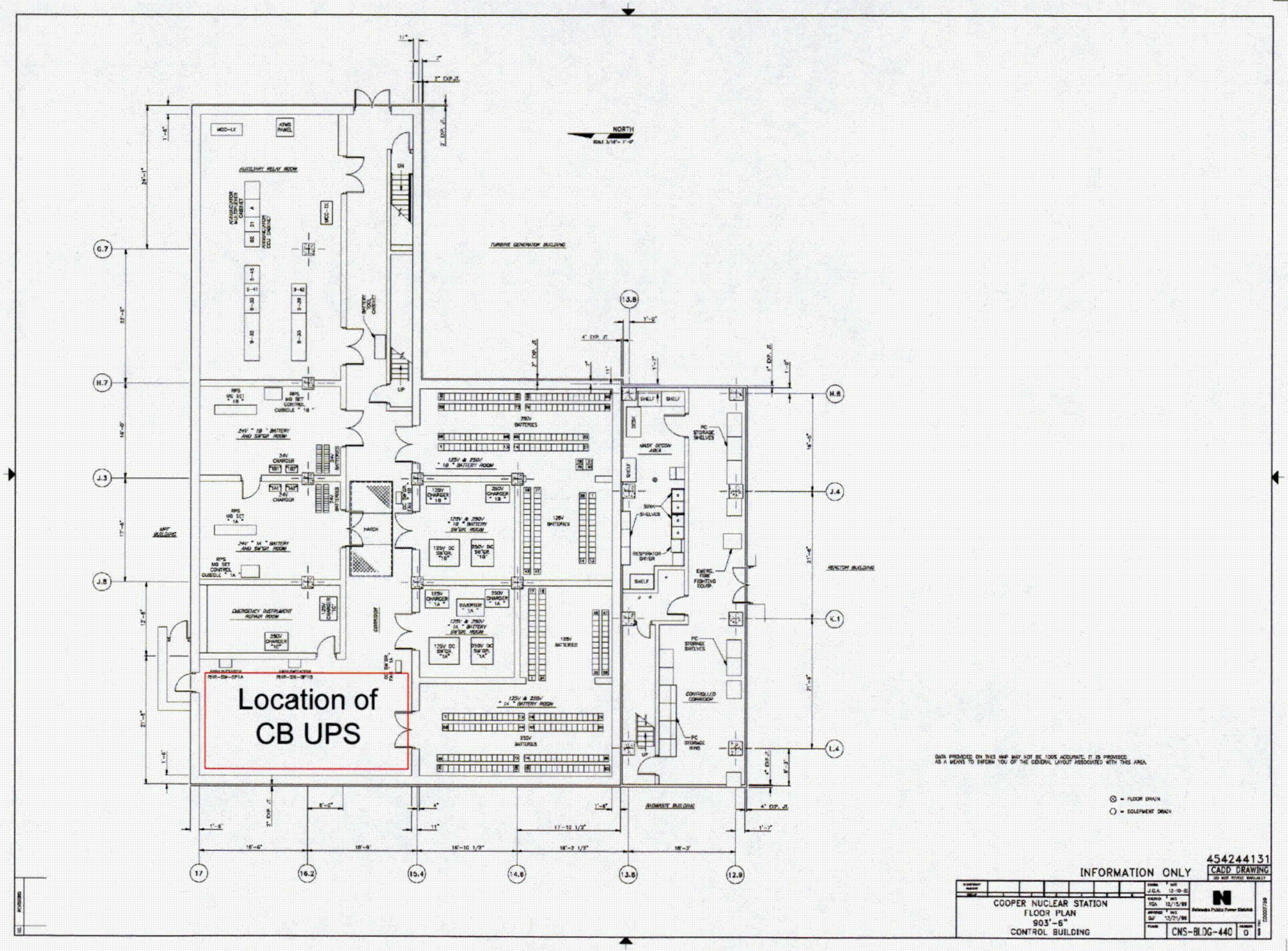
Sketch 4: P&ID Layout of SAWA (conceptual design)



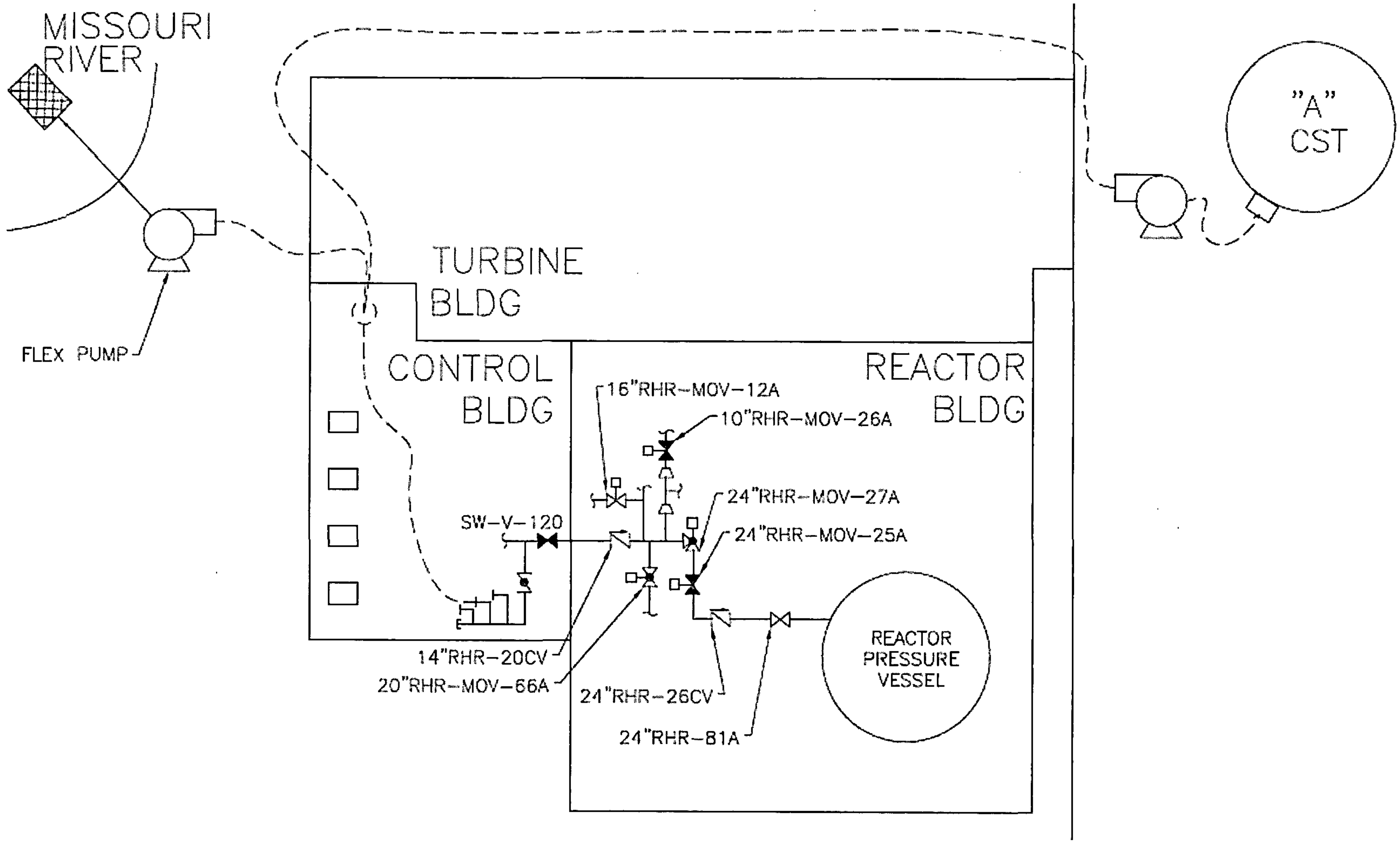
Sketch 1: Electrical Layout of UPS Systems (Final design)



Sketch 2: P&ID Layout of HCVS (Final design)



Sketch 3: Control Building UPS Location (Final design)



Sketch 4: P&ID Layout of SAWA (concetpual)

Attachment 4: **Failure Evaluation Table**

Table 4A: Wet Well HCVS Failure Evaluation Table

Functional Failure Mode	Failure Cause	Alternate Action	Failure with Alternate Action Impact on Containment Venting?
Failure of Vent to Open on Demand	Valves fail to open/close due to loss of normal AC power.	No action needed, as power from dedicated UPS system provides 24 hour supply. Or, station service battery via inverter for minimum 9 hours.	No
Failure of Vent to Open on Demand	Valves fail to open/close due to loss of alternate AC power (long term) or depletion of dedicated power supply.	UPS system can supply power for 24 hours. After that, UPS system can be supplied power directly (bypassing battery charger) from FLEX provided generators.	No
Failure of Vent to 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, power UPS system directly (bypassing battery charger) with FLEX provided generators, and/or recharge UPS system battery.	No
Failure of Vent to Open on Demand	Valves fail to open/close due to loss of normal pneumatic air supply.	No action needed, air can be supplied by accumulator tanks, which is sufficient for at least 8 cycles of AO32 valve over first 24 hours.	No
Failure of Vent to Open on Demand	Valves fail to open/close due to loss of alternate pneumatic air supply (long term).	At ROS, open manual valves of pre-connected nitrogen cylinders to air system supporting HCVS valves, replace bottles as needed with on-site nitrogen bottles.	No
Failure of Vent to Open on Demand	Valves fail to open/close due to SOV failure.	Go to the ROS to supply nitrogen to the new shuttle valves associated with air-operated valves PC-AOV-237AV and PC-AOV-AO32 to open the valves with pneumatic motive force.	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, Sequences for HCVS Design and Method for Determining Radiological Dose from HCVS Piping
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 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

28. Cooper Nuclear Station EA-12-049 (FLEX) Overall Integrated Implementation Plan, Rev 0, February 2013

29. Cooper Nuclear Station EA-12-050 (HCVS) Overall Integrated Implementation Plan, Rev 0, February 2013

30. Cooper Nuclear Station EA-12-051 (SFP LI) Overall Integrated Implementation Plan, Rev 0, February 2013

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

32. NEDC 92-092, Review of Nutech Calculation of THPV Flow Rate and Vent Pipe Size, Nutech Calc. No. XNP033.0201

33. ISG-JLD-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, August 29, 2012

34. CNS DC 91-041, Torus Hard Pipe Vent, August 5, 1993

35. CNS Emergency Operating Procedure 5.8.21, PC Venting and Hydrogen Control (Less than Combustible Limits), Revision 18

36. CNS Emergency Operating Procedure 5.8.22, PC Venting and Hydrogen Control (Greater than Combustible Limits), Revision 15

37. CNS Emergency Procedure 5.3ALT-STRATEGY, Alternate Core Cooling Mitigating Strategies, Revision 36

38. Nebraska Public Power District's Second Six-Month Status Report in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events (Order Number EA-12-049), February 26, 2014

39. CNS Emergency Operating Procedure 5.8.18, Primary Containment Venting for PCPL, PSP, or Primary Containment Flooding, Revision 16

40. Cooper Nuclear Station Updated Safety Analysis Report (USAR)

41. Cooper Nuclear Station Design Change Document Chapter 9 and Chapter 7

42. Cooper Nuclear Station Drawing 3617, sh. 1, Control Room Vertical Board H Arrangement

43. Cooper Nuclear Station Drawing 3621, sh. 2, Control Room Vertical Board P2 Arrangement

44. NEDC 14-026, Revision 0, Review of ERIN Calculation C122140001-11622 - "MAAP Analysis to Support Cooper FLEX Strategy," October 3, 2014; EC 14-027, Revision 0, Acceptance of MAAP Analysis to Support Initial FLEX Strategy, October 4, 2014.

45. Cooper Nuclear Station EA-13-109 (HCVS) Overall Integrated Implementation Plan, Rev 0, June 30, 2014 (NRC ADAMS Document number: ML14189A415)

46. 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

47. Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments, SECY-12-0157, ML12344A030

48. NUREG/CR-7110, V1, R1, State-of-the-Art Reactor Consequence Analyses (SOARCA) Project: Peach Bottom Integrated Analysis, ML13150A053

49. NEI HCVS-FAQ-10, Severe Accident Multiple Unit Response

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

51. NEI HCVS-FAQ-12, Radiological Evaluations on Plant Actions Prior to HCVS Initial Use

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

53. Cooper Nuclear Station Hardened Containment Venting System Phase 1 Overall Integrated Plan, Revision 1

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

Significant changes to this plan will be communicated to the NRC staff in the 6 Month Status Reports.

The following items summarize the main changes to the design following the submission of the OIP on June 30, 2014 (Reference 45):

- Rather than reusing the entire existing THPV line, the existing THPV line will be partly demolished (from the rupture disk to the existing tie into the 24" thin-walled pipe) and a new HCVS line will be installed. Equipment located in the section of the existing THPV line to be demolished will be removed.
- No rupture disk will be present in the new HCVS line.
- The new HCVS line will entirely be routed through the Reactor Building.
- The new HCVS line will have a diameter of 16" (the THPV line had a diameter of 10").
- The new line will not be connected to ventilation systems such as the SGT.
- The HCVS effluent will exit from the roof of the Reactor Building: the ERP will not be used.
- The existing THPV control valve, PC-AOV-AO32, will be replaced by a new control valve.
- The following boundary valves will be replaced: PC-AOV-235AV, PC-AOV-239AV.

This Overall Integrated Plan has been updated in format and content to encompass both Phase 1 and Phase 2 of Order EA-13-109.

The following items summarize the main changes to the design following the submission of the revised OIP on December 19, 2014 (Reference 53):

- Vent pipe size changed to 12".
- Changed method of H2 control to no longer require a purge system.
- Changed method of rain/snow protection for release point.
- Removed need for a vacuum breaker.

Progression on the status of the existing OIP open items can be found in Attachment 7.

Attachment 7: List of Overall Integrated Plan Open Items

OIP Open Item #	Action	Status/Comment
1	Determine location of HCVS ROS.	Open Item closed. The Mechanical ROS will be located along the Reactor Building South exterior wall.
2	Evaluate accessibility of the Mechanical ROS for radiological and environmental conditions. Address dose and temperature items for the Mechanical ROS and non-MCR locations. FAQ-HCVS-01 (Reference 14) will be used as guidance.	Open Item in progress. A preliminary estimation of the dose rate received in the ROS from the vent line was calculated. Evaluation of ROS accessibility for radiological and environmental remains to be determined. Formal dose calculation at the ROS remains to be performed. Temperature conditions at the ROS remains to be assessed.
3	Determine the location of the Dedicated HCVS Battery transfer switch.	Open Item closed. The dedicated HCVS battery transfer switch will be located at the 903' elevation in the Control Building along the west wall.
4	Determine the location of backup nitrogen bottles and evaluate the effects of radiological and temperature constraints on their deployment.	Open Item in progress. Nitrogen bottles will be installed and pre-connected in the Mechanical ROS. On-site location of additional nitrogen bottles remains to be confirmed. FLEX storage buildings are likely to be used for storage of additional nitrogen bottles. Radiological and temperature constraints during the deployment of these additional nitrogen bottles remain to be evaluated.
5	Evaluate the location of the Portable DG for accessibility under Severe Accident HCVS use.	Open Item in progress.
6	Confirm suppression pool heat capacity.	Open Item in progress.
7	Determine which approach or combination of approaches Cooper Nuclear Station (CNS) will take to address the control of flammable gases, clearly demarcating the segments of vent system to which an approach applies.	Open Item closed. Hydrogen control will be addressed using a check valve combined with a purging system.
8	Identify qualification method used for HCVS instruments.	Open Item in progress.

OIP Open Item #	Action	Status/Comment
9	Evaluate HCVS monitoring location for accessibility, habitability, staffing sufficiency, and communication capability with vent-use decision makers.	Open Item in progress (see Open Item 2).
10	Determine the number of required valve cycles during the first 24 hours. Size the electrical and pneumatic supplies accordingly.	Open Item in progress. The size of the new air-operated venting valve remains to be determined. Size of the electrical supplies will be finalized during the detailed design. The size of the accumulator of the air-operated PCIV is sufficient to supply 24 hours of pneumatic motive force.
11	Evaluate the impact of SA environmental conditions for post-24 hour actions supporting the implementation of power and pneumatic supplies.	Open Item in progress.
12	Determine the control document for HCVS out of service time criteria.	Open Item in progress.

ISE Open Item #	Action / ISE Section Reference	Status
1	Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit. Sections 3.2.2.1, 3.2.2.2	In progress
2	Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack. Section 3.2.2.3	In progress
3	Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods. Section 3.2.2.10	In progress

ISE Open Item #	Action / ISE Section Reference	Status
4	Make available for NRC staff audit a determination of the number of required valve cycles during the first 24 hours. Section 3.2.3.1	In progress
5	Make available for NRC audit the control document for HCVS out of service time criteria. Section 3.4.1	In progress
6	Make available for NRC staff to audit, an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during severe accident wetwell venting. Section 3.2.2.9	In progress
7	Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions. Section 3.2.2.5	In progress
8	Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment. Sections 3.2.1, 3.2.2.3, 3.2.2.4, 3.2.2.5, 3.2.2.10, 3.2.4.1, 3.2.4.2, 3.2.5.2, 3.2.6	In progress
9	Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger and incorporate into FLEX DG loading calculation. Sections 3.2.2.4, 3.2.3.1, 3.2.3.2, 3.2.4.1, 3.2.4.2, 3.2.5.1, 3.2.5.2, 3.2.6	In progress
10	Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location. Sections 3.2.1, 3.2.2.4, 3.2.3.1, 3.2.3.2, 3.2.4.1, 3.2.4.2, 3.2.5.1, 3.2.5.2, 3.2.6	In progress
11	Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves,	In progress

ISE Open Item #	Action / ISE Section Reference	Status
	instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions. Sections 3.2.2.3, 3.2.2.5, 3.2.2.9, 3.2.2.10	

Attachment 8: List of Acronyms

AC	Alternating Current
AOV	Air-Operated Valve
ASME	American Society of Mechanical Engineers
AST	Alternate Source Term
BDBEE	Beyond-Design-Basis External Event
BWR	Boiling Water Reactor
CAP	Containment Accident Pressure
CLTP	Current Licensed Thermal Power
CNS	Cooper Nuclear Station
CST	Condensate Storage Tank
DBLOCA	Design-Basis Loss Of Coolant Accident
DC	Direct Current
DDT	Deflagration-to-Detonation
DG	Diesel Generator
DW	Drywell
ECCS	Emergency Core Cooling System
ELAP	Extended Loss of AC Power
EMC	Electromagnetic Compatibility
EOP	Emergency Operating Procedures
EPG	Emergency Procedure Guidelines
ERO	Emergency Response Organization
ERP	Elevated Release Point
EQ	Environmental Qualification
GDC	General Design Criterion
HCVS	Hardened Containment Venting System
HCVS UPS	HCVS UPS (main UPS)
HPCI	High Pressure Coolant Injection
HPV	Hard Pipe Vent
IEEE	Institute of Electrical and Electronics Engineers
ISG	Interim Staff Guidance
MCC	Motor Control Center
MCR	Main Control Room
MOV	Motor-Operated Valve
NEI	Nuclear Energy Institute
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
PC233MV UPS	UPS dedicated to powering PC-MOV-233MV
PRA	Probability Risk Assessment
PRV	Pressure Relief Valve
OIP	Overall Integrated Plan
PCIV	Primary Containment Isolation Valve
PCPL	Primary Containment Pressure Limit
PSP	Pressure Suppression Pressure
RCIC	Reactor Core Isolation Cooling

RHR	Residual Heat Removal
ROS	Remote Operating Station
RPV	Reactor Pressure Vessel
RRC	Regional Response Center
SA	Severe Accident
SAG	Severe Accident Guidelines
SAMG	Severe Accident Management Guidelines
SADV	Severe Accident Capable Drywell Vent
SAWA	Severe Accident Water Addition
SAWM	Severe Accident Water Management
SAWV	Severe Accident Wetwell Vent
SGT	Standby Gas Treatment (System)
SME	Seismic Margin Earthquake
SFP	Spent Fuel Pool
SRM	Staff Requirement Memorandum
SOP	Standard Operating Procedures
SOV	Solenoid-Operated Valve
SW	Service Water
TBD	To Be Determined
THPV	Torus Hard Pipe Vent
UPS	Uninterruptible Power Supply
VAC	Volts Alternating Current
VDC	Volts Direct Current
WW	Wetwell