Nebraska Public Power District
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NLS2014101
December 19, 2014

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

Subject: 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)
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. NRC Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated November 14, 2013 (Accession No. ML13304B836)

3. NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109 BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated November 2013

4. 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)

Dear Sir or Madam:

On June 6, 2013, the Nuclear Regulatory Commission (NRC) issued an Order (Reference 1) to Nebraska Public Power District (NPPD). Reference 1 was immediately effective and directs NPPD to install a reliable hardened venting capability at Cooper Nuclear Station (CNS) for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris. 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. Reference 2 endorses industry guidance document NEI 13-02, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided NPPD's overall integrated plan for CNS.

Reference 1 requires submission of a status report at six-month intervals following submittal of the OIP. Reference 3 provides direction regarding the content of the status reports. The purpose of this letter is to provide the first six-month status report pursuant to Section IV, Condition D, of Reference 1, that delineates progress made in implementing the requirements of Reference 1.

Attachment 1 provides an update of milestone accomplishments since submittal of the OIP, including any changes to the compliance method, schedule, or need for relief and the basis, if any. Attachment 2 provides Revision 1 of CNS' OIP for Order EA-13-109.

This letter contains no new regulatory commitments.

If you have any questions regarding this report, please contact Jim Shaw, Licensing Manager, at (402) 825-2788.

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

Executed on: 12-19-14

Sincerely,

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

/bk

Attachments: 1. 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)

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

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

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

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

Senior Resident Inspector, w/attachments
USNRC - CNS

NPG Distribution, w/o attachments

CNS Records, w/attachments

Attachment 1

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)

Introduction

Nebraska Public Power District (NPPD) developed an Overall Integrated Plan (OIP) (Reference 1), documenting the installation of a Hardened Containment Vent System (HCVS) at Cooper Nuclear Station (CNS) that provides a reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris, in response to Reference 2. The OIP for Phase 1 was developed in accordance with the guidance contained in References 3 and 4.

This attachment provides an update of milestone accomplishments since submittal of the Phase 1 OIP, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

Milestone Accomplishments

The following milestone(s) have been completed since the development of the Phase 1 OIP, and are current as of December 15, 2014.

- None.

Milestone Schedule Status

The following table provides an update to the milestones contained in the OIP. It provides the activity status of each item, and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date/ Comments
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	Not Started	
Design Engineering On-site/Complete	September 2015	Started	

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date/ Comments
Submit 6 Month Status Report	December 2015	Not Started	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	
Implementation Outage	October 2016	Not Started	
Procedure Changes Active	November 2016	Not Started	
Walk Through Demonstration/Functional Test	November 2016	Not Started	
Submit Completion Report	November 2016	Not Started	January 2017 (60 days after full compliance)

Changes to Compliance Method

NPPD is changing the method of compliance with regard to the design of the wetwell vent as described in CNS' Phase 1 OIP. The design described in the OIP used the existing Generic Letter 89-16 hardened vent. This design used the Torus Ventilation Inlet penetration and the Standby Gas Treatment system discharge piping. This piping exited the Reactor Building underground, continued approximately 500 feet through underground, concrete-encased piping, and discharged through the Elevated Release Point (plant stack).

The new design will continue to use the Torus Ventilation Inlet penetration and Primary Containment Isolation Valves, but will discharge through a new pipe that will run vertically through the inside of the Reactor Building via a stairwell and exit the Reactor Building roof. It will include a check valve to prevent backflow and a purge system to purge hydrogen from the small amount of piping downstream of the check valve. Changes to the remote operating station (ROS) will also be made to accommodate the new design.

This change was necessary due to the increasing complexity of the design needed to support using the existing underground piping, especially in the area of hydrogen control.

Revision 1 of CNS's Phase 1 OIP is provided as Attachment 2 to this submittal. Revision 1 is considered a major rewrite. As such, revision bars are not shown due to the significant number of changes made.

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

NPPD expects to comply with the Order implementation date and no relief/relaxation is required at this time.

Open Items from Overall Integrated Plan

The following table provides a summary of the open items documented in the Phase 1 OIP. As of 12/10/2014, NPPD has not received an Interim Staff Evaluation (ISE).

Open Item #	Overall Integrated Plan Phase 1 Open Item	Status
1	Determine location of the HCVS ROS.	Complete. The Mechanical ROS will be located along the Reactor Building South exterior wall. The OIP has been revised to describe this location.
2	Evaluate accessibility of the Mechanical ROS for radiological and environmental conditions. Address dose and temperature items for the Mechanical ROS and non-Main Control Room locations. FAQ-HCVS-01 will be used as guidance.	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 remain to be assessed.
3	Determine the location of the dedicated HCVS battery transfer switch.	Complete. The dedicated HCVS battery transfer switch will be located at the 903' elevation in the Control Building along the west wall. The OIP has been revised to describe this location.
4	Determine the location of backup nitrogen bottles and evaluate the effects of radiological and temperature constraints on their deployment.	In progress. Nitrogen bottles will be installed and pre-connected in the Mechanical ROS. On-site location

Open Item #	Overall Integrated Plan Phase 1 Open Item	Status
		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 diesel generator for accessibility under severe accident HCVS use.	In progress.
6	Confirm suppression pool heat capacity.	In progress.
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. Hydrogen control will be addressed using a check valve combined with a purging system. The OIP has been revised to address this approach.
8	Identify qualification method used for HCVS instruments.	In progress.
9	Evaluate HCVS monitoring location for accessibility, habitability, staffing sufficiency, and communication capability with vent-use decision makers.	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.	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 primary containment isolation valve is sufficient to supply 24 hours of motive power.
11	Evaluate the impact of severe accident environmental conditions for post-24 hour actions supporting the implementation of power and pneumatic supplies.	In progress.

Open Item #	Overall Integrated Plan Phase 1 Open Item	Status
12	Determine the control document for HCVS out-of-service time criteria.	In progress.

Interim Staff Evaluation Impacts

As previously discussed, NPPD is changing the method of compliance with regard to the design of the wetwell vent as described in CNS' Phase 1 OIP. A revised OIP is provided as Attachment 2 to this submittal. There are no other potential impacts to the ISE identified at this time.

References

The following references support the updates to the Phase 1 OIP described in this attachment.

1. 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)

2. 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

3. NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109 BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated November 2013

4. NRC Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated November 14, 2013 (Accession No. ML13304B836)

Attachment 2

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

Cooper Nuclear Station

Hardened Containment Venting System

Phase 1 Overall Integrated Plan, Revision 1

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).

Cooper Nuclear Station

Hardened Containment Venting System

Phase 1 Overall Integrated Plan, Revision 1

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Introduction

In 1989, the NRC issued Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," to all licensees of BWRs with Mark I containments to encourage licensees to voluntarily install a hardened wetwell vent. In response, licensees installed a hardened vent pipe from the wetwell 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 SRM for SECY-12-0157, to require licensees with Mark I and Mark II containments to "upgrade or replace the reliable hardened vents required by Order EA-12-050 with a containment venting system designed and installed to remain functional during severe accident conditions." In response, the NRC issued Order EA-13-109, "Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," 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 SA conditions resulting from an 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 ISG (JLD-ISG-2013-02) issued in November 2013. The ISG endorses the compliance approach presented in NEI 13-02, Revision 0, "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 this ISG (NEI 13-02) to evaluate licensee compliance as presented in submittals required in Order EA-13-109.

The Order also requires submittal of an 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. Six month progress reports will be provided consistent with the requirements of Order EA-13-109.

The plant venting actions for the EA-13-109 severe accident capable venting scenario can be summarized by the following:

- The HCVS will be initiated via manual action from the MCR or 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, Level, and Temperature from the MCR instrumentation to monitor effectiveness of the venting actions.

- The vent operation will be monitored by HCVS valve position, temperature, pressure, 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.

Part 1: General Integrated Plan Elements and Assumptions

Extent to which the guidance, JLD-ISG-2013-02 and NEI 13-02, 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

Compliance will be attained for CNS with no known deviations to the guidelines in JLD-ISG-2013-02 and NEI 13-02 for each phase as follows:

- Phase 1 (wetwell): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for 4th Quarter (November) of 2016.

- Phase 2: No later than startup from the first refueling outage that begins after June 30, 2017, or June 30, 2019, whichever comes first. Currently scheduled for 4th Quarter (November) of 2018.

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

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

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

Provide key assumptions associated with implementation of HCVS Phase 1 Actions.

Ref: NEI 13-02 Section 1

Part 1: General Integrated Plan Elements and Assumptions

Mark I/II Generic HCVS 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 item 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) (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, notifications, SFP level and makeup, security response, opening doors for cooling, and initiating conditions for the event, can be credited as previously evaluated for FLEX.

Applicable EA-13-109 generic assumptions:

109-1. 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).
109-2. 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.
109-3. SFP level is maintained with either on-site or off-site resources such that the SFP does not contribute to the analyzed source term (Reference 20, HCVS-FAQ-07).
109-4. Existing containment components design and testing values are governed by existing plant containment criteria (e.g., Appendix J) and are not subject to the testing criteria from NEI 13-02 (References 18 (HCVS-FAQ-05) and 11 (NEI 13-02), section 6.2.2).
109-5. Classical design basis evaluations and assumptions are not required when assessing the

Part 1: General Integrated Plan Elements and Assumptions

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 SA with ex-vessel core debris which classical design basis evaluations are intended to prevent. (Reference 11 (NEI 13-02), section 2.3.1).

109-6. 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)).

109-7. 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 23 (White Paper HCVS-WP-01)).

109-8. 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.

109-9. Utilization of NRC Published Accident evaluations (e.g., SOARCA, SECY-12-0157, and NUREG 1465) as related to Order EA-13-109 conditions are acceptable as references (Reference 11 (NEI 13-02), section 8).

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

109-11. This OIP is based on EOP changes consistent with EPG/SAGs Revision 3 as incorporated per the sites EOP/SAMG procedure change process.

109-12. Under the postulated scenarios of order EA-13-109, the Control Room is adequately protected from excessive radiation dose per GDC 19 in 10CFR50 Appendix A, and no further evaluation of its use as the preferred HCVS control location is required (Reference 14 (HCVS-FAQ-01)). In addition, adequate protective clothing and respiratory protection is available if required to address contamination issues.

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.

Part 1: General Integrated Plan Elements and Assumptions

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 a purging system.

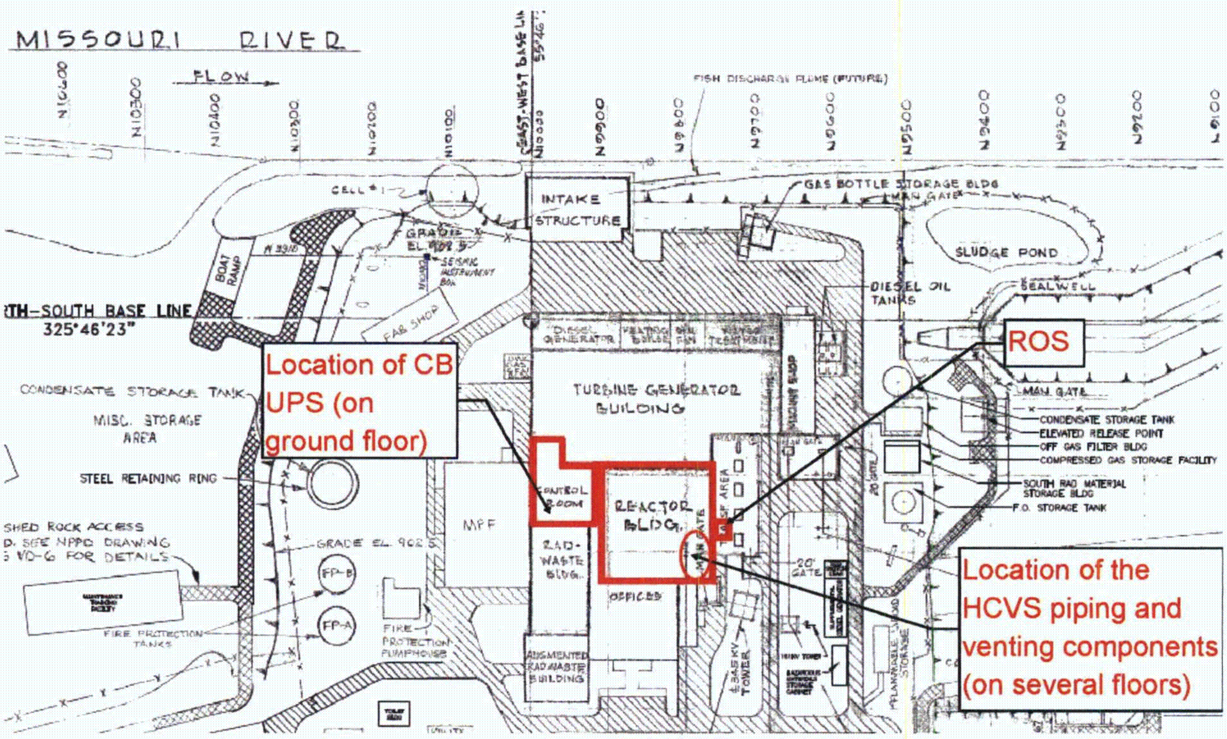

Figure 1-1, Cooper Nuclear Station Layout

Part 2: Boundary Conditions for Wetwell Vent

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

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

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

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

See attached sequence of events timeline (Attachment 2).

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. Immediate operator actions will be completed by plant personnel and will include the capability for remote-manual initiation from the HCVS control station. A list of the remote manual actions performed by plant personnel to open the HCVS vent path can be found in the following Table 2-1. A 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 MOV 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	

Part 2: Boundary Conditions for Wetwell Vent

	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 (by 4-way solenoid) from ROS panel, as well.
	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 (by 4-way solenoid) from ROS panel, as well.
Hydrogen control	9. Activate Argon purging.	MCR	This action is not necessary to *open* the HCVS vent path, but is necessary toward the end of a venting cycle.
	10. Deactivate Argon purging.	MCR	This action is not necessary to *open* the HCVS vent path, but is necessary after the end of a venting cycle.
Post-24 hours actions	11. Connect FLEX DG to emergency connection of the UPS system.	CB 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.
	12. Switch UPS power from 120 VDC battery to bypass source.	CB 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.
	13. Replenish pneumatics with replaceable nitrogen bottles to pre-installed connections.	Mechanical ROS N2 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.

Part 2: Boundary Conditions for Wetwell Vent

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 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.

Discussion of time constraints identified in Attachment 2 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 2.

- 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 Control Building UPS (CB 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 60 battery cells providing 120VDC powering a 4kW 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 (MOV UPS). Therefore, providing power to the UPS is under no time constraint until at least 24 hours.

- 24 hours: 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

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be connected to the receptacles installed on the transfer switch enclosure and connected to the cables from a FLEX DG that will be brought into the Auxiliary Relay Room.

- 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 2:

- 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 MOV UPS, operators will be required to travel to the transfer switch located in the Reactor Building near the MCC-RA (floor elevation 958'-3"). 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 RB 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 CB 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

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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. Additional nitrogen bottles could be stored in the FLEX storage building, should the pre-connected nitrogen bottles become depleted.

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). 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

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requirements. Indicate the area in the plant from where the installed/dedicated power and pneumatic supply sources are coming.

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

Location of Control Panels (EA-13-109 Section 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.2.4, 1.2.5 / NEI 13-02 Section 4.1.3, 4.2.2, 4.2.3, 4.2.5, 4.2.6, 6.1.1 and Appendix F/G)
Indicate the location of the panels, and the dose fields in the area during severe accidents and any shielding that would be required in the area. This can be a qualitative assessment based on criteria in NEI 13-02.

Hydrogen (EA-13-109 Section 1.2.10, 1.2.11, 1.2.12 / NEI 13-02 Section 2.3,2.4, 4.1.1, 4.1.6, 4.1.7, 5.1, & Appendix H)
State which approach or combination of approaches the plant will take to address the control of flammable gases, clearly demarcating the segments of vent system to which an approach applies.

Unintended Cross Flow of Vented Fluids (EA-13-109 Section 1.2.3, 1.2.12 / NEI 13-02 Section 4.1.2, 4.1.4, 4.1.6 and Appendix H)
Provide a description to eliminate/minimize unintended cross flow of vented fluids with emphasis on interfacing ventilation systems (e.g. SGTS). What design features are being included to limit leakage through interfacing valves or Appendix J type testing features?

Prevention of Inadvertent Actuation (EA-13-109 Section 1.2.7/NEI 13-02 Section 4.2.1)
The HCVS shall include means to prevent inadvertent actuation.

Component Qualifications (EA-13-109 Section 2.1 / NEI 13-02 Section 5.1, 5.3)
State qualification criteria based on use of a combination of safety related and augmented quality dependent on the location, function and interconnected system requirements.

Monitoring of HCVS (Order Elements 1.1.4, 1.2.8, 1.2.9/NEI 13-02 4.1.3, 4.2.2, 4.2.4, and Appendix F/G)
Provides a description of instruments used to monitor HCVS operation and effluent. Power for an instrument will require the intrinsically safe equipment installed as part of the power sourcing.

Component reliable and rugged performance (EA-13-109 Section 2.2 / NEI 13-02 Section 5.2, 5.3)
HCVS components including instrumentation should be designed, as a minimum, to meet the seismic design requirements of the plant.

Components including instrumentation that are not required to be seismically designed by the design basis of the plant should be designed for reliable and rugged performance that is capable of ensuring HCVS functionality following a seismic event (References 6 (ISG-JLD-2012-01) and 33 (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

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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 16", 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 at a tee right beyond the penetration. This pipe contains two butterfly PCIVs, PC-MOV-233MV and PC-AOV-237AV. Currently, further downstream, the 24" pipe changes to a 24" piping/thin-walled piping. The portion of the thin-walled piping that is currently 14 gauge will be upgraded from 14 gauge to 10 gauge stainless steel (i.e., thicker gauge), and a new 16" line will be tied

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into this upgraded 24" line. The new control valve that replaces PC-AOV-AO32 (the venting valve) will be installed on the new 16" line in the torus room area. The pipe will then travel along the south wall of the Reactor Building, to the southwest corner room. The pipe will enter the corner room using a new penetration in the southwest diagonal wall. The pipe will then travel across the corner room to enter the southwest staircase "A2" below floor elevation 903'-6". Once in the staircase, the pipe will follow the underside of the staircase and penetrate the southwest corner of the stairwell landing (i.e., the first stairwell landing on the west wall above 903'-6"). The pipe will travel through the staircase all the way to the refueling floor (elevation 1001'-0"). It will penetrate the 1001' concrete floor slab in the southwest corner of the stairwell landing, and it will exit the top of the stairwell concrete structure (9' above elevation 1001') on the refuel floor. The vent line will then follow the south wall to a structural beam. The vent line will then go vertically out to the Reactor Building roof for the release point. The effluent will exit out of the Reactor Building.

Release Point:

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

Drains and Water-Hammer Prevention:

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

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

Wind and Missile Protection:

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

In summary, the location of the HCVS was evaluated against the guidance proposed in NEI HCVS-FAQ-04, Revision 3 (Reference 17) with respect to missile protection, distance of the release point to

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the nearest structures, potential for damage due to deflagration/detonation in effluent plume, and the release point distance and elevation relative to emergency filtration intake and exhaust pathways.

1. The release point will be at least 3' above the roof and related structures of the building that it emanates from (such as roof parapets).
2. Missile protection evaluation is required for piping segments outside of Seismic Class I structures. This evaluation, referenced by NEI 13-02, section 5.1.1.6.2, can utilize: NRC Regulation Guide 1.76, Revision 1, Design-Basis Tornado And Tornado Missiles For Nuclear Power Plants, which limits automobile missile impact to "all altitudes less than 30 feet"; the plants current licensing bases; or other pertinent information. An evaluation will show that smaller missiles are very unlikely to hit the pipe exhaust at this height.
3. The ROS is the only structure located under the 25' horizontal limit. The radiological and environmental conditions at the ROS, and the impact of vent operations on accessibility of the ROS will be evaluated as part of Open Item 2.
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 CB UPS system. The CB UPS will consist of a bank of 60 battery cells providing 120VDC powering a 4kW inverter, which supplies alternate HCVS 120VAC power, and a 120VAC Distribution Panel. The battery of choice is a sealed cell (or voltage regulated lead acid) due to its minimal hydrogen generation. The HCVS has no tie to the station batteries 125 DCA, 125 DCB, 250VDCA or 250VDCB. The only indicators at the UPS are the AC and DC voltmeters, used to monitor HCVS battery power availability.

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

If the station power is not restored after 24 hours, power to the HCVS Distribution Panel will be provided directly by a FLEX DG (bypassing the UPS battery charger) or by recharging the UPS

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batteries with a FLEX DG. The transfer switch will be aligned to supply normal AC power to the battery charger during normal operation. During the Beyond Design Basis event, cables will be connected to the receptacles installed on the transfer switch enclosure and connected to the cables from a FLEX DG that will be brought into the Auxiliary Relay Room.

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

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

Pneumatic Power Supply:

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

1. The HCVS flow path valves are a 24" MOV, AC power to open and close, followed by a 24" AOV, air-to-open and spring-to-shut. The vent control valve will be a 16" AOV with air-to-open and spring-to-shut. Opening the AOVs requires energizing an AC powered SOV and providing motive air/gas, while opening the MOV requires AC power. Power to energize the SOVs will be provided by the CB UPS. Power to operate the MOV will be provided by a separate, MOV-dedicated UPS. To prevent failure of the HCVS due to failure of the solenoid valves to actuate PC-AOV-237AV and PC-AOV-AO32, 4-way solenoids will be installed to allow these AOVs to accept nitrogen from the Mechanical ROS. Actuation of PC-AOV-237AV and PC-AOV-AO32 via nitrogen through the associated 4-way solenoids will be performed from the Mechanical ROS. The CB UPS, the MOV dedicated UPS, and the AOV accumulators provide permanently installed power source and motive air/gas supply adequate for the first 24 hours. Beyond the first 24 hours, FLEX generators will be used to maintain battery power to the HCVS

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components. The initial stored motive air/gas will allow for 8 valve operating cycles for the HCVS valves for the first 24 hours. This is conservative in regards to the results contained in the September 2014 MAAP 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 2.

3. All permanently installed HCVS equipment, including any connections required to supplement the HCVS operation during an ELAP (i.e., electric power, N2/air) will be located in areas reasonably protected from defined hazards listed in Part 1 of this OIP.

4. All valves required to open the flow path or valves that require manual operation to be closed to prevent diversion or cross-flow into other systems/units will be designed for remote manual operation following an ELAP, such that the primary means of valve manipulation does not rely on use of a hand wheel, reach–rod or similar means that requires close proximity to the valve (Reference 16, 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. 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

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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 combined with a purging system. A new check valve will be installed on the 1001' floor (refueling floor) of the Reactor Building. The function of this valve is twofold: first, the function of the valve is to eliminate air ingress further down the pipe when the venting stops and the steam condenses; second, the function of the check valve is to bottle up the steam and hydrogen in the pipe volume below this valve and above the upstream control valve. The check valve will be designed for the temperature, pressure, and radiological conditions seen at its location.

Based on the run-up distance required for a DDT to occur (NEI HCVS-WP03, Reference 25), detonation loading cannot be ruled out for the section of piping downstream of the check valve (from check valve to exhaust point). Therefore, either the downstream pipe including the valve on the 1001' floor must be designed for detonation, or a purging system must be implemented to remove all hydrogen in this section before condensation draws in a substantial amount of air (oxygen). Argon purging has been selected for prevention of DDT in the HCVS at CNS. The HCVS piping will not be designed for detonation.

As presented in NEI HCVS-WP-03 (Reference 25), argon is a relatively inexpensive inert gas of choice since its atomic mass (~40 amu) is higher than that of oxygen (~16 amu). Injecting argon in the line will create an argon "plug" between the hydrogen potentially below the check valve and the oxygen in the atmosphere above. Argon bottles will be located on the refueling floor and connected to the 16" vent line above the valve with ½" carbon steel lines. A flow diagram of the system is included in the overall HCVS flow diagram, in Attachment 3, Sketch 2. Purging is initiated just before the vent line is closed in order to exhaust the radiologically contaminated steam out of the pipe downstream of the

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check valve and prevent contaminated water condensation and water accumulation on top of the check valve.

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

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)**

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.
- A new vacuum breaker will be installed for the HCVS, since vacuum breaker PC-CV-30CV will be removed along with the existing 10" THPV piping. The new vacuum breaker will meet the requirements of 10CFR50 Appendix J per NEI HCVS FAQ-05 (Reference 18). The vacuum breaker will be designed to withstand the temperature, pressure, and radiological conditions

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experienced during the accident. At minimum, the vacuum breaker will be designed for the pressure and temperature conditions of the Primary Containment, 56 psig and 281°F, respectively. Per its function, the vacuum breaker will be assumed closed during venting. Testing and maintenance will be performed to ensure that the valve remains leak-tight.

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

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

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

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

- Pipe leakage to the Reactor Building and other buildings will be minimized:
    - Leak tightness of the vent pipe from PC-AOV-237AV to the exhaust will be tested in compliance with the requirements of USAS 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.

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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.

Likewise, any electrical or controls component which interfaces with Class 1E power sources will be considered safety-related up to and including appropriate isolation devices such as fuses or breakers, as their failure could adversely impact containment isolation and/or a safety-related power source. The CB UPS and MOV UPS are considered Balance of Plant. Where the UPS circuits interface with safety-related circuits, the appropriate separation will be provided by transfer switches, disconnects, or interposing relays between safety and non-safety-related circuits. The remaining components will be considered Augmented Quality. Newly installed piping and valves will be seismically qualified to handle the forces associated with the SME back to their isolation boundaries. Electrical and controls

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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

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Existing Suppression Pool Level	ISO9001 / IEEE 344-2004 / Demonstration
Existing Suppression Pool Temperature	ISO9001 / IEEE 344-2004 / Demonstration
Nitrogen Bottles Pressure	ISO9001 / IEEE 344-2004 / Demonstration
Argon Purging Indicators	ISO9001 / IEEE 344-2004 / Demonstration

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

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.

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

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

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

Table 2-3, HCVS Monitoring and Control Changes

NRC Requirements & Industry Recommendations	Existing I&C	Change
Order Requirement 1.2.4: The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.	The primary controlling location of the existing THPV is the MCR. PCIVs valves can be manually operated from the MCR using key-locked override switches on Panel P2 and open/close switches on Vertical Board H (PC-SW-CS(233AV) and PC-SW-CS(237AV)). AOV-AO32 can be controlled from Panel P2 using key-locked switches.	The primary controlling location of the HCVS is the MCR. During a severe accident, controls will be powered from a HCVS-dedicated UPS. PC-MOV-233MV will be powered from a separate alternate power supply (MOV UPS). The supply of pneumatic motive force after 24 hours will be performed from the Mechanical ROS.

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Order Reference 1.2.5: The HCVS shall, in addition to the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.	N/A	The installation of a HCVS dedicated source of power ensures operation of the HCVS from the MCR. The supply of pneumatic motive force after 24 hours will be operated from the Mechanical ROS. In case the SOV of PC-AOV-237AV and/or PC-AOV-AO32 fails, 4-way solenoids will allow actuation of the valves from the Mechanical ROS with pneumatic motive force.
Order Requirement 1.2.8: The HCVS shall include means to monitor the status of the vent system (e.g., valve position indication) from the control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of AC power. HCVS valve position indication should be available at the primary controlling location. (NEI 13-02, 4.2.2.1.5)	The position of the following valves is indicated in the MCR: MOV-233MV, AOV-237AV, AOV-AO32.	PC-AOV-AO32 will be replaced. The circuit indicating position lights for PC-AOV-AO32 on MCR Panel P2 will be modified accordingly to indicate the position of the new control AOV. An effluent pressure transmitter will be added to the line in the Torus Room to measure the effluent pressure and confirm the status of venting operations.

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Order Requirement 1.2.9: The HCVS shall include a means to monitor the effluent discharge for radioactivity that may be released from operation of the HCVS. The monitoring system shall provide indication from the control panel required by 1.2.4 and shall be designed for sustained operation during an extended loss of AC power.	Currently, RMA-RE-27 measures radiation doses in the THPV. Indications are provided on MCR Panel 9-11.	The existing radiation monitor is located near the section of the THPV line which will be demolished. A new radiation monitor will be installed in the same area (Torus Room). The indication on Panel 9-11 will be modified to indicate the doses recorded on the new radiation monitor.
HCVS valve position indicators should be capable of operating under the temperature/radiation conditions existing at the valve locations. (NEI 13-02, 4.2.2.1.6)	N/A	Refer to Part 2, "Component Qualifications."
HCVS valve position indicators and indications should be powered from sources that will be available during the appropriate mission time of the HCVS system. (NEI 13-02, 4.2.2.1.7)	N/A	The position lights for the MOV will only be on when the MOV is energized from its temporary power supply. Once the valve is positioned open and the power supply is secured, the lights will be off. Position lights for PC-AOV-237AV and the new control valve (on MCR Vertical Board H) will be powered from the UPS.

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

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

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

Location / I&C	MCR	CB UPS	Mechanical ROS
PCIV controls	Existing key-locked override switches on Panel P2 and open/close switches on Vertical Board H (PC-SW-CS(233AV) and PC-SW-CS(237AV)) Powered from CB UPS.	None	None, except piping to supply nitrogen to the new 4-way solenoid for PC-AOV-237AV.
PCIV position indicators	Existing indicating lights on VBD H Powered from CB UPS.	None	None
Control valve controls	PC-AOV-AO32 key-locked switch on Panel P2 to be replaced, as AO32 will be replaced. Powered from CB UPS.	None	None, except piping to supply nitrogen to the new 4-way solenoid for PC-AOV-AO32.
Control valve position indication	PC-AOV-AO32 position indication (light on Panel P2) to be replaced. Powered from CB UPS.	None	New install. Powered from CB UPS.
Containment (DW and WW) pressure transmitters	Existing Drywell Pressure from PC-PT-512A, -B; PC-PT-4A1, -4B2; Torus Pressure on PC-PT-30A, -30B; Recorded on Panels 9-3 or 9-4. Powered from CB UPS.	None	None
Suppression Pool Level	Existing on PC-DPT-3A1, -3B1. Powered from CB UPS.	None	None
Effluent Temperature Monitor	New install. Powered from CB UPS.	None	None
Effluent Radiation Monitor	RMA-RE-27 indication on Panel 9-11 to be replaced. Powered from CB UPS.	None	None

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Effluent Pressure Monitor	PC-PS-20 to be replaced by a pressure transmitter. Powered from CB UPS.	None	None
Accumulator pressure monitors	IA-PS-3 is replaced by a pressure transmitter. A new pressure transmitter is added to the AOV-237AV accumulators (in order to know when to use the Mechanical ROS). Powered from CB UPS.	None	New install. Accumulator pressure for valves PC-AOV-237AV and PC-AOV-AO32 to be indicated.
Pneumatic motive force controls for AOVs (manual ball valves)	None (located at the Mechanical ROS).	None	New install – not powered from UPS (mechanical system), normally not needed before 24 hours.
Nitrogen bottle availability (analog pressure gauges)	None (located at the Mechanical ROS).	None	New – not powered from UPS (mechanical system), normally not needed before 24 hours.
UPS Power availability status	None (located at the CB UPS).	New install	None
Power transfer switch for CB UPS	None (Transfer switch located at the CB UPS).	New install	None
Power transfer switch for MOV UPS	None (located at the MOV UPS which is at, or near, MCC-RA).	New install; at or near MCC-RA in Reactor Building	None
RPV Pressure	Currently available with RFC-PI-90A, B, C.	None	None
Suppression Pool Temperature	Existing PC-TE-1A to -1H and -2A to -2H. Recorded on PC-TR-24 and PC-TR-25 in MCR Vertical Board J. Powered from CB UPS.	None	None
Argon purging in process indicators (flow monitor and pressure transmitter)	New install. Powered from CB UPS.	None	None
Argon purging SOV	New install. Powered from CB UPS.	None	None

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

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

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

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- 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 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 MOV-dedicated UPS, which will be performed at or near the MCC-RA in the Reactor Building. If needed, supply of nitrogen to the AOVs' 4-way SOVs could be completed from the ROS. Actions will include remote-manual initiation, except the action of transferring MOV-233MV power. The operator actions required to open a vent path are as described in Table 2-1.

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

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

This scenario credits anticipatory venting at t=8 hours and anticipates cycling of the control valve PC-AOV-AO32. Therefore, PCIVs PC-MOV-233MV and PC-AOV-237AV are expected to be opened only once and left open during the first 24 hours of mitigation. Valve PC-AOV-237AV currently has two accumulators which provide sufficient back up air to operate the valve once and compensate for assumed leakage for 24 hours. Valve PC-AOV-AO32 will be cycled to control anticipatory venting. The new accumulator that will support operation of the new PC-AOV-AO32 will be sized for eight valve cycles. As per industry white paper HCVS-WP-02 "Hardened Containment Vent System Cyclic Operations Approach" (Reference 24), 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.

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

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

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

System control:

i. Active: Control valves and/or PCIVs are operated in accordance with EOPs/SOPs to control containment pressure. Controlled venting will be permitted in the revised EPGs and associated implementing EOPs. Anticipatory Venting will be permitted, and the vent line will be kept open (or cycled) until 24 hours in the event. A key-lock switch permissive circuit without any automatic controls will allow the containment isolation valves to be opened regardless of existing containment isolation signals.
ii. Passive: Inadvertent actuation protection is provided by the current circuitry associated with the containment isolation valves used to operate the HCVS. The containment isolation valves can be opened with key-lock switches in the MCR, as directed by applicable procedures.

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 that will be brought into the Auxiliary Relay Room.

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

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

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

Details:

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

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 pre-staged FLEX DG may be required.

EA-13-109 Modifications:

- A modification will be required to upgrade the existing 24" 14 gauge thin-walled pipe to a 10 gauge stainless steel thin-walled pipe from PC-AOV-237AV.
- A modification will be required to remove the existing 10" THPV line from the 24" thin-walled pipe to the rupture disk. 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 install a blind flange at the location of the rupture disk. The blind flange 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 16" 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 4-way SOVs 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 CB UPS) to maintain power for the HCVS for 24 hours following the ELAP event.

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

- A modification will be required to provide power at the MCC-RA for PC-MOV-233MV, by installing the MOV UPS.
- A modification will be required to route cables from the 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.

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	New – TBD	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	CB UPS
HCVS process radiation monitor	RMA-RE-27	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

Part 2 Boundary Conditions for WW Vent: BDBEE Venting

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
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 EA-13-109.

Notes:

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 MOV-dedicated UPS, which will be performed at or near the MCC-RA in the Reactor Building. Since this action will be performed at the very beginning of the event, water will still be covering the core and no additional radiological conditions will be present at the location. If needed, supply of nitrogen to the AOVs' 4-way SOVs could be completed from the HCVS ROS. Actions will include remote-manual actions, except the action of transferring MOV-233MV power. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this OIP (Table 2-1).

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

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

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

System control:

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

Part 2 Boundary Conditions for WW Vent: Severe Accident Venting

Greater Than 24 Hour Coping Detail

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

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

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

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

OPEN ITEM 11: 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.

Details:

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, except for the need to purge the last HCVS line segment with argon to prevent accumulation of flammable gases resulting from a potential uncovering of the core. 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 will be required to install additional post-24 hours nitrogen bottles on-site.
- 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 and an argon purging station which will include pre-staging argon bottles, purge system components and the associated tubing.

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).

Part 2 Boundary Conditions for WW Vent: Severe Accident Venting
The same as for BDBEE Venting Part 2 plus indicators that the argon purging is in process (flow monitor, pressure transmitter) (in the MCR).
Notes:

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 MOV-dedicated UPS located in the Reactor Building elevation 958'-3", at or near the MCC-RA. Venting will require support from the HCVS installed UPS batteries, UPS battery charger, and pneumatic supply. This installed equipment will provide a minimum of 24 hour operation. Connection points will be provided.

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

The UPS to be installed will provide at least 24 hours of power supplies and support venting for 24 hours in a BDBEE with or without core damage. The proposed location for the UPS is the far end of the Control Building corridor at the 903'-6" level. This location is proposed based on the seismic class of the Control Building and being above the design basis flood level. The relative absence of other safety-related equipment in that area is also a positive feature. Additionally, this location is in relatively close proximity to both the Control Room and anticipated connection points for FLEX power sources. During the final design evaluation for NFPA 805 Fire PRA compatibility of this new design must be evaluated as well as the effects of an additional combustible and heat source to the area. Floor loading requires an engineered foundation to support the weight of the new equipment. As described in the section, "Power and Pneumatic Supply Sources," the CB UPS will consist of a bank of 60 battery cells

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

providing 120VDC powering a 4kW inverter, which supplies alternate HCVS 120VAC power, and a 120VAC Distribution Panel. The battery of choice is a sealed cell (or voltage regulated lead acid - VRLA) due to its minimal hydrogen generation. The HCVS has no tie to the station batteries 125 DCA, 125 DCB, 250VDCA or 250VDCB.

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

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

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. Additional nitrogen bottles will be stored on-site (potentially in the FLEX storage building) to substitute depleted bottles in the ROS and replenish pneumatic power supply if needed. FLEX storage buildings locations are defined in Reference 28 (FLEX OIP).

Post-24 hours Electric Power Supply:

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

New 4-way SOVs associated with AOVs:

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

Part 2 Boundary Conditions for WW Vent: HCVS Support Equipment Functions
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. Similar to the BDBEE scenario, nitrogen bottles that will be located outside of the Reactor Building in the FLEX storage building will be available to tie-in supplemental pneumatic sources if the nitrogen bottles located in the Mechanical ROS become depleted. Refer to "Part 2 - Hydrogen" to find a description of the approaches used to prevent the accumulation of flammable gases to support venting operations.
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 SA Capable/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 and additional nitrogen bottles 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 4-way solenoids associated with AOVs PC-AOV-237AV and PC-AOV-AO32. - Install the two UPS systems to deliver power the HCVS equipment and I&C: the CB UPS system will consist of 60 battery cells, a 4kW inverter, and a 120VAC distribution panel; the MOV-dedicated 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

Part 2 Boundary Conditions for WW Vent: HCVS Support Equipment Functions
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. - Indicators of argon purging system operating.
Notes:

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). Most likely the additional nitrogen bottles would be stored in a FLEX storage building. If not, the nitrogen bottles would need to be stored in a rugged structure protected from all applicable screened-in hazards and located such that operator exposure to radiation and occupational hazards will be minimized, to meet the requirements identified in NEI-12-06 section 11 for screened in hazards. Off-site supplies would relieve the on-site supplies after about 72 hours in the event. The effect of the vent operation on deployment operations is an Open Item (Open Items 2 and 11).

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

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 CB UPS and equipment

Part 2 Boundary Conditions for WW Vent: HCVS Venting Portable Equipment Deployment		
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).		
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: <u>Boundary Conditions for Drywell Vent</u>

Provide a sequence of events and identify any time constraint required for success including the basis for the time 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, a walk-through of deployment).

Describe in detail in this section the technical basis for the time constraint identified on the sequence of events timeline Attachment 2B

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

Ref: EA-13-109 Section X.X.X / NEI 13-02 Section X.X.x

This section (Part 3) will be completed with the Phase 2 OIP submittal by December 31, 2015.

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 X.X.X / NEI 13-02 Section X.X.x

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 X.X.X / NEI 13-02 Section X.X.x

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 X.X.X / NEI 13-02 Section X.X.x

Details:

Provide a brief description of Procedures / Guidelines:

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

Part 3: Boundary Conditions for Drywell Vent
Identify modifications: *List modifications and describe how they support the HCVS Actions.*
Key Venting Parameters: *List instrumentation credited for the venting HCVS Actions.*
Notes:

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 3.1, 3.2 / NEI 13-02 Section 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 SA defined in NRC Order EA-13-109 and the hazards applicable to the site per Part 1 of this OIP.
- Routes for transporting portable equipment from storage location(s) to deployment areas will be developed as the response details are identified and finalized. The identified paths and deployment areas will be accessible during all modes of operation and during SAs.

Procedures:

Procedures will be established for system operations when normal and backup power is available, and during ELAP conditions.

The HCVS procedures will be developed and implemented following CNS' process for initiating or revising procedures and contain the following details:

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

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

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

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

- If for up to 90 consecutive days, the primary or alternate means of HCVS operation are non-functional, no compensatory actions are necessary.
- If for up to 30 days, the primary and alternate means of HCVS operation are non-functional, no compensatory actions are necessary.

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:
  - The condition will be entered into the corrective action system.
  - The HCVS functionality will be restored in a manner consistent with plant procedures.
  - A cause assessment will be performed to prevent future loss of function for similar causes.
  - Initiate action to implement appropriate compensatory actions.

OPEN ITEM 12: 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 will receive necessary training in the use of plant procedures for system operations when normal and backup power is available and during ELAP conditions. The training will be refreshed on a periodic basis and as any changes occur to the HCVS. Training content and frequency will be established using the Systematic Approach to Training 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 14-01as codified in NTTF Recommendation 8 and 9 rulemaking

The Licensee should demonstrate use of the HCVS 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).

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

Part 4: Programmatic Controls, Training, Drills and Maintenance

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:

- The HCVS maintenance program should ensure that the HCVS equipment reliability is being achieved in a manner similar to that required for FLEX equipment. Standard industry templates (e.g., EPRI) and associated bases may be developed to define specific maintenance and testing.
  - Periodic testing and frequency should be determined based on equipment type, expected use and manufacturer's recommendations (further details are provided in Section 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 permanent installed equipment should be maintained in a manner that is consistent with assuring that it performs its function when required.
  - HCVS permanently installed equipment should be subject to maintenance and testing guidance provided to verify proper function.
- HCVS 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 components. The control program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines.

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

Part 4: Programmatic Controls, Training, Drills and Maintenance

Table 4-1, Testing and Inspection Requirements

Description	Frequency
Cycle the HCVS valves and the interfacing system valves not used to maintain containment integrity during operations.	Once per operating cycle
Perform visual inspections and a walk down of HCVS components.	Once per operating cycle
Test and calibrate the HCVS radiation monitors.	Once per operating cycle
Leak test the HCVS.	(1) Prior to first declaring the system functional; (2) Once every three operating cycles thereafter; and (3) After restoration of any breach of system boundary within the buildings.
Validate the HCVS operating procedures by conducting an open/close test of the HCVS control logic from its control panel and ensuring that all interfacing system valves move to their proper (intended) positions.	Once per every other operating cycle

Notes:

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 schedule is 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.

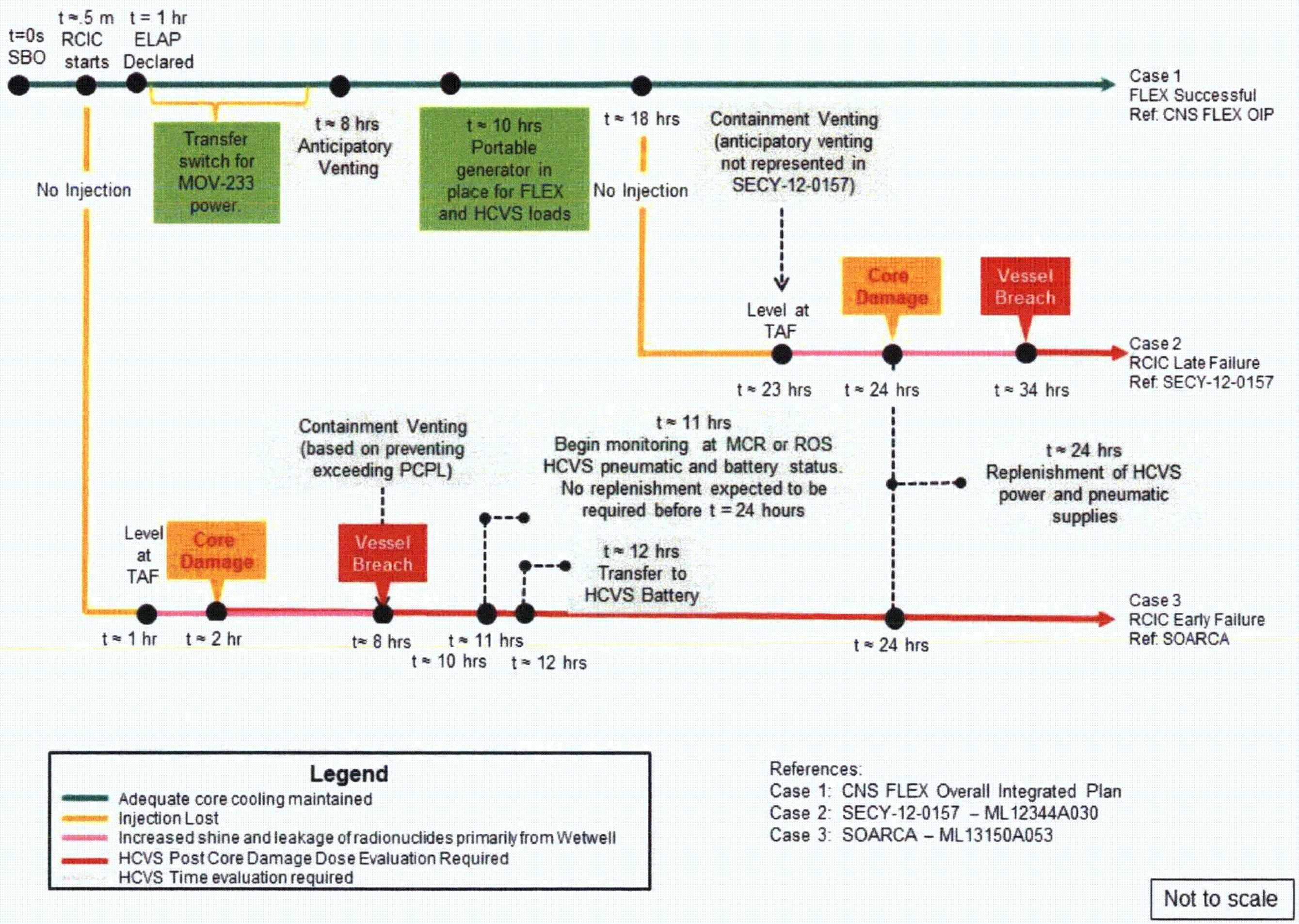
Milestone	Target Completion Date	Activity Status	Comments/ Date Changes
Hold preliminary/conceptual design meeting	June 2014	Complete	
Submit Overall Integrated Implementation Plan	June 2014	Complete	
Submit 6 Month Status Report	December 2014	Complete	
Submit 6 Month Status Report	June 2015		
Design Engineering On-site/Complete	September 2015	Started	
Submit 6 Month Status Report	December 2015		Simultaneous with Phase 2 OIP
Submit 6 Month Status Report	June 2016		
Operations Procedure Changes Developed	August 2016		
Site Specific Maintenance Procedure Developed	August 2016		
Training Complete	September 2016		
Implementation Outage	October 2016		
Procedure Changes Active	November 2016		
Walk Through Demonstration/Functional Test	November 2016		
Submit Completion Report	November 2016		January 2017

Attachment 1: <u>HCVS Portable Equipment</u>

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	X	X	TBD	Per Response to EA-12-049.

Attachment 2: Sequence of Events Timeline

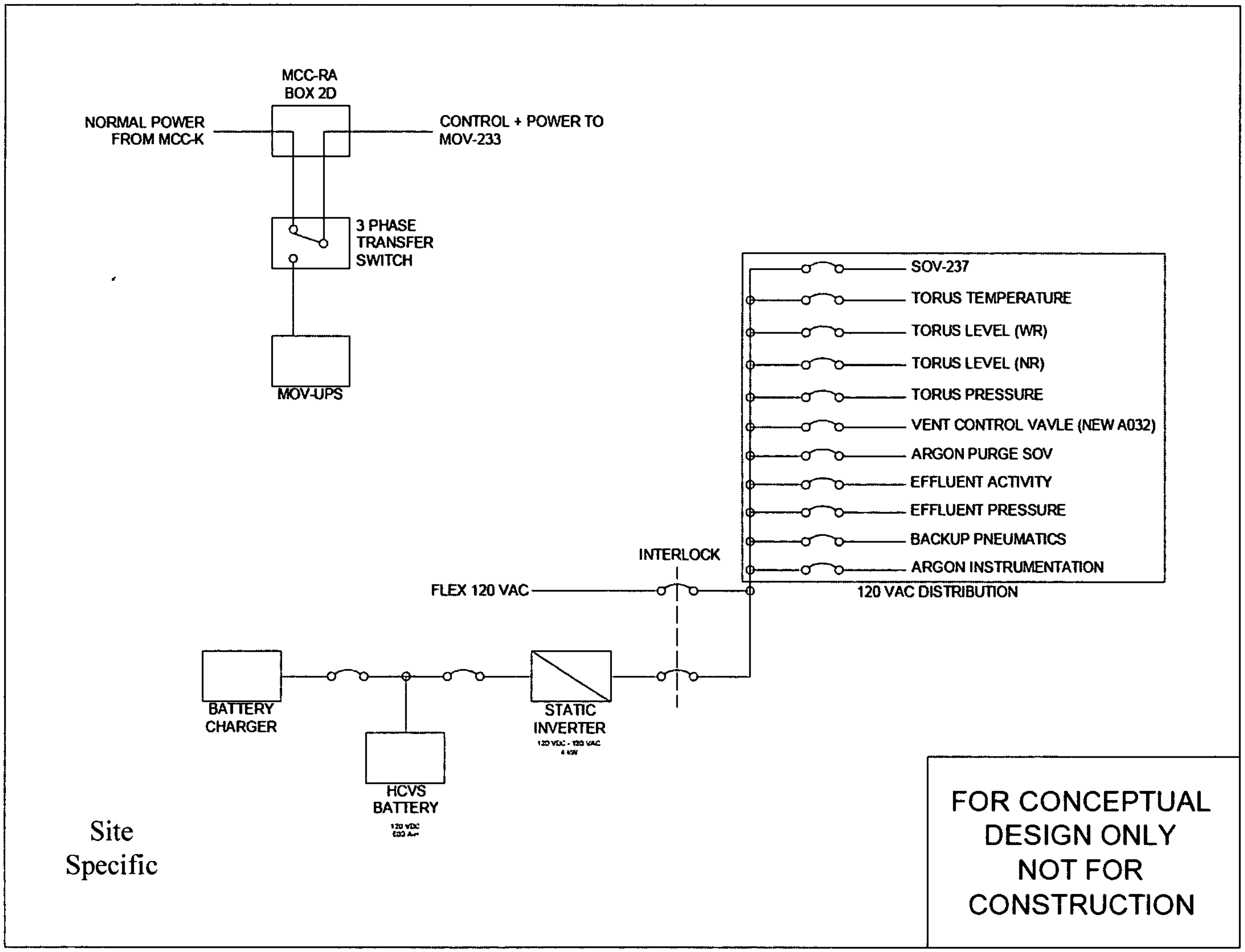
Figure 2: Wetwell HCVS Timeline



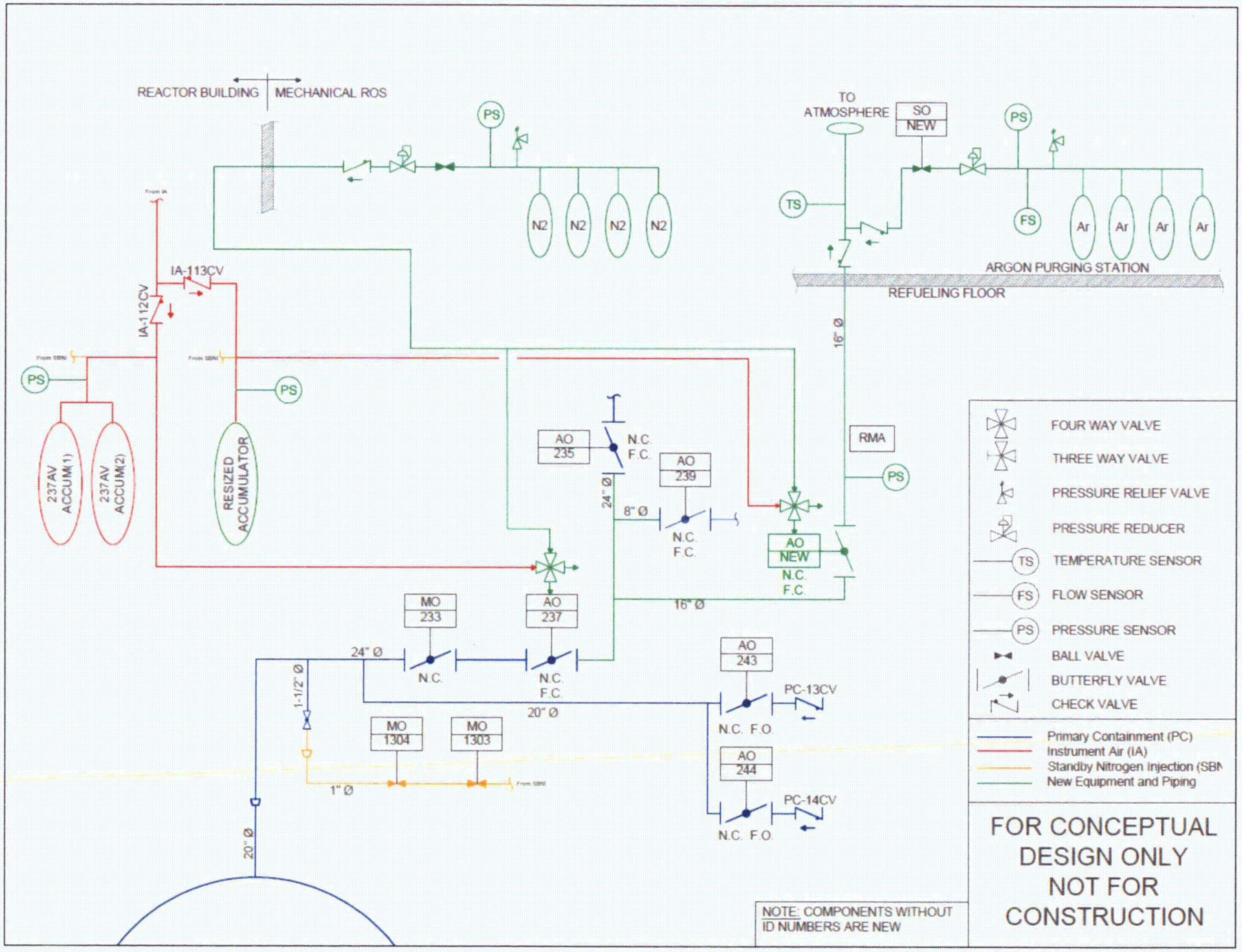
Attachment 3: Conceptual Sketches

Sketch 1: Electrical Layout of UPS Systems ***(conceptual design)***
Sketch 2: P&ID Layout of HCVS ***(conceptual design)***
- **Piping routing for vent path**

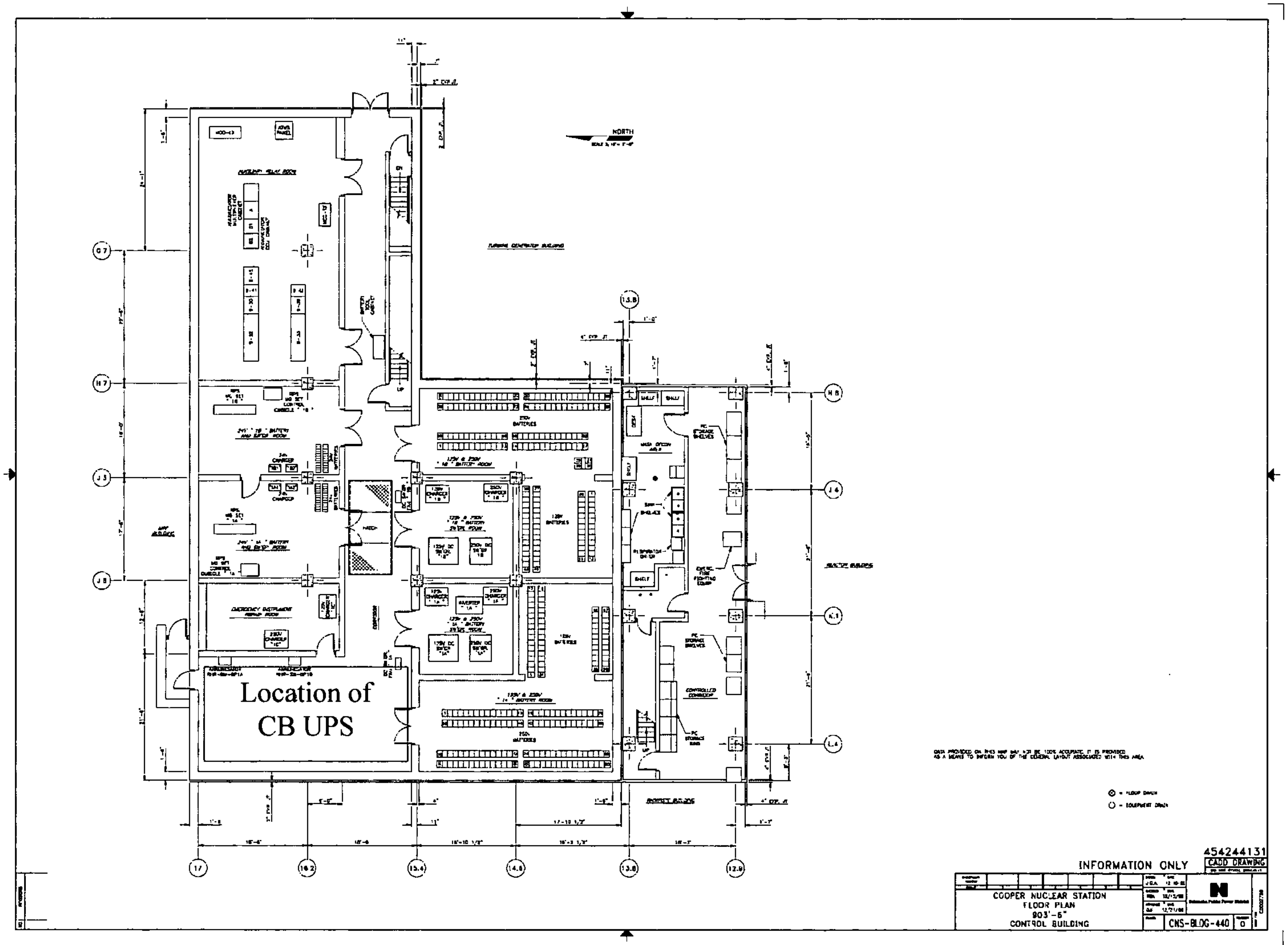
Sketch 3: Control Building UPS Location ***(conceptual design)***



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



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



Sketch 3: Control Building UPS Location (conceptual design)

Attachment 4: Failure Evaluation Table

Table 4A: Wetwell 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	At ROS, open manual valves of pre-connected nitrogen cylinders to air system supporting HCVS valves, replace bottles as	No

	air supply (long term).	needed with on-site nitrogen bottles.	
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 4-way solenoids 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 1, dated August 2012
11. NEI 13-02, Industry Guidance for Compliance with Order EA–13–109, Revision 0, Dated November 2013
12. NEI 13-06, Enhancements to Emergency Response Capabilities for Beyond Design Basis Accidents and Events, Revision 0, dated March 2014
13. NEI 14-01, Emergency Response Procedures and Guidelines for Extreme Events and Severe Accidents, Revision 0, dated March 2014
14. NEI FAQ HCVS-01, HCVS Primary Controls and Alternate Controls and Monitoring Locations
15. NEI FAQ HCVS-02, HCVS Dedicated Equipment
16. NEI FAQ HCVS-03, HCVS Alternate Control Operating Mechanisms
17. NEI FAQ HCVS-04, HCVS Release Point
18. NEI FAQ HCVS-05, HCVS Control and 'Boundary Valves'
19. NEI FAQ HCVS-06, FLEX Assumptions/HCVS Generic Assumptions
20. NEI FAQ HCVS-07, Consideration of Release from Spent Fuel Pool Anomalies
21. NEI FAQ HCVS-08, HCVS Instrument Qualifications
22. NEI FAQ HCVS-09, Use of Toolbox Actions for Personnel

23. NEI White Paper HCVS-WP-01, HCVS Dedicated Power and Motive Force
24. NEI White Paper HCVS-WP-02, HCVS Cyclic Operations Approach
25. NEI White Paper HCVS-WP-03, Hydrogen/CO Control Measures
26. NEI White Paper HCVS-WP-04, FLEX/HCVS Interactions
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, May 31, 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)

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 46):

- 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.

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

Attachment 7: List of Overall Integrated Plan Open Items

Open Item #	Action	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.
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.

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
CB UPS	Control Building UPS (main UPS)
CLTP	Current Licensed Thermal Power
CNS	Cooper Nuclear Station
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
ERP	Elevated Release Point
EQ	Environmental Qualification
GDC	General Design Criterion
HCVS	Hardened Containment Venting System
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

MOV UPS	UPS dedicated to powering PC-MOV-233MV
NEI	Nuclear Energy Institute
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
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
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
TBD	To Be Determined
THPV	Torus Hard Pipe Vent
UPS	Uninterruptible Power Supply
VAC	Volts Alternating Current
VDC	Volts Direct Current
WW	Wetwell