Southern Nuclear

Cheryl A. Gayheart
Regulatory Affairs Director

3535 Colonnade Parkway
Birmingham, AL 35243
205 992 5316 tel
205 992 7795 fax

cagayhea@southernco.com

NOV 1 2 2018

Docket No.: 50-321
50-366

NL-18-1333

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

Edwin I. Hatch Nuclear Plant – Unit 2
Completion of Required Action for NRC Order EA-13-109
Reliable Hardened Containment Vents Capable of
Operation Under Severe Accident Conditions

Reference:

1. Letter from Southern Nuclear (Justin T. Wheat) to NRC Document Control Desk, "Edwin I. Hatch Nuclear Plant – Unit 1, Completion of Required Action for NRC Order EA-13-109 Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," April 12, 2018 (ML18102B148).

Ladies and Gentlemen:

On June 6, 2013, the Nuclear Regulatory Commission (NRC) issued Order EA-13-109, *Order Modifying Licenses with Regard to Requirements for Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions*, to Southern Nuclear Operating Company (SNC). This Order was immediately effective and directs the Edwin I. Hatch Nuclear Plant (HNP) - Units 1 and 2 to install 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. This letter, along with the Enclosure 1, provides the notification required by Item IV.D.4 of Order EA-13-109 that full compliance (Phase 1 and Phase 2) with the requirements described in Attachment 2 of the Order has been achieved for HNP Unit 2. HNP Unit 1 and Unit 2 are now both in full compliance to the Order since HNP Unit 1 previously reached Full Compliance to the Order in February 2018 as documented in Reference 1.

Enclosure 2 contains the HNP Units 1 and 2 Hardened Containment Vent System (HCVS) Final Integrated Plan (FIP) which provides strategies for the enhancement of hardened venting capabilities to manage containment over-pressurization for Mitigation Strategies for Beyond-Design-Basis External Events (FLEX) and establishment of hardened venting capabilities for a non-mitigated (Severe Accident) Extended Loss of all AC Power (ELAP). The HNP Units 1 and 2 HCVS FIP is based on NEI 13-02, *Industry Guidance for Compliance with*

Order EA-13-109 BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, Revision 1, dated April 2015.

This letter contains no new Regulatory Commitments and no revision to existing Regulatory Commitments. If you have any questions, please contact Jamie Coleman at (205) 992-6611.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 9th day of November 2018.

Respectfully submitted,

Cheryl A. Gayheart
Regulatory Affairs Director

CAG/TLE/scm

Enclosures: 1. HNP Unit 2 Compliance with Order EA-13-109
2. HNP Units 1 and 2 HCVS FIP

cc: Director of the Office of Nuclear Reactor Regulations
Regional Administrator, Region II
NRR Project Manager – Hatch
Senior Resident Inspector – Hatch
Director, Environmental Protection Division – State of Georgia
RType: CHA02.004

Edwin I. Hatch Nuclear Plant – Unit 2
Completion of Required Action for NRC Order EA-13-109
Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions

Enclosure 1

HNP Unit 2 Compliance with Order EA-13-109

(8 pages)

BACKGROUND

On June 6, 2013, the Nuclear Regulatory Commission (NRC) issued Order EA-13-109, *Order Modifying Licenses with Regard to Requirements for Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions* (Reference 1), to Southern Nuclear Operating Company (SNC). This Order was immediately effective and directs the Edwin I. Hatch Nuclear Plant (HNP) - Units 1 and 2 to install 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 (HCVS) in response to Order EA-13-109. SNC developed an Overall Integrated Plan (OIP) (Reference 6) to provide HCVS. The information provided herein, as well as the implementation of the OIP (Phase 1 Reference 5, and Phase 2 Reference 6), documents full compliance for HNP Unit 2 in response to the Order (Reference 1). HNP Unit 1 previously reached Full Compliance to the Order (Reference 1) per Reference 17.

OPEN ITEM RESOLUTION

The Phase 1 and 2 NRC Interim Staff Evaluation (ISE) Open Items (References 14 and Reference 15) have been addressed and documented in subsequent Order EA-13-109 six-month status reports (References 6 - 13) and are considered complete per the NRC (Reference 16). The following table provides completion references for each ISE Phase 1 and 2 Open Item.

HNP 1 & 2 HCVS Phase 1 ISE Open Items		Response
1	Make available for NRC staff audit the location of the ROS's	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
2	Make available for NRC staff audit the location of the dedicated HCVS battery transfer switch	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
3	Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
4	Make available for NRC staff audit the deployment location of the portable diesel generators	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
5	Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Clarification in Reference 11. Closure concurrence per Reference 16.

HNP 1 & 2 HCVS Phase 1 ISE Open Items		Response
6	Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
7	Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
8	Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Clarification in Reference 11. Closure concurrence per Reference 16.
9	Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
10	Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
11	Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.

HNP 1 & 2 HCVS Phase 1 ISE Open Items		Response
12	Make available descriptions of design details that minimize unintended cross flow of vented fluids within a unit and between units	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
13	Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
14	Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.
15	Make available for NRC staff audit the control document for HCVS out of service time criteria	Closed per Reference 10 and verified in NRC Audit call on March 7, 2017. Closure concurrence per Reference 16.

HNP 1 & 2 HCVS Phase 2 ISE Open Items		Response
1	Licensee to demonstrate that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions Section 3.3.3	Closed per Reference 10, consistent with the BWROG generic closure criteria for Order EA-13-109 Phase 2 Open Items. Closure concurrence per Reference 16.
2	Licensee shall demonstrate how the plant is bounded by the reference plant analysis that shows the SAWM strategy is successful in making it unlikely that a drywell vent is needed Section 3.3.3.1	Closed per Reference 10, consistent with the BWROG generic closure criteria for Order EA-13-109 Phase 2 Open Items. Closure concurrence per Reference 16.
3	Licensee to demonstrate that there is adequate communication between the MCR and the Intake Structure operator at the FLEX manual valve during severe accident conditions. Section 3.3.3.4	Closed per Reference 10, consistent with the BWROG generic closure criteria for Order EA-13-109 Phase 2 Open Items. Closure concurrence per Reference 16.

MILESTONE SCHEDULE - ITEMS COMPLETE

Milestone	Activity Status
Submit Phase 1 Overall Integrated Plan	Complete
Submit Phase 2 Overall Integrated Plan	Complete
Submit 6 Month Updates:	
Update 1	Complete
Update 2	Complete
Update 3	Complete
Update 4	Complete
Update 5	Complete
Update 6	Complete
Update 7	Complete
Update 8	Complete
Phase 1 Modifications:	
Hold preliminary/conceptual design meeting	Complete
Unit 2 Design Engineering On-site/Complete	Complete
Unit 2 Implementation Outage	Complete
Unit 2 Walk Through Demonstration/Functional Test	Complete
Phase 1 Procedure Changes:	
Operations Procedure Changes Developed	Complete
Site Specific Maintenance Procedure Developed	Complete
Procedure Changes Active	Complete
Phase 1 Training:	
Training Complete	Complete
Phase 1 Completion:	
Unit 2 HCVS Implementation	Complete
Phase 2 Modifications:	
Hold preliminary/conceptual design meeting	Complete
Unit 2 Design Engineering On-site/Complete	Complete
Unit 2 Walk Through Demonstration/Functional Test	Complete
Unit 2 Implementation Outage	Complete
Phase 2 Procedure Changes:	
Operations Procedure Changes Developed	Complete

Milestone	Activity Status
Site Specific Maintenance Procedure Developed	Complete
Procedure Changes Active	Complete
Phase 2 Training:	
Training Complete	Complete
Phase 2 Completion:	
HCVS Implementation	Complete
Full Site HCVS Implementation	Complete
Submit Unit 2 Compliance Letter and site Final Integrated Plan [60 days after full site compliance]	Complete

ORDER EA-13-109 COMPLIANCE ELEMENTS SUMMARY

The elements identified below for HNP Unit 2 as well as the HCVS Phase 1 and Phase 2 OIP (Reference 6), the 6-Month Status Reports (References 6 - 13) and additional docketed correspondence, demonstrate compliance with Order EA-13-109.

HCVS PHASE 1 AND PHASE 2 FUNCTIONAL REQUIREMENTS AND DESIGN FEATURES – COMPLETE

The HNP Unit 2, Phase 1 HCVS provides a vent path from the wetwell to remove decay heat, vent the containment atmosphere, and control containment pressure within acceptable limits. The Phase 1 HCVS will function for those accident conditions for which containment venting is relied upon to reduce the probability of containment failure, including accident sequences that result in the loss of active containment heat removal capability during an extended loss of alternating current power.

The HNP Unit 2, Phase 2 HCVS provides a reliable containment venting strategy that makes it unlikely that the plant would need to vent from the containment drywell before alternative reliable containment heat removal and pressure control is reestablished. The HNP Unit 2, Phase 2 HCVS strategies implement Severe Accident Water Addition (SAWA) with Severe Accident Water Management (SAWM) as an alternative venting strategy. This strategy consists of the use of the Phase 2 wetwell vent and SAWA hardware to implement a water management strategy that will preserve the wetwell vent path until alternate reliable containment heat removal can be established.

The HNP Unit 2, Phase 1 and Phase 2 HCVS strategies are in compliance with Order EA-13-109. The modifications required to support the HCVS strategies for HNP Unit 2 have been fully implemented in accordance with the station processes.

HCVS Phase 1 and Phase 2 Quality Standards – Complete

The design and operational considerations of the Phase 1 and Phase 2 HCVS installed at HNP Unit 1 complies with the requirements specified in the Order and described in NEI 13-02, Revision 1, "Industry Guidance for Compliance with Order EA-13-109". The Phase 1 and Phase 2 HCVS has been installed in accordance with the station design control process.

The Phase 1 and Phase 2 HCVS components including piping, piping supports, containment isolation valves, containment isolation valve actuators and containment isolation valve position indication have been designed consistent with the design basis of the plant. All other Phase 1 and Phase 2 HCVS components including electrical power supply, valve actuator pneumatic supply and instrumentation have been designed for reliable and rugged performance that is capable of ensuring Phase 1 and Phase 2 HCVS functionality following a seismic event.

HCVS Phase 1 and Phase 2 Programmatic Features - Complete

Storage of portable equipment for HNP Unit 2 Phase 1 and Phase 2 HCVS provides adequate protection from applicable site hazards, and identified paths and deployment areas will be accessible during all modes of operation and during severe accidents, as recommended in NEI 13-02, Revision 1, Section 6.1.2.

Training in the use of the Phase 1 and Phase 2 HCVS for HNP Unit 2 has been completed in accordance with an accepted training process as recommended in NEI 13-02, Revision 1, Section 6.1.3.

Operating and maintenance procedures for HNP Unit 2 have been developed and integrated with existing procedures to ensure safe operation of the Phase 1 and Phase 2 HCVS. Procedures have been verified and are available for use in accordance with the site procedure control program.

Site processes have been established to ensure the Phase 1 and Phase 2 HCVS is tested and maintained as recommended in NEI 13-02, Revision 1, Sections 6.1.2 and 6.2.

HNP Unit 2 has completed validation in accordance with industry developed guidance to assure required tasks, manual actions and decisions for HCVS strategies are feasible and may be executed within the constraints identified in the HCVS Phase 1 and 2 OIP for Order EA-13-109 (References 5 and 6).

HNP Unit 2 has completed evaluations to confirm accessibility, habitability, staffing sufficiency, and communication capability in accordance with NEI 13-02, Sections 4.2.2 and 4.2.3.

References:

The following references support the HNP Unit 2 compliance with the requirements of Order EA-13-109:

1. NRC Order EA-13-109, Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, dated June 6, 2013 (ML 13143A321).

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, dated November 14, 2013 (ML13304B836).

3. NRC Interim Staff Guidance JLD-ISG-2015-01, Compliance with Phase 2 of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions, dated November 14, 2013 (ML15104A118).

4. NEI 13-02, Industry Guidance for Compliance with Order EA-13-109 BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, Revision 1, dated April 2015.

5. SNC Letter, *Edwin I. Hatch Phase I Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Requirements for Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109),* dated June 27, 2014 (ML14178B464).

6. SNC Letter with Combined Phase 1 and 2 Overall Integrated Plan, *Edwin I. Hatch Nuclear Plant – Units 1 and 2 Third Six-Month Status Report of the Implementation of the Commission Order with Regard to Requirements for Reliable Hardened Containment Vents (EA-13-109),* dated December 23, 2015 (ML15357A212).

7. SNC Letter, *Edwin I. Hatch Nuclear Plant – Units 1 and 2 First Six-Month Status Report of the Implementation of Commission Order with Regard to Requirements for Reliable Hardened Containment Vents (EA-13-109)*, dated December 30, 2014.

8. SNC Letter, *Edwin I. Hatch Nuclear Plant – Units 1 and 2 Second Six-Month Status Report of the Implementation of Commission Order with Regard to Requirements for Reliable Hardened Containment Vents (EA-13-109)*, dated June 26, 2015.

9. SNC Letter, *Edwin I. Hatch Nuclear Plant – Units 1 and 2 Fourth Six-Month Status Report of the Implementation of Commission Order with Regard to Requirements for Reliable Hardened Containment Vents (EA-13-109)*, dated June 13, 2016.

10. SNC Letter, *Edwin I. Hatch Nuclear Plant – Units 1 and 2 Fifth Six-Month Status Report of the Implementation of Commission Order with Regard to Requirements for Reliable Hardened Containment Vents (EA-13-109)*, dated December 16, 2016.

11. SNC Letter, *Edwin I. Hatch Nuclear Plant – Units 1 and 2 Sixth Six-Month Status Report of the Implementation of Commission Order with Regard to Requirements for Reliable Hardened Containment Vents (EA-13-109)*, dated June 12, 2017.

12. SNC Letter, *Edwin I. Hatch Nuclear Plant – Units 1 and 2 Seventh Six-Month Status Report of the Implementation of Commission Order with Regard to Requirements for Reliable Hardened Containment Vents (EA-13-109)*, dated December 5, 2017.

13. SNC Letter, *Edwin I. Hatch Nuclear Plant – Units 1 and 2 Eighth Six-Month Status Report of the Implementation of Commission Order with Regard to Requirements for Reliable Hardened Containment Vents (EA-13-109)*, dated June 27, 2018.

14. NRC Letter, *Edwin I. Hatch Nuclear Plant, Units 1 and 2 - Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4479 and MF4480),* dated March 25, 2015 (ML14335A137).

15. NRC Letter, *Edwin I. Hatch Nuclear Plant, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 2 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (CAC NOS. MF4479 and MF4480),* dated August 2, 2016.

16. NRC Letter, *Edwin I. Hatch Nuclear Plant, Units 1 and 2 - Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (CAC NOS. MF4479 and MF4480),* dated September 19, 2017.

17. SNC Letter, *Edwin I. Hatch Nuclear Plant – Unit 1 Completion of Required Action for NRC Order EA-13-109 Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions*, dated April 12, 2018.

Edwin I. Hatch Nuclear Plant – Unit 2
Completion of Required Action for NRC Order EA-13-109
Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions

Enclosure 2

HNP Units 1 and 2 HCVS FIP

Final Integrated Plan

HCVS Order EA-13-109

for

E. I. Hatch Nuclear Plant (HNP)

October 31, 2018, Revision 0

Table of Contents

Section I: Introduction

In 1989, the NRC issued Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," (Reference 1) to all licensees of BWRs with Mark I containments to encourage licensees to voluntarily install a hardened wetwell 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 Nuclear Regulatory Commission (NRC) Commissioners directed the staff per Staff Requirements Memorandum (SRM) for SECY-12-0157, Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments (References 2 and 3), to require licensees with Mark I and Mark II containments to "upgrade or replace the reliable hardened vents required by Order EA-12-050, Order to Modify Licenses with Regard to Reliable Hardened Containment Vents (Reference 4) with a containment venting system designed and installed to remain functional during severe accident conditions." In response, the NRC issued Order EA-13-109, Issuance of Order to Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accidents, June 6, 2013 (Reference 5). The Order (EA-13-109) requires that licensees of BWR facilities with Mark I and Mark II containment designs ensure that these facilities have a reliable hardened vent to remove decay heat from the containment, and to maintain control of containment pressure within acceptable limits following events that result in the loss of active containment heat removal capability while maintaining the capability to operate under severe accident (SA) conditions resulting from an Extended Loss of AC Power (ELAP).

E. I. Hatch Nuclear Plant (HNP) is required by NRC Order EA-13-109 to have a reliable, severe accident capable hardened containment venting system (HCVS).
Order EA-13-109 allows implementation of the HCVS Order in two phases:

- Phase 1 upgraded the venting capabilities from the containment wetwell to provide reliable, severe accident capable hardened vent to assist in preventing core damage and, if necessary, to provide venting capability during severe accident conditions. HNP achieved Phase 1 compliance for Units 1and 2 on February 27, 2018.

- Phase 2 provided additional protections for severe accident conditions through the development of a reliable containment venting strategy that makes it unlikely that HNP would need to vent from the containment drywell during severe accident conditions. HNP achieved Phase 2 compliance for Units 1 and 2 on October 31, 2018.

NEI developed guidance for complying with NRC Order EA-13-109 in 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 (Reference 6) with significant interaction with the NRC and Licensees. NEI issued Revision 1 to NEI 13-02 in April 2015 (Reference 7) which contained guidance for compliance with both Phase 1 and Phase 2 of the order. NEI 13-02, Revision 1 also includes HCVS - Frequently Asked Questions (FAQs) 01 through 09 and reference to white papers, HCVS-WP-01 through 03 (References 8 through 10). The NRC endorsed NEI 13-02 Revision 0 as an acceptable approach for complying with Order EA-13-109 through 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, issued in November 2013 (Reference 12) and JLD-ISG-2015-01, Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions issued in April 2015 (Reference 13) for NEI 13-02 Revision 1 with some clarifications and exceptions. NEI 13-02 Revision 1 provides an acceptable method of compliance for both Phases of Order EA-13-109.

In addition to the endorsed guidance in NEI 13-02, the NRC staff endorsed several other documents that provide guidance for specific areas. HCVS-FAQs 10 through 13 (References 14 through 17) were endorsed by the NRC after NEI 13-02 Revision 1 on October 8, 2015. NRC staff also endorsed four White Papers, HCVS-WP-01 through 04 (References 8 through 11), which cover broader or more complex topics than the FAQs.

As required by the Order, HNP submitted a Phase 1 Overall Integrated Plan (OIP) in June of 2014 (Reference 18) and subsequently submitted a combined Phase 1 and 2 OIP in December 2015 (Reference 19). These OIPs followed the guidance NEI 13-02 Revision 0 and 1, respectively. The NRC staff used the methods described in the ISGs to evaluate licensee compliance as presented in the Order EA-13-109 OIPs. While the Phase 1 and combined Phase 1 and 2 OIPs were written to different revisions of NEI 13-02, HNP conforms to NEI 13-02 Revision 1 for both Phases of Order EA-13-109.

The NRC reviewed each OIP submittal and provided Interim Staff Evaluations (ISEs) (References 20 and 21) that assessed HNP's compliance methods. The ISEs identified open items that were required to be addressed prior to compliance with each Phase of the Order. Six-month status reports, as required by Order EA-13-109 (References 22 through 28), provided updated schedules as well as progress reports and responses to the ISE Open Items. In addition, the site participated in NRC ISE Open Item audit calls where the information provided in the six-month updates and on the E-Portal were used by the NRC staff to determine whether the ISE Open Items were addressed.

By submittal of this Final Integrated Plan, HNP has addressed all the elements of NRC Order EA-13-109 utilizing the endorsed guidance in NEI 13-02, Rev 1 and the related HCVS-FAQs and HCVS-WPs documents. In addition, the site has addressed the NRC Phase 1 and Phase 2 ISE Open Items as documented in previous six-month updates and documented in the NRC Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 letter (Reference 37).

Section III contains the HNP Final Integrated Plan details for Phase 1 of the Order. Section IV contains the HNP Final Integrated Plan details for Phase 2 of the Order.

Section V details the programmatic elements of compliance.

Section I.A: Summary of Compliance

Section I.A.1: Summary of Phase 1 Compliance

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

The HCVS is initiated via manual action from the Main Control Room (MCR) or Remote Operating Station (ROS) at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms.

- The vent utilizes containment parameters of pressure and level from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation is monitored by HCVS valve position, temperature and effluent radiation levels.
- The HCVS motive force is monitored and has 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 are capable of being maintained for a sustained period of at least 7 days.

The operation of the HCVS is designed to minimize the reliance on operator actions in response to external hazards. The screened in external hazards for HNP are seismic, high winds, extreme high temperature, and extreme cold – ice only. Initial operator actions are completed by plant personnel and include the capability for remote-manual initiation from the HCVS Remote Operating Station. Attachment 2 contains a one-line diagram of the HCVS vent flow path.

Section I.A.2: Summary of Phase 2 Compliance

The Phase 2 actions can be summarized as follows:

- Utilization of Severe Accident Water Addition (SAWA) to initially inject water into the Reactor Pressure Vessel (RPV).
- Utilization of Severe Accident Water Management (SAWM) to control injection and Suppression Pool level to ensure the HCVS Phase 1 wetwell vent will remain functional for the removal of heat from the containment.
- Heat can be removed from the containment for at least seven (7) days using the HCVS or until alternate means of heat removal are established that make it unlikely the drywell vent will be required for containment pressure control.

- The SAWA and SAWM actions can be manually activated and controlled from areas that are accessible during severe accident conditions.
- Drywell pressure, Suppression Pool level, SAWA flowrate and the HCVS Phase 1 vent path parameters are measured.

The locations of the SAWA equipment and controls, as well as ingress and egress paths, have been evaluated for the expected severe accident conditions (temperature, humidity, radiation) for the Sustained Operating period. Equipment has been evaluated to remain operational throughout the Sustained Operating period. Personnel radiological exposure, temperature and humidity conditions for operation of SAWA equipment will not exceed the limits for ERO dose or plant safety guidelines for temperature and humidity.

The SAWA flow path is the same as the FLEX primary injection flow path with no changes from the flow path reviewed for Order EA-12-049 compliance.

The SAWA electrical loads are addressed in the design documents listed below for sequential operation of RHR valves from the Main Control Room (MCR) after re-energization of Reactor Building MCCs from the Control Building.

Documentation	Title
SENH-13-001	Station Service Battery 1A U1 SBO Extended Coping Time Study, Version 1
SENH-13-002	Station Service Battery 1B U1 SBO Extended Coping Time Study, Version 1
SENH-14-001	Inverter Sizing for FLEX Instrument Cabinets 1A & 1B, Version 2
RER SNC699222-02	Assessment of RHR Flow path sequential valve operation
A-53324	Assessment of unintentional valve movement when energizing 1/2R24-S011/12/18A/18B with FLEX Generator
SENH-13-003	Station Service Battery 2A SBO Extended Coping Time Study, Version 1.0
SENH-13-004	Station Service Battery 2B SBO Extended Coping Time Study, Version 1.0
SENH-13-005	Load Data for Sizing the Inverters for FLEX and HCVS
SENH-13-006	Inverter Sizing for FLEX Instrument Cabinets 2A & 2B, Version 2.0

The FLEX Diesel Generators (DGs) are located west and south of the RB. The FLEX DGs are staged a significant distance and on the opposite side of the plant from the discharge of the HCVS through the Main Stack (located on the east side of the plant). See Attachment 6 for applicable locations. Refueling of the FLEX DG is accomplished from the installed EDG fuel oil tanks as described in the Order EA-12-049 FIP and Safety Evaluation.

Evaluations for projected SA conditions (radiation / temperature) indicate that personnel can complete the initial and support activities without exceeding the site safety standards or ERO-allowable dose for equipment operation.

Electrical equipment and instrumentation is powered from the existing station batteries, and from AC distribution systems that are powered from the FLEX DGs. The battery chargers are also powered from the FLEX generators to maintain the battery capacities during the Sustained Operating period.

Section II: List of Acronyms

AC	Alternating Current
AOV	Air Operated Valve
BDBEE	Beyond Design Basis External Event
BWROG	Boiling Water Reactor Owners' Group
CAP	Containment Accident Pressure
CST	Condensate Storage Tank
DC	Direct Current
DG	Diesel Generator
ECCS	Emergency Core Cooling Systems
ELAP	Extended Loss of AC Power
EOP	Emergency Operating Procedure
EPG/SAG	Emergency Procedure and Severe Accident Guidelines
EPRI	Electric Power Research Institute
ERO	Emergency Response Organization
FAQ	Frequently Asked Question
FIP	Final Integrated Plan
FLEX	Diverse & Flexible Coping Strategy
FSB	FLEX Storage Building
FSAR	Final Safety Analysis Report
GL8916HV	Generic Letter hardened vent
GPM	Gallons per minute
HCVS	Hardened Containment Vent System
HNP	E. I. Hatch Nuclear Plant
ISE	Interim Staff Evaluation
ISG	Interim Staff Guidance
JLD	Japan Lessons Learned Project Directorate
LPCI	Low Pressure Coolant Injection (RHR flow path)
MAAP	Modular Accident Analysis Program
MCR	Main Control Room
N_2	Nitrogen
NEI	Nuclear Energy Institute
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
OIP	Overall Integrated Plan
PCPL	Primary Containment Pressure Limit
RCIC	Reactor Core Isolation Cooling System
RHR	Residual Heat Removal System
RHRSW	RHR Service Water System
RM	Radiation Monitor
ROS	Remote Operating Station
RPV	Reactor Pressure Vessel
RWCU	Reactor Water Cleanup

SA	Severe Accident
SAMG	Severe Accident Management Guidelines
SAWA	Severe Accident Water Addition
SAWM	Severe Accident Water Management
SBGT	Standby Gas Treatment System
SFP	Spent Fuel Pool
SRV	Safety-Relief Valve
UFSAR	Updated Final Safety Analysis Report
VAC	Voltage AC
VDC	Voltage DC
WW	Wetwell

Section III: Phase 1 Final Integrated Plan Details

Section III.A: HCVS Phase 1 Compliance Overview

HNP modified the existing hardened wetwell vent path installed in response to NRC Generic Letter 89-16 to comply with NRC Order EA-13-109.

Section III.A.1: Generic Letter 89-16 Vent System

HNP installed a hardened containment vent (Generic Letter 89-16 hardened vent (GL8916HV) system) in response to NRC Generic Letter 89-16. The modifications associated with the GL8916HV vent were performed under the provisions of 10CFR50.59 and thus the HNP GL8916HV was designed, analyzed, and implemented consistent with the design basis of the plant. The existing GL8916HV vent path at HNP consists of a wetwell and drywell vent on each unit. The drywell vent exits the Primary Containment into the Reactor Building and proceeds down to the torus bay. Wetwell and drywell vent piping merges into a common header in the torus bay. Vent path for both wetwell and drywell exits the reactor building through an underground pipe. This pipe travels approximately 500 feet from both units and combines in a mixing chamber at the base of the substantial concrete Main Stack. All effluents exit out the Main Stack.

Section III.A.2: EA-13-109 Hardened Containment Vent System (HCVS)

The Order EA-13-109 compliant HCVS system utilizes the GL 89-16 wetwell vent system. The vent system is initiated, operated and monitored from the MCR using the switches described above. A ROS has been installed in a readily accessible location and provides a means to manually operate the wetwell vent. The controls available at the ROS are accessible and functional under a range of plant conditions, including severe accident conditions. The ROS is located at the 147' elevation of the Control Building, which is one floor below the elevation of the MCR and one floor above ground level. Table 2 provides the evaluation of the acceptability of the ROS location with respect to severe accident conditions.

All electrical power required for operation of HCVS components is routed through two inverters per unit, one for each electrical division. These inverters were sized at 7.5 kW each and convert DC power from installed batteries into AC power for the end users (instruments, solenoid valves, etc.). Battery power is provided by the existing station service batteries for at least 12 hours following an ELAP event. At about 12 hours, power can be transferred to the HCVS dedicated batteries that can supply power for an additional time of >12 hours. At 24 hours, power can be transferred back to the normal configuration, where it is expected that FLEX generators will be in service providing power to the DC bus.

The Main Control Room is the primary operating station for the HCVS. During an ELAP, electric power to operate the vent valves will be provided by batteries with a capacity to supply the required loads for at least the first 24 hours. Before the batteries are depleted, the FLEX generator will recharge batteries to support operation of the vent valves. The ROS is designated as the alternate control location and method and is powered via the batteries or FLEX DGs. Attachment 2 shows the HCVS vent flow path.

Regarding the MCR location, the operators can operate the HCVS isolation as well as monitor HCVS vent valve position, drywell pressure, suppression pool level, and backup nitrogen pressure. HCVS radiation monitor (RM) instrumentation and vent pipe temperature indication are also in the MCR area. The ROS has HCVS effluent temperature, pneumatic supply pressure, valve position indication, power status and effluent radiation monitor indicators. Table 1 contains a complete list of instruments available to the operators for operating and monitoring the HCVS.

The following list highlights the final electrical design installed for each unit:

- Added a new ROS to control the HCVS valves and display indication of the new vent temperature, pneumatic supply pressure, and vent radiation monitor instrumentation.

- Added a new radiation monitor for monitoring effluent in the wetwell vent path, with remote indication in the Main Control Room (MCR) and at the Remote Operating Station (ROS.)

- Added a new temperature element for monitoring effluent in the wetwell vent path, with indication in the MCR and at the ROS.

- Added a new pressure transmitter for monitoring the pneumatic supply to the HCVS valves, with indication in the MCR and at the ROS.

- Added new dedicated HCVS batteries and chargers (Division 1 and 2) to supplement the existing station batteries and extend battery capacity to 24-hours for HCVS equipment.

The one-line diagram of the HCVS electrical distribution system is in Attachment 3 and the one-line diagram for the HCVS instrumentation is in Attachment 3a (design is typical for both units).

The wetwell vent up to, and including, the second containment isolation barrier, is designed consistent with the design basis of the plant. These items include piping, piping supports, containment isolation valves, containment isolation valve actuators and containment isolation valve position indication components. The original design for the GL 89-16 vent line was 343°F, so engineering judgement was used for qualification to 350°F based on downstream cooling of hardened vent piping, between the wetwell and Main Stack mixing chamber.

The new equipment procured to comply with Order EA-13-109, was purchased through new specifications for the ROS, batteries, and battery charger. Those specifications contained the required parameters for the equipment to operate under normal operational conditions, design basis accidents, and BDBEE requirements. The radiation monitor is an "off the shelf" monitor without its own specification. It was procured with a datasheet specific to HNP for radiation and temperature requirements.

Each engineered item procured with a specification required the vendor to provide test reports that verified that the test specimens were in compliance with the specification requirements. The radiation monitor also has multiple test reports which document compliance with required operating conditions/parameters.

Other commodities such as conduit, wiring, transfer switches, piping, etc. were procured consistent with the design requirements of the systems and locations where they were being installed. For example, items installed in the control building – non-harsh environment were procured according to temperature considerations consistent with current SBO temperatures and radiation. These other items like pipe, cable, valves, transmitters were procured Augmented Quality as necessary to meet the BDBEE requirements for the location where they were installed. The majority of installed equipment is located outside the reactor building, and therefore does not require additional qualification beyond normal operating/accident conditions of the plant

Calculations determined the hydrogen concentrations in the piping connected to the main plant stack mixing chamber (reference SMNH-13-023). To prevent leakage of vented effluent to other parts of the Reactor Building or other systems (Standby Gas Treatment), boundary valves 1T46-F005, 1T48-F081, 1T48-F082, 1T48-F083, 1T48-F320, 1N62-F526A, 1N62-F526B, 2N62-F054A, 2N62-F054B, 2T46-F002A, 2T48-F081, 2T48-F082, 2T48-F083 2T48-F085 and 2T48-F320 require closure to prevent crossflow of vented effluent (reference calculation and DOEJ-HDSNC598056-M001, DOEJ-HDSNC692852-M001, and DOEJ-HDSNC598056-M003). Valves 1T46-F005, 1T48-F081, 1T48-F082, 1T48-F083, 1T48-F320, 1N62-F526A, 1N62-F526B, 2N62-F054A, 2N62-F054B, 2T46-F002A, 2T48-F081, 2T48-F082, 2T48-F083 2T48-F085 and 2T48-F320 are leak tested in accordance with 10CFR50, Appendix J. This is acceptable for prevention of inadvertent cross-flow of vented fluids per HCVS-FAQ-05.

To prevent inadvertent actuation, the HCVS includes a key lock switch at the primary control which is an acceptable method of preventing inadvertent actuation per

NEI 13-02. In addition, the HCVS has a rupture disc located downstream of the control valve. This rupture disc has a burst set pressure above the header pressure expected (at the disc) during a design basis event (because of the timing of the isolation valve closure). Actuation of the rupture disc, for FLEX anticipatory venting, will occur outside of the MCR and will require manual operation. During Severe Accident venting, the rupture disc will passively breach at approximately 17 psig when the vent line is opened from the MCR.

As required by Order EA-13-109, Section 1.2.11, the wetwell vent is designed to prevent air/oxygen backflow into the discharge piping to ensure the flammability limits of hydrogen, and other non-condensable gases, are not reached. HNP utilizes the Main Stack HVAC duct instrument test ports for introduction of argon into the Main Stack mixing chamber. Argon is heavier than air and will fall from the instrument test port into the base of the mixing chamber. Sufficient volume of argon will be introduced to fill the mixing chamber and "spill over" into connected system pipes. Additional defense against oxygen infiltration into the HCVS or connected systems, if the venting has ceased, is accomplished by introducing Argon into the vent path a second time within the first few minutes of closing the vent path.

The HCVS radiation monitor with an ion chamber detector is qualified for the ELAP and external event conditions. In addition to the RM, a temperature element is installed on the vent line to provide operators with the ability to monitor operation of the HCVS. Electrical components and controls are seismically qualified and can handle harsh environmental conditions (although they are not considered part of the site Environmental Qualification (EQ) program).

<u>Section III.B</u>: HCVS Phase 1 Evaluation Against Requirements:

The functional requirements of Phase 1 of NRC Order EA-13-109 are outlined below along with an evaluation of the HNP response to maintain compliance with the Order and guidance from JLD-ISG-2015-01. Due to the difference between NEI 13-02, Revision 0 and Revision 1, only Revision 1 will be evaluated. Per JLD-ISG-2015-01, this is acceptable as Revision 1 provides acceptable guidance for compliance with Phase 1 and Phase 2 of the Order.

1. HCVS Functional Requirements

1.1 The design of the HCVS shall consider the following performance objectives:

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

<u>Evaluation:</u>

The operation of the HCVS was designed to minimize the reliance on operator actions in response to hazards identified in NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide* (Reference 31), which are applicable to the plant site. Operator actions to initiate the

HCVS vent path can be completed by plant personnel and include the capability for remote-manual initiation from the HCVS Remote Operating Station. A list of the remote manual actions performed by plant personnel to open the HCVS vent path is in the following table:

Table 3-1: HCVS Operator Actions

Primary Action	Primary Location/ Component	Notes
1. Isolate Standby Gas Treatment System (SBGT) by closing inlet valve 1/2T48-F081 and outlet isolation valves 1T46-F005, 2T46-F002A & F002B	Hand switches located in the MCR	or at the Remote Operating Station (ROS), depending on where operator of HCVS is stationed
2. Disable PCIV interlocks by Installing electrical jumpers for PCIVs (Reference Procedures 31EO-EOP-101-1 and 31EO-EOP-101-2)	Panels in MCR containing PCIV interlocks	
3. Confirm closed HCVS condensate drain valve 2T48-F085 (Unit 2 only)	Hand switch located in the Unit 2 MCR for condensate drain valve	And at ROS panel Unit 2 only.
4. Breach the rupture disc by opening the argon cylinder valve & valve 1/2T48-F407	Manual hand wheels for valves at the argon bottle and at the piping at the argon bottle station	Not required during SA event. Only required if performing early venting for FLEX
5. Close argon cylinder valve & valve 1/2T48-F407	Manual hand wheels for valves at the argon bottle and at the piping at the argon bottle station	Not required during SA event. Only required if performing early venting for FLEX
6. Open Wetwell PCIVs 1/2T48-F318 & 1/2T48-F326	Hand switches located in the MCR	And at ROS
7. Open HCVS vent control valve 1/2T48-F082	Hand switch for valve in the MCR	And at ROS
8. Align power supplies for all valves and instruments via Inverters 1/2R44-S006 & 1/2R44-S007.	Instruments and controls located in the MCR or Control Building	Prior to depletion of station batteries, actions will be required to swap to dedicated HCVS power supply.
9. Replenish pneumatics with replaceable nitrogen bottles	Primary nitrogen bottles for FLEX response and early venting are located in the Reactor Building. Back-up nitrogen bottles are installed in the Control Building to	Prior to depletion of the pneumatic sources actions will be required to connect back-up sources at a time greater than 24 hours.

Primary Action	Primary Location/ Component	Notes
	ensure severe accident pneumatic supply access.	
10. Re-align power supplies for all valves and instruments via Inverters 1/2R44-S006 & 1/2R44-S007.	Instruments and controls located in the MCR or Control Building	Prior to depletion of the installed power sources actions will be required to connect back-up sources at a time greater than 24 hours.

Permanently installed electrical power and pneumatic supplies are available to support operation and monitoring of the HCVS for a minimum of 24 hours.

After 24 hours, available personnel will be able to connect supplemental electric power and pneumatic supplies for sustained operation of the HCVS for a minimum of 7 days. The FLEX generators provide this motive force. The actions in Table 3-1 are expected to be completed in less than 24 hours, however, the HCVS can be operated for at least 24 hours without any supplementation.

The actions in Table 3-1 (above) conform to the guidance in NEI 13-02 Revision 1 Section 4.2.6 for minimizing reliance on Operator actions and are acceptable for compliance with Order element A.1.1.1. These were identified in the OIP and subsequent NRC ISE.

Table 3-2 provides a Failure Evaluation of select HCVS vent path action.

Table 3-2: Failure Evaluation

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, power is already tied into station service battery via inverter for minimum 12 hours	No
Failure of Vent to Open on Demand	Valves fail to open/close due to loss of alternate AC power (long term)	Connect dedicated batteries to inverter via transfer switch for minimum 12 hours	No

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 complete loss of batteries (long term)	Recharge station service batteries with FLEX provided generators, considering severe accident conditions	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 F082 valve over first 24 hours.	No
Failure of Vent to Open on Demand	Valves fail to open/close due to loss of alternate pneumatic air supply (long term)	Tie-in nitrogen cylinders to air system supporting HCVS valves, replace bottles as needed.	No
Failure of Vent to Open on Demand	Valves fail to open/close due to SOV failure	Heroic action needed	Yes

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

Evaluation:

Primary control of the HCVS is accomplished from the main control room. Alternate control of the HCVS is accomplished from the ROS at the 147'elevation of the Control Building, one floor below MCR. FLEX actions that will maintain the MCR and ROS habitable were implemented in response to NRC Order EA-12-049 (Reference 31). These include:

1. Opening MCR doors to the outside (if required)

2. Restoring MCR ventilation via the FLEX DG. MCR ventilation was included as a load in the FLEX generator sizing calculations and is acceptable.

3. Providing cooling water to MCR ventilation near the MCR

Table 2 contains a thermal evaluation of all the operator actions that may be required to support HCVS operation. The relevant ventilation calculation (the same ones used for the Order EA-12-049 response) demonstrate that the final design meets the order requirements to minimize the plant operators' exposure to occupational hazards.

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

Evaluation:

As previously stated, primary control of the HCVS is accomplished from the main control room. Under the postulated scenarios of order EA-13-109, the control room is adequately protected from excessive radiation dose and no further evaluation of its use is required. (Reference HCVS-FAQ-06)

Alternate control of the HCVS is accomplished from the ROS. The ROS was evaluated for radiation effects due to a severe accident and determined to be acceptable. The ROS is located in a low dose area during normal operation. During an accident resulting in core ex-vessel, the core material will be further from the ROS than during normal operation. In addition, there will be additional shielding from the two additional concrete floors after the core has re-located to the pedestal area. The additional distance and shielding combined with the short duration of actions required at the ROS show the ROS to be an acceptable location for alternate control.

Table 2 contains a radiological evaluation of the operator actions that may be required to support HCVS operation in a severe accident. There are no abnormal radiological conditions present for HCVS operation without core damage. The evaluation of radiological hazards demonstrates that the final design meets the order requirements to minimize the plant operators' exposure to radiological hazards.

The HCVS vent is routed away from the MCR such that building structures provide shielding, thus per HCVS-FAQ-01 the MCR is the preferred control location. If venting operations create the potential for airborne contamination in the MCR, the ERO will provide personal protective equipment to minimize any operator exposure.

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

Evaluation:

Primary control of the HCVS is accomplished from the main control room. Under the postulated scenarios of Order EA-13-109 the control room is adequately protected from excessive radiation dose and no further evaluation of its use is required (HCVS-FAQ-06).

Alternate control of the HCVS is accomplished from the ROS at the 147' elevation of the Control Building. The ROS at the 147' elevation of the Control Building is in an area evaluated to be accessible before and during a severe accident.

For ELAP with injection, the HCVS wetwell vent will be opened to protect the containment from overpressure. The operator actions to perform this function under ELAP conditions (and timing of those actions) were evaluated as part of HNP response to NRC Order EA-12-049 as stated in the HNP SE (Reference 58).

Table 2 contains a thermal and radiological evaluation of all the operator actions at the MCR or alternate location that may be required to support HCVS operation during a severe accident. The relevant ventilation calculations demonstrate that the final design meets the order requirements to minimize the plant operators' exposure to occupational and radiological hazards.

Table 1 contains an evaluation of the controls and indications that are or may be required to operate the HCVS during a severe accident. The evaluation demonstrates that the controls and indications are accessible and functional during a severe accident with a loss of AC power and inadequate containment cooling.

1.2 The HCVS shall include the following design features:

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

<u>Evaluation</u>

The suppression pool is capable of accepting exhausted steam from the reactor core isolation cooling (RCIC) system and safety relief valves (SRVs) without any suppression pool cooling for the duration of the station blackout (SBO) event. (Reference Section 8.4 of the Final Safety Analysis Report)

The current containment and Reactor Pressure Vessel thermal hydraulic analysis for SBO took credit for analysis performed for 10CFR50, Appendix R (fire protection). As part of the extended power uprate, the SBO scenario was reanalyzed assuming that suppression pool cooling was initiated in 1 hour when the alternate AC is assumed available. The peak pool temperature is 167 °F. Even if SPC is not initiated until 4 hours, the resulting peak pool temperature of 194 °F is acceptable for containment and ECCS pump operation. (Reference NEDC- 32749P, "Extended Power Uprate Safety Analysis Report for Edwin I. Hatch Units 1 and 2," July 1997 and GE MDE-03-0186 "Safe Shutdown Appendix R Analysis for Edwin I. Hatch Nuclear Power Station Units 1 and 2"). Additionally, the evaluation in FLEX NEDC 33771 P, "GEH Evaluation of FLEX Implementation Guidelines," (a FLEX OIP reference) determined that a 12-inch vent provided adequate venting. The size of the HNP wetwell portion of the HCVS is ≥18 inches in diameter which provides adequate capacity to meet or exceed the Order criteria. The stack mixing chamber and Main Stack pipe is ≥18 inches also, thus based on the NEDC assessment of a 12-inch vent, the HNP vent (≥18 inches) is adequate.

The decay heat absorbing capacity of the suppression pool and the selection of venting pressure were made such that the HCVS will have sufficient capacity to maintain containment pressure at or below the containment design pressure (56 psig) (the lower of CDP or PCPL (62 psig)). This assessment of containment response is contained in the HNP FSAR that was reviewed by the NRC in the Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 letter, ML17254A042 (Phase 1 ISE Open Item 6). It also shows that containment is maintained below the design pressure once the vent is opened, even if it is not opened until PCPL.

1.2.2 The HCVS shall discharge the effluent to a release point above main plant structures.

<u>Evaluation</u>

The wetwell vent exits the Primary Containment through the torus bay through an underground pipe. This pipe travels approximately 500 feet from both units and combines in a mixing chamber at the base of the Main Stack. All effluents exit out the Main Stack.

The HCVS discharge path uses the Main Stack.

Based on the above description of the vent pipe design, the HNP HCVS vent pipe design meets the order requirement to be robust with respect to all external hazards including wind-borne missiles.

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

Evaluation

Cross flow potential exists between the HCVS and the Standby Gas Treatment System (SBGT). These valves are tested, and will continue to be tested, for leakage under 10CFR50 Appendix J (Reference HNP LLRT program procedure 42SV-TET-001-2) as part of the containment boundary in accordance with HCVS-FAQ-05. An additional cross-flow avenue exists between the HCVS of the two units and other connected systems at the mixing chamber in the shared Main Stack. The interfacing valves in the Main Stack mixing chamber are connected to long runs of piping that will be evacuated of any combustible gases before combustible gas levels are approached. However, for defense in depth and per the testing criteria in HCVS-FAQ-04, the interfacing valves were leak tested as described in HCVS-FAQ-05. (Reference DOEJ-HDSNC-598056-M003 and calculations SMNH-13-023). The assessment to minimize unintended cross flow of vented fluids was reviewed by the NRC in the Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 letter, ML17254A042 (Phase 1 ISE Open Item 12).

Based on the above description, the HNP design meets the requirements to minimize unintended cross-flow of vented fluids within a unit and between units on site.

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.

Evaluation

The existing HCVS allows for initiation and then operation and monitoring from a control panel located in the MCR.

1.2.5 The HCVS shall 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.

Evaluation

To meet the requirement for an alternate means of operation, the ROS, a readily accessible alternate location was added. Initial operator actions can be completed by Operators from the HCVS control stations (MCR and/or ROS) and include remote-manual initiation. The operator actions required to open a vent path are as described in Table 3-1. Remote-manual is defined 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 and this provides a diverse method of valve operation that improves system reliability.

The ROS is located on the 147' elevation of the Control Building in an area shielded from the HCVS vent pipe by intervening structures, with a direct path to the MCR. Refer to the sketch provided in Attachment 6 for the HCVS site layout. The controls available at the ROS location are accessible and functional under a range of plant conditions, including severe accident conditions (with due consideration to source term and dose impact on operator exposure), extended loss of AC power (ELAP), inadequate containment cooling, and loss of reactor building ventilation. Table 1 contains an evaluation of all the controls and instruments that are required for severe accident response and demonstrates their functionality during a loss of AC power and severe accident. Table 2 contains a thermal and radiological evaluation of all operator actions that may be required to support HCVS operation during a loss of AC power and severe accident, and demonstrates that these actions will be possible without undue hazard to the operators. Attachment 6 contains a site layout showing the location of these HCVS actions.

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

Evaluation

HCVS-WP-01 contains clarification on the definition of “dedicated and permanently installed” with respect to the Order. In summary, it is acceptable to use plant equipment that is used for other functions, but it is not acceptable to credit in the first 24-hour period of the ELAP, portable equipment that must be moved and connected.

During a no-core damage ELAP scenario, FLEX generators will be manually deployed, connected, started and loaded, so there will be no need to use other power sources for HCVS wetwell venting components during the first 24 hours. However, this Order element does not allow crediting of FLEX generators for HCVS wetwell venting components until after 24 hours. Therefore, electrical power required for operation of HCVS components in the first 24 hours will come from existing station service batteries and dedicated HCVS batteries. Both sets of these batteries are permanently installed in the Control Building where they are protected from the applicable hazards and have sufficient capacity to provide this power without recharging. Calculation SENH-16-003 demonstrated that the combined battery capacity is sufficient to supply HCVS wetwell venting components for >24 hours. At 24 hours, FLEX generators can be credited to repower the station critical instrument buses and/or the battery charger to recharge the station service batteries. Combustible gas control during recharging and room temperature control is per the response to Order EA-12-049. Calculation SENH-13-003 included the station service battery chargers in the FLEX DG loading calculations. There is no additional load on the FLEX DG for HCVS beyond those included in the FLEX DG loading calculations. Thus, the FLEX DGs are capable of carrying HCVS wetwell venting components electrical loads. Station service battery voltage status will be indicated on the ROS so that operators will be able to monitor the status of the station service batteries. Attachment 3 and 3a contains a diagram of the HCVS electrical distribution system and HCVS instrumentation.

Pneumatic power for the HCVS valve actuators is normally provided by the non-interruptible air system with backup accumulators which can be supplemented (post 24 hours) with nitrogen bottles. Following an ELAP event, the non-interruptible air system is lost and normal backup from installed nitrogen supply tanks is isolated. Installed dedicated air accumulator tanks supply pneumatics for the first 24 hours for hardened wetwell vent valves. These tanks will supply the required motive force to those HCVS valves needed to maintain flow through the HCVS effluent piping. After the first 24 hours, backup nitrogen provided by nitrogen supply bottles located near the ROS will be manually valved-in and the bottles will be replenished as needed. Calculation SMNH-13-013 demonstrated that these installed tanks have the capacity to supply the required motive force to those HCVS valves needed to maintain flow through the HCVS effluent piping for 24 hours without replenishment.

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

Evaluation

Emergency operating procedures provide clear guidance that the HCVS is not to be used to defeat containment integrity during any design basis transients and accidents. In addition, the HCVS was designed to provide features to prevent inadvertent actuation due to equipment malfunction or operator error. Also, these protections are designed such that any credited containment accident pressure (CAP) that would provide net positive suction head to the emergency core cooling system (ECCS) pumps will be available (inclusive of a design basis loss-of-coolant accident). However, the ECCS pumps will not have normal power available because of the ELAP.

The containment isolation valves must be open to permit vent flow. Inadvertent actuation protection is provided by the current containment isolation circuitry associated with the PCIVs used to operate the HCVS. The physical features that prevent inadvertent actuation are the key lock switch at the primary control station and a rupture disc located downstream. This rupture disc has a burst set pressure above the header pressure expected (at the disc) during a design basis event. Intentional breaching of the rupture disc will occur outside of the MCR and will require manual operation. These design features meet the requirement to prevent inadvertent actuation of HCVS.

1.2.8 The HCVS shall include a 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.

Evaluation

The HCVS includes indications for HCVS valve position, vent pipe temperature and effluent radiation levels in the MCR, as well as information on the status of station service battery voltage supporting systems.

This monitoring instrumentation provides the indication from the MCR per Requirement 1.2.4. The wetwell HCVS and required containment instrumentation will be supplied by the station service batteries and dedicated installed batteries designed for sustained operation during an ELAP event using the FLEX equipment.

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

The HCVS instruments, including valve position indication, vent pipe temperature, radiation monitoring, and support system monitoring, are seismically qualified as indicated on Table 1 and include the ability to handle harsh environmental conditions (although they may not be considered part of the site Environmental Qualification (EQ) program).

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.

Evaluation

The HCVS radiation monitoring system consists of an ion chamber detector coupled to a process and control module. The process and control module is mounted in MCR panel 1/2H11-P654. The detector (1/2T48-N152) is installed in the torus bay. The radiation detector electronics (1/2T48-K152) and line filter (1/2T48-S006) are installed in enclosure 1/2T48-P801 in the control building adjacent to the ROS (same for Unit 1). The RM detector is fully qualified for the expected environment at the vent pipe during accident conditions, and the process and control module is qualified for the mild environment in the CB. Both components are qualified for the seismic requirements. Table 1 includes a description and qualification information on the radiation monitor.

1.2.10 The HCVS shall be designed to withstand and remain functional during severe accident conditions, including containment pressure, temperature, and radiation while venting steam, hydrogen, and other non-condensable gases and aerosols. The design is not required to exceed the current capability of the limiting containment components.

Evaluation

The wetwell vent up to, and including, the second containment isolation valve is designed consistent with HNP's design basis. These items include piping, piping supports, containment isolation valves, containment isolation valve actuators and containment isolation valve position indication components.

The existing hardened wetwell vent piping and components installed downstream of the containment isolation boundary are designed for beyond design basis conditions.

HCVS piping and components have been analyzed and shown to perform under severe accident conditions using the guidance provided in HCVS-FAQ-08 and HCVS-WP-02. The existing PCIVs (designed and procured to meet the containment design pressures) which perform a Design Basis function were utilized for the HCVS and therefore (per NEI 13-02) no further evaluation of these PCIVs is required. The expected differential pressure and temperatures are within the scope of containment design for compliance with GL 89-16 since containment pressure is managed below the design pressure.

The NRC performed an assessment of the HCVS components for capability during severe accident conditions in the NRC Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items

Related to NRC Order EA-13-109 letter, ML17254A042, Phase 1 Open Item 14.

Refer to Order EA-13-109, requirement 1.2.11 for a discussion on designing for combustible gas.

1.2.11 The HCVS shall be designed and operated to ensure the flammability limits of gases passing through the system are not reached; otherwise, the system shall be designed to withstand dynamic loading resulting from hydrogen deflagration and detonation.

Evaluation

Per the NRC Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 letter (Reference 37) for Phase 1 Open Item 10, HNP's DOEJ-HDSNC598056-M003 (Documentation of Engineering Judgement) addressed the HCVS Control of Flammable Gases and was considered to be consistent with Option 1 of the endorsed white paper HCVS-WP-03.

In addition, HNP plans to close HCVS boundary valves and Main Stack interconnecting valves and purge the Main Stack mixing chamber. HNP will utilize a portable DG deployed to the stack to repower the stack mixing chamber fans and power operators on some of the interconnecting valves.

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

Evaluation

The response under Order element 1.2.3 explains how the potential for hydrogen migration into other systems, the reactor building, or other buildings is minimized.

1.2.13 The HCVS shall include features and provisions for the operation, testing, inspection and maintenance adequate to ensure that reliable function and capability are maintained.

Evaluation:

As endorsed in the ISG, sections 5.4 and 6.2 of NEI 13-02 provide acceptable method(s) for satisfying the requirements for operation, testing, inspection, and maintenance of the HCVS.

Primary and secondary containment required leakage testing is covered under existing design basis testing programs. The HCVS outboard of the containment boundary shall be tested to ensure that vent flow is released to the outside environment with minimal leakage, if any, through the interfacing boundaries with other systems or units.

HNP has implemented the following operation, testing and inspection requirements for the HCVS to ensure reliable operation of the system. These are from NEI 13-02, Table 6.1. The implementing modification packages contain these as well as additional testing required for post-modification testing.

Table 3-3: Testing and Inspection Requirements

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

[1] Not required for HCVS check valves.

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

[3] Not required if integrity of check function (open and closed) is demonstrated by other plant testing requirements.

[4] After two consecutive successful performances, the test frequency may be reduced by one operating cycle to a maximum of once per every fourth operating cycle.

[5] Interfacing system boundary valves that are normally closed and fail closed under ELAP conditions (loss of power and/or air) do not require control function testing under this section. Performing existing plant design basis function testing or system operation that reposition the valve(s) to the HCVS required position will meet this requirement without the need for additional testing.

2. HCVS Quality Standards

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

Evaluation:

The HCVS upstream of and including the second containment isolation valve (1/2T48-F326) and penetrations are not being modified for order compliance to ensure that they continue to be designed consistent with the design basis of primary containment including pressure, temperature, radiation, and seismic loads.

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

Evaluation:

The HCVS components downstream of the outboard containment isolation valve and components that interface with the HCVS are routed in seismically qualified structures or supported from seismically qualified structures.

The HCVS downstream of the outboard containment isolation valve, including piping and supports, electrical power supply, valve actuator pneumatic supply, and instrumentation (local and remote) components, have been designed and analyzed to conform to the requirements consistent with the applicable design codes for the plant and to ensure functionality following a design basis earthquake. This includes environmental qualification consistent with expected conditions at the equipment location.

Table 1 contains a list of components, controls and instruments required to operate HCVS, their qualification and evaluation against the expected conditions. All instruments are fully qualified for the expected seismic conditions so that they will remain functional following a seismic event.

Section IV: HCVS Phase 2 Final Integrated Plan

Section IV.A: The requirements of EA-13-109, Attachment 2, Section B for Phase 2

Licensees with BWRs Mark 1 and Mark II containments shall either:

(1) Design and install a HCVS, using a vent path from the containment drywell, that meets the requirements in section B.1 below, or

(2) Develop and implement a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell before alternate reliable containment heat removal and pressure control is reestablished and meets the requirements in Section B.2 below.

B.1. HCVS Drywell Vent Functional Requirements

1.1 The drywell venting system shall be designed to vent the containment atmosphere (including steam, hydrogen, non-condensable gases, aerosols, and fission products), and control containment pressure within acceptable limits during severe accident conditions.

1.2 The same functional requirements (reflecting accident conditions in the drywell), quality requirements, and programmatic requirements defined in Section A of this Attachment for the wetwell venting system shall also apply to the drywell venting system.

B.2. Containment Venting Strategy Requirements

Licensees choosing to develop and implement a reliable containment venting strategy that does not require a reliable, severe accident capable drywell venting system shall meet the following requirements:

2.1 The strategy making it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions shall be part of the overall accident management plan for Mark I and Mark II containments.

2.2 The licensee shall provide supporting documentation demonstrating that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.

2.3 Implementation of the strategy shall include licensees preparing the necessary procedures, defining and fulfilling functional requirements for installed or portable equipment (e.g., pumps and valves), and installing needed instrumentation.

Because the order contains just three requirements for the containment venting strategy, the compliance elements are in NEI 13-02, Revision 1. NEI 13-02, Revision 1, endorsed by NRC in JLD-ISG-2015-01, provides the guidance for the containment venting strategy (B.2) of the order. NEI 13-02, Revision 1, provides SAWA in conjunction with Severe Accident Water Management (SAWM), which is designed to maintain the wetwell vent in service until alternate reliable containment heat removal and pressure control are established, as the means for compliance with part B of the order.

HNP has implemented Containment Venting Strategy (B.2), as the compliance method for Phase 2 of the Order and conforms to the associated guidance in NEI 13-02 Revision 1 for this compliance method.

Section IV.B: HCVS Existing System

There previously was not a strategy at HNP that complied with Phase 2 of the order.

Section IV.C: HCVS Phase 2 SAWA System and SAWM Strategy

The HCVS Phase 2 SAWA system and SAWM strategy utilizes the FLEX mitigation equipment and strategies to the extent practical. This approach is reasonable because the external hazards and the event initiator (ELAP) are the same for both FLEX mitigation strategies and HCVS. For SAWA, it is assumed that the initial FLEX response actions are unsuccessful in providing core cooling such that core damage contributes to significant radiological impacts that may impede the deployment, connection and use of FLEX equipment. These radiological impacts, including dose from containment and HCVS vent line shine were evaluated and modifications made as necessary to mitigate the radiological impacts such that the actions needed to implement SAWA and SAWM are feasible in the timeframes necessary to protect the containment from an overpressure related failure. To the extent practical, the SAWA equipment, connection points, deployment locations and access routes are the same as the FLEX primary strategies. This is intentional so that a Unit that initially implements FLEX actions and then later degrades to severe accident conditions can readily transition between FLEX and SAWA strategies. This approach further enhances the feasibility of SAWA under a variety of event sequences including timing.

HNP has implemented the containment venting strategy utilizing SAWA and SAWM. The SAWA system consists of a FLEX (SAWA) pump injecting into the Reactor Pressure Vessel (RPV) and SAWM consists of flow control at the FLEX (SAWA) pump along with instrumentation and procedures to ensure that the wetwell vent is not submerged (SAWM). Procedures have been issued to implement this strategy, including revision 3 to the BWROG Generic Severe Accident Management Guidelines (SAMG). This strategy has been shown via Modular Accident Analysis Program (MAAP) analysis to protect containment without requiring a drywell vent for at least seven days which is the guidance from NEI 13-02 for the period of sustained operation.

Section IV.C.1: Detailed SAWA Flow Path Description

The SAWA flow path is the same as the FLEX primary injection path. The SAWA system, shown on Attachment 4, consists of a FLEX pump injecting into the Reactor Pressure Vessel (RPV), and SAWM consists of flow control at the FLEX pump along with wetwell level indication to ensure that the wetwell vent is not submerged (SAWM). The SAWA injection path, starts at the Altamaha river, goes to the FLEX pump via suction hoses, and then goes through the FLEX pump and a flexible discharge hose, to a FLEX header on the RHRSW system at the Intake Structure. From the Intake Structure, the FLEX path runs through the RHRSW system to the Reactor Building (RB) where it is connected via permanently installed piping to RHR, then to the Reactor Pressure Vessel (RPV) via the RHR A LPCI lineup. BWROG generic assessment, BWROG-TP-15-008, provides the principles of Severe Accident Water Addition to ensure protection of containment. The hoses and pumps are stored in the FLEX Storage Building (FSB) which is protected from all hazards. This SAWA injection path is qualified for all the screened-in hazards (Section III) in addition to severe accident conditions.

Section IV.C.2: Severe Accident Assessment of Flow Path

There are no HCVS Flow Path actions inside the RB that could be subjected to a high radiation field due to a severe accident. The action to open (and possibly close) valves inside the RB can be performed from the MCR or ROP. The time for different HCVS actions was validated as part of the Time Sensitive Action validation for Order EA-13-109 and is less than the FLEX deployment time period because of a limited debris removal assessment for HCVS actions. Procedure NMP-OS-019-262/282(SIG-2), 600V Alternate Power Division 1/2 and NMP-OS-019-295, FLEX 85KW Diesel Generator Operating Instruction directs timely accomplishment of actions that must be completed early in the severe accident event when a loss of all AC power and a loss of all high-pressure injection to the core exists simultaneously. In this event, core damage is not expected for at least one hour so there should be no excessive radiation levels or heat related concerns in the RB in that time frame. All other SAWA actions take place outside the RB at the MCR, CB, FSB, Main Stack and the deployment pathways. Since these locations are outside the RB, they are shielded from the severe accident radiation by the thick concrete walls of the RB. Once SAWA is initiated, the operators will monitor the containment response from the MCR to determine that venting and SAWA are operating satisfactorily by maintaining containment pressure low enough to avoid containment failure. A stable or slowly rising trend in wetwell level with SAWA at the minimum flow rate indicates water on the drywell floor up to the downcomer openings. After some period, as decay heat levels decrease, the operators will be able to reduce SAWA flow to keep the core debris cool while avoiding overfilling the suppression pool to the point where the wetwell vent is submerged.

Section IV.C.3: Severe Accident Assessment of Safety-Relief Valves

HNP has methods available to extend the operational capability of manual pressure control using SRVs as provided in the HNP's Order EA-12-049 submittal. Assessment of manual SRV pressure control capability for use of SAWA during the Order defined accident is unnecessary because RPV depressurization is directed by the EPGs in all cases prior to entry into the SAGs.

Section IV.C.4: Available Freeboard Use

The freeboard between 102' and 114.5' elevation in the wetwell provides approximately 805,160 gallons of water volume before level instruments would be off scale high. BWROG generic assessment BWROG-TP-15-011, provides the principles of Severe Accident Water Management to preserve the wetwell vent for a minimum of 7 days. After containment parameters are stabilized using SAWA, SAWA flow will be reduced to a point where containment pressure will remain low while wetwell level is stable or rising very slowly. As shown by BWROG TP-15-011 and since HNP is bounded by the reference plant (refer to NRC Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 letter, ML17254A042, Phase 2 ISE Open Item 2), the wetwell level will not reach the wetwell vent for at least 7 days. A diagram of the available freeboard is shown on Attachment 1.

Section IV.C.5: Upper Range of Wetwell Level Indication

The upper range elevation of wetwell level indication provided for SAWA/SAWM is 114.5'. This defines the upper limit of wetwell volume that will preserve the wetwell vent function as shown in Attachment 1.

Section IV.C.6: Wetwell Vent Service Time

Reference 27 in NEI 13-02, Revision 1 and BWROG-TP-15-011, demonstrates that throttling SAWA flow after containment parameters have stabilized, in conjunction with venting containment through the wetwell vent, will result in a stable or slowly rising wetwell level. These references demonstrate that, for the analyzed scenario, wetwell level will remain below the wetwell vent pipe for greater than the 7 days of sustained operation, allowing significant time for restoration of alternate containment pressure control and heat removal.

Section IV.C.7: Strategy Time Line

The overall accident management plan for HNP is developed from the BWR Owner's Group Emergency Procedure Guidelines and Severe Accident Guidelines (EPG/SAG). As such, the SAWA/SAWM implementing procedures are integrated into the HNP SAMGs. In particular, EPG/SAG Revision 3, when implemented with Emergency Procedures Committee Generic Issue 1314, allows throttling of SAWA in order to protect containment while maintaining the wetwell vent in service. The

SAMG flow charts direct use of the hardened vent as well as SAWA/SAWM when the appropriate plant conditions have been reached.

Using NEI letter from Nicholas X. Pappas, Senior Project Manager of NEI to Industry Administrative Points of Contact, Validation Document for FLEX Strategies, dated July 18, 2014, HNP has validated that the SAWA pump can be deployed and commence injection in less than 8 hours. The studies referenced in NEI 13-02 demonstrated that establishing flow within 8 hours will protect containment. The initial SAWA flow rate will be at least 500 gpm. After a period of time (approximately 4 hours), once the maximum flow rate is maintained, the SAWA flow will be reduced. The reduction in flow rate and the timing of the reduction will be based on stabilization of the containment parameters of drywell pressure and wetwell level.

NEI 13-02 generic analysis per NEI 13-02 Reference 27 demonstrated that, SAWA flow could be reduced to 100 gpm after 4 hours of initial SAWA flow rate and containment would be protected. As wetwell level begins to rise, indicating that the SAWA flow is greater than the steaming rate due to containment heat load, SAWA flow can be reduced. While this is expected to be 4-6 hours, no time is specified in the procedures because the SAMGs are symptom-based guidelines.

Section IV.C.8: SAWA Flow Control

HNP will accomplish SAWA flow control using four separate discharge lines with throttle valves and digital flow meters on the SAWA pump skid. The operators at the SAWA pump will be in communication with the MCR via radios or runners and because of the large margin between normal wetwell level and the level at which the wetwell vent will be submerged, the exact time to throttle flow is not critical. The communications capabilities used for communication between the MCR and the SAWA flow control location are the same as those accepted for FLEX strategies. The communications capabilities have been tested to ensure functionality at the SAWA flow control and monitoring locations.

Section IV.C.9: SAWA/SAWM Element Assessment

Section IV.C.9.1: SAWA Pump

HNP uses a portable diesel-driven pump for FLEX and SAWA. The FLEX pumps are capable of 3000 gpm at the pressures required for RPV injection during an ELAP. Each of these pumps can supply the required flow rate to the RPV and the SFP for FLEX and for SAWA scenarios. The pumps are rugged, over the road, trailer-mounted units and are stored in the FSB where they are protected from all screened-in hazards, and therefore will be available to function after a seismic event.

Section IV.C.9.2: SAWA analysis of flow rates and timing

HNP SAWA flow is 500 gpm which is the amount assumed in NEI 13-02 Section 4.1.1.2.1. The initial SAWA flow will be injected into the RPV within 8 hours of the loss of injection. The reference power level is 3514 MWth, equivalent to the reference plant rated thermal power level used in NUREG-1935, State of the Art Reactor Consequence Analysis (SOARCA). NUREG 1935 is Reference 9 of NEI 13-02 Revision 1.

Section IV.C.9.3: SAWA Pump Hydraulic Analysis

Calculation A-47400 analyzed the FLEX pumps and the lineup for RPV injection that would be used for SAWA, which is the same as the FLEX lineup. This calculation showed that the pumps have adequate capacity to meet the SAWA flow rate required to protect containment.

Section IV.C.9.4: SAWA Method of backflow prevention

The HNP SAWA flow path goes through check valves in the RHR system. The RHR LPCI injection check valve 1/2E11-F050 provides backflow prevention for SAWA. The integrity of the check function (open and closed) of these valves is demonstrated by other plant testing requirements such that additional testing per NEI 13-02 Revision 1 Section 6.2 is not required per NEI 13-02 Revision 1, Table 6-1, Note 3. Thus, backflow is prevented by check valves in the SAWA flow path inside the RB.

Section IV.C.9.5: SAWA Water Source

The Altamaha River is the initial source of water for SAWA which can provide water injection without makeup based on the FLEX analysis. This long-term water supply strategy was qualified for Order EA-12-049 response and is available during a severe accident. Therefore, there will be sufficient water for injection to protect containment during the period of sustained operation.

Section IV.C.9.6: SAWA/SAWM Motive Force

Section IV.C.9.6.1: SAWA Pump Power Source

The SAWA pumps are stored in the FSB where they are protected from all screened-in hazards. The SAWA pumps are diesel-driven commercial pumps rated for long-term outdoor use in emergency scenarios. The pumps will be refueled by FLEX refueling equipment that has been qualified for long-term refueling operations per Order EA-12-049. The action to refuel the SAWA pumps was evaluated under severe accident conditions in Table 2 and were demonstrated to be acceptable. Since the pumps are stored in a protected structure, are qualified for the environment in which they will be used, and will be refueled by a qualified refueling strategy, they will perform their function to maintain SAWA flow needed to protect primary containment per Order EA-13-109.

<u>Section IV.C.9.6.2</u>: DG loading calculation for SAWA/SAWM equipment

Table 1 shows the electrical power source for the SAWA/SAWM instruments. Based on calculations SENH-13-005, SENH-16-003 and A-47402, station service batteries can provide power to required SAWA/SAWM instruments until the FLEX generator restores power to the battery charger.

The FLEX load on the FLEX DG per Order EA-12-049 was evaluated in calculation A-47402. Calculation SENH-16-003, "Battery Sizing, Voltage Drop, Cable Sizing and Short Circuit Evaluation for 250V Dedicated Battery System (Unit 2)", Version 2, verified the capability of the existing Class 1 E batteries (supplemented with the HCVS Division 1 and 2 batteries) to extend the battery capacity to 24 hours of operation for HCVS functions. The HCVS batteries meet separation and isolation criteria from the Class 1 E batteries. The required loads for the Phase 2 600 V, 545 kW FLEX DG total approximately 387 kW for both units' Division I loads and 383 kW for both units' Division II loads. This also takes into account the HCVS loads. The FLEX generator was qualified to carry the remaining FLEX loads as part of Order EA-12-049 compliance.

DG loading for SAWA/SAWM equipment was assessed in the NRC Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 letter, ML17254A042, Phase 1 ISE Open Item 8.

<u>Section IV.C.10</u>: SAWA/SAWM Instrumentation

<u>Section IV.C.10.1</u>: SAWA/SAWM instruments

Table 1 contains a listing of all the instruments needed for SAWA and SAWM implementation. This table also contains the expected environmental parameters for each instrument, its qualifications, and its power supply for sustained operation.

<u>Section IV.C.10.2</u>: Describe SAWA instruments and guidance

The drywell pressure and wetwell level instruments, used to monitor the condition of containment, are pressure and differential pressure detectors that are safety-related and qualified for post-accident use. These instruments are referenced in Severe Accident Guidelines for control of SAWA flow to maintain the wetwell vent in service while maintaining containment protection. These instruments are powered by batteries for at least 24 hours and will be re-powered by FLEX generator systems for the sustained operating period. These instruments are on buses included in the FLEX generator loading calculations for Order EA-12-049. Note that other indications of these parameters may be available depending on the exact scenario.

The SAWA flow meters are mounted on the pump skid and powered by the pump's electrical system.

No containment temperature instrumentation is required for compliance with HCVS Phase 2. However, most FLEX electrical strategies repower other containment instruments that include drywell temperature, which may provide information for the operations staff to evaluate plant conditions under a severe accident and to provide confirmation for adjusting SAWA flow rates. SAMG strategies will evaluate and use drywell temperature indication (if available) consistent with the symptom-based approach. NEI 13-02 Revision 1 Section C.8.3 discusses installed drywell temperature indication.

Section IV.C.10.3: Qualification of SAWA/SAWM instruments

The drywell pressure and wetwell level instruments are pressure and differential pressure detectors that are safety-related and qualified for post-accident use. These instruments are qualified per RG-1.97 Revision 2 (Reference 34) which is the HNP committed version per FSAR Appendix A as post-accident instruments and are therefore qualified for Order EA-13-109 events.

The SAWA flow meters are rated for continuous use under the expected ambient conditions and will be available for the entire period of sustained operation. Furthermore, since the pump is deployed outside the RB, and a significant distance from the vent path, there is no concern for any effects of radiation exposure to the flow instrumentation.

Section IV.C.10.4: Instrument Power Supply through Sustained Operation

HNP FLEX strategies will restore the containment instruments, containment pressure and wetwell level, necessary to successfully implement SAWA. The strategy will be to use the FLEX generator to re-power battery chargers before the batteries supplying the instruments are depleted. Since the FLEX generators are refueled per FLEX strategies for a sustained period of operation, the instruments will be powered for the sustained operating period.

Section IV.C.11: SAWA/SAWM Severe Accident Considerations

The SAWA/SAWM actions are all outside the RB.

The HCVS design allows initiating and then operating and monitoring the HCVS from the Main Control Room (MCR) or the Remote Operating Station (ROS). The MCR location is protected from adverse natural phenomena and is the normal control point for HCVS operation and Plant Emergency Response actions.

The ROS is located on the 147'elevation of the Control Building, one floor below the elevation of the MCR. Additional support equipment is located on the 130' elevation of the Control Building (battery throw-over switch and nitrogen bottle rack). Reference Assumption HNP-5 from OIP, HCVS-FAQ-08 and HCVS-FAQ-04. Temperatures where personnel are expected to remain for long periods of time do not exceed 110 degrees Fahrenheit (F°), which is acceptable for long-term personnel habitability. Radiological conditions result in low operator dose.

Severe accident considerations were assessed in the NRC Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 letter, ML17254A042, Phase 1 ISE Open Item 5.

Section IV.C.11.1: Severe Accident Effect on SAWA Pump and Flowpath

Since the SAWA pump is stored in the FSB and will be operated from outside the RB, significantly away from the vent path, no issues with radiation dose rates at the SAWA pump control location and no significant dose to the SAWA pump are expected.

Inside the RB, the SAWA flow path consists of stainless steel pipe which will remain unaffected by the radiation or elevated temperatures. Therefore, the SAWA flow path will not be affected by radiation or temperature effects due to a severe accident.

Section IV.C.11.2: Severe Accident Effect on SAWA/SAWM Instruments

The SAWA/SAWM instruments are described in section IV.C.9.3, which provides severe accident effects.

Section IV.C.11.3: Severe Accident Effect on personnel actions

Section IV.C.2 describes the actions within the first 7 hours. The actions, including access routes outside the Reactor Building, that are performed after the first use of the vent during severe accident conditions (assumed to be 7 hours per HCVS-FAQ-12) are located such that they are either shielded from direct exposure to the vent line or are a significant distance from the vent line. This is to ensure that expected dose is maintained below the ERO exposure guidelines.

As part of the response to Order EA-12-049, HNP performed thermal-hydraulic analysis of the temperature response of the Reactor and Control Buildings during the ELAP event. Since the core materials are contained inside the primary containment in the severe accident, the temperature response of the RB and CB is driven by the loss of ventilation and ambient conditions and therefore will not change. Thus, the FLEX analyses are acceptable for severe accident use.

Table 2 provides a list of SAWA/SAWM operator actions as well as an evaluation of each for suitability during a severe accident. Attachment 6 shows the approximate locations of the actions.

After the SAWA pipe is aligned inside the RB via MCR controls, the operators can control SAWA/SAWM as well as observe the necessary instruments from outside the RB. The thick concrete RB walls (below 147' level) as well as the distance to the core materials provide sufficient shielding to ensure there is no radiological concern with any actions outside the RB. Therefore, all SAWA controls and indications are accessible during severe accident conditions.

The SAWA pump and monitoring equipment can all be operated from outside the RB at ground level. Plant monitoring to support SAWA and SAWM is in the MCR or ROS. The HNP FLEX response ensures that the SAWA pump, FLEX generators and other equipment can all be run for a sustained period by refueling. All of the refueling locations are in shielded or protected areas so that there is no radiation hazard from Reactor core material during a severe accident. The monitoring instrumentation includes SAWA flow at the pump, wetwell level, and containment pressure in the MCR.

Section V: HCVS Programmatic Requirements

Section V.A: HCVS Procedure Requirements

Licensees shall develop, implement, and maintain procedures necessary for the safe operation of the HCVS. Procedures shall be established for system operations when normal and backup power is available, and during an extended loss of AC power.

Evaluation:

Procedures have been established for system operations when normal and backup power is available, and during ELAP conditions. The implementing design change documents provided technical support for modifying the HCVS specific procedures.

The HCVS and SAWA procedures have been developed and implemented following HNP's process for initiating and/or revising procedures and contain the following details:

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

- training on portable equipment operation, and
- testing portable equipment

HNP has implemented the BWROG Emergency Procedures Committee Issue 1314 that implements the Severe Accident Water Management (SAWM) strategy in the Severe Accident Management Guidelines (SAMGs). The following general cautions, priorities and methods have been evaluated for plant specific applicability and incorporated as appropriate into the plant specific SAMGs using administrative procedures for EPG/SAG change control process and implementation. SAMGs are symptom-based guidelines and therefore address a wide variety of possible plant conditions and capabilities. While these changes are intended to accommodate those specific conditions assumed in Order EA-13-109, the changes were made in a way that maintains the use of SAMGs in a symptom-based mode while at the same time addressing those conditions that may exist under extended loss of AC power (ELAP) conditions with significant core damage including ex-vessel core debris. A site specific SBO/ELAP flowchart was also developed as part of FLEX response and revised to include HCVS specific actions, to supplement EPG/SAGs and provide symptom-based guidance for Operators during a loss of all offsite and onsite AC power leading up a severe accident scenario.

From issue 1314:

Cautions

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

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

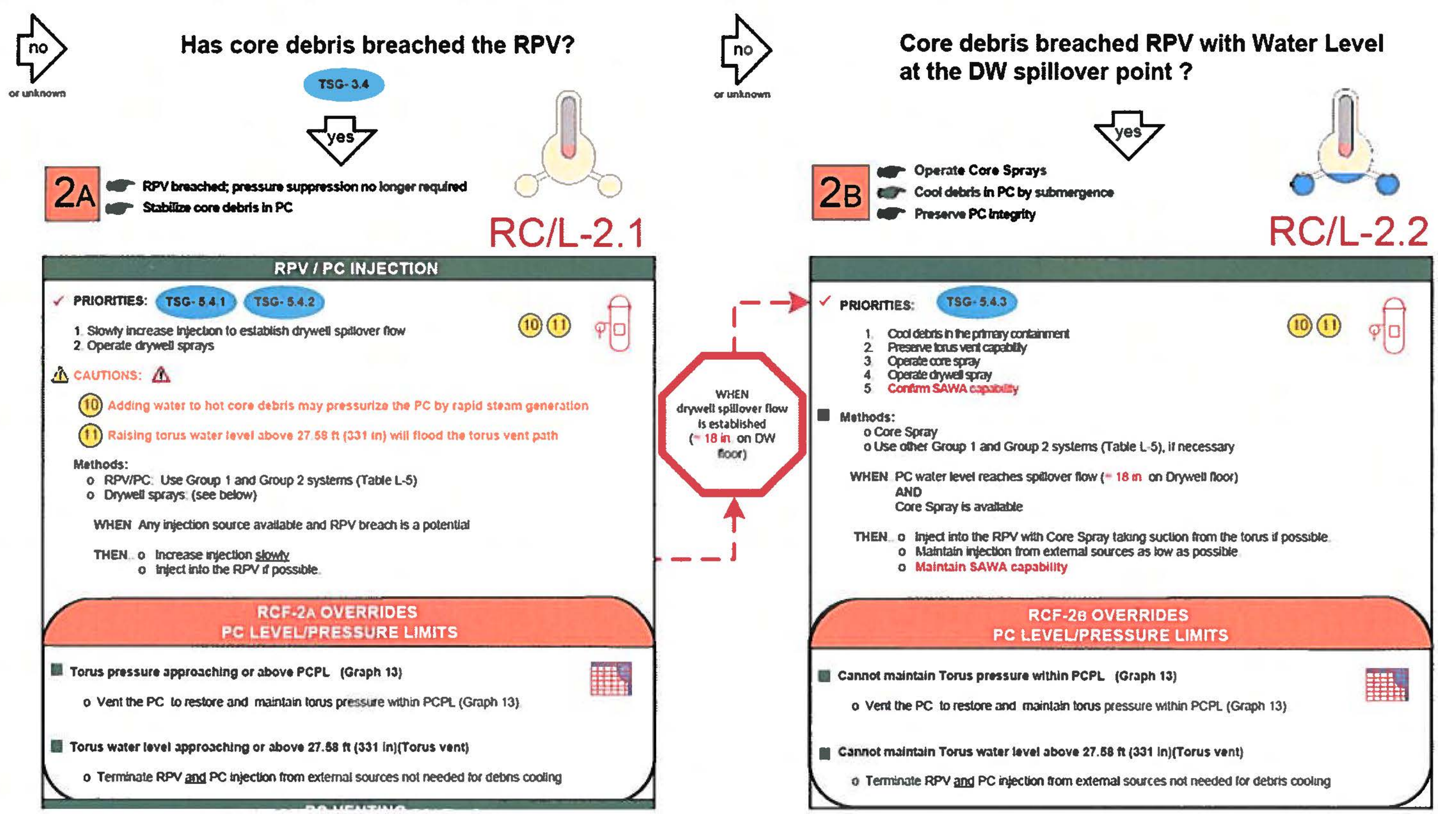
- Core debris in the primary containment is stabilized by water addition (SAWA).
- Primary containment pressure is controlled below the Primary Containment Pressure Limit (Wetwell venting)
- Water addition is managed to preserve the Mark I/II suppression chamber vent paths, thereby retaining the benefits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

minimizing the likelihood of radioactivity and hydrogen release into the secondary containment (SAWM)

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

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

Actual HNP SAMG Flow Chart shown below:



Section V.B: HCVS Out of Service Requirements

Provisions for out-of-service requirements of the HCVS and compensatory measures have been added to the tracking application in the Shift Operations Management System (eSOMS) per NMP-OS-019-013, Beyond Design Basis Equipment Unavailability Tracking so that it is with the FLEX out-of-service program.

Programmatic controls have been implemented to document and control the following:

NOTE: Out of service times and required actions noted below are for HCVS and SAWA functions. Equipment that also supports a FLEX function that is found to be non-functional must also be addressed using the out of service times and actions in accordance with the FLEX program.

The provisions for out-of-service requirements for HCVS and SAWA functionality are applicable in Modes 1, 2, and 3 per NEI 13-02, Section 6.3.

- If for up to 90 consecutive days, the primary or alternate means of HCVS operation are non-functional, no compensatory actions are necessary.
- If up for to 30 days, the primary and alternate means of HCVS operation or SAWA are non-functional, no compensatory actions are necessary.
- If the out of service times are projected to exceed 30 or 90 days as described above, the following actions will be performed through the corrective action system to determine:
    - The cause(s) of the non-functionality,
    - The actions to be taken and the schedule for restoring the system to functional status and prevent recurrence,
    - Initiate action to implement appropriate compensatory actions, and
    - Restore full HCVS functionality at the earliest opportunity not to exceed one full operating cycle.

The HCVS system is functional when piping, valves, instrumentation and controls including motive force necessary to support system operation are available. Since the system is designed to allow a primary control and monitoring or alternate valve control by Order Criterion 1.2.4 or 1.2.5, allowing for a longer out of service time with either of the functional capabilities maintained is justified. A shorter length of time when both primary control and monitoring and alternate valve control are unavailable is needed to restore system functionality in a timely manner, while at the same time allowing for component repair or replacement in a time frame consistent with most high priority maintenance scheduling and repair programs, not to exceed 30 days unless compensatory actions are established per NEI 13-02 Section 6.3.1.3.3.

SAWA is functional when piping, valves, motive force, instrumentation and controls necessary to support system operation are functional.

The system functionality basis is for coping with beyond design basis events and therefore plant shutdown to address non-functional conditions is not warranted. However, such conditions should be addressed by the corrective action program and compensatory actions to address the non-functional condition should be established. These compensatory actions may include alternative containment venting strategies or other strategies needed to reduce the likelihood of loss of fission product cladding integrity during design basis and beyond design basis events even though the severe accident capability of the vent system is degraded or non-functional. Compensatory actions may include actions to reduce the likelihood of needing the vent but may not provide redundant vent capability.

Applicability for allowed out of service time for HCVS and SAWA for system functional requirements is limited to startup, power operation and hot shutdown conditions when primary containment is required to be operable and containment integrity may be challenged by decay heat generation.

Section V.C: HCVS Training Requirements

Licensee shall train appropriate personnel in the use of the HCVS. The training curricula shall include system operations when normal and backup power is available, and during an extended loss of AC power.

Evaluation:

Personnel expected to perform direct execution of the HCVS have received 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. The personnel trained and the frequency of training was determined using a systematic analysis of the tasks to be performed using the Systems Approach to Training (SAT) process.

In addition, per NEI 12-06, any non-trained personnel on-site will be available to supplement trained personnel.

Section V.D: Demonstration with Other Post Fukushima Measures

HNP will demonstrate use of the HCVS and SAWA systems in drills, tabletops or exercises as follows:

1. Hardened containment vent operation on normal power sources (no ELAP).

2. During FLEX demonstrations (as required by Order EA-12-049: Hardened containment vent operation on backup power and from primary or alternate locations during conditions of ELAP/loss of UHS with no core damage). System use is for containment heat removal AND containment pressure control.

3. HCVS operation on backup power and from primary or alternate locations 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.

Evaluation

NOTE: Items 1 and 2 above are not applicable to SAWA.

The use of the HCVS and SAWA capabilities will be demonstrated during drills, tabletops or exercises consistent with NEI 13-06 and on a frequency consistent with 10 CFR 50.155(e)(4) once issued. HNP will perform the first drill demonstrating at least one of the above capabilities by February 27, 2022 which is within four years of the first unit compliance with Phase 2 of Order EA-13-109, or consistent with the next FLEX strategy drill or exercise. Subsequent drills, tabletops or exercises will be performed to demonstrate the capabilities of different elements of Items 1, 2, and 3 above that are applicable to HNP in subsequent eight-year intervals.

Section VI: References

Number	Rev	Title	Location[6]
1. GL-89-16	0	Installation of a Hardened Wetwell Vent (Generic Letter 89-16), dated September 1, 1989.	ML031140220
2. SECY-12-0157	0	Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments	ML12345A030
3. SRM-SECY-12-0157	0	Staff Requirements – SECY-12-0157 – Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments	ML13078A017
4. EA-12-050	0	Order to Modify Licenses with Regard to Reliable Hardened Containment Vents	ML12054A694
5. EA-13-109	0	Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions	ML13143A321
6. NEI 13-02	0	Industry Guidance for Compliance with Order EA-13-109, BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions	ML13316A853
7. NEI 13-02[7]	1	Industry Guidance for Compliance with Order EA-13-109, BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions	ML15113B318
8. HCVS-WP-01	0	Hardened Containment Vent System Dedicated and Permanently Installed Motive Force, Revision 0, April 14, 2014	ML14120A295 ML14126A374
9. HCVS-WP-02	0	Sequences for HCVS Design and Method for Determining Radiological Dose from HCVS Piping, Revision 0, October 23, 2014	ML14358A038 ML14358A040
10. HCVS-WP-03	1	Hydrogen/Carbon Monoxide Control Measures Revision 1, October 2014	ML14302A066 ML15040A038
11. HCVS-WP-04	0	Missile Evaluation for HCVS Components 30 Feet Above Grade	ML15244A923 ML15240A072

[6] Where two ADAMS accession numbers are listed, the first is the reference document and the second is the NRC endorsement of that document.
[7] NEI 13-02 Revision 1 Appendix J contains HCVS-FAQ-01 through HCVS-FAQ-09.

Number	Rev	Title	Location[6]
12. JLD-ISG-2013-02	0	Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions	ML13304B836
13. JLD-ISG-2015-01	0	Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions	ML15104A118
14. HCVS-FAQ-10	1	Severe Accident Multiple Unit Response	ML15273A141 ML15271A148
15. HCVS-FAQ-11	0	Plant Response During a Severe Accident	ML15273A141 ML15271A148
16. HCVS-FAQ-12	0	Radiological Evaluations on Plant Actions Prior to HCVS Initial Use	ML15273A141 ML15271A148
17. HCVS-FAQ-13	0	Severe Accident Venting Actions Validation	ML15273A141 ML15271A148
18. Phase 1 OIP	0	HCVS Phase 1 Overall Integrated Plan (OIP)	ML14178B464
19. Combined OIP	0	Combined HCVS Phase 1 and 2 Overall Integrated Plan (OIP)	ML15357A212
20. Phase 1 ISE	0	HCVS Phase 1 Interim Staff Evaluation (ISE)	ML14335A137
21. Phase 2 ISE	0	HCVS Phase 2 Interim Staff Evaluation (ISE)	ML16099A260
22. 1st Update	0	First Six Month Update	ML15049A513
23. 2nd Update	0	Second Six Month Update	ML15177A353
24. 3rd Update	0	Third Six Month Update	ML15357A212
25. 4th Update	0	Fourth Six Month Update	ML16165A184
26. 5th Update	0	Fifth Six Month Update	ML16349A160
27. 6th Update	0	Sixth Six Month Update	ML17163A224
28. 7th Update	0	Seventh Six Month Update	ML17339A347
29. NL-18-0200	0	Edwin I. Hatch Nuclear Plant – Unit 1, Completion of Required Action for NRC Order EA-13-109 Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions	ML18102B148

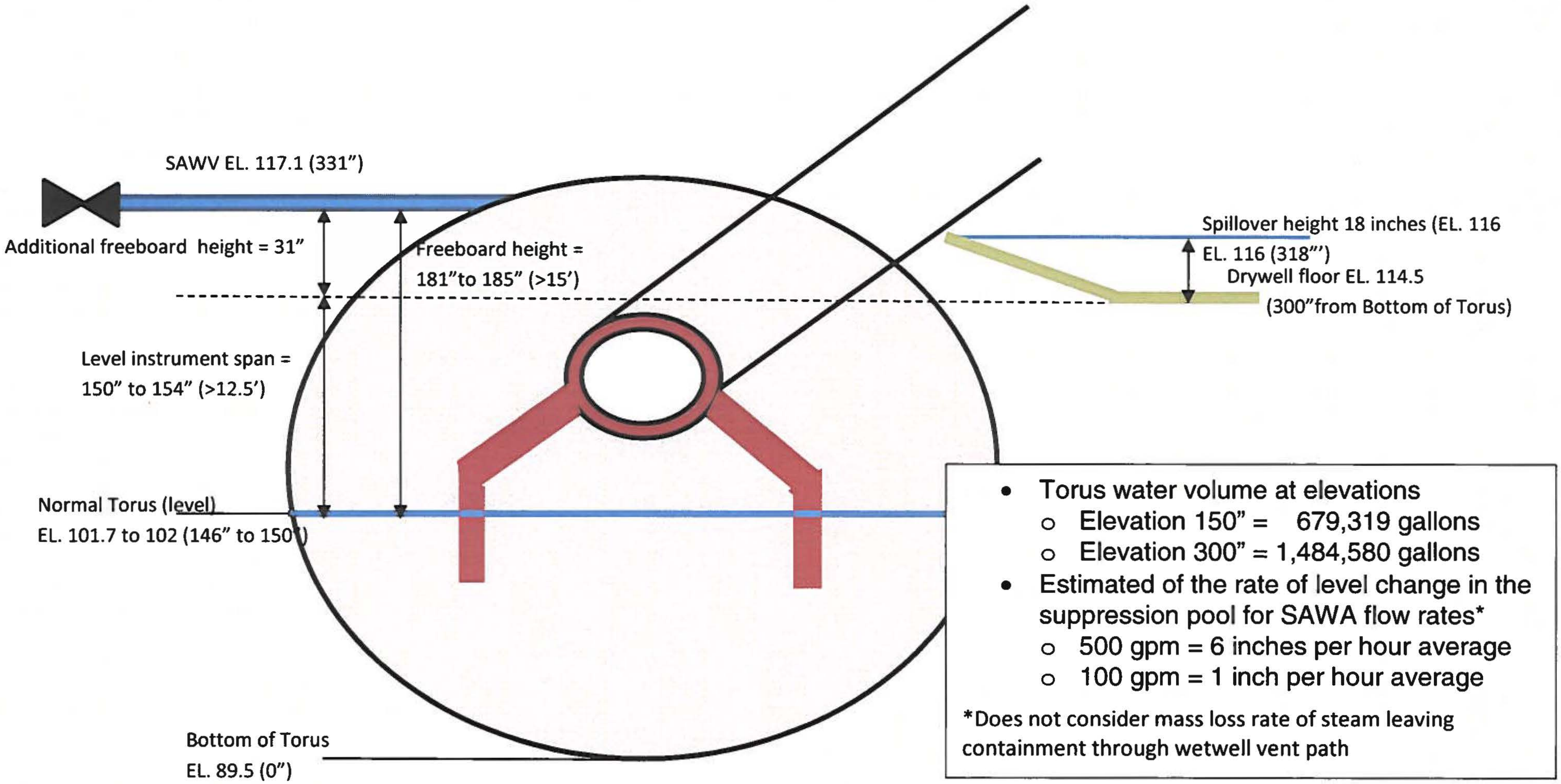
Number	Rev	Title	Location[6]
30. MCR FLEX Heat-up Calc.	1.0	SMNH-12-031, Hatch Main Control Room Heat up Evaluation During an Extended Loss of all AC Power	
31. EA-12-049	2.0	SMNH-13-005, Hatch Switchgear Room on Control Building Elevation 130 Heatup Evaluation During an Extended Loss of all AC Power (ELAP)	
32. NEI 12-06	0	Diverse and Flexible Coping Strategies (FLEX) Implementation Guide	ML12221A205
33. EA-12-049	0	Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012	ML12054A735
34. RG 1.97	2	Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Conditions During and Following an Accident	ML060750525
35. TR-1026539	0	EPRI Investigation of Strategies for Mitigating Radiological Releases in Severe Accidents BWR, Mark I and Mark II Studies, October 2012	N/A
36. EA-12-049	0	E. I. Hatch Unit 1 and 2 - Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051	ML17179A286
37. EA-13-109	0	E. I. Hatch Unit 1 and 2 Report for the Audit of Licensee Responses to Interim Staff Evaluation Open Items Related to NRC Order EA-13-109 Letter	ML17254A042
38. EA-13-109		Calculation SMNH-13-013, "Sizing of Accumulator Tanks for Reliable Hardened Containment Vent System"	N/A
39. EA-13-109		Calculation SMNH-13-019, "Sizing of Nitrogen Bottles for Reliable Hardened Containment Venting System"	N/A
40. FSAR		NEDC-32749P, "Extended Power Uprate Safety Analysis Report for Edwin I. Hatch Units 1 and 2"	N/A
41. FSAR		GE MDE-03-0186, "Safe Shutdown Appendix R Analysis for Edwin I. Hatch Nuclear Power Station Units 1 and 2"	N/A

Number	Rev	Title	Location[6]
42. FSAR		Hatch Nuclear Plant Unit 2 Final Safety Analysis Report, Revision 33, September 2015, Section 8.4, "Standby AC Power Supply"	N/A
43. EA-12-049		Calculation SENH-13-005, "Load Data for Sizing the Inverters for FLEX and HCVS"	N/A
44. EA-13-109		Calculation SENH-16-003, "Battery Sizing, Voltage Drop, Cable Sizing, and Short Circuit Evaluation for 250V Dedicated Battery System"	N/A
45. EA-12-049		Calculation A-47402, "FLEX DG Sizing"	N/A
46. EA-13-109		Calculation DOEJ-HDSNC598056-M001, "Identification of Boundary and Control Valves Required to Prevent Hydrogen Migration for the Unit 2 Hardened Containment Vent System (HCVS)"	N/A
47. EA-13-109		Calculation DOEJ-HDSNC598056-M003, "Hardened Containment Vent System (HCVS) Control of Flammable Gases"	N/A
48. EA-13-109		Calculation SMNH-13-023, "Hydrogen Crossflow in Mixing Chamber"	N/A
49. EA-13-109		Procedure NMP-OS-019-013, "Beyond Design Basis Equipment Unavailability Tracking"	N/A
50. EA-13-109		Procedure OS-019-013-GL02, "Hatch BDB Equipment Unavailability Tracking Guideline"	N/A
51. EA-13-109		BWROG-TP-008, "Severe Accident Water Addition Timing"	N/A
52. EA-13-109		BWROG-TP-011, "Severe Accident Water Management Supporting Evaluations"	N/A
53. EA-12-049		NEDC-33771P, Project Task Report BWROG GEH Evaluation of FLEX Implementation Guidelines, Revision 1	N/A
54. FSAR	36	Hatch Nuclear Plant Unit 1 Final Safety Analysis Report, Revision 36, August 2018	N/A
55. EA-12-049	1.0	SMNH-13-002, RCIC Room Heat-Up During an Extended Loss of all ac Power (FLEX)	N/A
56. EA-12-049	1.0	SMNH-14-006, Hatch Station Battery Room Heat up Evaluation During an Extended Loss of All AC Power	N/A

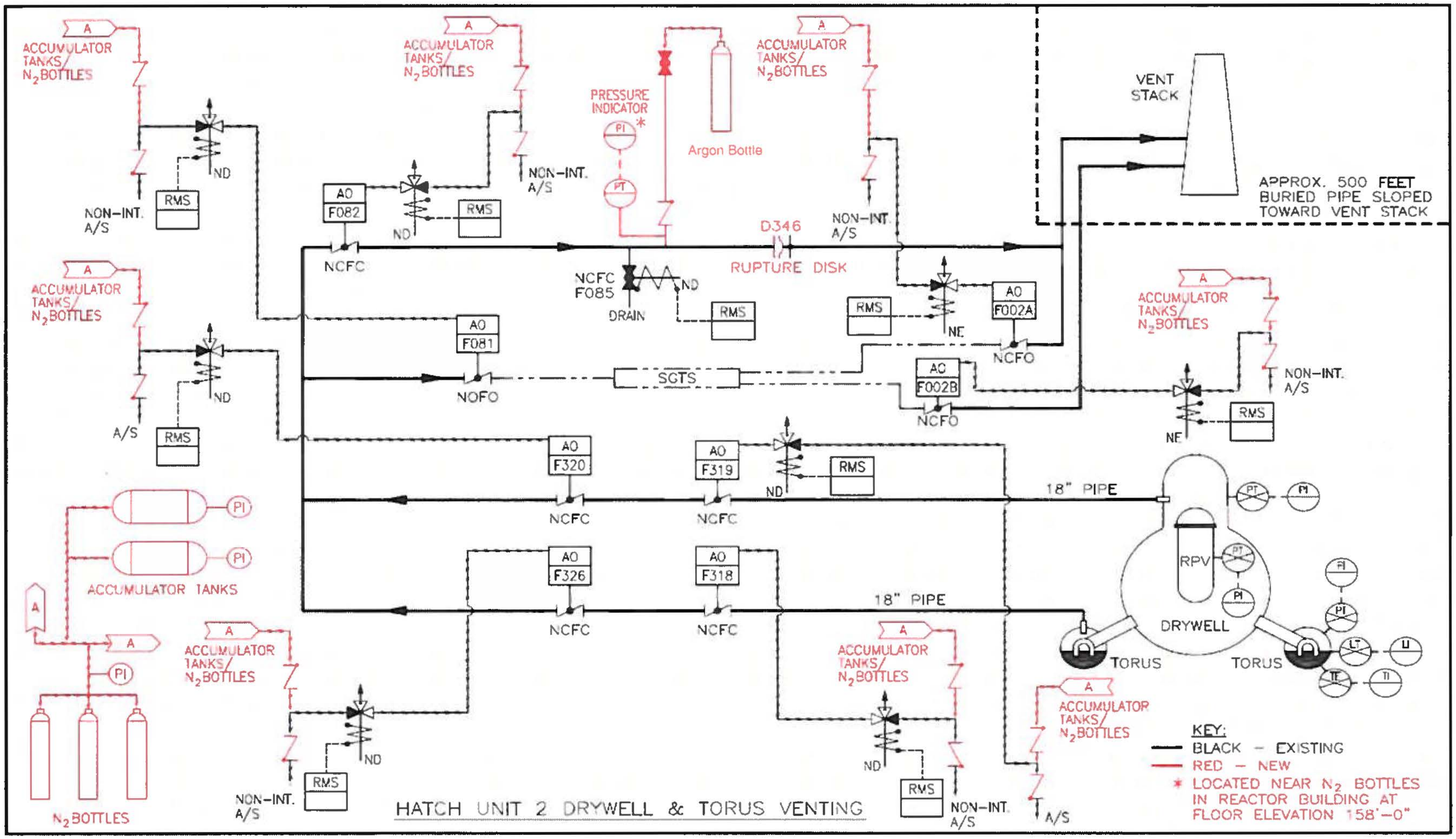
Number	Rev	Title	Location[6]
57. EA-12-049		A-47400, Pump Sizing Evaluation for Hatch Units 1 and 2 Core Cooling Phase 2	N/A
58. EA-12-049		NRC Edwin I. Hatch Nuclear Plant, Units 1 and 2 - Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051, Dated August 4, 2017	ML17179A286
59. BWROG-TP-15-008	0	Severe Accident Water Addition Timing	
60. BWROG-TP-15-011	0	Severe Accident Water Management Supporting Evaluations	
61. TP17-3-375	0	BWROG Fukushima Response Committee Owners' Group Positions (ODPs) HCVS-OGP-001 through HCVS-OGP-003	
62. TP17-5-375	0	BWROG Fukushima Response Committee Owners' Group Positions (ODPs) HCVS-OGP-005 through HCVS-OGP-008	
63. TP18-1-375	0	BWROG Fukushima Response Committee Owners' Group Positions (ODPs) HCVS-OGP-009 through HCVS-OGP-012	

Attachment 1: Phase 2 Freeboard diagram

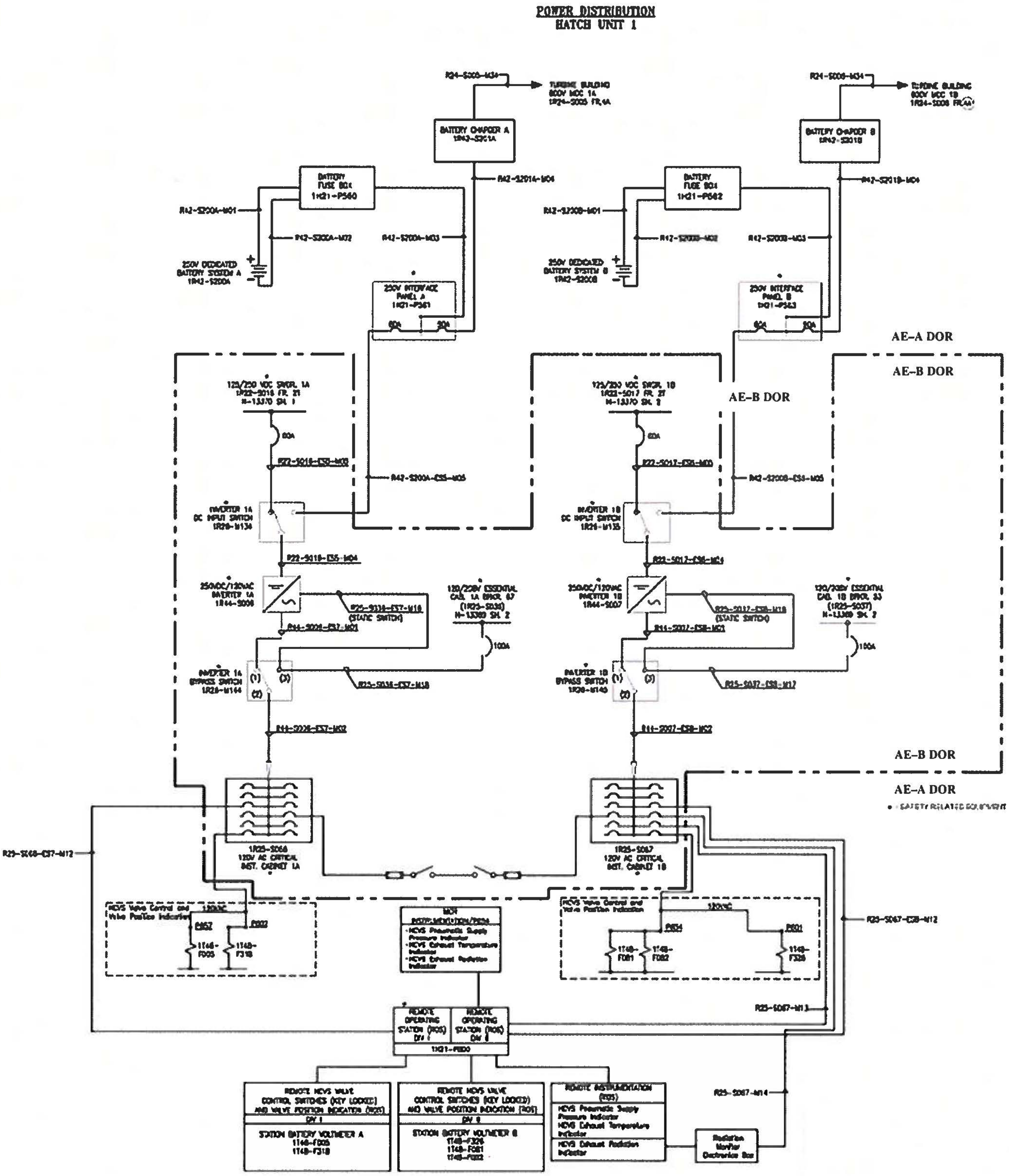
Reference Plant	HNP
Torus freeboard volume is 525,00 gallons	Torus freeboard volume is >805,161 gallons
SAWA flow is 500 GPM at 8 hours followed by 100 GPM from 12 hours to 168 hours	SAWA flow is 500 GPM at 8 hours followed by 100 GPM from 12 hours to 168 hours
The above parameters for HNP demonstrate that the reference plant values are bounding. Therefore, the SAWM strategy implemented at HNP makes it unlikely that a DW vent is needed to prevent containment overpressure related failure.	



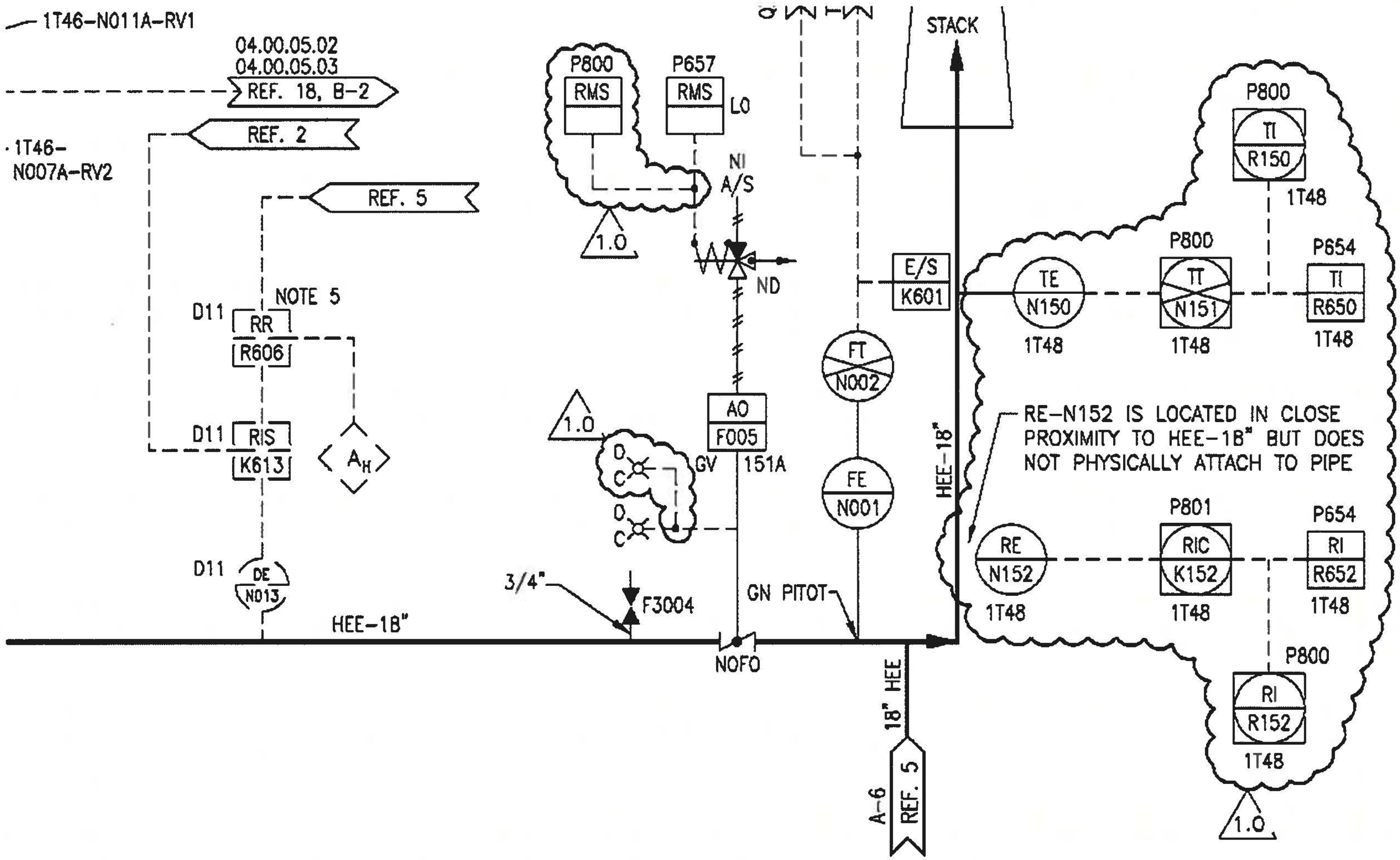
Attachment 2: One Line Diagram of HCVS Vent Path



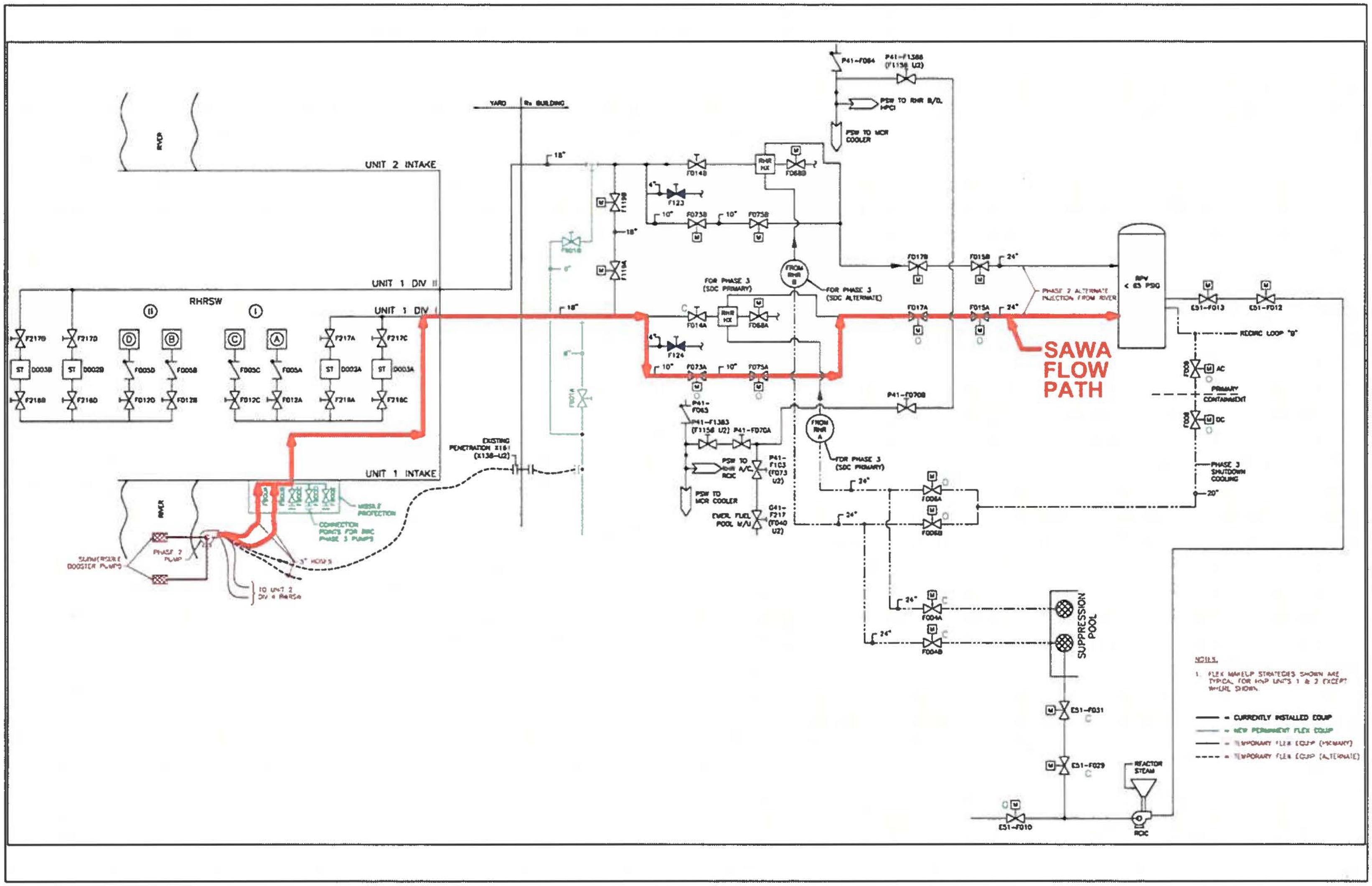
Attachment 3: One Line Diagram of HCVS Electrical Power Supply - Unit 1



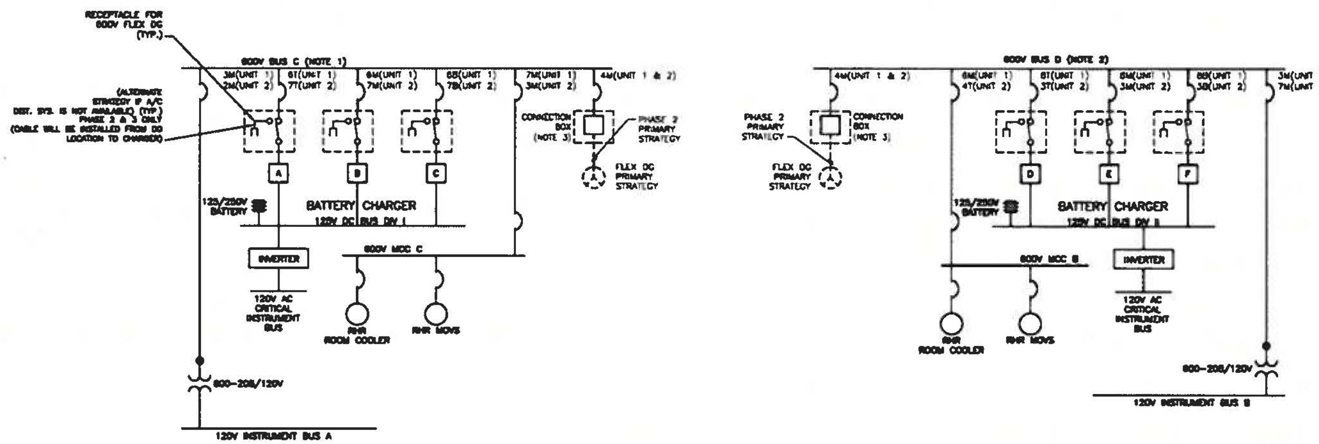
Attachment 3a: One Line Diagram of HCVS Instrumentation - Unit 1



Attachment 4: One Line Diagram of SAWA Flow Path



<u>Attachment 5</u>: One Line Diagram of SAWA Electrical Power Supply



	125V DC		120V AC BUS		600V AC BUS		4160V AC BUS	
	STRATEGY	METHOD	STRATEGY	METHOD	STRATEGY	METHOD	STRATEGY	METHOD
PHASE I	PROVIDE CRITICAL INSTRUMENTATION RCIC CR LIGHTING	125V DC BUSES SUPPLIED BY STATION BATTERIES DIV I & II	120V AC POWER NOT AVAILABLE	N/A	600V AC POWER NOT AVAILABLE	N/A	4160V AC POWER NOT AVAILABLE	N/A
PHASE II	CHARGE 125V DC BATTERIES CRITICAL INSTRUMENTS RCIC CR EMERGENCY LIGHTING	POWER 600V BUS C & D FROM FLEX DG TO SUPPLY BATTERIES DG TO POWER BOTH DIV BUSES	POWER 120V AC INSTRUMENT POWER BUS POWER PLANT PA	POWER 120V AC INSTRUMENT BUS VIA 600V BUS	POWER 600V BUS C & D POWER BATTERY CHARGERS POWER 600V MCC	POWER 600V BUS C & D VIA FLEX DG	4160V AC POWER NOT AVAILABLE	N/A
PHASE III	CHARGE 125V DC BATTERIES POWER CRITICAL INSTRUMENTS POWER RCIC CR EMERGENCY LIGHTING MISCELLANEOUS LOADS	POWER 600V BUS C & D VIA 4160V BUS	POWER 120V AC INSTRUMENT BUS POWER PLANT PA	POWER 120V AC INSTRUMENT BUS VIA 600V BUS	POWER 600V BUS C & D POWER BATTERY CHARGERS POWER 600V MCC	POWER 600V BUS C & D VIA 4160V BUS	POWER 4160V AC BUS	POWER 4160V AC BUS VIA 4160V FLEX DG DISCONNECT SMALL DG AS POWER TO 4160V AC BUS IS ESTABLISHED

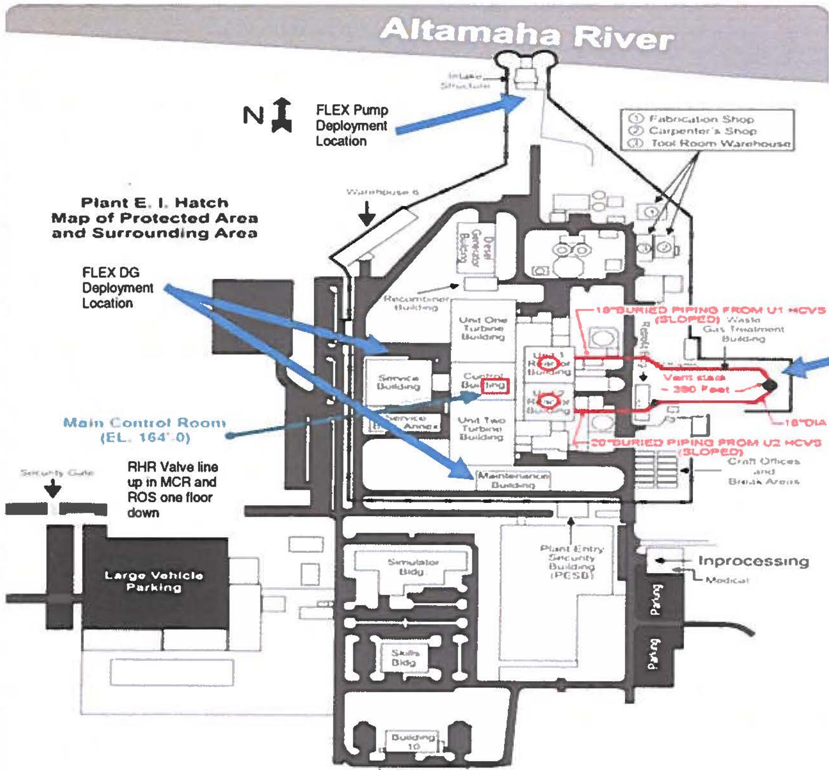
<u>NOTES:</u>

1. CONFIGURATION TYPICAL FOR CONNECTIONS TO UNIT 1 DIVISION I (TO POWER 600V BUS 1C) AND UNIT 2 DIVISION I (TO POWER 600V BUS 2C). ONE DIESEL GENERATOR WILL BE USED TO POWER BOTH 600V BUS 1C AND 2C.
2. CONFIGURATION TYPICAL FOR CONNECTIONS TO UNIT 1 DIVISION II (TO POWER 600V BUS 1D) AND UNIT 2 DIVISION II (TO POWER 600V BUS 2D). ONE DIESEL GENERATOR WILL BE USED TO POWER BOTH 600V BUS 1D AND 2D.
3. ONE CONNECTION BOX WILL BE AVAILABLE FOR EACH DIVISION IN EACH UNIT TO POWER EACH OF THE FOUR EMERGENCY BUSES (600V BUS 1C, 600V 1D, 600V 2C, AND 600V 2D).
4. EQUIPMENT INSIDE DASHED LINES TO BE INSTALLED PER DCP'S SNC470861 (FOR UNIT 1) AND SNC487474 (FOR UNIT 2).
5. REFER TO DCP'S SNC470861 (FOR UNIT 1) AND SNC487474 (FOR UNIT 2) FOR EQUIPMENT SIZING AND INSTALLATION OF PERMANENT FIELD EQUIPMENT.
6. REFER TO H-13361 FOR A SINGLE LINE OF PERMANENTLY INSTALLED FLEX EQUIPMENT TO SUPPORT UNIT 1 STRATEGIES.
7. REFER TO H-23362 FOR A SINGLE LINE OF PERMANENTLY INSTALLED FLEX EQUIPMENT TO SUPPORT UNIT 2 STRATEGIES.

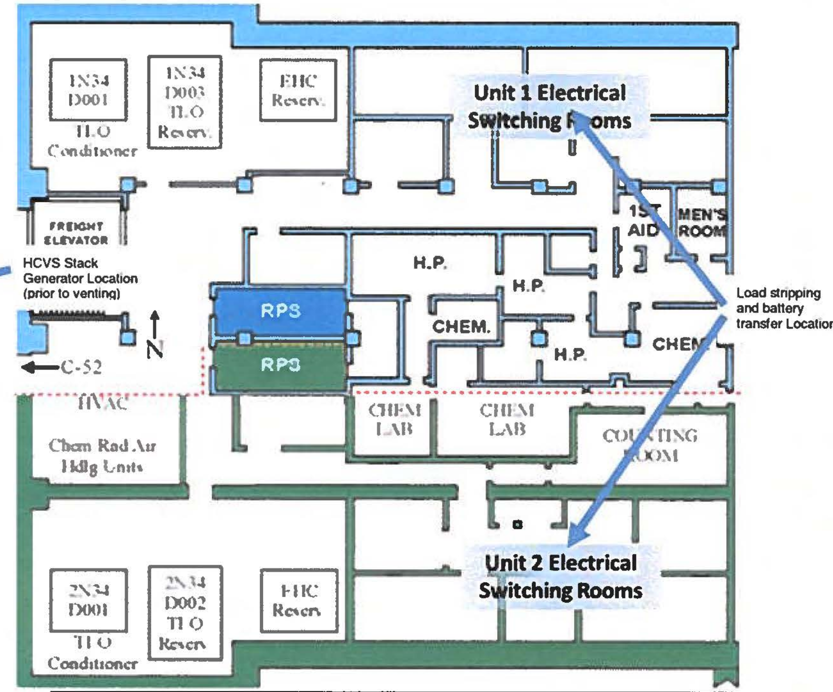
<u>LEGEND</u>	
————	PERMANENT PLANT EQUIPMENT
- - - - - -	TEMPORARY FLEX EQUIPMENT (PRIMARY STRATEGY)

FIGURE 3: PHASE 2 ELECTRICAL DIAGRAM

Attachment 6: Plant Layout Showing Operator Action Locations



HNP Site Layout



HNP Control Building Ground Floor (EL 130)

Table 1: List of HCVS Component, Control and Instrument Qualifications

Component Name	Equipment ID	Range	Location	Local Event Temp	Local Event Humidity	Local Radiation Level	Qualification[8]	Qualification Temp	Qualification Humidity	Qualification Radiation	Power Supply
Wetwell Vent Instruments and Components											
Remote operating station (ROS)	1, 2H21-P800	N/A	147' CB	135°F	20-90%	**CB					1R25-S066 and 1R25-S067
HCVS effluent strap-on thermocouple	1T48-N150	0-400°F	Torus Bay	218°F	50-100%	1.39+E7 RAD	IEEE 344-1975	0-500°F	No electronics, not susceptible	3.00E+08 RAD	None required
HCVS effluent strap-on thermocouple transmitter	1T48-N151		147' CB								
HCVS effluent temperature indicator	1T48-R650	0-400°F	MCR			**CB					
HCVS effluent temperature indicator (ROS panel)	1T48-R150	0-400°F	147' CB			**CB					1R25-S067
HCVS effluent radiation monitor	1T48-N152	1E-1 to 1E+5 RAD/HR	Torus Bay								
HCVS effluent radiation monitor electronics	1T48-K152		147' CB			**CB					
HCVS effluent radiation indicator	1T48-R652		MCR			**CB					
HCVS effluent radiation indicator (ROS panel)	1T48-R152	1E-1 to 1E+5 RAD/HR	147' CB			**CB					1R25-S067
HCVS pneumatic supply transmitter	1P52-N060	0 to 150 psig	130' CB			**CB					
HCVS pneumatic supply indicator	1P52-R630	0 to 150 psig	MCR			**CB					
HCVS pneumatic supply indicator (ROS panel)	1P52-R030	0 to 150 psig	147' CB			**CB					1R25-S067

[8] See FSAR Section 8.3.1.2 for qualification code of record IEEE-323-1971 and IEEE-344-1971. Where later code years are referenced, this was reconciled in the design process.

Component Name	Equipment ID	Range	Location	Local Event Temp	Local Event Humidity	Local Radiation Level	Qualification[8]	Qualification Temp	Qualification Humidity	Qualification Radiation	Power Supply
SAWA/SAWM Instruments											
Drywell Pressure Transmitter	1, 2T48-N020A	- 5 to 5 psig					IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S066
Drywell Pressure Indicator / Recorder	1, 2T48-R607A		MCR				IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S066
Drywell Pressure Transmitter	1, 2T48-N020B	- 5 to 5 psig					IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S067
Drywell Pressure Indicator / Recorder	1, 2T48-R607B		MCR				IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S067
Drywell Pressure Transmitter	1T48-N023A	0 to 90 psig					IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1R25-S066
Drywell Pressure Indicator / Recorder	2T48-R631B		MCR				IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	2R25-S067
Wetwell Water Level Transmitter	1, 2T48-N010A	0" to 300"					IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S066
Wetwell Water Level Indicator / Recorder	1, 2T48-R622A		MCR				IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S066
Wetwell Water Level Transmitter	1, 2T48-N010B	0" to 300"					IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S067
Wetwell Water Level Indicator / Recorder	1, 2T48-R622B		MCR				IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S067
Wetwell Water Level Transmitter	1, 2T48-N021A	133" to 163"					IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S066
Wetwell Water Level Indicator / Recorder	1, 2T48-R607A		MCR				IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S066
Wetwell Water Level Transmitter	1, 2T48-N021B	133" to 163"					IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S067
Wetwell Water Level Indicator / Recorder	1, 2T48-R607B		MCR				IEEE 323-1974, IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	1, 2R25-S067
SAWA flow instrument and readout	N/A	0-500 gpm	Outside, mounted on the FLEX pump	104°F	N/A	Outside, radiation not a concern	Commercial instrument qualified for over the road use, therefore qualified per NEI 12-06	120°F	100%	N/A	FLEX Pump alternator

* Denotes non-required item, added for site-specific design.
** Denotes Control Building where local radiation levels are not applicable. Building has no significant radiation sources.
*** This switch is not manipulated for EA-13-109 compliance.

Table 2: Operator Actions Evaluation

Operator Action		Evaluation Time[9]	Validation Time	Location	Thermal conditions	Radiological Conditions	Evaluation
1	Isolate Standby Gas Treatment System (SBGT) by closing inlet valve 1/2T48-F081 and outlet isolation valves 1T46-F005 & 2T46-F002A & F002B	≤ 7 hours	≤ 7 hours	Hand switches located in the MCR or at the Remote Operating Station (ROS), depending on where operator of HCVS is stationed	<120°F MCR Per GOTHIC calculations performed for FLEX actions	MCR is removed from the vent pipes and RP actions will provide protection from any airborne activity	Acceptable MCR is a preferred location based on HCVS-FAQ-1.
2	Disable PCIV interlocks by Installing electrical jumpers for PCIVs (Reference Procedures 31EO-EOP-101-1/2)	≤ 7 hours	≤ 7 hours	Panels in MCR containing PCIV interlocks	<120°F MCR Per GOTHIC calculations performed for FLEX actions	MCR is removed from the vent pipes and RP actions will provide protection from any airborne activity	Acceptable MCR is a preferred location based on HCVS-FAQ-1.
3	Confirm closed HCVS condensate drain valve 2T48-F085	≤ 7 hours	≤ 7 hours	Unit 2 only, Hand switch located in the MCR for condensate drain valve and at ROS panel (Unit 1 N/A)	<120°F MCR Per GOTHIC calculations performed for FLEX actions	MCR is removed from the vent pipes and RP actions will provide protection from any airborne activity	Acceptable MCR is a preferred location based on HCVS-FAQ-1.
4	Breach the rupture disc by opening the argon cylinder valve & valve 1/2T48-F407	≤ 5 hours	≤ 5 hours	Manual hand wheels for valves at the argon bottle and at the piping at the argon bottle station	N/A	N/A	Not required during SA event. Only required if performing early venting for FLEX
5	Close argon cylinder valve & valve 1/2T48-F407	≤ 5 hours	≤ 5 hours	Manual hand wheels for valves at the argon bottle and at the piping at the argon bottle station	N/A	N/A	Not required during SA event. Only required if performing early venting for FLEX

[9] Evaluation timing is from NEI 13-02 to support radiological evaluations.

Operator Action		Evaluation Time[9]	Validation Time	Location	Thermal conditions	Radiological Conditions	Evaluation
6	Open Wetwell PCIVs 1/2T48-F318 & 1/2T48-F326	≤ 7 hours	≤ 7 hours	Hand switches located in the MCR and at ROS	<120°F MCR Per GOTHIC calculations performed for FLEX actions	MCR is removed from the vent pipes and RP actions will provide protection from any airborne activity	Acceptable MCR is a preferred location based on HCVS-FAQ-1.
7	Open HCVS vent control valve 1/2T48-F082	≤ 8 hours	≤ 8 hours	Hand switch for valve in the MCR and at ROS	<120°F MCR Per GOTHIC calculations performed for FLEX actions	MCR is removed from the vent pipes and RP actions will provide protection from any airborne activity	Acceptable MCR is a preferred location based on HCVS-FAQ-1.
8	Align power supplies for all valves and instruments via Inverters 1/2R44-S006 & 1/2R44-S007.	≤ 8 hours	≤ 8 hours	Instruments and controls located in the MCR or Control Building	<120°F MCR Per GOTHIC calculations performed for FLEX actions	MCR is removed from the vent pipes and RP actions will provide protection from any airborne activity	Acceptable MCR is a preferred location based on HCVS-FAQ-1.
9	Replenish pneumatics with replaceable nitrogen bottles	24+ hours	24 hours	Primary nitrogen bottles for FLEX response and early venting are located in the Reactor Building. Back-up nitrogen bottles are installed in the Control Building to ensure severe accident pneumatic supply access.	N/A	N/A	Not required to enter Reactor Building during SA event. Only required to enter Control Building
10	Re-align power supplies for all valves and instruments via Inverters 1/2R44-S006 & 1/2R44-S007.	12+ hours	12 hours	Instruments and controls located in the MCR or Control Building	<120°F MCR Per GOTHIC calculations performed for FLEX actions	MCR is removed from the vent pipes and RP actions will provide protection from any airborne activity	Acceptable MCR is a preferred location based on HCVS-FAQ-1.

Operator Action		Evaluation Time[9]	Validation Time	Location	Thermal conditions	Radiological Conditions	Evaluation
11	Connect SAWA pump / motive component to water source	≤ 8 hours	≤ 8 hours	RHRSW at River Intake	<113°F per FLEX SER	N/A	N/A
12	Connect SAWA pump discharge to injection piping	≤ 8 hours	≤ 8 hours	RHRSW at River Intake using installed piping	<113°F per FLEX SER	N/A	N/A
13	Power up SAWA (RHR/RHRSW) valves with EA-12-049 (FLEX) generator	≤ 8 hours	≤ 8 hours	RHR/RHRSW valves may be operated from the main control room after re-establishing power to the MOVs using the FLEX diesel generator	<113°F per FLEX SER	N/A	N/A
14	Inject to RPV using SAWA pump (diesel) Initial SAWA injection rate is 500 gpm	≤ 8 hours (approximate venting start)	≤ 8 hours (approximate venting start)	River Intake	<113°F per FLEX SER	N/A	N/A
15	Monitor SAWA indications Using Skid mounted Pump Flow meter	≤ 8 hours	≤ 8 hours (approximate venting start)	River Intake	<113°F per FLEX SER	N/A	N/A
16	Use SAWM to maintain availability of the SAWV (Section 3.1.A)	≤ 8 hours	≤ 8 hours	MCR and Intake	<120°F MCR Per GOTHIC calculations performed for FLEX actions	N/A	N/A