Exelon Generation

Order No. EA-13-109

RS-18-062
NMP2L2677

July 3, 2018

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

Nine Mile Point Nuclear Station, Unit 2
Renewed Facility Operating License No. NPF-69
NRC Docket No. 50-410

Subject: Report of Full Compliance with Phase 1 and Phase 2 of June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)

References:

1. NRC Order Number EA-13-109, "Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," dated June 6, 2013
2. Constellation Energy Nuclear Group, LLC's Answer to June 6, 2013, Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 21, 2013
3. NRC Interim Staff Guidance 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," Revision 0, dated April 2015
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. Exelon Generation Company, LLC Nine Mile Point Nuclear Station, Units 1 and 2, Phase 1 Overall Integrated Plan per Order EA-13-109 Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, dated June 27, 2014
6. Exelon Generation Company, LLC Nine Mile Point Nuclear Station, Units 1 and 2 December 2014 (First) Six-Month Status Report Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 16, 2014 (FLL-14-035)
7. Exelon Generation Company, LLC Nine Mile Point Nuclear Station, Units 1 and 2 Second Six-Month Status Report Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2015 (RS-15-153)

8. Exelon Generation Company, LLC Nine Mile Point Nuclear Station, Units 1 and 2 Phase 1 (Updated) and Phase 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 15, 2015 (RS-15-302)
9. Exelon Generation Company, LLC Nine Mile Point Nuclear Station, Units 1 and 2 Fourth Six-Month Status Report For Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2016 (RS-16-111)
10. Exelon Generation Company, LLC Nine Mile Point Nuclear Station, Units 1 and 2 Fifth Six-Month Status Report For Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 14, 2016 (RS-16-236)
11. Exelon Generation Company, LLC Nine Mile Point Nuclear Station, Units 1 and 2 Sixth Six-Month Status Report For Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2017 (RS-17-067)
12. Exelon Generation Company, LLC Nine Mile Point Nuclear Station, Units 1 and 2 Seventh Six-Month Status Report For Phases 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 15, 2017 (RS-17-154)
13. NRC letter to Exelon Generation Company, LLC, Nine Mile Point Nuclear Station, Unit 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 No. MF4482), dated February 11, 2015
14. NRC letter to Exelon Generation Company, LLC, Nine Mile Point Nuclear Station, Unit 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 No. MF4482), dated August 25, 2016
15. NRC letter to Exelon Generation Company, LLC, Nine Mile Point Nuclear Station, Unit 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, dated October 17, 2017

On June 6, 2013, the Nuclear Regulatory Commission ("NRC" or "Commission") issued Order EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," (Reference 1) to Exelon Generation Company, LLC (EGC), previously Constellation Energy Nuclear Group, LLC (Exelon, the licensee). Reference 1 was immediately effective and directs EGC to require their BWRs with Mark I and Mark II containments to take certain actions to ensure that these facilities have a hardened containment vent system (HCVS) to remove decay heat from the containment, and maintain control of containment pressure within acceptable limits following events that result in loss of active containment heat removal capability while maintaining the capability to operate under severe accident (SA) conditions resulting from an Extended Loss of AC Power (ELAP). Specific requirements are outlined in Attachment 2 of Reference 1. Reference 2 provided EGC's initial answer to the Order.

Reference 3 provided the NRC interim staff guidance on methodologies for compliance with Phases 1 and 2 of Reference 1 and endorsed industry guidance document NEI 13-02, Revision 1 (Reference 4) with clarifications and exceptions. Reference 5 provided the Nine Mile Point Nuclear Station, Unit 2 Phase 1 Overall Integrated Plan (OIP), which was replaced with the Phase 1 (Updated) and Phase 2 OIP (Reference 8). References 13 and 14 provided the NRC review of the Phase 1 and Phase 2 OIP, respectively, in an Interim Staff Evaluation (ISE).

Reference 1 required submission of a status report at six-month intervals following submittal of the OIP. References 6, 7, 8, 9, 10, 11, and 12 provided the first, second, third, fourth, fifth, sixth, and seventh six-month status reports, respectively, pursuant to Section IV, Condition D.3, of Reference 1 for Nine Mile Point Nuclear Station, Unit 2.

The purpose of this letter is to provide the report of full compliance with Phase 1 and Phase 2 of the June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109) (Reference 1) pursuant to Section IV, Condition D.4 of the Order for Nine Mile Point Nuclear Station, Unit 2.

Nine Mile Point Nuclear Station, Unit 2 has designed and installed a venting system that provides venting capability from the wetwell during severe accident conditions in response to Phase 1 of NRC Order EA-13-109. Nine Mile Point Nuclear Station, Unit 2, has implemented 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 in response to Phase 2 of NRC Order EA-13-109.

Nine Mile Point Nuclear Station, Unit 2 Phase 1 and Phase 2 OIP Open Items have been addressed and closed as documented in References 8, 9, 10, and 11 and are considered complete per Reference 15. The information provided herein documents full compliance for Nine Mile Point Nuclear Station, Unit 2 with NRC Order EA-13-109.

EGC's response to the NRC Interim Staff Evaluation (ISE) Phase 1 Open Items identified in Reference 13 have been addressed and closed as documented in References 8, 9, 10, and 11 and are considered complete per Reference 15. The following table provides completion references for each OIP and ISE Phase 1 Open Item.

Reference 15 provided the results of the audit of ISE Open Item closure information provided in References 8, 9, 10, 11, and 12. All Phase 1 and Phase 2 ISE Open Items are statused as closed in Reference 15.

OIP Phase 1 Open Item No. 1 Perform final sizing evaluation for HCVS batteries and battery charger and include in FLEX DG loading calculation.	Deleted (closed to ISE open item number 8 below)

OIP Phase 1 Open Item No. 2 Perform final vent capacity calculation for the Torus HCVS piping confirming 1% minimum capacity.	Deleted (closed to ISE open item number 3 below)
OIP Phase 1 Open Item No. 3 Perform final sizing evaluation for pneumatic Nitrogen (N2) supply.	Deleted (closed to ISE open item number 9 below)
OIP Phase 1 Open Item No. 4 Perform seismic evaluation of Reactor Building Track Bay.	Deleted (closed to ISE open item number 2 below)
OIP Phase 1 Open Item No. 5 State which approach or combination of approaches the plant determines is necessary to address the control of combustion gases downstream of the HCVS control valve.	Deleted (closed to ISE open item number 4 below)
OIP Phase 1 Open Item No. 6 Complete evaluation for environmental/seismic qualification of HCVS components.	Deleted (closed to ISE open item numbers 10 and 12 below)
OIP Phase 1 Open Item No. 7 Complete evaluation for environmental conditions and confirm the travel path accessibility.	Deleted (closed to ISE open item number 7 below)
OIP Phase 1 Open Item No. 8 Perform final environmental evaluation of the Remote Opertating Station (ROS) location.	Deleted (closed to ISE open item number 7 below)
OIP Phase 1 Open Item No. 9 Perform radiological evaluation for Phase 1 vent line impact on ERO response actions.	Closed per Reference 9
ISE Phase 1 Open Item No. 1 Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.	Closed per Reference 9

ISE Phase 1 Open Item No. 2 Make available for NRC staff review documentation of a determination of seismic adequacy for the ROS location in the Reactor Building Track Bay.	Closed per Reference 8
ISE Phase 1 Open Item No. 3 Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one (1) 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 9
ISE Phase 1 Open Item No. 4 Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	Closed per References 8 and 11
ISE Phase 1 Open Item No. 5 Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions.	Closed per Reference 9
ISE Phase 1 Open Item No. 6 Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress in the reactor building or other buildings.	Closed per Reference 8
ISE Phase 1 Open Item No. 7 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 9

ISE Phase 1 Open Item No. 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 9
ISE Phase 1 Open Item No. 9 Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.	Closed per Reference 8
ISE Phase 1 Open Item No. 10 Make available for NRC staff audit documentation of a seismic qualification evaluation of HCVS components.	Closed per References 9 and 11
ISE Phase 1 Open Item No. 11 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 References 9 and 10
ISE Phase 1 Open Item No. 12 Make available for NRC staff audit the description 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 9
ISE Phase 1 Open Item No. 13 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 9

EGC's response to the NRC Interim Staff Evaluation (ISE) Phase 2 Open Items identified in Reference 14 have been addressed and closed as documented in References 11 and 12 and are considered complete per Reference 15. The following table provides completion references for each OIP and ISE Phase 2 Open Item.

OIP Phase 2 Open Item No. 1 Perform radiological evaluation to determine feasibility of reactor building actions.	Closed per Reference 12.
ISE Phase 2 Open Item No. 1 Licensee to provide the site-specific MAAP evaluation that establishes the initial SAWA flow rate. (Section 3.3.2.2)	Closed per References 11 and 12 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 2 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 References 11 and 12 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 3 Licensee to demonstrate that there is adequate communication between the MCR and the operator at the FLEX manual valve during severe accident conditions. (Section 3.3.3.4)	Closed per References 11 and 12 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 4 Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions. (Section 3.3.3.4)	Closed per Reference 12 utilizing BWROG generic response template.

MILESTONE SCHEDULE – ITEMS COMPLETE

NMP2 - Phase 1 Specific Milestone Schedule

Milestone	Completion Date
Hold preliminary/conceptual design meeting	November 2013
Submit Overall Integrated Implementation Plan	June 2014
Submit 6 Month Status Report	December 2014
Design Engineering Complete	March 2015

Submit 6 Month Status Report	June 2015
Operations Procedure Changes Developed	December 2015
Submit 6 Month Status Report	December 2015
Training Complete	February 2016
NMP2 Implementation Outage	April 2016
Procedure Changes Active	April 2016
Walk Through Demonstration/Functional Test	April 2016
Submit Fourth 6-Month Status Report	June 2016
Submit Fifth 6-Month Status Report	December 2016
Submit Sixth 6-Month Status Report	June 2017
Submit Seventh 6-Month Status Report	December 2017
Submit Completion Report	Complete with this submittal

NMP2 - Phase 2 Specific Milestone Schedule

Milestone	Completion Date
Submit Overall Integrated Implementation Plan	December 2015
Hold preliminary/conceptual design meeting	January 2016
Submit 6 Month Status Report	June 2016
Submit 6 Month Status Report	December 2016
Design Engineering On-site/Complete	September 2017
Submit 6 Month Status Report	June 2017
Operations Procedure Changes Developed	December 2017
Site Specific Maintenance Procedure Developed	December 2017
Submit 6 Month Status Report	December 2017
Training Complete	February 2018
Implementation Outage	April 2018
Procedure Changes Active	April 2018
Walk Through Demonstration/Functional Test	April 2018
Submit Completion Report	Complete with this submittal

ORDER EA-13-109 COMPLIANCE ELEMENTS SUMMARY

The elements identified below for Nine Mile Point Nuclear Station, Unit 2, as well as the Phase 1 (Updated) and Phase 2 OIP response submittal (Reference 8), and the 6-Month Status Reports (References 6, 7, 8, 9, 10, 11, and 12), demonstrate compliance with NRC Order EA-13-109. The Nine Mile Point Nuclear Station, Unit 2 Final Integrated Plan for reliable hardened containment vent Phase 1 and Phase 2 strategies is provided in the enclosure to this letter.

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

The Nine Mile Point Nuclear Station, 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 Nine Mile Point Nuclear Station, 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 Nine Mile Point Nuclear Station, 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 1 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 Nine Mile Point Nuclear Station, 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 Nine Mile Point Nuclear Station, 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 Nine Mile Point Nuclear Station, Unit 2 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 Nine Mile Point Nuclear Station, Unit 2 Phase 1 and Phase 2 HCVS use 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 Nine Mile Point Nuclear Station, 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 Nine Mile Point Nuclear Station, 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 5.4 and 6.2.

Nine Mile Point Nuclear Station, 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 Phases 1 and 2 OIP for Order EA-13-109 (Reference 8).

Nine Mile Point Nuclear Station, 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.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David J. Distel at 610-765-5517.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 3rd day of July 2018.

Respectfully submitted,

D. P. Helker

David P. Helker
Manager - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure: Nine Mile Point Nuclear Station, Unit 2 Final Integrated Plan Document – Hardened Containment Vent System NRC Order EA-13-109

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region I
NRC Senior Resident Inspector – Nine Mile Point Nuclear Station
NRC Project Manager, NRR – Nine Mile Point Nuclear Station
Mr. John P. Boska, NRR/JLD/JOMB, NRC
Mr. Brian E. Lee, NRR/JLD/JCBB, NRC
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Enclosure

Nine Mile Point Nuclear Station, Unit 2

Final Integrated Plan Document – Hardened Containment Vent System
NRC Order EA-13-109

(63 pages)

Final Integrated Plan

HCVS Order EA-13-109

for

Nine Mile Point Nuclear Power Station – Unit 2 (NMP2)

July 3, 2018

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).

Nine Mile Point Nuclear Station – Unit 2 (NMP2) 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. NMP2 achieved Phase 1 compliance in April 2016.

- Phase 2 provided additional protections for severe accident conditions through the development of a reliable containment venting strategy that makes it unlikely that NMP2 would need to vent from the containment drywell during severe accident conditions. NMP2 achieved Phase 2 compliance in May 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, NMP2 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 in NEI 13-02 Revision 0 and 1 respectively, Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents. 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, NMP2 conforms to NEI 13-02 Revision 1 for both Phases of Order EA-13-109.

The NRC performed a review of each OIP submittal and provided NMP2 with Interim Staff Evaluations (ISEs) (References 20 and 21) assessing the site's compliance methods. In the ISEs the NRC identified open items which the site needed to address before that phase of compliance was reached. Six-month progress reports (References 22 through 28) were provided consistent with the requirements of Order EA-13-109. These status reports were used to close many of 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 Item appeared to be addressed.

By submittal of this Final Integrated Plan NMP2 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.

Section III contains the NMP2 Final Integrated Plan details for Phase 1 of the Order. Section IV contains the Final Integrated Plan details for Phase 2 of the Order. Section V details the programmatic elements of compliance.

<u>Section I.A</u>: Summary of Compliance

<u>Section I.A.1</u>: Summary of Phase 1 Compliance

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

The HCVS is initiated via manual action at the Remote Operating Station (ROS) combined with control from either the Main Control Room (MCR) or the 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, HCVS vent line temperature, HCVS vent line pressure 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 NMP2 are seismic, external flooding, tornado, extreme high temperature, extreme cold and ice/snow. Initial operator actions are completed by plant personnel and include the capability for remote-manual initiation from the HCVS control station. Initial operator actions are completed by plant personnel to perform initial valve line-up at the ROS. Then, the primary location of vent operation is the main control room (MCR). The HCVS system can also be operated manually from the ROS. Attachment 2 contains a one-line diagram of the HCVS vent flow path.

<u>Section I.A.2</u>: 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.

- Parameters measured are wetwell (suppression chamber) pressure, Suppression Pool level, SAWA flowrate and the HCVS Phase 1 vent path parameters. Drywell pressure instrumentation may also be referenced during the event.

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 secondary injection flow path as discussed below except that the FLEX valve distribution manifold has been modified to 1) install a SAWA flow meter and 2) to increase the size of the throttle valve to accommodate the higher SAWA flow rate. The modified valve distribution manifold will be moved to the reactor building track bay to avoid dose from the drywell equipment hatch during severe accident radiological conditions. This modified flow path has been evaluated and found to be acceptable in a revision to the FLEX hydraulic calculation A10.1-A-016 (Reference 36).

NMP2 complies with NEI 13-02 Revision 1 guidance for HCVS Phase 2 using Division II systems (Residual Heat Removal System Loop B and Division II AC and DC electrical distribution system). When isolation valve maintenance that impacts the ability to ensure SAWA flow can be delivered to the RPV (diversionary flow path concern) is completed on the equivalent Division I systems (Residual Heat Removal System Loop A and Division I AC and DC electrical distribution system), NMP2 plans to continue compliance with NEI 13-02 Revision 1 guidance for HCVS Phase 2 using Division I systems. Following completion of isolation valve maintenance, the use of Division I systems for continued compliance has been evaluated and confirmed to be an acceptable SAWA strategy meeting NEI 13-02 Revision 1 guidance as described in this FIP. The Engineering Change (EC) that supports HCVS Phase 2, including supporting calculations, technically evaluated the use of either Division I or II systems for HCVS Phase 2 compliance. This FIP is written to document the acceptable use of either Division I or II systems to implement the HCVS Phase 2 SAWA strategy. From a SAWA strategy perspective, the Division I and II systems as described in this FIP are functionally equivalent.

The flow path will be from the FLEX suction at the intake structure for the plant Ultimate Heat Sink (UHS) through the FLEX (SAWA) pump discharge valve manifold. Hose connected to the pump discharge valve manifold will be routed to the modified valve distribution manifold where SAWA flow indication and control will be provided. This valve distribution manifold will also provide minimum flow and freeze protection for the pump. From this distribution manifold, 2-inch hose will be routed to the permanent SAWA connection point located within the reactor building on the "A or B" loop of Residual Heat Removal (RHR) via a flange adaptor connection, threaded hose connections, a manual valve (2RHS*V70/*V79) and necessary piping. The manual valve at the connection will be manually opened when the hose is connected. Once the SAWA components are deployed and connected, the SAWA flow path is completed by opening the RHR Low Pressure Coolant Injection (LPCI) valve 2RHS*MOV24A/B with backflow prevention provided by installed containment isolation check valve 2RHS*VI6A/B. Flow paths into other portions of the RHR system will be isolated by ensuring closure of the MOVs from the MCR and cross-ties to other systems will be isolated. Communication will be established between the MCR and the SAWA flow control location at the ROS.

Attachment 4 contains a one-line diagram of the SAWA flow path.

The SAWA electrical loads are the same as those included in the FLEX DG loading calculation reviewed for EA-12-049 compliance. The FLEX DG is located east of the control building and is a significant distance from the discharge of the HCVS on the northwest side of the reactor building. See Attachment 6 for applicable locations. Refueling of the FLEX DG is accomplished from the EDG fuel oil storage tanks as described in the EA-12-049 FIP (Ref 57). The SAWA flow meter is self-powered from internal lithium batteries with a battery life of 10 years.

Attachment 5 contains a one-line diagram of the SAWA electrical power supply.

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

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

<u>Section II</u>: List of Acronyms

AC	Alternating Current
AOV	Air Operated Valve

BDBEE	Beyond Design Basis External Event
BWROG	Boiling Water Reactor Owners' Group
CPS	Containment Purge System
CAP	Containment Accident Pressure
CST	Condensate Storage Tank
DC	Direct Current
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
GPM	Gallons per minute
HCVS	Hardened Containment Vent System
ISE	Interim Staff Evaluation
ISG	Interim Staff Guidance
JLD	Japan Lessons Learned Project Directorate
MAAP	Modular Accident Analysis Program
MCR	Main Control Room
N_2	Nitrogen

NEI	Nuclear Energy Institute
NMP1	Nine Mile Point Nuclear Station – Unit 1
NMP2	Nine Mile Point Nuclear Station – Unit 2
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
OIP	Overall Integrated Plan
PCPL	Primary Containment Pressure Limit
POS	Primary Operating Station
RCIC	Reactor Core Isolation Cooling System
RM	Radiation Monitor
ROS	Remote Operating Station
RPV	Reactor Pressure Vessel
RWCU	Reactor Water Cleanup
SA	Severe Accident
SAMG	Severe Accident Management Guidelines (NMP2 SAMGs are referred to as Severe Accident Procedures – SAPs. SAPs and SAMGs are used interchangeably through-out this document)
SAP	Severe Accident Procedure
SAWA	Severe Accident Water Addition
SAWM	Severe Accident Water Management
SBGT	Standby Gas Treatment System
SFP	Spent Fuel Pool
SRV	Safety-Relief Valve
USAR	Updated 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

NMP2 installed a new hardened wetwell vent path to comply with NRC Order EA-13-109.

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

NMP2 has a Mark II primary containment design and was not required to comply with NRC Generic Letter 89-16.

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

The HCVS vent path at NMP2 utilizes existing Containment Purge System (CPS) piping from the suppression chamber and drywell up to the Standby Gas Treatment System isolation valves (2GTS*AOV101 and 2GTS*SOV102). The inboard primary containment isolation valves (PCIV) on the suppression chamber line has been relocated from inside the containment to outside the containment. The outboard PCIV was relocated to provide room for the inboard valve. The suppression chamber piping exits the containment into the reactor building and continues until it ties into a combined Drywell/Wetwell 20" header. New 16" piping ties into this header upstream of 2GTS*AOV101/SOV102. A new air-operated valve is added to this piping, which serves as the means to control HCVS flow. Although this control valve is not a PCIV, it is designed and fabricated to the same requirements as the HCVS PCIVs. A rupture disc was added downstream of this control valve to serve as the secondary containment pressure boundary and to prevent secondary containment bypass leakage due to valve leakage during a design basis LOCA. The discharge piping exits through the reactor building wall 52 feet above ground elevation and is routed over to and up the Northwest side of the reactor building to a discharge point approximately 3' above the highest point of the reactor building roof. The NMP2 vent path is separate from the Nine Mile Point Unit 1 (NMP1) vent path. The external piping meets the reasonable protection requirements of HCVS-WP-04 for tornado missiles.

An HCVS control panel is located in the MCR which allows for the operating and monitoring of the HCVS. A secondary location for HCVS operation is the ROS located in the reactor building Track Bay. Both locations are protected from adverse natural phenomena and are sufficiently shielded. The MCR is the normal control point for HCVS operation and Plant Emergency Response actions. The reactor building Track Bay is a seismic category I structure and is also designed to withstand tornado missiles (including the outer door). Table 2 contains 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 provided by a dedicated HCVS battery charger and battery. The HCVS battery has a minimum capacity capable of providing power for 24 hours without recharging. The HCVS battery charger provided requires a 120 VAC supply. This will be supplied by a 600 VAC bus (via a 600 – 120/240 VAC step-down distribution transformer) that will be re-powered by a portable diesel generator as part of the FLEX response. In addition, a connection point that utilizes standard 120 VAC electrical connections will be provided locally for a portable generator for sustained operation of the HCVS. In the event that power is not restored to the bus, these local 120 VAC connections will allow the HCVS battery charger to receive power from a small portable generator. Actions to replenish the electrical supply include refueling the DG or connecting and refueling a small portable generator.

For the first 24 hours following the event, the motive supply for the air-operated valves (AOVs) will be nitrogen gas bottles that have been pre-installed in the ROS and are available. Calculation A10.1-P-051 determined the required amount of nitrogen needed for the required number of vent cycles in a 24-hour period. These bottles were sized such that they can provide motive force for at least 8 cycles of a vent path, which includes two openings for each of the two PCIVs (2CPS*AOV109 and 2CPS*AOV111) and at least 8 openings of the HCVS isolation valve, 2CPS-AOV134.

The HCVS design includes an Argon purge system connected just downstream of the HCVS isolation valve 2CPS-AOV134. It is designed to prevent hydrogen detonation downstream of that valve. However, the Argon purge system is required to be used only if the ELAP progresses to severe accident conditions which result in the creation of hydrogen. The Argon purge system has a switch for the control valve in the MCR to allow opening the purge for the designated time, but the system also allows for local operation at the ROS in case of a DC power or control circuit failure. The installed capacity for the Argon purge system is sized for 6 purges within the first 24 hours of the ELAP. Evaluation N2-MISC-003, "MAAP Analysis to Support SAWA Strategy" shows that in a severe accident, NMP2 would not be expected to exceed 6 vent cycles in the first 24-hour period. The design allows for Argon bottle replacement for continued operation past 24 hours. The Argon purge system can also be used to breach the rupture disc to establish the vent flow path. The MCR panel includes an indication of vent line pressure upstream of the disc to show when the disc has burst due to the increased Argon pressure.

To address the potential for creating an oxygen deficiency hazard (ODH) at the ROS, where nitrogen and argon bottles are stored, an oxygen monitor has been installed in the area. The oxygen monitor will alert any personnel in the area when the oxygen concentration is below 19.5%, which is the minimum allowable oxygen concentration, as defined by OSHA.

Instrumentation and Controls:

Existing control room indications for wetwell (suppression chamber) pressure and suppression pool (primary containment) water level are used for HCVS venting operation. Operation of the HCVS will be based on guidance in the EOPs and SAPs and will follow the primary containment pressure limit (PCPL) curves contained in these procedures. The PCPL curve uses suppression chamber pressure vs. primary containment water level parameters to determine when to vent containment. Therefore, containment wetwell pressure indication is preferred to determine the need, timing and effectiveness of the venting operation following a BDBEE, in order to ensure that containment pressure does not exceed the PCPL. Existing control room indication for wetwell pressure, shown on 2CMS*PI7A (Division 1) and 2CMS*PR7B (Division 2), will be used for this purpose. These indicators receive pressure signals from pressure transmitters 2CMS*PT7A and 2CMS*PT7B, respectively. These pressure transmitters sense the wetwell pressure from penetrations Z-337-1 and Z-338-1, both located at elevation 224'-0".

Drywell pressure instrumentation may also be referenced during the event. Existing control room indication for drywell pressure, shown on 2CMS*PI2A (Division 1) and 2CMS*PR2B (Division 2), will be used for this purpose. These indicators receive pressure signals from pressure transmitters 2CMS*PT2A and 2CMS*PT2B, respectively.

Wetwell level indication is needed to determine that the wetwell vent path is preserved. Wetwell level is displayed on indicator 2CMS*LI9A (Division 1) and 2CMS*LR9B (Division 2). These indicators receive level signals from level transmitters 2CMS*LT9A and 2CMS*LT9B, respectively. Both of the instruments interface with the suppression pool at low and high elevation of 192' and 217' and can therefore monitor between those elevations. The inlet to the HCVS vent pipe is at elevation 227'. Therefore, water level will have to be maintained below 217' in order to ensure that the vent inlet does not get covered with water. The NMP2 plant-specific MAAP analysis (Reference 37) demonstrates that the suppression pool level will remain approximately 6' below the maximum indicated level of 217'.

These pressure and level indicators and related transmitters are all Safety Related, Regulatory Guide 1.97 compliant components (Ref. NMP2-RG197-01). They are also environmentally qualified for accident conditions (Ref. 2EQDP-XMTR001). Division 1 is the FLEX diesel power backed loop, and Division 2 can be powered as the alternate FLEX strategy.

The FLEX primary electrical strategy is to provide power using a FLEX generator to Division 1 600 VAC unit substation to maintain instrumentation power supply and the alternate strategy is Division 2. Depending on availability, either loop may be used for containment pressure and wetwell level determination.

New HCVS Instrumentation and Controls:

The I&C scope for the HCVS is to display the following parameters:

- HCVS Isolation Valve Position Indication (MCR)
- HCVS Vent Pipe Temperature and Pressure (MCR)
- HCVS Vent Pipe Radiation (MCR and ROS)
- HCVS Purge System Supply Pressure (ROS)
- HCVS Valve Nitrogen Supply Pressure (ROS)
- HCVS Battery Voltage (MCR)

The control of SOVs associated with the new primary containment isolation valves is from new control room panel 2CEC-PNL801 located in the Main Control Room. The SOVs are controlled via key-lock control switches. New track bay control panel 2CPS-PNL100 serves as the main power distribution for all HCVS I&C components. Manual valves installed in the ROS that bypass the argon and nitrogen supply SOVs can be used to operate the argon purge and HCVS valves.

Table 1 contains a complete list of instruments available to the operators for operating and monitoring the HCVS.

Attachment 3 contains a one-line diagram of the HCVS electrical distribution system.

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 hardened vent piping, between the wetwell and the reactor building wall, is designed to 45 psig and 340 °F. The design pressure is not changing and is consistent with the design pressure and PCPL of primary containment.

Operating Pressure – 15.5 psia
Operating Temperature – 135 °F
BDBE Operating Temperature – 350 °F

This change has no impact on the existing design basis inputs. Existing and new CPS piping will not have the design temperature increased, but was evaluated for the beyond design basis temperature of 350 °F in accordance with Reference 7. The new temperature has been evaluated to be acceptable in the pipe stress analyses AX-515B (Reference 38).

There is only one interfacing mechanical system on the HCVS flow path, which is the Standby Gas Treatment System (GTS). The boundary valves between the two systems are 2GTS*AOV101 and 2GTS*SOV102. These valves are normally closed and will fail closed on loss of power or air, preventing the cross flow into the GTS system. Per the guidance given in NEI 13-02, leak rate testing is suggested for the HCVS system boundary valves (e.g., 2GTS*AOV101/*SOV102). Per FAQ-05, "HCVS Control and Boundary Valves" the allowable leakage was set equal to the allowable leakage for the PCIV of the valve pair associated with the HCVS containment penetrations which exhibits the highest accepted leakage rate during a 10CFR50, Appendix J testing cycle.

In this way, expectations set for boundary valves will not be set higher than those for the existing safety related PCIVs.

HCVS features to prevent inadvertent actuation include a key lock switch at the primary control station and locked closed manual valves and a normally open vent valve at the ROS which is an acceptable method of preventing inadvertent actuation per NEI 13-02.

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 allow the operators to monitor operation of the HCVS. Electrical and controls components are seismically qualified and include the ability to handle harsh environmental conditions (although they are not considered part of the site Environmental Qualification (EQ) program).

Section III.B: 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 NMP2 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.

Evaluation:

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 control 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. Open inner track bay door.	Reactor Building Track Bay	Action only required in winter months to keep Track bay >50 °F.
2. Isolate three-way valve leak-off connection upstream of the rupture disc. Unlock and Close Argon and PCIV Nitrogen Supply vent valves. Unlock and Open Argon and PCIV Nitrogen Supply isolation valves.	ROS, 2CPS*V168 (Three-way Valve) 2CPS-V155 (Nitrogen Vent) 2CPS*V150 & *156 (Nitrogen isolation valves) 2CPS-V165 (Argon vent valve) 2CPS*V169 and 2CPS-V160A thru V160H V160 (Argon isolation valves)	Remainder of HCVS operation from the MCR or ROS
3. Breach the rupture disc by unlocking and opening the purge isolation valve.	ROS, 2CPS-V140A; or MCR, 2CPS-SOV140	
4. As soon as disc is breached, close purge isolation valve.	ROS, 2CPS-V140A or MCR, 2CPS-SOV140	
5. Open Suppression Chamber Inboard Containment Isolation Valve (PCIV) 2CPS*AOV109.	Key-locked switch for 2CPS-SOV109A at HCVS Control Panel in MCR	Alternate control via manual valves at ROS.
6. Open Suppression Chamber Outboard Containment Isolation Valve (PCIV) 2CPS*AOV111.	Key-locked switch for 2CPS-SOV111A at HCVS Control Panel in MCR	Alternate control via manual valves at ROS.
7. Open HCVS Isolation Valve [2CPS-AOV134].	Key-locked switch for 2CPS-AOV134A at HCVS Control Panel in MCR	Alternate control via manual valves at ROS. After closing 2CPS-AOV134 initiate argon purge from MCR using 2CPS-SOV140

Primary Action	Primary Location/ Component	Notes
8. Monitor electrical power status, and HCVS conditions.	HCVS Control Panel in MCR	This action not required for alternate control.
9. Connect back-up power to HCVS battery charger using a small portable generator stored in the FLEX Storage Building (FSB).	Reactor Building Track Bay	Prior to depletion of the dedicated HCVS power supply batteries (no less than 24 hours from initiation of ELAP). Not necessary if FLEX diesel generator is operating.
10. Replenish pneumatic supply with replaceable Nitrogen bottles (stored in track bay rack or FSB) and/or portable air compressor stored in FSB. Replenish purge supply with replaceable Argon bottles from the FSB.	Reactor Building Track Bay	Prior to depletion of the pneumatic/purge supply (no less than 24 hours from initiation of ELAP).

Permanently installed electrical power and pneumatic supplies are available to support operation and monitoring of the HCVS for a minimum of 24 hours. No portable equipment is needed in the first 24 hours to operate the HCVS.

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 (or small generator), spare protected nitrogen/argon bottles and air compressors provide this motive force. In all likelihood, these actions will be completed in less than 24 hours. However, the HCVS can be operated for at least 24 hours without any supplementation.

The above set of actions 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 below provides a list of functional failure modes and the corresponding mitigating actions.

Table 3-2: Failure Evaluation

Functional Failure Mode	Failure Cause	Alternate Action	Failure with Alt. Action Prevents Containment Venting?
Fail to Vent (Open) on Demand	Valves fail to open/close due to loss of normal AC power/DC batteries.	None required – system SOVs utilize dedicated 24-hour power supply.	No
	Valves fail to open/close due to depletion of dedicated power supply.	Recharge system with FLEX provided portable generators or small generator.	No
	Valves fail to open/close due to complete loss of power supplies.	Manually operate backup pneumatic supply/vent lines at remote panel.	No
	Valves fail to open/close due to loss of normal pneumatic supply.	No action needed. Valves are provided with dedicated motive force capable of 24-hour operation.	No
	Valves fail to open/close due to loss of alternate pneumatic supply (long term).	Replace bottles as needed and/or recharge with portable air compressors.	No
	Valve fails to open/close due to SOV failure.	Manually operate backup pneumatic supply/vent lines at remote panel.	No
Fail to stop venting (Close) on demand	Not credible as there is not a common mode failure that would prevent the closure of at least 1 of the 3 valves needed for venting.	N/A	No
Spurious Opening	Not credible as key-locked switches prevent mispositioning of the HCVS PCIVs. Also, two locked closed nitrogen isolation valves and a locked open nitrogen vent valve in series prevent pneumatic supply to the PCIVs.	N/A	No
Spurious Closure	Valves fail to remain open due to depletion of dedicated power supply.	Recharge system with FLEX provided portable generators or small generator.	No
	Valves fail to remain open due to complete loss of power supplies.	Manually operate backup pneumatic supply/vent lines at remote panel.	No
	Valves fail to remain open due to loss of alternate pneumatic supply (long term).	Replace bottles as needed and/or recharge with portable air compressors.	No

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 in the reactor building track bay on floor elevation 261' (ground elevation). 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. Restoring MCR ventilation via the FLEX DG. MCR ventilation through control room air conditioning fan 2HVC*ACU1A (or 2HVC*ACU1B) and through Special Filter Train fan 2HVC*FN2A (or 2HVC*FN2B) were included as acceptable loads in the FLEX generator sizing calculation EC-206 (Reference 39) and FLEX generator procedure (Reference 42).
2. Opening MCR and Relay Room access doors to the outer surrounding areas, if required (References 40 and 43).
3. Opening doors and a roof hatch in the RB to establish natural circulation air flow in the RB (References 40 and 41).

Table 2 contains a thermal evaluation of all the operator actions that may be required to support HCVS operation. The relevant ventilation calculations (References 30 and 31) 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:

Primary control of the HCVS is accomplished from the primary control station (POS) in 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. (Ref. 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 in calculation H21C-114 (Reference 44).

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.

Peak maximum dose rates and 7-day total integrated dose have been calculated for the POS and the ROS in Calculation H21C-114. The radiation dose to personnel occupying defined habitability locations, resulting from HCVS operation are below the 5 rem whole body gamma dose acceptance criteria as shown below:

MCR: 7-day Total Integrated Dose = 4.1 rem whole body
ROS: 7-day Total Integrated Dose < 1 rem whole body

Therefore, during the 7 days of sustained operation for BDBEE, the predicted radiological conditions will be acceptable for the operators to gain access to areas required for HCVS operation in the POS and ROS.

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 or ROS, 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 in the reactor building track bay. The ROS 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 were evaluated as part of NMP2's response to NRC Order EA-12-049 as stated in the Reference 45 NRC Safety Evaluation.

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 evaluations mentioned in Section 1.1.2 above and calculation H21C-114 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>

Calculation A10.1-P-050 contains the verification of 1% power flow capacity at Design Pressure/PCPL (45 psig). At 1% reactor thermal power the required vent capacity is 148,607 lbm/hr. The analysis was performed by a RELAP5 model created for the HCVS piping and fittings. The current design has been evaluated considering pipe diameter, length, and geometry as well as vendor provided valve Cv's, and the losses associated with a burst rupture disc. At a wetwell pressure of 45 psig the HCVS can vent 153,900 lbm/hr of steam. As such, calculation A10.1-P-050 concludes that the design provides margin to the minimum required flow rate.

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 lower of the containment design pressure (45 psig) or the PCPL (45 psig). This calculation of containment response is contained in MAAP Calculation N2-MISC-003 that was submitted in Reference 26 and which 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.

Evaluation

The HCVS vent pipe release point to the outside atmosphere is at an elevation that is higher than the adjacent power block structures. The wetwell vent exits the Primary Containment through the existing Containment Purge System (CPS) piping, though two outboard CPS PCIVs (2CPS*AOV109 and AOV111) and the HCVS isolation valve (2CPS-AOV134). Downstream of the HCVS isolation valve, the vent piping will exit the reactor building on the southwest side of the reactor building about 52 feet above ground elevation and is routed to the west-northwest side of the building before going vertical to the top of the building. All effluents are exhausted above the unit's reactor building. This discharge point at elevation 435 feet was extended approximately three (3) feet above the reactor building parapet wall. The release point is on the far northwest side of the RB and a minimum of 25' from the reactor building and turbine building HVAC exhaust ductwork. Since the effluent release velocity of the vent exceeds 8000 fpm, it is assured that the effluent plume will not be entrained into the recirculation zone of the turbine building, reactor building, emergency response facilities or ventilation system intakes, and open doors used for natural circulation in the BDBE response.

Part of the HCVS-FAQ-04 guidance is designed to ensure that vented fluids are not drawn immediately back into any emergency ventilation intake and exhaust pathways. Such ventilation intakes should be below a level of the pipe by 1 foot for every 5 horizontal feet. As described in Section 1.1.2.1 above, power to restore MCR ventilation components is provided by the FLEX EDG and since the FSGs include restoration of MCR ventilation it was evaluated to the 1:5 ratio HCVS-FAQ-04 guidance. The most limiting intake or exhaust pathway relative to the 1:5 ratio is through an MCR emergency intake damper (2HVC*DMP4) in the ELAP event at the 316 feet elevation which is approximately 119 feet below the HVCS pipe outlet. This intake is approximately 247 feet from the Unit 2 vent pipe, which would require the intake to be approximately 49 feet below the vent pipe. Therefore, the vent pipe is appropriately placed relative to this air intake.

The vent pipe extends approximately 3 ft. above the parapet wall of the RB roof. This satisfies the guidance for height from HCVS-FAQ-04.

ECP-13-000087 Design Consideration Summary was provided to the NRC and contains an evaluation of vent pipe for protection from missiles. HCVS-WP-04 provides criteria that demonstrate robustness of the HCVS pipe. NMP2 meets all the requirements of this white paper. This evaluation documents that the HCVS pipe is adequately protected from all external events and no further protection is required.

NMP2 evaluated the vent pipe robustness with respect to wind-borne missiles against the requirements contained in HCVS-WP-04. This evaluation demonstrated that the pipe was robust with respect to external missiles per HCVS-WP-04 in that:

1. The HCVS vent piping exits the reactor building at an elevation of 313 feet, which is 52 feet above grade. Therefore, none of the HCVS vent pipe outside the reactor building is less than 30 feet above grade that would require further evaluation.

2. The exposed piping greater than 30 feet above grade has the following characteristics:

   a. The total vent pipe exposed area is 240 square feet which is less than the 300 square feet.

   b. The pipe is made of standard schedule carbon steel and is not plastic and the pipe components have no small tubing susceptible to missiles.

   c. There are no obvious sources of missiles located in the proximity of the exposed HCVS components.

3. NMP2 maintains a large cutoff saw as part of the FLEX equipment. This saw is capable of cutting the vent pipe should it become damaged such that it restricts flow to an unacceptable level.

4. Hurricanes are not a screened in hazard for NMP2.

Based on the above description of the vent pipe design, the NMP2 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

The HCVS for NMP2 is fully independent of NMP1 with separate discharge points. Therefore, the capacity at each unit is independent of the status of the other unit's HCVS. The only interfacing system with the NMP2 HCVS is the Standby Gas Treatment System (SGTS). There are two parallel interface isolation valves separating the SGTS and the HCVS discharge piping (one 20-inch air operated butterfly valve (2GTS*AOV101) and one 2-inch AC solenoid operated globe valve (2GTS*SOV102). The interface valves between the HCVS and the SGTS are normally-closed, fail-closed (spring and solenoid operated) valves. Upon initiation of an ELAP and associated loss of instrument air, if opened the valves would automatically shut due to spring pressure or loss of power to the solenoid. Therefore, no additional power is necessary.

These boundary valves are located at a high point of the SGTS piping. When closed, the leakage is minimized. At slow leakage rates, there would be no motive force to move any accumulated hydrogen away from the high point of the piping, thereby preventing a combustible mixture in any areas of the reactor building. A test connection was installed downstream of the boundary valves to facilitate local leak rate testing of the interface valves. Testing and maintenance will be performed to ensure that the valves remain within established leakage criteria in accordance with the leak test provision identified in HCVS-FAQ-05.

Based on the above description, the NMP2 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 HCVS is initiated via manual action at the ROS combined with manual control from either the MCR or the ROS at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms. Table 3-1 in Section 1.1.1 above provides a list of manual Operator actions required to initiate and operate the HCVS and the location of those actions (MCR or ROS).

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, a readily accessible alternate location, called the ROS was added. The ROS contains manually operated valves that supply pneumatics to the HCVS flow path valve actuators so that these valves may be opened without power to the valve actuator solenoids and regardless of any containment isolation signals that may be actuated. This provides a diverse method of valve operation improving system reliability.

The location for the ROS is in the reactor building track bay on the northeast side of the reactor building on elevation 261 feet. The HCVS piping is on the west side of the reactor building where it exits the building on the southwest side before being routed to the northwest side and going vertical to the top of the building. Therefore, the reactor building provides shielding for the reactor building track bay. 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 required controls and instruments that are required for severe accident response and demonstrates that all these controls and instruments will be functional during a loss of AC power and severe accident. Table 2 contains a thermal and radiological evaluation of all the 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 portable equipment that must be moved and connected for the first 24-hour period of the ELAP.

The FLEX generators will start and load, thus 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 the FLEX generators for HCVS wetwell venting components until after 24 hours. Therefore, backup electrical power required for operation of HCVS components in the first 24 hours will come from a dedicated HCVS battery charger and battery. The HCVS battery has a minimum capacity capable of providing power for 24 hours without recharging. These batteries are permanently installed in the reactor building track bay ground floor where they are protected from screened in hazards, and have sufficient capacity to provide this power without recharging. A battery sizing calculation in DCS ECP-13-000087 Attachment 3 (Reference 51) and testing

(Reference 59) demonstrated that the battery capacity is sufficient to supply HCVS wetwell venting components for 24 hours. The new battery selected is a sixty (60) cell battery with the battery cells connected in series to create 125VDC nominal voltage. The battery is rated for 104 ampere-hours.

At 24 hours, FLEX generators can be credited to repower the station instrument buses and/or the battery charger to recharge the 125VDC batteries, gas control during recharging and room temperature control is per the response to order EA-12-049. The HCVS battery charger provided requires a 120 VAC supply. This will be supplied by a 600 VAC bus (via a 600 – 120/240 VAC step-down distribution transformer) that will be re-powered by a portable diesel generator as part of the FLEX response. In addition, a connection point that utilizes standard 120 VAC electrical connections is provided locally for use of a small portable generator from the FSB for sustained operation of the HCVS.

Following a BDBE, the battery charger is expected to draw a maximum load of 2.9 kVA. This load was credited in the Reference 39 NMP2 FLEX Portable Diesel Generator Calculation EC-206 which was revised to reflect the load addition of the battery charger and an additional 0.18 kVA for the oxygen monitor described in Section III.A.2. The additional loads added remain within the capability of the NMP2 FLEX Diesel Generator. 125VDC battery voltage status will be indicated on panel 2CEC-PNL801 so that operators will be able to monitor the status of the 125VDC batteries. Attachment 3 contains a diagram of the HCVS electrical distribution system.

The two HCVS PCIVs are normally supplied by the instrument air system. To open the PCIVs remotely upon a loss of instrument air, a motive force independent from the instrument air system is required. For the first 24 hours following the event, the motive supply for the air-operated valves (AOVs) will be nitrogen gas bottles that have been pre-installed in the ROS and are available. Calculation A10.1-P-051 determined the required amount of nitrogen needed for the required number of vent cycles in a 24-hour period. These bottles were sized such that they can provide motive force for at least 8 cycles of a vent path, which includes two openings for each of the two PCIVs (2CPS*AOV109 and *AOV111) and at least 8 openings of the HCVS isolation valve, 2CPS-AOV134. Evaluation N2-MISC-003, "MAAP Analysis to Support SAWA Strategy" shows that in a severe accident, NMP2 would not be expected to exceed 6 vent cycles in the first 24-hour period. Motive force nitrogen pressure is indicated locally on three pressure gages installed in the system valve manifolds (2CPS-PI151, 2CPS-PI153 and 2CPS–PI170).

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

Evaluation

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. The physical features that prevent inadvertent actuation are the key lock switch for 2CPS-SOV109A, 2CPS-SOV111A and 2CPS-SOV134A at the primary control station and locked closed manual nitrogen supply valves and a normally open vent valve at the ROS. These design features meet the requirement to prevent inadvertent actuation of HCVS per NEI 13-02.

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, vent pipe pressure and effluent radiation levels in the MCR, as well as information on the status of supporting systems which are 125 VDC battery voltage and nitrogen pressure at the ROS.

This monitoring instrumentation provides the indication from the MCR per Requirement 1.2.4. In the event that the FLEX DGs do not energize the emergency buses, the wetwell HCVS will be supplied by the HCVS 125VDC batteries and 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, pressure, radiation monitoring, and support system monitoring, are seismically qualified as indicated on Table 1 and they 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 (2CPS-RE136) at reactor building 306'-6" floor elevation, coupled to a process and control module in panel 2CPS-PNL102. The process and control module is mounted in the ROS in the reactor building track bay 261' elevation. The MCR has radiation indication on 2CEC-PNL801 panel to verify venting operation. Radiation indication to verify venting is also available at the ROS at 2CPS-PNL102 as a direct readout on the process and control module. 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 environment in the reactor building track bay ROS. 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 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 existing hardened vent piping, between the wetwell and the reactor building wall, including valves 2CPS*AOV109 and 2CPS*AOV111 are designed to 45 psig and 340 °F. The rupture disc 2CPS*PSE55 is designed to burst at 42.5 psig. 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. Refer to 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

In order to prevent a detonable mixture from developing in the pipe, a purge system is installed to purge hydrogen from the pipe with argon after a period of venting. Prior to operating the purge system valves need to be properly aligned. Valve 2CPS*V169 is to be unlocked and opened, valves 2CPS-V160A-H are to be opened, vent valve 2CPS-V165 is to be closed and 2CPS*V168 (a three-way valve) is to be unlocked and repositioned into the "PURGE" position. Once aligned, purge operations can be performed from MCR panel 2CEC-PNL801 using 2CPS-SOV140.The argon purge system is utilized to provide the pressure needed to burst the rupture disc. Per calculation A10.1-P-053 an approximate 10-second purge time is required to burst the rupture disc. For purging the combustibles after a vent cycle, a 45-second purge time has been calculated. The use of a purge system meets the requirement to ensure the flammability limits of gases passing through the vent pipe will not be reached.

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 the containment boundary shall be tested to ensure that vent flow is released to the outside with minimal leakage, if any, through the interfacing boundaries with other systems or units.

NMP2 has implemented the operation, testing and inspection requirements in Table 3-3 for the HCVS/SAWA to ensure reliable operation of the system. These requirements are from the NEI 13-02 table under section 6.2.4. The implementing modification packages contain these as well as additional testing required for post-modification testing with the following exception to the NEI SAWA valve testing requirements noted:

Per the Exelon Preventive Maintenance (PM) template, manual valves installed in severe environmental conditions need to be cycled every 6 years; or every 8 years if installed in mild environmental conditions for design basis PM requirements. Per Exelon's engineering judgement, it is deemed cycling the manual valves (and MOVs) consistent with design basis requirements is sufficient for BDBEE systems/programs such as SAWA. No new failure modes or degradation is expected for BDBEE systems/programs that is different from design basis.

Table 3-3: Testing and Inspection Requirements

Description	Frequency
Cycle the HCVS valves and installed SAWA valves[1] and the interfacing system valves not used to maintain containment integrity during Mode 1, 2 and 3. For HCVS valves, this test may be performed concurrently with the control logic test described below.	Once per every[2] operating cycle. See discussion above for SAWA valves.
Cycle the HCVS and installed SAWA check valves not used to maintain containment integrity during unit during unit operations.[3]	Once per every other[4] operating cycle.
Perform visual inspections and a walk down of HCVS and installed SAWA components.	Once per operating cycle
Functionally test the HCVS radiation monitors.	Once per operating cycle

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

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

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

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

Description	Frequency
Leak test the HCVS (as described in Section 6.2.2 and 6.2.3).	(1) Prior to first declaring the system functional; (2) Once every three operating cycles thereafter; and (3) After restoration of any breach of system boundary within the buildings
Validate the HCVS operating procedures by conducting an open/close test of the HCVS control function from its control location and ensuring that all HCVS vent path and interfacing system boundary[5] valves move to their proper (intended) positions.	Once per every other operating cycle

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.

<u>Evaluation:</u>

The HCVS upstream of and including the second containment isolation valve (2CPS*AOV111) and penetrations are not being modified for order compliance so 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.

<u>Evaluation:</u>

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 structure(s).

[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.

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 evaluation 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.

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.

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.

NMP2 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 neither a hardened drywell vent nor a strategy at NMP2 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 utilize 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 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 so that a Unit that initially implements FLEX actions that 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.

NMP2 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) valve distribution manifold cart 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 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.

<u>Section IV.C.1</u>: Detailed SAWA Flow Path Description

The SAWA flow path is the same as the FLEX secondary injection flow path as described in Section I.A.2, except that the FLEX valve distribution manifold has been modified to 1) install a SAWA flow meter and 2) to increase the size of the throttle valve to accommodate the higher SAWA flow rate. The modified valve distribution manifold will be moved to the reactor building track bay to avoid dose from the drywell equipment hatch during severe accident radiological conditions. This modified flow path has been evaluated and found to be acceptable in a revision to the FLEX hydraulic calculation A10.1-A-016 (Reference 36). 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 (SAWA) valve distribution manifold in the reactor building track bay along with wetwell level indication to ensure that the wetwell vent is not submerged (SAWM).

The SAWA injection path, starts at the FLEX suction at the intake structure for the plant Ultimate Heat Sink (UHS) through the FLEX (SAWA) pump discharge valve manifold. Hose connected to the pump discharge valve manifold will be routed to the modified valve distribution manifold where SAWA flow indication and control are be provided. This valve distribution manifold will also provide minimum flow and freeze protection for the pump. From this distribution manifold, a 2-inch hose will be routed to the permanent SAWA connection point located within the reactor building on the "A or B" loop of Residual Heat Removal (RHR) injection line via a flange adaptor connection, threaded hose connections, a manual valve (2RHS*V70/*V79) and necessary piping. The manual valve at the connection will be manually opened when the hose is connected. The hoses and pumps are stored in the FLEX Storage Building (FSB) which is protected from all hazards. Once the SAWA components are deployed and connected, the SAWA flow path is completed by opening the RHR Low Pressure Coolant Injection (LPCI) valves 2RHS*MOV24A/B with backflow prevention provided by installed containment isolation check valves 2RHS*VI6A/B. Cross flow into other portions of the RHR system will be isolated by ensuring closure of the MOVs from the MCR and isolation of cross-ties to other systems. Communication will be established between the MCR and the SAWA flow control location using communication methods consistent with FLEX communication methods at NMP2.

BWROG generic assessment, BWROG-TP-15-008, provides the principles of Severe Accident Water Addition to ensure protection of containment. This SAWA injection path is qualified for the all the screened in hazards (Section III) in addition to severe accident conditions.

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

The actions inside the RB where there could be a high radiation field due to a severe accident will be to move the FLEX (SAWA) valve distribution manifold cart into the reactor building track bay from its storage location in the RB at the entrance to the track bay and to route hoses from outdoors through RB doors on ground elevation 261 feet to the SAWA cart and up to RB floor elevation 289 feet where the Operator then accesses a permanently installed elevated work platform to connect the hose via a flange adapter connection on elevation 301 feet to direct flow through RHS to the RPV. The above actions inside the RB can be performed before the dose is unacceptable, under the worst-case scenario within the first hour, after the loss of RPV injection. This time was validated as part of the Time Sensitive Action validation for FLEX. The only change in the FLEX deployment strategy is the FLEX valve distribution manifold now also becomes the SAWA valve distribution manifold with the SAWA flow meter now installed on it and the cart will be parked in the reactor building track bay instead of the RB hoist well area during the event for radiological shielding purposes. Reference 47 determined that this change had negligible impact on the time validation performed for FLEX.

Procedure N2-SOP-01 directs accomplishment of actions that must be done early in the severe accident event where there is a loss of all AC power and a loss of all high-pressure injection to the core. In this event, core damage is not expected for at least one hour so that there will be no excessive radiation levels or heat related concerns in the RB when the above Operator actions are implemented. The other SAWA actions all take place outside the RB at the MCR, FSB, Control Building 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. Calculation H21C-114 as amended by ECP-17-000280-CN-001 also determined that Operator actions performed in the reactor building track bay ROS are also adequately shielded (Reference 44). Once SAWA is initiated, the operators will monitor the response of containment from the MCR to determine that venting and SAWA are operating satisfactorily, maintaining containment pressure low to avoid containment failure. Stable or slowly rising trend in wetwell level with SAWA at the minimum flow rate indicates there is 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

NMP2 has methods available to extend the operational capability of manual pressure control using SRVs as provided in the plant specific 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 normal suppression pool water level of 200 feet and 217 feet elevation in the wetwell provides approximately 782,000 gallons of water volume before the level instrument 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 seven days. After containment parameters are stabilized with SAWA flow, SAWA flow will be reduced to a point where containment pressure will remain low while wetwell level is stable or very slowly rising. MAAP analysis (Reference 37) shows the suppression pool water level reaching approximately 35 feet (~elevation 211 ft.) over the course of the 7-day event, resulting in 6 feet (or ~ 276,000 gallons) of freeboard level to the limit of the level instrument at 217 feet and 16 feet of freeboard to the inlet of the HCVS vent pipe at 227 feet. A diagram of the available freeboard is shown on Attachment 1.

Section IV.C.5: Upper range of wetwell level indication

The upper range of wetwell level indication provided for SAWA/SAWM is 217 feet elevation. This defines an 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

NMP2 calculation N2-MISC-003 and BWROG-TP-15-011, demonstrate 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. The references demonstrate that, for the scenario analyzed, wetwell level will remain below the wetwell vent pipe for greater than the seven 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 NMP2 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 NMP2 severe accident procedures (SAPs). 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 the guidance in 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, NMP2 has validated that the SAWA pump can be deployed and commence injection in less than 8 hours as shown in FLEX Strategy Validation Plan No. NMP2-VP-007 (References 47, 48 and 49). 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 300 gpm. After a period of time, estimated to be about 6 hours, in which 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.

N2-MISC-003 demonstrated that, SAWA flow could be reduced to 100 gpm after six hours of initial SAWA flow rate and containment would be protected. At some point wetwell level will begin to rise indicating that the SAWA flow is greater than the steaming rate due to containment heat load such that flow can be reduced. While this is expected to be 4-6 hours, no time is specified in the procedures because the NMP2 SAPs are symptom based guidelines.

Section IV.C.8: SAWA Flow Control

NMP2 will accomplish SAWA flow control by the use of throttle valves on the FLEX (SAWA) valve distribution manifold cart. The operators at the SAWA cart will be in communication with the MCR via radios, sound powered phones, or runners and the exact time to throttle flow is not critical since there is a large margin between normal wetwell level and the level at which the wetwell vent will be submerged. The communications capabilities that will be used for communication between the MCR and the SAWA flow control location are the same as that evaluated and found acceptable for FLEX strategies (Reference 28). 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

NMP2 uses one or two portable diesel-driven pumps for FLEX and one portable diesel-driven pump for SAWA. One pump is capable of approximately 330 gpm at the pressures required for RPV injection during an ELAP (Reference 36). Each of these pumps has been demonstrated by calculation to be capable of supplying the required flow rate to the RPV and the SFP for FLEX and for SAWA scenarios (Reference 36). The pumps are stored in the FSB where they are protected from all screened-in hazards and are rugged, over the road, trailer-mounted units, and therefore will be available to function after a seismic event.

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

The Reference 37 MAAP analysis assumes a SAWA flow of 300 gpm starting 8 hours after the loss of injection and demonstrates that containment is protected at this initial flow rate by comparing it to the results using 500 gpm. The results are virtually indistinguishable with respect to containment pressure therefore proving that this flow rate prevents containment failure by over pressurization as required by the order.

Section IV.C.9.3: SAWA Pump Hydraulic Analysis

Calculation A10.1-A-016 analyzed the FLEX pumps and the lineup for RPV injection that would be used for SAWA. 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

NEI 13-02, Rev. 1, Section 4.1.4.2 requires a means of backflow prevention for the SAWA/SAWM flow path into containment in order to prevent unintended cross flow and migration from containment into other areas within the plant. Existing safety related check valves 2RHS*V16A/B provide a means of backflow prevention. Therefore, this order requirement is satisfied. These valves are tested as a part of the In-service Testing (IST) program; therefore, additional testing is not required in accordance with HCVS-FAQ-05 and NEI 13-02 Section 6.2.3.3.

Section IV.C.9.5: SAWA Water Source

NMP2 is located on the southeastern shore of Lake Ontario, which is the ultimate heat sink for the plant. NMP2 has chosen to use Lake Ontario as the primary water source throughout the ELAP/Severe Accident event. This allows the FLEX/SAWA strategy to position the FLEX/SAWA pumps at a source that can provide SAWA/SAWM that is unlimited. The FLEX/SAWA water source is taken from the intake tunnel of the NMP2 Service Water system which draws from Lake Ontario. The suction of the FLEX/SAWA pump is connected to dry hydrants which tap into the intake water tempering line located in the NMP2 Service Water system intake shaft. The dry hydrant connections are located on the north side of the Screenwell Building in a missile protection enclosure. The intake tunnels where the tempering line is located are Class I seismic structures. This long-term strategy of water supply 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 commercial pumps rated for long-term outdoor use in emergency scenarios. The pumps are diesel-driven by an engine mounted on the skid with the pump. The pumps will be refueled by the FLEX refueling equipment that has been qualified for long-term refueling operations per EA-12-049 using site procedure S-DRP-OPS-004 (Reference 50). The action to refuel the SAWA pumps was evaluated under severe accident conditions in Table 2. 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 EA-13-109.

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

Table 1 shows the electrical power source for the SAWA/SAWM instruments. For the HCVS instruments powered by the HCVS 125 VDC batteries, Reference 51 demonstrates that the HCVS batteries can provide power until the FLEX generator restores power to the battery charger.

The FLEX load on the FLEX DG per EA-12-049 was evaluated in calculation EC-206 (Reference 39). This calculation demonstrated 55 kW margin to full load. There are no additional loads on the FLEX DGs for SAWA and SAWM beyond the MOV loads already used to establish the SAWA flow path since this flow path is the same as the alternate FLEX strategy. There are no additional loads on the FLEX DGs for SAWA and SAWM instrumentation beyond those loads already described in the above Section III.A.2 under the "Instrumentation and Controls" section. The FLEX portable diesel generator is required to power one (1) safety related Division 600VAC bus in support of the following loads to support the SAWA/SAWM strategy:

- Provide power to one (1) existing safety related 125VDC static battery charger (SBC) for continual power to critical instrumentation such as the suppression pool level instrument, wetwell pressure instrument and drywell pressure instrument described in Section III.A.2 above. The diesel generator was evaluated to support the maximum input of the SBC to simultaneously supply the 125VDC electrical equipment loads and recharge the associated 125VDC station battery.

- Provide sufficient power to operate the RHR MOVs described in the above Section IV.C.1 given only one MOV will be operated at a time to establish the SAWA/SAWM flow path.

- Provide power to operate the HCVS battery charger and oxygen monitor.

The FLEX generator was qualified to carry the rest of the FLEX loads as part of Order EA-12-049 compliance.

Section IV.C.10: SAWA/SAWM Instrumentation

1) Section III.A.2 provides a complete listing of the specific instruments credited for SAWA.

2) A new portable digital based electromagnetic flow meter is used to provide a means of confirming the desired flow rate. The flow meter is installed on the FLEX (SAWA) valve distribution manifold cart stored in the reactor building. Since the flow meter is installed on the same cart that will be used for FLEX an N+1 FLEX cart with a flow meter is also stored in the robust FSB although a backup flow meter is not required by EA-13-109.

3) The flow meter is designed for the expected flow rate, temperature, pressure and radiation for SAWA over the period of sustained operation. The flow range for the model selected for NMP2 is approximately 2 to 544 GPM. This model is acceptable, because it bounds the NMP2 SAWA/SAWM flow rates of 100 to 300 gpm. The flow meter is rated for 740 psi which exceeds the 365 psi maximum expected pressure. The -4 to 140°F rated temperature range bounds the 50 to 120°F expected ambient/fluid temperature the meter will be exposed to (References 28 Closure of ISE Phase 2 Open Item 4 and Reference 52). The dose rate at the operating location of the flow meter cart (inside the reactor building track bay) is< 5E-3 rem/hr (see Reference 44, Table 8.1-1 on page 67). The total dose over the 7-day period is less than 1 rem, which is well below the generally accepted maximum for digital equipment, 1000 rem. The flow meter is commercial equipment and does not have a published radiation dose limit. The flow meter is generally rugged, is stored within a Class I Structure (i.e., the reactor building) in an area protected from non-seismic equipment that could fall on the cart and the cart has its wheels chocked to prevent movement. These measures are consistent with HCVS-OGP-011 to ensure availability following a seismic event (Reference 53).

4) The flow meter is self-powered from internal lithium 3.6-volt batteries with a battery life of 10 years.

5) Containment pressure and wetwell level instrumentation will be repowered through their respective electrical buses using the FLEX diesel generator as described in the above Section IV.C.9.6.2.

Section IV.C.10.1: 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.

Section IV.C.10.2: Describe SAWA instruments and guidance

The containment 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 used 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 station batteries until the FLEX generator is deployed and connected then powered by FLEX generator systems for the sustained operating period. These instruments are on buses included in the FLEX generator loading calculations for EA-12-049 (Reference 39). Note that other indications of these parameters may be available depending on the exact scenario.

The SAWA flow meter is a portable digital based electromagnetic flow meter installed on the FLEX (SAWA) valve distribution manifold cart and self-powered by internal batteries.

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 containment 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 3 (Reference 34) which is the NMP2 committed version per USAR Table 7.5-2 as post-accident instruments and are therefore qualified for EA-13-109 events.

The SAWA flow meter is rated for continuous use under the expected ambient conditions and so will be available for the entire period of sustained operation. Furthermore, since the FLEX/SAWA flow meter cart is deployed into the RB track bay, and on the opposite of the RB from the vent pipe, there is no concern for any effects of radiation exposure to the flow instrument as discussed in above section IV.C.10 item 3.

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

NMP2 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 most important Severe Accident consideration is the radiological dose as a result of the accident and operation of the HCVS. H21C-114 (Reference 44) analyzed dose at different locations and times where operator actions will take place during FLEX/SAWA/SAWM activities. The Design Consideration Summary in ECP-17-000280 includes an assessment of H21C-114 as amended by ECP-17-000280-CN-001 H21C-114 assuming the secondary FLEX RHS B Loop SAWA injection flow path is used. Key locations are MCR, ROS, travel paths for hose routing, UHS and FLEX/SAWA distribution manifold location. N2-SOP-02 and N2-DRP-FLEX-MECH provide guidance for ventilation strategies at various locations to mitigate high temperature conditions. Calculation ES-289 provides thermal analysis of reactor building during SAWA (Reference 30).

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

Since the SAWA pump is stored in the FSB and will be operated from outside the RB behind the screenwell building, there will be no issues with radiation dose rates at the SAWA pump control location. Inside the RB the SAWA flow path consists of stainless steel pipe which will remain unaffected by the radiation or elevated temperatures inside the RB. Inside the RB the SAWA flow path consists of piping that will either be unaffected by the radiation dose and hoses that will be run only in locations that are shielded from significant radiation dose or that have been evaluated for the integrated dose effects over the period of Sustained Operation. These hoses are qualified for the temperatures expected in the areas they will be run. This hose is a heavy duty double jacketed hose using both polyurethane and EPDM rubber. Per HCVS-OGP-009 these materials will withstand the maximum doses that can be experienced during a severe accident and are therefore acceptable provided the hose storage dose rates are ≤10 mrad/hr for remaining plant life ≤ 40 years and peak dose rates during the 7-day period of sustained HCVS operation are ≤ 9.966×10^6 mrad/hr. Hose storage locations are identified in procedure S-PM-FLEX Attachments 34-36 and the normal operating dose rates at the hose storage locations are shown on Radiation Protection Survey Maps. The dose rates are ≤10 mrad/hr and the remaining plant life is ≤ 40 years. The peak dose rates identified in dose calculation H21C-114 are ≤ 9.966×10^6 mrad/hr. 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, that section provides severe accident effects.

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

Section IV.C.2 describes the RB actions within the first 7 hours. The actions including access routes outside the reactor building that will be 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 so that expected dose is maintained below the ERO exposure guidelines.

As part of the response to Order EA-12-049, NMP2 performed calculations of the temperature response of the Reactor and Control Buildings during the ELAP event (References 30 and 31). Since, in the severe accident, the core materials are contained inside the primary containment, 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 calculations which include the heat from the HCVS vent pipe into the RB are acceptable for severe accident use (Reference 30).

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, the operators can control SAWA/SAWM as well as observe the necessary instruments from outside the RB. The thick concrete RB walls (below 387' level) as well as the distance to the core materials mean that there is no radiological concern with any actions outside the RB provided adequate distance and shielding exists between the HCVS vent pipe and personnel which has been addressed in H21C-114. Therefore, all SAWA controls and indications are accessible during severe accident conditions.

The SAWA pump and monitoring equipment can all be operated from the MCR or from outside the RB at ground level. The NMP2 FLEX response ensures that the SAWA pump, FLEX air compressors, FLEX generators and other equipment can all be run for a sustained period by refueling. All the refueling locations are located in shielded or protected areas so that there is no radiation hazard from core material during a severe accident. The monitoring instrumentation includes SAWA flow on the FLEX (SAWA) valve distribution manifold cart located in the RB track bay, and 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 contain instructions for modifying the HCVS specific procedures (References 54 and 55).

The HCVS and SAWA procedures have been developed and implemented following NMP2'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 available
- normal and backup power supplies,
- directions for sustained operation, including the storage location of portable equipment,
- training on operating the portable equipment, and
- testing portable equipment
- NMP2 does not rely on Containment Accident Pressure (CAP) to achieve net positive suction head (NPSH) for the Emergency Core Cooling System (ECCS) pumps however, the severe accident procedures include operating details that indicate the reduction of containment pressure affects margin to NPSH limits.

NMP2 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 (Reference 58). 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.

Actual language that is incorporated into site SAMGs.

Cautions

- Adding water to hot core debris may pressurize the primary containment by rapid steam generation.
- Raising suppression pool water level above El. 217 ft (top of scale) may result in loss of suppression chamber vent capability.

Priorities – With significant core damage and RPV breach, SAPs 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 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
- Verify Severe Accident Water Addition capability (N2-DRP-FLEX-MECH)

Section V.B: HCVS Out of Service Requirements

Provisions for out-of-service requirements of the HCVS and compensatory measures have been added to procedure CC-NM-118-101, Attachment 10 so that it is in the same procedure as 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, 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 projected to exceed 30 or 90 days as described above, the following actions will be performed through the corrective action system 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 criteria 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

NMP2 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 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 location during conditions of ELAP/loss of UHS with core damage. System use is for containment heat removal AND containment pressure control with potential for combustible gases.

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). NMP2 will perform the first drill demonstrating at least one of the above capabilities by May 18, 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 of exercise. Subsequent drills, tabletops or exercises will be performed to demonstrate the capabilities of different elements of Items 1, 2 and/or 3 above that is applicable to NMP2 in subsequent eight-year intervals. These requirements are captured in CC-AA-118.

Section VI: References

Number	Re	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.

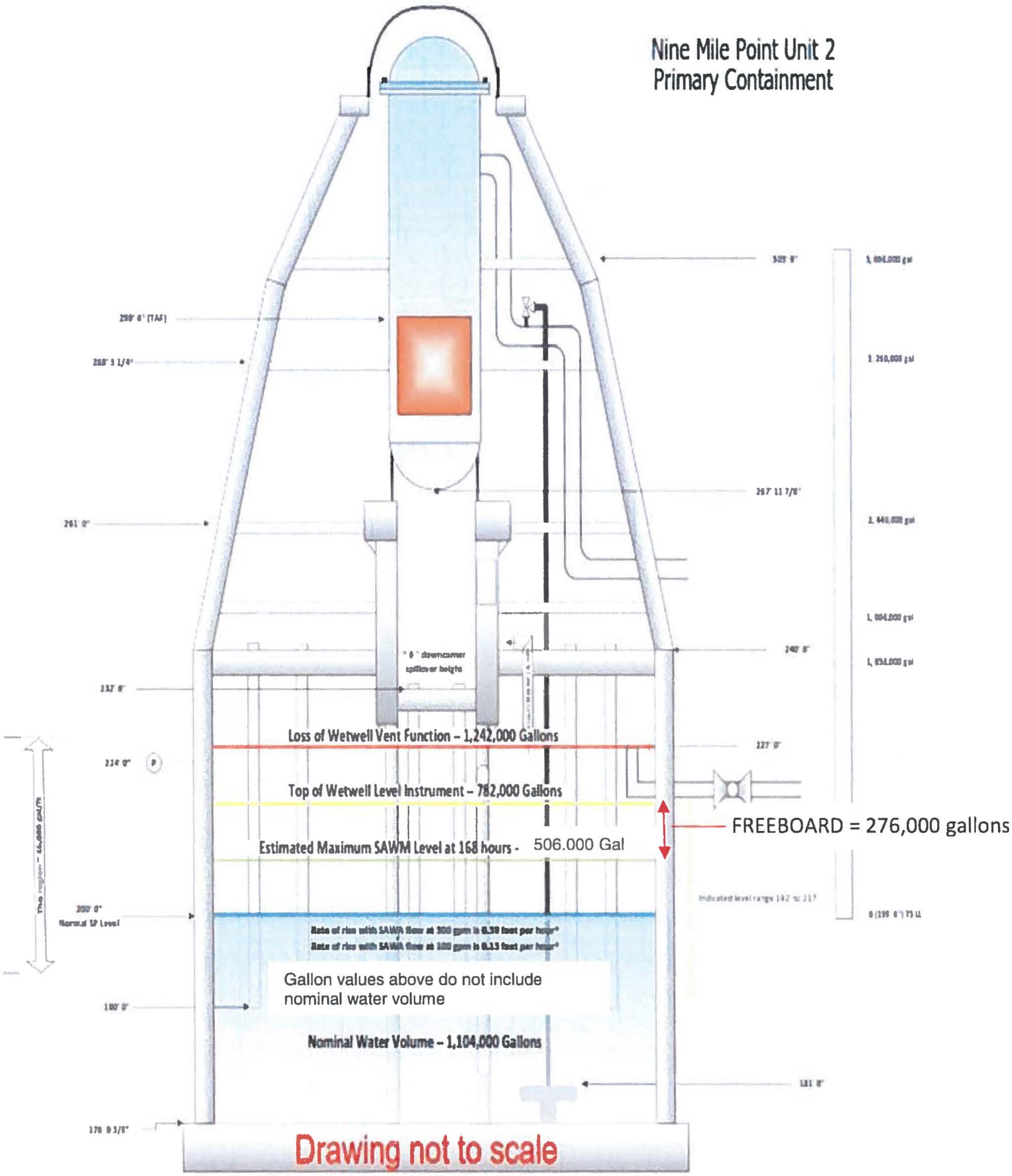
[7] NEI 13-02 Revision 1 Appendix J contains HCVS-FAQ-01 through HCVS-FAQ-09.

Number	Re	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)	ML14184B340
19. Combined OIP	0	Combined HCVS Phase 1 and 2 Overall Integrated Plan (OIP)	ML15364A075
20. Phase 1 ISE	0	HCVS Phase 1 Interim Staff Evaluation (ISE)	ML15028A149
21. Phase 2 ISE	0	HCVS Phase 2 Interim Staff Evaluation (ISE)	ML16223A853
22. 1st Update	0	First Six Month Update	ML14356A192
23. 2nd Update	0	Second Six Month Update	ML15181A017
24. 3rd Update	0	Third Six Month Update (same as Ref 19)	ML15364A075
25. 4th Update	0	Fourth Six Month Update	ML16182A013
26. 5th Update	0	Fifth Six Month Update	ML16349A033
27. 6th Update	0	Sixth Six Month Update	ML17181A033
28. 7th Update	0	Seventh Six Month Update	ML17349A031
29. Compliance Letter	0	HCVS Phase 1 and Phase 2 compliance letter	[Accession No]
30. ES-289	1	Reactor Building Thermal Response Following an Extended Loss of AC Power	N/A
31. ES-198	1	Control Building Station Blackout Analysis	N/A
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

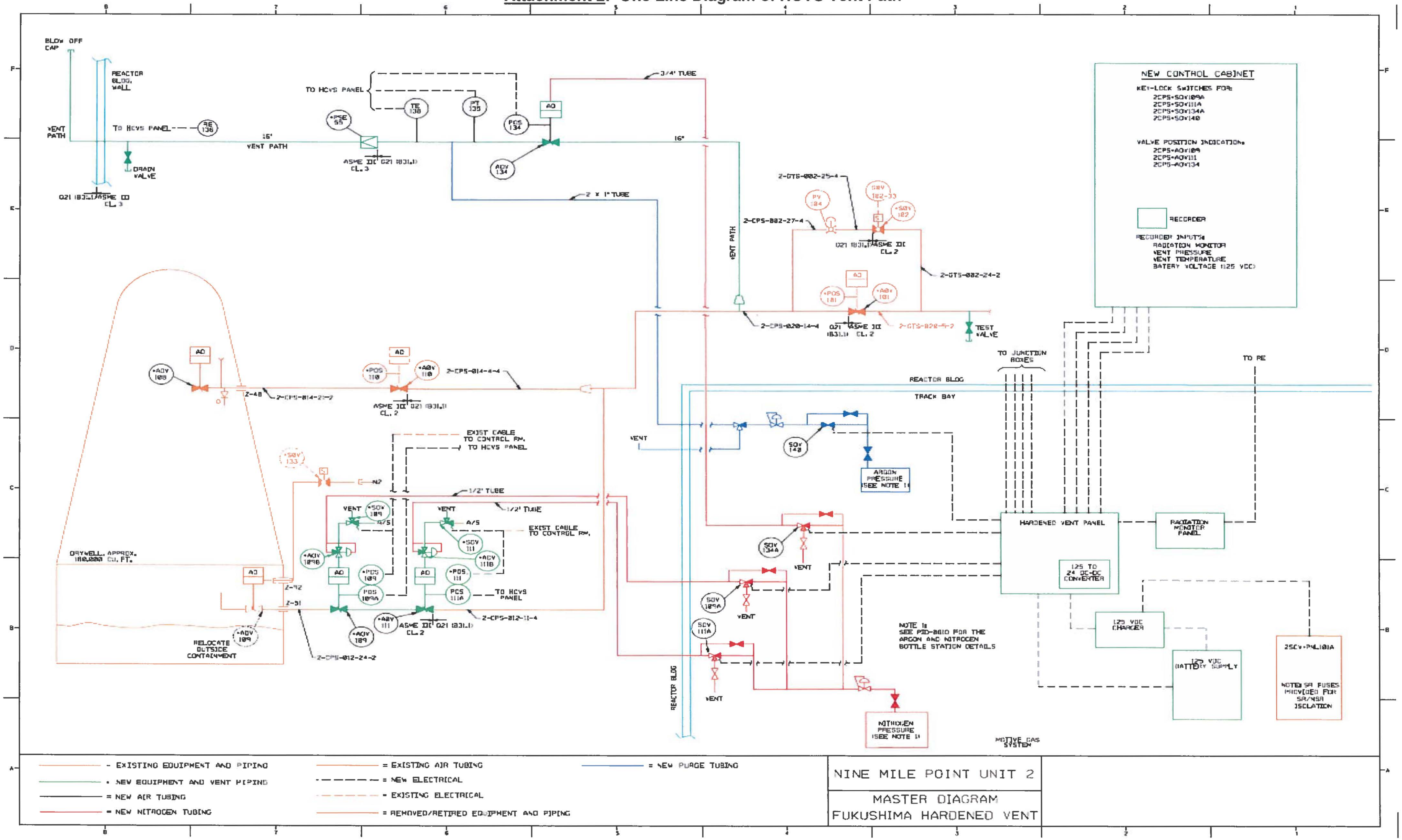
Number	Re	Title	Location[6]
34. RG 1.97	3	Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Conditions During and Following an Accident	ML003740282
35. TR-1026539	0	EPRI Investigation of Strategies for Mitigating Radiological Releases in Severe Accidents BWR, Mark I and Mark II Studies, October 2012	N/A
36. A10.1-A-016	1	Hydraulic Analysis of NMP2 FLEX Water Makeup to the RPV and SFP	N/A
37. N2-MISC-003	2	NMP2 - MAAP Analysis to Support SAWA Strategy	N/A
38. AX-515B	4	HCVS Pipe Stress Analysis	N/A
39. EC-206	0	600 VAC FLEX Phase II Portable 450kW Diesel Generator Sizing Calculation (and as amended by ECP-13-000087-CN-145 EC-206-00.00)	N/A
40. N2-SOP-02	11	Station Blackout/Extended Loss of AC Power Support Procedure	N/A
41. N2-DRP-FLEX-MECH	3	Emergency Damage Repair – BDB/FLEX Pump Deployment Strategy	N/A
42. N2-DRP-FLEX-ELEC	2	Emergency Damage Repair – BDB/FLEX Generator Deployment Strategy	N/A
43. N2-SOP-01	15	Station Blackout/Extended Loss of AC Power	N/A
44. H21C-114	0	Hardened Containment Vent System (HCVS) Radiological Dose Analysis (as amended by ECP-17-000280-CN-001 H21C-114)	N/A
45. NRC SE	0	NMP1 & NMP2 Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (January 31, 2017)	ML17009A141
46. A10.1-P-053	0	Hardened Containment Vent Purge System Design Calculation	N/A

Number	Re	Title	Location[6]
47. 04038299-016	-	PASSPORT Action Item: Review and revise as necessary NMP2 FLEX validation document (FLEX-16-000005) to ensure it bounds SAWA conditions.	N/A
48. FLEX-16-000005	0	NMP2 FLEX Strategy Validation Document (Attachment 2: Validation Plan No. NMP2-VP-007)	N/A
49. OP-NM-102-106	7	Operator Response Time Program at Nine Mile Point - ATTACHMENT 7: Nine Mile Point Unit 2 - Master List of FLEX Time Sensitive Actions (TSA109)	N/A
50. S-DRP-OPS-004	1	Refueling Diesel Driven Portable Equipment	N/A
51. ECP-13-000087-103-02	7	Engineering Change Package Design Consideration Summary FORM-103-DCS, Attachment 3 "125 VDC Battery Sizing Calculation"	N/A
52. NOB035001NDREC001	0	"M-Series Electromagnetic Flow Meter Vendor Manual"	N/A
53. HCVS-OGP-011	0	SAWA Potable Equipment Qualification	N/A
54. ECP-13-000087	7	NMP2 Reliable Hardened Containment Vent System – Phase 1	N/A
55. ECP-17-000280	0	NMP2 Reliable Hardened Containment Vent System – Phase 2	N/A
56. A10.1-P-054	0	Evaluation of N2 Supply to ADS SRV's During an ELAP	N/A
57. RS-16-089	0	Report of Full Compliance with EA-12-049 (NMP2 FLEX FIP)	ML16188A271
58. N2-SAP-1	8	Severe Accident Procedure: RPV and Primary Containment Injection	N/A
59. C92990704	0	Work Order Task 175 – Post installation testing on new batteries at 2CPS-BAT-HCVS	N/A
60. S-PM-FLEX	9	FLEX Equipment Inventories and Checklists	N/A

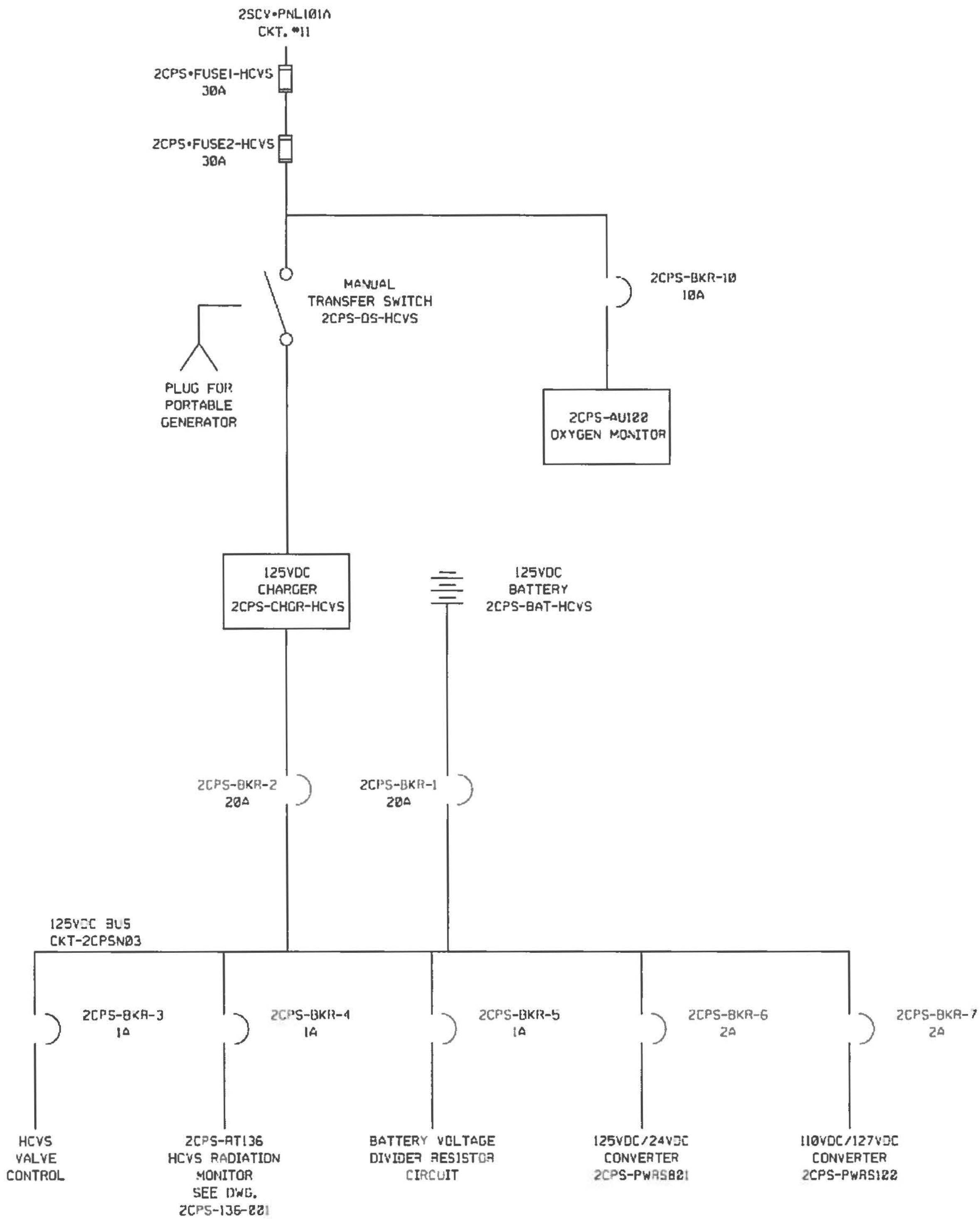
Attachment 1: Phase 2 Freeboard diagram



Attachment 2: One Line Diagram of HCVS Vent Path

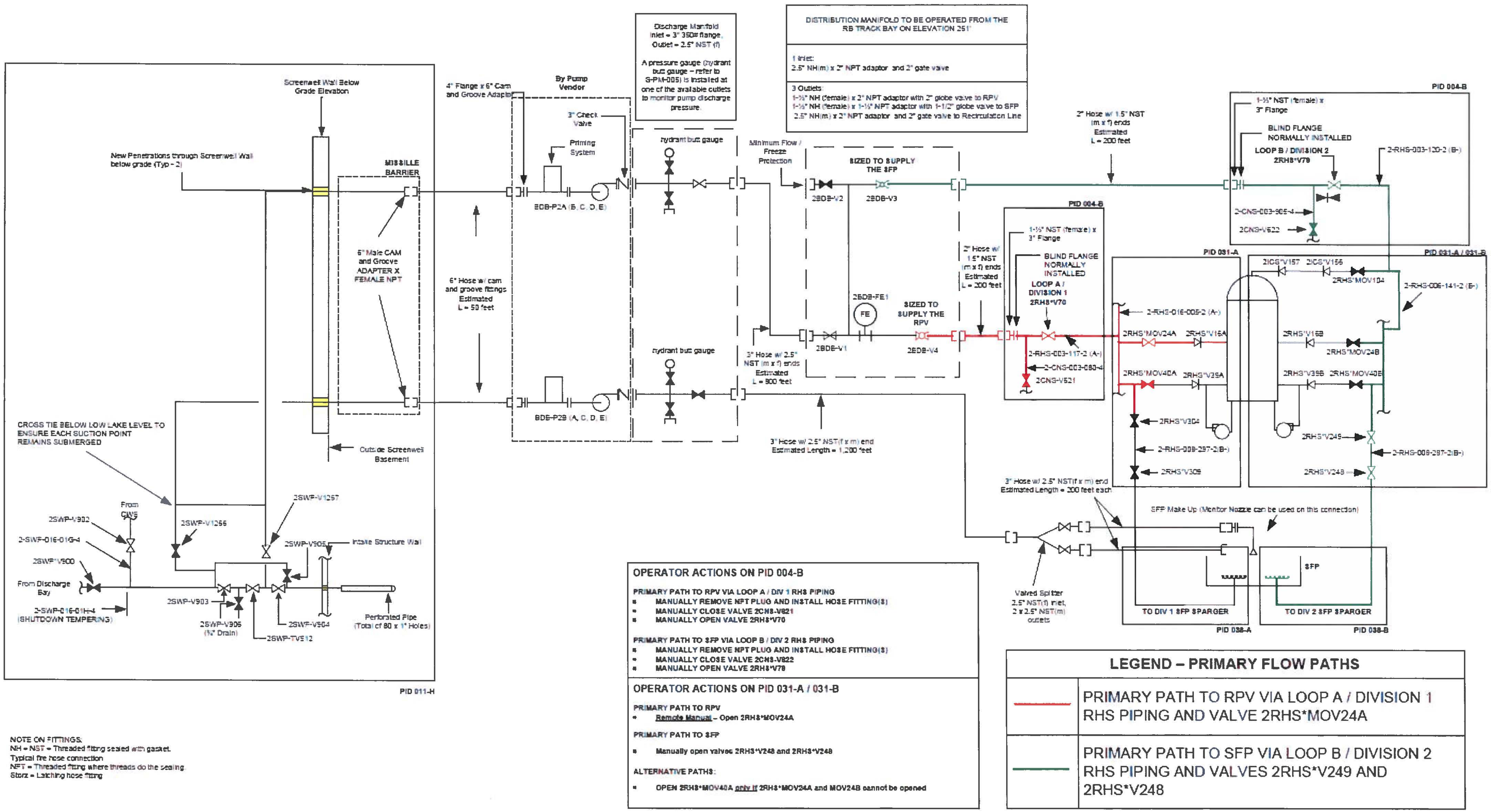


<u>Attachment 3</u>: One Line Diagram of HCVS Electrical Power Supply - Unit 2



Reference: EE-001DA Rev. 01

<u>Attachment 4</u>: One Line Diagram of SAWA Flow Path (FLEX Primary Path)



Attachment 4: One Line Diagram of SAWA Flow Path (FLEX Secondary Path)

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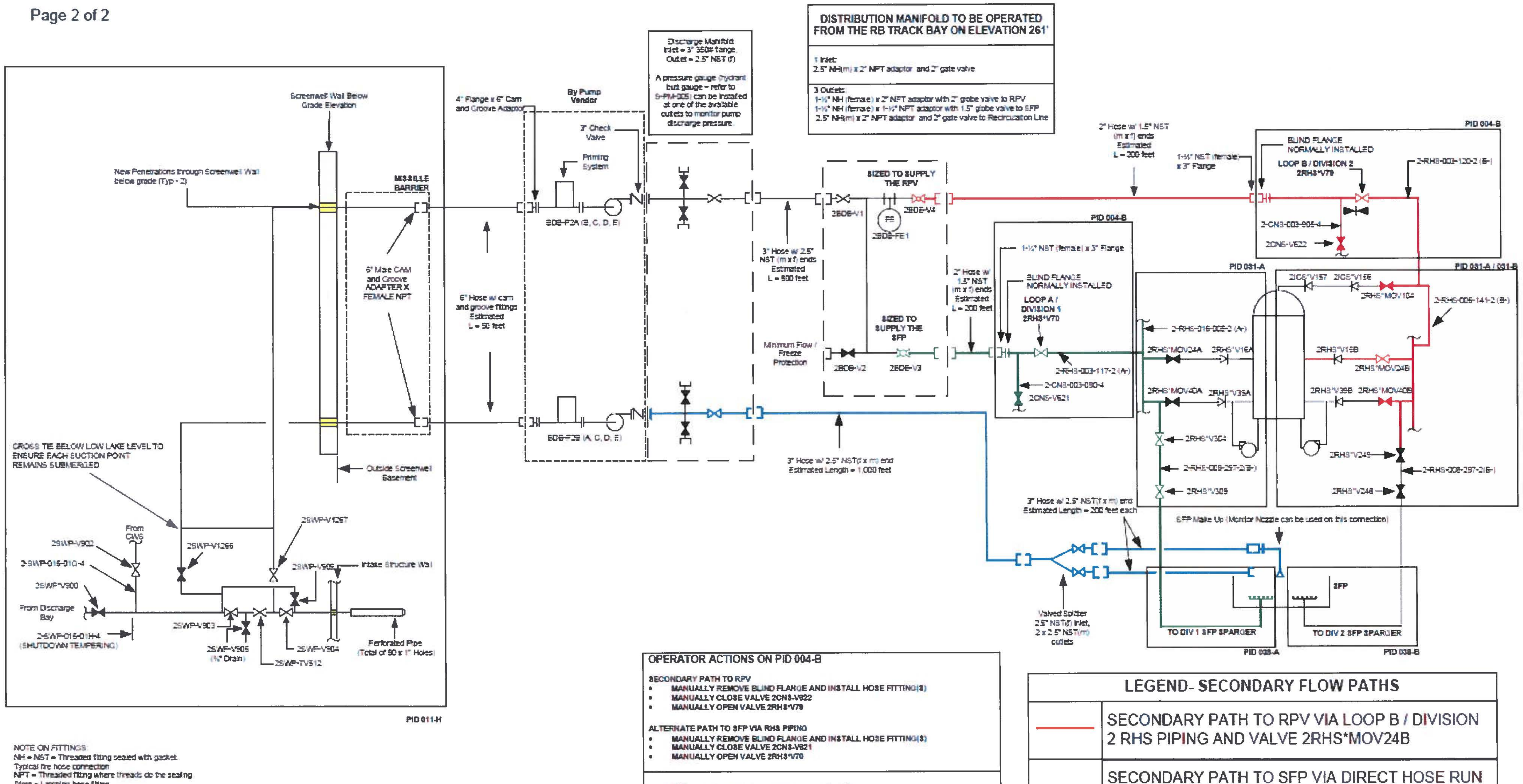


OPERATOR ACTIONS ON PID 004-B

SECONDARY PATH TO RPV
- MANUALLY REMOVE BLIND FLANGE AND INSTALL HOSE FITTING(S)
- MANUALLY CLOSE VALVE 2CNS-V822
- MANUALLY OPEN VALVE 2RHS*V79

ALTERNATE PATH TO SFP VIA RHS PIPING
- MANUALLY REMOVE BLIND FLANGE AND INSTALL HOSE FITTING(S)
- MANUALLY CLOSE VALVE 2CNS-V821
- MANUALLY OPEN VALVE 2RHS*V70

OPERATOR ACTIONS ON PID 031-A / 031-B

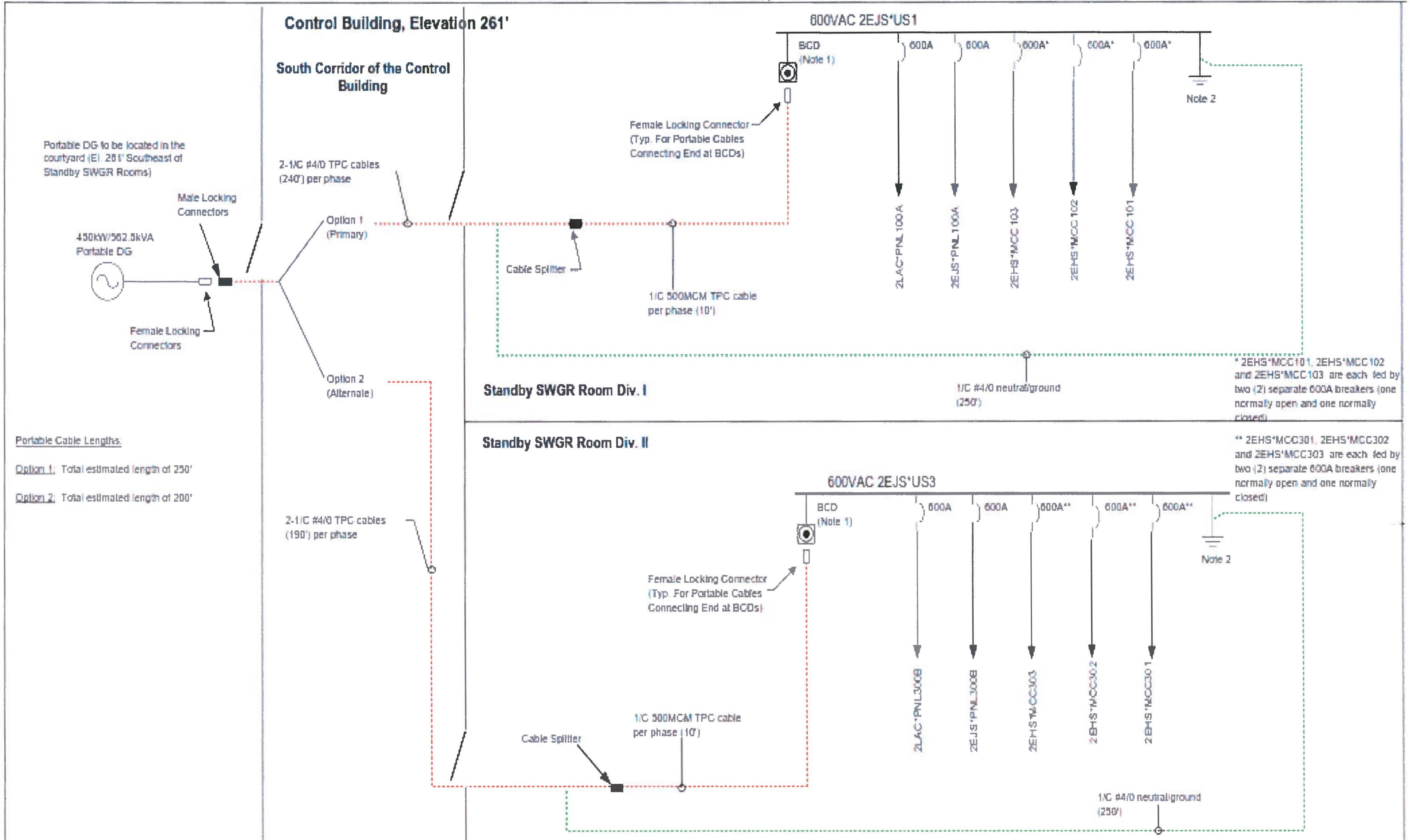
SECONDARY PATH TO RPV
- Remote Manual – Open 2RHS*MOV24B

ALTERNATIVE PATHS:
- OPEN 2RHS*MOV40B only if 2RHS*MOV24A and MOV24B cannot be opened
- Open 2RHS*MOV104 only if 2RHS*MOV24A, MOV24B and MOV40B cannot be opened.

ALTERNATE PATH TO SFP VIA RHS PIPING
- MANUALLY OPEN VALVES V304 AND V309 TO MAKE-UP SFP

LEGEND- SECONDARY FLOW PATHS	
(red line)	SECONDARY PATH TO RPV VIA LOOP B / DIVISION 2 RHS PIPING AND VALVE 2RHS*MOV24B
(blue line)	SECONDARY PATH TO SFP VIA DIRECT HOSE RUN TO MONITOR SPRAY NOZZLE OR HOSE RUN OVER THE EDGE
(green line)	OR ALTERNATE PATH TO SFP VIA LOOP A / DIVISION 1 RHS PIPING AND VALVES 2RHS*V304 AND 2RHS*V309

Attachment 5: One Line Diagram of SAWA Electrical Power Supply



LEGEND:

- .... Portable Cable consist of three parallel sets of 2 – 1/C #4/0 AWG and 1/C 500 MCM TPC cables
- -------- 1/C #4/0 AWG TPC Cables for portable DG system grounding

Note:

1.) Existing "future space", cubicle 5C will be used for connection via a Bus Connection Device (BCD). The BCD is non-safety related (NSR) and will be equipped with (1) TPC male locking receptacle, Model # PA22MR, per phase.

2.) Portable DG neutral to be grounded at the Switchgear neutral/ground bus.

Attachment 6: Plant Layout Showing Operator Action Locations

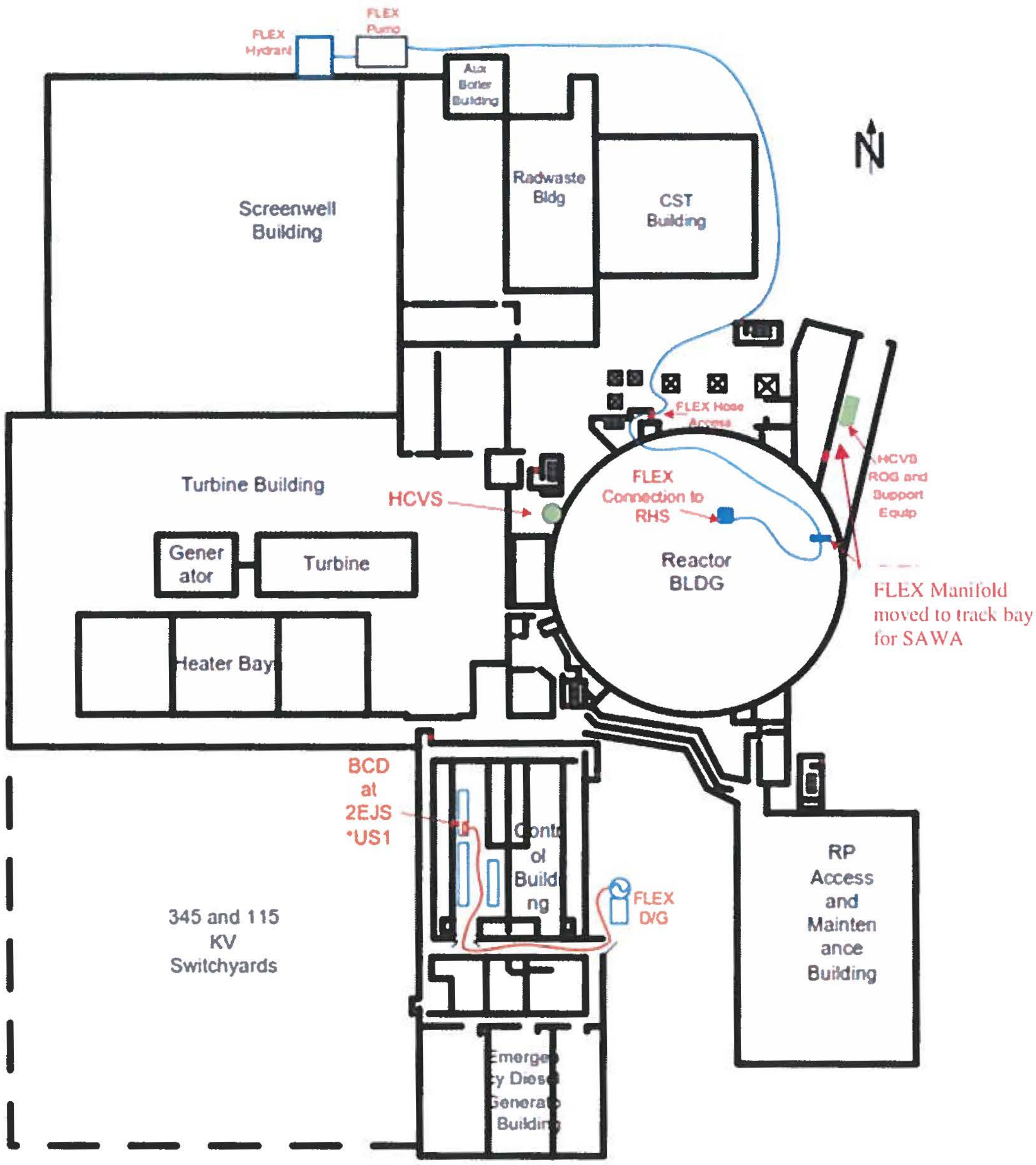


Table 1: List of HCVS Component, Control and Instrument Qualifications

Component Name	Equipment ID	Range	Location	Local BDBE Temp	Local BDBE Humidity	Local BDBE Radiation	Qualification[8]	Qualification Temp	Qualification Humidity	Qualification Radiation	Power Supply
Wetwell Vent Instruments and Components											
HCVS effluent temperature RTD	2CPS-TE138	0-900°F	306' RB Floor, on 16" pipe	280°F (Local to pipe)	100%	5.5E6 R TID	IEEE 323-1974 IEEE 344-1975	485°F	100%	3.0E8 R TID	HCVS 125 VDC Batt & Batt Charger
HCVS effluent pressure transmitter	2CPS-PT135	0-300 psig	306' RB Floor, ~30' from pipe	180°F	100%	1.5E6 R TID	IEEE 323-1974 IEEE 344-1975	250°F	100%	3.5E6 R TID	HCVS 125 VDC Batt & Batt Charger
HCVS effluent Radiation Detector	2CPS-RE136	10E-2 to 10E4 Rad/hr	306' RB Floor, adjacent to pipe	280°F	100%	5.5E6 R TID	IEEE 323-1974 IEEE 344-1975	350°F (max normal operating)	100%	2E8 R TID	HCVS 125 VDC Batt & Batt Charger
Wetwell vent radiation monitor/ processor	2CPS-RT136	10E-2 to 10E4 Rad/hr	MCR, ROS, RB Track Bay	120°F	90%	< 1 R TID	IEEE 323-1974 IEEE 344-1975	131°F	95%	1E3 TID	HCVS 125 VDC Batt & Batt Charger
HCVS Limits Switches used at 2CPS-AOV134, 2CPS*AOV109 & AOV111	2CPS*AOV109-O/C 2CPS*AOV111-O/C 2CPS-AOV134-O/C	-	215' & 306' RB Floor, adjacent to pipe	280°F (Local to pipe)	100%	5.5E6 R TID	IEEE 323-1974 IEEE 344-1975 IEEE-383-1977	>280°F (Ref. 54, FORM-103-DCS, Section 4.1.14)	100%	3.63E8 R TID	HCVS 125 VDC Batt & Batt Charger
HCVS Valve Actuators for 2CPS-AOV134, 2CPS*AOV109 & AOV111	2CPS*AOV109-ACT 2CPS*AOV111-ACT 2CPS-AOV134-ACT	-	215' & 306' RB Floor, adjacent to pipe	280°F (Local to pipe)	100%	5.5E6 R TID	IEEE 323-1974 IEEE 344-1975 IEEE-383-1977	>280°F (Ref. 54, FORM-103-DCS, Section 4.1.14)	100%	7.8E7 R TID	HCVS Nitrogen Supply
HCVS Control Panel and internal components	2CEC-PNL801	-	MCR	100°F	90%	4.1 R TID	N/A - insensitive	N/A - insensitive	N/A - insensitive	N/A - insensitive	HCVS 125 VDC Batt & Batt Charger

[8] See USAR for qualification code of record IEEE-323-1974 and IEEE-344-1975. Where later code years are referenced, this was reconciled in the design process.

Component Name	Equipment ID	Range	Location	Local BDBE Temp	Local BDBE Humidity	Local BDBE Radiation	Qualification[8]	Qualification Temp	Qualification Humidity	Qualification Radiation	Power Supply
HCVS Components in ROS	2CPS-PNL100 125 VDC Battery/ Voltage Meter, Batteries, Argon/N2 Pressure Indicators	-	ROS, RB Track Bay	120°F	90%	< 1 R TID	IEEE 323-1974 IEEE 344-1975	120°F	>90%	>1 R TID	HCVS 125 VDC Batt & Batt Charger
Wetwell Level Indication	2CMS*LI9A (2CMS*LR9B)	192'–217'	MCR	100°F	90%	4.1 R TID	IEEE 323-1974 IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	Backed by FLEX EDG
Wetwell Pressure Indication	2CMS*PI7A (2CMS*PR7B)	0-150 psig	MCR	100°F	90%	4.1 R TID	IEEE 323-1974 IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	Backed by FLEX EDG
Drywell Pressure Indication	2CMS*PI2A (2CMS*PR2B)	0-150 psig	MCR	100°F	90%	4.1 R TID	IEEE 323-1974 IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	Backed by FLEX EDG
SAWA Flow Meter	2DBD-FE1	2-544 gpm	RB 261' Floor, Near ROS	120°F	90%	< 1 R TID	N/A	-4-140°F	N/A	1E3 TID	Internal Batteries

Table 2: Operator Actions Evaluation

	Operator Action	Evaluation Time[9]	Validation Time[10]	Location	Thermal Conditions	Radiological Conditions[11]	Evaluation VP # & TCA/TSA #
1	Control Bldg. ventilation & PPC shutdown	0-1 hour	52 min	MCR, Computer room one elev. Below MCR, Relay room outside MCR	No heat stress concerns in Control Building (CB).	No rad concerns in CB.	Acceptable NMP2-VP-001 NMP2-VP-002 TCA2, TSA108
2	DC 1-hr load shed	0-1 hour	33 min	MCR, CB East & West Cable Chases 288' & 306' elevations	No heat stress concerns in CB.	No rad concerns in CB.	Acceptable NMP2-VP-003 TSA107
3	DC 2-hr load shed	≤7 hours	88 min	MCR, CB, RB 215', 261' and 306' elev. TB, Aux Boil, Radwaste & N/S Aux Bays	No heat stress concerns in RB or CB per Ref 30 & 31 this early in event.	No rad concerns in CB, TB, Aux Bays, RW, Aux Boil due to RB wall shielding & no HCVS operation until > 7 hrs (Ref. 37). Dose points in SW side of RB elevations 215', 261', 306' for load shedding are similar to those evaluated in Reference 44 for the SE RB side provided Operators do not linger in RB areas & HCVS operation > 7 hrs (Ref. 44).	Acceptable NMP2-VP-005 TSA112

Operator Action		Evaluation Time[9]	Validation Time[10]	Location	Thermal Conditions	Radiological Conditions[11]	Evaluation VP # & TCA/TSA #
4	DC 4-hr load shed	≤70-4 hours	36 min	CB elev. 261', N/S Aux Bays	No heat stress concerns per Ref 30 & 31 this early in event.	No rad concerns in CB or Aux Bays due to RB wall shielding & no HCVS operation until > 7 hrs (Ref. 37).	Acceptable NMP2-VP-006 TSA113
5	Deploy SAWA pump/hoses /cart and make connections for preferred FLEX path = SAWA path	≤70-4 hours	2 hrs & 25 min	Outdoors, RB 261', 289' elev. & RB Track Bay	No heat stress concerns for outside ambient conditions. No heat stress concerns per Ref 30 this early in event in RB.	No rad concerns outdoors due to RB wall shielding & no HCVS operation until > 7 hrs. Dose points on RB elevations 306', 289', 261' and 215' for Operator travel paths were evaluated in Ref 44 and dose acceptable provided Operators do not linger in RB areas & HCVS operation > 7 hrs (Ref. 37).	Acceptable NMP2-VP-007 TSA109
6	Deploy FLEX EDG for Div. I Battery Charger.	≤70-6 hours	1 hr & 59 min	CB Cable Storage Rm and Outdoors.	No heat stress concerns for outside ambient conditions. No heat stress concerns per Ref 31 in CB.	No rad concerns outdoors or in CB due to RB wall shielding & no HCVS operation until > 7 hrs (Ref. 37).	Acceptable NMP2-VP-010 TSA114

	Operator Action	Evaluation Time[9]	Validation Time[10]	Location	Thermal Conditions	Radiological Conditions[11]	Evaluation VP # & TCA/TSA #
7	RB cooling & passive ventilation	≤7 hours	60 min	RB elev. 261' N/S stair towers & RB elev. 427' roof door	No heat stress concerns in RB 261' elev. and higher for first 7 hours (Ref. 30). Actions complete prior to 7 hours (Start Time + Validation Time = 7 hrs)	No rad concerns as Start Time + Validation Time = 7 hrs, such that actions are complete prior to venting (HCVS operation > 7 hrs per Ref. 37)	Acceptable NMP2-VP-012 NMP2-VP-013 TSA117 TSA118
8	HCVS Valves switch actuation and instrument monitoring	≥ 7 hours (approx. venting start)	N/A	MCR & ROS (See Table 3-1 for Operator actions necessary to initiate venting)	No heat stress concerns in RB Track Bay (ROS) or CB per Ref 30 & 31. Outer RB track bay door can be opened if necessary to promote ventilation.	MCR & ROS 7-day TID = 4.1 R & < 1 R, respectively (both < 5R acceptance) and RP actions will provide protection from any airborne activity	Acceptable
9	Backup HCVS valve operation (if primary method fails)	≥ 7 hours (approximat e venting start)	N/A	ROS only (See Table 3-1 for Operator actions necessary to initiate venting)	No heat stress concerns in RB Track Bay (ROS) per Ref 30. Outer RB track bay door can be opened if necessary to promote ventilation.	ROS 7-day TID < 1 R and RP actions will provide protection from any airborne activity. Precautions are provided in N2-EOP-6.21 for Operator travel path from MCR to ROS.	Acceptable

	Operator Action	Evaluation Time[9]	Validation Time[10]	Location	Thermal Conditions	Radiological Conditions[11]	Evaluation VP # & TCA/TSA #
10	SAWA pump operation and refueling	>7 hours (maximum injection start time is 8 hours & max refueling time is 14 hours)	1 hour 41 minutes to refuel SAWA pump + FLEX EDG	Outside, North of Screenwell Bldg. and travel path from FLEX Bldg. to Screenwell Bldg.	No heat stress concerns for outside ambient conditions.	N2-DRP-FLEX-MECH Section 6.2 provides instruction as to where to locate the SAWA pump and where personnel should stay to ensure the pump and personnel are shielded from direct shine from the HCVS vent pipe. Precautions are provided in the portable equipment refueling procedure S-DRP-OPS-004 to perform refueling activities for the SAWA pump and FLEX EDG when HCVS is not venting and/or use FLEX Transfer Cube fuel oil trailer travel paths that are not in a direct line of sight of the HCVS vent pipe.	Acceptable NMP2-VP-016 TSA121

	Operator Action	Evaluation Time[9]	Validation Time[10]	Location	Thermal Conditions	Radiological Conditions[11]	Evaluation VP # & TCA/TSA #
11	FLEX Generator operation and refueling	>7 hours (maximum refueling time is 14 hours)	1 hour 41 minutes to refuel SAWA pump + FLEX EDG	Outside, Southeast side of CB courtyard travel path from FLEX Bldg. to Screenwell Bldg. to EDG	No heat stress concerns for outside ambient conditions.	FLEX EDG will be located as specified in Ref 44 Section 8.3.2 to prevent direct shine from HCVS pipe. Precautions are provided in N2-DRP-FLEX-ELEC for locating the FLEX EDG in an area shielded from the HCVS vent pipe.	Acceptable NMP2-VP-016 TSA121
12	Actions to deploy & refuel FLEX portable air compressor to repressurize N2 tank 2IAS*TK4/5	>7 hours per Ref 56. (FLEX compressor requires refueling 6 hours after being placed in service per FLEX FIP Ref 57)	62 minutes	Outside RB, east of the seismic isolation space	No heat stress concerns for outside ambient conditions.	Unit 2 Nitrogen tank farm where compressor will be deployed is located on the southeast side of RB and is shielded from containment and vent pipe by RB concrete walls, so no dose concern.	Acceptable NMP2-VP-017 TSA122

[9] Evaluation timing is from NEI 13-02 to support radiological evaluations and are based on the Time Required or Time Constraint columns in OP-NM-102-106 Attachments 5 & 7, respectively.
[10]Validation time is based on times listed in OP-NM-102-106 Attachment 7 Results column and when added to the Start Time must be < Max Evaluation Time.
[11]Refer to Reference 44 for dose assessment.