Exelon Generation

Order No. EA-13-109

RS-18-088
NMP1L3229

August 20, 2018

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

Nine Mile Point Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-63
NRC Docket No. 50-220

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 1 – 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. MF4481), dated March 26, 2015
14. NRC letter to Exelon Generation Company, LLC, Nine Mile Point Nuclear Station, Unit 1 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 2 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC No. MF4481), dated August 30, 2016
15. NRC letter to Exelon Generation Company, LLC, Nine Mile Point Nuclear Station, Unit 1 – 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 30, 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 1 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 1.

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 1.

Nine Mile Point Nuclear Station, Unit 1 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 1, 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 1 Phase 1 and Phase 2 OIP Open Items have been addressed and closed as documented in References 8, 9, 10, 11, and 12 and are considered complete per Reference 15. The information provided herein documents full compliance for Nine Mile Point Nuclear Station, Unit 1 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 9, 10, 11, and 12 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 chartger and include in FLEX DG loading calculation.	Deleted (closed to ISE open item number 7 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 2 below)
OIP Phase 1 Open Item No. 3 Perform final sizing evaluation for pneumatic Nitrogen (N2) supply.	Deleted (closed to ISE open item number 8 below)
OIP Phase 1 Open Item No. 4 Perform confirmatory environmental condition evaluation for the Turbine Building in the vicinity of the Remote Operating Station (ROS) and HCVS dedicated pneumatic supply and batteries.	Deleted (closed to ISE open item numbers 6 and 11 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 3 below)
OIP Phase 1 Open Item No. 6 Complete evaluation for environmental/seismic qualification of HCVS components.	Deleted (closed to ISE open item numbers 9 and 11 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 6 below)
OIP Phase 1 Open Item No. 8 Perform radiological evaluation for Phase 1 vent line impact on ERO response actions.	Closed per Reference 11
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 References 9 and 11
ISE Phase 1 Open Item No. 2 Make available for NRC staff audit	Closed per References 9 and 11

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.	
ISE Phase 1 Open Item No. 3 Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	Closed per References 10 and 11
ISE Phase 1 Open Item No. 4 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. 5 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 References 9 and 11
ISE Phase 1 Open Item No. 6 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 References 10 and 11
ISE Phase 1 Open Item No. 7 Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.	Closed per References 9 and 12

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

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, 12, and 15 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 the SAWA flow control point location.	Deleted (closed to ISE open item number 1 below)
ISE Phase 2 Open Item No. 1 Licensee to confirm through analysis the temperature and radiological conditions to ensure that operating personnel can safely	Closed per References 12 and 15 utilizing BWROG generic response template.

access and operate controls and support equipment (ISE Section 3.3.2.1)	
ISE Phase 2 Open Item No. 2 Licensee to evaluate the SAWA equipment and controls, as well as ingress and egress paths for the expected severe accident conditions (temperature, humidity, radiation) for the sustained operating period (ISE Section 3.3.2.3).	Closed per References 12 and 15 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 3 Licensee to demonstrate how instrumentation and equipment being used for SAWA and supporting equipment is capable to perform for the sustained operating period under the expected temperature and radiological conditions (ISE Section 3.3.2.3).	Closed per References 12 and 15 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 4 Licensee to demonstrate that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions (ISE Section 3.3.3).	Closed per References 11 and 15 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 5 Licensee to demonstrate how the plant is bounded by the reference plant analysis that shows the SAWM strategy is successful in making it unlikely that a drywell vent is needed (ISE Section 3.3.3.1).	Closed per References 11 and 15 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 6 Licensee to demonstrate that there is adequate communication between the MCR and the operator at the FLEX manual valve during severe accident conditions (ISE Section 3.3.3.4).	Closed per References 11 and 15 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 7 Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions (ISE Section 3.3.3.4).	Closed per References 11 and 15 utilizing BWROG generic response template.

MILESTONE SCHEDULE – ITEMS COMPLETE

NMP1 - 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
Submit 6 Month Status Report	June 2015
Submit 6 Month Status Report	December 2015
Submit 6 Month Status Report	June 2016
Design Engineering Complete	January 2017
Submit 6 Month Status Report	December 2016
Submit 6 Month Status Report	June 2017
Operations and Maintenance Procedure Changes Developed, Training Complete	February 2017
NMP1 Implementation Outage	April 2017
Procedure Changes Active, Walk-Through Demonstration/Functional Test	April 2017
Submit Completion Report	Complete with this submittal

NMP1 - Phase 2 Specific Milestone Schedule

Milestone	Completion Date
Submit Overall Integrated Implementation Plan	December 2015
Hold preliminary/conceptual design meeting	June 2015
Submit 6 Month Status Report	June 2016
Submit 6 Month Status Report	December 2016
Submit 6 Month Status Report	June 2017
Submit 6 Month Status Report	December 2017
Design Engineering Complete	December 2017
Maintenance and Operations Procedure Changes Developed, Training Complete	February 2018

Implementation Outage	April 2017
Procedure Changes Active, 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 1, 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 1 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 1, 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 1, 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 1, 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 1, 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 1 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 1 complies with the requirements specified in the Order and described in NEI 13-02, Revision 1, "Industry Guidance for Compliance with

Order EA-13-109". The Phase 1 and Phase 2 HCVS has been installed in accordance with the station design control process.

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

HCVS PHASE 1 AND PHASE 2 PROGRAMMATIC FEATURES - COMPLETE

Storage of portable equipment for Nine Mile Point Nuclear Station, Unit 1 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 1 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 1 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 1 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 1 has completed evaluations to confirm accessibility, habitability, staffing sufficiency, and communication capability in accordance with NEI 13-02, Revision 1, 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 20th day of August 2018.

Respectfully submitted,

James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure: Nine Mile Point Nuclear Station, Unit 1 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. Jason C. Paige, NRR/JLD/JOMB, NRC
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Enclosure

Nine Mile Point Nuclear Station, Unit 1

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

(60 pages)

Final Integrated Plan

HCVS Order EA-13-109

for

Nine Mile Point Nuclear Power Station – Unit 1 (NMP1)

August 20, 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 1 (NMP1) 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. NMP1 achieved Phase 1 compliance in April 2017.

- Phase 2 provided additional protections for severe accident conditions through the development of a reliable containment venting strategy that makes it unlikely that NMP1 would need to vent from the containment drywell during severe accident conditions. NMP1 achieved Phase 2 compliance on in June 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, NMP1 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, NMP1 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 NMP1 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 NMP1 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 NMP1 Final Integrated Plan details for Phase 1 of the Order. Section IV contains the NMP1 Final Integrated Plan details for Phase 2 of the Order. Section V details the programmatic elements of compliance.

Section I.A: Summary of Compliance

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

The plant venting actions for the 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 Auxiliary Control Room (ACR) or the ROS at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms. The ACR is located one elevation below the Main Control Room (MCR) and is connected to the MCR by an open stairway within the MCR envelop.

- 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 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 NMP1 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 in the ACR. The HCVS system can also be operated manually from the ROS. Attachment 2 contains a one-line diagram of the HCVS vent flow path.

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

The Phase 2 actions can be summarized as follows:

- Utilization of Severe Accident Water Addition (SAWA) to initially inject water into the Reactor Pressure Vessel (RPV).

- Utilization of Severe Accident Water Management (SAWM) to control injection and torus 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 (torus) 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 alternate RPV injection flow path except that a cart has been added to the flow path that includes a flow meter and valve for throttling the SAWA flow rate. The cart will be stored in the FLEX Storage Building (FSB) and then moved to the Turbine Building adjacent to the ROS to avoid dose from the Reactor Building airlock personnel access on Turbine Building elevation 261 feet during severe accident radiological conditions. This alternate RPV injection modified flow path has been evaluated and found to be acceptable in a revision to the FLEX hydraulic calculation S0-FLEX-F001 (Reference 36).

The flow path will be from the FLEX suction at the intake structure for the plant Ultimate Heat Sink (UHS) through the SAWA cart mounted flow meter and throttle valve. A hose connected to the FLEX pump discharge valve manifold will be routed to the SAWA cart. From the discharge of the SAWA cart a 3-inch hose is connected via a Storz connection to manual valve 29-412 which is the cross tie between fire protection piping and high-pressure feedwater piping located between the feedwater pumps and the fifth point feedwater heaters located in the Turbine Building. Once the SAWA components are deployed and connected, the SAWA flow path is completed by verifying closed six manual feedwater valves which could divert RPV injection flow and then after the hoses are charged valve 29-412 is manually opened to initiate flow to the RPV. Flow paths into other portions of the feedwater system will be isolated by check valves. Communication will be established between the ACR/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 south of the Turbine 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 56). 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.

Section II: List of Acronyms

AC	Alternating Current
ACR	Auxiliary Control Room
AOV	Air Operated Valve
BDBEE	Beyond Design Basis External Event
BWROG	Boiling Water Reactor Owners' Group
CAP	Containment Accident Pressure
CST	Condensate Storage Tank
DC	Direct Current
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
ERV	Electromatic Relief Valves
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 (NMP1 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
UFSAR	Updated Final Safety Analysis Report
VAC	Voltage AC
VDC	Voltage DC
WW	Wetwell

Section III: Phase 1 Final Integrated Plan Details

Section III.A: HCVS Phase 1 Compliance Overview

NMP1 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

NMP1 has a Mark I primary containment design and has an existing hardened wetwell vent path installed in response to NRC Generic Letter 89-16.

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

The HCVS vent path at NMP1 utilizes the existing penetration piping for the Containment Vent and Purge System from the Torus up to the first Primary Containment Isolation Valve, VLV-201-16. The torus (wetwell) vent piping tees off from the existing penetration piping described above. The dedicated HCVS piping then continues up through the Reactor Building and exits the Reactor Building roof on the north-east side to a discharge point at least 3' above the highest point of the Reactor Building roof or any nearby structure.

The HCVS vent path includes two PCIVs (IV-201.13-74 & IV-201.13-71) dedicated to the HCVS function with a downstream rupture disc (DISK-201.13-128). After the HCVS flow path is opened, the downstream PCIV IV-201.13-71 will be used to control HCVS flow by closing and reopening. The rupture disc will serve as the secondary containment pressure boundary to prevent PCIV leakage from being released to the outside during a design basis loss of coolant accident (DB LOCA). The argon purge system can be used to breach the rupture disc. The NMP1 vent path is separate from the Nine Mile Point Unit 2 (NMP2) vent path. The vent piping meets the reasonable protection requirements of HCVS-WP-04 for tornado missiles.

An HCVS control panel is located in the ACR which provides for the operation and monitoring of the HCVS. A secondary location for HCVS operation is the ROS located in the Turbine Building. Both locations are protected from adverse natural phenomena and are sufficiently shielded. The ACR which is connected to the MCR is the normal control point for HCVS operation and the MCR is the normal control point for Plant Emergency Response actions. The Turbine Building is a Seismic Class II Structure and the ROS is located in the Turbine Building in an area protected from tornado missiles. 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. After 24 hours, the HCVS power will be supplied by the FLEX portable diesel generator via 125 VDC battery board #12. In addition, a connection point that utilizes standard 120 VAC electrical connections has been provided locally for a small portable generator to support sustained operation of the HCVS. In the event that power is not restored to the battery board, the local 120 VAC connections will allow the HCVS battery charger to receive power from a small portable generator that is stored in the FSB. Actions to replenish the electrical supply include refueling the FLEX 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 upon demand. Calculation S22.4-201.13M002 (Reference 62) determined the amount of nitrogen needed for the required number of vent cycles in a 24-hour period.

These nitrogen gas bottles were sized such that they can provide motive force for at least 8 cycles of a vent path, which includes two openings of IV-201.13-74 and at least 8 openings of IV-201.13-71. PCIV 201.13-71 is cycled open and close for venting control while IV-201.13-74 remains open.

The HCVS design includes an argon gas purge function with piping connected just downstream of IV-201.13-71. It is designed to prevent hydrogen detonation downstream of that valve by displacement of any explosive gases in the vent pipe. The argon purge function is required to be used only if the ELAP progresses to severe accident conditions which results in the creation of combustible gases. The argon purge function utilizes a switch on the HCVS station in the ACR for solenoid operated purge gas control valve SOV-201.13-14 to allow opening the purge valve for the designated time. The design also allows for local operation at the ROS in case of a DC power loss or control circuit failure. The installed capacity of the argon purge gas is sized for 8 purges within the first 24 hours of the ELAP (Reference 46). Evaluation N1-MISC-004, "MAAP Analysis to Support SAWA Strategy" (Reference 37) shows that in a severe accident, NMP1 would not be expected to exceed 3 vent cycles in the first 24-hour period. The design allows for argon bottle replacement for continued operation past 24 hours. The argon purge function is designed to breach the rupture disc in order to establish the vent flow path.

An oxygen monitor has been installed in the ROS area, near the argon and nitrogen bottles, due to potential to create an oxygen deficient hazard (ODH). 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. The monitor is equipped with a back-up power supply from the primary FLEX electrical strategy so that it will remain functional during an ELAP.

Instrumentation and Controls:

Existing control room indications for wetwell (torus) pressure and primary containment water level are used for HCVS venting operation. Operation of the HCVS is 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 torus 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, to ensure that containment pressure does not exceed the PCPL. Existing control room indication for wetwell pressure, is displayed on PI-201.2-595A (Channel 12) and PI-201.2-594A (Channel 11), which will be used for this purpose. These indicators receive pressure signals from pressure transmitters PT-201.2-595 and PT-201.2-594, respectively. These pressure transmitters sense the torus pressure from a penetration at the top of the torus and therefore will not be impacted by high torus water levels.

Drywell pressure instrumentation may also be referenced during the event. Containment pressure is displayed on indicator PI-201.2-483A (Channel 12) and PI-201.2-484A (Channel 11). These indicators receive pressure signals from pressure transmitters PT-201.2-483 and PT-201.2-484, respectively.

Wetwell level indication is needed to determine that the wetwell vent path is preserved. Wetwell level is displayed on indicator LI-201.2-595D (Channel 12) and LI-201.2-594C (Channel 11). LI-201.2-595D receives signals from PT-201.2-595 and PT-201.2-596 while LI-201.2-594C receives signals from PT-201.2-594 and PT-201.2-680. As stated above, PT-201.2-595 & -594 senses pressure at the top of the torus. PT-201.2-596 & -680 sense pressure at interfaces with the torus at elevations 201'-2 ¾" and 201'-3 ¾" (Reference 59). Therefore, the level instrumentation will be able to track water level for the full range of the torus. The NMP1 plant-specific MAAP analysis (Reference 37) demonstrates that the torus water level will range between 12 and 16 ft. over the course of the 7-day event. With a torus height of 27 ft., a margin of 11 ft. exists.

These pressure and level indicators and related transmitters are all Safety Related, Regulatory Guide 1.97 compliant components (Reference 55). They are also environmentally qualified for accident conditions (Reference 55). Channel 12 is the FLEX diesel power backed loop, and Channel 11 can be powered as an alternate strategy.

The FLEX primary strategy is to provide power using a FLEX generator to the NMP1 existing safety related 600VAC/125VDC Static Battery Charger 171A or 171B for the #12 Battery and the alternate strategy is to connect the generator to the portable National Fire Protection Association (NFPA) 805 battery charger to power battery board 11 or 12. Depending on availability, either channel 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 (ACR)
- HCVS Vent Pipe Temperature (ACR)
- HCVS Vent Pipe Radiation (ACR and ROS)
- HCVS Purge System Supply Pressure (ACR and ROS)
- HCVS Valve Nitrogen Supply Pressure (ROS)
- HCVS Battery Voltage (ROS)

The control of SOVs associated with the new pneumatically operated primary containment isolation valves is from new control panel PNL-1S90 located in the Aux Control Room. The SOVs are controlled via key-lock control switches. The Turbine Building (ROS) control panel PNL-HCVS 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 new hardened 10-inch vent piping, between the existing wetwell 20-inch piping and the Reactor Building roof, is designed to BDBEE conditions of 65 psig and 350 °F. Pipe stress analyses in References 38 and 57 evaluated the torus attached and non-torus attached piping, respectively. HCVS branches off the torus attached piping upstream of all existing PCIVs, therefore the potential for cross flow or hydrogen gas migration into other systems from HCVS does not exist.

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).

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

The functional requirements of Phase 1 of NRC Order EA-13-109 are outlined below along with an evaluation of the NMP1 response to maintain compliance with the Order and guidance from JLD-ISG-2015-01. Due to the difference between NEI 13-02, Revision 0 and Revision 1, only Revision 1 will be evaluated. Per JLD-ISG-2015-01, this is acceptable as Revision 1 provides acceptable guidance for compliance with Phase 1 and Phase 2 of the Order.

1. HCVS Functional Requirements

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

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

<u>Evaluation:</u>

The operation of the HCVS was designed to minimize the reliance on operator actions in response to hazards identified in NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide* (Reference 31), which are applicable to the plant site. Operator actions to initiate the HCVS vent path can be completed by plant personnel and include the capability for remote-manual initiation from the HCVS 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. To enable the nitrogen motive force and argon purge functions, unlock and close argon and PCIV nitrogen supply vent valves. Unlock and open argon and PCIV nitrogen supply isolation valves.	ROS VLV-201.13-06 (nitrogen vent) VLV-201.13-02 & 03 (nitrogen isolation valves) VLV-201.1-21 (argon vent valve) VLV-201.13-13 and VLV-201.13-10A thru 10E (argon isolation valves)	Required step prior to commencing control from the ACR. Alternate control via manual valves at the ROS.
2. Unlock and position three-way valve to the PURGE position.	ROS, VLV-201.13-20 (Three-way Valve)	Required step to prevent venting argon gas into the Reactor building through the 3-way valve.
3. Breach the rupture disc by unlocking and opening the purge isolation valve.	ROS, VLV-201.13-14A; or ACR, SOV-201.13-14	The rupture disc DISK-201.13-128 is designed to burst at 32.5 psig.
4. As soon as disc is breached, close purge isolation valve.	ROS, VLV-201.13-14A; or ACR, SOV-201.13-14	
5. Open Inboard HCVS Containment Isolation Valve (PCIV) IV-201.13-74	Key-locked switch for SOV-201.13-74A at HCVS Control Panel in ACR	Alternate control via manual valves at ROS
6. Open Outboard HCVS Containment Isolation Valve (PCIV) IV-201.13-71	Key-locked switch for SOV-201.13-71A at HCVS Control Panel in ACR	Alternate control via manual valves at ROS.
7. Monitor electrical power status, and HCVS conditions (e.g. vent line radiation).	Battery Voltage on HCVS Panel in ROS and other HCVS conditions on ACR/ROS	This action not required for alternate control.

Primary Action	Primary Location/Component	Notes
8. Connect back-up power to HCVS battery charger using a small portable generator stored in the FLEX Storage Building (FSB).	Turbine Building ROS	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 using primary strategy.
9. Replenish pneumatic supply with replaceable Nitrogen bottles (stored in FSB) and/or portable air compressor stored in FSB. Replenish purge supply with replaceable Argon bottles from the FSB.	Turbine Building ROS	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 capability. 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 Alternate 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 2 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 Auxiliary Control Room. Alternate control of the HCVS is accomplished from the ROS in the Turbine Building on floor elevation 261' (ground elevation). FLEX actions that will maintain the MCR/ACR and ROS habitable were implemented in response to NRC Order EA-12-049 (Reference 31). These include:

1. Opening MCR and ACR access doors to the outer surrounding areas, if required (Reference 40).
2. Opening RB/TB doors, a TB roof hatch and TB side wall vents to the atmosphere to establish natural circulation air flow in the RB/TB (References 40 and 41).
3. Other MCR/ACR heat load reduction actions are to remove the Plant Process Computer from service by shutdown of the Uninterruptible Power Supply (UPS 175) providing it power (Reference 40).

Table 2 contains a thermal evaluation of all the operator actions that may be required to support HCVS operation. The Reference 54 Design Consideration Summary form temperature evaluation and relevant ventilation calculations (References 30, 31 and 58) 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 Auxiliary 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). Although the MCR and ACR are connected, the ACR was further evaluated for radiological dose in calculation H21C115 and was found to be acceptable (Reference 44).

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 H21C115 (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 H21C115. 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:

ACR: 7-day Total Integrated Dose = 3.775E-04 rem whole body
ROS: 7-day Total Integrated Dose < 1.538E-03 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 ACR/MCR such that building structures provide shielding, thus per HCVS-FAQ-01 the ACR/MCR is the preferred control location. If venting operations create the potential for airborne contamination in the ACR/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 auxiliary control room. Under the postulated scenarios of order EA-13-109 the auxiliary 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 Turbine Building. 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 NMP1'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 ACR/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 H21C115 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.

Evaluation

Calculation S22.4-201.13F004 (Reference 60) contains the verification of 1% power flow capacity at the torus design pressure (35 psig). At 1% reactor thermal power the required vent capacity is 68,303 lbm/hour. 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 coefficients of flow, and the losses associated with a burst rupture disc. At a torus pressure of 35 psig, the HCVS can vent 79,859 lbm/hr of steam. As such, calculation S22.4-201.13F004 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 torus design pressure (35 psig) or the PCPL (43 psig). This calculation of containment response is contained in MAAP Calculation N1-MISC-004 (Reference 37) that was submitted in Reference 27 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 torus through an existing 20-inch Containment Vent and Purge piping penetration XS-327 and though two new outboard HCVS PCIVs (IV-201.13-74 and IV-201.13-71). Downstream of the second isolation valve, the vent piping will exit the Reactor Building on the northeast side of the Reactor Building roof. All effluents are exhausted above the unit's Reactor Building. This discharge point at elevation 402 feet was extended approximately three (3) feet above the Reactor Building parapet wall. The release point is on the northeast side of the RB and a minimum of 25 feet 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 (TSC) 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 intakes. Such ventilation intakes should be below a level of the pipe by 1 foot for every 5 horizontal feet. This guidance does not apply to NMP1 because restoring power to any emergency ventilation system including the control room emergency ventilation (CREV) system is not credited in the FLEX strategy. However, it was assumed CREVs was restarted and the CREVs intake is at approximately 320 feet elevation which is approximately 82 feet below the HVCS pipe outlet. This intake is approximately 370 feet from the Unit 1 vent pipe, which would require the intake to be approximately 74 feet below the vent pipe. Therefore, the vent pipe is appropriately placed relative to this air intake.

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

ECP-13-000086 Design Consideration Summary was provided to the NRC in Reference 25 and contains an evaluation of vent pipe for protection from missiles. HCVS-WP-04 provides criteria that demonstrate robustness of the HCVS pipe. NMP1 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.

NMP1 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 majority of the new HCVS vent piping added is routed through the Reactor Building, which is a seismic Category I structure. The piping is well protected by the Reactor Building reinforced concrete walls up to the refuel floor (el. 340'-0"), 79'-0" 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 166 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. NMP1 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 NMP1.

Based on the above description of the vent pipe design, the NMP1 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 NMP1 is fully independent of NMP2 with separate discharge points. Therefore, the capacity at each unit is independent of the status of the other unit's HCVS. Because the HCVS branches off torus attached piping upstream of all existing PCIVs, there is no potential for cross flow or hydrogen gas migration into other systems from the HCVS.

Based on the above description, the NMP1 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 control from either the ACR 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 (ACR or ROS). Both locations are readily accessible as evaluated in Table 2. These evaluations demonstrate that the design meets the requirement to be manually operated from a readily accessible location during sustained operation.

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 Remote Operating Stations (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 Turbine Building auxiliary equipment area, el. 261'-0", in a narrow passage way between the feedwater heater bays. The HCVS piping is on the northeast side of the Reactor Building where it exits the building through the Reactor Building roof. Therefore, the Reactor Building provides shielding for the Turbine Building ROS. 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 Turbine Building auxiliary equipment area, el. 261'-0", in a narrow passage way between the feedwater heater bays 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-13-000086 Attachment M (Reference 51) and testing (Reference 61) 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.

The HCVS battery charger requires a 120 VAC supply. This will be fed by a 120/240 VAC rated lighting panel during normal plant operation. At 24 hours, FLEX generators can be credited to repower the station battery board # 12 to power the HCVS components directly. Gas control during recharging and room temperature control is per the response to order EA-12-049. 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 to power the HCVS battery charger for sustained operation of the HCVS.

As mentioned above, after the initial 24-hour period, the system can be aligned to 125 V DC Battery Board 12, which will be re-powered by a diesel generator as part of the FLEX response. The battery charger is expected to draw a maximum load of 2.46 kVA. This load was credited in calculation NIMO-ELMS-AC01-01.00 which was revised by ECP-13-000086-CN-002 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 125 VDC battery board #12 is downstream of the station battery charger #12 SBC171A or B. The FLEX Diesel Generator sizing calculation 600VACDGES-FLEX-BDB currently models the full load rating of the station battery charger. As such, the FLEX Diesel Generator sizing calculation 600VACDGES-FLEX-BDB is not directly impacted by powering the HCVS components directly from Battery Board # 12 via the FLEX EDG. Hence, the impact of the HCVS loads on the FLEX portable power sources at T ≥ 24 hours following a BDBE was determined to be acceptable. 125VDC battery voltage status is 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 HCVS vent path includes two PCIVs (IV-201.13-74 & IV-201.13-71) dedicated to the HCVS function with a downstream rupture disc (DISK-201.13-128). After the HCVS flow path is opened, the downstream PCIV 201.13-71 will be used to control HCVS flow by closing and reopening. For the first 24 hours following the event, the motive supply for the air-operated valves (AOVs) is from nitrogen gas bottles that have been pre-installed in the ROS and are available upon demand. Calculation S22.4-201.13M002 (Reference 62) 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 of IV-201.13-74 and at least 8 openings of IV-201.13-71. PCIV 201.13-71 is used to cycle the vent open and closed while IV-201.13-74 remains open. Evaluation N1-MISC-004, "MAAP Analysis to Support SAWA Strategy" (Reference 37) shows that in a severe accident, NMP1 would not be expected to exceed 3 vent cycles in the first 24-hour period. Motive force nitrogen pressure is indicated locally on three pressure gages installed in the nitrogen supply system valve manifold (PI-201.13-01 and PI-201.13-05A/05B).

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

<u>Evaluation</u>

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 SOV-201.13-74A and SOV-201.13-71A 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, purge supply pressure and effluent radiation levels in the ACR HCVS Panel, as well as information on the status of supporting systems which are 125 VDC battery voltage indication and radiation from the ROS HCVS Panel and nitrogen and argon pressure from gages at the ROS.

This monitoring instrumentation provides the indication from the ACR 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, 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 (RE-201.13-79) at Reactor Building 261' floor elevation, coupled to a process and control module in panel PNL-HCVS-R. The process and control module are mounted in the ROS in the Turbine Building 261' elevation. The ACR has radiation indication on panel PNL-1S90 to verify venting operation. Radiation indication to verify venting is also available at the ROS at PNL-HCVS-R 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 Turbine Building 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 20-inch piping, between the wetwell penetration and the and existing containment IVs 201-16 and 201-17 is designed to 65 psig and 310 °F. The new hardened 10-inch vent piping, between the existing wetwell 20-inch piping and the Reactor Building roof, is designed to BDBEE conditions of 65 psig and 350 °F. The new rupture disc DISK-201.13-128 is designed to burst at 32.5 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 combustible gas from the pipe with argon after a period of venting. Prior to operating the purge system valves need to be properly aligned. Valve 201.13-13 is to be unlocked and opened, valves 201.13-10A-10E are to be opened, vent valve 201.13-21 is to be closed and 201.13-20 (a three-way valve) is to be unlocked and repositioned into the "PURGE" position. Once aligned, purge operations can be performed from ACR panel PNL-1S90 using SOV-201.13-14. The argon purge system is utilized to provide the pressure needed to burst the rupture disc. Per calculation S22.4-201.13F001 (Reference 46) an approximate 8-second purge time is required to burst the rupture disc. For purging the combustibles after a vent cycle, a 67-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.

NMP1 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

[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
Functionally test the HCVS radiation monitors.	Once per operating cycle
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.

Evaluation:

The HCVS penetration and containment isolation valves are designed and installed consistent with the design basis of primary containment including pressure, temperature, radiation, and seismic loads.

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

Evaluation:

The HCVS components downstream of the outboard containment isolation valve

[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.

and components that interface with the HCVS are routed in seismically qualified structures or supported from seismically qualified structure(s).

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.

NMP1 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.

<u>Section IV.B</u>: HCVS Existing System

There previously was neither a hardened drywell vent nor a strategy at NMP1 that complied with Phase 2 of the order.

<u>Section IV.C</u>: 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.

NMP1 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 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.

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

The SAWA flow path is the same as the FLEX alternate injection flow path except that a new throttle valve cart has been fabricated to install a SAWA flow meter (FE-BDB-008) and throttle valve (VLV-BDB-007). The new cart will be stored in the FSB and will deployed to the Turbine Building adjacent to the ROS. The location of the cart was evaluated and found acceptable for operating during severe accident radiological conditions. The modified alternate RPV injection flow path has been evaluated and found to be acceptable in a revision to the FLEX hydraulic calculation S0-FLEX-F001 (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 cart in the Turbine Building 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 new flow meter and throttle valve cart where SAWA flow indication and control will be provided. The 3" hose on the cart's throttle valve discharge is connected to the firewater to feedwater Storz connection on TB elevation 261' using a 3" Storz to fire hose adapter at valve 29-412. The hoses and pumps are stored in the FSB which is protected from all hazards. Once the SAWA components are deployed and connected, the SAWA flow path is completed by opening normally locked valve 29-07 (Firewater to Feedwater Outlet Block Valve). Manual valve 29-412 at the Storz connection is then manually opened after the pump is started and the hose is charged. Backflow prevention is provided by existing safety related containment isolation check valves CKV-31-01R and 31-02R. Cross flow into other portions of the feedwater system will be isolated by closing small normally open manual valves in the Turbine Building. Communication will be established between the MCR and the SAWA flow control location using communication methods consistent with FLEX communication methods at NMP1.

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

By using the FLEX alternate RPV injection flow path for SAWA in lieu of the FLEX primary RPV injection path, the actions necessary to inject flow are moved from the Reactor Building to the Turbine Building to reduce the radiation exposure during a severe accident. The original FLEX flow control point for the FLEX alternate RPV injection path was at valve 29-412. Dose assessment calculation H21C115 (Reference 44) determined the dose at this valve could be in a high radiation field during a severe accident due to shine from the HCVS pipe through the Reactor Building airlock doors on elevation 261' across from valve 29-412. For this reason, N1-DRP-FLEX-MECH was revised to incorporate the FLEX/SAWA flow meter/throttle valve cart which will be located in a low dose field in the Turbine Building during a severe accident event.

The worst case severe accident scenario is an early Emergency Condenser (EC) failure defined in the Attachment 2A Sequence of Events Timeline (Sequence 3) in Reference 19. In this scenario the actual time in which the Reference 37 MAAP model predicts the torus pressure vs primary containment level will exceed the PCPL was used to initiate the first vent through the HCVS. The model predicts the first vent will occur at approximately 8 hours. The actions needed to connect and establish the SAWA flow path inside the TB can be performed before the dose through the airlock doors from the HCVS vent pipe is unacceptable, under the worst-case scenario within the first two hours, after the loss of RPV injection. This time was validated as part of the Time Sensitive Action validation for FLEX (Reference 48). The only change in the FLEX deployment strategy is the need to move the new FLEX/SAWA flow meter/valve cart from the FSB to the Turbine Building and the additional hook ups necessary to connect the hoses from the cart to the feedwater to firewater Storz connection. Reference 47 implemented the time validation change and the time validation document was revised accordingly.

Procedure N1-SOP-33A.2 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 Reactor Building. The SAWA actions all take place outside the Reactor Building at the ACR/MCR, FLEX Support Building, Turbine Building, and outside along the deployment pathways. Since these locations are outside the Reactor Building, they are shielded from the severe accident radiation by the thick concrete walls of the Reactor Building. Calculation H21C115 as amended by ECP-17-000279-CN-001 also determined that while there are no planned Operator actions in the Reactor Building track bay, Operator actions in the Reactor Building track bay should be avoided due to the potential for large dose rates (Reference 44). Once SAWA is initiated, the operators will monitor the response of containment from the ACR/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 torus to the point where the wetwell vent is submerged.

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

NMP1 has methods available to extend the operational capability of manual pressure control using ERVs as provided in the plant specific order EA-12-049 submittal. Assessment of manual ERV 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 torus water level of 11.5 feet and 27 feet elevation in the wetwell provides approximately 862,288 gallons of water volume before the water level reaches the bottom of the wetwell vent pipe as shown in Attachment 1. 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 torus water level reaching approximately 15.7 feet over the course of the 7-day event, resulting in approximately 11 ft of margin to the inlet of the HCVS vent pipe at 27 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 described in Section III.A.2 above, is at 27 feet elevation, which is the same as the elevation of the wetwell vent line. The wetwell level indication spans the entire volume of the torus and defines the upper limit of wetwell volume that will preserve the wetwell vent function as shown in Attachment 1.

Section IV.C.6: Wetwell vent service time

NMP1 calculation N1-MISC-004 (Reference 37) 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 NMP1 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 NMP1 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, NMP1 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. NMP1-VP-008 (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 263 gpm. After a period of time, estimated to be about 4 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.

N1-MISC-004 demonstrated that, SAWA flow could be reduced to 54 gpm after four 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 NMP1 SAPs are symptom-based guidelines.

Section IV.C.8: SAWA Flow Control

NMP1 will accomplish SAWA flow control by the use of a throttle valve on the FLEX (SAWA) valve 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 25). 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

NMP1 uses one or two portable diesel-driven pumps for FLEX and one portable diesel-driven pump for SAWA. One pump is capable of approximately 375 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, ECs and the SFP for FLEX and to the RPV and SFP 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

NMP1 SAWA flow is 263 gpm which is the site-specific flow rate based on the site's rated thermal power when compared to the reference power level of NEI 13-02. The initial SAWA flow will be injecting to the RPV within 8 hours of the loss of injection. The reference power level is 3514 MWth, equivalent to the reference plant rated thermal power level used in NUREG-1935, State of the Art Reactor Consequence Analysis (SOARCA). NUREG 1935 is Reference 9 of NEI 13-02 Revision 1. The Reference 37 MAAP analysis assumes a SAWA flow of 263 gpm starting 8 hours after the loss of injection. This plant-specific MAAP analysis demonstrates that the wetwell vent is adequately sized to prevent containment overpressure under severe accident conditions and that the SAWA/SAWM flowrates will ensure that the wetwell vent remains functional for the period of sustained operation.

Section IV.C.9.3: SAWA Pump Hydraulic Analysis

Calculation S0-FLEX-F001 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 containment isolation check valves CKV-31-01R and 31-02R 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

NMP1 is located on the southeastern shore of Lake Ontario, which is the ultimate heat sink for the plant. NMP1 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 Circulating Water intake tunnel which draws from Lake Ontario. The suction hose of the FLEX/SAWA pump is routed through a NMP1 Screen House north wall penetration and through a designated floor hatch into the intake tunnel. The intake tunnels where the water is pumped from 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 pump is stored in the FSB where it is protected from all screened-in hazards. The SAWA pump is a commercial pump rated for long-term outdoor use in emergency scenarios. The pump is diesel-driven by an engine mounted on the skid with the pump. The pump 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 pump was evaluated under severe accident conditions in Table 2. Since the pump is stored in a protected structure, is qualified for the environment in which it will be used, and will be refueled by a qualified refueling strategy, it will perform its 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 600VACDGES-FLEX-DBD (Reference 39). This calculation demonstrated 187 kW margin to full load. There are no additional loads on the FLEX DGs for SAWA and SAWM. 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 Phase 2 primary strategy is to provide power using a FLEX generator to the NMP1 existing safety related 600VAC/125VDC Static Battery Charger 171A or 171B for the #12 Battery, or as the alternate strategy, connect the generator to the portable National Fire Protection Association (NFPA) 805 battery charger to power battery board 11 or 12. Depending on availability, either channel may be used for containment pressure and wetwell level determination. The primary FLEX DG can also 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) Except for the flow meter described below, 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 cart stored in the FSB. Although the SAWA flow meter and throttle valve cart can be used for the FLEX alternate RPV injection strategy, an N+1 FLEX/SAWA cart with a flow meter and throttle valve is not required by EA-13-109 since the FLEX alternate RPV injection strategy can be implemented without the use of the SAWA cart.

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 NMP1 is approximately 2 to 544 GPM. This model is acceptable, because it bounds the NMP1 SAWA/SAWM flow rates of 54 to 263 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 43°F to 98°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 Turbine Building just west of the ROS, between column rows G and H is 2.25E-05 rem/hr (see Reference 44, Attachment C). The area just east of the ROS may be acceptable as well if an Operator does not stay at the flow meter for an extended period of time as the dose rate east of the ROS increases to 7.335E-01 rem/hr. Using the higher dose rate, the total dose over the 7-day period is 123 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 FSB) 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 battery chargers/boards 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 referenced in Severe Accident Guidelines for control of SAWA flow to maintain the wetwell vent in service while maintaining containment protection. These instruments are powered by 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 power sources 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) 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 2 (Reference 34) which is the NMP1 committed version per UFSAR Section VIII.C.5.0 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 a lower dose location in the Turbine Building, away from high dose areas near the Reactor Building airlock, 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

NMP1 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. H21C115 (Reference 44) analyzed dose at different locations and times where operator actions will take place during FLEX/SAWA/SAWM activities. Key locations are ACR/MCR, ROS, travel paths for hose routing, UHS and FLEX/SAWA cart location. N1-SOP-33A.2 and N1-DRP-FLEX-MECH provide guidance for ventilation strategies at various locations to mitigate high temperature conditions. Calculation S0-GOTHIC-ELAP001 (Reference 30) provides thermal analysis of Reactor Building during SAWA. Calculation S10HVACHV11 (Reference 31) provides thermal analysis and expected temperatures in the vicinity of the ROS and SAWA flow meter cart which are within acceptable operating ranges for the equipment and personnel.

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 Reactor Building behind the screen house, there will be no be no significant dose to the SAWA pump. Inside the Reactor/Turbine Building the SAWA flow path consists of stainless/carbon steel pipe which will remain unaffected by the radiation or elevated temperatures inside the Reactor Building. Inside the Reactor/Turbine Building 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 x 10^6 mrad/hr. The hose used for SAWA is stored on the FLEX Hose trailer which is stored in the FSB. There is no dose in the FSB during normal plant operation. The peak dose rates identified in dose calculation H21C115 (Reference 44) are ≤ 9.966 x 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.10.3. That section provides severe accident effects

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

Section IV.C.2 describes the Reactor Building 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, are a significant distance from the vent line or are located such that maximum stay times may be needed, so that expected dose is maintained below the ERO exposure guidelines.

As part of the response to Order EA-12-049, NMP1 performed calculations of the temperature response of the Reactor and Turbine Buildings and of the MCR/ACR during the SBO/ELAP event (References 30, 31 and 58). Since, in the severe accident, the core materials are contained inside the primary containment, the temperature response of the Reactor Building, ACR/MCR and Turbine Building is driven by the loss of ventilation and ambient conditions and therefore will not change. Thus, the RB heat-up calculations which includes the heat from the HCVS vent pipe 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 TB, the operators can control SAWA/SAWM as well as observe the necessary instruments from outside the RB. The thick concrete RB walls (below 340' 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 or provide maximum stay times are imposed which has been addressed in H21C115 (Reference 44) and procedures. Therefore, all SAWA controls and indications are accessible during severe accident conditions.

The SAWA pump and monitoring equipment can all be operated from the ACR/MCR or from outside the RB at ground level. The NMP1 FLEX response ensures that the SAWA pump, 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 cart located near the TB ROS, and wetwell level and containment pressure in the MCR.

Depending on the positioning of personnel operating the SAWA pump radiation dose rates can be high during venting and will vary such that maximum stay times will need to be imposed to prevent personnel from exceeding 5 Rem over the 7-day coping period. N1-EOP-4.1 and N1-DRP-FLEX-MECH provide guidance to minimize radiation exposure during operation of the pump.

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 NMP1'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
- NMP1 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 that venting may reduce margin to NPSH limits.

NMP1 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 43). 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. 27 ft will result in loss of torus 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 I torus vent paths, thereby retaining the benefits of torus 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 (N1-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

NMP1 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). NMP1 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 or 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 NMP1 in subsequent eight-year intervals. These requirements are captured in CC-AA-118.

Section VI: References

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

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

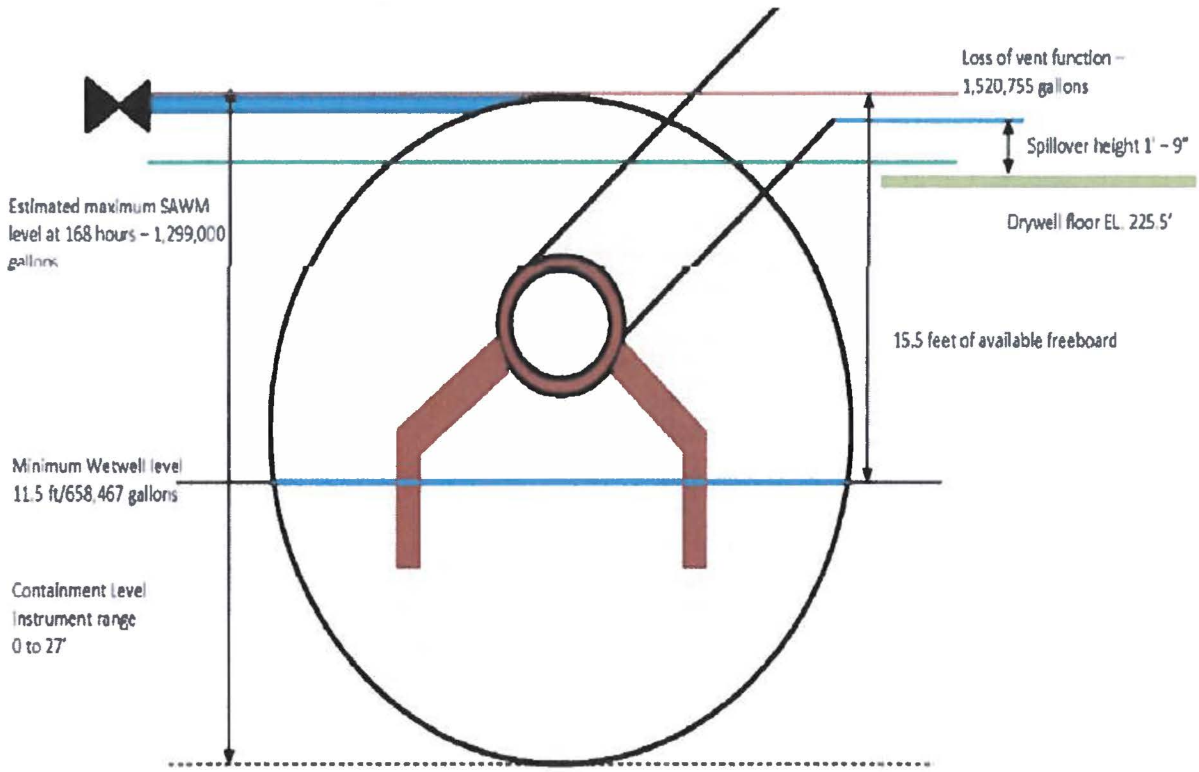
Number	Rev	Title	Location[6]
12. JLD-ISG-2013-02	0	Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident	ML13304B836
13. JLD-ISG-2015-01	0	Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe	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	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	ML15069A671
21. Phase 2 ISE	0	HCVS Phase 2 Interim Staff Evaluation	ML16231A452
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	N/A
30. S0-GOTHIC-ELAP001	0	Reactor Building Thermal Response Following an Extended Loss of AC Power (as amended by ECP-13-000651-CN-036 and ECP-13-000086-CN-072)	N/A
31. S10HVACHV11	1	Turbine Building Minimum and Maximum Temperatures	N/A
32. NEI 12-06	0	Diverse and Flexible Coping Strategies (FLEX) Implementation Guide	ML12221A205

Number	Rev	Title	Location[6]
33. EA-12-049	0	Issuance of Order to Modify Licenses With Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012.	ML12054A735
34. RG 1.97	2	Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Conditions During and Following an Accident	N/A
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. S0-FLEX-F001	1	NMP1 FLEX and SAWA Hydraulic Flow Evaluation	N/A
37. N1-MISC-004	2	NMP1 - MAAP Analysis to Support SAWA Strategy	N/A
38. S22.4-201.1P002	0	HCVS Piping Analysis for Torus Attached Piping.	N/A
39. 600VACDGES-FLEX-BDB	0	Fukushima 600 VAC FLEX-BDB 450kW/536KVA Diesel Generator Sizing Calculation	N/A
40. N1-SOP-33A.2	14	Station Blackout/Extended Loss of AC Power Support Procedure	N/A
41. N1-DRP-FLEX-MECH	6	Emergency Damage Repair – BDB/FLEX Pump Deployment Strategy	N/A
42. N1-DRP-FLEX-ELEC	2	Emergency Damage Repair – BDB/FLEX Generator Deployment Strategy	N/A
43. N1-SAP-1	9	Severe Accident Procedure: RPV and Primary Containment Injection	N/A
44. H21C115	0	Hardened Containment Vent System (HCVS) Radiological Dose Analysis (as amended by ECP-17-000279-CN-001 H21C115)	N/A

Number	Rev	Title	Location[6]
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. S22.4-201.13F001	1	Hardened Containment Vent Purge System Design Calculation	N/A
47. 04038299-011	-	PASSPORT Action Item: Review and revise as necessary NMP1 FLEX validation document (FLEX-16-000005) to ensure it bounds SAWA conditions.	N/A
48. FLEX-16-000005	1	NMP1 FLEX Strategy Validation Document (Attachment 2: Validation Plan No. NMP1-VP-008)	N/A
49. OP-NM-102-106	8	Operator Response Time Program at Nine Mile Point - ATTACHMENT 4: Nine Mile Point Unit 1 - Master List of FLEX Time Sensitive Actions (TSA112)	N/A
50. S-DRP-OPS-004	1	Refueling Diesel Driven Portable Equipment	N/A
51. ECP-13-000086-103-02	7	Engineering Change Package Design Consideration Summary FORM-103-DCS, Attachment M "125 VDC Battery Sizing Calculation" (and as amended by the action plan to address Issue Report (IR) 04059544)	N/A
52. NOB035001NDREC001	0	"M-Series Electromagnetic Flow Meter Vendor Manual"	N/A
53. HCVS-HG-011	0	SAWA Potable Equipment Qualification	N/A
54. ECP-13-000086	7	NMP1 Reliable Hardened Containment Vent System – Phase 1	N/A
55. ECP-17-000279	0	NMP1 Reliable Hardened Containment Vent System – Phase 2	N/A

Number	Rev	Title	Location[6]
56. RS-15-117	0	Report of Full Compliance with EA-12-049 (NMP1 FLEX FIP)	ML16188A271
57. S22.4-201.13P003	0	HCVS Piping Analysis for Non-Torus Attached Piping	N/A
58. S10-210HV12	3	Evaluate CR and ACR Building Temperatures for Cold and Hot Weather Scenarios with Loss of Offsite Power (Appendix R) and LOCA (as amended by the latest CNs posted in FCMS)	N/A
59. C18178C-002	9	Reactor Building Instrument & Metering Piping Torus Level Plan El. 198'-0" W/Details	N/A
60. S22.4-201.13F004	0	Hardened Containment Vent Capacity	N/A
61. C93376356, Task 80	0	HCVS Battery Testing Work Order	N/A
62. S22.4-201.13M002	1	HCVS Valve Motive Gas Supply Sizing	N/A

Attachment 1: Phase 2 Freeboard diagram



DRAWING NOT TO SCALE

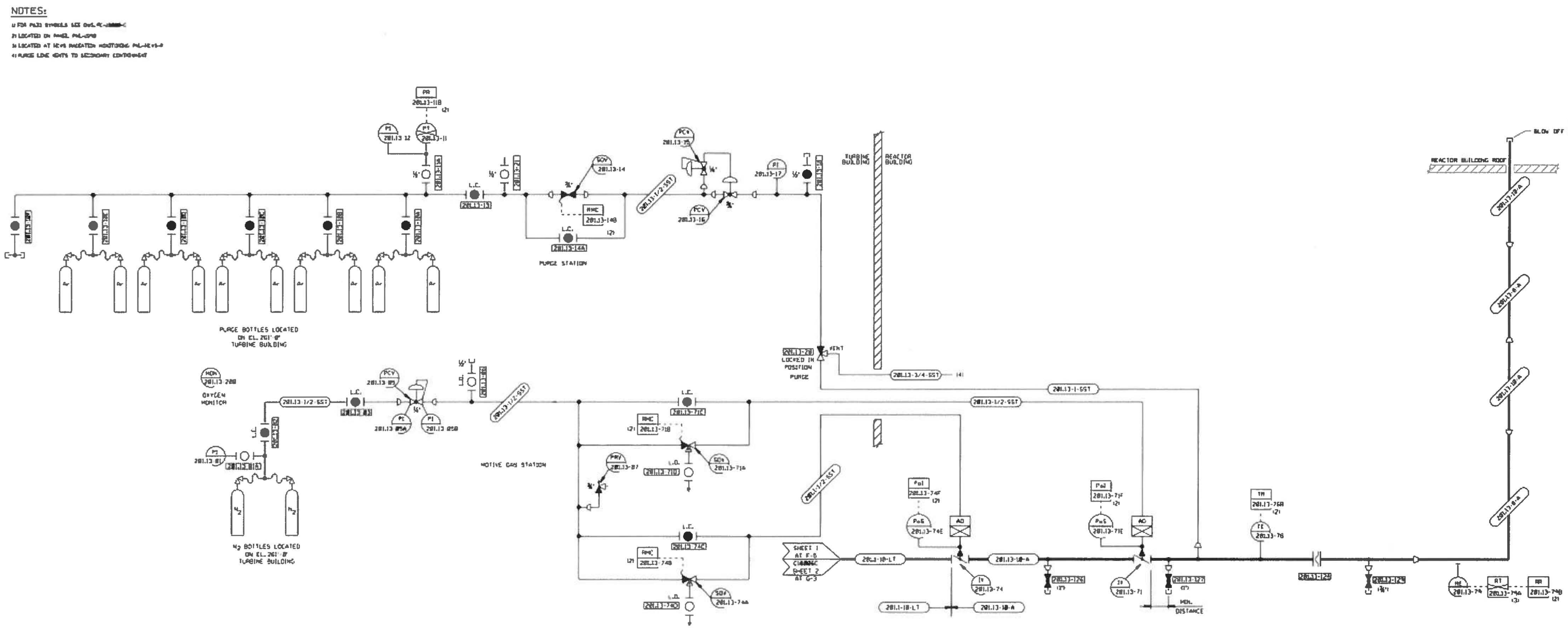
Notes:

1. NMP1 torus level indication is to top of torus (27 feet), the same elevation as the vent line tap.
2. The SAWM maximum level shown at 168 hours is a conservative calculation based on water addition only. It does not reflect mass loss due to venting. This is preliminary, bounding information only.
3. SAWA injection flowrates are 263 gpm for the 1st 4 hours and lowered to 53 gpm for the remainder. Once torus level reaches 6 feet above nominal height:
   - At a flowrate of 263 gpm the average rate of rise is 0.241 ft/hour*
   - At a flowrate of 53 gpm the average rate of rise is 0.049 ft/hour*

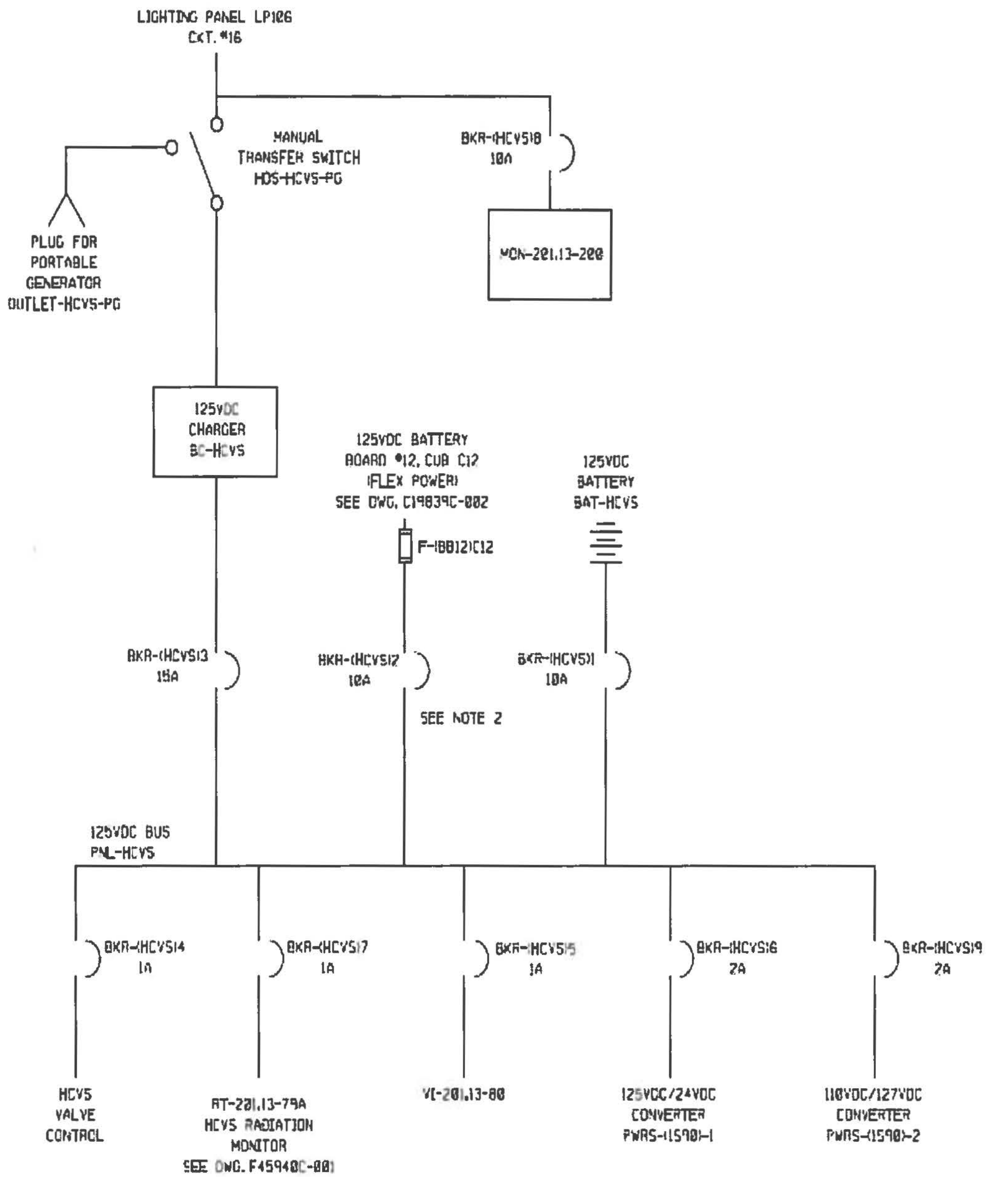
*Does not consider mass loss rate of steam leaving containment through wetwell vent path.

Note: The above diagram is an excerpt from the combined OIP (Reference 19, Attachment 2.1.C). The Reference 37 MAAP analysis used an initial water level of 11.25 ft and flowrates of 263 gpm/54 gpm. The MAAP analysis predicted a maximum torus level of 15.7 feet after 168 hours resulting in approximately 11 ft of margin to the HCVS vent pipe inlet at 27 ft.

Attachment 2: One Line Diagram of HCVS Vent Path



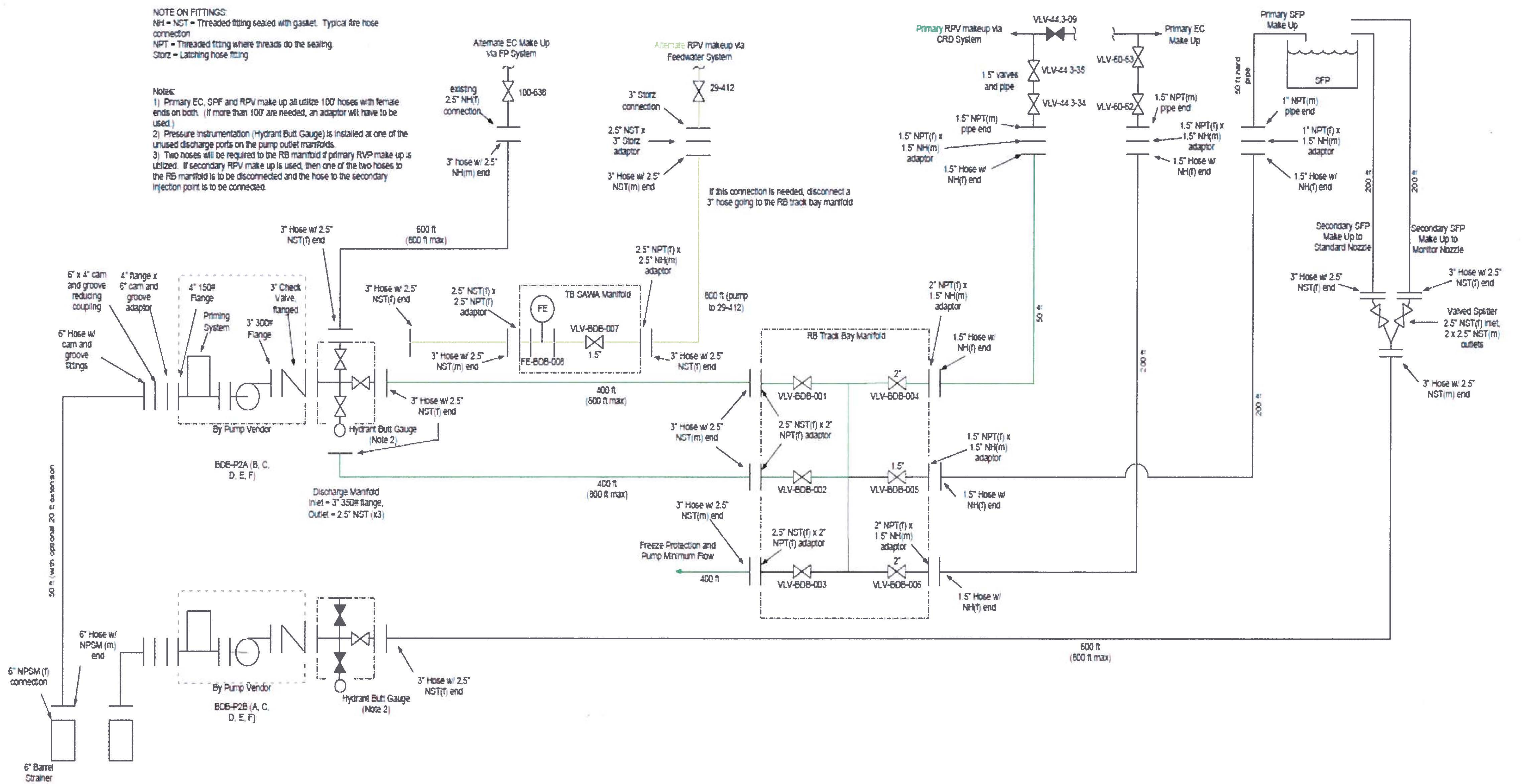
Attachment 3: One Line Diagram of HCVS Electrical Power Supply – NMP1



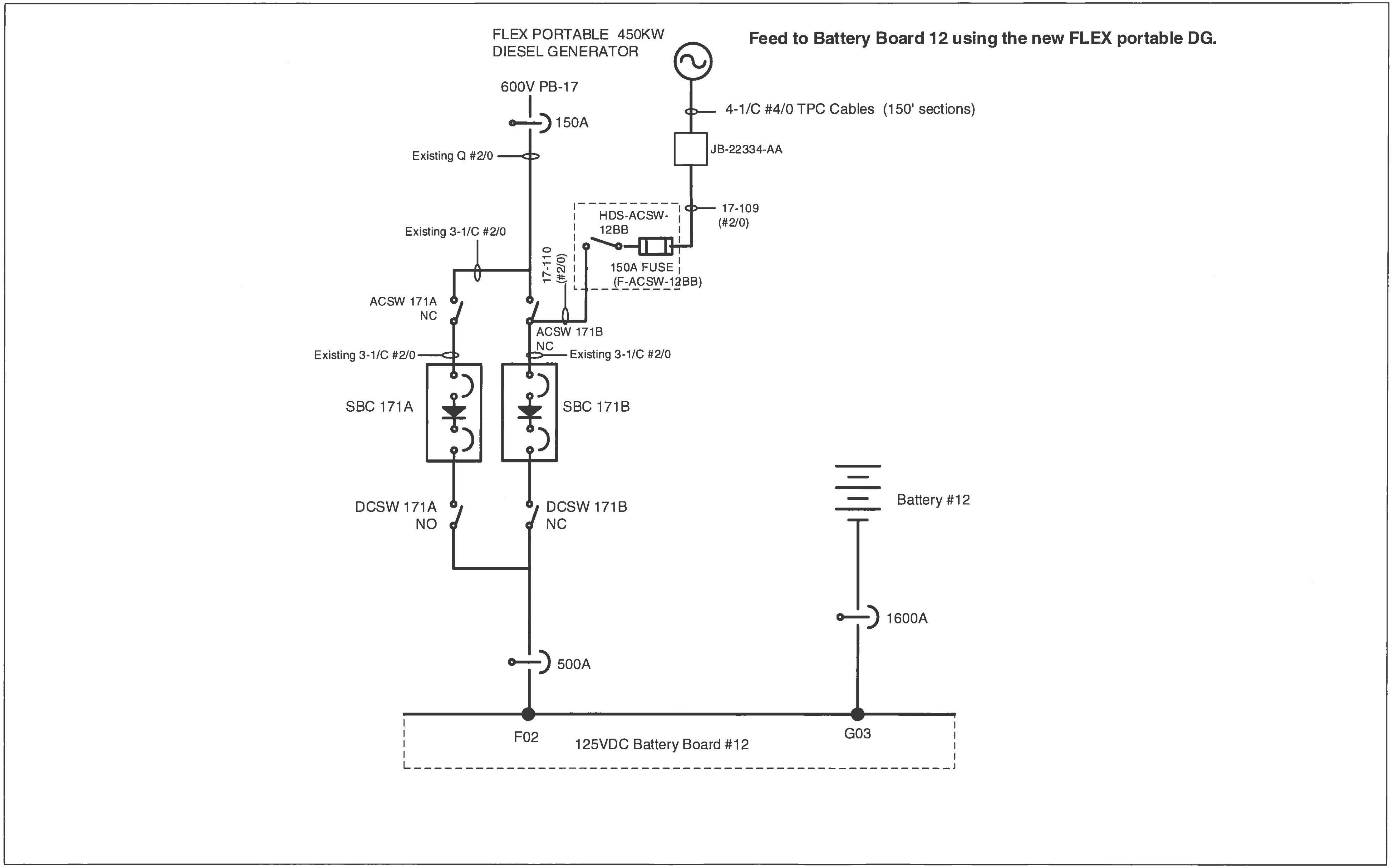
NOTES:
1. NOT USED.
2. BREAKER IS KEPT OPEN DURING PLANT NORMAL OPERATION AND CLOSED ONLY IF REQUIRED DURING A BEYOND DESIGN BASIS EXTERNAL EVENT(BDBEE).

Reference: Drawing F4590C-002 Rev 0

Attachment 4: One Line Diagram of SAWA Flow Path



Attachment 5: One Line Diagram of SAWA Electrical Power Supply



Attachment 6: Plant Layout Showing Operator Action Locations

UNIT NO. 1

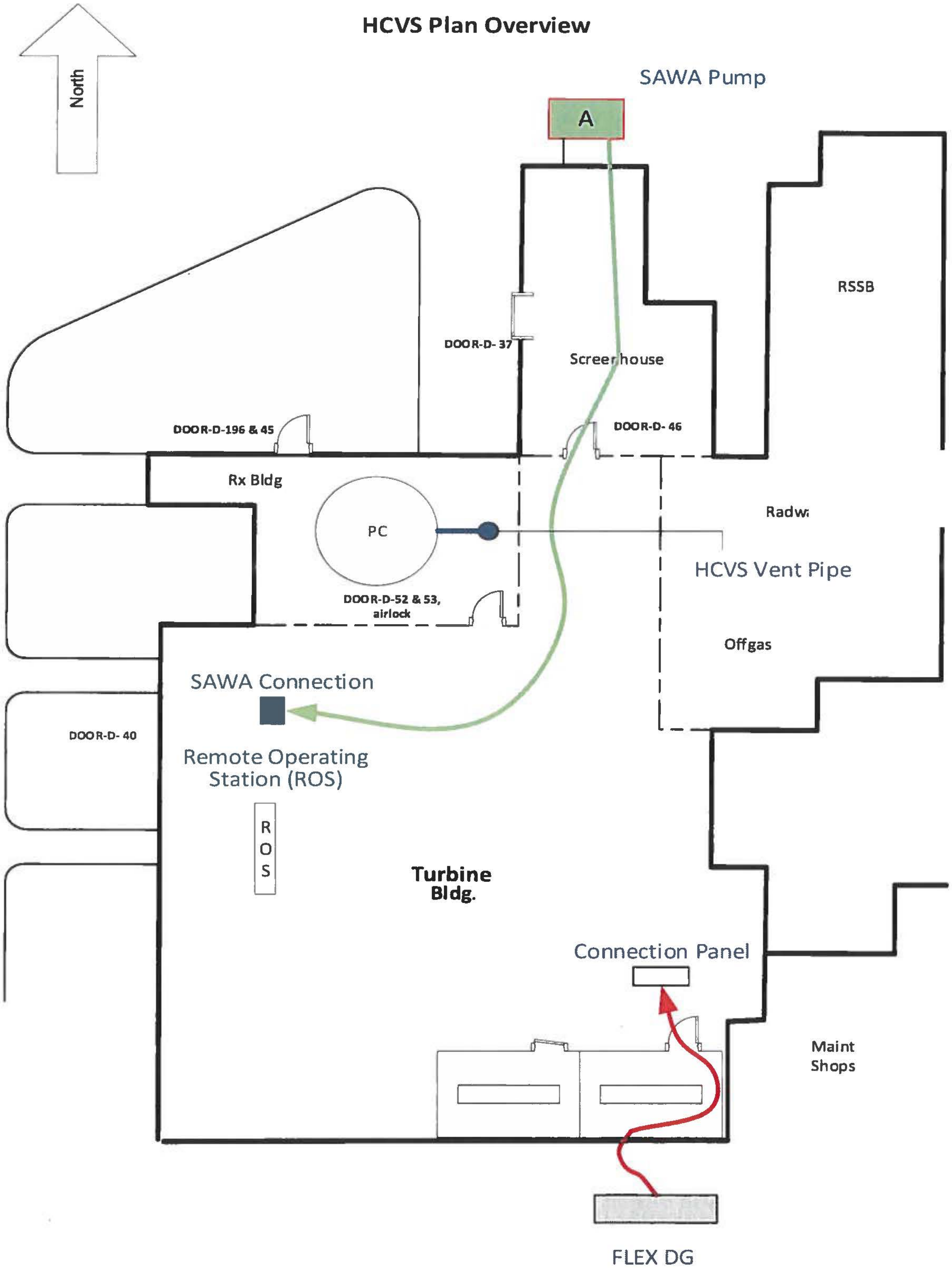


Table 1: List of HCVS Component, Control and Instrument Qualifications

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	TE-201.13-76	0-460°F	RB Elev 245' on 10" pipe	290°F (Local to pipe)	~90%	4.047E6 R TID	IEEE 323-1974 IEEE 344-1975	300°F	100%	3E8 R TID	HCVS 125 VDC Batt & Batt Charger
HCVS effluent Radiation Detector	RE-201.13-79	10E-2 to 10E4 Rad/hr	281' RB Floor, adjacent to pipe	290°F	~90%	3.95E5 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	RT-201.13-79A	10E-2 to 10E4 Rad/hr	ROS, TB Floor Elev 261'	97.82°F	~90%	5.25E2 R TID	IEEE 323-1974 IEEE 344-1975	131°F	95%	1E3 TID	HCVS 125 VDC Batt & Batt Charger
Limit Switches used at HCVS valves IV-201.13-71 & 74	POS-201.13-71E-IO/IC POS-201.13-74E-IO/IC	-	RB Floor Elev 237' adjacent to pipe	290°F (Local to pipe)	~90%	1.336E6 R TID	IEEE 323-1974 IEEE 344-1975 IEEE-383-1977	>290°F (Ref. 54, FORM-103-DCS, Section 4.1.14)	100%	2.04E8 R TID	HCVS 125 VDC Batt & Batt Charger
HCVS Valve Actuators for IV-201.13-71 & 74	IV-201.13-71 IV-201.13-74	-	RB Floor Elev 237' adjacent to pipe	290°F (Local to pipe)	~90%	1.336E6 R TID	IEEE 323-1974 IEEE 344-1975 IEEE-383-1977	>290°F (Ref. 54, FORM-103-DCS, Section 4.1.14)	100%	7.8E7 R TID	HCVS Nitrogen Supply
HCVS Control Panel and internal components	PNL-1S90	-	ACR	103.6°F	~90%	3.775E-04 R TID	N/A - insensitive	N/A - insensitive	N/A - insensitive	N/A - insensitive	HCVS 125 VDC Batt & Batt Charger
HCVS Components in ROS	PNL-HCVS 125 VDC Battery/ Voltage Meter, Batteries, Argon/N2 Pressure Indicators	-	ROS, TB 261' Floor Elev.	97.82°F	~90%	5.25E2 R TID	IEEE 323-1974 IEEE 344-1975	120°F	>90%	≥ 1E3 R TID	HCVS 125 VDC Batt & Batt Charger

[8] See UFSAR 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
Wetwell Level Indication	PT-201.2-595 PT-201.2-596	~8" to 27 ft	RB 237'	~200°F	~90%	3.775E-04 R TID in ACR	IEEE 323-1974 IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	Backed by FLEX EDG
Wetwell Pressure Indication	PT-201.2-595	0-60 psig	RB 237'	~200°F	~90%	3.775E-04 R TID in ACR	IEEE 323-1974 IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	Backed by FLEX EDG
Drywell Pressure Indication	PT-201.2-483	0-250 psig	RB 281'	~140°F	~90%	3.775E-04 R TID in ACR	IEEE 323-1974 IEEE 344-1975	RG 1.97	RG 1.97	RG 1.97	Backed by FLEX EDG
SAWA Flow Meter	FE-BDB-008	2-544 gpm	TB 261' Floor, Near ROS	43°F to 98°F	~90%	5.25E2 R TID	N/A	-4 to 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 # & TCS/TSA #
1. Perform DC load shed actions	0-1 hour	22 min	TB Battery Board Rooms and EDG Rooms	No heat stress concerns in TB and EDG areas	Done in the first 1 hour, so no radiological concerns.	Acceptable NMP1-VP-003 TSA107
2. Refuel floor early hose deployment for Alternate SFP makeup	0-1 hour	48 min	RB Southeast or Northwest stair tower up to 318' and 340' elev.	No heat stress concerns per Ref 30 this early in the event.	Done in the first 1 hour, so no radiological concerns.	Acceptable TSA108
3. Deploy SAWA pump/hoses/cart and make connections for alternate FLEX path = SAWA path	≤ 7 hours	2 hr 53 min	Outdoors, TB 261', Screenhouse 261'	No heat stress concerns for outside ambient conditions. No heat stress concerns per Ref 31.	No rad concerns outdoors due to RB wall shielding & no HCVS operation until > 7 hrs (Ref. 37).	Acceptable NMP1-VP-008 TSA112
4. Deploy FLEX EDG for Charging Battery 12	≤ 7 hours	2 hr 20 min	Outdoors, TB 261'	No heat stress concerns for outside ambient conditions and TB (Ref 31).	No rad concerns outdoors due to RB wall shielding & no HCVS operation until > 7 hrs (Ref. 37).	Acceptable NMP1-VP-009 TSA113
5. RB cooling & passive ventilation	≤ 7 hours	2 hr 17 min[12]	TB elev. 333' & 351', RB airlocks 261' through track bay and on 340' elev.	No heat stress concerns per Ref 30 this early in the event.	RB travel pathways and RB Track Bay dose from containment penetration shine between 1 and 7 hours is high. Procedures provide cautions to not	Acceptable NMP1-VP-012 TSA116

Operator Action	Evaluation Time[9]	Validation Time[10]	Location	Thermal Conditions	Radiological Conditions[11]	Evaluation VP # & TCS/TSA #
					linger in these areas. No rad concerns from HCVS vent as actions are complete prior to venting (HCVS operation > 7 hrs per Ref. 37)	
6. HCVS Valves switch actuation & instrument monitoring	> 7 hours (approx. venting start - Reference 37)	N/A	ACR & ROS (See Table 3-1 for Operator actions necessary to initiate venting)	No heat stress concerns in ACR & TB (Refs 58 & 31).	ACR & ROS 7-day TID << 1 R, and RP actions will provide protection from any airborne activity	Acceptable
7. Backup HCVS valve operation (if primary method fails)	> 7 hours (approx. venting start – Reference 37)	N/A	ROS only (See Table 3-1 for Operator actions necessary to initiate venting)	No heat stress concerns in TB per Ref 31.	ROS 7-day TID <<1 R. RP actions will provide protection from any airborne activity. Cautions added to N1-EOP-4.1/N1-DRP-FLEX-MECH to avoid RB airlock on 261'.	Acceptable
8. SAWA pump &, FLEX EDG operation and refueling of portable equipment.	>7 hours (maximum injection start time is 8 hours & max refueling time is 14 hours)	9 hr 41 min to refuel SAWA pump + FLEX EDG	Outside, North of Screen House Bldg. and travel path from FLEX Bldg. to Screen House.	No heat stress concerns for outside ambient conditions.	HCVS venting procedures provide precautions to warn personnel staged at SAWA pump and personnel performing refueling when venting is to commence. Cautions are provided in the portable equipment refueling	Acceptable NMP1-VP-014 TSA118

Operator Action	Evaluation Time[9]	Validation Time[10]	Location	Thermal Conditions	Radiological Conditions[11]	Evaluation VP # & TCS/TSA #
					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.	

[9] Evaluation timing is from NEI 13-02 to support radiological evaluations and are based on the time listed in the Validation Time column.

[10] Validation time is based on times listed in OP-NM-102-106 Attachment 4 Start Time + Time in Results column.

[11] Refer to Reference 44 for dose assessment.

[12] As described in table Note 10, the validation time is based on the start time + the time it takes to complete the action. For RB cooling and passive ventilation, the start time is 2 hours and the action time to complete the tasks in the high dose area once started is 5 minutes of the 17 total minutes.