Exelon Generation.

Order No. EA-13-109

RS-18-113

September 28, 2018

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

Peach Bottom Atomic Power Station, Unit 2
Renewed Facility Operating License No. DPR-44
NRC Docket No. 50-277

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. Exelon Generation Company, 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 26, 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 Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2014 (RS-14-062)
6. Exelon Generation Company, LLC 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 19, 2014 (RS-14-305)
7. Exelon Generation Company, LLC 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-15-151)

8. Exelon Generation Company, LLC 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-15-303)
9. Exelon Generation Company, LLC 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-16-109)
10. Exelon Generation Company, LLC 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 15, 2016 (RS-16-235)
11. Exelon Generation Company, LLC 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-17-068)
12. Exelon Generation Company, LLC 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-17-155)
13. Exelon Generation Company, LLC Eighth 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 29, 2018 (RS-18-060)
14. NRC letter to Exelon Generation Company, LLC, Peach Bottom Atomic Power Station, Units 2 and 3 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4416 and MF4417), dated February 12, 2015
15. NRC letter to Exelon Generation Company, LLC, Peach Bottom Atomic Power Station, Units 2 and 3 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 2 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4416 and MF4417), dated August 2, 2016
16. NRC letter to Exelon Generation Company, LLC, Peach Bottom Atomic Power Station, Units 2 and 3 – Report for the Audit of Licensee Responses to Interim Staff Evaluations 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 November 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). 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 Peach Bottom Atomic Power Station, Unit 2 Phase 1 Overall Integrated Plan (OIP), which was replaced with the Phase 1 (Updated) and Phase 2 OIP (Reference 8). References 14 and 15 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, 12, and 13 provided the first, second, third, fourth, fifth, sixth, seventh, and eighth six-month status reports, respectively, pursuant to Section IV, Condition D.3, of Reference 1 for Peach Bottom Atomic Power Station, Unit 2.

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

Peach Bottom Atomic Power Station, Unit 2 has designed and installed a venting system that provides venting capability from the wetwell during severe accident conditions in response to Phase 1 of NRC Order EA-13-109. Peach Bottom Atomic Power Station, Unit 2 has implemented a reliable containment venting strategy that makes it unlikely that the plant would need to vent from the containment drywell before alternative reliable containment heat removal and pressure control is reestablished in response to Phase 2 of NRC Order EA-13-109. The information provided herein documents full compliance for Peach Bottom Atomic Power Station, Unit 2 with NRC Order EA-13-109.

Peach Bottom Atomic Power Station, Unit 2 Phase 1 OIP Open Items have been addressed and closed as documented in Reference 10, and are considered complete per Reference 16. It is noted that there were no Phase 2 OIP Open Items.

EGC's response to the NRC Interim Staff Evaluation (ISE) Phase 1 Open Items identified in Reference 14 have been addressed and closed as documented in Reference 10, and are considered complete per Reference 16. The following table provides completion references for each OIP and ISE Phase 1 Open Item.

Reference 16 provided the results of the audit of ISE Open Item closure information provided in References 10 and 11. All Phase 1 and Phase 2 ISE Open Items are statused as closed in Reference 16.

OIP Phase 1 Open Item No. 1 Confirm that the Remote Operating Station (ROS) will be in an accessible area following a Severe Accident (SA).	Deleted (Closed to ISE Open Item No. 9 below)
OIP Phase 1 Open Item No. 2 Provide procedures for HCVS Operation.	Deleted (Closed to ISE Open Item No. 1 below)
OIP Phase 1 Open Item No. 3 Identify site specific controlling document for HCVS out of service and compensatory measures.	Deleted (Closed to ISE Open Item No. 2 below)
OIP Phase 1 Open Item No. 4 Determine the approach for combustible gases.	Deleted (Closed to ISE Open Item No. 8 below)
OIP Phase 1 Open Item No. 5 Perform radiological evaluation for Phase 1 vent line impact on ERO response actions.	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 1 Make available for NRC staff audit guidelines and procedures for HCVS operation. (Section 3.2.3.1)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 2 Make available for the NRC staff audit the site specific controlling document for HCVS out of service and compensatory measures. (Section 3.4.1)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 3 Make available for NRC staff audit a technical justification for use of jumpers in the HCVS strategy. (Section 3.1.3)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 4 Make available for NRC staff audit analyses demonstrating that the HCVS has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit. (Sections 3.2.2.1 and 3.2.2.2)	Closed per References 10 and 16.

ISE Phase 1 Open Item No. 5 Make available for NRC staff audit descriptions or diagrams of reactor building ventilation including exhaust dampers failure modes to support licensee justification for the HVAC release point being below and 150 feet from the reactor building ventilation release point. (Section 3.2.2.3)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 6 Make available for NRC staff audit details to justify the deviation from tornado protection standards provided in NEI 13-02 or make available a description of how the HCVS will comply with the tornado protection standards provided in NEI-13-02. (Section 3.2.2.3)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 7 Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident condition. (Section 3.2.2.5)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 8 Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration. (Section 3.2.2.6)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 9 Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment. (Sections 3.2.1, 3.2.2.3, 3.2.2.4, 3.2.2.5, 3.2.2.10, 3.2.4.1, 3.2.4.2, 3.2.5.2, and 3.2.6)	Closed per References 10 and 16.
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. (Sections 3.2.2.9 and 3.2.2.10)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 11 Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation. (Sections 3.2.2.4, 3.2.3.1, 3.2.3.2, 3.2.4.1, 3.2.4.2, 3.2.5.1, 3.2.5.2, and 3.2.6)	Closed per References 10 and 16.

ISE Phase 1 Open Item No. 12 Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions. (Sections 3.2.2.3, 3.2.2.5, 3.2.2.9, and 3.2.2.10)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 13 Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting. (Section 3.2.2.9)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 14 Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings. (Section 3.2.2.6 and 3.2.2.7)	Closed per References 10 and 16.
ISE Phase 1 Open Item No. 15 Make available for NRC audit documentation confirming that HCVS will remain isolated from standby gas treatment system during ELAP and severe accident conditions. (Section 3.2.2.7)	Closed per References 10 and 16.

EGC's response to the NRC ISE Phase 2 Open Items identified in Reference 15 have been addressed and closed as documented in Reference 11, and are considered complete per Reference 16. The following table provides completion references for each ISE Phase 2 Open Item.

ISE Phase 2 Open Item No. 1 Licensee to demonstrate the SAWA equipment and controls, as well as ingress and egress paths for the expected severe accident conditions (temperature, humidity, radiation) remain operational throughout the sustained operating period. (Section 3.3.2.3)	Closed per References 11 and 16 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 2 Licensee to demonstrate that instrumentation and equipment being used for SAWA and supporting equipment is capable to perform for	Closed per References 11 and 16 utilizing BWROG generic response template.

the sustained operating period under the expected temperature and radioloqical conditions. (Section 3.3.2.3)	
ISE Phase 2 Open Item No. 3 Licensee to demonstrate that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions. (Section 3.3.3)	Closed per References 11 and 16 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 4 Licensee shall demonstrate whether a site specific MAAP evaluation will be used to determine an initial SAWA flow rate. If the evaluations performed in BWROG TP-15-011 is considered, provide a description of how the plant is bounded by the reference plant analysis that shows the SAWM strategy is successful in making it unlikely that a drywell vent is needed. (Section 3.3.3.1)	Closed per References 11 and 16 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 5 Licensee to demonstrate that there is adequate communication between the MCR and the Intake Structure operator at the FLEX manual valve during severe accident conditions. (Section 3.3.3.4)	Closed per References 11 and 16 utilizing BWROG generic response template.
ISE Phase 2 Open Item No. 6 Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions. (Section 3.3.3.4)	Closed per References 11 and 16 utilizing BWROG generic response template.

MILESTONE SCHEDULE – ITEMS COMPLETE

Peach Bottom Atomic Power Station, Unit 2 - Phases 1 and 2 Specific Milestone Schedule

Milestone	Target Completion Date	Activity Status	Comments
Submit Phase 1 Overall Integrated Plan	**Jun. 2014**	Complete	

Milestone	Target Completion Date	Activity Status	Comments
Submit Phase 2 Overall Integrated Plan	**Dec. 2015**	Complete	
Submit 6 Month Updates:			
Update 1	**Dec. 2014**	Complete	
Update 2	**Jun. 2015**	Complete	
Update 3	**Dec. 2015**	Complete	Simultaneous with Phase 2 OIP
Update 4	**Jun. 2016**	Complete	
Update 5	**Dec. 2016**	Complete	
Update 6	**Jun. 2017**	Complete	
Update 7	**Dec. 2017**	Complete	
Update 8	**Jun. 2018**	Complete	
Phase 1 Specific Milestones			
Phase 1 Modifications:			
Hold preliminary/conceptual design meeting	**Apr. 2014**	Complete	
Unit 2 Design Engineering On-site/Complete	**Jun. 2016**	Complete	
Unit 2 Implementation Outage	**Nov. 2016**	Complete	
Unit 2 Walk Through Demonstration/Functional Test	**Nov. 2016**	Complete	
Phase 1 Procedure Changes			
Operations Procedure Changes Developed	**Nov. 2016**	Complete	
Site Specific Maintenance Procedure Developed	**Nov. 2016**	Complete	
Procedure Changes Active	**Nov. 2016**	Complete	
Phase 1 Training:			
Training Complete	**Nov. 2016**	Complete	
Phase 1 Completion			
Unit 2 HCVS Implementation	**Nov. 2016**	Complete	

Milestone	Target Completion Date	Activity Status	Comments
Phase 2 Specific Milestones			
Phase 2 Modifications:			
Hold preliminary/conceptual design meeting	**N/A**	N/A	
Unit 2 Design Engineering On-site/Complete	**Sept. 2017**	Complete	
Unit 2 Walk Through Demonstration/Functional Test	**Aug. 2018**	Complete	
Unit 2 Implementation Outage	N/A	N/A	
Phase 2 Procedure Changes			
Operations Procedure Changes Developed	**Aug. 2018**	Complete	
Site Specific Maintenance Procedure Developed	**Aug. 2018**	Complete	
Procedure Changes Active	**Aug. 2018**	Complete	
Phase 2 Training:			
Training Complete	**Aug. 2018**	Complete	
Phase 2 Completion			
Unit 2 HCVS Implementation	**August 31, 2018**	Complete	
Submit Unit 2 Phases 1 and 2 Completion Report	**Sept. 2018**	Complete with this submittal.	

ORDER EA-13-109 COMPLIANCE ELEMENTS SUMMARY

The elements identified below for Peach Bottom Atomic Power Station, Unit 2, as well as the Phase 1 (Updated) and Phase 2 OIP response submittal (Reference 8), and the 6-Month Status Reports (References 6, 7, 8, 9, 10, 11, 12, and 13), demonstrate compliance with NRC Order EA-13-109. The Peach Bottom Atomic Power Station, Units 2 and 3 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 Peach Bottom Atomic Power Station, Unit 2, Phase 1 HCVS provides a vent path from the wetwell to remove decay heat, vent the containment atmosphere, and control containment pressure within acceptable limits. The Phase 1 HCVS will function for those accident conditions for which containment venting is relied upon to reduce the probability of containment failure, including accident sequences that result in the loss of active containment heat removal capability during an extended loss of alternating current power.

The Peach Bottom Atomic Power Station, Unit 2, Phase 2 HCVS provides a reliable containment venting strategy that makes it unlikely that the plant would need to vent from the containment drywell before alternative reliable containment heat removal and pressure control is reestablished. The Peach Bottom Atomic Power Station, Unit 2, Phase 2 HCVS strategies implement Severe Accident Water Addition (SAWA) with Severe Accident Water Management (SAWM) as an alternative venting strategy. This strategy consists of the use of the Phase 1 wetwell vent and SAWA hardware to implement a water management strategy that will preserve the wetwell vent path until alternate reliable containment heat removal can be established.

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

HCVS Phase 1 and Phase 2 Quality Standards – Complete

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

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

HCVS Phase 1 and Phase 2 Programmatic Features - Complete

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

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

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

Site processes have been established to ensure the Phase 1 and Phase 2 HCVS is tested and maintained as recommended in NEI 13-02, Revision 1, Sections 5.4 and 6.2.

Peach Bottom Atomic Power Station, Unit 2 has completed validation in accordance with industry developed guidance to assure required tasks, manual actions and decisions for HCVS strategies are feasible and may be executed within the constraints identified in the HCVS Phases 1 and 2 OIP for Order EA-13-109 (Reference 8).

Peach Bottom Atomic Power Station, Unit 2 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 28th day of September 2018.

Respectfully submitted,

D. P. Helker

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

Enclosure: Peach Bottom Atomic Power Station, Units 2 and 3 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 – Peach Bottom Atomic Power Station
NRC Project Manager, NRR – Peach Bottom Atomic Power Station
Mr. Peter J. Bamford, NRR/JLD/JOMB, NRC
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Director, Bureau of Radiation Protection – Pennsylvania Department of Environmental Resources
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Enclosure

Peach Bottom Atomic Power Station, Units 2 and 3

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

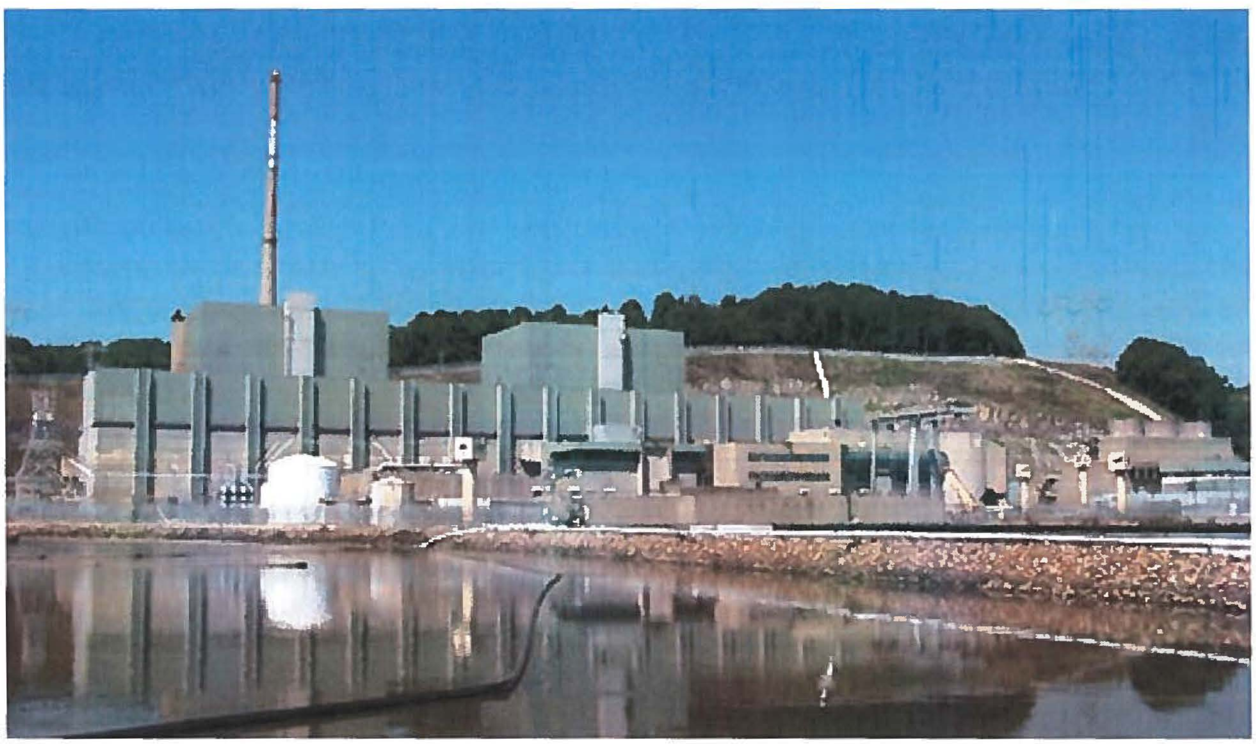
(69 pages)

Final Integrated Plan

HCVS Order EA-13-109

for

Peach Bottom Atomic Power Station (PBAPS) Units 2 & 3



September 28, 2018

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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).

Peach Bottom Atomic Power Station (PBAPS) 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. PBAPS achieved Phase 1 compliance in November 2016 for Unit 2 and in November 2017 for Unit 3.

- Phase 2 provided additional protections for severe accident conditions through the development of a reliable containment venting strategy that makes it unlikely that PBAPS would need to vent from the containment drywell during severe accident conditions. PBAPS achieved Phase 2 compliance in November 2017 for Unit 3 and August 2018 for Unit 2.

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, PBAPS submitted a phase 1 Overall Integrated Plan (OIP) in June of 2014 (Reference 18) and subsequently submitted a combined Phase 1 and 2 OIP in December 2015 (Reference 19). These OIPs followed the guidance NEI 13-02 Revision 0 and 1 respectively, 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 where written to different revisions of NEI 13-02, PBAPS conform 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 PBAPS 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 29) 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 PBAPS 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 PBAPS Final Integrated Plan details for Phase 1 of the Order. Section IV contains the Final Integrated Plan details for Phase 2 of the Order. Section V details the programmatic elements of compliance.

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 Main Control Room (MCR) or the ROS at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms.

- The vent utilizes containment parameters of pressure and level from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation is monitored by HCVS valve position, 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 PBAPS are seismic, external flooding, high winds, extreme cold, and extreme high temperature. Initial operator actions are completed by plant personnel and include the capability for remote-manual initiation from the HCVS control station. Initial operator actions are completed by plant personnel to perform initial valve line-up at the ROS. Then, the primary location of vent operation is the MCR. The HCVS system can also be operated manually from the ROS. Attachment 2 contains a one-line diagram of the HCVS vent flowpath.

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

The Phase 2 actions can be summarized as follows:

- Utilization of Severe Accident Water Addition (SAWA) to initially inject water into the Reactor Pressure Vessel (RPV).
- Utilization of Severe Accident Water Management (SAWM) to control injection and Suppression Pool level to ensure the HCVS Phase 1 wetwell vent will remain functional for the removal of heat from the containment.
- Heat can be removed from the containment for at least seven (7) days using the HCVS or until alternate means of heat removal are established that make it unlikely the drywell vent will be required for containment pressure control.
- The SAWA and SAWM actions can be manually activated and controlled from areas that are accessible during severe accident conditions.
- Parameters measured are Drywell pressure, Suppression Pool level, SAWA flowrate and the HCVS Phase 1 vent path parameters.

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

The SAWA flow path is the same as the FLEX primary injection flow path. Attachment 4 contains a one-line diagram of the SAWA flowpath.

For severe accident (SA) conditions, the operators will follow Emergency Operating Procedures (EOP) flowcharts (i.e., TRIP/SAMP) for various scenarios where one unit is under FLEX and the other under SA conditions or both units are under SA conditions. FLEX procedures guide implementation of FLEX strategies for the FLEX unit. PBAPS will inject 500 gpm for 4 hours and then lower the injection rate to the 100 gpm wetwell preservation flow rate. A FLEX (SAWA) Pump for each unit is staged north of the Unit 3 Reactor Building (RB) between the Plant Services Building and the Unit 3 Startup Switchgear Building. The FLEX Pumps take suction from the Emergency Cooling Tower (ECT). To control the injection rate, the FLEX Pump discharge hoses are equipped with flow meters and flow rate is controlled by adjusting FLEX Pump rpm and/or throttling discharge valves. The location of the FLEX Pumps has been analyzed for hydraulics and dose rates.

All the hose connections, valve lineups, and the staging of the FLEX Pumps will be completed to allow RPV makeup within 8 hours of the onset of the event. The FLEX

Pump for each unit is capable of meeting all water makeup requirements for FLEX or SA conditions. As discussed in OIP (Reference 19), the total amount of water added will not completely fill up the torus to render wetwell venting inoperable.

The SAWA electrical loads are included in the FLEX Generator loading calculation reviewed for EA-12-049 compliance. The Unit 2 FLEX Generator is located south of the Unit 2 RB outside of the Unit's outer railroad door. The Unit 3 FLEX Generator is located north of the Unit 3 RB outside of the Unit's outer railroad door. See Attachment 6 for applicable locations. Refueling of the FLEX Generators is accomplished as described in FSG-50, "FLEX Equipment Fuel Oil Supply" (Reference 38).

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 Generators. The battery chargers are also powered from the FLEX Generators to maintain the battery capacities during the Sustained Operating period.

Section II: List of Acronyms

AC	Alternating Current
AOV	Air Operated Valve
BDBEE	Beyond Design Basis External Event
BWROG	Boiling Water Reactor Owners' Group
CAP	Containment Accident Pressure
DBA	Design Basis Accident
DBLOCA	Design Basis Loss of Coolant Accident
DC	Direct Current
ECCS	Emergency Core Cooling Systems
ECT	Emergency Cooling Tower
ELAP	Extended Loss of AC Power
EOP	Emergency Operating Procedure
EPG/SAG	Emergency Procedure and Severe Accident Guidelines EPRI Electric Power Research Institute
ERO	Emergency Response Organization
FAQ	Frequently Asked Question
FB	FLEX Building
FIP	Final Integrated Plan
FLEX	Diverse & Flexible Coping Strategy
GPM	Gallons per minute
HCVS	Hardened Containment Vent System
ISE	Interim Staff Evaluation

ISG	Interim Staff Guidance
JLD	Japan Lessons Learned Project Directorate
LOCA	Loss of Coolant Accident
LPCI	Low Pressure Coolant Injection System
MAAP	Modular Accident Analysis Program
MCR	Main Control Room
N_2	Nitrogen
NEI	Nuclear Energy Institute
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
OIP	Overall Integrated Plan
PBAPS	Peach Bottom Atomic Power Station
PCIV	Primary Containment Isolation Valve
PCPL	Primary Containment Pressure Limit
PCM	Performance Centered Maintenance
RB	Reactor Building
RBCCW	Reactor Building Closed Cooling Water
RHR	Residual Heat Removal
RM	Radiation Monitor
ROS	Remote Operating Station
RPV	Reactor Pressure Vessel
SA	Severe Accident
SAMG	Severe Accident Management Guidelines

SAWA	Severe Accident Water Addition
SAWM	Severe Accident Water Management
SBGT	Standby Gas Treatment System
SFP	Spent Fuel Pool
SGIG	Safety Grade Instrument Gas
SRV	Safety-Relief Valve
TB	Turbine Building
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

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

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

PBAPS installed a hardened Torus (i.e., wetwell) vent for each unit in response to NRC Generic Letter 89-16 under Mod 5236. The description of the vent system below is common to both units. The Torus hardened vent pipe provides venting capabilities for the Torus vapor space via Primary Containment Isolation Valves (PCIVs) AO-2-07B-2511 (Unit 2) and AO-3-07B-3511 (Unit 3) [hereafter referred to as AO-2(3)511], Primary Containment Outboard Barrier Valve AO-2-07B-80290 (Unit 2) and AO-3-07B-90290 (Unit 3) [hereafter referred to as AO-8(9)0290], and Rupture Disc PSD-80293 (Unit 2) and PSD-90293 (Unit 3) [hereafter referred to as AO-8(9)0293] to above the RB roof. The purpose of the vent is to maintain the Primary Containment pressure below the design limit (PCPL, 60 psig) when shut down cooling is lost for an extended period. This containment emergency vent path will prevent a containment breach with the subsequent uncontrolled radioactivity release.

The hardened vent system for each unit is connected to the Standby Gas Treatment System (SGTS) by valve AO-2-07B-2512 (Unit 2) and AO-3-07B-3512 (Unit 3) [hereafter referred to as AO-2(3)512]. During venting, the Torus vent pipe is isolated from the SGTS by AO-2(3)512 which remains closed. This valve has T-ring boot seals which inflate to prevent potential leakage across the valve seat to the SGTS. The HCVS nitrogen supply is connected to the AO-2(3)512 actuator tubing to maintain the boot seal inflated.

The hardened vent pipe discharge point is positioned above all buildings in the PBAPS protected area. The RB roof parapet is at Elevation 294'. The Torus vent discharge point is at Elevation 300'. The only higher structure in the protected area is the RB ventilation exhaust discharge point at Elevation 305', on the east side of the RB, approximately 150 feet away (east-west). The RB ventilation exhaust fans are not powered during an Extended Loss of AC Power (ELAP); however, chimney effect would preclude an inward pressure gradient. The hardened vent pipe release point is away from MCR ventilation system intake, which is below Elevation 177'. The PBAPS Main Stack is positioned at a higher elevation and is not located in the PBAPS protected area.

As detailed in calculation PM-1190 (Reference 39), the hardened vent discharge does not adversely impact any ventilation intake or exhaust openings, MCR location, location of portable equipment, access routes required following an ELAP and Beyond Design Basis severe accident or emergency response facilities.

The AO-2(3)511 air operated valve (AOV) is normally closed/fail closed. The valve control switch and position indication (open/close) lights are located in the MCR on

Panel 2(3)0C003-03. When the control switch is set to 'open', the 125 Vdc solenoid valve is energized. The solenoid opens a path for instrument air or Safety Grade Instrument Gas (SGIG) to the valve actuator, opening the AOV. The valve automatically closes under spring pressure on loss of air. The 125 Vdc control power supply is provided from a Class 1E station battery.

AO-8(9)0290 is the hardened vent outboard barrier valve. Instrument air opens the valve against spring pressure and the valve fails closed. SGIG Nitrogen backs up the Instrument Air supply. The valve is opened when venting is required using Procedures T-200-2(3) and T-200J-2(3) (References 40 and 41). This valve is normally closed/fails closed and has no auto-close feature or stroke time requirement. The key locked control switch and position indication lights (open/close) are located on MCR Panel 2(3)0C003-03. The 125 Vdc control power for the valve actuating solenoid is normally supplied from a Class 1E station battery. To guard against inadvertent actuation, the control power fuses are removed during normal operations. The control power fuses are installed per Procedure T-200-2(3) when the valve is to be stroked open.

Rupture Disc PSD-8(9)0293 is downstream of AO-8(9)0290 and precludes the occurrence of Secondary Containment bypass leakage. PSD-8(9)0293 guards against inadvertent venting of Secondary Containment. The rupture disc prevents radioactive releases caused by upstream valve leakage during design basis operation. The rupture disc burst pressure is set at 30 psig which is less than the Torus design pressure rating (56 psig). The disc set point precludes reaching the Primary Containment Pressure Limit (PCPL) of 60 psig. The portion of the vent pipe that is downstream of PSD-8(9)0293 penetrates the Torus Room roof which is at grade level on the west side of the RB El 135'-0". The downstream side of the rupture disc and the piping between the rupture disc and the Torus Room roof are part of Secondary Containment.

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

The EA-13-109 compliant HCVS system utilizes the existing GL-89-16 wetwell hardened vent system with the addition of a dedicated 125 Vdc battery, Nitrogen motive gas source, and Argon purge systems. In addition, new HCVS radiation monitoring and temperature sensors and new control switches have been added. After initial valve line-up at ROS located in the Radwaste Building 135' elevation, the vent system is initiated, operated and monitored from the MCR. The vent system can also be initiated and operated from the ROS. Table 2 contains the evaluation of the acceptability of the ROS location with respect to severe accident conditions.

The MCR is the primary operating station for the HCVS. During an ELAP, electric power to operate the vent valves will be provided by batteries with a capacity to supply required loads for at least the first 24 hours. Before the batteries are depleted, the FLEX Generator will supplement and recharge batteries to support operation of the vent valves. The ROS is designated as the alternate control location and method. Since the ROS does not require any electrical power to operate, the valve solenoids do not need any additional backup electrical power. Attachment 2 shows the HCVS vent flow path.

A dedicated HCVS 125 Vdc battery supplies power to the actuating solenoid for Inner Primary Containment Isolation Valve (PCIV) AO-2(3)511 and Primary Containment Outboard Barrier Valve AO-8(9)0290. This battery also powers the new HCVS instrumentation via the Distribution Panel 00D508. With the exception of the HCVS Radiation Monitoring System, HCVS instrumentation (argon pressure and HCVS temperature loops) is de-energized during normal operating conditions.

A new dedicated motive gas (Nitrogen) source is installed for the valve actuators for AO-2(3)511 and AO-8(9)0290. Nitrogen bottles are staged at the ROS. In addition, a new Argon Purge System is installed at the ROS to allow anticipatory breach of the vent rupture disc and to purge the vent pipe after venting to suppress the potential for Hydrogen (H2) detonation. The Argon bottles and Nitrogen bottles are isolated from their respective headers because the valves for each bottle are maintained closed.

The control switches [RMS-2(3)-16A-S025 and RMS-2(3)-16A-S116] and status lights for existing AO-2(3)511 and AO-8(9)0290 are re-used and remain at MCR Panel 2(3)0C003-03.

New switch RMS-2(3)-16A-S118 is mounted on Panel 2(3)0C003-03 and controls power to the HCVS components, except for the new RMS components. This switch, when aligned to the HCVS power source, also bypasses the normal PCIS logic that locks out operation of AO-2(3)511. The need to install AO-8(9)0290 control power fuses is also bypassed.

If AO-2(3)511 or AO-8(9)0290 should fail to operate normally from Panel 2(3)0C003-03, manual 3-way valves at the ROS will be re-positioned to place Nitrogen on the valve actuators to open these valves.

Control of the Argon Purge System is from new control switch RMS-2(3)-07K-2(3)3472 at the existing MCR Panel 00C767. The Argon supply solenoid valve SV-2(3)-07K-2(3)3472 is installed at the ROS. This valve is opened to allow Argon to discharge into the Torus vent pipe and to rupture the Torus Vent Rupture Disc PSD-8(9)0293. The Argon flow rate is controlled by PCV-2(3)-07K-2(3)3477A/B. Argon header supply pressure indicator PI-8(9)1406 is installed in the Panel 00C767 to allow Operator monitoring of purge gas supply pressure during purge or disc rupture operations.

A new HCVS strap-on temperature sensor TE-8(9)1407 is installed on the vent line in the Torus Room and the indicator TI-8(9)1407 is added to Panel 2(3)0C003-03 to provide temperature indication of the vent pipe during venting.

A new HCVS vent pipe Radiation Monitoring System [RE/RT/RI-8(9)1405] has been installed. Radiation detector assembly RE-8(9)1405 is installed in the Unit 2 RB El. 195'-0" and in the Unit 3 RB El.165'-0". The radiation processor RT-8(9)1405 is installed in Panel 00C1062 located in the ROS. Panel 00C1062 will house the Radiation processors for both Unit 2 and Unit 3, RT-8(9)1405, and their associated power supplies. Radiation indication RI-8(9)1405 is provided in the MCR panel 2(3)0C010.

The HCVS radiation monitor (RM) 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).

Table 1 provides HCVS instrumentation and equipment environment and qualifications.

Attachment 3 and 3a contain 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 maximum operating temperature in the Torus and Torus vent at the PCPL is 308°F based on saturated steam properties at 60 psig.

NEI 13-02 suggests a 350°F value for HCVS design temperature based on the highest Primary Containment Pressure Limit (PCPL) among the Mark I and II plants. Since 308°F corresponds to the saturation temperature for the PBAPS PCPL of 60 psig, it will be retained as the pipe design temperature. Per NEI 13-02, it is acceptable to assume saturation conditions in containment (2.4.3.1) so that these design parameters are acceptable.

To prevent leakage of vented effluent to the Standby Gas Treatment (SBGT) system, boundary valve AO-2(3)512 must close before wetwell venting. AO-2(3)512 is the only boundary between the HCVS and the interfacing SBGT system. This valve is normally closed, fail closed, and is not required to change state in order to perform its' safety related containment isolation function; therefore, it can be assumed to be closed when required. AO-2(3)512 is part of the IST program and is leak tested in accordance with 10CFR50, Appendix J. This is acceptable for prevention of inadvertent cross-flow of vented fluids per HCVS-FAQ-05.

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

Manual bypass valve HV-2(3)-07K-2(3)3476 has been installed around SV-2(3)-07K-2(3)3472. Exelon Position Paper EXC-WP-11 (Reference 46) Attachment 3, second paragraph indicates that use of the manual bypass valve around SV-2(3)-07K-2(3)3472 to inject Argon satisfies NRC Order EA 13-109 requirements and associated NEI 13-02 Revision 1 and HCVS-WP-03 Revision 1 guidance for hydrogen detonation control elements of the Order. Thus, if SV-2(3)-07K-2(3)3472 is inoperable, the HCVS is compliant with NRC requirements despite this condition.

With the onset of ELAP, Operations will open each of the Argon bottle isolation valves, open the Nitrogen bottle isolation valves, align the Argon supply valve HV-2(3)-07K-2(3)3478, and, if conditions warrant, actuate SV-2(3)-07K-2(3)3472 via MCR control switch RMS-2(3)-07K-2(3)3472 to rupture the PSD-8(9)0293 rupture disc in preparation for venting. The MCR switch RMS-2(3)-16A-S118 in Panel 2(3)0C003 will be used to energize the HCVS instrumentation. If SV-2(3)-07K-2(3)3472 is not available, Operators will use bypass valve HV-2(3)-07K-2(3)3476 to inject Argon. Re-alignment of the HCVS Nitrogen header supply valves is necessary. Nitrogen from the bottles is supplied to the upstream side of the actuating solenoids for AO-2(3)511, AO-2(3)512 and AO-8(9)0290. If the normal instrument air supply and SGIG supply are lost, HCVS Nitrogen will be supplied to the actuators for these valves. The AO-2(3)511 valve is opened via MCR control switch RMS-2(3)-16A-S025 and is maintained opened. The outer vent valve AO-8(9)0290 will then be cycled open/closed via MCR control switch RMS-2(3)-16A-S116 as directed by operating procedures. After each time AO-8(9)0290 is closed, the vent pipe is purged with Argon within the period specified in calculation PM-1189. Argon will be injected to the vent pipe using control switch RMS-2(3)-07K-2(3)3472 at MCR Panel 00C767 or the manual bypass mentioned above. If the solenoid for the vent valve actuator should fail to operate, Operators will access the ROS to perform manual stroking of the HCVS hardened vent valves. The pathway used to access the ROS is detailed in Calculation PM-1190 (Reference 39).

Section III.B: HCVS Phase 1 Evaluation Against Requirements:

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

1. HCVS Functional Requirements

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

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

Evaluation:

The operation of the HCVS was designed to minimize the reliance on operator actions in response to hazards identified in NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide (Reference 31), which are applicable to the plant site. Operator actions to initiate the HCVS vent path can be completed by plant personnel and include the capability for remote-manual initiation from the HCVS control station. A list of the remote manual actions performed by plant personnel to open the HCVS vent path is in the following table:

Table 3-1: HCVS Operator Actions

Primary Action	Primary Location/ Component	Notes
1. Valve in Argon gas bottles (16) and Nitrogen gas bottles (2).	ROS Radwaste 135'	
2. Open HV-2(3)-16C-2(3)3434A "2(3)AS1108 N2 Btl to Ctmt Vent Sys Isol Vv".	ROS Radwaste 135'	
3. Open HV-2(3)-16C-2(3)3434B "2(3)BS1108 N2 Btl to Ctmt Vent Sys Isol Vv".	ROS Radwaste 135'	
4. Adjust PCV-2(3)-16C-2(3)3435, "Backup N2 SUP Press Reg To Ctmt Vent Hdr" if required.	ROS Radwaste 135'	
5. Open HV-2(3)-16C-2(3)3436, "B/U N2 to Ctmt Vent Sys Hdr Isol Vv"	ROS Radwaste 135'	
6. Unlock and open HV-2(3)-07K-2(3)3478, "Argon Gas Supply to Ctmt Vent Hdr Isol Valve".	ROS Radwaste 135'	
7. Energize the system by placing RMS-2(3)-16A-S118, "HCVS Power Transfer Switch", in "Bypass".	MCR Panel 2(3)0C003-03 key lock switch	Powered by the HCVS 125 VDC batteries
8. Rupture PSD-8(9)0293, "Ctmt Emerg Vent Rupture Disc"	MCR Panel 00C767	Open SV-2(3)3472, "HCVS Argon Purge"

Primary Action	Primary Location/ Component	Notes
9. Open AO-2(3)511, "Inbd 18" Vent"	MCR Panel 2(3)0C003-03	
10. Open AO-8(9)0290, "Ctmt Emerg Vent".	MCR Panel 2(3)0C003-03	This action starts venting primary containment from the Torus.

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 needs to be moved in the first 24 hours.

After 24 hours, available personnel will be able to connect supplemental electric power and pneumatic supplies for sustained operation of the HCVS for a minimum of 7 days. The FLEX Generators and Nitrogen bottles provide this motive force. In all likelihood, these actions will be completed in less than 24 hours. However, the HCVS can be operated for at least 24 hours without any supplementation.

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

Table 3-2: Failure Evaluation

Functional Failure Mode	Failure Cause	Alternate Action	Failure with Alternate Action Impact on Containment Venting?
Fail to Vent (Open) on Demand	Valves fail to open/close due to loss of normal DC power	Transfer power to alternate DC power from HCVS battery	No
Fail to Vent (Open) on Demand	Valves fail to open/close due to loss of alternate DC power	Manually open valves from ROS Radwaste 135'	No
Fail to Vent (Open) on Demand	Valves fail to open/close due to loss of normal pneumatic supply	Open valves using backup nitrogen system (SGIG) – no operator action required	No
Fail to Vent (Open) on Demand	Valve fails to open/close due to loss of backup pneumatic supply (SGIG)	Align HCVS nitrogen bottles at ROS Radwaste 135'	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 MCR. Alternate control of the HCVS is accomplished from the ROS at Radwaste 135' elevation. FLEX actions that will maintain the MCR and ROS habitable were implemented in response to NRC Order EA-12-049 (Reference 32). Actions specified in FSG-30, "Establishing Control Room Ventilation and Lighting" (Reference 47), include:

1. Restoring MCR ventilation using the FLEX Generator. The MCR ventilation loads were included in FLEX Generator load calculations.

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

3. Operating portable generators and fans to move outside air through the MCR (if required).

4. A ROS temperature of 120°F conservatively bounds the expected temperature response in the first 7 days following an ELAP.

5. For extreme cold temperatures, the ROS temperature will be a minimum of 50°F for the first 7 days following an ELAP.

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

<u>Evaluation:</u>

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

Alternate control of the HCVS is accomplished from the ROS. The ROS was evaluated for radiation effects due to a severe accident and determined to be acceptable. The ROS is located in a low dose area during normal operation. Calculation PM-1190 (Reference 39) provides a radiological evaluation of all the operator actions that may be required to support HCVS operation. The evaluation of radiological hazards demonstrates that the final design meets the order requirements to minimize the plant operators' exposure to radiological hazards.

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

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

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

Evaluation:

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

Alternate control of the HCVS is accomplished from the ROS in Radwaste 135'. 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 and timing of those actions to perform this function under ELAP conditions were evaluated as part of the PBAPS response to NRC Order EA-12-049 as stated in Reference 35.

Table 2 contains a thermal and radiological evaluation of all the operator actions at the MCR or alternate location that may be required to support HCVS operation during a severe accident. The relevant calculation (Reference 30) demonstrates 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 PM-0546 (Reference 48) has evaluated the capability of the current Torus Hardened Vent for Unit 2 and Unit 3. The results of this analysis show that the torus hardened vent remains capable of its design function of removing 1% of decay heat at 4030 MWt while maintaining primary containment pressures below both the containment design pressure (56 psig) and PCPL (60psig).

The decay heat absorbing capacity of the suppression pool and the selection of venting pressure were made such that the HCVS will have sufficient capacity to maintain containment pressure at or below the lower of the containment design pressure (56 psig) or the PCPL (60 psig). This calculation of containment response is contained in PB-MISC-010 (Reference 49) that was submitted in Reference 35 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 wetwell vent exits the Primary Containment through the 18" wetwell purge exhaust piping and associated inboard Primary Containment Isolation Valve AO-2(3)511. Between the inboard PCIV and SBGT isolation valve AO-2(3)512, the 16" wetwell vent piping with outboard PCIV AO-8(9)0290 and PSD-8(9)0293 rupture disc is installed. Downstream of the rupture disc, the vent piping exits the Reactor Building through the Torus Room roof which is at grade level on the west side of the RB El 135'-0". The downstream side of the rupture disc and the piping between the rupture disc and the Torus Room roof are part of Secondary Containment. The vent traverses up the exterior of the RB to above the RB roof. The Torus vent pipe discharge point is positioned above all buildings in the PBAPS protected area. The RB roof parapet is at Elevation 294'. The Torus vent discharge point is at Elevation 300'. The only higher structure in the protected area is the RB ventilation exhaust discharge point at Elevation 305', on the east side of the RB, approximately 150 feet away (east-west). The RB ventilation exhaust fans are not powered during an Extended Loss of AC Power (ELAP); however, chimney effect would preclude an inward pressure gradient. The PBAPS Main Stack is positioned at a higher elevation and is not located in the PBAPS protected area. 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. The MCR emergency intake in the ELAP event is below the 190 ft. elevation which is approximately 110 feet below the HCVS pipe outlet. This intake is approximately 73 feet from the Unit 2 vent pipe (farther than Unit 3), which would require the intake to be approximately 15 feet below the vent pipe. Therefore, the vent pipe is appropriately placed relative to this air intake.

The vent pipe extends approximately 6 ft. above the parapet wall of the RB roof. This satisfies the guidance for height from HCVS-FAQ-04.

HCVS-WP-04 provides criteria that demonstrate robustness of the HCVS pipe. PBAPS 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.

PBAPS 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. For the portions of exposed piping below 30 feet above grade.

    On each unit, the exposed vent pipe rises from the Torus Room roof at El 135'-0" to El 300'-0" along the west side of the respective reactor building, which faces a steeply rising slope of exposed bedrock. The slope base begins at approximate El 135' and the top of the slope is at approximate El 270'; therefore, the entire exposed portion of vent pipe is considered to be below 30 feet above grade.

    A TORMIS analysis (ARA-002611) was performed as a "reasonable protection evaluation" which calculated the damage probabilities to the external vent piping that would crimp the pipe to a point of not being able to perform as expected under SA conditions following an ELAP event. The damage probabilities are less than the numerical criterion stated in the NRC staff established position in the (TORMIS) SER dated May 7, 1983.

2. No portion of the exposed vent pipe is considered to be 30 feet above grade per Item 1 above.

3. Compensatory measures are available in the event the external vent piping becomes crimped.

4. PBAPS is not screened in for hurricanes.

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

With respect to unintended cross flow of vented fluids, the HCVS for PBAPS Units 2 and 3 are fully independent of each other. Therefore, the status at each unit is independent of the status of the other unit.

The HCVS for each unit interfaces with the SBGT system, which is common to both Units 2 and 3. The interface valve is AO-2(3)512 which is a normally closed/fail closed valve. During venting, the Torus vent pipe is isolated from the SGTS by AO-2(3)512 which remains closed. Inflation of the boot seal prevents potential leakage across the valve seat to the SGTS. The HCVS nitrogen supply, which is unit specific, is connected to the AO-2(3)512 actuator tubing to maintain the boot seal inflated. These valves are tested, and will continue to be tested, for leakage under 10CFR50 Appendix J as part of the containment boundary in accordance with HCVS-FAQ-05.

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

1.2.4 The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.

Evaluation

The existing wetwell vent will allow initiating and then operating and monitoring from a control panel located in the MCR. The system can be operated from the ROS.

1.2.5 The HCVS shall be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.

Evaluation

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

The location for the ROS is on Radwaste EL. 135' and is common to both Units 2 and 3. The ROS is readily accessible from the MCR. Refer to the sketch provided in Attachment 6 for the HCVS site layout. The controls available at the ROS location are accessible and functional under a range of plant conditions, including severe accident conditions with due consideration to source term and dose impact on operator exposure, extended loss of AC power (ELAP), inadequate containment cooling, and loss of reactor building ventilation. Table 1 contains an evaluation of all the 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 dedicated 125 Vdc Battery 00D510, which is common to both Units 2 and 3. This battery is permanently installed in the Turbine Building (TB) El.135' 3A/3C Battery Room where it is protected from screened in hazards, and has sufficient capacity to provide this power without recharging. Calculation PE-0308 (Reference 50) demonstrated that the 125 Vdc battery capacity is sufficient to supply HCVS wetwell venting components for 24 hours. At 24 hours, FLEX Generators can be credited to repower the battery charger 00D509 to recharge the 125 Vdc battery. Gas control during recharging and room temperature control is per the response to order EA-12-049. Calculation PE-0301 (Reference 51) included the battery charger 00D509 in the FLEX Generators loading calculation. The FLEX Generators are capable of carrying the additional HCVS wetwell venting components electrical loads. 125 Vdc battery voltage status will be indicated on battery charger 00D509 located in the E33 Switchgear Room in the TB El.135' so that operators will be able to monitor the status of the 125 Vdc battery. Attachment 3 and 3a contains a diagram of the HCVS electrical distribution system.

Pneumatic power for the HCVS valve actuators is normally provided by the instrument air system and the SGIG nitrogen system with backup nitrogen provided from the HCVS nitrogen backup system. Following an ELAP event, and the loss of instrument air and SGIG, the HCVS nitrogen backup system provides operating pneumatics to the hardened wetwell vent valves. Therefore, for the first 24 hours post-ELAP initiation, pneumatic force will be supplied from the HCVS nitrogen backup system located at the ROS on Radwaste EL. 135'. Calculation PM-1188 (Reference 52) demonstrated that these installed bottles have the capacity to supply the required motive force to those HCVS valves needed to maintain flow through the HCVS effluent piping for 24 hours without replenishment. HCVS nitrogen backup system pressure indication will be provided locally (i.e., in the ROS) by pressure gauges. There are two HCVS nitrogen bottles, each with its' own pressure gauge. In addition, there is a pressure gauge upstream of the nitrogen pressure regulator and another gauge downstream.

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

Evaluation

Emergency operating procedures provide clear guidance that the HCVS is not to be used to defeat containment integrity during any design basis transients and accidents. In addition, the HCVS was designed to provide features to prevent inadvertent actuation due to equipment malfunction or operator error.

The containment isolation valves must be open to permit vent flow. The physical features that prevent inadvertent actuation are the key lock switch for SV-2(3)-07K-2(3)3472 in the MCR and locked closed valves at the ROS. These design features meet the requirement to prevent inadvertent actuation of HCVS.

1.2.8 The HCVS shall include a means to monitor the status of the vent system (e.g., valve position indication) from the control panel required by 1.2.4. The monitoring system shall be designed for sustained operation during an extended loss of AC power.

Evaluation

The HCVS includes indications for HCVS valve position, vent pipe temperature, effluent radiation levels, and argon supply pressure in the MCR, as well as information on the status of supporting systems which are HCVS 125 VDC battery voltage in the E33 switchgear room and backup nitrogen pressure at the ROS.

This monitoring instrumentation provides the necessary indication from the MCR per Requirement 1.2.4. In the event that the FLEX Generators do not energize the emergency buses, the wetwell HCVS will be supplied by the HCVS 125 Vdc battery for 24 hours and sustained operation during an ELAP event can be accomplished using manual operations at the ROS. Containment pressure and wetwell level instrumentation may be read by portable measuring equipment using FSG-045-2(3) (Reference 53) if the FLEX Generators do not energize the emergency buses.

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 installed on Unit 2 RB EL. 195' and Unit 3 RB EL. 165', coupled to a process and control module. The process and control module for both Units 2 and 3 is installed in Panel 00C1062 in the ROS in Radwaste Building EL 135'. The MCR has a radiation indicator on Panel 2(3)0C010 to verify venting operation. 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 Radwaste 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.

<u>Evaluation</u>

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

The existing hardened vent piping, between the wetwell and the Torus Room roof is designed to meet the saturation temperature of 308°F at the PBAPS PCPL of 60 psig. AO-2(3)511, AO-2(3)512, and AO-8(9)0290, are also designed to 60 psig. Order EA-13-109 Section A.1.2.10 states that "the design is not required to exceed the current capability of the limiting Containment components". Thus, the 350°F design requirement is not mandatory for Peach Bottom. The 350°F requirement exceeds the current capability of AO-2(3)511, AO-2(3)512, and AO-8(9)0290. Rupture disc PSD-8(9)0293 is designed to burst at 30 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 evaluated for radiological impact due to HCVS system operation under severe accident conditions using the guidance provided in HCVS-FAQ-08 and HCVS-WP-02. The PBAPS HCVS OIP Fifth Six-Month Update (Reference 26) contains the response to Phase 1 ISE (Reference 20) open item 12 regarding the evaluation of HCVS components for severe accident conditions.

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

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

Evaluation

In order to prevent a detonable mixture from developing in the pipe, a purge system is installed to purge hydrogen from the pipe with argon after a period of venting. The purge system is described in EC 556049 (Reference 42) for Unit 2 and EC 556318 (Reference 43) for Unit 3. After an initial line-up of locked valve HV-2(3)-07K-2(3)3478 in ROS and opening argon bottle manifold valves, the system can be operated from MCR by energizing the solenoid valve SV-2(3)-07K-2(3)3472. Per calculation PM-1189 (Reference 54), an 8-second purge time is required to burst the rupture disc. For purging the combustibles after a vent cycle, a 33-second purge time has been calculated.

Using the purge system described above 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.

PBAPS has implemented the operation, testing and inspection requirements in Table 3-3 for the HCVS 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:

Per Exelon Performance Centered Maintenance (PCM) template, manual valves need to be cycled every 6 years if installed in severe environmental conditions or every 8 years if installed in mild environmental conditions for design basis PM requirements. Per Exelon's engineering judgement, it is deemed that cycling the manual valves (and motor operated valves, check valves within the HCVS pneumatic supply line, and solenoid/air operated valves) within the frequency of the design basis requirements is sufficient for Beyond Design Basis External Events (BDBEE) systems/programs such as HCVS. No new failure modes or degradation is expected for BDBEE systems/programs that is different from design basis. Valves that currently have procedural/programmatic requirements to be cycled on a higher frequency will continue to meet those requirements.

Table 3-3: Testing and Inspection Requirements

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

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

2. HCVS Quality Standards:

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

Evaluation:

The HCVS upstream of and including the second containment isolation valve (AO-8(9)0290) and penetrations are not being modified for order compliance so that they continue to be designed consistent with the design basis of primary containment including pressure, temperature, radiation, and seismic loads.

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

Evaluation:

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

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

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

Section IV: HCVS Phase 2 Final Integrated Plan

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

Licensees with BWRs Mark I 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.

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

Section IV.B: HCVS Existing System

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

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

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

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

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

The SAWA flow path is the same as the FLEX primary injection path. The SAWA system, shown on Attachment 4, consists of a FLEX Pump injecting into the Reactor Pressure Vessel (RPV) and SAWM consists of flow control at the FLEX Pump along with wetwell level indication to ensure that the wetwell vent is not submerged (SAWM). The SAWA injection path, starts at the Emergency Cooling Tower (ECT), goes to the FLEX Pump via suction hoses, goes through the FLEX Pump to a flexible discharge hose, then to a Residual Heat Removal (RHR)_ connection in the Unit's Reactor Building Closed Cooling Water (RBCCW) room to the Reactor Pressure Vessel (RPV). The hoses and pumps are stored in the FLEX Building (FB) which is protected from all hazards. BWROG generic assessment, BWROG-TP-15-008 (Reference 36), provides the principles of Severe Accident Water Addition to ensure protection of containment. This SAWA injection path is qualified for the all the screened in hazards (Section III) in addition to severe accident conditions.

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

The actions inside the RB where there could be a high radiation field due to a severe accident will be to open valves at the RHR connection in the RBCCW room at EL. 116' that is accessed via doors and a stairwell from outside of the RB at EL. 135'. The action to open valves inside the RB will be performed before the dose is unacceptable after the loss of RPV injection. In this event, radiation levels and heat related concerns in the RB when the valves are operated were evaluated and determined to be acceptable per PM-1207 (Reference 55). The other SAWA actions all take place outside the RB at the MCR, ECT, FB, and the deployment pathways. Since these locations are outside the RB, they are shielded from the severe accident radiation by the thick concrete walls of the RB and other structures. Once SAWA is initiated, the operators will monitor the response of containment from the MCR to determine that venting and SAWA are operating satisfactorily, maintaining containment pressure low to avoid containment failure. Stable or slowly rising trend in wetwell level with SAWA at the minimum flow rate indicates water on the drywell floor up to the vent pipe or downcomer openings. After some period of time, 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

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

Section IV.C.4: Available Freeboard Use

The freeboard between 14.7' to 21' elevation in the wetwell provides approximately 525,000 gallons of water volume before the level instrument would be off scale high. BWROG generic assessment BWROG-TP-15-011, provides the principles of Severe Accident Water Management to preserve the wetwell vent for a minimum of seven days. After containment parameters are stabilized with SAWA flow, SAWA flow will be reduced to a point where containment pressure will remain low while wetwell level is stable or very slowly rising. As shown in PB-MISC-023 (Reference 64), the wetwell level will not reach the wetwell vent for at least seven days. A diagram of the available freeboard is shown on Attachment 1.

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

The upper range of wetwell level indication [LI-8(9)123A] provided for SAWA/SAWM is 21 feet elevation. This defines the upper limit of wetwell indicated level that will preserve the wetwell vent function as shown in Attachment 1.

Section IV.C.6: Wetwell vent service time

EPRI Technical Report 3002003301 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 PBAPS 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 PBAPS SAMGs. In particular, EPG/SAG Revision 3, when implemented with Emergency Procedures Committee Generic Issue 1314, allows throttling of SAWA in order to protect containment while maintaining the wetwell vent in service. The SAMG flow charts direct use of the hardened vent as well as SAWA/SAWM when the appropriate plant conditions have been reached.

Using NEI 12-06, PBAPS has validated that the SAWA pump can be deployed and commence injection in less than 8 hours. The studies referenced in NEI 13-02 demonstrated that establishing flow within 8 hours will protect containment. The initial SAWA flow rate will be at least 500 gpm. After a period of time, 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.

NEI 13-02 generic analysis per EPRI Technical Report 3002003301 demonstrated that, SAWA flow could be reduced to 100 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 SAMGs are symptom-based guidelines.

Section IV.C.8: SAWA Flow Control

PBAPS will accomplish SAWA flow control by the use of throttle valves and/or adjusting FLEX/SAWA Pump speed. The operators at the FLEX/SAWA Pump will be in communication with the MCR via radios 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. The communications capabilities have been tested to ensure functionality at the SAWA flow control and monitoring locations. PBAPS utilizes FSG-020, "Deploying Alternate Radio Communications Antenna" (Reference 57) to place a spare radio repeater in service to facilitate radio communications between the MCR and remote locations such as the FLEX/SAWA Pump.

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

Section IV.C.9.1: SAWA Pump

PBAPS uses two portable diesel-driven pumps for FLEX and SAWA, one pump for each Unit. Each pump is capable of meeting the required flowrates at the pressures required for RPV injection during an ELAP. Each of these pumps has been shown to be capable of supplying the required flow rate to the RPV and the SFP for FLEX and for SAWA scenarios. The pumps are stored in the FLEX Building 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

PBAPS SAWA flow is 500 gpm which is the amount assumed in NEI 13-02 Section 4.1.1.2.1. The initial SAWA flow will be 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.

Section IV.C.9.3: SAWA Pump Hydraulic Analysis

Calculation PM-1205 (Reference 56) 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

The PBAPS SAWA flow path goes through a FLEX/SAWA Pump check valve that is integral with the pump skid and will close and prevent leakage when the FLEX/SAWA Pump is secured. The SAWA flow path also includes existing station Primary Containment Isolation Valve (PCIV) check valve AO-2(3)-10-046A whose integrity of check function (open and closed) is demonstrated by other plant testing requirements such that additional testing per NEI 13-02 Revision 1 Section 6.2 is not required for the valve per NEI 13-02 Revision 1 Table 6-1 Note 3. Thus, backflow is prevented by check valves in the SAWA flow path.

Section IV.C.9.5: SAWA Water Source

The initial source of water for SAWA is the ECT which can provide at least 3.55 million gallons of water sufficient for approximately 69 hours of water injection without makeup based on the FLEX analysis. Before this initial supply of water is depleted, arrangements will be made for obtaining water makeup to the ECT via the Emergency Response Organization or the Nuclear Duty Officer (NDO). Makeup water can be obtained through contact with the National SAFER Response Centers (NSRC). 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 FLEX/SAWA Pumps are stored in the FLEX Building where they are protected from screened-in hazards or pre-deployed, if necessary. The FLEX/SAWA Pumps are commercial pumps rated for long-term outdoor use in emergency scenarios. The pumps are diesel-driven by an engine mounted on the skid with the pump. The pumps will be refueled by the FLEX refueling equipment that has been qualified for long-term refueling operations per EA-12-049. The action to refuel the FLEX/SAWA Pumps was evaluated under severe accident conditions in Table 2, and demonstrated to be acceptable. Since the pumps are stored in a protected structure(s), are qualified for the environment in which they will be used, and will be refueled by a qualified refueling strategy, they will perform their function to maintain SAWA flow needed to protect primary containment per EA-13-109.

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

Table 1 shows the electrical power source for the SAWA/SAWM instruments. For the instruments powered by the HCVS 125VDC battery, calculation PE-0308 (Reference 50) demonstrates that the batteries can provide power until the FLEX Generator restores power to the battery charger.

The FLEX load on the FLEX Generator per EA-12-049 was evaluated in calculation PE-0301 (Reference 51). This calculation demonstrated that the total kW and kVA loading is less than machine rating of 500 kW and 625 kVA, and therefore, the loading meets the acceptance criteria of the calculation. The additional load on the FLEX Generator for SAWA and SAWM consist of the HCVS 125 VDC battery charger 00D509. This additional load was evaluated in calculation PE-0301 and determined to be acceptable. 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) The instruments credited for SAWA are:
   - PT/PR/TR-4(5)805 used to measure containment pressure
   - LI-8(9)123A used to measure wetwell level
   - SAWA/SAWM flow meter used to measure flow to the RPV

2) The SAWA/SAWM flow meter is required to determine the flow of water going to the Reactor Pressure Vessel. The flow meter is a Badger M5000 Electronic Remote Monitor Flow Meter (reference EC 618957 Attachment 4, Reference 45) that will measure and display flow rate directly. The instrument is designed around a digital meter with an electromagnetic flow sensor.

3) Recorders PR/TR-4(5)805 are currently relied upon to obtain containment pressure indication under FLEX Strategies. Components PR/TR-4(5)805 are Regulatory Guide (RG) 1.97 qualified (Class 2) and therefore do not require further evaluation; however, not all components that are either in the associated instrument loop or that may affect the loop are RG 1.97 qualified and were evaluated against RG 1.97 criteria for both dose and thermal effects. These components include PT-4(5)805 and Panel 2(3)DC834. Per EC 618957 Attachment 09A (Reference 45), these components are determined to be either acceptable or have no adverse effect on the PR/TR-4(5)805 instrument loop if failure occurred.

   The SAWA/SAWM flow meter, installed with 300-lb flanges, is capable of withstanding pressure up to 740 psi, which is considerably greater than FLEX/SAWA Pump discharge pressure. The temperature range is -4°F to 140°F. The flow meter is stored in the FB which is a seismically qualified building and temperature controlled. In the FB, radiation exposure will be kept minimal based on the storage location. When deployed for BDB event, the SAWA/SAWM flow meters will be placed on the ground in close proximity to the FLEX/SAWA Pumps that are located north of the Unit 3 RB in an area where dose is analyzed as acceptable by calculation PM-1190 (Reference 39). Per Exelon White Paper EXC-WP-06, Documenting ELAP Design Bases, Attachment 2 (Reference 58), a reasonable conservative outside ambient temperature that is not exceeded more than 1% of the time is considered reasonably conservative for a BDBEE. Therefore, based on the ASHRAE Handbook, temperatures do not drop lower than 15.5°F more than 1% of the time in Lancaster, PA, and is used to establish an approximate low end ambient temperature for Peach Bottom, which is well above the -4°F lower temperature limit of the Badger M5000 flow meter. The 140°F upper temperature limit is not an issue as the flow meter is located outside the plant.

4) The SAWA/SAWM flow meter is powered by a local lithium ion battery pack. The life of the battery pack is dependent on the frequency that the flow meter measures flow. At the shortest sampling frequency of 0.25 seconds, the battery pack will last 3 months.

5) Containment pressure and wetwell level instrumentation will be repowered through their respective electrical buses by the use of the FLEX Generator.

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

The SAWA flow meter is an electromagnetic flow meter installed in the FLEX/SAWA Pump discharge hose in close proximity to the pump and is powered by a local lithium ion battery pack.

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 provide confirmation to adjust SAWA flow rates. SAMG strategies will evaluate and use drywell temperature indication if available consistent with the symptom-based approach. NEI 13-02 Revision 1 Section C.8.3 discusses installed drywell temperature indication.

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

The drywell pressure and wetwell level instruments are pressure and differential pressure detectors that are safety-related and qualified for post-accident use.

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 Pump is deployed outside the RB, and in a low dose area as analyzed by calculation PM-1190 (Reference 39), there is no concern for any effects of radiation exposure to the flow instrument.

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

PBAPS 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. Calculation PM-1207 (Reference 55) analyzed dose at different locations and times where operator actions will take place during FLEX/SAWA/SAWM activities. Tables 8-1 and 8-2 of PM-1207 provide this dose information. FSG-030, FSG-031, FSG-032-2(3), and FSG-033-2(3) (References 47, 59, 60, and 61) provide guidance for ventilation strategies at various locations to mitigate high temperature conditions.

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

Since the FLEX/SAWA Pumps are stored in the FLEX Building and will be operated from outside the RB north of the Unit 3 RB in an area shielded from the vent pipes, there will be no issues with radiation dose rates at the SAWA pump control location and there will be no significant dose to the SAWA pump.

Inside the RB the SAWA flow path consists of piping that will 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. Therefore, the SAWA flow path will not be affected by radiation or temperature effects due to a severe accident.

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

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

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

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

As part of the response to Order EA-12-049, PBAPS performed 02493544-28, Technical Evaluation to Document PBAPS ELAP Temperature (Reference 62) for the temperature response of the Reactor Building during the ELAP event. Since, in the severe accident, the core materials are contained inside the primary containment, the temperature response of the RB is driven by the loss of ventilation and ambient conditions and therefore will not change. Thus, the FLEX technical evaluation is acceptable for severe accident use as evaluated in EC 618957 Attachment 09B, "Temp Eval during a SA" (Reference 45).

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

After the SAWA pipe is aligned inside the RB, the operators can control SAWA/SAWM as well as observe the necessary instruments from outside the RB. The thick concrete RB walls as well as the distance to the core materials means that there is no radiological concern with any actions outside the RB. Therefore, all SAWA controls and indications are accessible during severe accident conditions.

The FLEX/SAWA Pump and flow monitoring equipment can all be operated from outside the RB at ground level. The PBAPS FLEX response ensures that the FLEX/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 at the FLEX/SAWA Pump, and wetwell level and containment pressure in the MCR.

Section V: HCVS Programmatic Requirements

Section V.A: HCVS Procedure Requirements

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

Evaluation:

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

The HCVS and SAWA procedures have been developed and implemented following PBAPS 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

PBAPS has implemented the BWROG Emergency Procedures Committee Issue 1314 that implements the Severe Accident Water Management (SAWM) strategy in the Severe Accident Management Guidelines (SAMGs). The following general cautions, priorities and methods have been evaluated for plant specific applicability and incorporated as appropriate into the plant specific SAMGs using administrative procedures for EPG/SAG change control process and implementation. SAMGs are symptom-based guidelines and therefore address a wide variety of possible plant conditions and capabilities. While these changes are intended to accommodate those specific conditions assumed in Order EA-13-109, the changes were made in a way that maintains the use of SAMGs in a symptom-based mode while at the same time addressing those conditions that may exist under extended loss of AC power (ELAP) conditions with significant core damage including ex-vessel core debris.

Cautions

- Adding water to hot core debris may pressurize the containment by rapid steam generation.
- Raising Torus level above 21 ft. will prevent use of the Torus vent path

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

- Stabilize core debris in the containment (SAWA)
- Operate Drywell sprays
- Cool core debris in the containment (SAWM)
- Preserve Torus vent capability
- Operate Core Spray
- Primary containment pressure is controlled below the Primary Containment Pressure Limit (Wetwell venting)

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

- Use any available injection source
- Raise injection slowly
- Inject into the RPV if possible

- Maintain injection from external sources of water as low as practicable

Section V.B: HCVS Out of Service Requirements

Provisions for out-of-service requirements for FLEX and HCVS are provided in CC-PB-118, Attachment 7 (Reference 63).

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

PBAPS 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). PBAPS will perform the first drill demonstrating at least one of the above capabilities by November 6, 2021 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 PBAPS in subsequent eight-year intervals.

Section VI: References

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

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

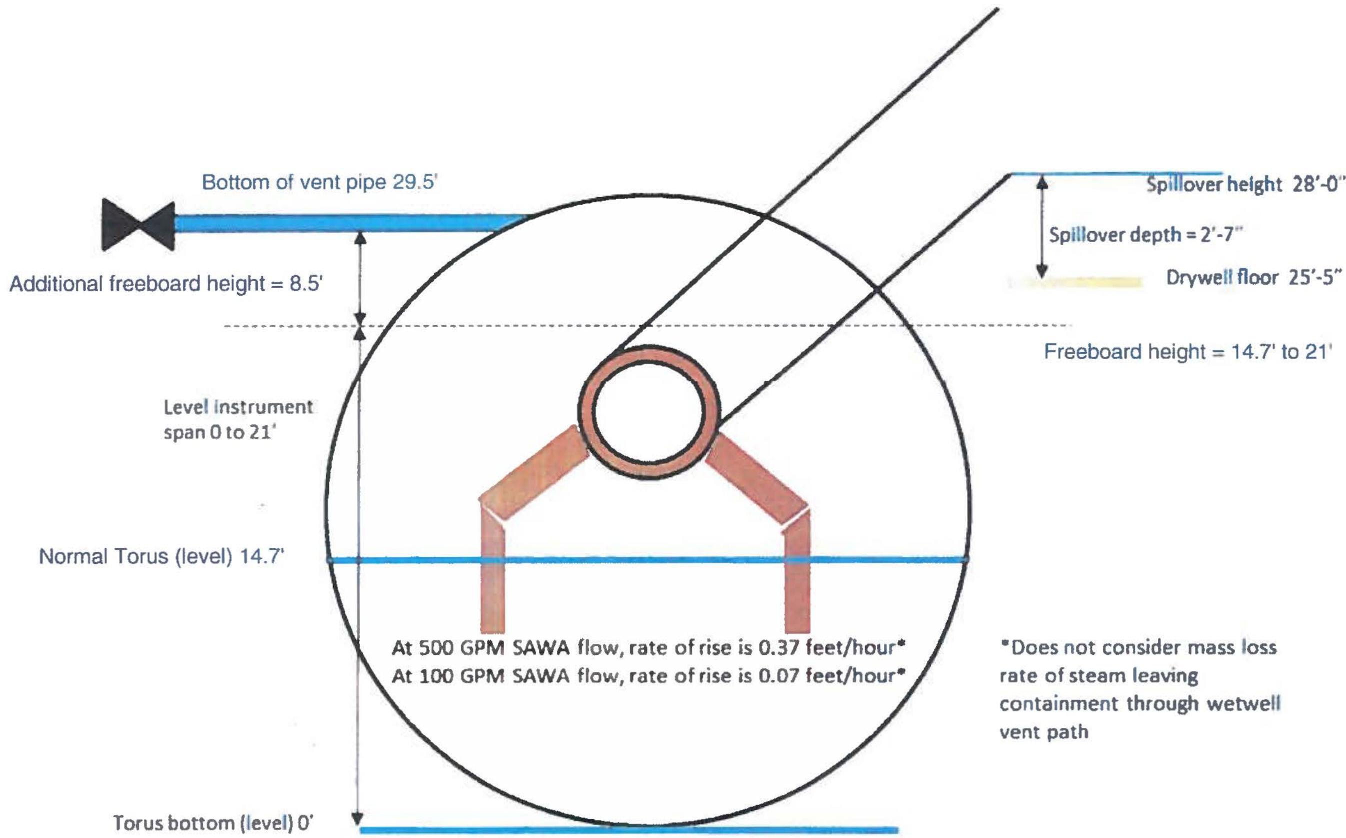
Number	Rev	Title	Location[6]
12. JLD-ISG-2013-02	0	Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions	ML13304B836
13. JLD-ISG-2015-01	0	Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions	ML15104A118
14. HCVS-FAQ-10	1	Severe Accident Multiple Unit Response	ML15273A141 ML15271A148
15. HCVS-FAQ-11	0	Plant Response During a Severe Accident	ML15273A141 ML15271A148
16. HCVS-FAQ-12	0	Radiological Evaluations on Plant Actions Prior to HCVS Initial Use	ML15273A141 ML15271A148
17. HCVS-FAQ-13	0	Severe Accident Venting Actions Validation	ML15273A141 ML15271A148
18. Phase 1 OIP	0	HCVS Phase 1 Overall Integrated Plan (OIP)	ML14181A301
19. Combined OIP	0	Combined HCVS Phase 1 and 2 Overall Integrated Plan (OIP), Dec. 2015	ML15364A015
20. Phase 1 ISE	0	HCVS Phase 1 Interim Staff Evaluation (ISE)	ML15026A469
21. Phase 2 ISE	0	HCVS Phase 2 Interim Staff Evaluation (ISE)	ML16099A272
22. 1st Update	0	First Six-Month Update, Dec. 2014	ML14353A125
23. 2nd Update	0	Second Six-Month Update, June 2015	ML15181A018
24. 3rd Update	0	Third Six-Month Update (same as Ref 19)	ML15364A015
25. 4th Update	0	Fourth Six-Month Update, June 2016	ML16182A012
26. 5th Update	0	Fifth Six-Month Update, Dec. 2016	ML16350A265
27. 6th Update	0	Sixth-Six Month Update, June 2017	ML17181A034
28. 7th Update	0	Seventh-Six Month Update, Dec. 2017	ML17349A038
29. 8th Update	0	Eighth-Six Month Update, June 2018	ML18180A032
30. Radwaste ROS Temp Eval	4	ECR 15-00148 (EC 556049) Attachments 46A and 46B	N/A
31. NEI 12-06	0	Diverse and Flexible Coping Strategies (FLEX) Implementation Guide	ML12221A205
32. EA-12-049	0	Issuance of Order to Modify Licenses With Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012.	ML12054A735

Number	Rev	Title	Location[6]
33. RG 1.97	3	Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Conditions During and Following an Accident	ML003740282
34. 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
35. RS-18-002	0	PBAPS FLEX Final Integrated Plan Document, January 5, 2018	ML18005A701
36. BWROG-TP-15-008	0	BWROG Fukushima Response Committee, Severe Accident Water Addition Timing, Sept. 2015	N/A
37. BWROG-TP-15-011	0	BWROG Fukushima Response Committee, Severe Accident Water Management Supporting Evaluations, Oct. 2015	N/A
38. FSG-050	3	FLEX Equipment Fuel Oil Supply	N/A
39. PM-1190	1	HCVS Dose Assessment	N/A
40. T-200-2(3)	14 (17)	Primary Containment Venting	N/A
41. T-200J-2(3)	5 (4)	Containment Venting via the Torus Hardened Vent	N/A
42. EC 556049	4	Fukushima Modification – U2 Hardened Containment Vent System	N/A
43. EC 556318	4	Fukushima Modification – U3 Hardened Containment Vent System	N/A
44. EC 620431	0	Fukushima Modification – U2 HCVS Phase 2 (SAWA/SAWM)	N/A
45. EC 618957	1	Fukushima Modification – U3 HCVS Phase 2 (SAWA/SAWM)	N/A

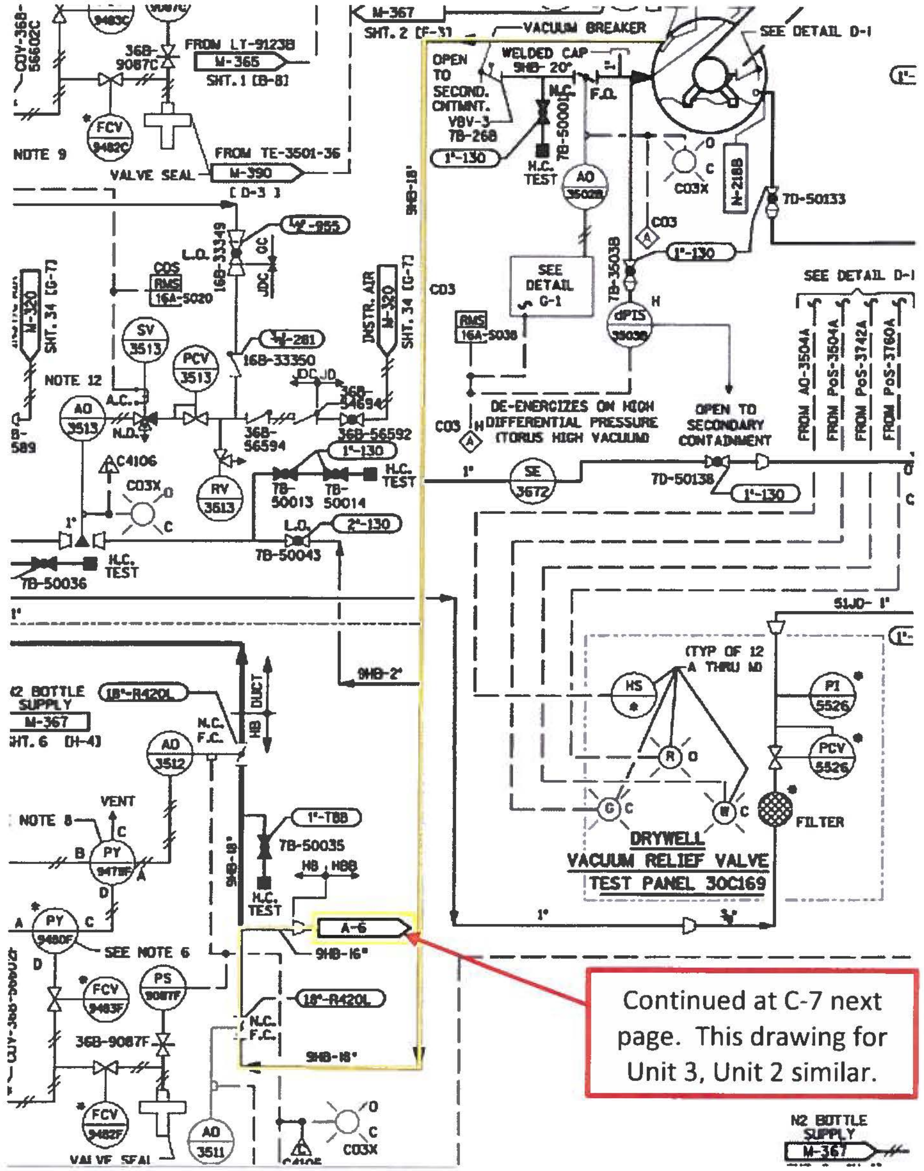
Number	Rev	Title	Location[6]
46. EXC-WP-11	2	Prevention of Hydrogen Deflagration and Detonation in HCVS Piping	N/A
47. FSG-030	1	Establishing Control Room Ventilation and Lighting	N/A
48. PM-0546	6	Torus Hardened Vent-Flow Calculation	N/A
49. PB-MISC-010	6	Peach Bottom MAAP Analysis to Support FLEX Initial Strategy	N/A
50. PE-0308	1	HCVS Battery Sizing and Selection	N/A
51. PE-0301	0c	FLEX Electrical Loading and Voltage Drop	N/A
52. PM-1188	2	HCVS Compressed Nitrogen Bottle Sizing Calculation	N/A
53. FSG-045-2(3)	0 (0)	Obtaining Transmitter Instrument Readings	N/A
54. PM-1189	2	Hardened Containment Vent System Purge System Design Calculation	N/A
55. PM-1207	1	HCVS Phase II Dose Assessment	N/A
56. PM-1205	0	Severe Accident Water Addition SAWA Makeup Analysis in Response to NRC Order EA-13-109	N/A
57. FSG-020	0	Deploying Alternate Radio Communications Antenna	N/A
58. EXC-WP-06	2	Documenting ELAP Design Bases	N/A
59. FSG-031	0	Establishing Battery Room and Switchgear Room Ventilation	N/A

Number	Rev	Title	Location[6]
60. FSG-032-2(3)	0 (0)	Establishing HPCI/RCIC/Sump Room Ventilation, Lighting and Water Removal	N/A
61. FSG-033-2(3)	0 (0)	Establishing Natural Circulation of the Secondary Containment Atmosphere	N/A
62. 02493544-28	-	Technical Evaluation to Document PBAPS ELAP Temperature (Passport Action Item)	N/A
63. CC-PB-118	6	Peach Bottom Implementation of Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Pool Instrumentation Program	N/A
64. PB-MISC-023	1	MAAP Analysis to Support HCVS Design	N/A

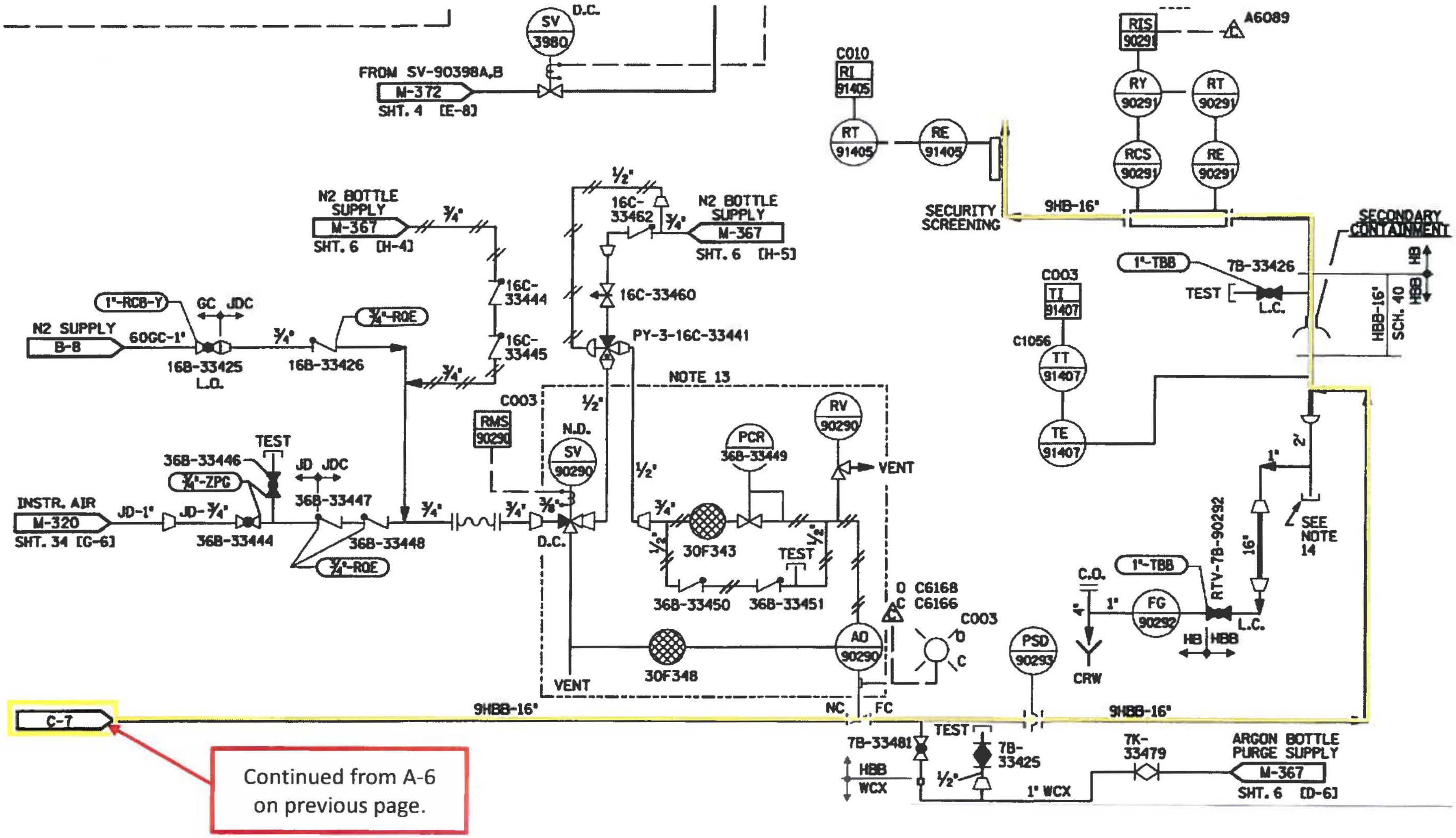
Attachment 1: Phase 2 Freeboard diagram



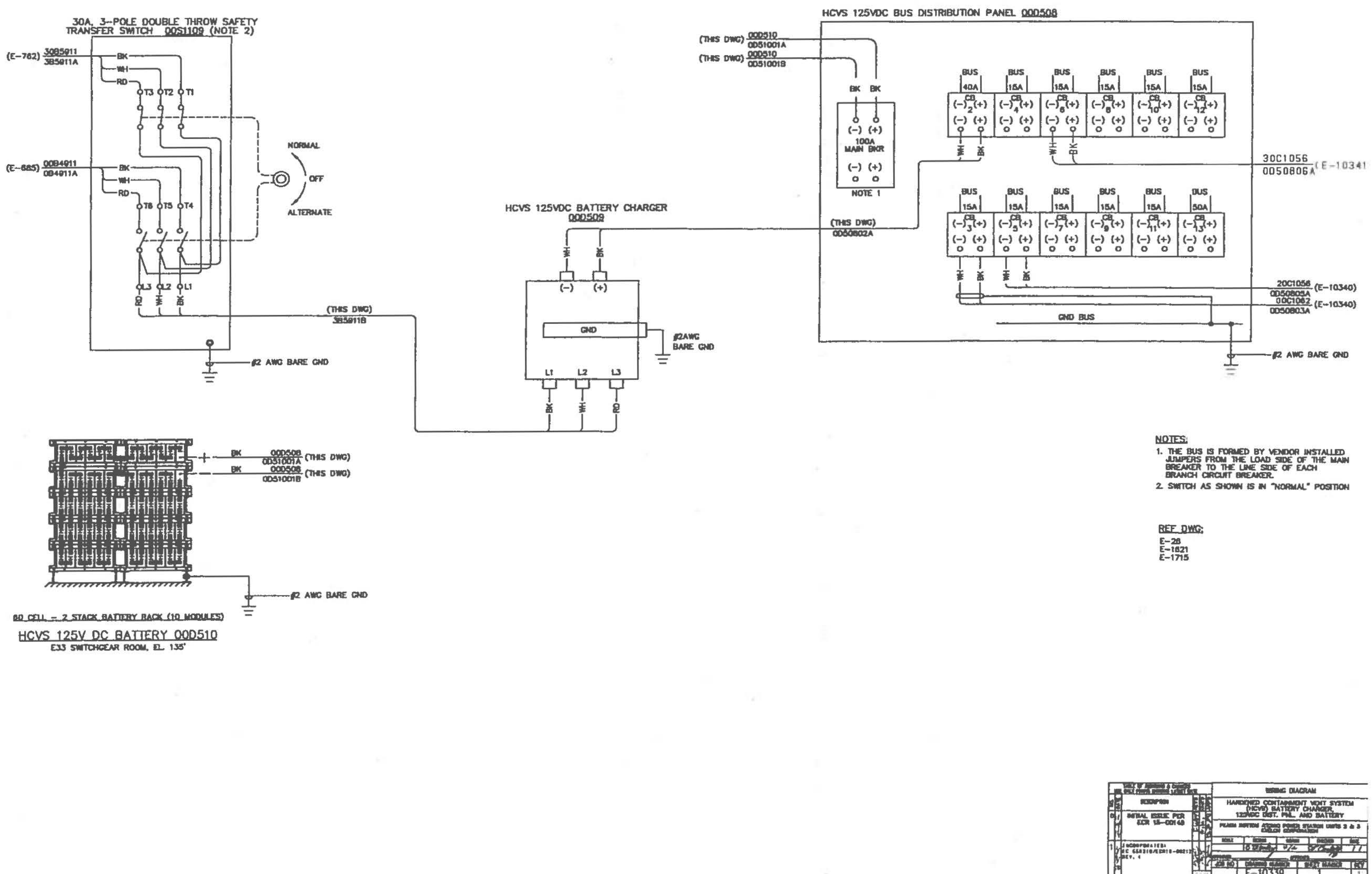
Attachment 2: **One Line Diagram of HCVS Vent Path**



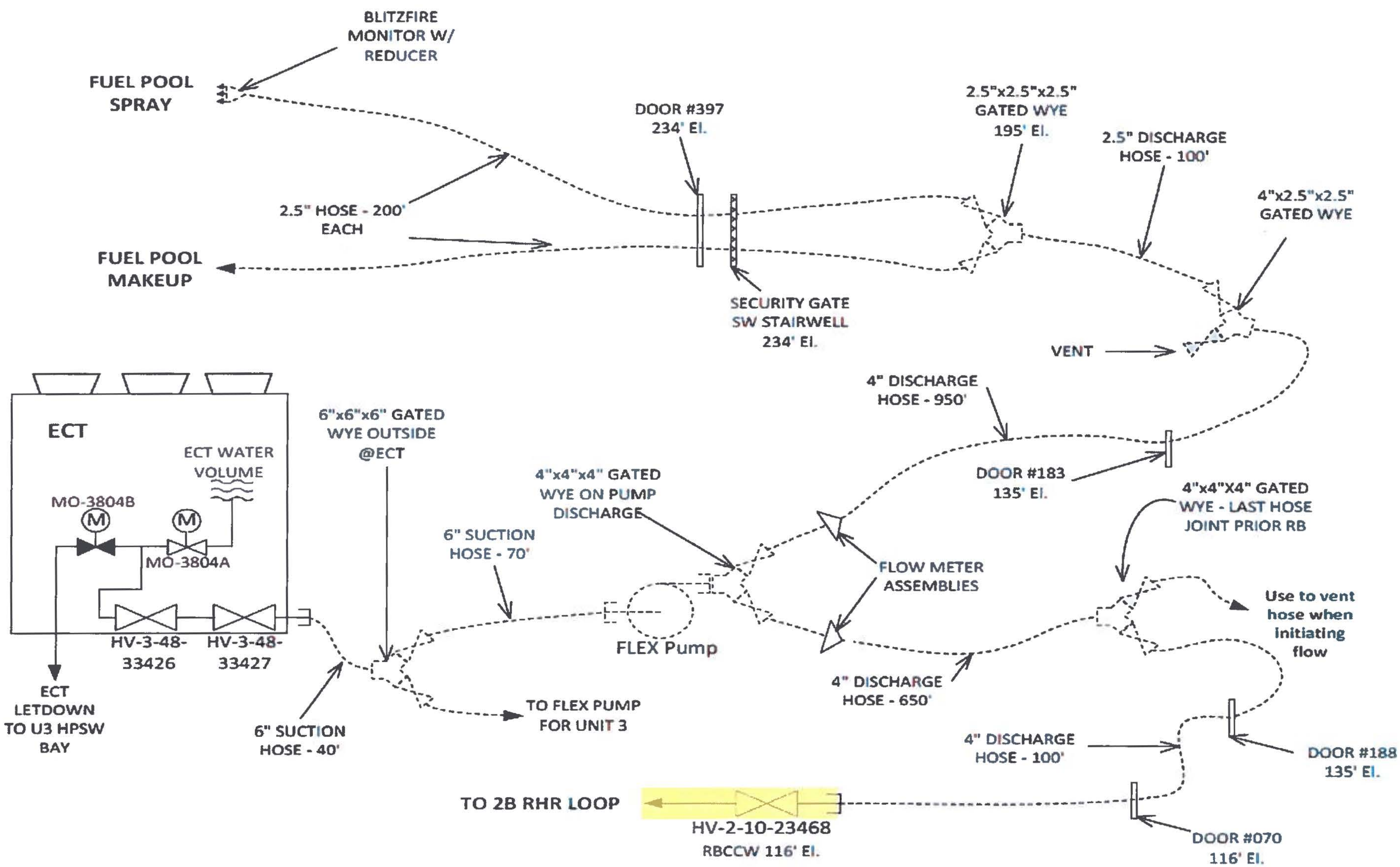
Attachment 2: **One Line Diagram of HCVS Vent Path (continued)**



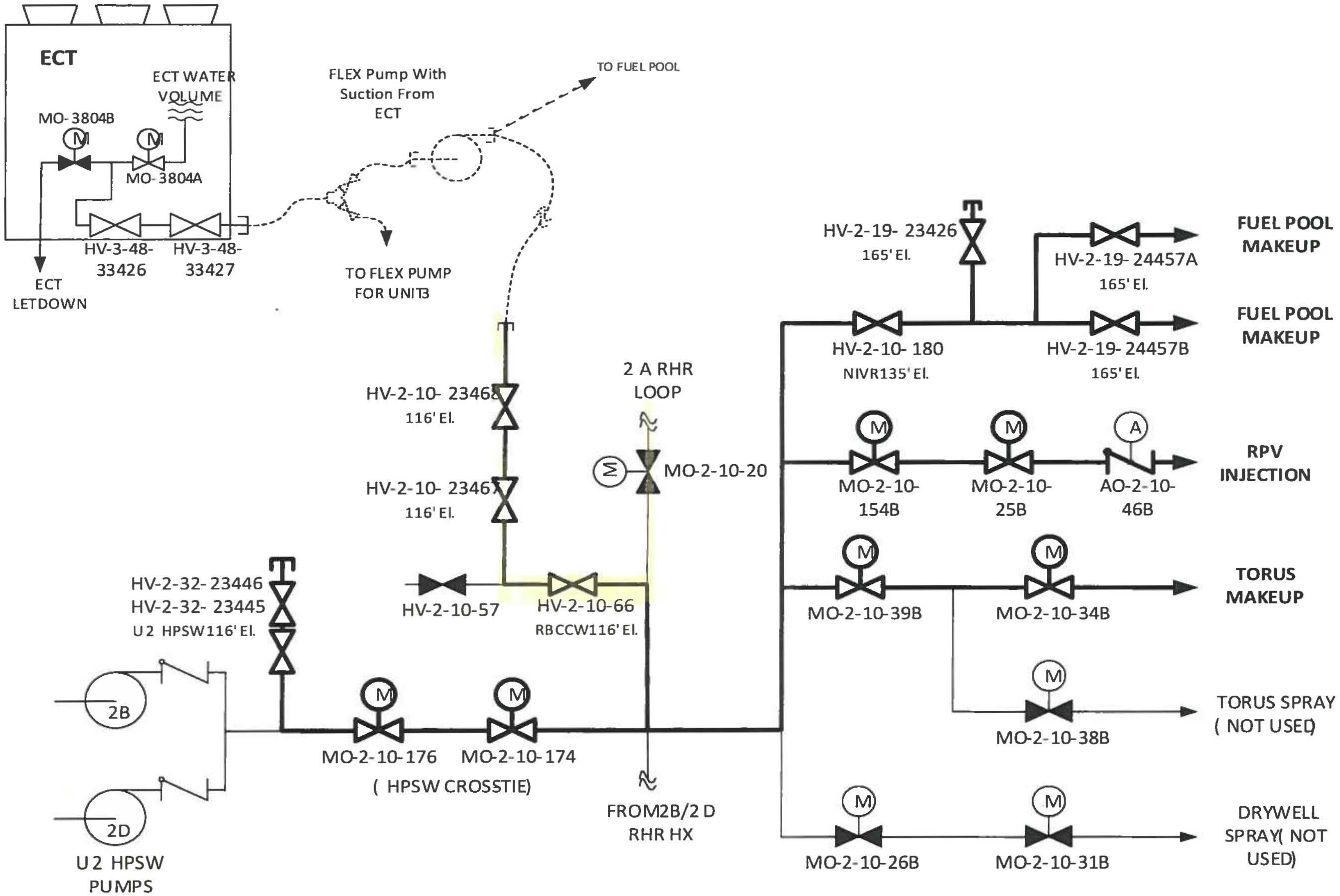
Attachment 3: One Line Diagram of HCVS Electrical Power Supply - Units 2 & 3



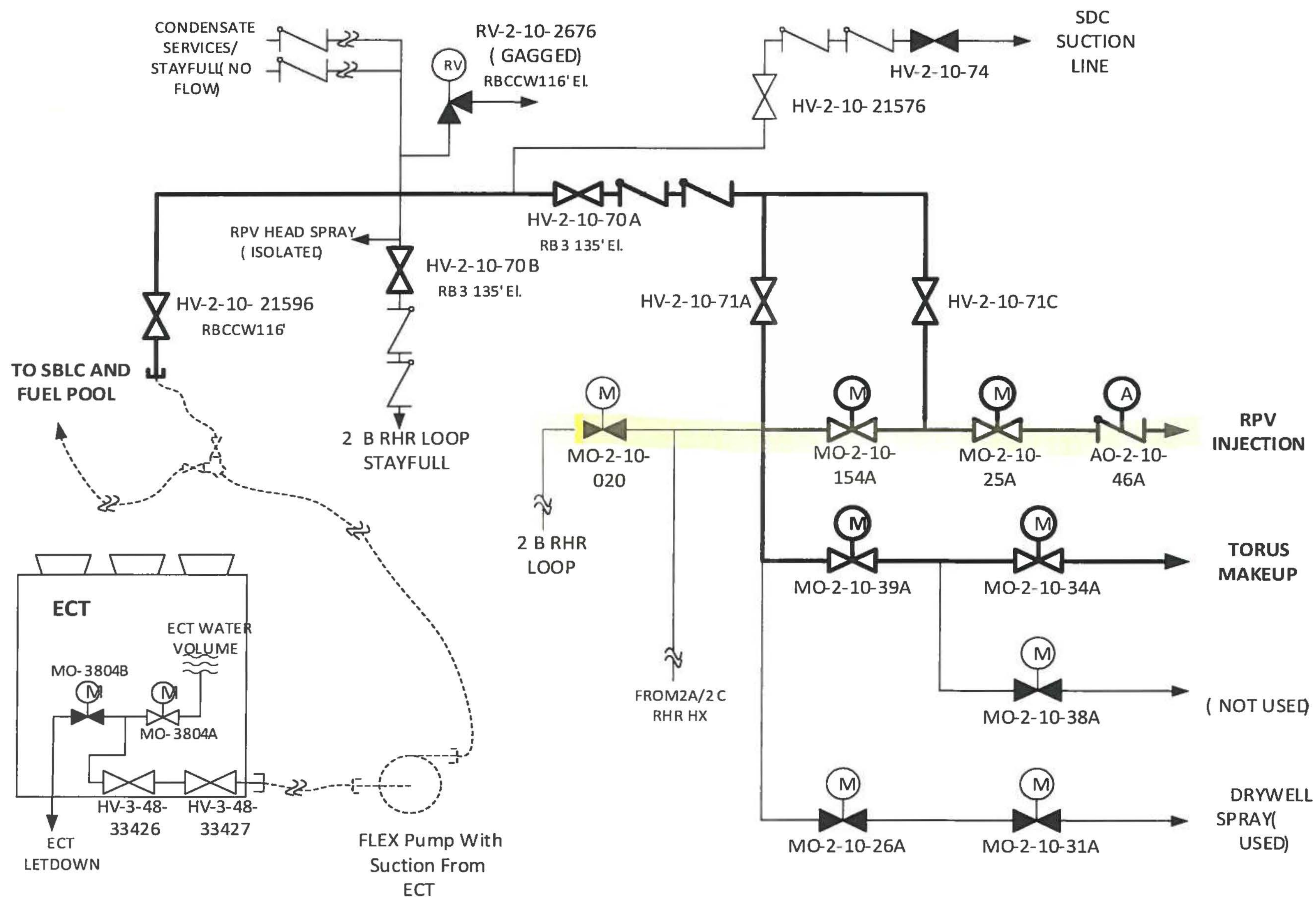
Attachment 4: One Line Diagram of SAWA Flow Path – Unit 2



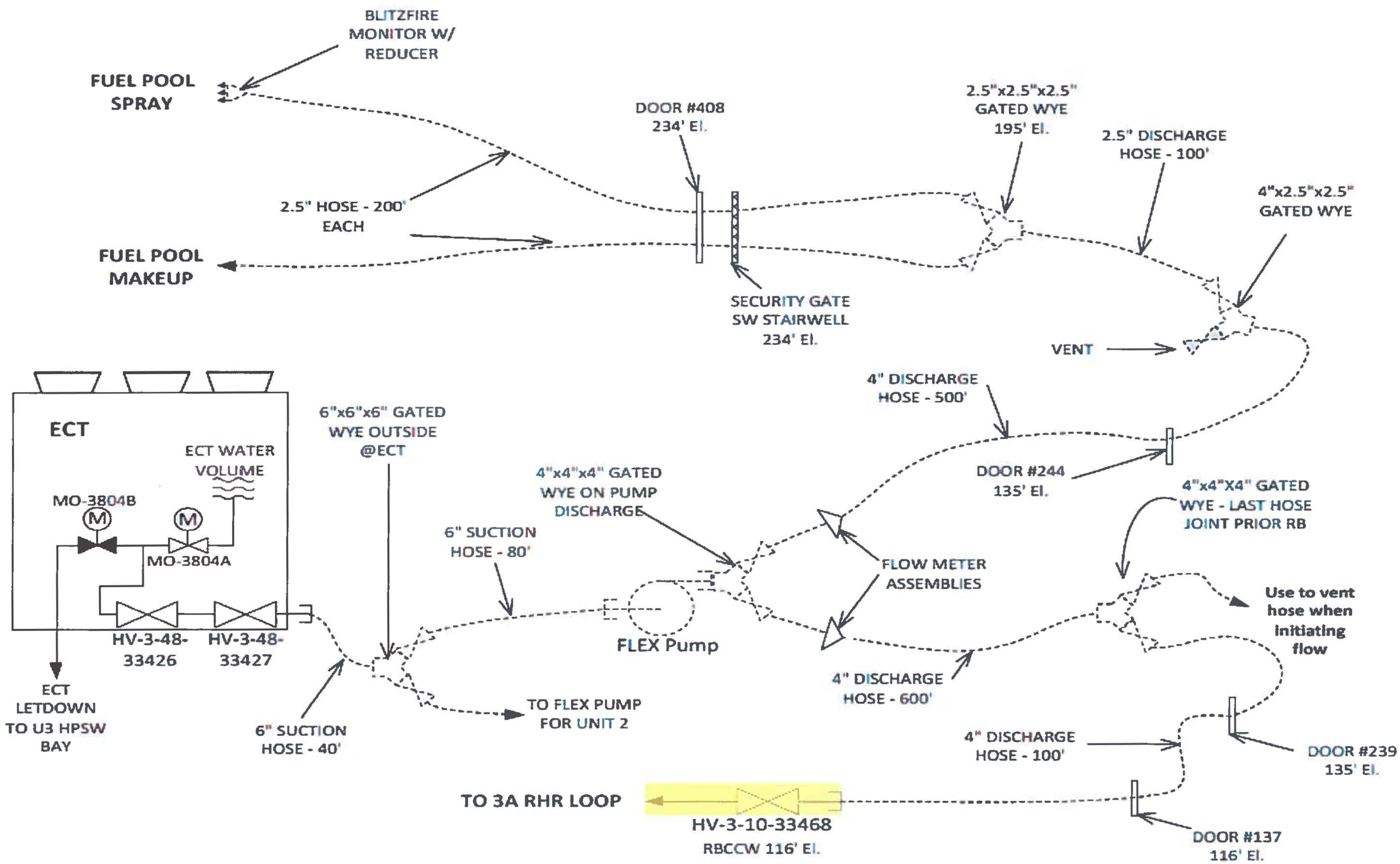
Attachment 4: One Line Diagram of SAWA Flow Path – Unit 2 (continued)



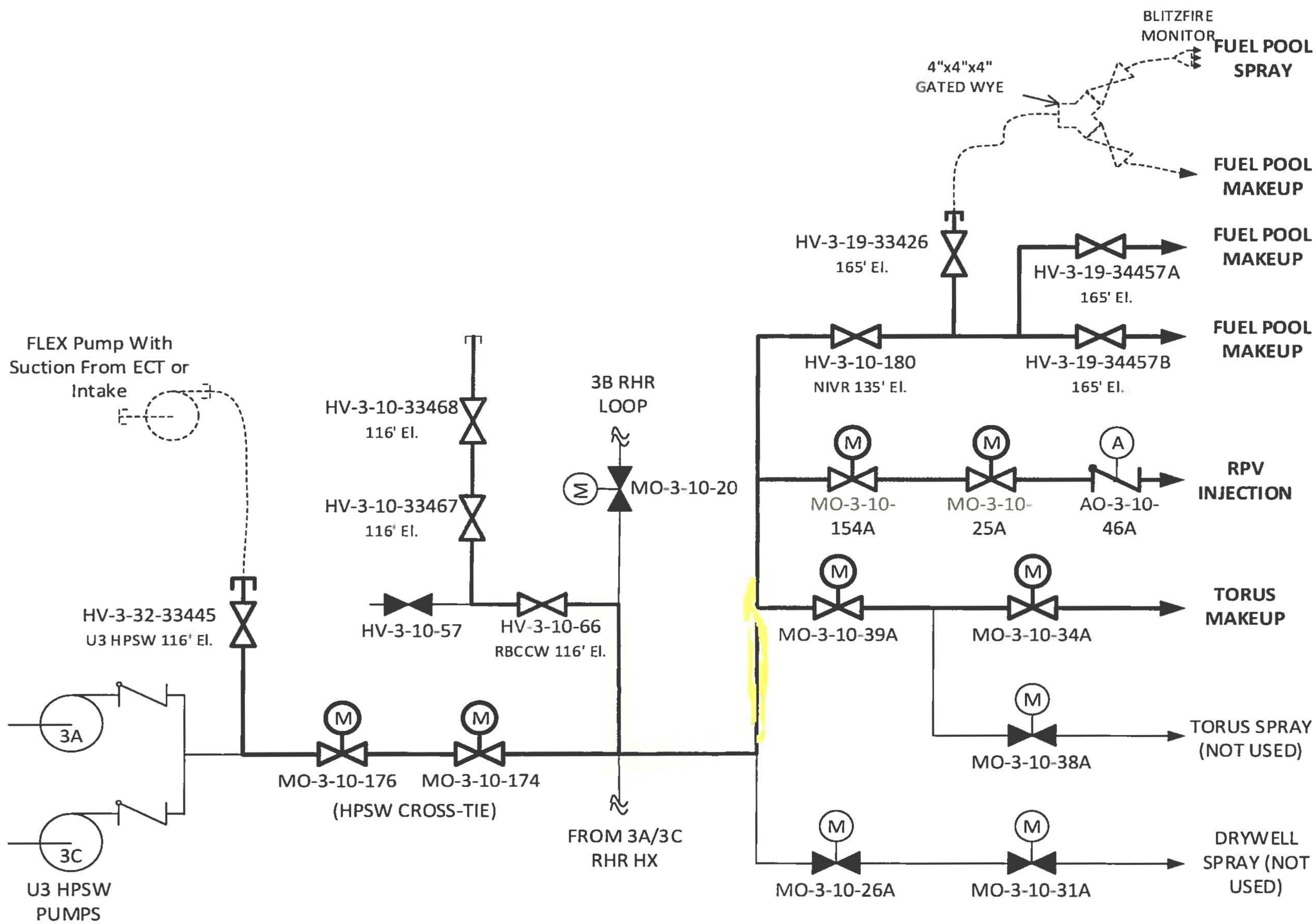
Attachment 4: One Line Diagram of SAWA Flow Path – Unit 2 (continued)



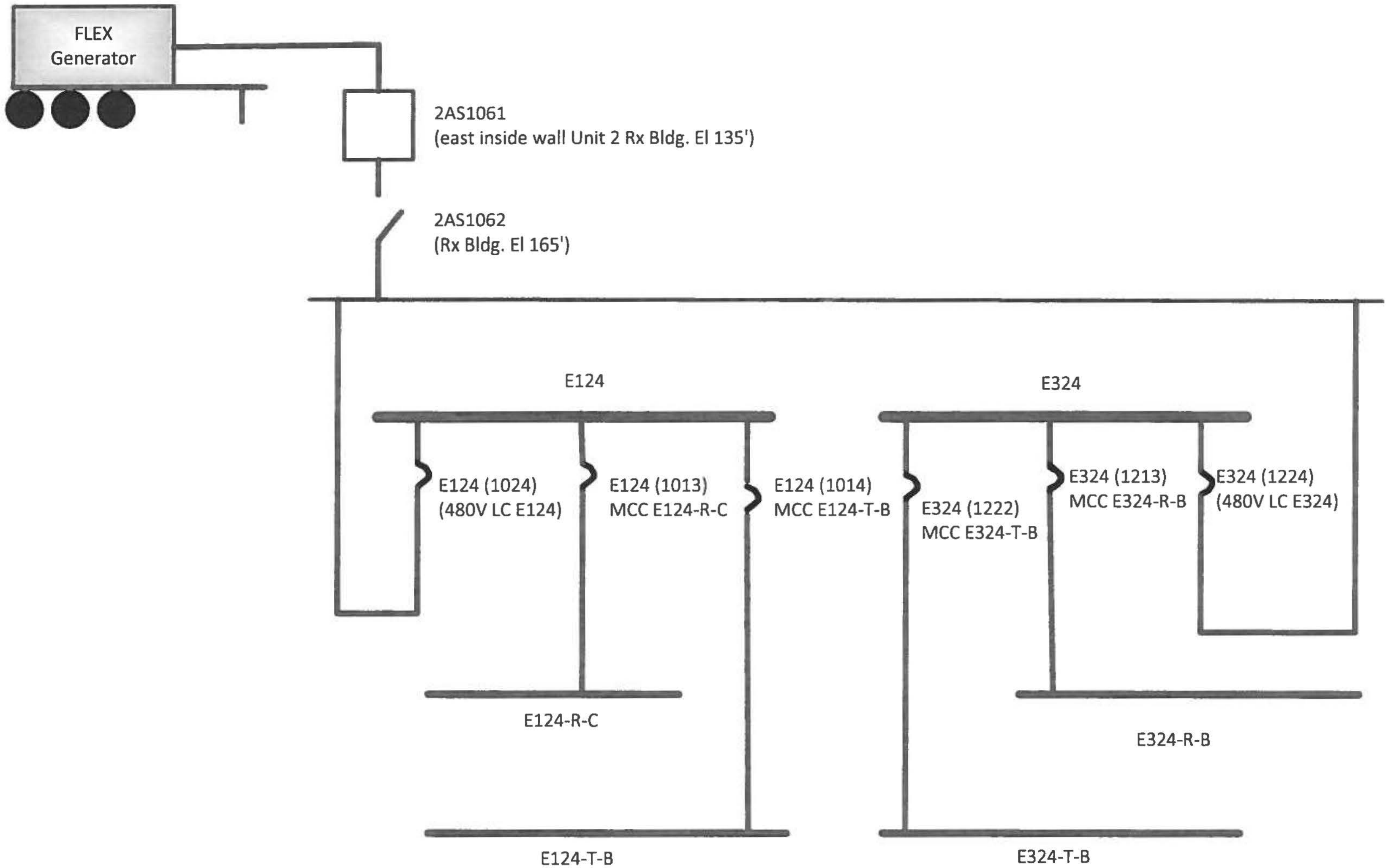
Attachment 4a: One Line Diagram of SAWA Flow Path – Unit 3



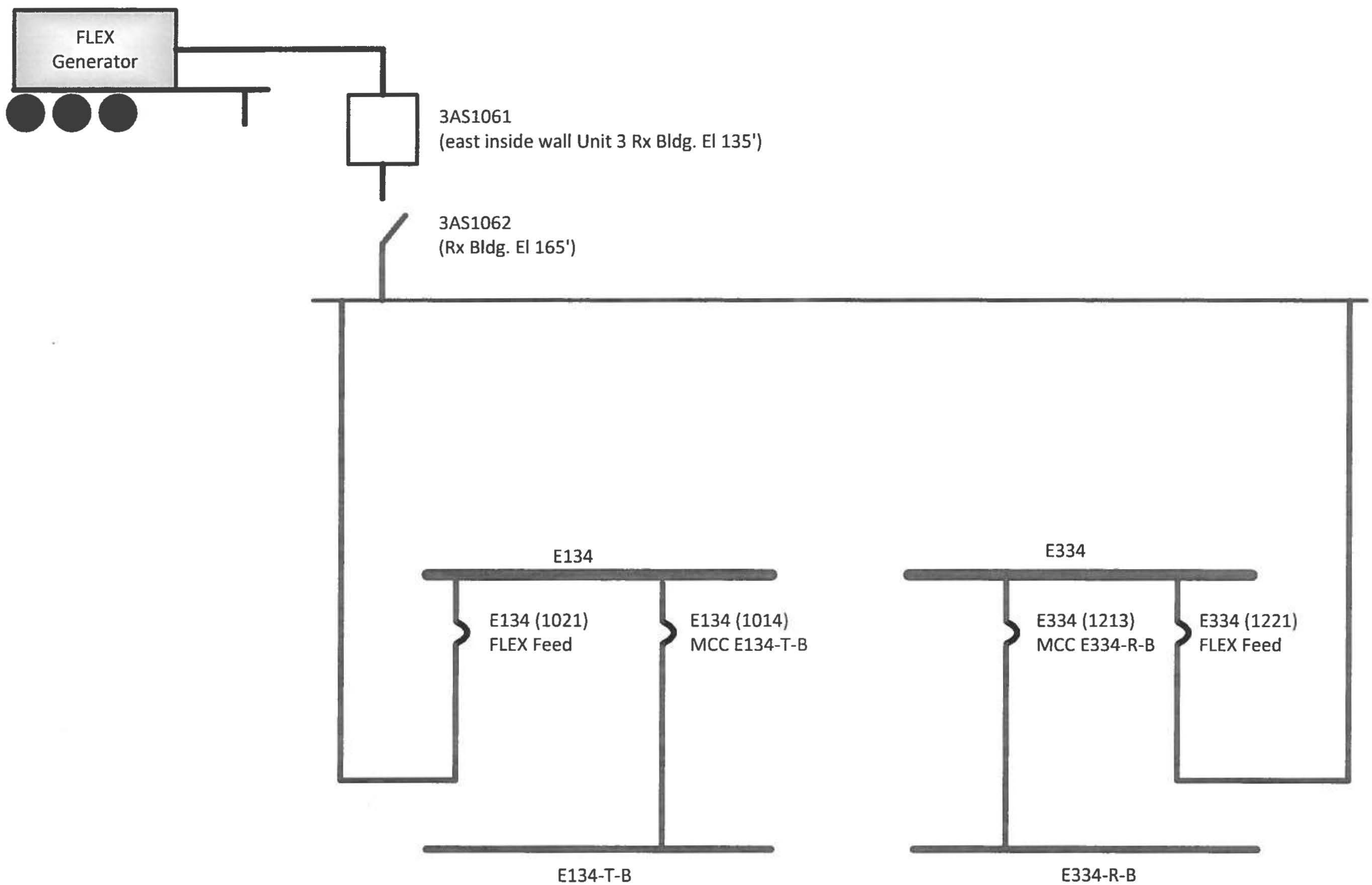
Attachment 4a: One Line Diagram of SAWA Flow Path – Unit 3 (continued)



Attachment 5: One Line Diagram of SAWA Electrical Power Supply – Unit 2



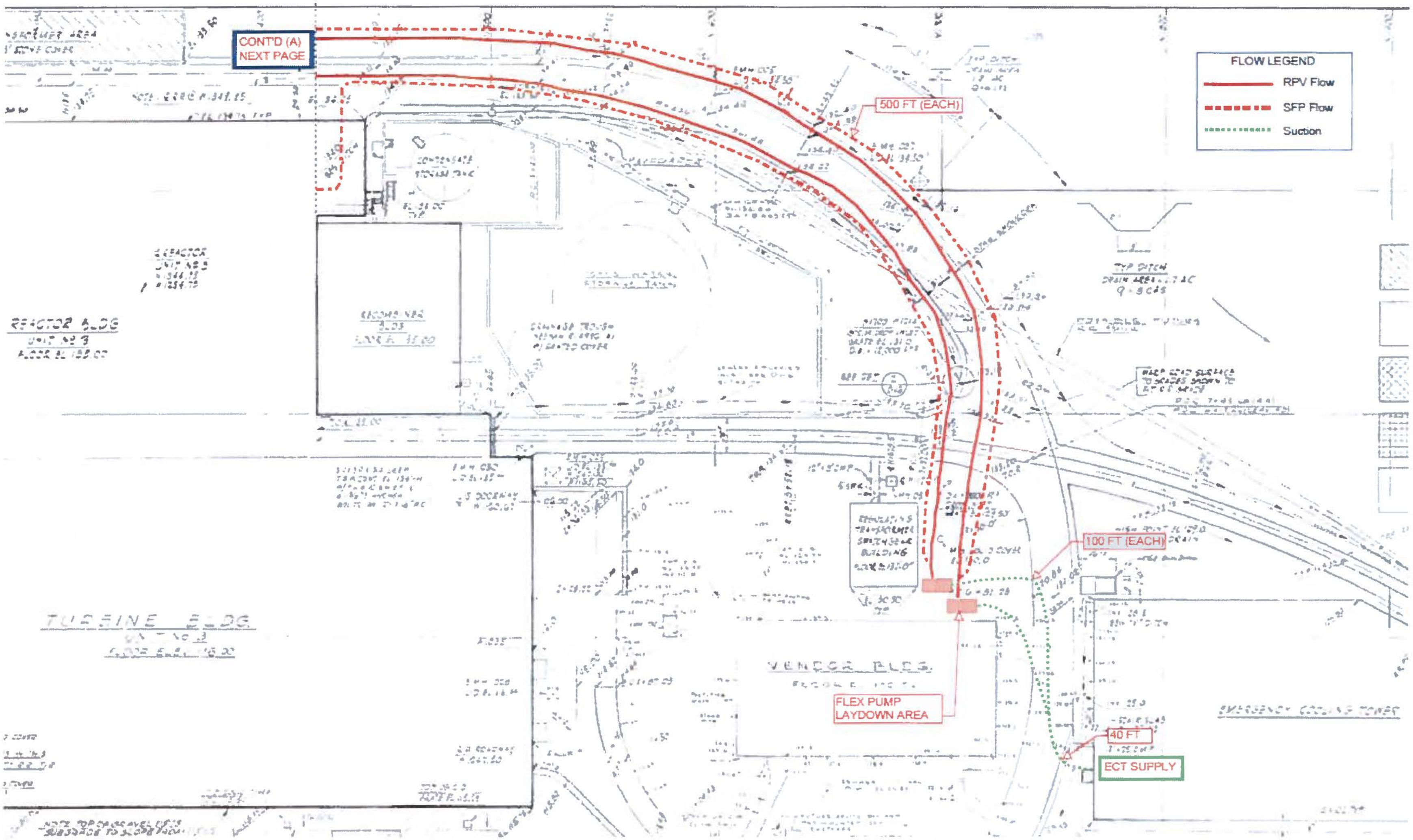
Attachment 5a: One Line Diagram of SAWA Electrical Power Supply – Unit 3



Attachment 6: Plant Layout Showing Operator Action Locations

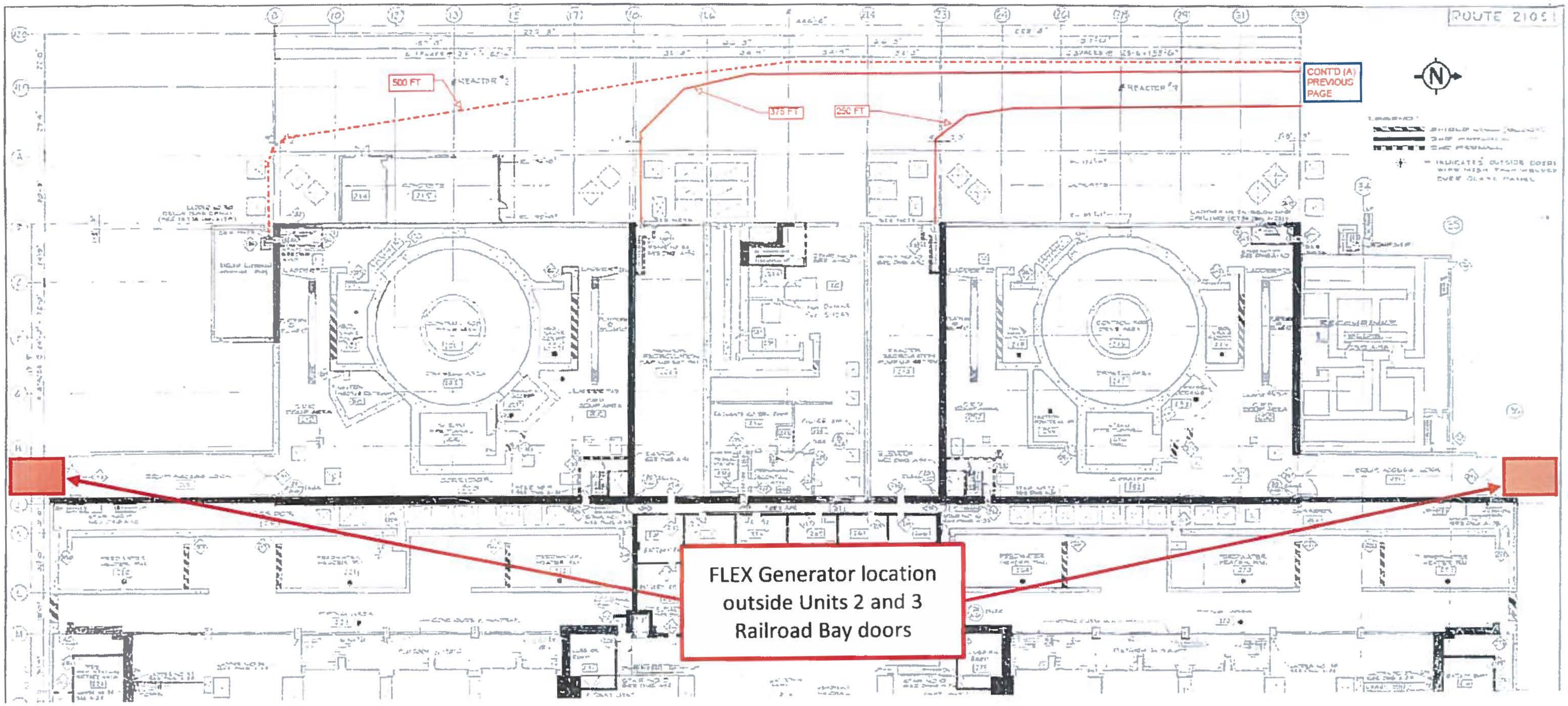
Attachment 6A

Outside Locations for FLEX Pump, Hoses, and FLEX Generator (continued next page)



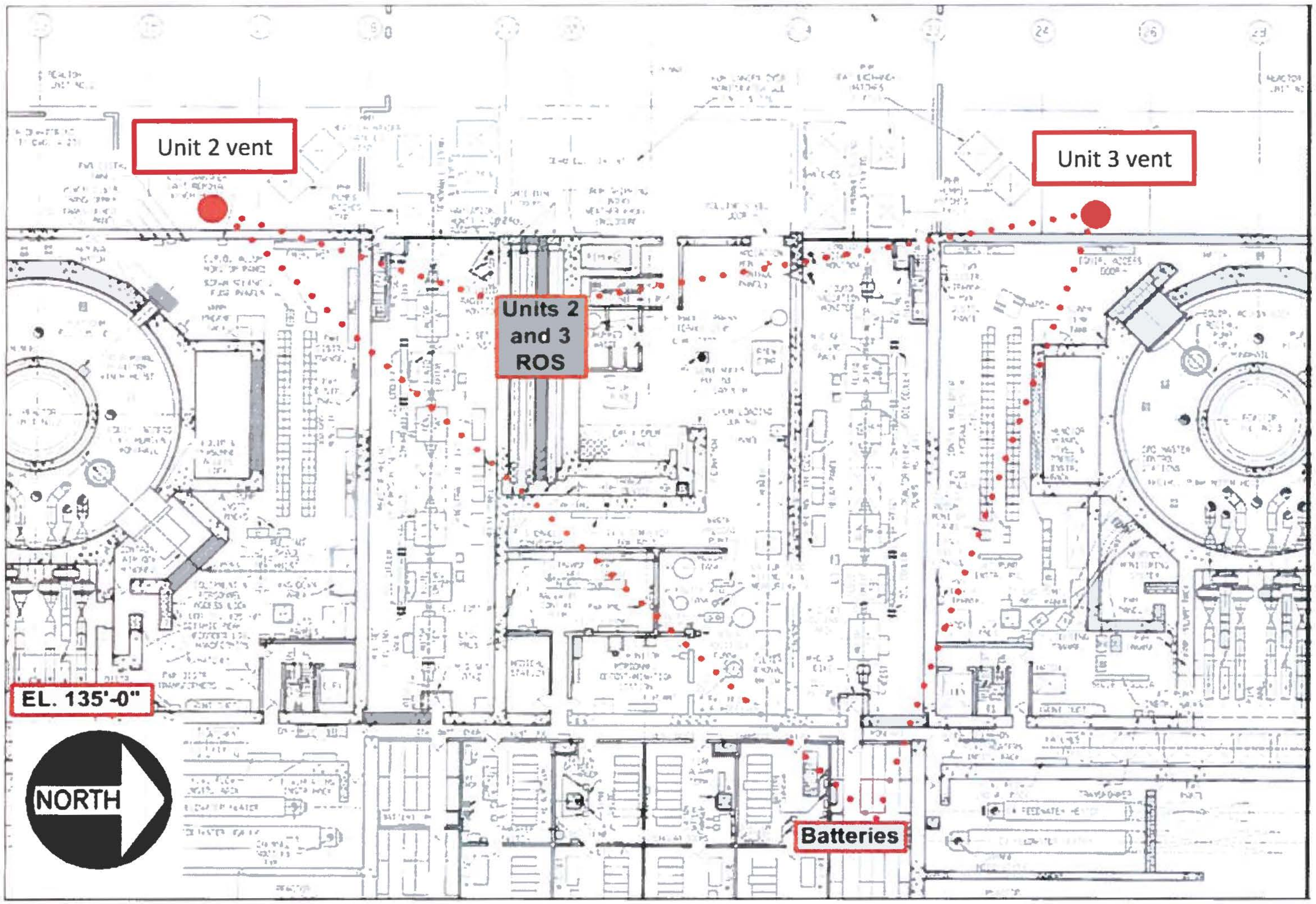
Attachment 6A (continued)

Outside Locations for FLEX Pump, Hoses, and FLEX Generator



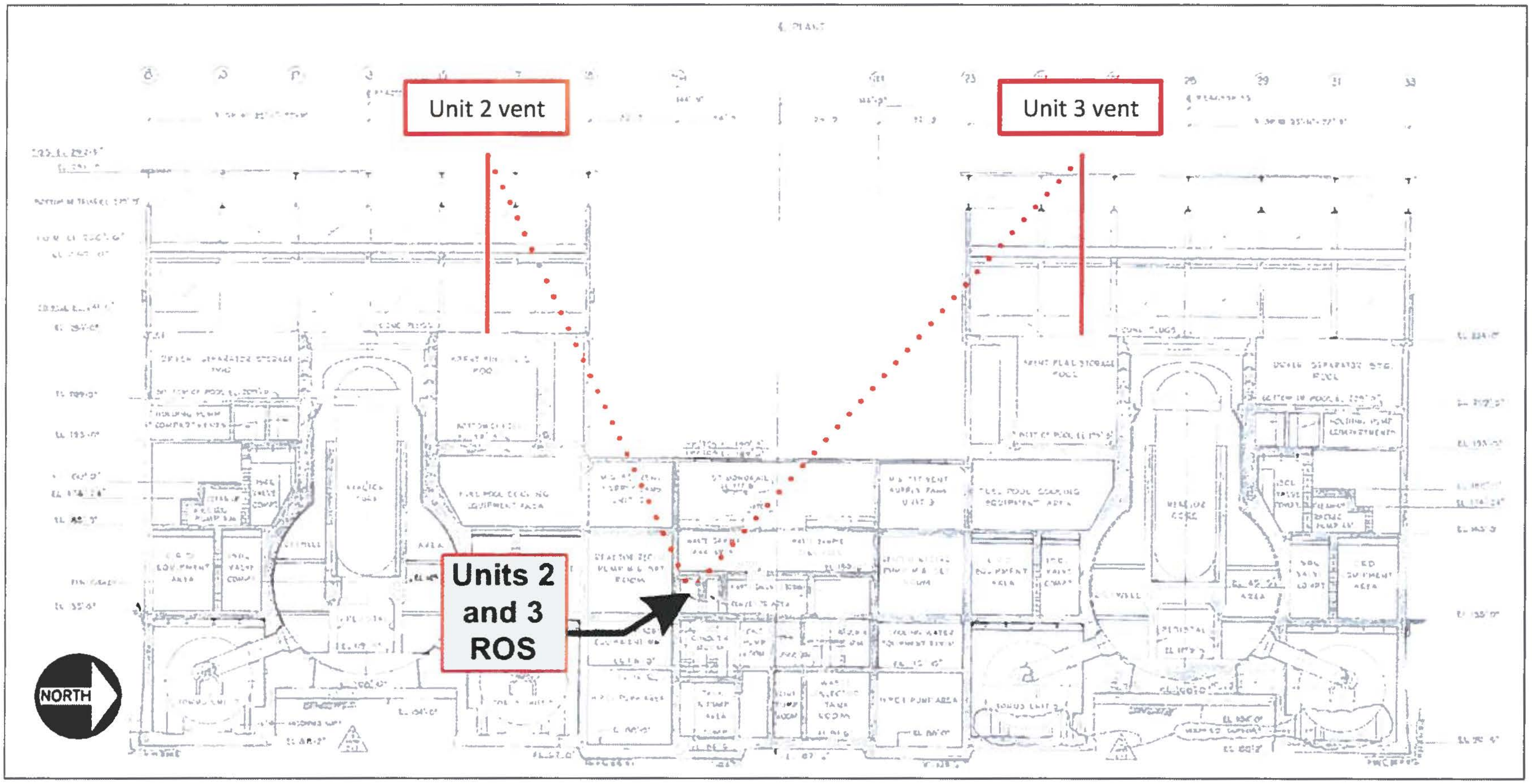
Attachment 6B

ROS Location Radwaste 135' Elevation Birdseye View



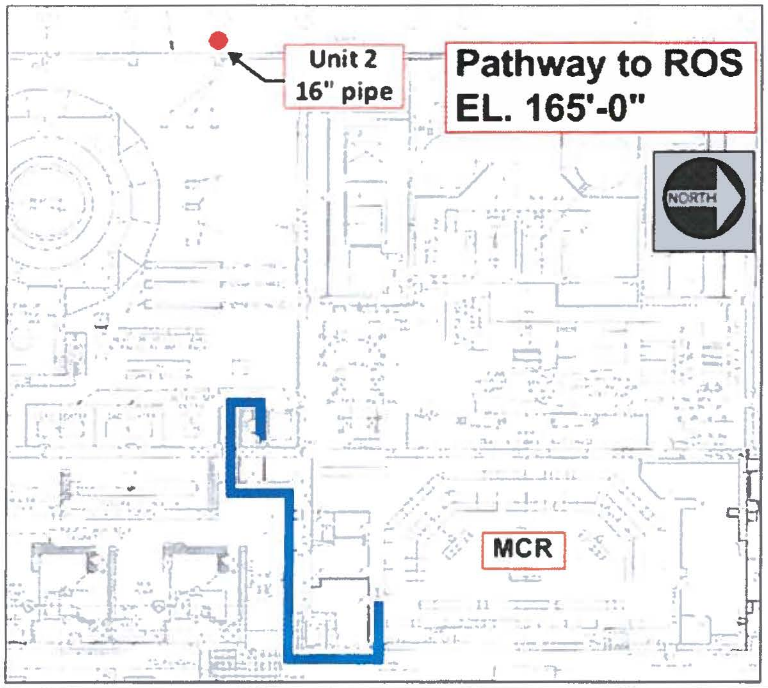
Attachment 6C

ROS Location Vertical View



Attachment 6D

Pathway to ROS



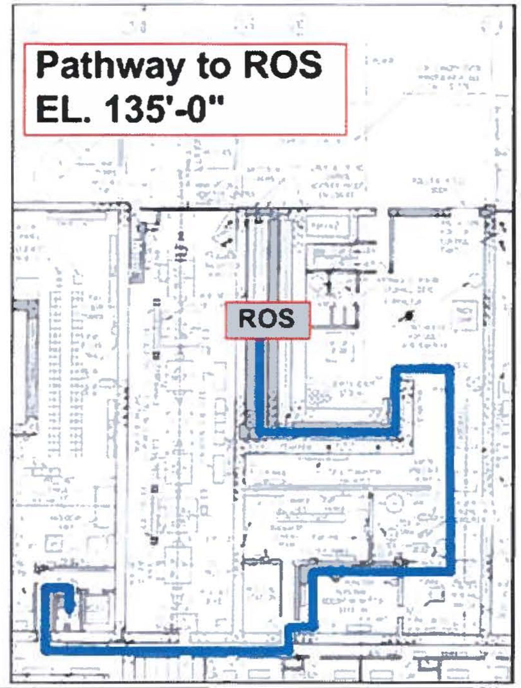


Table 1: List of HCVS Component, Control and Instrument Qualifications

Component Name	Equipment ID	Range	Location	Local Event Temp	Local Event Humidity	Local Radiation Level	Qualification	Qualification Temp	Qualification Humidity	Qualification Radiation	Power Supply
Wetwell Vent Instruments and Components											
HCVS effluent temperature sensor	TE-8(9)1407	0-500°F	Torus Room	303.4°F	100%	4.0E+07 Rads over life of plant	IEEE-323-1974 & 1983, IEEE-344-1975 & 1987	0 - 500°F	No electronics, not susceptible	300 Mrad	None required
HCVS effluent temperature transmitter	TT-8(9)1407	0-400°F	ROS	120°F	90%	5.6 mr/hr during accident and 350 Rad over plant life	IEEE-323-1974 & 1983, IEEE-344-1975 & 1987	-15 - 185°F	100%	1 Mrad	24 VDC power supply E/S-8(9)1408 powered by 125VDC HCVS Battery
HCVS effluent temperature indication	TI-8(9)1407	0-400°F	MCR	112.7°F	90%	*CR	IEEE-344-1987, IEEE-420-1973	-4 - 150°F	100%	N/A	24 VDC power supply E/S-8(9)1408 powered by 125VDC HCVS Battery
Wetwell Vent line radiation detector	RE-8(9)1405	10^{-2} to 10^{4} R/hr	RB El. 195' (U2) 165' (U3)	146°F U2 185°F U3	100%	5.0 x 10^{6} Rads	IEEE-323-1983, IEEE-344-1987	40 - 350°F	100%	2 x 10^{8} Rad	125 VDC HCVS Battery
Wetwell Vent line radiation processor/ transmitter	RT-8(9)1405	10^{-2} to 10^{4} R/hr	ROS	120°F	90%	5.6 mr/hr during accident and 350 Rad over plant life	IEEE-323-1983, IEEE-344-1987	40 - 131°F	95%	1 x 10^{3} Rad	125 VDC HCVS Battery
Wetwell Vent line radiation indicator	RI-8(9)1405	10^{-2} to 10^{4} R/hr	MCR	112.7°F	90%	*CR	IEEE-344-1987, IEEE-420-1973	-4 - 150°F	100%	N/A	125 VDC HCVS Battery
N2 supply pressure gages	PI-8(9)1429 and PI-8(9)1430	0-3000 psig and 0-160 psig	ROS	120°F	90%	5.6 mr/hr during accident and 350 Rad over plant life	N/A	-40 - 200°F	100%	N/A	None required

Component Name	Equipment ID	Range	Location	Local Event Temp	Local Event Humidity	Local Radiation Level	Qualification	Qualification Temp	Qualification Humidity	Qualification Radiation	Power Supply
Argon supply pressure gages	PI-8(9)1431 and PI-8(9)1428	0-3000 psig and 0-400 psig	ROS	120°F	90%	5.6 mr/hr during accident and 350 Rad over plant life	N/A	-40 - 200°F	100%	N/A	None required
Argon supply pressure transmitter	PT-8(9)1406	0-4000 psig	ROS	120°F	90%	5.6 mr/hr during accident and 350 Rad over plant life	IEEE-323-1974, 1983 & 2003, IEEE-344-1975, 1987 & 2004	40 - 200°F	100%	6.5 Mrad	24 VDC power supply E/S-8(9)1408 powered by 125VDC HCVS Battery
Drywell Pressure transmitter	PT-4(5)805	0 to 70 psig	RB El. 116'	300°F	100%	2.00E+03 Rads	IEEE 323-1974, IEEE 344-1975	**200°F	100%	2.2E+07 Rads TID	FLEX Generator
Drywell Pressure indication	PR/TR-4(5)805	0 to 70 psig	MCR	112.7°F	90%	*CR	N/A – RG 1.97 qualified	RG 1.97	RG 1.97	RG 1.97	FLEX Generator
Wetwell Level transmitter	LT-8(9)123A	20 ft H_2O	RB El. 91'-6"	300°F	100%	2.00E+03 Rads	N/A – RG 1.97 qualified	RG 1.97	RG 1.97	RG 1.97	FLEX Generator
Wetwell Level indication	LI-8(9)123A	1 to 21 ft H_2O	MCR	112.7°F	90%	*CR	N/A – RG 1.97 qualified	RG 1.97	RG 1.97	RG 1.97	FLEX Generator
SAWA flow instrument and readout	N/A	3.3 - 1100 gpm	Outside close to FLEX/ SAWA Pump	N/A (outside)	N/A (outside)	Outside, radiation not a concern	Commercial instrument qualified for over the road use, therefore qualified per NEI 12-06	-4 - 140°F	N/A	N/A	Internal Battery

* Denotes Control Room where local radiation levels are not applicable. Building has no significant radiation sources.
** 200 °F for normal operating limits, with ±(0.75% upper range limit +0.5% span) per 100 °F (55.6 °C) ambient temperature change. Analyzed as acceptable in EC 618957 Attachment 09A.

Table 2: Operator Actions Evaluation

Operator Action		Evaluation Time[8]	Validation Time	Location	Thermal conditions	Radiological Conditions	Evaluation
1	Open RB roof hatch for ventilation	≤ 1 hour	00:26:10	RB refueling floor	Done in the first hour, so no concerns.	Done in the first hour, so no concerns.	Acceptable
2	Align HCVS to support venting capability	≤ 1 hour	00:32:10	ROS (RW Building 135')	Done in the first hour, so no concerns.	Done in the first hour, so no concerns.	Acceptable
3	FLEX Generator connection and alignment	≤ 7 hours	02:16:08 (from start of deployment; will be complete within 8 hours)	The Unit 2 FLEX Generator is located south of the Unit 2 RB outside of the Unit's outer railroad door. The Unit 3 FLEX Generator is located north of the Unit 3 RB outside of the Unit's outer railroad door.	Outside - outdoor ambient conditions do not cause a temperature concern.	Action will be complete prior to venting start so no radiological concern	Acceptable
4	SAWA pump staging and hose connection	≤ 8 hours	02:30:54 (from start of deployment; will be complete within 8 hours)	North of the Unit 3 Reactor Building (RB) between the Plant Services Building and the Unit 3 Startup Switchgear Building.	Outside - outdoor ambient conditions do not cause a temperature concern.	Action will be complete prior to venting start so no radiological concern	Acceptable

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

Operator Action		Evaluation Time[8]	Validation Time	Location	Thermal conditions	Radiological Conditions	Evaluation
5	SAWA manual valve alignment in RB	≤ 8 hours	02:30:54 (from start of deployment; will be complete within 8 hours)	RBCCW Room 116'	125°F Max. per Ref. 45 Attachment 09B and Ref. 62	1.71E+04 mR/hr per Ref. 55	Acceptable
6	FLEX Generator operation and refueling	8 hours – event duration	N/A	East of DG Building and at pump and generator staging locations	Outside - outdoor ambient conditions do not cause a temperature concern.	1.85E+03 mR/hr per Ref. 55	Acceptable
7	SAWA pump operation and refueling	8 hours – event duration	N/A	East of DG Building and at pump and generator staging locations	Outside - outdoor ambient conditions do not cause a temperature concern.	5.60E+02 mR/hr per Ref. 55	Acceptable