Exelon Generation

RS-18-131

Order No. EA-13-109

December 14, 2018

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

LaSalle County Station, Unit 2
Renewed Facility Operating License No. NPF-18
NRC Docket No. 50-374

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-14-059)
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 17, 2014 (RS-14-303)
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-15-149)

8. Exelon Generation Company, LLC Third Six-Month Status Report 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 16, 2015 (RS-15-300)
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-16-107)
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 14, 2016 (RS-16-233)
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 29, 2017 (RS-17-065)
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-17-152)
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 22, 2018 (RS-18-058)
14. NRC letter to Exelon Generation Company, LLC, LaSalle County Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4456 and MF4457), dated March 31, 2015
15. NRC letter to Exelon Generation Company, LLC, LaSalle County Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 2 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4456 and MF4457), dated August 2, 2016
16. NRC letter to Exelon Generation Company, LLC, LaSalle County Station, Units 1 and 2 – 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 December 22, 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 LaSalle County 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 LaSalle County 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 LaSalle County Station, Unit 2.

LaSalle County 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. LaSalle County 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 LaSalle County Station, Unit 2 with NRC Order EA-13-109.

LaSalle County Station, Unit 2 Phases 1 and 2 OIP Open Items have been addressed and closed as documented in References 8 and 13, and are considered complete per Reference 16.

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 13, 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 Reference 13. All Phase 1 and Phase 2 ISE Open Items are statused as closed in Reference 16.

OIP Phase 1 Open Item No. 1 Determine how Motive Power and/or HCVS Battery Power will be disabled during normal operation.	Deleted (Closed to ISE Open Item No. 1 below)
OIP Phase 1 Open Item No. 2 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. 4 below)
OIP Phase 1 Open Item No. 3 Determine wetwell line size to meet 1% venting criteria.	Deleted (Closed to ISE Open Item No. 5 below)
OIP Phase 1 Open Item No. 4 Confirm suppression pool heat capacity.	Closed per Reference 8.
OIP Phase 1 Open Item No. 5 Determine the approach for combustible gases.	Deleted (Closed to ISE Open Item No. 9 below)
OIP Phase 1 Open Item No. 6 Provide procedures for HCVS Operation.	Deleted (Closed to ISE Open Item No. 13 below)
OIP Phase 1 Open Item No. 7 Perform radiological evaluation for Phase 1 vent line impact on ERO actions.	Closed per Reference 13.
ISE Phase 1 Open Item No. 1 Make available for NRC staff audit documentation of a method to disable HCVS during normal operation to provide assurances against inadvertent operation that also minimizes actions to enable HCVS operation following an ELAP.	Closed per Reference 13.
ISE Phase 1 Open Item No. 2 Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG	Closed per Reference 13.

loading calculation.	
ISE Phase 1 Open Item No. 3 Make available for NRC staff audit documentation of the HCVS argon pneumatic system design including sizing and location.	Closed per Reference 13.
ISE Phase 1 Open Item No. 4 Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.	Closed per Reference 13.
ISE Phase 1 Open Item No. 5 Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit.	Closed per Reference 13.
ISE Phase 1 Open Item No. 6 Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.	Closed per Reference 13.
ISE Phase 1 Open Item No. 7 Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	Closed per Reference 13.

ISE Phase 1 Open Item No. 8 Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions.	Closed per Reference 13.
ISE Phase 1 Open Item No. 9 Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	Closed per Reference 13.
ISE Phase 1 Open Item No. 10 Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings.	Closed per Reference 12.
ISE Phase 1 Open Item No. 11 Make available for NRC staff audit documentation of a seismic qualification evaluation of HCVS components.	Closed per Reference 13.
ISE Phase 1 Open Item No. 12 Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	Closed per Reference 13.
ISE Phase 1 Open Item No. 13 Make available for NRC staff audit the procedures for HCVS operation.	Closed per Reference 13.

EGC's response to the NRC ISE Phase 2 Open Items identified in Reference 15 have been addressed and closed as documented in Reference 13, and are considered complete per Reference 16. The following table provides completion references for each ISE Phase 2 Open Item.

OIP Phase 2 Open Item No. 1 Evaluate feasibility of strategy due to radiological conditions.	Closed per Reference 13.
OIP Phase 2 Open Item No. 2 Verify required modifications to support SAWA/SAWM.	Closed per Reference 13.
ISE Phase 2 Open Item No. 1 Licensee to confirm through analysis the temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment. (ISE Section 3.3.1)	Closed per Reference 13.
ISE Phase 2 Open Item No. 2 Licensee to evaluate the ingress and egress paths for the expected severe accident conditions (temperature, humidity, radiation) for the sustained operating period. (ISE Section 3.3.2.3)	Closed per Reference 13.
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 Reference 13.
ISE Phase 2 Open Item No. 4 Licensee shall demonstrate how the plant is bounded by the reference plant analysis that shows the SAWM strategy is successful in making it unlikely that a DW vent is needed. (ISE Section 3.3.3.1)	Closed per Reference 13.
ISE Phase 2 Open Item No. 5 Licensee to demonstrate that there is adequate communication between the MCR and the operator at the FLEX pump during severe accident conditions. (Section 3.3.3.4)	Closed per Reference 13.

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 Reference 13.

MILESTONE SCHEDULE – ITEMS COMPLETE

LaSalle County Station, Unit 2 - Phases 1 and 2 Specific Milestone Schedule

Milestone	Completion Date
Submit Phase 1 Overall Integrated Plan	**June 2014**
Submit 6 Month Updates:	
Update 1	**December 2014**
Update 2	**June 2015**
Update 3 and Phase 2 Overall Integrated Plan	**December 2015**
Update 4	**June 2016**
Update 5	**December 2016**
Update 6	**June 2017**
Update 7	**December 2017**
Update 8	**June 2018**
Phase 1 Modifications:	
Hold preliminary/conceptual design meeting	**June 2014**
Unit 2 Design Engineering On-site/Complete	**November 2016**
Unit 2 Implementation Outage	**March 2017**
Unit 2 Walk Through Demonstration/Functional Test	**March 2017**
Phase 1 Procedure Changes	
Operations Procedure Changes Developed	**December 2016**
Site Specific Maintenance Procedure Developed	**December 2016**
Procedure Changes Active	**March 2017**
Phase 1 Training:	
Training Complete	**December 2016**

Milestone	Completion Date
Phase 1 Completion	
Unit 2 HCVS Implementation	**March 2017**
Phase 2 Modifications:	
Hold preliminary/conceptual design meeting	**June 2015**
Unit 2 Design Engineering On site/Complete	**March 2018**
Unit 2 Walk Through Demonstration/Functional Test	**November 2018**
Unit 2 Implementation Outage	N/A
Phase 2 Procedure Changes	
Operations Procedure Changes Developed	**November 2018**
Site Specific Maintenance Procedure Developed	**November 2018**
Procedure Changes Active	**November 2018**
Phase 2 Training:	
Training Complete	**November 2018**
Phase 2 Completion	
Unit 2 HCVS Implementation	**November 2018**
Submit Unit 2 Phases 1 and 2 Completion Report	**December 2018 Completed with this submittal**

ORDER EA-13-109 COMPLIANCE ELEMENTS SUMMARY

The elements identified below for LaSalle County 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 LaSalle County Station, Units 1 and 2 Final Integrated Plan for reliable hardened containment vent Phase 1 and Phase 2 strategies is provided in the enclosure to this letter.

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

The LaSalle County 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 LaSalle County 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 LaSalle County 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 LaSalle County 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 LaSalle County 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 LaSalle County 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 LaSalle County 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 LaSalle County 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 LaSalle County 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.

LaSalle County 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).

LaSalle County 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 14th day of December 2018.

Respectfully submitted,

David M. Gullott
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure: LaSalle County Station, Units 1 and 2 Final Integrated Plan Document – Hardened Containment Vent System NRC Order EA-13-109

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region III
NRC Senior Resident Inspector – LaSalle County Station
NRC Project Manager, NRR – LaSalle County Station
Mr. John P. Boska, NRR/JLD/JOMB, NRC
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Mr. Rajender Auluck, NRR/JLD/JCBB, NRC
Illinois Emergency Management Agency – Division of Nuclear Safety

Enclosure

LaSalle County Station, Units 1 and 2

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

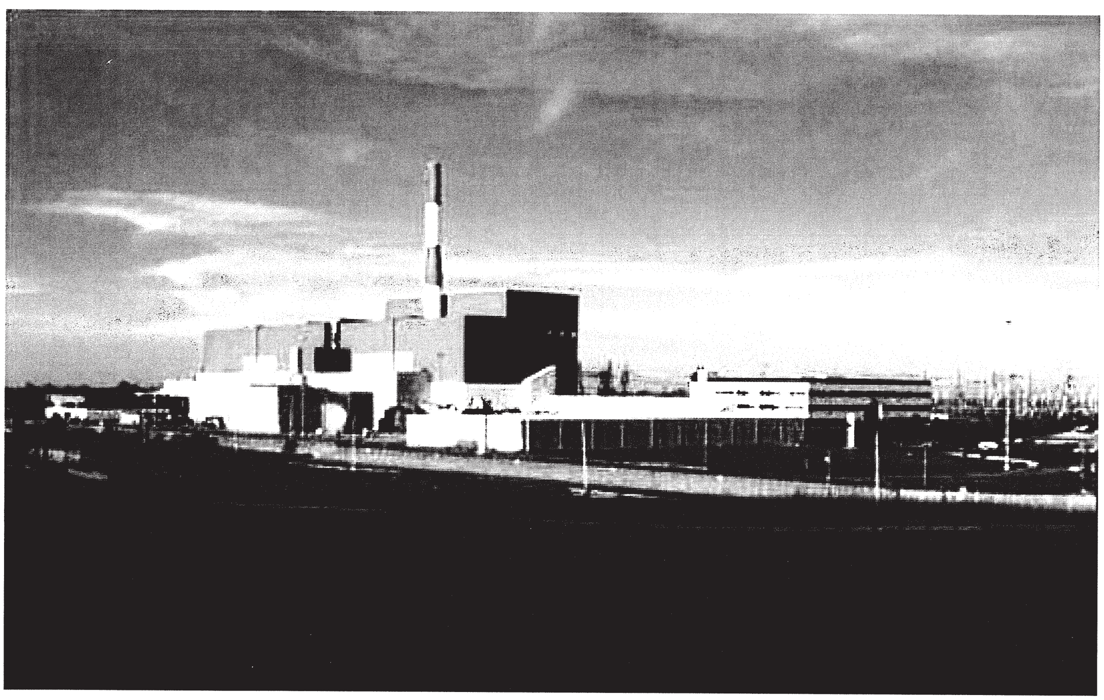
(70 pages)

Final Integrated Plan

HCVS Order EA-13-109

for

LaSalle County Station (LSCS)
Units 1 & 2



December 14, 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).

LaSalle County Station (LSCS) 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. LSCS achieved Phase 1 compliance in March 2017 for U2 and in March 2018 for U1.

- Phase 2 provided additional protections for severe accident conditions through the development of a reliable containment venting strategy that makes it unlikely that LSCS would need to vent from the containment drywell during severe accident conditions. LSCS achieved Phase 2 compliance in March 2018 for Unit 1 and November 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, LSCS 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, LSCS conforms to NEI 13-02 Revision 1 for both Phases of Order EA-13-109.

The NRC performed a review of each OIP submittal and provided LSCS with Interim Staff Evaluations (ISEs) (References 20 and 21) assessing the site's compliance methods. In the ISEs, the NRC identified open items which the site needed to address before that phase of compliance was reached. Six-month progress reports (References 22 through 28) were provided consistent with the requirements of Order EA-13-109. These status reports were used to close many of the ISE open items. In addition, the site participated in NRC ISE Open Item audit calls where the information provided in the six-month updates and on the E-Portal were used by the NRC staff to determine whether the ISE Open Item appeared to be addressed.

By submittal of this Final Integrated Plan, LSCS 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-FAQ and HCVS-WP 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 LSCS 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 from the Main Control Room (MCR) or Remote Operating Station (ROS) at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms.

- The vent utilizes containment parameters of drywell pressure and wetwell level from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation is monitored by HCVS valve position, HCVS vent line temperature, and effluent radiation levels.
- The HCVS motive force is monitored and has the capacity to operate for 24 hours with installed equipment. Replenishment of the motive force will be by use of portable equipment once the installed motive force is exhausted.
- Venting actions are capable of being maintained for a sustained period of at least 7 days.

The operation of the HCVS is designed to minimize the reliance on operator actions in response to external hazards. The screened in external hazards for LSCS are seismic; severe storms with high winds; snow, ice, and extreme cold; and high temperature (Reference 19). Initial operator actions are completed by plant personnel and include the capability for remote-manual initiation from the HCVS control station. Initial operator actions are completed by plant personnel to perform initial valve line-up at the ROS. Then, the primary location of vent operation is the main control room (MCR). The HCVS system can also be operated manually from the ROS. Attachment 2 contains a one-line diagram of the HCVS vent flow path.

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 as reviewed for EA-12-049 compliance, with the addition of the SAWA flow meter and relocation of the hose connection to installed plant piping from inside the Reactor Building (RB) into the Diesel Generator Building (DB) Corridor. These changes to the flow path were evaluated in a revision to the FLEX hydraulic calculation, L-003961, and found to be acceptable. Attachment 4 contains a one-line diagram of the SAWA flow path. The SAWA flow path cannot be inadvertently actuated since it is a manual system consisting of unconnected hoses, manual valves, and a pump normally not connected to installed plant piping.

The SAWA piping does not share any piping with the HCVS wetwell vent: there are independent flow paths for SAWA flow to the RPV and HCVS flow from containment. This is consistent with NEI 13-02, Rev. 1, Section 4.1.8.4.

For severe accident (SA) conditions, the operators will follow procedure LOA-FSG-003 that provides various attachments for different scenarios where one unit is under FLEX and the other under SA conditions or both units are under SA conditions. For the unit under SA conditions, LaSalle will inject greater than or equal to 500 gpm for 4 hours, then reduce flow to 100 gpm to slow the rate of Suppression Pool level increase. Operators then monitor the Suppression Pool level trend to make any additional adjustments over the next 7 days such that injection is maximized while ensuring the HCVS penetration is never flooded. To control the injection rate, flow will be throttled using valve 1(2)FC030AN located in the DB Corridor.

The ‘B’ FC EMU hose connection station, for both units, has been relocated from the Reactor Building to the Diesel Corridor in order to minimize the thermal and radiological impacts on operators. A portable wye (to divert SFP flow from RPV flow) and the 1(2)FI-FF001 SAWA flow meter for each unit are permanently mounted on carts located in the Diesel Corridor Vestibules.

Actions for hose deployment in the Reactor Building at elevation 761' and breaker alignments on 710' elevation will be completed prior to T=1 hour post-RCIC failure.

Concurrently, activities will be initiated to deploy the FLEX (SAWA) pump at the Ultimate Heat Sink (UHS). The FLEX pump will be ready to deliver flow prior to T=8 hours. One FLEX pump is capable of meeting all water makeup requirements for both units under any combination of FLEX or SA conditions. As discussed in the OIP (Reference 19), the total amount of water added will be managed so the HCVS penetration is never flooded.

The SAWA electrical loads are included in the FLEX DG loading calculation reviewed for EA-12-049 compliance. The FLEX DG deployment locations were changed to move them out of direct shine from the HCVS vent to the north (U2) and south (U1) of the RB. See Attachment 6 for applicable locations. Refueling of the FLEX DGs is accomplished from the EDG fuel oil tanks as described in LOA-FSG-009, FLEX Equipment Fueling. Attachment 5 contains a one-line diagram of the SAWA electrical power supply.

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

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

Section II: List of Acronyms

AC	Alternating Current
AEER	Aux Electric Equipment Room
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
DB	Diesel Generator Building
DC	Direct Current
LSCS	LaSalle County Station
ECCS	Emergency Core Cooling Systems
EL	Elevation
ELAP	Extended Loss of AC Power
EOP	Emergency Operating Procedure
EPG/SAG	Emergency Procedure and Severe Accident Guidelines EPRI Electric Power Research Institute
EAA	Equipment Access Airlock
ERO	Emergency Response Organization
FAQ	Frequently Asked Question
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
MAAP	Modular Accident Analysis Program
MCR	Main Control Room
N_2	Nitrogen
NEI	Nuclear Energy Institute
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
OIP	Overall Integrated Plan
PCPL	Primary Containment Pressure Limit
RB	Reactor Building
RCIC	Reactor Core Isolation Cooling
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
SRV	Safety-Relief Valve
TB	Turbine Building
UFSAR	Updated Final Safety Analysis Report
UHS	Ultimate Heat Sink
VAC	Voltage AC
VDC	Voltage DC
WW	Wetwell

Section III: Phase 1 Final Integrated Plan Details

Section III.A: HCVS Phase 1 Compliance Overview

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

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

LSCS Units 1 and 2 have a Mark II primary containment design and are not required to comply with NRC Generic Letter 89-16.

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

LSCS venting actions to comply with NRC Order EA-13-109, Phase 1 severe accident capable venting scenario can be summarized by the following:

- The HCVS will be initiated via manual action from the MCR and/or from the ROS at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms. Once initiated, HCVS operation from the ROS is limited to the Order EA-13-109 Requirement 1.2.5. Specifically, in case the HCVS flow path valves or the Argon purge flow cannot be operated from the MCR, the ROS provides a back-up means of operating the valve(s) that does not require electrical power or control circuitry.
- The operators will utilize Containment Parameters of Pressure and Suppression Pool Level from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation will be monitored by HCVS valve position, vent line temperature and effluent radiation levels.
- The HCVS motive force will be monitored and have the capacity to operate for 24 hours with installed equipment. Replenishment of the motive force will be by use of portable equipment prior to the installed motive force being exhausted.

Venting actions will be capable of being maintained for a sustained period of up to 7 days. The EA-13-109 compliant HCVS utilizes piping associated with the 1(2)PC001A wetwell to primary containment vacuum breaker as shown in Attachment 2. After initial valve line-up at the ROS, the vent system is initiated, operated, and monitored from the MCR. The Unit 1 and Unit 2 vent systems can also be initiated and operated entirely from the ROS, located on the respective 731' elevation of the Auxiliary Building. Table 2 contains the evaluation of the acceptability of the ROS location with respect to severe accident conditions.

Inside the RB, the vent lines for both units are 12" diameter pipes connected to the existing 24" wetwell to primary containment vacuum breaker line in the overhead of EL

710. The HCVS PCIVs, temperature element, rupture disc, and radiation detector are accessible from EL 740. The 12" vent pipes penetrate the Reactor Building at an elevation of 755'-5" and enter a 12"x14" reducing elbow (44'-11" above the plant grade of 710'-6") to run horizontally from the penetration to the HCVS tower. The vertical portion of the 14" vent pipe is supported by a structural steel tower evaluated in calculation L-004092. The tower is supported laterally by through-bolts to columns A-14 and A-15 of the Reactor Building, just below the refuel floor at EL 838"-6". At its base, the tower is supported off a concrete pedestal on the roof of the Equipment Access Airlock (EAA) structure at elevation 740'-6". The concrete pedestal is then tied down to the EAA base slab to resist the uplift condition. The tower does not attach to the reactor Building structural steel at any location, including above the Refuel Floor. Instead, it is cantilevered from the attachment point at EL 838'-6" to the top of the tower at elevation 891"-5". Section 4.1.5.2 of NEI 13-02, Rev. 1 requires that, if the release from HCVS is through a stack different than the plant meteorological stack, the elevation of the stack should be higher than the nearest power block building. For LSCS, the top of the HCVS pipe is 902'-8.5" and the top of the roof parapet is 894"-4", resulting in a release point 8'-4.5" higher than the reactor building roof parapet.

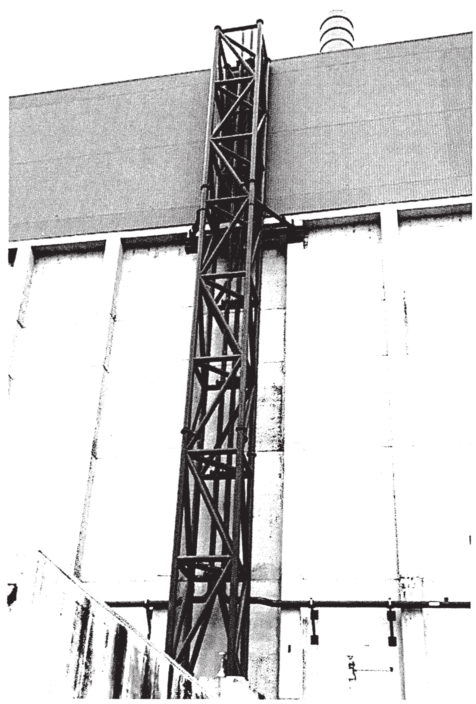
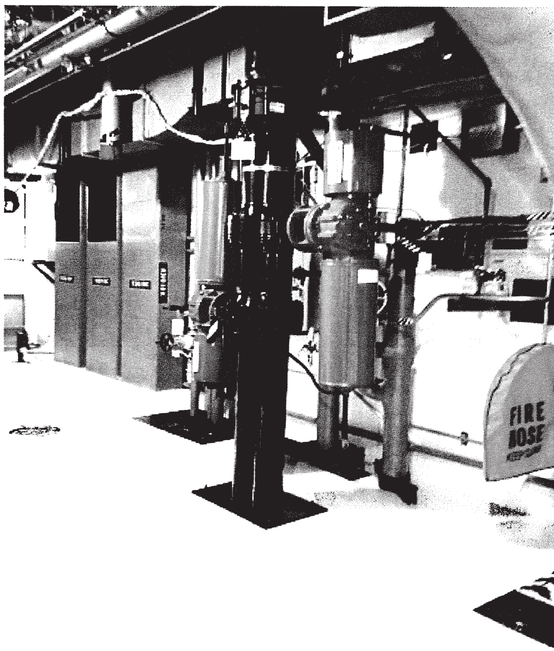
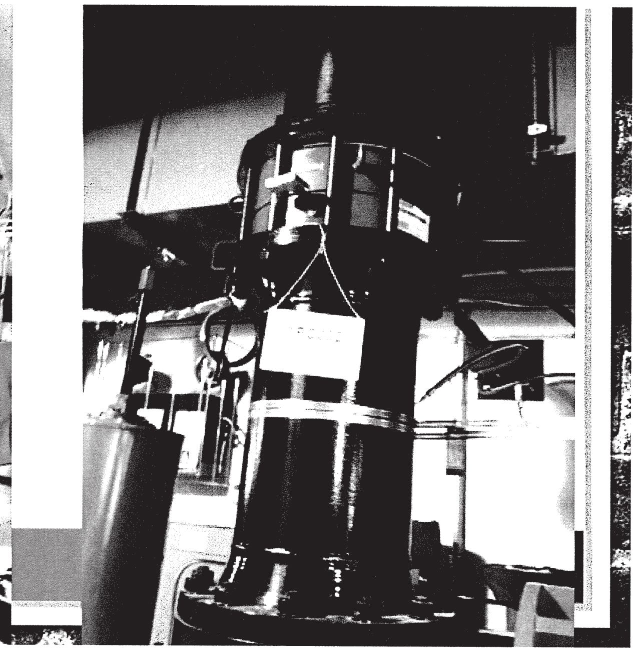


Figure 1: LSCS HCVS Tower and Vent Line Discharge

New isolation valves 1(2)PC009A and 1(2)PC010A are installed close to the connection point. As shown in Attachment 2, each vent line has a rupture disc, temperature element, and radiation detector at EL 740 of the RB. There is no cross connection between the two vent lines at any point.





Nitrogen gas bottles installed at the ROS provide the motive force to manipulate the HCVS PCIVs 1(2)PC009A and 1(2)PC010A. The system is designed such that valve 1(2)PC009A is opened and remains open once venting is needed to control the primary containment pressure. Valve 1(2)PC010A is operated to initiate and complete the venting cycle. The 2 nitrogen bottles can stroke 2PC009A one time and 2PC010A at least eight (8) times when the initial pressure in the nitrogen bottles is at least 2000 psig as evaluated in calculations L-004117 and L-004184. This meets the requirement for 8 vent cycles in the first 24 hours.

The HCVS design includes an Argon purge system connected just downstream of 1(2)PC010A. It is designed to prevent hydrogen detonation in the vent line downstream of the PCIVs. The Argon purge system has a switch for the control valve in the MCR to allow purging for the required time, but the system also allows for manual operation at the ROS. The installed capacity for the Argon purge system is sized for 8 purges within the first 24 hours of the event. The design allows for system recharge or Argon bottle replacement for continued operation past 24 hours. The Argon purge system is also designed to breach the rupture disc to establish the vent flow path. The MCR panel includes an indication Argon header pressure to monitor for when replenishment of the Argon supply is required. Reference design calculations L-004137 and L-004185.

The MCR is the primary operating station for the HCVS. During an ELAP, electric power to operate the vent valves will be provided by a common, dedicated HCVS battery with sufficient capacity to supply both units' HCVS loads for at least the first 24 hours. Before the batteries are depleted, the FLEX generator will supplement and recharge the battery to support operation of the HCVS. The ROS is designated as the alternate control location. Since control from the ROS does not require any electrical power, the solenoid valves do not need backup electrical power.

Missile Protection

In accordance with the design requirements, the ROS components and their supports must remain functional post seismic and tornado events. For the tornado event, both tornado wind and missile impact must be considered. The LSCS ROS is located within the safety related and seismic category I Auxiliary Building, protected from all design basis missiles.

Temperature Analysis

Section B.2 of UFSAR Table 3.11-22 provides the temperature versus time for the 4160-V Switchgear Bus 142X/242X area following a loss of ventilation. The ROS is located near Switchgear Busses 142X and 242X. Even with the maximum initial temperature 106°F, the area temperature does not exceed 120°F for at least 150 hours. This temperature is conservatively high for it includes heat loads that will not be present during an ELAP. The minimum temperature at the ROS is expected to be no lower than 50°F based on the thermal capacitance of the concrete structure surrounding the ROS.

Seismic Evaluation

In accordance with the ROS design requirements, the ROS equipment must remain functional post SSE seismic and tornado events. The ROS is located in the seismic category I Auxiliary Building, and all components at the ROS are seismically supported and qualified to function post SSE. The portions of the HCVS that support FLEX (i.e. anticipatory venting) are designed and qualified to the re-evaluated seismic hazard, identified by the new Ground Motion Response Spectra (GMRS) (Reference ECs 392353 and 397691, DCS Section 4.1.4.3).

POS and ROS Dose Assessment Evaluation

Maximum dose rates and integrated doses are determined for the Unit 1 POS, Unit 1 ROS, Unit 2 POS, and Unit 2 ROS, which are the personnel habitability areas required for Unit 1 Phase I HCVS and Unit 2 Phase I HCVS. The Unit 1 POS and Unit 2 POS are located in the MCR, so they are acceptable from a radiological habitability perspective with no further analysis required.

Operators are also required to access the Auxiliary Building Unit 1 and Unit 2 ROS at Elevation 731' (the common battery is located near the Unit 2 ROS) and the associated travel paths in order to operate the HCVS following a BDBEE. Analysis L-004115, "HCVS Phase I Dose Assessment," demonstrates that dose to the operators will be less than the 5 Rem limit over the 7 days following the event.

The integrated dose at the Unit 1 ROS is calculated to be approximately 1.609 rem. The integrated dose at the Unit 2 ROS is calculated to be approximately 0.3744 rem. Both of these areas are continuously habitable since the integrated doses are less than the 5-rem acceptance criterion for continuous habitability. Refer to calculation L-004115.

Accessibility

The ROS is located on EL 731 in the AB, directly below the MCR at EL 768. The following snapshots from calculation L-004115 show the operator pathway between the POS and ROS. The AB is a safety related and seismic category I structure, protected from heat, radiation, and missiles. Therefore, the ROS would be readily accessible during a Severe Accident.

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2.6 Personnel Transit Pathways to Access ROS Following HCVS Operation

Personnel traverse the pathway between the Main Control Room (MCR) and the Unit 1 or Unit 2 Remote Operating Station (ROS) locations. The pathways between the MCR and ROS locations are based on drawings A-191, A-189, A-187, and A-185 (References 4.15, 4.16, 4.17, and 4.67, respectively).

Figures 2.1, 2.2, 2.3, and 2.4 show the transit pathway between the MCR and the ROS locations. The transit pathways between the Unit 1 or Unit 2 ROS locations and the MCR are simply the reverse of the displayed paths. Operators may also exit the control room using the central doors just south of Column 15 and utilize stairwell A2 (References 4.9 and 4.57), but it is not necessary to separately evaluate the pathway because the dose rate field near Row 'R' in the Auxiliary Building (AB) does not vary greatly due to operation of the HCVS nor shine from the containment vacuum breakers.

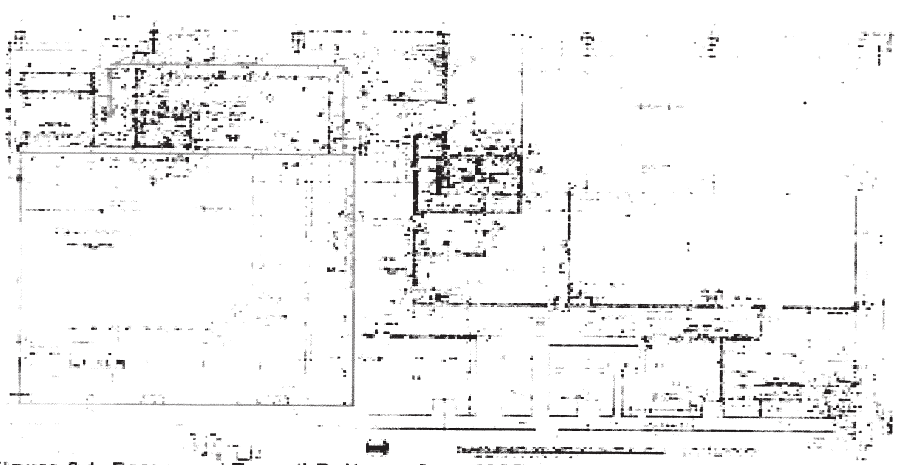

Figure 2.1 Personnel Transit Pathway from MCR to ROS Locations – AB El. 768'-0"

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Figure 2.2 Personnel Transit Pathway from MCR to ROS Locations – AB El. 749'-0"

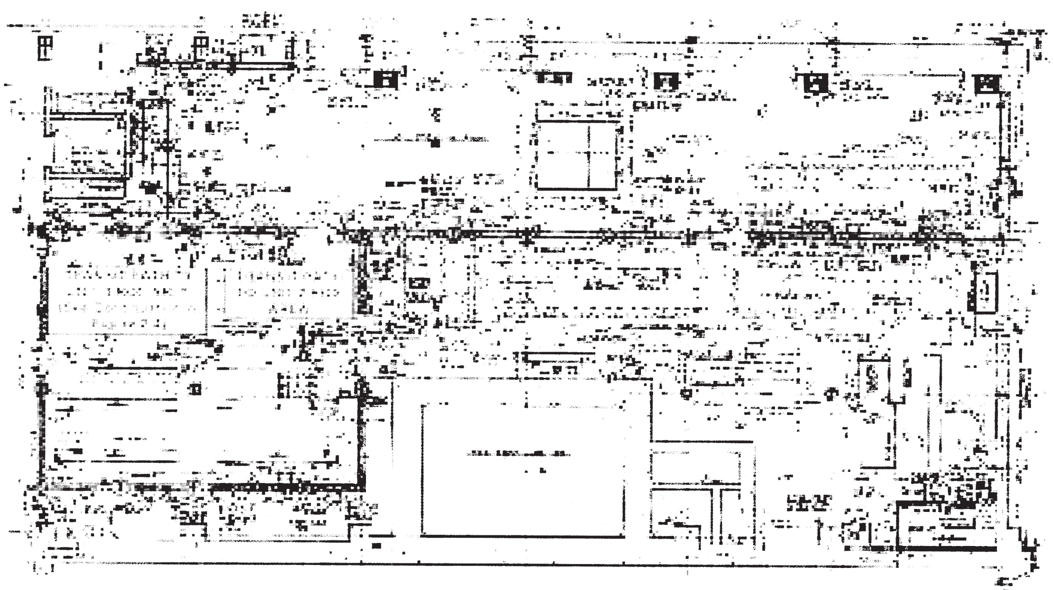

Figure 2.3 Personnel Transit Pathway from MCR to ROS – AB El. 731'-0"
(Stairwell Area to Unit 1 and 2 ROS Areas)

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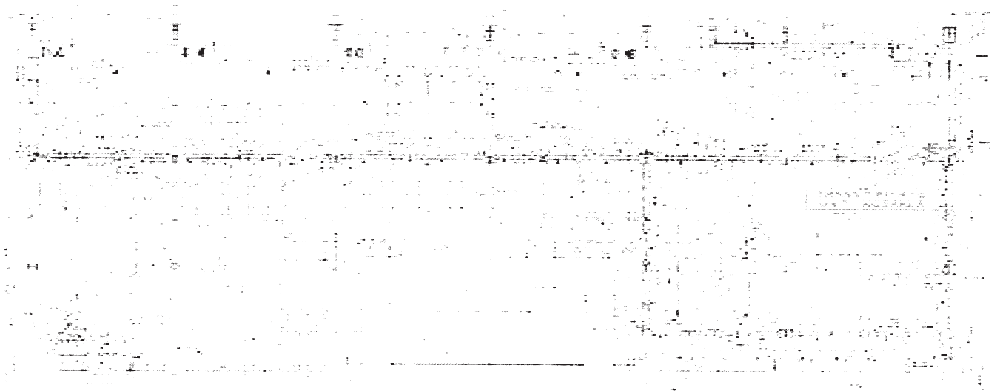


Figure 2.4 Personnel Transit Pathway from MCR to ROS – AB El. 731'-0"
(Stairwell Area to Unit 1 ROS Area – Continued from Figure 2.3)

Radiation Monitor and Temperature Element

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

Oxygen Monitoring

An oxygen monitoring system has been installed for each ROS location for U1 and U2 to alert personnel of a low oxygen environment due to a gas release from the ROS argon compressed gas bottles. The oxygen monitors at the ROS are non-safety and non-seismic as they are not required under EA-13-109 – the personnel safety concern is during normal operation when argon header pressure is not continuously monitored. The oxygen monitoring system will alert (via strobe lights and horns) any personnel in the area when the oxygen concentration at the bottle area in the ROS is below 19.5%. Details of oxygen monitoring are provided in EC 397691 (U1) and EC 392353 (U2) DCS sections 4.1.35 and 4.1.19 respectively.

Design Temperature and Pressure

The HCVS system provides sufficient venting capacity to prevent a long-term overpressure failure of the containment by keeping the containment pressure below the containment design pressure. The system is protected from the effects of BDBE and capable of functioning for sustained operation during an ELAP. The HCVS piping and components have been selected based on their ability to withstand the pressure and temperature expected during a severe accident. The vent line and components subjected to venting pressure have been designed to the PCPL pressure of 60 psig (which exceeds the containment design pressure) and a design temperature of 350°F (as recommended in Section 2.4.6 of NEI 13-02). The HCVS vent line has been sized based on containment design pressure of 45 psig, which is the lesser of PCPL or Containment Design Pressure. Details of the HCVS design and its capability to withstand and remain functional during severe accident conditions are provided in ECs 397691 and 392353, DCS Sections 4.1.5, 4.1.14 and 4.1.19. Based on the information provided in the EC, requirements of NEI Section 4.1.1, to provide a system capable of withstanding and remaining functional during severe accident conditions, are met.

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 LSCS 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 30), 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. Slowly open, all Nitrogen bottle stop valves (2)	ROS – U1(2) AB EL 731	
2. Unlock and open 1(2)PC431, HCVS NITROGEN SUPPLY VALVE.	ROS – U1(2) AB EL 731	
3. Slowly open, all Argon bottle stop valves. (16)	ROS – U1(2) AB EL 731.	
4. Unlock and open 1(2)PC520, HCVS ARGON SUPPLY ISOLATION VALVE.	ROS – U1(2) AB EL 731.	
5. Unlock and open 1(2)PC516, HCVS ARGON SUPPLY DOWNSTREAM ISOLATION VALVE.	ROS – U1(2) AB EL 731.	
6. At 0PM08J, place to ON keylock switch 1(2)HS-PC415 HCVS POWER FEED	MCR 0PM08J Panel	
7. At 0PM08J OPEN 1(2)PC009A, HCVS INBOARD PCI VALVE	MCR 0PM08J Panel	Also closes 1(2)PC514 to isolate leak-off path U/S of rupture disk.
8. OPEN for 8 seconds then CLOSE 1(2)PC525B, HCVS ARGON PURGE SOV BYPASS VALVE	MCR 0PM08J Panel	Rupture vent line rupture disk
9. OPEN 1PC010A, HCVS OUTBOARD PCI VALVE	MCR 0PM08J Panel	Begin venting
10. CLOSE 1PC010A only, HCVS OUTBOARD PCI VALVE	MCR 0PM08J Panel	Stop venting
11. At 0PM08J OPEN for 56 seconds then CLOSE 1(2)PC525A, HCVS ARGON PURGE SOV	MCR 0PM08J panel	Purge vent line

Primary Action	Primary Location/ Component	Notes
12. Monitor electrical power status and HCVS conditions.	MCR 0PM08J panel or ROS	Electrical power not required for alternate control.
13. Connect back-up power to HCVS battery charger from FLEX Diesel Generator.	ROS	Prior to depletion of the dedicated HCVS batteries (not less than 24 hours from initiation of ELAP).
14. Replenish pneumatic supply with replacement N2 bottles and/or portable air compressor stored in FLEX Building. Replenish purge supply with replacement Argon bottles from the FLEX Building.	ROS	Installed supplies have sufficient capacity for the first 24 hours post-ELAP.

Permanently installed electrical power and pneumatic supplies are available to support operation and monitoring of the HCVS for a minimum of 24 hours. No portable equipment needs to be utilized 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 and Argon 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 Prevents Containment Venting?**
Fail to Vent (Open) on Demand	Valves fail to open due to loss of HCVS DC power	Manually bypass solenoids at ROS 731'AB EL.	No
	Valves fail to open due to depletion of HCVS battery.	Manually bypass solenoids at ROS 731'AB EL and recharge battery with FLEX generator.	No
	Valves fail to open due to depletion of Nitrogen pneumatic supply	Replenish Nitrogen bottles	No
	Valve fails to open due to SOV failure	Manually bypass solenoids at ROS 731' AB EL.	No
Fail to stop venting (Close) on demand	Not credible as there is not a common mode failure that would prevent the closure of at least 1 of the 2 valves needed for venting.	N/A	No
Spurious Opening	Not credible as key-locked switches prevent mispositioning of the HCVS PCIVs. Also, locked closed nitrogen isolation valves prevent pneumatic supply to the PCIVs.	N/A	No
Spurious Closure	Valves fail to remain open due to depletion of dedicated power supply.	Manually bypass solenoids at ROS 731'AB EL and recharge battery with FLEX generator.	No
	Valves fail to remain open due to depletion of pneumatic supply.	Replace bottles as needed and/or recharge with portable air compressors.	No

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

Evaluation:

Primary control of the HCVS is accomplished from the main control room. Alternate control of the HCVS is accomplished from the ROS at the 731' elevation of the auxiliary building. FLEX actions that will maintain the MCR and ROS habitable were implemented in response to NRC Order EA-12-049 (Reference 31) and are specified in LOA-FSG-005. These actions include:

1. Restoring MCR ventilation via the FLEX DG. The MCR ventilation loads were included in FLEX DG load calculations.

2. Opening MCR doors to the auxiliary building (AB) (if required).

3. Operating portable fans to move AB air through the MCR (if required).

4. Opening doors in the Division 1 and 2 switchgear rooms to the diesel generator roof and establish air flow into the AB.

5. Opening doors between the AB stairways to the Division 1 and 2 switchgear rooms and establish air flow.

6. Opening doors in the Division 1 switchgear rooms to the turbine building to establish air flow.

7. Portable fans are installed to assist in air movement through the AB.

Table 2 contains a thermal evaluation of all the operator actions that may be required to support HCVS operation. The relevant evaluations (Reference ECs 392353 and 397691 DCS Section 4.1.14) demonstrate that the final design meets the order requirements to minimize the plant operators' exposure to occupational hazards.

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

Evaluation:

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

Alternate control of the HCVS is accomplished from the ROS. The ROS was evaluated for radiation effects due to a severe accident and determined to be acceptable. The ROS is located in a low dose area during normal operation.

The integrated dose at the Unit 1 ROS due to a Severe Accident is calculated to be approximately 1.609 rem. The integrated dose at the Unit 2 ROS is calculated to be approximately 0.3744 rem. Both of these areas are continuously habitable since the integrated doses are less than the 5-rem acceptance criterion for continuous habitability.

L-004115 Rev. 3 “HCVS Phase 1 Dose Assessment” 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 main control room. Under the postulated scenarios of order EA-13-109 the control room is adequately protected from excessive radiation dose and no further evaluation of its use is required (HCVS-FAQ-06).

Alternate control of the HCVS is accomplished from the Remote Operating Station (ROS). The ROS is in an area evaluated to be accessible before and during a severe accident.

For ELAP with injection, the HCVS wetwell vent will be opened to protect the containment from overpressure. The operator actions to perform this function under ELAP conditions were evaluated as part of LSCS response to NRC Order EA-12-049 as stated in the FLEX Final Integrated Plan (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 evaluations (Reference ECs 392353, 397691 DCS Section 4.1.14 and L-004115 Rev. 3 "HCVS Phase 1 Dose Assessment") demonstrate that the final design meets the order requirements to minimize the plant operators' exposure to occupational and radiological hazards.

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

1.2 The HCVS shall include the following design features:

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

Evaluation

Calculations L-004097 and L-004149 contain the verification of 1% power flow capacity at the lesser of the primary containment design pressure and the Primary Containment Pressure Limit (PCPL). These analyses were performed by RELAP5 models created for the HCVS piping and fittings.

Note that the design pressure and PCPL are based on the pressure in the drywell, so hydrostatic head must be considered when determining the pressure above the suppression pool water level where the HCVS system is attached to the wetwell. The steady state venting capacity of the HCVS was determined at a wetwell vapor space pressure of 38 psig, which corresponds to PCPL in the drywell reduced by the hydrostatic head of water above the downcomers connecting the drywell and wetwell with the maximum amount of water in the suppression pool (including RCS inventory and thermal expansion). Note that the wetwell will not be filled completely with water due to HCVS Phase 2 SAWM. However, for conservatism, the lower value of 38 psig is used. A higher wetwell air space pressure will result in higher flow rates through the vent line.

For U1, at a venting pressure of 38.4 psig, the HCVS can vent 151,351 lbm/hr of steam. At 1% reactor thermal power, the required vent capacity is 150,700 lbm/hr. For U2, at a wetwell pressure of 38.1 psig, the HCVS can vent 152,464 lbm/hr of steam. At 1% reactor thermal power, the required vent capacity is 150,650 lbm/hr. Therefore, both units' vent designs can accommodate a saturated steam flow rate equivalent to one percent licensed rated power.

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 primary containment vacuum breaker line. The vent lines for both units are 12" diameter pipes connected to the existing 24" wetwell to primary containment vacuum breaker line accessible from the EL 740' in Reactor Building. The 12" vent pipes penetrate the Reactor Building at an elevation of 755'-5" and enter a 12"x14" reducer (44'-11" above the plant grade of 710'-6"). Section 4.1.5.2 of NEI 13-02, Rev. 1 requires that, if the release from HCVS is through a stack different than the plant meteorological stack, the elevation of the stack should be higher than the nearest power block building. For LSCS, the top of the HCVS pipe is 902'-8.5" and the top of the roof parapet is 894''-4", resulting in a release point 8' -4.5" higher than the reactor building roof parapet as shown below. This satisfies the guidance for height from HCVS-FAQ-04. 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 at the 842 ft elevation which is approximately 60 feet below the HVCS pipe outlet. This intake is approximately 130 horizontal feet from the Unit 1 and U2 vent pipes, which would require the intake to be approximately 26 feet below the vent pipe. Therefore, the vent pipe is appropriately placed relative to this air intake.

The vent pipe extends approximately 8 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. LSCS 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.

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

1. The two HCVS vent lines exit the reactor building at EL 755'-5" (approximately 45' above the plant grade). Therefore, none of the HCVS vent pipe outside the RB is less than 30 feet above grade.

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

   a. The total vent pipe exposed area is about 275 square feet for Unit 1 and 252 square feet for Unit 2, less than the acceptance criterion of 300 square feet.

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

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

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

4. LSCS screens out for hurricanes as a credible threat.

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

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

Evaluation

The HCVS for Units 1 & 2 for LSCS are fully independent of each other. Therefore, the status at each unit is independent of the status of the other unit. The two vent lines are supported by a common tower but hydraulically there is no cross tie between them.

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

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

Evaluation

The HCVS is initiated via manual action at the ROS combined with manual control from either the MCR or the ROS at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms.

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

Evaluation

To meet the requirement for an alternate means of operation the ROS 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. This provides a diverse method of valve operation in accordance with order requirements.

The location for the ROS is in the Auxiliary Building at EL 731'. Each unit has a separate ROS area. The ROS is readily accessible from MCR.

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.

Electrical power required for operation of HCVS components in the first 24 hours will come from the common, dedicated HCVS 125 VDC battery. This battery is permanently installed on the 731' EL of the Unit 2 side of the Auxiliary Building. The battery is protected from screened in hazards and have sufficient capacity to provide this power without recharging. Calculation L-004114 demonstrates that the 125VDC battery capacity is sufficient to supply HCVS wetwell venting components for 24 hours. After 24 hours, FLEX generators can be connected to the HCVS battery charger via transfer switch to recharge the HCVS battery. EC 392353 concludes that the installation of these batteries would not result in an unacceptable level of hydrogen concentration in this area following a severe accident requiring HCVS operation. ECs 396062 (U1) and 396069 (U2) evaluated the FLEX DG loading. The U2 FLEX DG had unused margin of 418 amps and the U1 FLEX DG had unused margin of 337 amps. Per EC 392353, the HCVS battery charger input breaker is rated at 15 amps. Therefore, sufficient margin exists on either FLEX DG to repower both units' HCVS. 125VDC battery voltage status will be indicated on the HCVS battery chargers so that operators will be able to monitor the status of the 125VDC batteries. Attachment 3 shows a diagram of the HCVS electrical distribution system.

The pneumatic motive force is provided by two nitrogen bottles in each ROS. Per calculations L-004117 and L-004184, the 2 nitrogen bottles can stroke 1(2)PC009A one time and 1(2)PC010A at least eight (8) times when the initial pressure in the nitrogen bottles is at least 2000 psig. This is sufficient for the required 8 vent cycles in the first 24 hours post-ELAP.

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

Evaluation

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

The containment isolation valves must be opened to permit vent flow. The PCIVs are air-to-open, spring-to-close, fail-closed AOVs. The physical features that prevent inadvertent actuation are the key-lock switches at the 0PM08J panel in the MCR (for the pneumatic supply SOVs) and locked-closed pneumatic supply manual isolation valves at the. 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 in the MCR for HCVS valve position, vent pipe temperature, and effluent radiation levels, as well as argon supply header pressure.

This monitoring instrumentation provides the indication from the MCR per Requirement 1.2.4. In an ELAP, the HCVS controls and indication will be supplied by the HCVS 125VDC battery and designed for sustained operation using the FLEX generator.

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

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

1.2.9 The HCVS shall include a means to monitor the effluent discharge for radioactivity that may be released from operation of the HCVS. The monitoring system shall provide indication from the control panel required by 1.2.4 and shall be designed for sustained operation during an extended loss of AC power.

Evaluation

The HCVS radiation monitoring system consists of an ion chamber detector on the 740' EL of the RB, coupled to a process and control module, mounted in the ROS at the Auxiliary Building 731' elevation. The MCR has radiation indication at the 0PM08J panel 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 Auxiliary Building ROS. Both components are qualified for the seismic requirements. Table 1 includes a description and qualification information on the radiation monitor.

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

Evaluation

The drywell-to-wetwell containment vacuum breaker line 1(2)PC01AA, which provides the wetwell connection for the HCVS vent path, has a design pressure of 32 psig and temperature of 350 °F (including the 24"x24"x12" reducing tee where the HCVS ties in). New HCVS piping and components are designed to 60 psig (PCPL) and 350 °F (Refer to calculations 064055(EMD) and 062315(EMD)). The rupture disc 1(2)PC302 is designed to burst at 20 psig.

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.

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. After initial line-up to open locked supply isolation valves 1(2)PC516 and 1(2)PC520 at the ROS and opening all individual argon bottle stop valves, the system can be operated from the MCR by keylock switch to energize the solenoid valve 1(2)PC525A. Per L-004137 and L-004185, a 2-second purge time is required to burst the rupture disc. For purging the combustibles after a vent cycle, a 56-second purge time has been calculated for Unit 1 and 55-second purge time for Unit 2.

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 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.

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

Table 3-3: Testing and Inspection Requirements

Description	Frequency
Cycle the HCVS valves[1] and the interfacing system valves not used to maintain containment integrity during operations.	Once per every[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 drywell-to-wetwell containment vacuum breaker line 1(2)PC01AA, which provides the wetwell connection for the HCVS vent path, has a design pressure of 32 psig and temperature of 350 °F (including the 24"x24"x12" reducing tee where the HCVS ties in), consistent with the design basis of the plant. New HCVS piping and components, including the PCIVs, are designed to 60 psig (PCPL) and 350 °F (Refer to calculations 064055(EMD) and 062315(EMD)). The HCVS downstream of the reducing tee and including the two PCIVs are designed to the bounding Design Basis or BDB 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 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.

LSCS 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 LSCS 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 were 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.

LSCS 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 along with instrumentation and procedures to ensure that the wetwell vent is not submerged. 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 system, shown on Attachment 4, uses FLEX flow paths from the lake to the reactor building, and injects to the Reactor Pressure Vessel (RPV). The system consists of FLEX Portable Diesel Driven Pump (PDDP) and SAWA RPV Supply Portable Flow Meter, wetwell level indication in the MCR, and various lengths of hose.

The SAWA injection path starts at the Ultimate Heat Sink (UHS) where the FLEX PDDP suction will be submerged near the Lake Screen House intake, outside the protected area. Underground piping has been installed to communicate discharge from the pump to inside the protected area. Lay-flat hose is routed from discharge of the PDDP to underground piping and then to reactor building/diesel generator vestibule penetration.

Inside the diesel generator vestibule, the hose is connected to the SAWA RPV Supply Portable Flow Meter cart ("SAWA cart"). The cart consists of a wye connection, flow meter, and requisite lengths of straight pipe for accurate flow measurement.

The SAWA injection path uses the 'B' Fuel Pool Emergency Make-up (FC-EMU) system piping. Hose is routed between the SAWA cart and FC-EMU piping located on 710'-6" EL of the diesel generator corridor. A second hose is installed between FC-EMU piping and Residual Heat Removal (RHR) system piping in reactor building at 761' EL. Valves inside the reactor building will be lined-up so that water can be injected in to the RPV via 'B' RHR Low Pressure Coolant Injection (LPCI) system piping. BWROG generic assessment, BWROG-TP-15-008 (Reference 37), provides the principles of Severe Accident Water Addition to ensure protection of containment. This SAWA injection path is qualified for the all screened in hazards (Section 1) in addition to severe accident conditions.

Once the hose deployment and valve line-up are complete, all actions of flow control and measurement will be performed in the diesel generator corridor and vestibule, which have been evaluated to be low dose areas per calculation L-004151. Operators at this location will be in communication via FLEX protocols with the MCR where other parameters, such as suppression pool level, are monitored. Operators at the SAWA pump and SAWA cart will be in low dose areas when no equipment manipulation is needed.

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 line-up valves to establish the SAWA flow path and perform breaker alignment and load shedding per SBO procedures. These actions can be performed before the dose is unacceptable, under the worst-case scenario within the first hour after the loss of RPV injection. This time was validated as part of the Time Sensitive Action validation for EA-13-109.

Procedure LOA-FSG-003 directs actions that must be done early in the severe accident event where there is a loss of all AC power and a loss of all high-pressure injection to the core. In this event, core damage is not expected for at least 1 hour so that there will be no excessive radiation levels or heat related concerns in the RB when the above actions are implemented. The other SAWA actions all take place outside the RB at the UHS, MCR, DG Corridor and Vestibule, RB outer wall, FLEX Buildings, and the deployment pathways. Since these locations are outside the RB, they are shielded from the severe accident radiation by the thick concrete walls of the RB. Once SAWA is initiated, the operators will monitor the 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 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 suppression pool to the point where the wetwell vent is submerged.

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

LSCS 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 suppression chamber freeboard volume is at least 1.23 million gallons (Reference 28). BWROG generic assessment BWROG-TP-15-011, provides the principles of Severe Accident Water Management to preserve the wetwell vent for a minimum of seven days. After containment parameters are stabilized with SAWA flow, SAWA flow will be reduced to a point where containment pressure will remain low while wetwell level is stable or very slowly rising. MAAP analysis LS-MISC-034 shows the suppression pool water level reaching approximately 38.5 feet above the bottom of the wetwell (~elevation 711.9 ft.) over the course of the 7-day event, resulting in 12 feet of freeboard level to the inlet of the HCVS vent pipe at 724 feet. A diagram of the available freeboard is shown on Attachment 1.

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

The upper range of wetwell level indication on 1(2)LI-CM192 credited for Severe Accident scenarios is 712 feet elevation (EC 618667 & EC 620478), which is the maximum elevation reached by wetwell level during the sustained operating period per SAWA MAAP analysis (LS-MISC-034).

Section IV.C.6: Wetwell vent service time

LSCS MAAP evaluation LS-MISC-034 and BWROG-TP-15-011 (Reference 38), 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 LSCS 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 LSCS 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 Appendix E, LSCS has validated that the FLEX 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.

LSCS MAAP analysis (LS-MISC-034) demonstrates 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

LSCS will accomplish SAWA flow control by the use of throttle valves 1(2)FC030AN. The operators at the SAWA cart will be in communication with the MCR via radios or unaffected telephones, 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. LSCS utilizes LOA-FSG-010, "FLEX Communication" to communicate between the MCR and remote locations, for example using sound powered phone system.

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

Section IV.C.9.1: SAWA Pump

LSCS uses two portable diesel-driven pump (PDDP) for FLEX and SAWA strategies for all BDBEEs. As documented in L-003961, each pump has been shown to be individually capable of supplying the required flow rates to the RPV, Suppression Pool and Spent Fuel Pool for all SAWA and FLEX scenarios. LSCS has procured two identical PDDPs that are trailer mounted. Each trailer has diesel driven hydraulic unit, hydraulically driven submersible pump, a crane to deploy the pump, instrumentation, and hydraulic hose reels. This fully contained pump unit is key to a rapid deployment of the pump in the UHS. The FLEX pumps are stored in a robust FLEX building located outside the protected area near the Lake Screen House.

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

The initial SAWA flow will be injecting to the RPV within 8 hours of the loss of injection. The initial flow rate is 500 gpm for 4 hours, followed by a reduction to 100 gpm, based on the generic analysis referenced in NEI 13-02 (Reference 7), Section 4.1.1.2.1. The LSCS MAAP evaluation (LS-MISC-034) verifies that these flow rates successfully cool the core debris and prevent flooding of the wetwell vent.

Section IV.C.9.3: SAWA Pump Hydraulic Analysis

Calculation L-003961 shows that each FLEX pump has adequate capacity to meet the SAWA flow rates required to protect containment under various scenarios where either one or both units are under FLEX or SA conditions.

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

NEI 13-02, Rev. 1, Section 4.1.4.2 requires a means of backflow prevention for the SAWA/SAWM flow path into containment in order to prevent unintended cross flow and migration from containment into other areas within the plant. Existing safety related primary containment isolation check valves 1(2)E12-F041B provide a means of backflow prevention. Therefore, this guidance is satisfied. These valves are tested as a part of the In-service Testing (IST) program; therefore, additional testing is not required in accordance with HCVS-FAQ-05 and NEI 13-02 Section 6.2.3.3.

Section IV.C.9.5: SAWA Water Source

The water source for SAWA is the Ultimate Heat Sink (UHS), which is the undrainable volume of the LaSalle Cooling Lake. The total amount of water injected at the flow rates and timing identified in Section IV.C.9.2 is 1,056,000 gallons, which is approximately 3.24 acre-feet of water. Per UFSAR 9.2.1.3, the surface area of the UHS is 83 acres, meaning that if the UHS were only 1 ft deep, the required volume for SAWA injection would be an insignificant amount compared to the available volume in the UHS.

Based upon the above considerations, LSCS has ample supply of water to support FLEX/SAWA strategies for the sustained operating period.

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

Section IV.C.9.6.1: SAWA Pump Power Source

LSCS has procured two identical pumps that are trailer mounted. Each trailer has diesel driven hydraulic unit, hydraulically driven submersible pump, a crane to deploy the pump, instrumentation and hydraulic hose reels. This fully contained pump unit is key to a rapid deployment of the pump in the UHS. The hydraulic units are diesel driven. Each trailer has a double wall 375-gallon capacity tank. The full-load consumption of the diesel engine is 15.3 GPH. Thus, the pump will run for about 24 hours before refueling is needed. LSCS maintains sufficient supply of diesel fuel for a sustained operation for more than 7 days. LOA-FSG-009 provides guidance for fueling FLEX equipment including the FLEX pump. Both FLEX pumps are stored in a fully protected FLEX Building.

Since the pumps are stored in a protected structure, are qualified for the environment in which they will be used, and will be refueled by a qualified refueling strategy, they will perform their function to maintain SAWA flow needed to protect primary containment per EA-13-109.

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

Table 1 shows the electrical power source for the SAWA/SAWM instruments. For the instruments powered by the HCVS 125VDC battery, calculation L-004114 demonstrates that the batteries can provide power until the FLEX generator restores power to the battery charger.

There are no additional continuous loads on the FLEX DGs for SAWA and SAWM. The only new instrument is the SAWA Flow Meter, which is powered by an internal battery. The FLEX generator was sized with sufficient margin to carry all required FLEX loads plus intermittent other loads. This margin allows for repositioning of MOVs (in sequence) to align an injection pathway for SAWA. (Reference ECs 396062, 396069, 618667, and 620478.)

Section IV.C.10: SAWA/SAWM Instrumentation

1) A new portable digital based electromagnetic flow meter is required to

measure the flow rate of RPV injection. The flow meter is installed on the SAWA RPV Supply Portable Flow Meter/Indicator cart, stored in the DB vestibule.

2) The flow meter is designed for the expected flow rate, temperature, pressure and radiation for SAWA/SAWM over the period of sustained operation. The flow range for the selected model is 3.3 to 1100 GPM. This is acceptable because it bounds the SAWA/SAWM flow rates of 100 to 500 gpm. The flow meter is rated for 285 psi which exceeds the 250 psi maximum FLEX Pump discharge pressure.

   Per UFSAR Table 3.11-18, Harsh Environmental Zone H7 (Ref. Figure 3.11-1), service conditions during a loss of ventilation after loss of offsite power can reach 150 °F. The portable flowmeter is rated for an ambient temperature range of -4 to 140°F. Per the Note in UFSAR Table 3.11-18, temperature changes linearly from one-time step to the next; therefore, the expected time for the Diesel Corridor to reach 140°F is approximately 180 hours following a loss of ventilation. Since SAWA has a sustained operation of 168 hours (7 days) this time supports the use of the portable flow meter for SAWA/SAWM, and the maximum expected temperature for SAWA would be less than 140°F. Consistent with procedure LOA-FSG-005 “Area Ventilation”, ventilation fans are available to reduce the temperature of the Diesel Corridor.

   The flow meter is generally rugged, is stored within a Class I Structure (i.e., the diesel building) in an area protected from non-seismic equipment that could fall on the cart, and the cart has a floor lock to prevent movement. These measures are consistent with HCVS-OGP-011 to ensure availability following a seismic event (Reference 41).

3) The unit is powered by an internal battery with a 10-year life. An additional battery pack is stored in a nearby FLEX Knaack box.

4) Containment pressure and wetwell level instrumentation will be repowered through their respective electrical buses by the use of the FLEX Diesel 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 initially by batteries until the FLEX generator is deployed and connected and then by FLEX generator systems for the sustained operating period. Note that other indications of these parameters may be available depending on the exact scenario.

The SAWA flow meter is a portable digital based electromagnetic flow meter installed on the SAWA cart and self-powered by internal batteries.

No containment temperature instrumentation is required for compliance with HCVS Phase 2. However, most FLEX electrical strategies repower other containment instruments that include drywell temperature, which may provide information for the operations staff to evaluate plant conditions under a severe accident and 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. These instruments are qualified per RG-1.97 Revision 2 (Reference 32) which is the LSCS committed version per UFSAR Section 7.5 as post-accident instruments and are therefore qualified for EA-13-109 events.

The SAWA flow meter is rated for continuous use under the expected ambient conditions and so will be available for the entire period of sustained operation. The flowmeter battery is rated for 10 years of continuous operation.

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

LSCS 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. Calculations L-004115 and L-004151 analyzed dose at different locations and times where operator actions will take place during FLEX/SAWA/SAWM activities. Key locations are MCR, ROS, DG Corridor and Vestibule, travel paths, UHS and deployment pathways. LOA-

FSG-005 provides guidance for ventilation strategies at various location to mitigate high temperature conditions, including use of ice vests.

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

The FLEX pumps are stored in FLEX Building 23 outside the PA. Because it and the UHS are east of the RB, they will be exposed to shine from the HCVS. Calculation L-004151 determined the peak dose rate at the FLEX pump deployment location, and integrated dose was evaluated in EC 618667. The evaluation determined that refueling and periodic monitoring of the FLEX pump may be performed without exceeding the ERO limit for dose.

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 (Reference attachments to ECs 618667 and 620478). 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, LSCS used the results of calculations L-003968 and L-003969. These provide temperature response of the Reactor and Auxiliary Buildings during a BDB event.

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 flow path is aligned inside the RB, the operators can control SAWA/SAWM as well as observe the necessary instruments from outside the RB. Dose at the SAWA/SAWM locations has been evaluated in ECs 618667 and 620478. All SAWA/SAWM actions can be performed without exceeding ERO dose limits. Therefore, all SAWA controls and indications are accessible during severe accident conditions.

The SAWA pump and flow monitoring equipment can all be operated from outside the RB. The LSCS FLEX response ensures that the FLEX pump, FLEX generators and other equipment can all be run for a sustained period by refueling. Refueling during a Severe Accident was evaluated in EC 618667. The monitoring instrumentation includes SAWA flow at the SAWA cart, 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 LSCS 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
- LSCS does not rely on Containment Accident Pressure (CAP) to achieve net positive suction head (NPSH) for the Emergency Core Cooling System (ECCS) pumps.

LSCS 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 primary containment by rapid steam generation.
- Raising suppression pool water level above 712' elevation (top of scale) may result in loss of the suppression chamber vent capability.

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

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

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

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

<u>Section V.B</u>: HCVS Out of Service Requirements

Provisions for out-of-service requirements for FLEX and HCVS are provided in CC-LA-118-1001.

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

<u>NOTE</u>: 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 are 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,
  - Determine 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 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 were determined using a systematic analysis of the tasks to be performed using the Systematic 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

LSCS 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). LSCS will perform the first drill demonstrating at least one of the above capabilities by February 28, 2022 which is within four years of the first unit compliance with Phase 2 of Order EA-13-109, or consistent with the next FLEX strategy drill or exercise. Subsequent drills, tabletops or exercises will be performed to demonstrate the capabilities of different elements of Items 1, 2, and/or 3, above, that are applicable to LSCS 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	ML13130A067
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

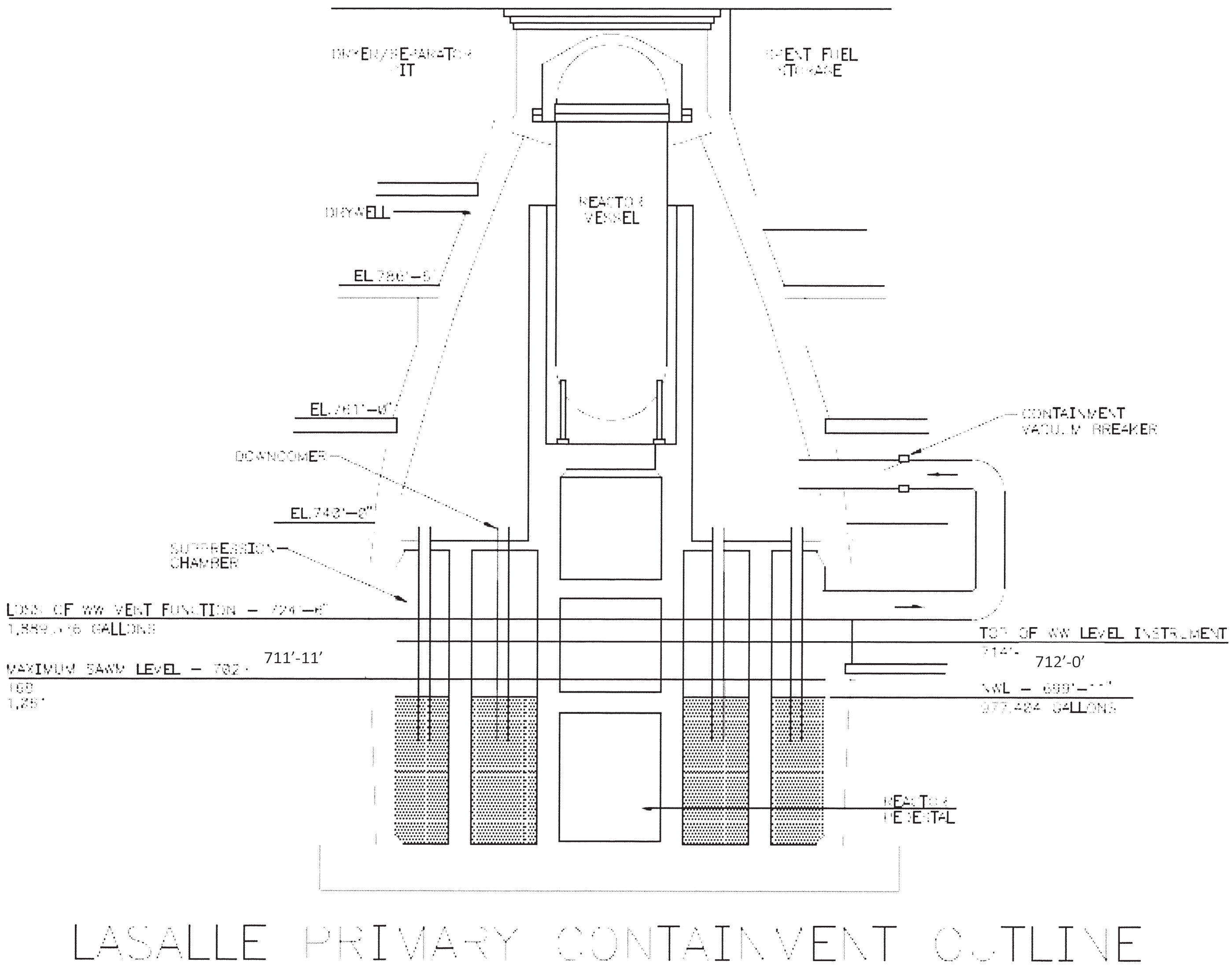
[6] Where two ADAMS accession numbers are listed, the first is the reference document and the second is the NRC endorsement of that document.

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

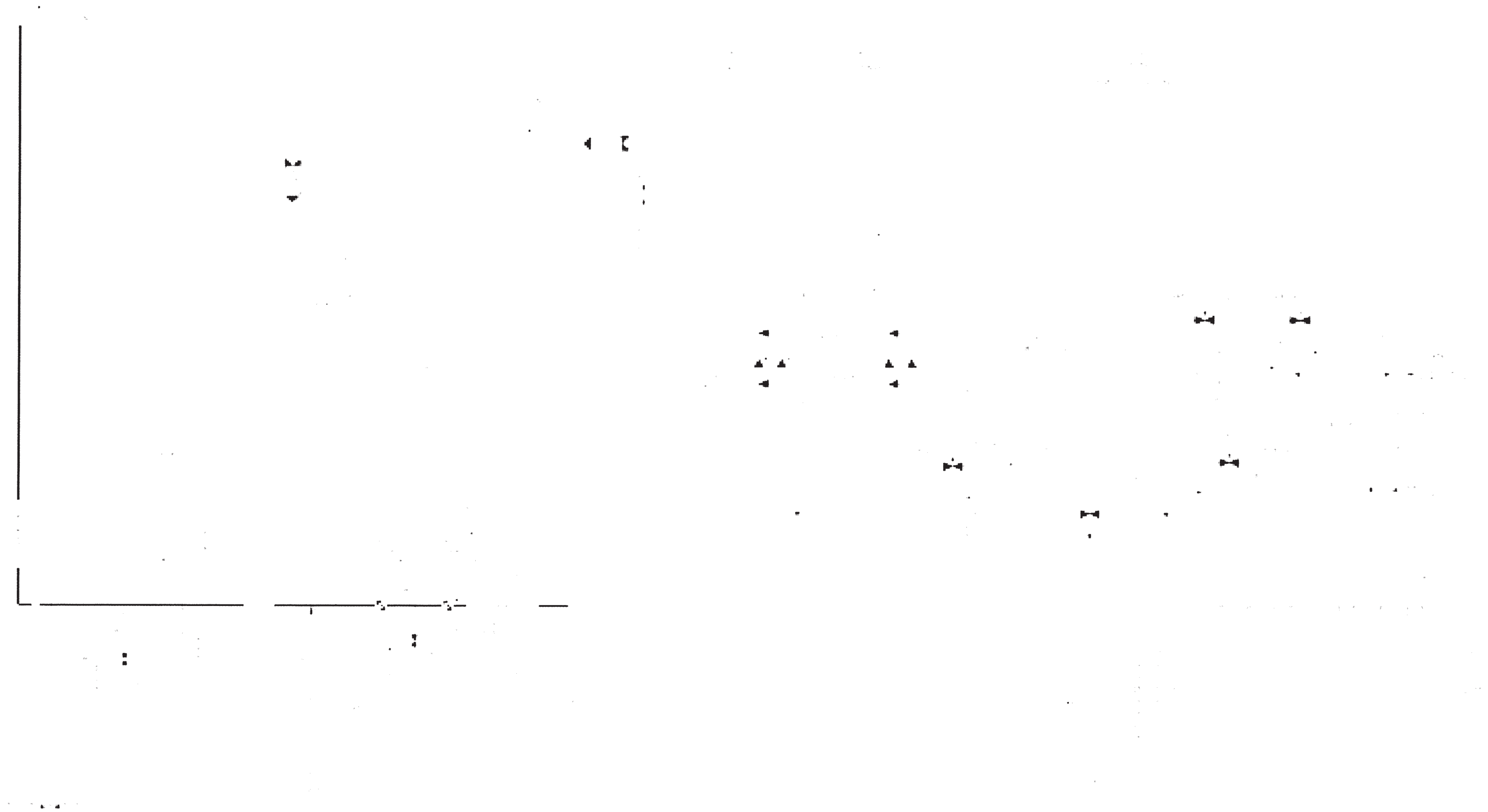
Number	Rev	Title	Location[6]
12. JLD-ISG-2013-02	0	Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions	ML13304B836
13. JLD-ISG-2015-01	0	Compliance with Order EA-13-109, Order Modifying Licenses 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)	ML14184A016
19. Phase 1&2 OIP	0	HCVS Phase 1 (Updated) & Phase 2 OIP	ML15352A109
20. Phase 1 ISE	0	HCVS Phase 1 Interim Staff Evaluation (ISE)	ML15084A180
21. Phase 2 ISE	0	HCVS Phase 2 Interim Staff Evaluation (ISE)	ML16110A368
22. 1st Update	0	First Six-Month Update, Dec. 2014	ML14351A450
23. 2nd Update	0	Second Six-Month Update, June 2015	ML15181A226
24. 4th Update	0	Fourth Six Month Update, June 2016	ML16182A394
25. 5th Update	0	Fifth Six Month Update, Dec. 2016	ML16349A439
26. 6th Update	0	Sixth Six Month Update, June 2017	ML17180A391
27. 7th Update	0	Seventh Six Month Update, Dec. 2017	ML18239A032
28. 8th Update	0	Eighth Six Month Update, June 2018	ML18173A072
29. Audit Report	0	Audit of Responses to ISE, Dec. 2017	ML17354B306
30. NEI 12-06	0	Diverse and Flexible Coping Strategies (FLEX) Implementation Guide	ML12221A205
31. 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
32. RG 1.97	2	Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Conditions During and Following an Accident	ML060750525

Number	Rev	Title	Location[6]
33. 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
34. Not used	N/A	N/A	N/A
35. N/A	0	LaSalle FLEX Final Integrated Plan Document, May 2018	N/A
36. OP-LA-102-106	12	LaSalle Station Operator Response Time Program	N/A
37. BWROG-TP-15-008	0	BWROG Fukushima Response Committee, Severe Accident Water Addition Timing, Sept. 2015	N/A
38. BWROG-TP-15-011	0	BWROG Fukushima Response Committee, Severe Accident Water Management Supporting Evaluations, Oct. 2015	N/A
39. TP-17-3-0375	0	BWROG Fukushima Response Committee Owners' Group Positions (OGPs), HCVS-OGP-001 through -003. Oct. 2017	N/A
40. TP-17-5-0375	0	BWROG Fukushima Response Committee Owners' Group Positions (OGPs), HCVS-OGP-005 through -008. Oct. 2017	N/A
41. HCVS-OGP-011	0	SAWA Portable Equipment Qualification	N/A

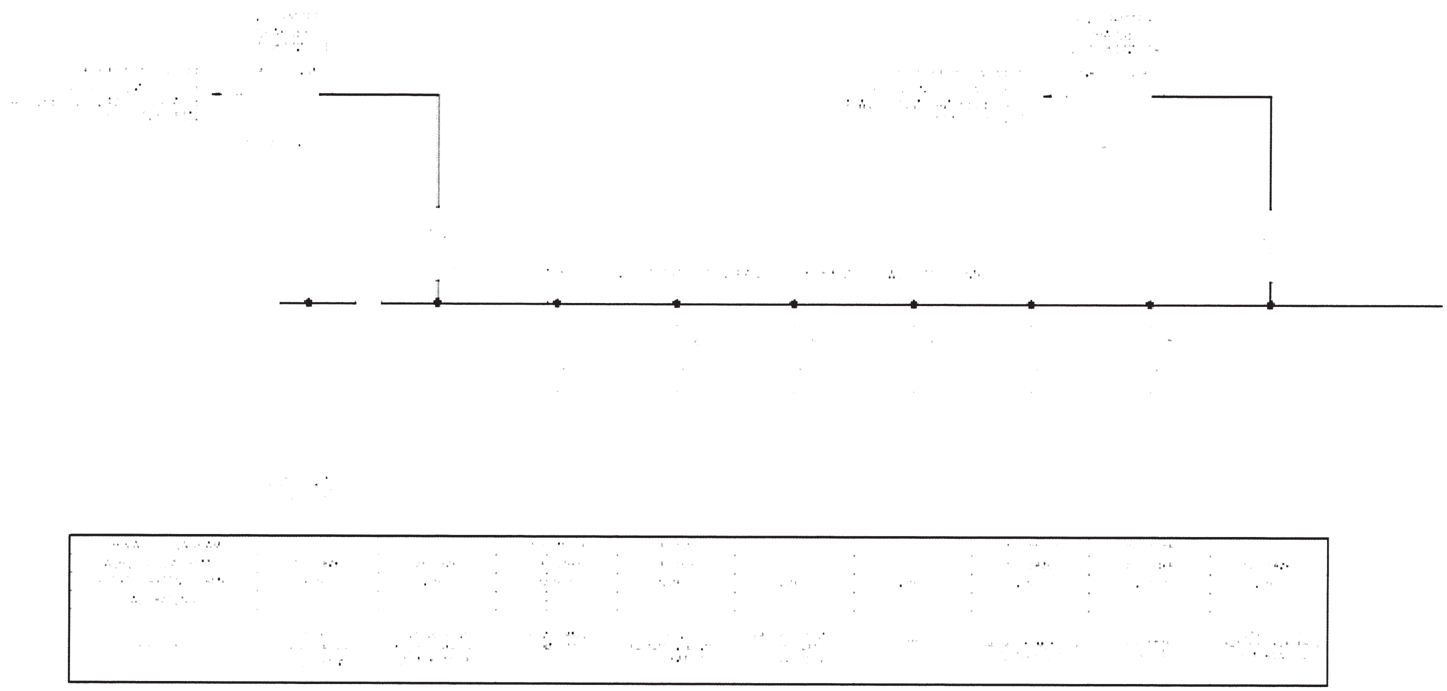
Attachment 1: Phase 2 Freeboard diagram



Attachment 2: One Line Diagram of HCVS Vent Path

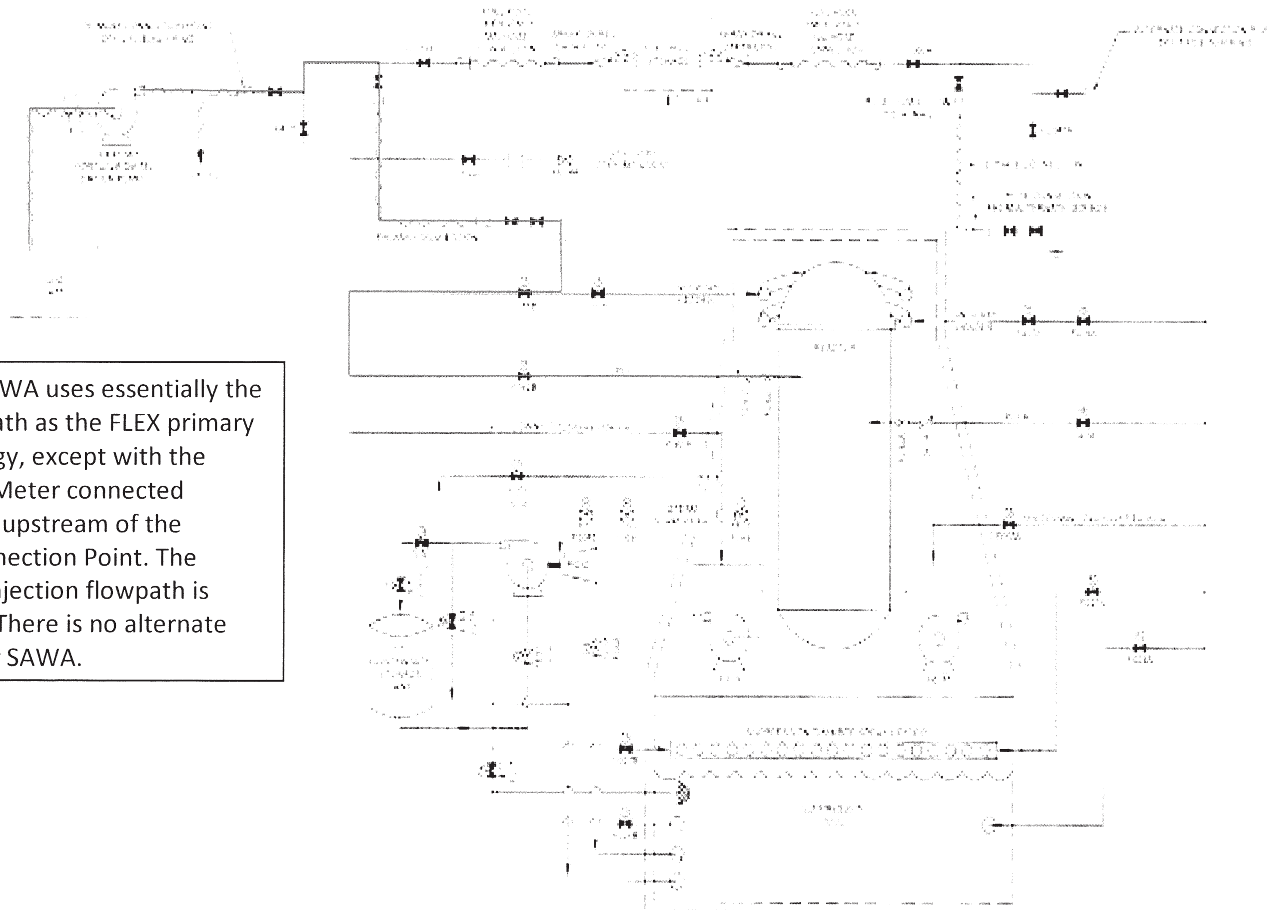


Attachment 3: One Line Diagram of HCVS Electrical Power Supply



<u>Attachment 4</u>: One Line Diagram of SAWA Flow Path

Note that SAWA uses essentially the same flow path as the FLEX primary water strategy, except with the SAWA Flow Meter connected immediately upstream of the Primary Connection Point. The SAWA RPV injection flowpath is highlighted. There is no alternate flow path for SAWA.



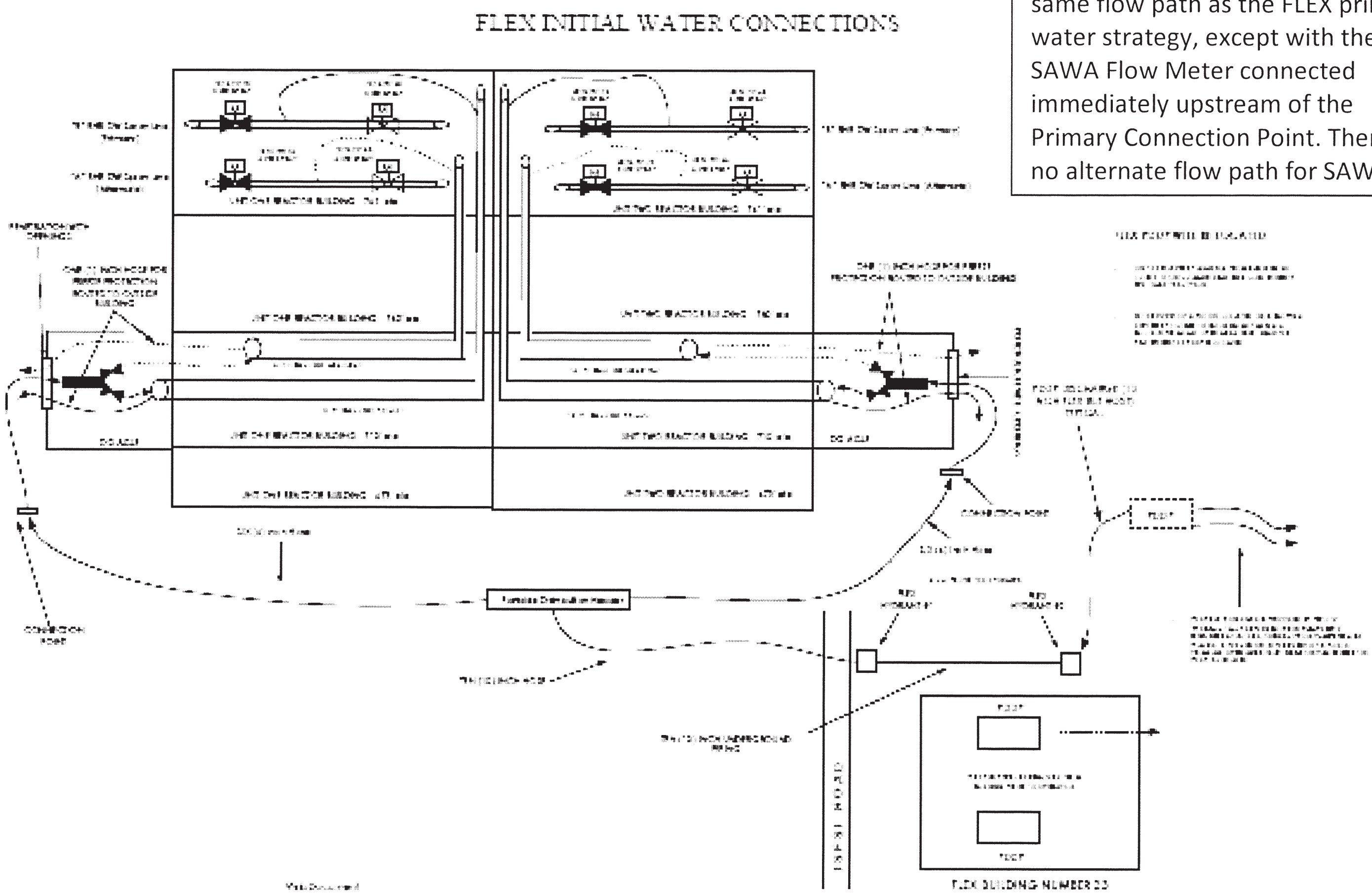
Attachment 5: One Line Diagram of SAWA Electrical Power Supply

Note that the only dedicated SAWA instrument, the SAWA flow meter, is powered via internal battery. However, SAWA does rely on containment parameters powered by station batteries and then FLEX diesel generators.

Attachment 6: Plant Layout Showing Operator Action Locations

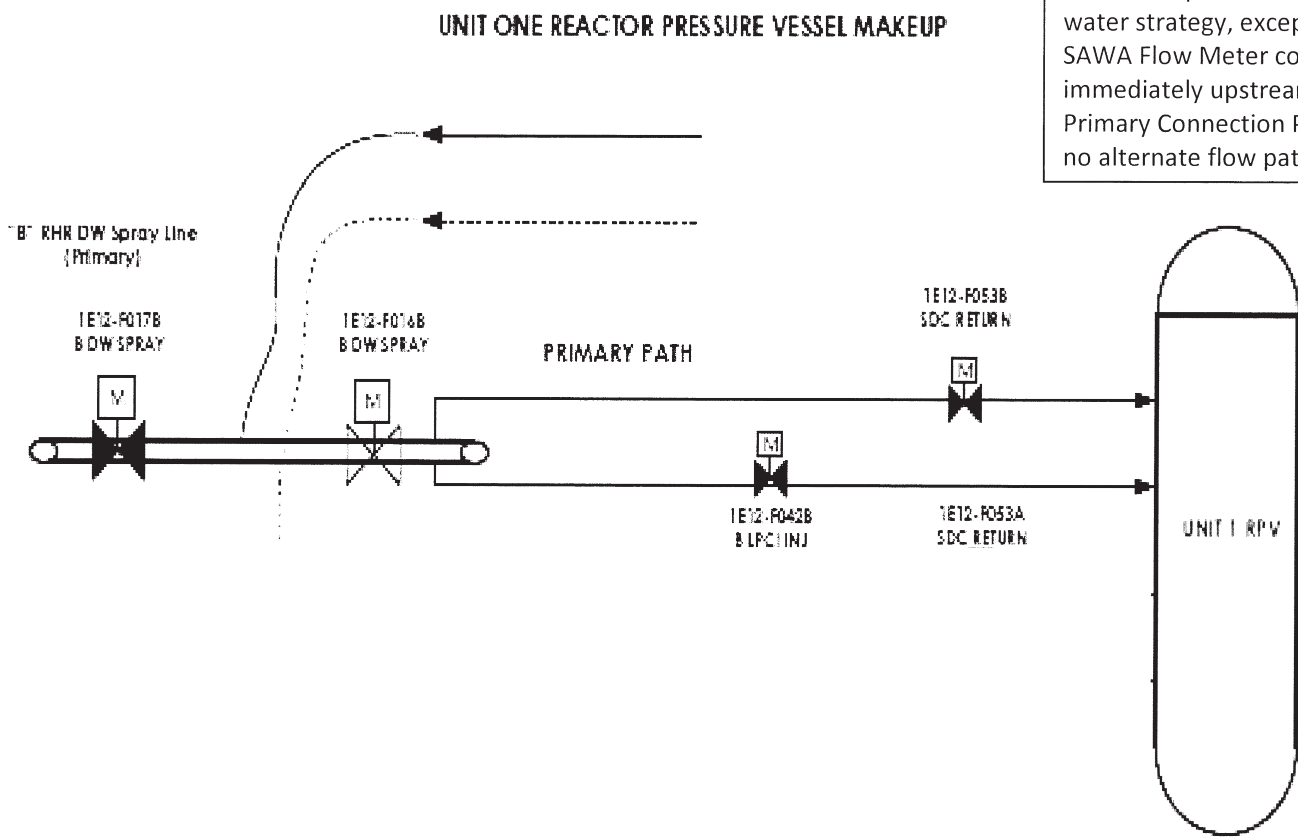
Attachment 6A

Note that SAWA uses essentially the same flow path as the FLEX primary water strategy, except with the SAWA Flow Meter connected immediately upstream of the Primary Connection Point. There is no alternate flow path for SAWA.



Attachment 6B

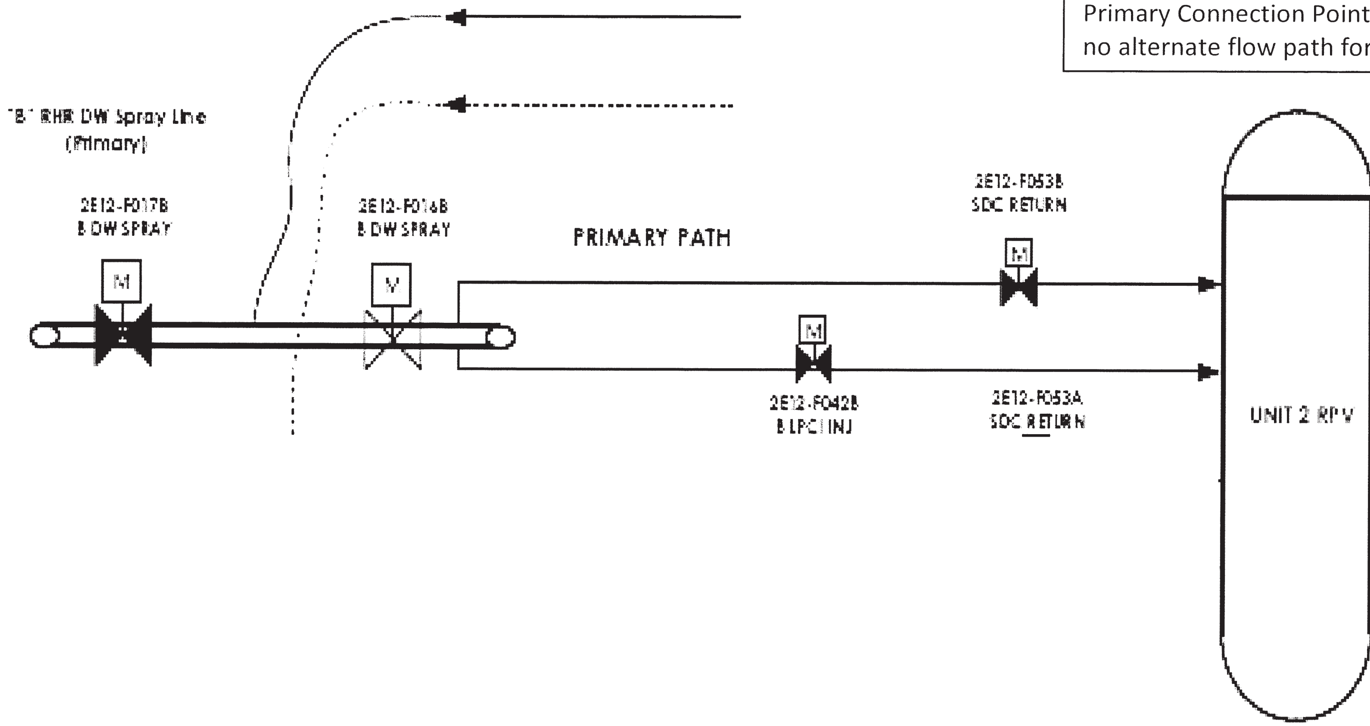
Note that SAWA uses essentially the same flow path as the FLEX primary water strategy, except with the SAWA Flow Meter connected immediately upstream of the Primary Connection Point. There is no alternate flow path for SAWA.



Attachment 6C

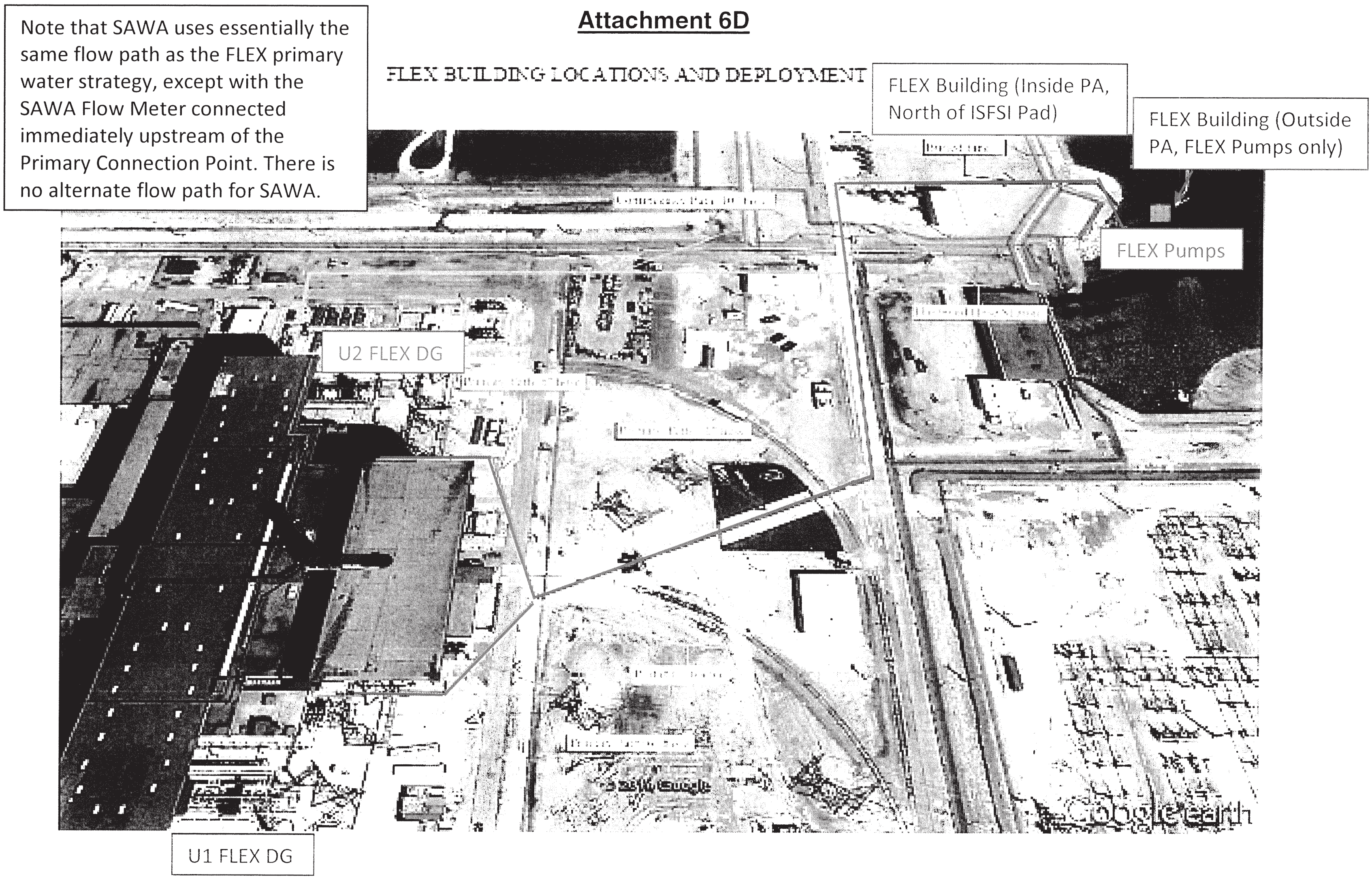
UNIT TWO REACTOR PRESSURE VESSEL MAKEUP

Note that SAWA uses essentially the same flow path as the FLEX primary water strategy, except with the SAWA Flow Meter connected immediately upstream of the Primary Connection Point. There is no alternate flow path for SAWA.



Attachment 6D

FLEX BUILDING LOCATIONS AND DEPLOYMENT



Attachment 6E

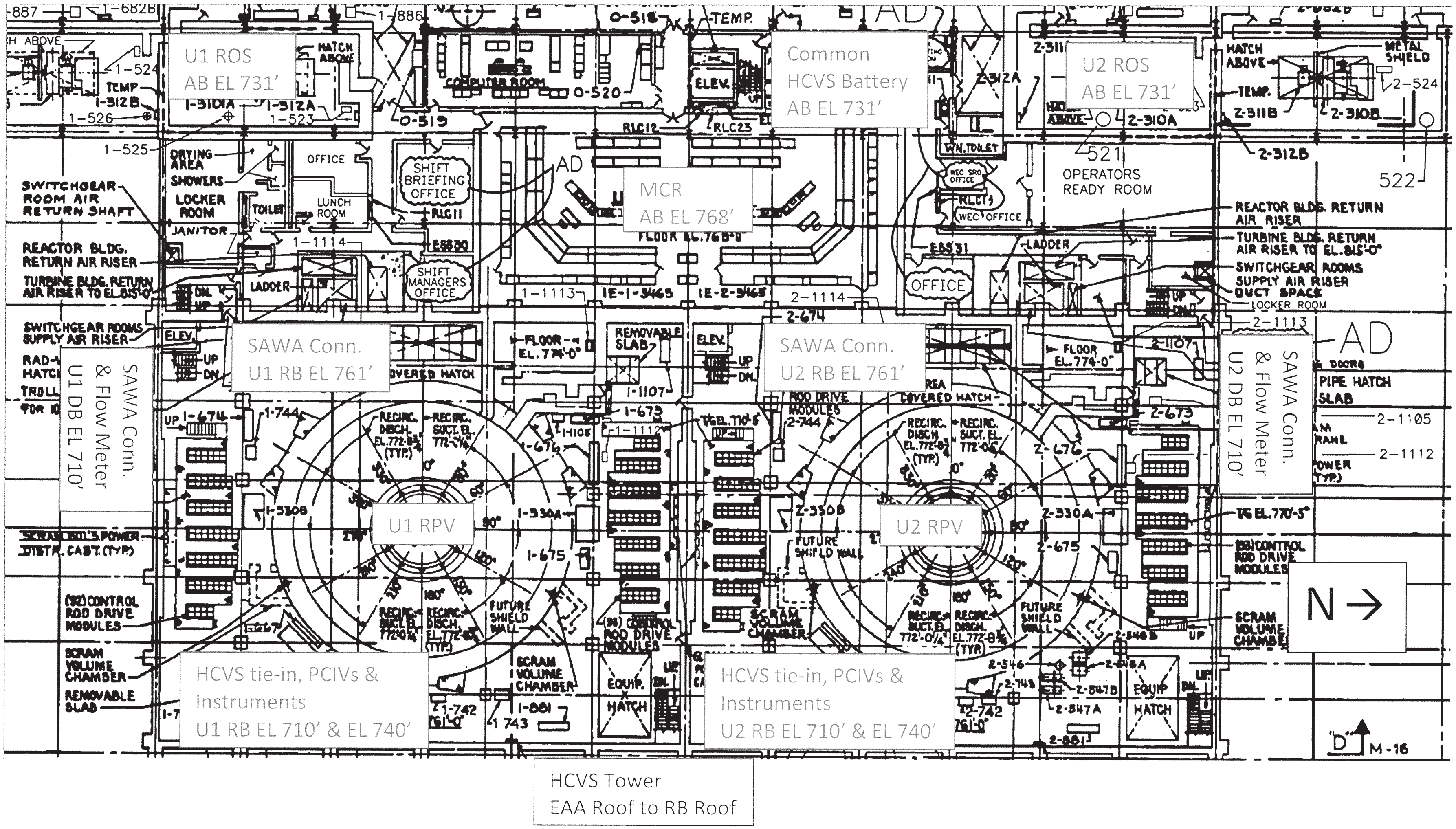


Table 1: List of HCVS Component, Control and Instrument Qualifications

Component Name	Equipment ID	Range	Location	Local BDBE Temp	Local BDBE Humidity	Local BDBE Rad Level	Qualification[8]	Qualification Temp	Qualification Humidity	Qualification Radiation	Power Supply
Wetwell Vent Instruments and Components											
HCVS temperature sensor	1(2)TE-PC310	0-400°F	RB 740'	350°F	100%	5.22E6 R TID	IEEE-344-1975 IEEE-344-1987	500°F	No electronics, not susceptible	3.06E8 R TID	None required
HCVS Radiation Detector	1(2)RE-PC320	10E-2 to 10E+4 Rad/hr	RB 740'	350°F	100%	5.22E6 R TID	IEEE-344-1975	350°F	100%	2E8 R TID	Radiation Monitor
HCVS PCIVs and accessories	1(2)PC009A 1(2)PC010A	N/A	RB 740'	350°F	100%	5.22E6 R TID	IEEE-344-1975	350°F to 500°F	100%	8.6E7 to 2.2E8 R TID	HCVS Battery & N2
HCVS temp transmitter	1(2)TT-PC311	-200 to 850°F	ROS	50-120°F	90%	1.61 R TID	IEEE-344-1975 IEEE-344-1987	32-158°F	90%	1E3 R TID[9]	HCVS Battery
125 VDC battery charger and voltage indication	0DC51E	0-195 VDC	ROS	50-120°F	90%	1.61 R TID	IEEE 344-1975	122°F	95%	1E3 R TID[9]	480 VAC then FLEX DG
125 VDC battery	0DC50E	125 VDC	ROS	50-120°F	90%	1.61 R TID	IEEE 344-1975	120°F	>90%	N/A	HCVS Battery Charger
HCVS radiation monitor/ processor	1(2)RT-PC321	10E-2 to 10E+4 Rad/hr	ROS	50-120°F	90%	1.61 R TID	IEEE-344-1975	131°F	95%	1E3 R TID[9]	HCVS Battery
N2 supply pressure gauges	1(2)PI-PC440 1(2)PI-PC450	0-160 psig and 0-3000 psig	ROS	50-120°F	90%	1.61 R TID	IEEE 344-1975	200°F	>90%	N/A	None required
Argon supply pressure gauges	1(2)PI-PC535 1(2)PI-PC545	0-400 psig and 0-3000 psig	ROS	50-120°F	90%	1.61 R TID	IEEE 344-1975	200°F	>90%	N/A	None required
Argon pressure transmitter	1(2)PT-PC546	0-3000 psig	ROS	50-120°F	90%	1.61 R TID	IEEE 344-1975	>120°F	>90%	N/A	HCVS Battery
SAWA flow instrument and readout	1(2)FI-FF001	3.3 – 1100 gpm	DG Vestibule	140°F	90%	2.45E2 R TID @ peak dose rate for entire period	Commercial instrument qualified for over the road use, therefore qualified per Ref. 41	140°F	100%	1E3 R TID[9]	Internal Battery

[8] See UFSAR for qualification code of record IEEE 344-1975. Where later code years are referenced, this was reconciled in the design process.
[9] Generally accepted total exposure threshold for commercial grade electronics

Component Name	Equipment ID	Range	Location	Local BDBE Temp	Local BDBE Humidity	Local BDBE Rad Level	Qualification[8]	Qualification Temp	Qualification Humidity	Qualification Radiation	Power Supply
HCVS temp indication	1(2)TI-PC312	0-400°F	MCR	104°F	90%	**CR	IEEE 344-1975	>104°F	>90%	N/A	HCVS Battery
Argon pressure indication	1(2)PI-PC547	0-3000 psig	MCR	104°F	90%	**CR	IEEE 344-1975	>104°F	>90%	N/A	HCVS Battery
HCVS radiation indication	1(2)RI-PC322	10E-2 to 10E+4 Rad/hr	MCR	104°F	90%	**CR	IEEE 344-1975	>104°F	>90%	N/A	HCVS Battery
Drywell Pressure Indication	1(2)PI-CM029 1(2)PT-CM029	0-200 psig	MCR RB	104°F 212°F	90% 100%	**CR 1.7E6 R TID	IEEE 344-1975	RG 1.97 350°F	RG 1.97 100%	RG 1.97 1E7 R TID	Station Battery then FLEX DG
Wetwell Level Indication	1(2)LI-CM192 1(2)LT-CM030	-18 to +14 ft ref. 698'	MCR RB	104°F 212°F	90% 100%	**CR 1.7E6 R TID	IEEE 344-1975	RG 1.97 350°F	RG 1.97 100%	RG 1.97 1E7 R TID	Station Battery then FLEX DG

* Denotes non-required item, added for site-specific design.
** Denotes Control Room where local radiation levels are not applicable. Building has no significant radiation sources.

Table 2: Operator Actions Evaluation

Operator Action		Evaluation Time[10]	Validation Time[11]	Location	Thermal conditions	Radiological Conditions[12]	Evaluation
1	Open MCR panel doors and provide room cooling, LOA-AP-101(201)	30 min	8 minutes	Main Control Room	No heat stress concerns in the MCR	No rad concerns in the MCR	Acceptable
2	Open AEER panel doors and provide room cooling, LOA-AP-101(201)	30 min	6 minutes	AEER AB EL 731'	No heat stress concerns in the AB <1 hr post-ELAP	No rad concerns in the AEER <1 hr post-ELAP	Acceptable
3	Load Shed per SAWA Strategy to mitigate dose LOA-FSG-003 Att. B2	1 hour	36 minutes	RB EL 710', 740', 761', and 820'	No heat stress concerns in the RB <1 hr post-ELAP	No rad concerns in the RB <1 hr post-ELAP	Acceptable
4	FLEX Connections per SAWA Strategy to mitigate dose LOA-FSG-003 Att. B2	1 hour	36 minutes	RB EL 761'	No heat stress concerns in the RB <1 hr post-ELAP	No rad concerns in the RB <1 hr post-ELAP	Acceptable

[10] Evaluation timing is from NEI 13-02 to support radiological evaluations.
[11] Reference 36
[12] Reference calculation L-004151

Operator Action		Evaluation Time[10]	Validation Time[11]	Location	Thermal conditions	Radiological Conditions[12]	Evaluation
5	Extended DC load shed for applicable 125VDC batteries LOA-AP-101(201) Att. K	4.5 hours	12 minutes	AB EL 710' & EL 731'	Div 1 and 2 SWGR room temperatures stay below their required cooling temperature threshold (L-003969)	AB remains habitable for intermittent actions throughout the period of extended operation.	Acceptable
6	FLEX pumps connected & RPV Makeup alignment for SAWA established. LOS-FSG-003	6 hours	4.42 hours	Outside and Diesel Generator Corridor	Outdoor ambient air conditions do not cause a temperature concern Diesel Generator Corridor temperature will remain <140 degrees F. LOA-FSG-003 (EC 620478)	Exterior actions are complete prior to venting, thus no radiological concern. DG Corridor remains continuously habitable throughout the period of extended operation.	Acceptable
7	FLEX DGs connected to supply battery chargers for HCVS Battery, 125 VDC (Div 1 & 2) and 250VDC buses LOA-FSG-002	6 hours	4.5 hours	Outside, diesel generator corridor and AB EL 710' & EL 731'	Outdoor ambient air conditions do not cause a temperature concern. Diesel generator corridor temperature will remain <140 degrees F. LOA-FSG-003 (EC 620478). Div 1 and 2 SWGR room temperatures stay below their required cooling temperature threshold	Exterior actions are complete prior to venting, thus no radiological concern. DG Corridor remains continuously habitable throughout the period of extended operation. Div 1 and 2 SWGR Rooms are intermittently habitable throughout the period of extended operation.	Acceptable

Operator Action		Evaluation Time[10]	Validation Time[11]	Location	Thermal conditions	Radiological Conditions[12]	Evaluation
					(L-003969).		
8	Open doors and provide cooling to Div 1 & Div 2 SWGR rooms, LOA-FSG-005	7 hours	4 minutes	AB El 710' & EL 731'	Div 1 and 2 SWGR room temperatures stay below their required cooling temperature threshold (L-003969)	Div 1 and 2 SWGR Rooms are intermittently habitable throughout the period of extended operation.	Acceptable
9	Prepare & initiate venting with HCVS	8 hours	N/A[13]	MCR and ROS (AB EL 731')	No heat stress concerns in the MCR. No temperature concerns at ROS per ECs 392353 & 397691	No rad concerns in the MCR. ROS remains continuously habitable.	Acceptable
10	SAWA injection (500 gpm for 4 hours) and FLEX pump operation & refueling	8 hours (injection initiated as early as possible but not later than 8 hours)	Pump is ready for operation at 4.42 hours. The pump will be operated for long term as needed.	FLEX Pump storage building, outside northeast of Lake Screen House at intake. Unit 1 and Unit 2 Diesel Generator Corridor at EL 710' and MCR	Outside, so outdoor ambient conditions do not cause a temperature concern. Diesel generator corridor temperature will remain <140 degrees F. LOA-FSG-003 (EC 620478). No heat stress concerns in the MCR.	The Flex Pump peak dose rates will be 667 mR/hr (Unit 1) and 665 mR/hr (Unit 2) during the venting operation. The SAWA pump operation and refueling will be coordinated with venting to minimize dose. Evaluation in EC 618667 determines that refueling activities may be performed within ERO dose limits. SAWA flow control location in the DG	Acceptable

[13] Does not meet the criteria in Reference 36 for requiring time validation.

Operator Action		Evaluation Time[10]	Validation Time[11]	Location	Thermal conditions	Radiological Conditions[12]	Evaluation
						Corridor will see a peak dose rate of 1460 mR/hr during venting. Any valve manipulation at this location will be performed when the vent is not operating. No rad concerns in the MCR.	
11	SAWM flow control (reduce injection from 500 gpm to 100 gpm and manage SP level to maintain HCVS available)	<12 hours (4 hours after SAWA injection started)	SAWA flow is ready for injection at 4.42 hours. The SAWA flow control valve will be operated for long term as needed.	Unit 1 and Unit 2 Diesel Generator Corridor at EL 710' and MCR	Diesel generator corridor temperature will remain <140 degrees F. LOA-FSG-003 (EC 620478). No heat stress concerns in the MCR.	The SAWA flow control location in the DG Corridor will see a peak dose rate of 1460 mR/hr during venting. Any valve manipulation at this location will be performed when the vent is not operating. No rad concerns in the MCR.	Acceptable
12	FLEX DG operation and refueling to repower HCVS battery	>24 hours (HCVS Battery has sufficient capacity for at least 24 hrs)	Generator is ready for operation at 4.5 hours. The generator will be operated for long term as needed.	Plant grade, outside south of Unit 1 Diesel Generator Building (U-1) and north of Unit 2 Diesel Generator Building (U-2)	Outside, so outdoor ambient conditions do not cause a temperature concern	The FLEX EDG area peak dose rates will be 2031 mR/hr (Unit 1) and 2253 mR/hr (Unit 2). FLEX DG operation and refueling will be coordinated with venting to minimize dose. Evaluation in EC 618667 determines that refueling activities may	Acceptable

Operator Action		Evaluation Time[10]	Validation Time[11]	Location	Thermal conditions	Radiological Conditions[12]	Evaluation
						be performed within ERO dose limits.	
13	Replenish HCVS argon and nitrogen supply	>24 hours	N/A[14] (additional personnel available post-24 hours)	FLEX Building (outside northeast of RB) and ROS (AB EL 731')	Outside, so outdoor ambient conditions do not cause a temperature concern. No temperature concerns at ROS per ECs 392353 & 397691	HCVS argon and nitrogen replenishment will be coordinated with venting to minimize dose. Evaluation in EC 618667 determines that refueling activities may be performed within ERO dose limits, which applies to replenishment activities, as well. ROS remains continuously habitable.	Acceptable

[14] Does not meet the criteria in Reference 36 for requiring time validation.