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DEC 2 3 2015

U.S. Nuclear Regulatory Commission
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SUSQUEHANNA STEAM ELECTRIC STATION COMBINED PHASE 1 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) PLA-7421

Docket Nos. 50-387 and 50-388

References:

1. *NRC Order Number EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, dated June 6, 2013.*

2. *NRC Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated November 2013 (Accession No. ML13304B836).*

3. *NRC Endorsement of industry "Hardened Containment Venting System (HCVS) Phase 1 Overall Integrated Plan Template (EA-13-109) Rev 0" (Accession No. ML14128A219).*

4. *NEI 13-02, "Industry Guidance for Compliance with NRC Order EA-13-109, "To Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions," Revision 0, dated November 2013.*

5. *PPL Letter (PLA-7180), "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 26, 2014.*

6. *PPL Letter (PLA-7269) T. S. Rausch (PPL Susquehanna, LLC) to U.S. NRC, "First Six-Month Status Report 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 23, 2014.*

7. *Susquehanna Letter (PLA-7345) T. S. Rausch (Susquehanna Nuclear, LLC) to U.S. NRC, "Second Six-Month Status Report 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 23, 2015.*

8. *NRC Endorsement of industry "Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan Template," Revision 1, dated September 22, 2015, and Frequently Asked Questions (FAQs) 10, 11, 12, and 13 (Accession No. ML15273A141).*

On June 6, 2013, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to PPL Susquehanna, LLC (PPL). Reference 1 was immediately effective and directs Susquehanna to install a venting capability in accordance with the requirements outlined in Attachment 2 of Reference 1.

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 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).

The Order requirements are applied in a phased approach where:

- "Phase 1 involves upgrading the venting capabilities from the containment wetwell to provide reliable, severe accident capable hardened vents to assist in preventing core damage and, if necessary, to provide venting capability during severe accident conditions." (Completed "no later than startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first.")
- "Phase 2 involves providing additional protections for severe accident conditions through installation of a reliable, severe accident capable drywell vent system or the development of a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions." (Completed "no later than startup from the first refueling outage that begins after June 30, 2017, or June 30, 2019, whichever comes first.")

The NRC provided an acceptable approach for complying with Order EA-13-109 through Interim Staff Guidance (JLD-ISG-2013-02 issued in November 2013 and JLD-ISG-2015-01 issued in April 2015). The ISGs endorse the compliance approach presented in NEI 13-02 Revision 0 and 1, *Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents*, with clarifications. Except in those cases in which a licensee proposes an acceptable alternative method for complying with Order EA-13-109, the NRC staff will use the methods described in the ISGs to evaluate licensee compliance as presented in submittals required in Order EA-13-109.

The Order also requires submittal of an overall integrated plan which will provide a description of how the requirements of the Order will be achieved (Reference 8).

This letter and the Enclosure provides Susquehanna's combined and updated Phase 1 and Phase 2 Overall Integrated Plan (OIP) for complying with Order EA-13-109 using the methods described in NEI 13-02 and endorsed by NRC JLD-ISG-2013-02 and JLD-ISG-2015-01.

Six month progress reports will be provided hereafter consistent with the requirements of Order EA-13-109.

This letter contains no new regulatory commitments.

Should you have any questions regarding this submittal, please contact Mr. Jason Jennings, Manager – Nuclear Regulatory Affairs at (570) 542-3155.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 12/23/15

T. S. Rausch

Enclosure: Susquehanna Nuclear, LLC's Combined Phase 1 and Phase 2 Overall Integrated Plan in Response to 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)

cc: Director, Office of Nuclear Reactor Regulation
NRC Region I
Mr. Rajender Auluck, NRR/JLD/PSB, NRC
Mr. J. E. Greives, NRC Sr. Resident Inspector
Ms. T. E. Hood, NRC Project Manager
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Mr. M. Shields, PA DEP/BRP

Enclosure to PLA-7421

Combined Phase 1 and Phase 2 Overall Integrated Plan In Response to the June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (NRC Order Number EA-13-109)

December 2015 Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan Template

Susquehanna Nuclear, LLC's Combined Phase 1 and Phase 2 Overall Integrated Plan In Response to the June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (NRC Order Number EA-13-109)

Table of Contents:

Introduction

In 1989, the NRC issued Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," 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 suppression pool 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 to require licensees with Mark I and Mark II containments to "upgrade or replace the reliable hardened vents required by Order EA-12-050 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. 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 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).

The Order requirements are applied in a phased approach where:

- "Phase 1 involves upgrading the venting capabilities from the containment wetwell to provide reliable, severe accident capable hardened vents to assist in preventing core damage and, if necessary, to provide venting capability during severe accident conditions." (Completed "no later than startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first.")
- "Phase 2 involves providing additional protections for severe accident conditions through installation of a reliable, severe accident capable drywell vent system or the development of a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions." (Completed "no later than startup from the first refueling outage that begins after June 30, 2017, or June 30, 2019, whichever comes first.")

The NRC provided an acceptable approach for complying with Order EA-13-109 through Interim Staff Guidance (JLD-ISG-2013-02 issued in November 2013 and JLD-ISG-2015-01 issued in April 2015). The ISGs endorse the compliance approach presented in NEI 13-02 Revision 0 and 1, *Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents*, with clarifications. Except in those cases in which a licensee proposes an acceptable alternative method for complying with Order EA-13-109, the NRC staff will use the methods described in the ISGs to evaluate licensee compliance as presented in submittals required in Order EA-13-109.

The Order also requires submittal of an overall integrated plan which will provide a description of how the requirements of the Order will be achieved. This document provides the Overall Integrated Plan (OIP) for complying with Order EA-13-109 using the methods described in NEI 13-02 and endorsed by NRC JLD-ISG-2013-02 and JLD-ISG-2015-01. Six month progress reports will be provided consistent with the requirements of Order EA-13-109. The submittals required are:

- OIP for Phase 1 of EA-13-109 was required to be submitted by Licensees to the NRC by June 30, 2014. The NRC requires periodic (6 month) updates for the HCVS actions being taken. The first update for Phase 1 was due December 2014, with the second due June 2015.

- OIP for Phase 2 of EA-13-109 is required to be submitted by Licensees to the NRC by December 31, 2015. It is expected the December 2015 six month update for Phase 1 will be combined with the Phase 2 OIP submittal by means of a combined Phase 1 and 2 OIP.
- Thereafter, the 6 month updates will be for both the Phase 1 and Phase 2 actions until complete, consistent with the requirements of Order EA-13-109.

The Susquehanna Unit 1 and 2 venting actions for the 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 either the Main Control Room (MCR) or from a Remote Operating Station (ROS) at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms.
- The vent will utilize Containment Parameters of Pressure and Level from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation will be monitored by HCVS valve position, effluent 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 once the installed motive force is exhausted.
- Venting actions will be capable of being maintained for a sustained period of up to 7 days.

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) or Drywell.
- Utilization of Severe Accident Water Management (SAWM) to control injection and Suppression Pool level to ensure the HCVS (Phase 1) wetwell vent (SAWV) will remain functional for the removal of decay heat from containment.
- Decay heat can be removed from the containment for seven (7) days using the HCVS.
- The SAWA and SAWM actions will 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 parameters listed above.

Part 1: General Integrated Plan Elements and Assumptions

Extent to which the guidance, JLD-ISG-2013-02, JLD-ISG-2015-01 and NEI 13-02 (Revision 1), are being followed. Identify any deviations.

Include a description of any alternatives to the guidance. A technical justification and basis for the alternative needs to be provided. This will likely require a pre-meeting with the NRC to review the alternative.

Ref: JLD-ISG-2013-02, JLD-ISG-2015-01

Part 1: General Integrated Plan Elements and Assumptions

Compliance will be attained for Susquehanna with no known deviations to the guidelines in JLD-ISG-2013-02, JLD-ISG-2015-01 and NEI 13-02 for each phase as follows:

- The Hardened Containment Vent System (HCVS) will be comprised of installed and portable equipment and operating guidance:
  - Severe Accident Wetwell Vent (SAWV) – Permanently installed vent from the Suppression Chamber to the top of the Reactor Building.
  - Severe Accident Water Addition (SAWA) – A combination of permanently installed and portable equipment to provide a means to add water to the RPV or Drywell following a severe accident and monitor system and plant conditions.
  - Severe Accident Water Management (SAWM) strategies and guidance for controlling the water addition to the RPV or Drywell for the sustained operating period. (reference attachment 2.1.D)
- Phase 1 (wetwell): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for Unit 2 2nd quarter 2017 and for Unit 1 2nd quarter 2018.
- Phase 2 (alternate strategy): by the startup from the first refueling outage that begins after June 30, 2017 or June 30, 2019, whichever comes first. Currently scheduled for Unit 1 2nd quarter 2018 and for Unit 2 2nd quarter 2019.

If deviations are identified at a later date, then the deviations will be communicated in a future 6 month update following identification.

State Applicable Extreme External Hazard from NEI 12-06, Section 4.0-9.0

List resultant determination of screened in hazards from the EA-12-049 Compliance.

Ref: NEI 13-02 Section 5.2.3 and D.1.2

- The hazards applicable to Susquehanna Steam Electric Station (SSES) are seismic, external flooding, severe storms with high winds (hurricanes and tornados), snow, ice, extreme cold and high temperature. None of the NEI 12-06 hazards screened out for Susquehanna.

Key Site assumptions to implement NEI 13-02 HCVS, Phase 1 and 2 Actions.

Provide key assumptions associated with implementation of HCVS Phase 1 and Phase 2 Actions

Ref: NEI 13-02, Revision 1, Section 2 NEI 12-06 Revision 0

Mark I/II Generic EA-13-109 Phase 1 and Phase 2 Related Assumptions:

Applicable EA-12-049 assumptions:

049-1. Assumed initial plant conditions are as identified in NEI 12-06 section 3.2.1.2 items 1 and 2.

049-2. Assumed initial conditions are as identified in NEI 12-06 section 3.2.1.3 items 1, 2, 4, 5, 6 and 8

Part 1: General Integrated Plan Elements and Assumptions

049-3. Assumed reactor transient boundary conditions are as identified in NEI 12-06 section 3.2.1.4 items 1, 2, 3 and 4

049-4. No additional events or failures are assumed to occur immediately prior to or during the event, including security events except for failure of RCIC or HPCI. (Reference NEI 12-06 3.2.1.3 item 9)

049-5. At Time=0 the event is initiated and all rods insert and no other event beyond a common site ELAP is occurring at any or all of the units. (NEI 12-06, section 3.2.1.3 item 9 and 3.2.1.4 item 1-4)

049-6. At or before t+50 minutes an ELAP is declared and actions begin as defined in EA-12-049 compliance.

049-7. DC power and distribution can be credited for the duration determined per the EA-12-049 (FLEX) methodology for battery usage, (at least 8 hours) This assumption applies to the water addition capability under SAWA/SAWM. The power supply scheme for the HCVS shall be in accordance with EA-13-109 and the applicable guidance. (NEI 12-06, section 3.2.1.3 item 8)

049-8. Additional deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.

049-9. All activities associated with plant specific EA-12-049 FLEX strategies that are not specific to implementation of the HCVS, including such items as debris removal, communication, notification, SFP level and makeup, security response, opening doors for cooling, and initiating conditions for the event, can be credited as previously evaluated for FLEX. (Refer to assumption 109-02 below for clarity on SAWA)(HCVS-FAQ-11)

Applicable EA-13-109 generic assumptions:

109-01. Site response activities associated with EA-13-109 actions are considered to have no access limitations associated with radiological impacts while RPV level is above 2/3 core height (core damage is not expected). This is further addressed in HCVS-FAQ-12.

109-02. Portable equipment can supplement the installed equipment after 24 hours provided the portable equipment credited meets the criteria applicable to the HCVS. Examples include the use of portable gas supply credited to recharge pneumatic supply lines for HCVS components after 24 hours and use of portable 4160 vac FLEX generators to reenergize the credited HCVS system battery charger after 24 hours. The FLEX portable generators and the portable gas supply used must be demonstrated to meet the "SA Capable" criteria that are defined in NEI 13-02 and Appendix D Section D.1.3. This assumption does not apply to Phase 2 SAWA/SAWM because SAWA equipment needs to be connected and placed in service within 8 hours from the time of the loss of RPV injection. (Reference HCVS-FAQ-12)

109-03. SFP level is maintained with either on-site or off-site resources such that the SFP does not contribute to the analyzed source term (Reference HCVS-FAQ-07).

109-04. Existing containment components design and testing values are governed by existing plant primary containment criteria (e.g., Appendix J) and are not subject to the testing criteria from NEI 13-02 (reference HCVS-FAQ-05 and NEI 13-02 section 6.2.2).

109-05. Classical design basis evaluations and assumptions are not required when assessing the operation of the HCVS. The reason this is not required is that the Order postulates an unsuccessful mitigation of an event such that an ELAP progresses to a severe accident with ex-vessel core debris, which classical design basis evaluations are intended to prevent. (Reference NEI 13-02 section 2.3.1).

109-06. HCVS manual actions that require minimal operator steps and can be performed in the postulated thermal and radiological environment at the location of the step(s) (e.g., load stripping, control switch manipulation, valving-in installed and portable gas supply bottles) are acceptable to obtain HCVS venting dedicated functionality. (reference HCVS-FAQ-01) This assumption does not apply to Phase 2 SAWA/SAWM because SAWA equipment needs to be connected and placed in service within 8 hours from the time of the loss of RPV injection and may require more than minimal operator action.

Part 1: General Integrated Plan Elements and Assumptions

109-07. HCVS dedicated equipment is defined as vent process elements that are required for the HCVS to function in an ELAP event that progresses to core melt ex-vessel. (Reference HCVS-FAQ-02 and White Paper HCVS-WP-01). This assumption does not apply to Phase 2 SAWA/SAWM because SAWA equipment is not dedicated to HCVS but shared to support FLEX functions. This is further addressed in HCVS-FAQ-11.

109-08. Use of MAAP Version 4 or higher provides adequate assurance of the plant conditions (e.g., RPV water level, temperatures, etc.) assumed for Order EA-13-109 BDBEE and SA HCVS operation. (reference FLEX MAAP Endorsement ML13190A201). Additional analysis using RELAP5/MOD 3, GOTHIC, PCFLUD, LOCADOSE and SHIELD are acceptable methods for evaluating environmental conditions in areas of the plant provided the specific version utilized is documented in the analysis. MAAP Version 5 was used to develop EPRI Technical Report 3002003301 to support drywell temperature response to SAWA under severe accident conditions.

109-09. NRC Published Accident evaluations (e.g. SOARCA, SECY-12-0157, and NUREG 1465) as related to Order EA-13-109 conditions are acceptable as references. (Reference NEI 13-02 section 8).

109-10. Permanent modifications installed or planned per EA-12-049 are assumed implemented and may be credited for use in EA-13-109 Order response.

109-11. This Overall Integrated Plan is based on Emergency Operating Procedure changes consistent with EPG/SAGs Revision 3 as incorporated per the sites EOP/SAMG procedure change process. This assumption does not apply to Phase 2 SAWM because SAWM is not part of revision 3.(reference to Attachment 2.1.D for SAWM SAMG Changes approved by the BWROG Emergency Procedures Committee)

109-12. Under the postulated scenarios of Order EA-13-109 the Control Room is adequately protected from excessive radiation dose due to its distance and shielding from the reactor (per General Design Criterion (GDC) 19 in 10CFR50 Appendix A) and no further evaluation of its use as the preferred HCVS control location is required provided that the HCVS routing is a sufficient distance away from the MCR or is shielded to minimize impact to the MCR dose. In addition, adequate protective clothing and respiratory protection are available if required to address contamination issues. (reference HCVS-FAQ-01 and HCVS-FAQ-09)

109-13. The suppression pool/wetwell of a BWR Mark I/II containment is considered to be bounded by assuming a saturated environment for the duration of the event response because of the water/steam interactions.

109-14. RPV depressurization is directed by the EOPs in all cases prior to entry into the SAGs. (reference NEI 13-02 Rev 1, §I.1.3)

109-15 The Severe Accident impacts are assumed on one unit only due to the site compliance with NRC Order EA-12-049. However, each BWR Mk I and II under the assumptions of NRC Order EA-13-109 must ensure the capability to protect containment exists for each unit. (HCVS-FAQ-1) This is further addressed in HCVS-FAQ-10

Plant Specific HCVS Related Assumptions/Characteristics:

PLT-1. Spent Fuel Pool heat loads correspond to expected decay heat following a refueling outage with an additional 25% conservatism to bound potentially higher decay heat associated with future reloads (Ref. EC-012-6122, Rev. 1, p. 9).

PLT-2. For severe accident condition resulting from ELAP with RCIC failure on demand and HPCI unavailable, containment venting to maintain pressure below the PCPL (65 psig) would be initiated soon after vessel breach, which is assumed to occur at 8 hours. Prior to vessel failure, a water pool would accumulate on the drywell floor as a result of recirculation pump seal leakage. The release of corium into the water pool would lead to rapid production of steam with an accompanying increase in drywell pressure that is expected to reach the PCPL. This assumption is consistent with plant response predicted in BWROG-TP-15-011, Rev. 0, Figure 3.

Part 2: Boundary Conditions for Wetwell Vent

Provide a sequence of events and identify any time or environmental constraint required for success including the basis for the constraint.

HCVS Actions that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, action to open vent valves).

HCVS Actions that have an environmental constraint (e.g. actions in areas of High Thermal stress or High Dose areas) should be evaluated per guidance.

Describe in detail in this section the technical basis for the constraints identified on the sequence of events timeline attachment.

See attached sequence of events timeline (Attachment 2A)

Ref: EA-13-109 Section 1.1.1, 1.1.2, 1.1.3 / NEI 13-02 Section 4.2.5, 4.2.6. 6.1.1

The operation of the HCVS will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1. Initial operator actions will be completed by plant personnel and will 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 can be found in the following table (2-1). A HCVS Extended Loss of AC Power (ELAP) Failure Evaluation table, which shows alternate actions that can be performed, is included in Attachment 4.

Table 2-1 HCVS Remote Manual Actions

Primary Action	Primary Location / Component	Notes
1. Power MCR HCVS Control Panel .	Key-locked switch at HCVS Control Panel in Main Control Room (MCR)	Or unlock ROS door if operation is to occur at the ROS.
2. Unlock ROS door and manually operate valves	Manual valves at remote operating station (simple operator action)	Required to provide gas supply to HCVS valves and rupture disk to initiate system operation.
3. Open Suppression Chamber Primary Containment Isolation Valves (PCIV)	Key-locked switches at HCVS Control Panel in MCR	Alternate PCIV control via manual valves at Remote Operating Station (ROS)
4. Monitor electrical power status, gas pressure, and HCVS conditions.	HCVS Control Panel in MCR	Can monitor gas pressure and HCVS conditions at ROS.

Part 2: Boundary Conditions for Wetwell Vent

5. Connect/re-energize HCVS battery charger using portable FLEX Generators	Battery chargers in ROS will be re-energized via FLEX procedure that installs the 4160 vac FLEX Generators.	The HCVS power supply is capable of operating the system for a minimum of 24 hours. (See Open Item #7 in Attachment 7). This FLEX action is expected to occur within 6 hours of the initiating event.
6. Replenish gas supply to HCVS PCIVs	At Remote Operating Station in Control Structure – Elevation 686'-6". Connect backup gas supply to PCIVs	Prior to depletion of the gas supply (no less than 24 hours from initiation of event)

Provide a sequence of events and identify any time or environmental constraint required for success including the basis for the constraint.

A timeline was developed to identify required operator response times and potential environmental constraints. This timeline is based upon the following three cases:

1. Case 1 is based upon the action response times developed for FLEX when utilizing anticipatory venting in a BDBEE without core damage.
2. Case 2 is based on a SECY-12-0157 long term station blackout (LTSBO) (or ELAP) with failure of RCIC after a black start where failure occurs because of subjectively assuming over injection.
3. Case 3 is based on NUREG-1935 (SOARCA) results for a prolonged SBO (or ELAP) with the loss of RCIC case without black start.

The following is a discussion of time constraints identified in Attachment 2A for the 3 timeline cases identified above

- 5 Hours, Use of Hardened Containment Vent System (HCVS) would be initiated per site procedures to maintain containment parameters below design limits and within the limits that allow continued use of RCIC. The reliable operation of HCVS will be met because HCVS will satisfy the seismic requirements identified in NEI 13-02 and will be powered by DC buses with motive force supplied to HCVS valves from permanently installed gas storage bottles. Critical HCVS controls and instruments associated with containment will be powered and operated from the MCR or the Remote Operating Station. The DC power for HCVS will be available as long as the HCVS is required. The selected electrical supply will be capable of supporting HCVS operation for a minimum of 24 hours with no additional operator actions (see Open Item #7 in Attachment 7). The phase 2 FLEX generator is expected to be connected within 6 hours of event initiation, which will re-energize the battery charger long before HCVS battery capacity is depleted. The simple operator actions required to initiate system operation (as identified in Table 2-1, above) will be readily accomplished within 5 hours to support anticipatory venting and

Part 2: Boundary Conditions for Wetwell Vent

will be performed to support severe accident conditions as described in Attachment 2A – Cases 2 and 3. Initiation of the HCVS under severe accident conditions would occur later than under anticipatory venting conditions; therefore, the anticipatory venting timeline is bounding. Thus, initiation of the HCVS from the MCR or the Remote Operating Station within 5 hours is acceptable because the actions would be performed any time after declaration of an ELAP until the venting would be needed at 5 hours for BDBEE venting.

- Within 6 hours, portable FLEX generators will be installed and connected to the station 4160 vac system. The generators will re-energize the battery chargers used for the HCVS electrical supply. Since the HCVS battery supply will be capable of operating the HCVS system for a minimum of 24 hours (see Open Item #7 in Attachment 7), this FLEX action will support extended HCVS operation. It will be confirmed that this FLEX action can be performed under both anticipatory venting conditions and severe accident conditions (Open Item 2).
- Within 24 hours, the FLEX generators will be connected to re-energize the battery chargers. This could be performed at any time prior to 24 hours to ensure adequate capacity is maintained so this time constraint is not limiting.
- Within 24 hours, supplemental gas supply will be provided to supplement the normal gas supply at the ROS. The gas bottles could be replenished one at a time leaving the other bottle(s) supplying the HCVS. This could be performed at any time prior to 24 hours to ensure adequate capacity is maintained so this time constraint is not limiting.

Discussion of radiological and temperature constraints identified in Attachment 2A

- Actions to initiate HCVS operation will be taken from the MCR and from the ROS in the Control Structure. Both locations are shielded and physically separated from radiological sources. Non-radiological habitability for the MCR has been addressed as part of the FLEX response (Reference: PLA-7138). An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the ROS, based on time constraints listed in Attachment 2 (see Open Item #5 in Attachment 7).
- Actions to replenish the gas supply will be completed at the ROS. Deployment under severe accident conditions will be confirmed (see Open Item 3, Attachment 7). The location for gas supply replenishment will be shielded from the HCVS piping to ensure accessibility.
- Actions to install the portable FLEX generators will occur on the North end of the Diesel Generator E building. The vent piping will be shielded, or other shielding provided, if required, to ensure the portable FLEX generators can be installed under severe accident conditions. The generic radiological approach criteria included in HCVS-WP-02 will be used as input in determining the need for shielding.

Provide Details on the Vent characteristics

Provide Details on the Vent characteristics

Vent Size and Basis (EA-13-109 Section 1.2.1 / NEI 13-02 Section 4.1.1)

What is the plants licensed power? Discuss any plans for possible increases in licensed power (e.g. MUR, EPU).

What is the nominal diameter of the vent pipe in inches/ Is the basis determined by venting at containment design pressure, Primary Containment Pressure Limit (PCPL), or some other criteria (e.g. anticipatory venting)?

Vent Capacity (EA-13-109 Section 1.2.1 / NEI 13-02 Section 4.1.1)

Indicate any exceptions to the 1% decay heat removal criteria, including reasons for the exception. Provide the heat capacity of the suppression pool in terms of time versus pressurization capacity, assuming suppression pool is the injection source.

Part 2: Boundary Conditions for Wetwell Vent

Vent Path and Discharge (EA-13-109 Section 1.1.4, 1.2.2 / NEI 13-02 Section 4.1.3, 4.1.5 and Appendix F/G)

Provides a description of Vent path, release path, and impact of vent path on other vent element items.

Power and Pneumatic Supply Sources (EA-13-109 Section 1.2.5 & 1.2.6 / NEI 13-02 Section 4.2.3, 2.5, 4.2.2, 4.2.6, 6.1)

Provide a discussion of electrical power requirements, including a description of dedicated 24 hour power supply from permanently installed sources. Include a similar discussion as above for the valve motive force requirements. Indicate the area in the plant from where the installed/dedicated power and pneumatic supply sources are coming

Indicate the areas where portable equipment will be staged after the 24 hour period, the dose fields in the area, and any shielding that would be necessary in that area. Any shielding that would be provided in those areas

Location of Control Panels (EA-13-109 Section 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.2.4, 1.2.5 / NEI 13-02 Section 4.1.3, 4.2.2, 4.2.3, 4.2.5, 4.2.6, 6.1.1 and Appendix F/G)

Indicate the location of the panels, and the dose fields in the area during severe accidents and any shielding that would be required in the area. This can be a qualitative assessment based on criteria in NEI 13-02.

Hydrogen (EA-13-109 Section 1.2.10, 1.2.11, 1.2.12 / NEI 13-02 Section 2.3,2.4, 4.1.1, 4.1.6, 4.1.7, 5.1, & Appendix H)

State which approach or combination of approaches the plant will take to address the control of flammable gases, clearly demarcating the segments of vent system to which an approach applies

Unintended Cross Flow of Vented Fluids (EA-13-109 Section 1.2.3, 1.2.12 / NEI 13-02 Section 4.1.2, 4.1.4, 4.1.6 and Appendix H)

Provide a description to eliminate/minimize unintended cross flow of vented fluids with emphasis on interfacing ventilation systems (e.g. SGTS). What design features are being included to limit leakage through interfacing valves or Appendix J type testing features?

Prevention of Inadvertent Actuation (EA-13-109 Section 1.2.7/NEI 13-02 Section 4.2.1)

The HCVS shall include means to prevent inadvertent actuation

Component Qualifications (EA-13-109 Section 2.1 / NEI 13-02 Section 5.1, 5.3)

State qualification criteria based on use of a combination of safety related and augmented quality dependent on the location, function and interconnected system requirements

Monitoring of HCVS (Order Elements 1.1.4, 1.2.8, 1.2.9/NEI 13-02 4.1.3, 4.2.2, 4.2.4, and Appendix F/G)

Provides a description of instruments used to monitor HCVS operation and effluent. Power for an instrument will require the intrinsically safe equipment installed as part of the power sourcing

Component reliable and rugged performance (EA-13-109 Section 2.2 / NEI 13-02 Section 5.2, 5.3)

HCVS components including instrumentation should be designed, as a minimum, to meet the seismic design requirements of the plant.

Components including instrumentation that are not required to be seismically designed by the design basis of the plant should be designed for reliable and rugged performance that is capable of ensuring HCVS functionality following a seismic event. (reference ISG-JLD-201201 and ISG-JLD-2012-03 for seismic details.)

The components including instrumentation external to a seismic category 1 (or equivalent building or enclosure should be designed to meet the external hazards that screen-in for the plant as defined in guidance NEI 12-06 as endorsed by JLD-ISG-12-01 for Order EA-12-049.

Part 2: Boundary Conditions for Wetwell Vent

Use of instruments and supporting components with known operating principles that are supplied by manufacturers with commercial quality assurance programs, such as ISO9001. The procurement specifications shall include the seismic requirements and/or instrument design requirements, and specify the need for commercial design standards and testing under seismic loadings consistent with design basis values at the instrument locations.

Demonstration of the seismic reliability of the instrumentation through methods that predict performance by analysis, qualification testing under simulated seismic conditions, a combination of testing and analysis, or the use of experience data. Guidance for these is based on sections 7, 8, 9, and 10 of IEEE Standard 344-2004, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," or a substantially similar industrial standard could be used.

Demonstration that the instrumentation is substantially similar in design to instrumentation that has been previously tested to seismic loading levels in accordance with the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges). Such testing and analysis should be similar to that performed for the plant licensing basis.

Vent Size and Basis

The HCVS wetwell path will be designed for venting steam/energy at a minimum capacity of 1% of 3952 MW thermal power at pressure of 53 psig (Reference: FSAR, Section 6.2.1.1.3.1 and Plant Technical Specifications, Definitions – Rated Thermal Power). This pressure is the lower of the containment design pressure (53 psig) and the PCPL value (65 psig). The size of the wetwell portion of the HCVS will be nominally 12 inches in diameter inside the Reactor Building and 14 inches in diameter outside the Reactor Building, which provides adequate capacity to meet or exceed the order criteria.

Vent Capacity

The 1% value at SSES Units 1 and 2 assumes that the suppression pool pressure suppression capacity is sufficient to absorb the decay heat generated during the first 3 hours. The vent would then be able to prevent containment pressure from increasing above the containment design pressure. As part of the detailed design, the duration of suppression pool decay heat absorption capability will be confirmed.

{Confirm suppression pool heat capacity (see Open Item # 1 in Attachment 7)}

Vent Path and Discharge

The Susquehanna Unit 1 and 2 HCVS vent paths will utilize existing spare penetrations in the wetwell. Two PCIVs will be installed in each path outside of containment, in accordance with NEI 13-02, Section 4.1.2.1.1.1.1, and will be located as close as possible to the penetration. The new PCIVs will be manually operated with air actuators and will be either fully open or fully closed during HCVS operation. The valve operators will have an air to open and spring to close design feature (fail closed valves). The outboard PCIV will also serve as the primary method of establishing flow through the system (open or closed). A rupture disk will be installed downstream of the PCIVs to ensure no leakage out of the vent pipe during normal operation. A check valve will be installed near the discharge of the HCVS for backflow considerations.

The Susquehanna Unit 1 and Unit 2 HCVS discharge paths will be routed separately and will exit through each Reactor Building wall a minimum of 30 feet above ground elevation to a point approximately 3 feet above each units Reactor Building roof parapet, which is above any adjacent structure. It is noted that the cooling towers have a higher elevation but they are not adjacent to the Reactor Building. Missile protection for the HCVS external piping will be provided in accordance with guidelines established in HCVS-FAQ-04 (Reference 17).

This HCVS discharge point is such that the release point will be as far as practical away from emergency ventilation system intake and emergency ventilation system exhaust openings, main control room location, ROS, storage location of

Part 2: Boundary Conditions for Wetwell Vent

HCVS portable equipment, access routes required following a ELAP and BDBEE, and emergency response facilities; however, these will be considered in conjunction with other design criteria (e.g., flow capacity) and pipe routing limitations, to the degree practical. The vent pipe routing will satisfy the vent routing guidance provided in HCVS-FAQ-04 and HCVS-WP-04.

Power and Pneumatic Supply Sources

All electrical power required for operation of HCVS components will be provided by the HCVS batteries. The electrical supply to the HCVS instruments/solenoid valves will be isolated during normal plant operation (except the radiation monitor).

Battery power will be provided by the HCVS batteries for the first 24 hours following the ELAP event (see Open Item #7 in Attachment 7). FLEX generators (4160 vac) will be deployed to reenergize plant system components in accordance with FLEX Mitigation Strategy Integrated Plan (Ref. PLA-7137) within 6 hours of event initiation. This includes re-energizing the battery chargers associated with the HCVS batteries, which will support extended HCVS operation.

Pneumatic power will be provided by a gas bottle rack installed at the ROS. The gas bottles will supply the required motive force to those HCVS valves needed to maintain flow through the HCVS effluent piping. The gas supply will be sized to support HCVS operation for a minimum of 24 hours (a minimum of 8 valve cycles of valve operation is assumed, consistent with recommendations in HCVS-WP-02). This design assumption will require future validation in the design phase of this project (see Open Item #4 in Attachment 7). Backup gas bottles will be available at the FLEX storage facility to support extended HCVS operation.

During normal plant operation, the gas supply to the PCIVs will be isolated to eliminate the potential for inadvertent operation of these valves. Following an ELAP event, simple operator actions will be required to unlock the ROS door and operate manual valves at the remote operating station to align the gas supply to the PCIVs and rupture disk.

The HCVS valves (inboard and outboard PCIVs) will be air-operated valves (AOV) with air-to-open and spring-to-close. Opening the valves would require energizing a DC powered solenoid operated valve (SOV), to establish a flow path for motive gas from the gas bottles to open the HCVS valve. The system design will provide adequate power and motive gas supply to support 24 hours of operation with only simple operator actions required to initiate/operate the system, consistent with the guidance provided in HCVS-WP-01. The system design will credit FLEX to sustain DC power for greater than 24 hours. The initial stored motive gas will allow for a minimum of 8 valve operating cycles for the HCVS valves for the first 24-hours

(Ref. HCVS-FAQ-02).

All HCVS valves required to open the flow path will be designed for remote manual operation following an ELAP, such that the primary means of valve manipulation will not rely on use of a hand wheel, reach–rod or similar means that requires close proximity to the valve (reference FAQ HCVS-03). If the power supply to the solenoid valves were to fail, or if the solenoid valve were to fail, manual valves will be provided at the remote operating station to bypass the solenoid and allow alignment of the gas supply to the HCVS valves, to enable opening of the valves. Consequently, a vent flow path could be established, with no power available to the solenoid valves. In order to prevent inadvertent operation of the system from the remote operating station, a locked fence (or door) will be provided to prevent access to the ROS during normal plant operation.

An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the ROS, based on time constraints listed in Attachment 2 (see Open Item #5 in Attachment 7).

All permanently installed HCVS equipment, including any connections required to supplement the HCVS operation during an ELAP (i.e., electric power, gas) will be located in areas reasonably protected from defined hazards listed in Part 1 of this report.

Part 2: Boundary Conditions for Wetwell Vent

Access to the locations described above will not require temporary ladders or scaffolding.

Location of Control Panels

The HCVS design will allow initiating and then operating and monitoring the HCVS from the MCR and ROS located on Elevation 686'-6" in the Control Structure. The MCR location is protected from adverse natural phenomena and is the normal control point for Plant Emergency Response actions. The ROS is also protected from natural phenomena. ROS accessibility and habitability will be evaluated in accordance with HCVS-FAQ-01 and HCVS-FAQ-12 (see Open Item #5 in Attachment 7.)

Hydrogen

As is required by EA-13-109, Section 1.2.11, the HCVS will be designed such that it is able to either provide assurance that oxygen cannot enter and mix with flammable gas in the HCVS (so as to form a combustible gas mixture), or it will be able to accommodate the dynamic loading resulting from a combustible gas detonation. Several configurations are available which will support the former (e.g., purge, mechanical isolation from outside air, etc.) or the latter (design of potentially affected portions of the system to withstand a detonation relative to pipe stress and support structures). Viable options available to meet the requirements of EA-13-109, Section 1.2.11 are provided in HCVS-WP-03. SSES plans to eliminate the detonation concern by installing a check valve near the vent exhaust (see Open Item #6 in Attachment 7).

Air will be used to actuate the rupture disk. The air will be used when the vent line is filled with air (anticipatory venting). The air supply will be mechanically isolated from the HCVS pipe by 2 manually operated valves.

Unintended Cross Flow of Vented Fluids

Since the Susquehanna Unit 1 and 2 HCVS design will not be shared with any existing containment vent/purge systems and the vent path will be routed separately for each unit, cross flow of vented fluids would not be a concern for the Susquehanna HCVS design.

For Normal and Design Basis Accident (DBA) Conditions, the safety related position of the HCVS PCIVs is closed. During normal plant operation or DBA conditions, the motive force (gas pressure/electrical supply) required to open these valves will be isolated, thereby eliminating the possibility for inadvertent opening of these valves. Consequently, these valves will be equivalent to manual containment isolation valves in the primary containment isolation system. No divisionalized electrical supplies will be required to support operation of the two (2) HCVS PCIVs, since these normally closed, fail closed valves only safety function will be to remain closed during normal plant operation and under DBA conditions. This design will satisfy the existing Containment Isolation System Requirements as required in NRC Order EA-13-109, Section 2.1.

For beyond design basis ELAP conditions, the function of these valves will be to open or close as required to support HCVS operation under either "anticipatory venting" or "severe accident" conditions. Procedures will be in place to manually align the system through simple operator actions to support HCVS operation under these conditions. In this mode of operation, the system would not be required to meet the design requirements of the existing containment isolation system design, since this is a beyond design basis mode of operation, not subject to compliance with GDCs. The system will be designed to satisfy NRC Order requirements.

Prevention of Inadvertent Actuation

Emergency operating procedures will provide guidance that the HCVS is not to be used to defeat containment integrity during any design basis transients and accidents. The HCVS will be designed to provide features to prevent inadvertent actuation due to a design error, equipment malfunction, or operator error. Susquehanna does not rely on Containment Accident Pressure (CAP) to maintain NPSH for ECCS pumps. In addition, it is noted that initially, the ECCS pumps will

Part 2: Boundary Conditions for Wetwell Vent

not have normal power available because of the starting boundary conditions of an ELAP.

The HCVS PCIVs will serve a PCIV function to remain closed under normal operation and DBA conditions. The HCVS PCIVs will not have an active containment isolation system design function. The valves will be air to open and spring to close and will be normally closed. The features that prevent inadvertent actuation of the HCVS system during normal plant operation and design basis accident conditions include:

- The gas supply to the HCVS PCIVs will be normally isolated to eliminate the potential for inadvertent operation of these valves (removes motive force to valves). Prior to initiation of the HCVS, a simple operator action will be required to operate manual valves at the ROS to align the gas supply to the PCIVs.
- The electrical supply to the PCIV solenoid valves will be normally isolated to prevent inadvertent operation of the solenoid valves. A keylock switch will be provided on the HCVS control station to initiate/energize the HCVS control panel in the MCR. A separate keylock switch will also be provided for each PCIV. The electrical supply to all HCVS components will be normally isolated (except the radiation monitor).
- In order to prevent inadvertent operation of the system from the ROS, a locked door will be provided to prevent access to the ROS during normal plant operation.

By isolating the electrical supply and gas supply to the HCVS PCIVs during normal plant operation, the PCIVs will be effectively equivalent to a manual PCIV (no motive force available to inadvertently open the valves). This satisfies the containment isolation system design requirements with regard to inadvertent operation.

Component Qualifications

The HCVS components downstream of the second containment isolation valve and components that interface with the HCVS will be routed in seismically qualified structures, with the exception of the HCVS piping and check valve outside the Reactor building. These and any other exceptions identified during the design phase of this project will be analyzed for seismic ruggedness to ensure that any potential failure would not adversely impact the function of the HCVS or other safety related structures or components (i.e. - seismic category II over category I criteria]. HCVS components that directly interface with the containment pressure boundary will be considered safety related, consistent with existing containment isolation system components. The containment system limits the leakage or release of radioactive materials to the environment to prevent offsite exposures from exceeding the guidelines of 10CFR50.67. During normal or design basis operations, this means serving as a pressure boundary to prevent release of radioactive material.

Likewise, any electrical or control component which interfaces with Class 1E power sources will be considered safety related up to and including appropriate isolation devices such as fuses or breakers, as their failure could adversely impact the safety-related power source. The remaining components will be considered augmented quality. Newly installed piping and valves will be seismically qualified to handle the forces associated with the new seismic hazards developed in response to Near Term Task Force (NTTF) Recommendation 2.1 – Seismic, back to their isolation boundaries. Electrical and control components will be seismically qualified and will include the ability to handle harsh environmental conditions (although they will not be considered part of the site Environmental Qualification (EQ) program).

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

The HCVS instruments, including valve position indication, process instrumentation, radiation monitoring, and support system monitoring, will be qualified by using one or more of the three methods described in the ISG, which includes:

Purchase of instruments and supporting components with known operating principles from manufacturers with commercial quality assurance programs (e.g., ISO9001) where the procurement specifications include the applicable seismic requirements, design requirements, and applicable testing.

Part 2: Boundary Conditions for Wetwell Vent

Demonstration of seismic reliability via methods that predict performance described in IEEE 344-2004.

Demonstration that instrumentation is substantially similar to the design of instrumentation previously qualified.

Instrument	Qualification Method*
HCVS Process Temperature	ISO9001 / IEEE 344 / Demonstration
HCVS Process Radiation Monitor	ISO9001 / IEEE 344/ Demonstration
HCVS Process Valve Position	ISO9001 / IEEE 344 / Demonstration
HCVS Gas Supply Pressure	ISO9001 / IEEE 344 / Demonstration
HCVS Electrical Power Supply Availability	ISO9001 / IEEE 344 / Demonstration

* The specific qualification method used for each required HCVS instrument will be reported in future 6-month status reports.

Monitoring of HCVS

The Susquehanna Unit 1 and 2 wetwell HCVS will be capable of being manually operated during sustained operations from a control panel located in the MCR and will meet the requirements of Order element 1.2.4. The MCR is a readily accessible location with no further evaluation required. Control Room dose associated with HCVS operation will conform to GDC 19/Alternate Source Term (AST). Additionally, to meet the intent for a secondary control location of section 1.2.5 of the Order, a readily accessible ROS will also be incorporated into the HCVS design as described in NEI 13-02 section 4.2.2.1.2.1. The controls and indications at the ROS location will be 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), and inadequate containment cooling. For the proposed ROS, an evaluation will be performed to determine accessibility to the location, habitability, staffing sufficiency, and communication capability with Vent-use decision makers (see Open Item #5 in Attachment 7).

The wetwell HCVS will include means to monitor the status of the vent system in the MCR and the ROS. The ability to open/close these valves multiple times during the event's first 24 hours will be provided by gas bottles at the ROS and will be supplemented by a portable gas supply, as required, to support extended HCVS operation beyond 24 hours.

The wetwell HCVS will include indications for vent pipe pressure, temperature and effluent radiation levels at both the MCR and ROS. Other important information on the status of supporting systems, such as gas supply pressure and battery voltage, will also be included in the design and located in the MCR and ROS to support HCVS operation.

The wetwell HCVS includes existing Drywell pressure and Suppression Pool level indication in the MCR to monitor vent operation. This monitoring instrumentation provides the indication in the MCR as per Requirement 1.2.4 and is designed for sustained operation during an ELAP event.

Component reliable and rugged performance

The HCVS downstream of the second containment isolation valve, including piping and supports, electrical supply, valve actuator gas supply, and instrumentation (local and remote) components, will be designed/analyzed to conform to the requirements consistent with the applicable design codes (e.g., Non-safety, Seismic Category 1, B31.1, NEMA 4, etc.) for

Part 2: Boundary Conditions for Wetwell Vent

the plant and to ensure functionality following a design basis earthquake.

Additional components required to meet the Order will be reliable temperature, pressure, and radiation level instrumentation consistent with the vent pipe conditions for sustained operations. The instrumentation/electrical supplies/cables/connections (components) will be qualified for temperature, radiation level and total integrated dose radiation for the HCVS Pipe and at the HCVS ROS location.

Conduit design will be installed to Seismic Class 1 criteria. All conduit will be installed inside seismically qualified structures. Augmented quality program will be applied to the components installed in response to this Order.

If the instruments are purchased as commercial-grade equipment, they will be qualified to operate under severe accident environment as required by NRC Order EA-13-109 and the guidance of NEI 13-02. The equipment will be demonstrated suitable for the seismic, environmental, and EMI/RFI conditions anticipated for their location. These qualifications will be bounding conditions for Susquehanna Units 1 and 2.

For the instruments required after a potential seismic event, the following methods will be used to verify that the design and installation is reliable, rugged and thus capable of ensuring HCVS functionality following a seismic event. Applicable instruments will be rated by the manufacturer (or otherwise tested) for seismic impact at levels commensurate with those of postulated severe accident event conditions in the area of the instrument component using one or more of the following methods:

- demonstration of seismic motion will be consistent with that of existing design basis loads at the installed location;
- substantial history of operational reliability in environments with significant vibration with a design envelope inclusive of the effects of seismic motion imparted to the instruments proposed at the location;
- adequacy of seismic design and installation is demonstrated based on the guidance in Sections 7, 8, 9, and 10 of IEEE Standard 344-2004, *IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations*, (Reference 27) or a substantially similar industrial standard;
- demonstration that proposed devices are substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges); or
- seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location.

Part 2: Boundary Conditions for Wetwell Vent

Part 2 Boundary Conditions for Wetwell Vent: **BDBEE Venting**

Determine venting capability for BDBEE Venting, such as may be used in an ELAP scenario to mitigate core damage.
Ref: EA-13-109 Section 1.1.4 / NEI 13-02 Section 2.2

First 24 Hour Coping Detail

Provide a general description of the venting actions for first 24 hours using installed equipment including station modifications that are proposed.

Ref: EA-13-109 Section 1.2.6 / NEI 13-02 Section 2.5, 4.2.2

The operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and BDBEE hazards identified in part 1 of this OIP. Operator actions can be completed by Operators from the HCVS control stations and include remote-manual initiation. The operator actions required to open a vent path are as described in Table 2-1.

Remote-manual is defined in this report as a non-automatic power operation of a component and does not require the operator to be at or in close proximity to the component. No other operator actions will be required to initiate venting under the guiding procedural protocol.

The HCVS will be designed to allow initiation, control, and monitoring of venting from the Main Control Room (MCR) or the ROS. These locations will minimize plant operators' exposure to adverse temperature and radiological conditions and are protected from hazards assumed in Part 1 of this report.

Permanently installed electrical supply and motive gas capability will be available to support operation and monitoring of the HCVS for a minimum of 24 hours during an ELAP event (see Open Item #7 in Attachment 7). Permanently installed equipment will supply air and power to HCVS for a minimum of 24 hours.

System control:

i. Active: PCIVs will be operated in accordance with procedures to control containment pressure. The HCVS will be designed for at least 8 open/close cycles under ELAP conditions over the first 24 hours following an ELAP. Controlled venting will be permitted in the revised EPGs and associated implementing EOPs.
ii. Passive: Inadvertent actuation protection will be provided by isolating the gas supply to the HCVS PCIVs and the power supply to the PCIV solenoid valves during normal plant operation and design basis accident conditions. The PCIVs will be air to open, spring to close valves, and will be normally closed. By isolating the power/gas supply to the HCVS PCIVs during normal plant operation, the PCIVs will be effectively equivalent to a normally closed manual valve with no motive force available to inadvertently open the valves, thereby effectively preventing inadvertent operation of the HCVS. In addition, keylock switches will be used in the MCR to isolate the power supply to the PCIV solenoid valves. A locked door (or equivalent) will be used to prevent access to the ROS during normal plant operation.

Greater Than 24 Hour Coping Detail

Part 2: Boundary Conditions for Wetwell Vent

Part 2 Boundary Conditions for Wetwell Vent: **BDBEE Venting**

Provide a general description of the venting actions for greater than 24 hours using portable and installed equipment including station modifications that are proposed.

Ref: EA-13-109 Section 1.2.4, 1.2.8 / NEI 13-02 Section 4.2.2

Within 24 hours, personnel will be available to connect supplemental motive gas

(e.g. - Gas Bottles) to the HCVS. FLEX procedures will also be initiated to connect 4160 V FLEX generators to Class 1E 4160 vac buses and supply the station 480 VAC system within approximately 6 hours following an ELAP. These generators will re-energize the battery chargers used to charge the HCVS batteries. The response to NRC EA-12-049 will demonstrate the capability for FLEX efforts to support this credited HCVS function. Connections for supplementing electrical power and motive air/gas required for HCVS will be located in accessible areas with reasonable protection per NEI 12-06 that minimize personnel exposure to adverse conditions for HCVS initiation and operation. Connections for the gas supply will be designed with connections to minimize manpower resources.

These actions will provide long term support for HCVS operation for the period beyond 24 hrs. to 7 days (sustained operation time period) because on-site and off-site personnel and resources will have access to the unit(s) to provide needed action and supplies.

Details:

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.
NEI 13-02 §6.1.2

Primary Containment Control Flowchart exists to direct operations in protection and control of containment integrity using the existing containment vent. Primary containment control procedures will be revised to incorporate use of the new HCVS during implementation of Revision 3 of the EOP/SAGs (Reference 31 and 32).

Identify modifications*:*

List modifications and describe how they support the HCVS Actions.

EA-12-049 Modifications

- EC 1719084 - PORTABLE GENERATOR TIE IN TO DIESEL GENERATOR E BLDG. This modification provides the required electrical FLEX connection points for tie–in of portable 4160 vac generators under ELAP conditions.

EA-13-109 Modifications

Unit 2 (lead Unit)

The proposed modifications required to implement the HCVS Vent order are identified below:

- A modification will be required to install the HCVS piping, containment isolation valves, rupture disk, and vent stack including the platform at the top of the vent for check valve maintenance. This modification breaches the reactor building wall.
- A modification will be required to install new remote operating station including conduit, cabling and tubing to

Part 2: Boundary Conditions for Wetwell Vent

Part 2 Boundary Conditions for Wetwell Vent: **BDBEE Venting**

instrument and valve locations. System and component testing will be included in this package.

- An outage modification will be required to install the HCVS control and instruments in the MCR and to connect the equipment in the MCR to the equipment in the ROS. System and component testing will be included in this package.
- An outage modification will be required to tie-in the new HCVS to the existing wetwell containment penetration and to the control room. System testing requirements would also be included in this package.

Modifications required to implement the Unit 1 HCVS will be similar.

Key Venting Parameters:

List instrumentation credited for this venting actions. Clearly indicate which of those already exist in the plant and what others will be newly installed (to comply with the vent order)

Initiation, operation and monitoring of the HCVS venting will rely on the following key parameters and new indicators (instruments provided for Unit 2, Unit 1 will be similar):

Key Parameter	Component Identifier	Indication Location
HCVS Effluent temperature	TI25753	MCR/ROS
HCVS Gas supply pressure	PI25731	MCR/ROS
HCVS valve position indication	ZI25701A, ZI25702A (Open) ZI25701B, ZI25702B (Closed)	MCR/ROS
HCVS Radiation Level Recorder	RR25756	MCR
HCVS Radiation Level Indication	RY25756	ROS

Initiation, operation and monitoring of the HCVS system will also utilize several existing Main Control Room key parameters and indicators which are qualified or evaluated to Reg. Guide 1.97 per the existing plant design (Reference NEI 13-02, Section 4.2.2.1.9:

Key Parameter	Component Identifier	Indication Location
Drywell and Suppression Pool pressure	UR15701A / UR15701B UR25701A / UR25701B	MCR
Suppression Pool Water Temperature	TIAH15751 / TIAH15752 TIAH25751 / TIAH25752	MCR
Suppression Pool Water level	UR15776A / UR15776B UR25776A / UR25776B	MCR
Reactor Pressure	PI14202A(B) / PI14204A(B) PI24202A(B) / PI24204A(B)	MCR

HCVS indications for HCVS valve position indication, HCVS gas supply pressure, and HCVS effluent radiation level, temperature, and pressure will be installed in the MCR to comply with EA-13-109.

Notes:

Part 2: Boundary Conditions for Wetwell Vent

Part 2 Boundary Conditions for Wetwell Vent: **Severe Accident Venting**

Determine venting capability for Severe Accident Venting, such as may be used in an ELAP scenario to mitigate core damage.

Ref: EA-13-109 Section 1.2.10 / NEI 13-02 Section 2.3

First 24 Hour Coping Detail

Provide a general description of the venting actions for first 24 hours using installed equipment including station modifications that are proposed.

Ref: EA-13-109 Section 1.2.6 / NEI 13-02 Section 2.5, 4.2.2

The operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and severe accident (SA) events. Severe accident event assumes that specific core cooling actions from the FLEX strategies identified in the response to Order EA-12-049 were not successfully initiated. Access to the reactor building will be restricted as determined by the RPV water level and core damage conditions. Immediate actions will be completed by Operators in the MCR or at the HCVS ROS and will include remote-manual actions. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this report (Table 2-1).
Permanently installed electrical supply and motive gas capable will be available to support operation and monitoring of the HCVS for 24 hours. Specifics are the same as for BDBEE Venting Part 2.
System control:

i. Active: PCIVs will be manually operated in accordance with EOPs/OPs to control containment pressure. For severe accident conditions (e.g. - Case 2 or 3 of Figure 2A), vent operation will be in accordance with the EOPs and SAMGs. It is anticipated that containment pressure will be maintained within a specified operating band by opening and closing the outboard PCIV in the HCVS. The HCVS will be designed for at least 8 open/close cycles under ELAP conditions over the first 24 hours following an ELAP. This assumption will require future validation during the design phase of this project, following finalization of HCVS operating strategy under severe accident conditions (see Open Item #4 in Attachment 7).

ii. Passive: Same as for BDBEE Venting Part 2.

Details:

Provide a general description of the venting actions for greater than 24 hours using portable and installed equipment including station modifications that are proposed.

Ref: EA-13-109 Section 1.2.4, 1.2.8 / NEI 13-02 Section 4.2.2

Part 2: Boundary Conditions for Wetwell Vent

Part 2 Boundary Conditions for Wetwell Vent: **Severe Accident Venting**

Specifics are the same as for BDBEE Venting Part 2 except the credited actions required to support HCVS system operation beyond 24 hours will be evaluated for SA environmental conditions resulting from the proposed damaged Reactor Core and resultant HCVS vent pathway.

Deployment of the FLEX generators under severe accident conditions will be confirmed (see Open Item #2, Attachment 7).

These actions will provide long term support for HCVS operation for the period beyond 24 hrs. to 7 days (sustained operation time period) because on-site and off-site personnel and resources will have access to the unit(s) to provide needed action and supplies.

First 24 Hour Coping Detail

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.

The operation of the HCVS will be governed the same for SA conditions as for BDBEE conditions. Existing guidance in the SAMGs directs the plant staff to consider changing radiological conditions in a severe accident.

Identify modifications*:*

List modifications and describe how they support the HCVS Actions.

The same as for BDBEE Venting Part 2.

Key Venting Parameters:

List instrumentation credited for the HCVS Actions. Clearly indicate which of those already exist in the plant and what others will be newly installed (to comply with the vent order)

The same as for BDBEE Venting Part 2.

Notes:

Part 2: Boundary Conditions for Wetwell Vent

Part 2 Boundary Conditions for Wetwell Vent: **HCVS Support Equipment Functions**

Determine venting capability support functions needed

Ref: EA-13-109 Section 1.2.8, 1.2.9 / NEI 13-02 Section 2.5, 4.2.4, 6.1.2

BDBEE Venting

Provide a general description of the BDBEE Venting actions support functions. Identify methods and strategy(ies) utilized to achieve venting results.

Ref: EA-13-109 Section 1.2.9 / NEI 13-02 Section 2.5, 4.2.2, 4.2.4, 6.1.2

Containment integrity is initially maintained by permanently installed equipment. All containment venting functions will be performed from the MCR or ROS.

Venting from the MCR will require a gas supply and DC power. Dedicated HCVS batteries will provide sufficient electrical supply for HCVS operation for greater than 24 hours. Before the HCVS batteries are depleted, portable FLEX generators, as detailed in the response to Order EA-12-049, will be credited to charge the HCVS batteries and maintain DC bus voltage after 24 hours. Permanently installed gas bottles will provide sufficient motive force for HCVS valve operation up to 24 hours. Portable gas supply will provide the motive force required for HCVS valve operation beyond 24 hours. Venting from the ROS will only require a gas supply.

Severe Accident Venting

Provide a general description of the Severe Accident Venting actions support functions. Identify methods and strategy(ies) utilized to achieve venting results.

Ref: EA-13-109 Section 1.2.8, 1.2.9 / NEI 13-02 Section 2.5, 4.2.2, 4.2.4, 6.1.2

The same support functions that are used in the BDBEE scenario would be used for severe accident venting. Actions required to-support HCVS operation beyond 24 hours will be evaluated for SA capability.

Details

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.

Most of the equipment used in the HCVS will be permanently installed. The key portable items are the FLEX Generators and the additional portable gas supply that will be needed to supplement the gas supply to the PCIVs after 24 hours. This equipment will be stored in the FLEX Building, which has been constructed to meet the requirements identified in NEI-12-06 section 11 for screened in hazards.

Identify modifications:

List modifications and describe how they support the HCVS Actions.

Part 2: Boundary Conditions for Wetwell Vent

Part 2 Boundary Conditions for Wetwell Vent: **HCVS Support Equipment Functions**

FLEX modifications applicable to HCVS operation: A modification will be implemented to provide the required electrical FLEX connection points for tie–in of portable 4160 vac generators under ELAP conditions (Reference: EC 1719084). These generators will provide power to the HCVS battery chargers after 24 hours.

HCVS modification: Gas supply connection points will be added at the Remote Operating Station to connect portable gas bottles for motive force to HCVS components after 24 hours. HCVS connections required for portable gas bottles will be protected from all applicable screened-in hazards and located such that operator exposure to radiation and occupational hazards will be minimized. Structures to provide protection of the HCVS connections will be constructed to meet the requirements identified in NEI-12-06 section 11 for screened in hazards.

Key Support Equipment Parameters:

List instrumentation credited for the support equipment utilized in the venting operation.
Clearly indicate which of those already exist in the plant and what others will be newly installed (to comply with the vent order)

Local control features of the FLEX generator electrical load and fuel supply.

Pressure gauge on supplemental gas bottles.

Notes:

Part 2: Boundary Conditions for Wetwell Vent

Part 2 Boundary Conditions for Wetwell Vent: **HCVS Venting Portable Equipment Deployment**

Provide a general description of the venting actions using portable equipment including modifications that are proposed to maintain and/or support safety functions.

Ref: EA-13-109 Section 3.1 / NEI 13-02 Section 6.1.2, D.1.3.1

Deployment pathways for compliance with Order EA-12-049 are acceptable without further evaluation needed except in areas around the Reactor Building or in the vicinity of the HCVS piping. Deployment in the areas around the Reactor Building or in the vicinity of the HCVS piping will allow access, operation and replenishment of consumables with the consideration that there is potential Reactor Core Damage and HCVS operation. (see Open Item #2 in Attachment 7)

Details:

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.

Operation of the portable equipment will be the same as for compliance with Order EA-12-049 thus they are acceptable without further evaluation

HCVS Actions	Modifications	Protection of connections
Identify Actions including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection is protected*
Per compliance with Order EA-12-049 (FLEX)	N/A	Per compliance with Order EA-12-049 (FLEX)

Notes:

Part 3: Boundary Conditions for EA-13-109, Option B.2

General:

Licensees that use Option B.1 of EA-13-109 (SA Capable DW Vent without SAWA) must develop their own OIP. This template does not provide guidance for that option.

Licensees using Option B.2 of EA-13-109 (SAWA and SAWM or 545°F SADW Vent (SADV) with SAWA) may use this template for their OIP submittal. Both SAWM and SADV require the use of SAWA and may not be done independently. The HCVS actions under Part 2 apply to all of the following:

This Part is divided into the following sections:

- *3.1: Severe Accident Water Addition (SAWA)*
  - *3.1.A: Severe Accident Water Management (SAWM) – applicable to Susquehanna*
  - *3.1.B: Severe Accident DW Vent (545 deg. F) – not applicable to Susquehanna*

Provide a sequence of events and identify any time constraint required for success including the basis for the time constraint.

SAWA and SAWM Actions supporting SA conditions that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, a walkthrough of deployment). Actions already identified under the HCVS part of this template need not be repeated here.

The time to establish the water addition capability into the RPV or Drywell should be less than 8 hours from the onset of the loss of all injection sources.

- *Electrical generators satisfying the requirements of EA-12-049 may be credited for powering components and instrumentation needed to establish a flow path.*
- *Time Sensitive Actions (TSAs) for the purpose of SAWA are those actions needed to transport, connect and start portable equipment needed to provide SAWA flow or provide power to SAWA components in the flow path between the connection point and the RPV or drywell. Actions needed to establish power to SAWA instrumentation should also be included as TSAs.*

Ref: NEI 13-02 Section 6.1.1.7.4.1, I.1.4, I.1.5

The operation of the HCVS using SAWA and SAWM will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1. Initial operator actions will be completed by plant personnel and will include the capability for remote-manual initiation from the MCR and ROS. Some SAWA and SAWM actions will occur near the ESSW Pumphouse.

Timelines (see attachments 2.1.A for SAWA/ SAWM) were developed to identify required operator response times and actions. The timelines are an expansion of Attachment 2A and begin either as core damage occurs (SAWA) or after initial SAWA injection is established and as flowrate is adjusted for option B.2 (SAWM). The timelines do not assume the core is ex-vessel and the actions taken are appropriate for both in-vessel and ex-vessel core damage conditions.

Part 3.1: Boundary Conditions for SAWA

Table 3.1 – SAWA Manual Actions

Primary Action	Primary Location / Component	Notes
1. Establish HCVS capability in accordance with Part 2 of this guidance.	■ ROS to unisolate gas supply to PCIVs and direct compressed gas to rupture disk. ■ MCR to remotely operate solenoid valves that open PCIVs in accordance with procedures.	■ Applicable to SAWA/SAWM strategy
2. Connect pumper truck to water source.	■ Spray Pond located at ESSW (Emergency Safeguards Service Water) Pumphouse.	■ Per EA-12-049 and NEI 12-06 responses.
3. Connect pumper truck discharge to injection piping	■ Use installed piping and hose connections in ESSW Pumphouse.	■ Connections are to RHRSW piping, which cross-connects to U1 and U2 RHR piping. ■ Injection to RPV is through LPCI line.
4. Power up SAWA flow path valves with EA-12-049 (FLEX) generators.	■ RHRSW-to-RHR cross-tie valves and RHR LPCI injection valves can be operated from the Main Control Room.	■ Injection flow path will be the same as that used for FLEX Mitigation strategy. ■ Time line for FLEX, supported by Validation Study, indicates this action can be completed within 6 hours of ELAP initiation.
5. Inject to RPV using pumper truck.	■ ESSW Pumphouse and Reactor Building.	■ Initial SAWA injection rate will be 500 gpm. One pumper truck will be used to supply both units. Capacity of pumper is sufficient to supply 500 gpm to SAWA unit and the required FLEX flow to opposite unit (OIP Open Item 8).

Part 3.1: Boundary Conditions for SAWA

6. Monitor SAWA flow indications	■ Main Control Room and pumper truck location near ESSW Pumphouse	■ Two hoses supplied by the pumper truck will be routed to separate FLEX hose connections in the ESSW Pumphouse. One connection will supply water to Unit 1 through RHRSW-to-RHR cross-tie line. The other connection will supply water to Unit 2 through an independent RHRSW-to-RHR cross-tie line. Each hose path will include an in-line flow meter to monitor flow rate to the SAWA unit and to the FLEX unit.
7. Use SAWM to maintain availability of the Wetwell vent (Part 3.1.A)	Main Control Room and pumper truck location near ESSW Pumphouse.	■ Monitor Drywell Pressure and Suppression Pool Level in MCR. o SAWM flow rate will be achieved by setting pumper truck discharge pressure (at pumper location) in accordance with procedure and throttling valves in pumper truck discharge hoses as necessary.

Discussion of timeline SAWA identified items

HCVS operations are discussed under Phase 1 of EA-13-109 (Part 2 of this OIP).

- 6 Hours – Establish electrical power to operate valves and power instruments needed to support the strategies for EA-13-109, Phase 1 and Phase 2. Action being taken within the reactor building under EA-12-049 conditions after RPV level lowers to 2/3 core height must be evaluated for radiological conditions assuming permanent containment shielding remains intact. (HCVS-FAQ-12) All other actions required are assumed to be in-line with the FLEX timeline submitted in accordance with the EA-12-049 requirements.
- ≤8 Hours – Initiate SAWA flow to the RPV. Having the HCVS in service will assist in minimizing the peak Drywell pressure during the initial cooling conditions provided by SAWA.

Severe Accident Operation

Determine operating requirements for SAWA, such as may be used in an ELAP scenario to mitigate core damage.

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section I.1.6, I.1.4.4

Part 3.1: Boundary Conditions for SAWA

It is anticipated that SAWA will be used in Severe Accident events based on presumed failure of injection systems or presumed failure to implement an injection system in a timely manner leading to core damage. This does not preclude the use of the SAWA system and equipment to supplement or replace the EA-12-049 injection systems if desired. SAWA will consist of both portable and installed equipment.

The motive force equipment needed to support the SAWA strategy shall be available prior to t=8 hours from the loss of injection (assumed at T=0).

The SAWA flow path includes methods to minimize exposure of personnel to radioactive liquids / gases and potentially flammable conditions by inclusion of backflow prevention. The RHR LPCI injection path has installed ECCS backflow prevention devices (HV151F050A/B, HV251F050A/B) qualified for design basis accident scenarios.

Description of SAWA actions for first 24 hours:

T < 1 hr.:

- No evaluation required for actions inside the reactor building for SAWA. Expected actions are:
    - No actions performed in Reactor Building during first hour of event.

T = 1 – 7* hr.:

- Evaluation of core gap and early in-vessel release impact to reactor building access for SAWA actions is required. It is assumed that reactor building access is limited due to the source term at this time unless otherwise noted. (Refer to HCVS-FAQ-12 for actions in T=1-7 hr.) Expected actions are:
    - Perform breaker alignments of Unit 1 and Unit 2 Reactor Building electrical distribution system in preparation for energization by on-site 4160 VAC FLEX generators. In parallel, chock Switchgear and Load Center doors open to provide ventilation in accordance with DC-FLEX-107/207. These tasks require a total of 2 NPOs for two hours.
        - Actions are performed in Switchgear (Rooms I/II-406 and I/II-407 on Elev. 719') and Load Center rooms (Rooms I/II-507 and I/II-510 on Elev. 749'). Breaker alignments are specified in DC-FLEX-010, R0, Attachments B & C.
        - Per ELAP Min Staffing Timing Strategy in Attachment K of SBO Procedure EO-200-030, Rev. 31, task is initiated at 1 hr. into ELAP. From FLEX Validation Study (AR-2015-04750), Item #10, task requires 1.35 hr. to complete.
        - Vessel is intact when the breaker alignments are performed. Damaged core is therefore shielded by vessel, reactor biological shield, and containment wall.
        - For DBA, dose rates in these areas are due primarily to shine from RHR piping (Ref. EC-076-1003). RHR would not be operating in an ELAP event; therefore, dose would be from shine through containment wall. Based on dose rates provided in FSAR §18.1.20.3.2.1.11 for post-accident vital area access, dose from shine through 6-foot concrete containment wall during DBA is equivalent to Zone I levels (≤15 mR/hr). Expected dose from performing the task is about 25 mR, which is well below the dose limit of 5 rem (FSAR §18.1.20.3.3.3). Note that the FSAR release fractions into containment are the same as those in HCVS-WP-02 for conditions prior to the vessel breach.

Part 3.1: Boundary Conditions for SAWA

- Deploy pumper truck and fuel trailers for vessel makeup, run hoses and hookup lines to RHRSW connections at ESSW Pumphouse (Ref. per DC-FLEX-003 and DC-B5B-202). FLEX Validation Report, Action Item #8 determined that this task can be completed within 1 hr. Two Fire Brigade Members are required for implementation. ELAP Min Staffing Timing Strategy in Attachment K of SBO Procedure EO-200-030, Rev. 31 indicates task is initiated at 1 hr. into ELAP. No actions are required in Reactor Building.

- Deploy and energize FLEX 4160 VAC generators and implement fuel deployment strategy (DC-FLEX-003/010/011).
  - Tasks are commenced within 1 hr. of ELAP initiation and completed within 6 hours of ELAP initiation (Ref. EO-200-030, Rev. 31, Attachment K and FLEX Strategy Validation Report, Item #10). Tasks are performed at 'E' DG Building, which is located east of Unit 1 and Unit 2 reactor buildings (see sketch on p. 65 of DC-FLEX-010 and Drawing A-3, Sheet 1). Tasks are completed prior to opening of containment vent, which occurs at approximately 8 hours (assumed time of vessel breach).
  - SAWA flow path valves would consist of RHRSW-to-RHR cross-tie valves (F073 and F075 valves) and LPCI line injection valve (F015). These valves will be powered by FLEX generators and could be opened from the Main Control Room at 6 hours.
- Establish flow to the RPV using SAWA equipment at a rate of ~500 GPM.
  - A single pumper truck would take suction from the Spray Pond and discharges through hose(s) that connect to RHRSW Loops A and B in the ESSW Pumphouse. Each loop of RHRSW will supply cooling water to one unit independent of the other unit. The hoses will include an in-line flow meter that would allow monitoring SAWA flow to the severe accident unit and FLEX flow to the opposite unit. In addition, the branch hoses will include valves for flow control. This arrangement will allow SAWA flow to be monitored and controlled to the target value of 500 GPM at a single location.

T ≤12 hr.:

- Continue injection for 4 hours after SAWA injection begins at initial SAWA rate of 500 gpm. Per Susquehanna EA-12-049 OIP Timeline (Ref. 28), SAWA injection to RPV would be available at 6 hr. Injection is assumed to begin at 8 hr. (time of vessel failure) in order to provide consistency with BWROG-TP-15-011, Rev. 0 and NEI 13-02, Rev. 1, §C.7.1.1.

T = 12 - 24 hr.:

- After 4 hours of injection at 500 GPM, proceed to SAWM actions (Part 3.1.A)

** The 1 hour gap between 7 and 8 hours is used to provide margin.*

Greater Than 24 Hour Coping Detail

Provide a general description of the SAWA actions for greater than 24 hours using portable and installed equipment including station modifications that are proposed.

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3/ NEI 13-02 Section 4.2.2.4.1.3.1, I.1.4,

Part 3.1: Boundary Conditions for SAWA

SAWA operation will be the same for the full period of sustained operation. If SAWM is employed flow rates will be managed to preserve the availability of the HCVS wetwell vent (see 3.1.A).

Details:

Details of Design Characteristics/Performance Specifications

SAWA shall be capable of providing a RPV injection rate of 500 gpm within 8 hours of a loss of all RPV injection following an ELAP/Severe Accident. SAWA shall meet the design characteristics of the HCVS with the exception of the dedicated 24 hour power source. Hydrogen mitigation is provided by backflow prevention for SAWA.

Ref: EA-13-109 Attachment 2, Section B.2.1, B.2.2, B.2.3/ NEI 13-02 Section I.1.4

Equipment Locations/Controls/Instrumentation

The locations of the SAWA equipment and controls, as well as ingress and egress paths will be evaluated for the expected severe accident conditions (temperature, humidity, radiation) for the Sustained Operating period. Equipment will be evaluated to remain operational throughout the Sustained Operating period. Personnel exposure and temperature / humidity conditions for operation of SAWA equipment will not exceed the limits for ERO dose and plant safety guidelines for temperature and humidity (OPEN ITEM 2 – need to evaluate dose for operation and refueling of FLEX generators).

The flow path will be from the FLEX suction in the Spray Pond near the ESSW Pumphouse. A single pumper truck will take suction from the Spray Pond and discharge through a hose, which will branch to two additional hoses that connect to RHRSW Loops A and B in the ESSW Pumphouse. Each loop of RHRSW will be aligned to supply cooling water to one unit independent of the other unit. The two hoses will each include an in-line flow meter that allows monitoring SAWA flow to the severe accident unit and FLEX flow to the opposite unit. In addition, the two hoses will include valves for flow control. This arrangement will allow SAWA flow to be monitored and controlled at a single location. RHRSW cross-connects to RHR by means of the F073 and F075 valves (Ref. P&IDs M-112, Sheet 1 and M-2112, Sheet 1). SAWA flow will then be directed to the severe-accident unit through the LPCI injection line (Ref. M-151 and M-2151). On the opposite unit, RHR and RHRSW will be aligned to support FLEX mitigation strategy as specified in applicable FLEX procedures.

MOVs in the 6-inch RHRSW-to-RHR cross-tie lines and the 24-inch LPCI injection lines will be opened from the Main Control Room after the 4160 VAC FLEX generators are energized and feeding the 4.16 KV ESS Buses. On the severe-accident unit, cross flow into segments of the RHR system other than LPCI line will be prevented by ensuring closure of the appropriate MOVs from the MCR. Drywell pressure and Suppression Pool level will be monitored from the MCR. SAWA flow rate will be adjusted by use of a valve in the flow path feeding the RHRSW Loop aligned to the severe-accident unit. Communication will be established between the MCR and the ESSW Pumphouse area. The pumper truck location will be a substantial distance from HCVS vent pipe, and nearly all of the vent pipe will be shielded from view of the ESSW Pumphouse by plant buildings (see Drawing A-3, Sheet 1).

FLEX generators will be positioned on the east side of the 'E' Diesel Generator Building such that the building provides as much shielding as possible from the HCVS piping that runs vertically along the east outside wall of the Reactor Buildings (see sketch on p. 65 of DC-FLEX-010, Rev. 0). FLEX generators will be situated and the refueling strategy implemented prior to opening the HCVS during a severe accident. Fuel oil will be pumped from the 'E' Diesel Generator fuel oil tank, which is also located on the east side of the 'E' Diesel Generator Building. It is expected that the PCPL would be reached and the vent would be opened when vessel failure is assumed to occur at 8 hours into the ELAP.

Part 3.1: Boundary Conditions for SAWA

An evaluation will be performed to evaluate the need for additional shielding to support ongoing operation and refueling of the FLEX generators after the vent is opened at 8 hours. Connection of the 4160 VAC FLEX generators to the ESS Busses and refueling of the FLEX generators will be performed as described in the EA-12-049 compliance documents. Drawing A-3, Sheet 1 shows the location of the 'E' Diesel Generator Building and the ESSW Pumphouse in relation to the east side of the Unit 1 and 2 Reactor Buildings.

Evaluations for projected SA conditions (radiation / temperature) will be performed to demonstrate that personnel can complete the initial and support activities without exceeding the ERO-allowable dose for equipment operation or site safety standards. (reference HCVS-WP-02, Plant-Specific Dose Analysis for the Venting of Containment during the SA Conditions, OIP Open Item 2)

Electrical equipment and instrumentation (non-HCVS) will be powered from the existing station batteries, and from AC distribution systems that are powered from the FLEX generators. The battery chargers will also be powered from the FLEX generators to maintain the battery capacities during the Sustained Operating period.
The indications include (* are minimum)

Parameter	Instrument	Location	Power Source / Notes
*Drywell Pressure	UR15701A/B UR25701A/B	MCR	Station batteries via EA-12-049 generator
*Suppression Pool Level	UR15776A/B UR25776A/B	MCR	Station batteries via EA-12-049 generator
*SAWA Flow	Inline flow meter in hose feeding severe-accident unit.	ESSW Pumphouse	Mechanical device. No external electrical power will be required.
Valve controls	MCR Panels for MOVs. For manual valves in pumper truck discharge lines, valve position will be inferred from local flow indication.	MCR for MOVs ESSW Pumphouse for manual flow control valves in hoses to RHRSW.	FLEX 4160 VAC generators for MOVs

The instrumentation and equipment being used for SAWA and supporting equipment will be evaluated to perform for the Sustained Operating period under the expected radiological and temperature conditions. The Drywell Pressure and Suppression Pool Level instruments listed above are Post Accident Monitoring Instruments (Reference – Technical Specification Table B 3.3.3.1-1).

Equipment Protection

Any SAWA component and connections external to protected buildings have been protected against the screened-in hazards of EA-12-049 for the station. All SAWA equipment is in either existing robust buildings (Reactor Buildings, ESSW Pumphouse, and Diesel Generator Buildings) or in the FLEX Building (that meets all NEI 12-06 requirements). The primary 4160 vac electrical strategy will use permanently installed, fully protected connections on the exterior wall of the 'E' Diesel Generator building. The alternate 4160 vac electrical strategy equipment is stored in the 'A' through 'D' Diesel Generator buildings and in the FLEX Building. Portable equipment used for SAWA implementation will

Part 3.1: Boundary Conditions for SAWA

meet the protection requirements for storage in accordance with the criteria in NEI 12-06 Revision 0.

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section 5.1.1, 5.4.6, I.1.6

Provide a brief description of Procedures / Guidelines:

Confirm that procedure/guidance exists or will be developed to support implementation.

Ref: EA-13-109 Attachment 2, Section A.3.1, B.2.3 / NEI 13-02 Section 1.3, 6.1.2

Procedure development will include the following:

- Hook up pumper truck to hose connections in ESSW Pumphouse at valves 112109 and 112110. Modify existing procedural guidance in DC-B5B-202 to include supplying pumper truck flow to both loops of RHRSW by means of the two hose connections in ESSW Pumphouse. Valve 112109 connects to RHRSW Loop A and Valve 112110 connects to RHRSW Loop B.
- Hook-up and start FLEX 4160 VAC generators to repower selected loads on 4.16 kV ESS busses. Use existing FLEX procedure DC-FLEX-010.
- Using MCR switches, open HV212F073B and HV212F075B to cross-connect RHRSW Loop B to RHR Loop B on Unit 2. Open HV112F073A and HV112F075A to cross-connect RHRSW Loop A to RHR Loop A on Unit 1.
- On the severe-accident unit, prepare RHR system alignment for RPV injection through LPCI flow path. On the opposite unit, align RHR/RHRSW flow paths per existing FLEX procedures.
- On severe-accident unit, open HV1(2)51F015A/B valve using MCR Switches to establish injection to vessel through RHR LPCI injection pathway.
- Adjust flow rate using inline flow meter and flow control valve in pumper truck hose feeding the severe-accident unit. Set flow to initial target value of 500 GPM.

Identify modifications:

List modifications and describe how they support the SAWA Actions.

Ref: EA-13-109 Attachment 2, Section B.2.2, / NEI 13-02 Section 4.2.4.4, 7.2.1.8, Appendix I

No new physical plant modifications are planned for SAWA.

Component Qualifications:

State the qualification used for equipment supporting SAWA

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section I.1.6

Permanently installed plant equipment shall meet the same qualifications as described in Part 2 of this OIP. Temporary/Portable equipment shall be qualified and stored to the same requirements as FLEX equipment as specified in NEI 12-06 Rev 0. SAWA components are not required to meet NEI 13-02, Table 2-1 design conditions.

Part 3.1: Boundary Conditions for SAWA

Notes:

None

Part 3.1.A: Boundary Conditions for SAWA/SAWM

Time periods for the maintaining SAWM actions such that the Wetwell vent remains available for > 7 days

SAWM Actions supporting SA conditions that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, a walkthrough of deployment). Actions already identified under the HCVS part of this template need not be repeated here.

There are three time periods for the maintaining SAWM actions such that the Wetwell vent remains available to remove decay heat from the containment:

- *SAWM can be maintained for >7 days without the need for a drywell vent to maintain pressure below PCPL or containment design pressure, whichever is lower.*
  - *Under this approach, no detail concerning plant modifications or procedures is necessary with respect to how alternate containment heat removal will be provided.*
- *SAWM can be maintained for at least 72 hours, but less than 7 days before DW pressure reaches PCPL or design pressure, whichever is lower.*
  - *Under this approach, a functional description is required of how alternate containment heat removal might be established before DW pressure reaches PCPL or design pressure whichever is lower. Under this approach, physical plant modifications and detailed procedures are not necessary, but written descriptions of possible approaches for achieving alternate containment heat removal and pressure control will be provided.*
- *SAWM can be maintained for < 72 hours* SAWM strategy can be implemented but for less than 72 hours before DW pressure reaches PCPL or design pressure whichever is lower.
  - *Under this approach, a functional description is required of how alternate containment heat removal might be established before DW pressure reaches PCPL or design pressure whichever is lower. Under this approach, physical plant modifications and detailed procedures are required to be implemented to insure achieving alternate containment heat removal and pressure control will be provided for the sustained operating period.*

Ref: NEI 13-02 Appendix C.7

SAWM can be maintained for >7 days without the need for a drywell vent to maintain pressure below PCPL.

Basis for SAWM time frame

Option 1 - SAWM can be maintained greater than or equal to 7 days:

Susquehanna is bounded by the evaluations performed in BWROG TP-2015-008 and BWROG-TP-2015-011 and representative of the reference plant in NEI 13-02 figures C-2 through C-6. (C.7.1.4.1)

Instrumentation relied upon for SAWM operations is Drywell Pressure, Suppression Pool level and SAWA flow. Drywell Pressure and Suppression Pool level instrumentation are initially powered by the station batteries and then by the FLEX (EA-12-049) generators which are placed in-service prior to vessel breach. The FLEX generators will provide

Part 3.1: Boundary Conditions for SAWA

power throughout the Sustained Operation period (7 days). Drywell Temperature monitoring is not a requirement for compliance with Phase 2 of the order, but some knowledge of temperature characteristics provides information for the operation staff to evaluate plant conditions under a severe accident and provide confirmation to adjust SAWA flow rates. (C.7.1.4.2, C.8.3.1) SAWA flow indication will be provided by in-line flow meter in the hose to RHRSW and will require no external power source.

Suppression Pool level indication will be maintained throughout the Sustained Operation period, so the HCVS remains in-service. The time to reach the level at which the Wetwell vent must be secured is greater than 7 days using conservative SAWM flowrates (C.6.3, C.7.1.4.3)

Attachment 2.1.A shows the timeline of events for SAWA / SAWM. (C.7.1.4.4)

Table 3.1.B – SAWM Manual Actions

Primary Action	Primary Location / Component	Notes
1. Lower SAWA injection rate to control Suppression Pool Level and decay heat removal	ESSW Pumphouse using flow indicator and valve that will be in hose supplying water to severe accident unit.	■ Control to maintain containment and wetwell parameters to ensure wetwell vent remains functional. ■ 100 gpm minimum capability is maintained for greater than 7 days
2. Control to SAWM flow rate for containment control / decay heat removal	ESSW Pumphouse per direction from MCR.	■ SAWM flow rates will be monitored using the following instrumentation o Inline flow indicator in hose supplying water to severe accident unit. o Suppression Pool Level (indicates too much or too little flow) o Drywell pressure (rising pressure indicates inadequate removal of decay heat) ■ SAWM flow rates will be controlled using manual flow control valve in hose to RHRSW.
3. Establish reliable alternate source of decay heat removal (run RHR in Suppression Pool Cooling or Shutdown Cooling) per existing FLEX procedures	ESSW Pumphouse, River Intake structure located at Susquehanna River, Reactor Building (RHR Room), MCR.	■ Not required for >7 days, but could be done earlier
4. Secure SAWA / SAWM	ESSW Pumphouse, MCR	■ When reliable alternate containment decay heat removal is established.

SAWM Time Sensitive Actions

Part 3.1: Boundary Conditions for SAWA

Time Sensitive SAWM Actions:
12 Hours – Initiate actions to maintain the wetwell vent capability by lowering injection rate, while maintaining the cooling of the core debris (SAWM). Monitor SAWM critical parameters while ensuring the wetwell vent remains available.

SAWM **Severe Accident Operation**

Determine operating requirements for SAWM, such as may be used in an ELAP scenario to mitigate core damage.

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Appendix C

It is anticipated that SAWM will only be used in Severe Accident Events based on presumed failure of plant injection systems per direction by the plant SAMGs. Refer to attachment 2.1.D for SAWM SAMG language additions.

First 24 Hour Coping Detail

Provide a general description of the SAWM actions for first 24 hours using installed equipment including station modifications that are proposed.

Given the initial conditions for EA-13-109:

- *BDBEE occurs with ELAP*
- *Failure of all injection systems, including steam-powered injection systems*

Ref: EA-13-109 Section 1.2.6, Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 2.5, 4.2.2, Appendix C, Section C.7

SAWA will be established as stated above. SAWM will use the installed instrumentation to monitor and adjust the flow from SAWA to control the pump discharge to deliver flowrates applicable to the SAWM strategy.

Once the SAWA initial flow rate has been established for 4 hours, the flow will be reduced while monitoring Drywell pressure and Suppression Pool level. SAWM flowrate will be lowered to maintain containment parameters and preserve the Wetwell vent path. SAWM will be capable of injection for the period of Sustained Operation.

Greater Than 24 Hour Coping Detail

Provide a general description of the SAWM actions for greater than 24 hours using portable and installed equipment including station modifications that are proposed.

Ref: EA-13-109 Section 1.2.4, 1.2.8, Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section 4.2.2, Appendix C, Section C.7

<u>SAWM can be maintained >7 days</u>:

The SAWM flow strategy will be the same as the first 24 hours until 'alternate reliable containment heat removal and pressure control' is reestablished. SAWM flow strategy will use the SAWA flow path. No additional physical plant modifications are planned for SAWM.

Details:

Part 3.1: Boundary Conditions for SAWA

Details of Design Characteristics/Performance Specifications

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Section Appendix C

SAWM shall be capable of monitoring the containment parameters (Drywell pressure and Suppression Pool Level) to provide guidance on when injection rates shall be reduced, until alternate containment decay heat/pressure control is established. SAWA will be capable of injection for the period of Sustained Operation.

Equipment Locations/Controls/Instrumentation

Describe location for SAWM monitoring and control.

Ref: EA-13-109 Attachment 2, Section B.2.2, B.2.3 / NEI 13-02 Appendix C, Section C.8, Appendix I

The SAWM control location will be the same as the SAWA control location. Local indication of SAWM flow rate will be provided at the ESSW Pumphouse where the pumper truck is located. A portable flow instrument qualified to operate under the expected environmental conditions will be used. The SAWA flow instrument will be an in-line mechanical device that does not require an external power supply (OIP Open Item 9). Communications will be established between the SAWM control location and the MCR.

Injection flow rate will be controlled by a manual valve included in the hose supplying flow to the severe accident unit.

Suppression Pool level and Drywell pressure are read in the control room using indicators powered by the FLEX generators installed under EA-12-049. These indications will be used to control SAWM flow rate to the RPV.

Key Parameters:

List instrumentation credited for the SAWM Actions.

Parameters that will be used for SAWM are:

- Drywell Pressure
- Suppression Pool Level
- SAWM Flowrate

The Drywell pressure and Suppression Pool level instruments are qualified to RG 1.97 *and* are the same as listed in part 2 of this OIP. The SAWM flow instrumentation will be qualified for the expected environmental conditions expected when needed.

Notes:

None

Part 3.1.B: Boundary Conditions for SAWA/SADV
Applicability of Wetwell Design Considerations
[If SAWA/SADV is chosen by a Plant Site then site specific detail to be provided in OIP] **This option is not chosen by Susquehanna.**
Table 3.1.C – SADV Manual Actions
Timeline for SADV
Severe Accident Venting
First 24 Hour Coping Detail
Greater Than 24 Hour Coping Detail
Details:

Part 4: Programmatic Controls, Training, Drills and Maintenance

Identify how the programmatic controls will be met.

Provide a description of the programmatic controls equipment protection, storage and deployment and equipment quality addressing the impact of temperature and environment

Ref: EA-13-109 Section 1.2.10, 3.1, 3.2 / NEI 13-02 Sections 5, 6.1.2, 6.1.3, 6.2

Program Controls:

The HCVS venting actions will include:

- Site procedures and programs are being developed in accordance with NEI 13-02 to address use and storage of portable equipment relative to the Severe Accident defined in NRC Order EA-13-109 and the hazards applicable to the site per Part 1 of this OIP.
- Routes for transporting portable equipment from storage location(s) to deployment areas will be developed as the response details are identified and finalized. The identified paths and deployment areas will be analyzed for radiation and temperature to ensure they are accessible during Severe Accidents.

Procedures:

Procedures will be established for system operations when normal and backup power is available, and during ELAP conditions.

The HCVS procedures will be developed and implemented following the plants process for initiating or revising procedures and contain the following details:

- appropriate conditions and criteria for use of the HCVS
- when and how to place the HCVS 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 of portable equipment

Susquehanna will establish provisions for out-of-service requirements of the HCVS and compensatory measures. The following provisions will be documented in a controlled document:

The provisions for out-of-service requirements for HCVS/SAWA functionality are applicable in Modes 1, 2 and 3.

- If for up to 90 consecutive days, the primary or alternate means of HCVS/SAWA operation are non-functional, no compensatory actions are necessary.
- If for up to 30 days, the primary and alternate means of HCVS/SAWA operation are nonfunctional, no compensatory actions are necessary.
- If the out of service times exceed 30 or 90 days as described above, the following actions will be performed through the sites corrective action program:
    - o The cause(s) of the non-functionality will be determined

Part 4: Programmatic Controls, Training, Drills and Maintenance

- The actions to be taken and the schedule for restoring the system to functional status and prevent recurrence will be determined
- Initiate action(s) to implement appropriate compensatory actions, and
- Restore full HCVS functionality at the earliest opportunity not to exceed one full operating cycle.

Describe training plan

List training plans for affected organizations or describe the plan for training development

Ref: EA-13-109 Section 3.2 / NEI 13-02 Section 6.1.3

Personnel expected to perform direct execution of the HCVS/SAWA/SAWM actions will receive 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/SAWA/SAWM actions, systems, or strategies. Training content and frequency will be established using the Systematic Approach to Training (SAT) process.

Identify how the drills and exercise parameters will be met.

Alignment with NEI 13-06 and 14-01 as codified in NTTF Recommendation 8 and 9 rulemaking

The Licensee should demonstrate use of the HCVS/SAWA/SAWM system in drills, tabletops, or exercises as follows:

- *Hardened containment vent operation on normal power sources (no ELAP).*
  - *During FLEX demonstrations (as required by EA-12-049: Hardened containment vent operation on backup power and from primary or alternate location during conditions of ELAP/loss of UHS with no core damage. System use is for containment heat removal AND containment pressure control.*
  - *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 (Demonstration may be in conjunction with SAG change).*
  - *Operation for sustained period with SAWA and SAWM to provide decay heat removal and containment pressure control.*

Ref: EA-13-109 Section 3.1 / NEI 13-02 Section 6.1.3

The site will utilize the guidance provided in NEI 13-06 and 14-01 for guidance related to drills, tabletops, or exercises for HCVS operation. In addition, the site will integrate these requirements with compliance to any rulemaking resulting from the NTTF Recommendations 8 and 9.

Describe maintenance plan:

Describe the elements of the maintenance plan

- *The maintenance program should ensure that the HCVS/SAWA/SAWM equipment reliability is being achieved in a manner similar to that required for FLEX equipment. Standard industry templates (e.g., EPRI) and associated bases may be developed to define specific maintenance and testing.*
  - *Periodic testing and frequency should be determined based on equipment type, expected use and manufacturer's recommendations (further details are provided in Part 6 of this document).*

Part 4: Programmatic Controls, Training, Drills and Maintenance

- *Testing should be done to verify design requirements and/or basis. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.*
- *Preventive maintenance should be determined based on equipment type and expected use. The basis should be documented and deviations from vendor recommendations and applicable standards should be justified.*
- *Existing work control processes may be used to control maintenance and testing.*

- *HCVS/SAWA permanent installed equipment should be maintained in a manner that is consistent with assuring that it performs its function when required.*
  - *HCVS/SAWA permanently installed equipment should be subject to maintenance and testing guidance provided to verify proper function.*
- *HCVS/SAWA non-installed equipment should be stored and maintained in a manner that is consistent with assuring that it does not degrade over long periods of storage and that it is accessible for periodic maintenance and testing.*

Ref: EA-13-109 Section 1.2.13 / NEI 13-02 Section 5.4, 6.2

Susquehanna will utilize the standard EPRI industry PM process (similar to the Preventive Maintenance Basis Database) for establishing the maintenance calibration and testing actions for HCVS/SAWA/SAWM components. The control program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines.

Susquehanna will implement the following operation, testing and inspection requirements for the HCVS and SAWA to ensure reliable operation of the system.

Table 4-1: Testing and Inspection Requirements

Description	Frequency
Cycle the HCVS and installed SAWA flow path valves[1] and the interfacing system boundary valves not used to maintain containment integrity during Mode 1, 2 and 3. For HCVS valves, this test may be performed concurrently with the control logic test described below.	Once per every[2] operating cycle
Cycle the HCVS and installed SAWA 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 and installed SAWA components.	Once per every other[4] operating cycle
Functionally test the HCVS radiation monitors.	Once per operating cycle

Part 4: Programmatic Controls, Training, Drills and Maintenance

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 function from its control location and ensuring that all HCVS vent path and interfacing system boundary valves[5] move to their proper (intended) positions.	Once per every other operating cycle

[1] Not required for HCVS and SAWA check valves.
[2] After two consecutive successful performances, the test frequency may be reduced to a maximum of once per every other operating cycle.
[3] Not required if integrity of check function (open and closed) is demonstrated by other plant testing requirements.
[4] After two consecutive successful performances, the test frequency may be reduced by one operating cycle to a maximum of once per every fourth operating cycle.
[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 part. 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.

Notes:

Part 5: Milestone Schedule

Provide a milestone schedule

This schedule should include:

- **Modifications timeline**
- **Procedure guidance development complete**
  - **HCVS Actions**
  - **Maintenance**
- **Storage plan (reasonable protection)**
- **Staffing analysis completion**
- **Long term use equipment acquisition timeline**
- **Training completion for the HCVS Actions**

The dates specifically required by the order are obligated or committed dates. Other dates are planned dates subject to change. Updates will be provided in the periodic (six month) status reports.

Ref: EA-13-109 Section D.1, D.3 / NEI 13-02 Section 7.2.1

The following milestone schedules are provided. The dates are planning dates subject to change as design and implementation details are developed. Any changes to the following target dates will be reflected in the subsequent 6 month status reports.

Phase 1 Milestone Schedule:

Phase 1 Milestone Schedule:

Milestone	Target Completion Date	Activity Status	Comments *{Include date changes in this column}*
Hold preliminary/conceptual design meeting	June 2014	Complete	
Submit Overall Integrated Plan	June 2014	Complete	
Submit 6 Month Status Report 1	Dec. 2014	Complete	
Submit 6 Month Status Report 2	June 2015	Complete	
Submit 6 Month Status Report 3 - Simultaneous with Phase 2 OIP	Dec. 2015	Complete	Simultaneous with Phase 2 OIP
U2 Design Engineering Complete	Mar. 2016	In Progress	
Submit 6 Month Status Report 4	June 2016	Not Started	
U2 Operations Procedure Changes Developed	Dec. 2016	Not Started	
U2 Maintenance Procedure Changes Developed	Dec. 2016	Not Started	
Submit 6 Month Status Report 5	Dec. 2016	Not Started	
U2 Training Complete	Dec. 2016	Not Started	
U2 Implementation Outage	Feb. 2017	Not Started	
U2 Procedure Changes Active	Mar. 2017	Not Started	
U2 Walk Through Demonstration/Functional Test	Mar. 2017	Not Started	

Part 5: Milestone Schedule

U1 Design Engineering Complete	Mar. 2017	Not Started	
Submit 6 Month Status Report 6	June 2017	Not Started	
Submit 6 Month Status Report 7	Dec. 2017	Not Started	
U1 Operations Procedure Changes Developed	Dec. 2017	Not Started	
U1 Maintenance Procedure Changes Developed	Dec. 2017	Not Started	
U1 Training Complete	Dec. 2017	Not Started	
U1 Implementation Outage	Feb. 2018	Not Started	
U1 Procedure Changes Active	Mar. 2018	Not Started	
U1 Walk Through Demonstration/Functional Test	Mar. 2018	Not Started	
Submit Phase 1 Compliance Letter	May 2018	Not Started	

Phase 2 Milestone Schedule:

Phase 2 Milestone Schedule

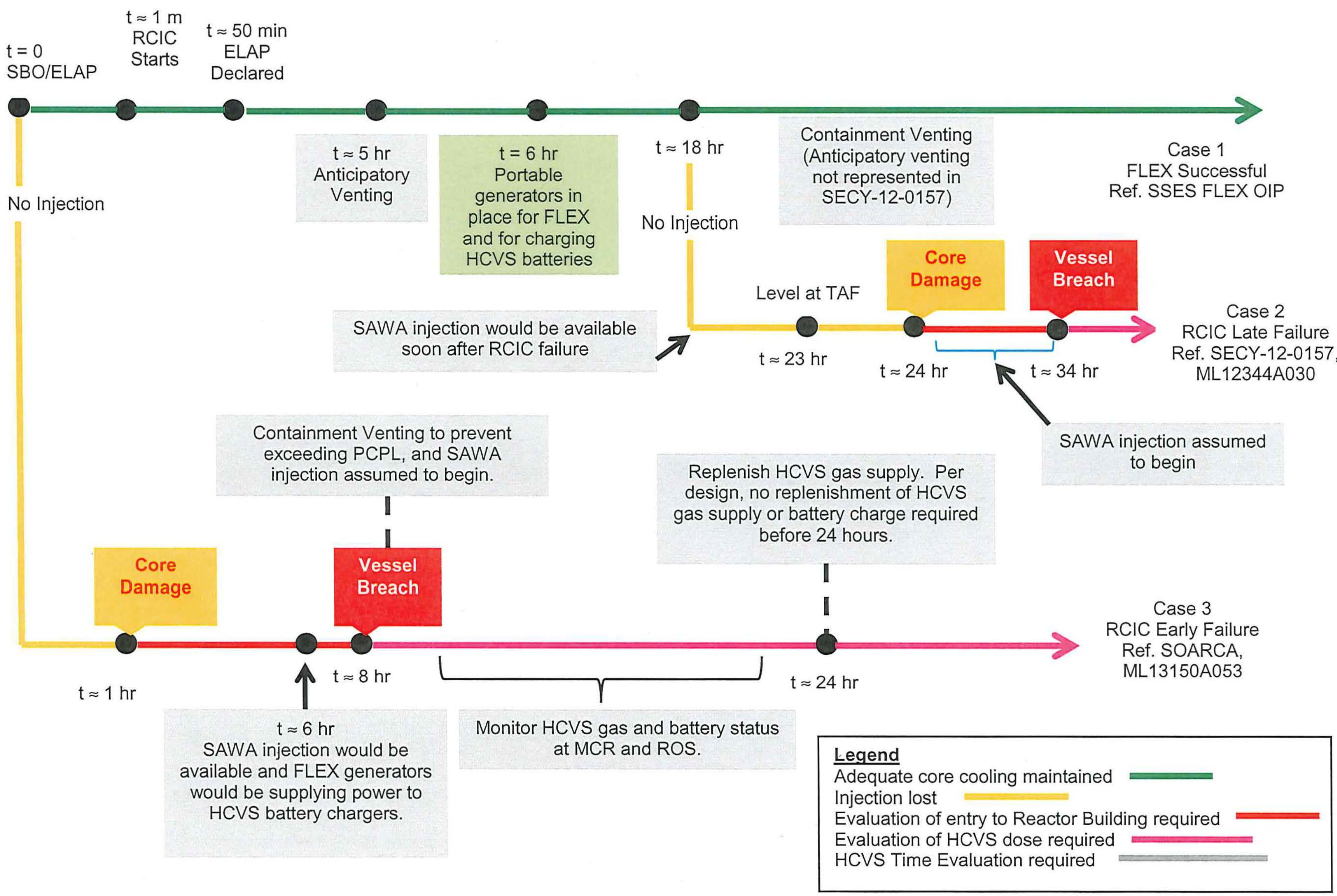
Milestone	Target Completion Date	Activity Status	Comments *{Include date changes in this column}*
Hold preliminary/conceptual design meeting	Oct 2015	Complete	
Submit Overall Integrated Implementation Plan	Dec 2015	Complete	
Submit 6 Month Status Report	June 2016	Not Started	
Submit 6 Month Status Report	Dec 2016	Not Started	
Submit 6 Month Status Report	June 2017	Not Started	
U1 Design Engineering On-site/Complete		Started	
Submit 6 Month Status Report	Dec 2017	Not Started	
U1 Operations Procedure Changes Developed	Dec 2017	Not Started	
U1 Maintenance Procedures Developed	Dec 2017	Not Started	
U1 Training Complete	Dec 2017	Not Started	
U1 Implementation Outage	Feb 2018	Not Started	
U1 Procedure Changes Active	Mar 2018	Not Started	
U1 Walk Through Demonstration/Functional Test	Mar 2018	Not Started	
U2 Design Engineering On-site/Complete		Started	
Submit 6 Month Status Report	June 2018	Not Started	
Submit 6 Month Status Report	June 2019	Not Started	
U2 Implementation Outage	Feb 2019	Not Started	
U2 Walk Through Demonstration/Functional Test	Mar 2019	Not Started	
Submit Completion Report	May 2019	Not Started	

Part 5: Milestone Schedule
Notes:

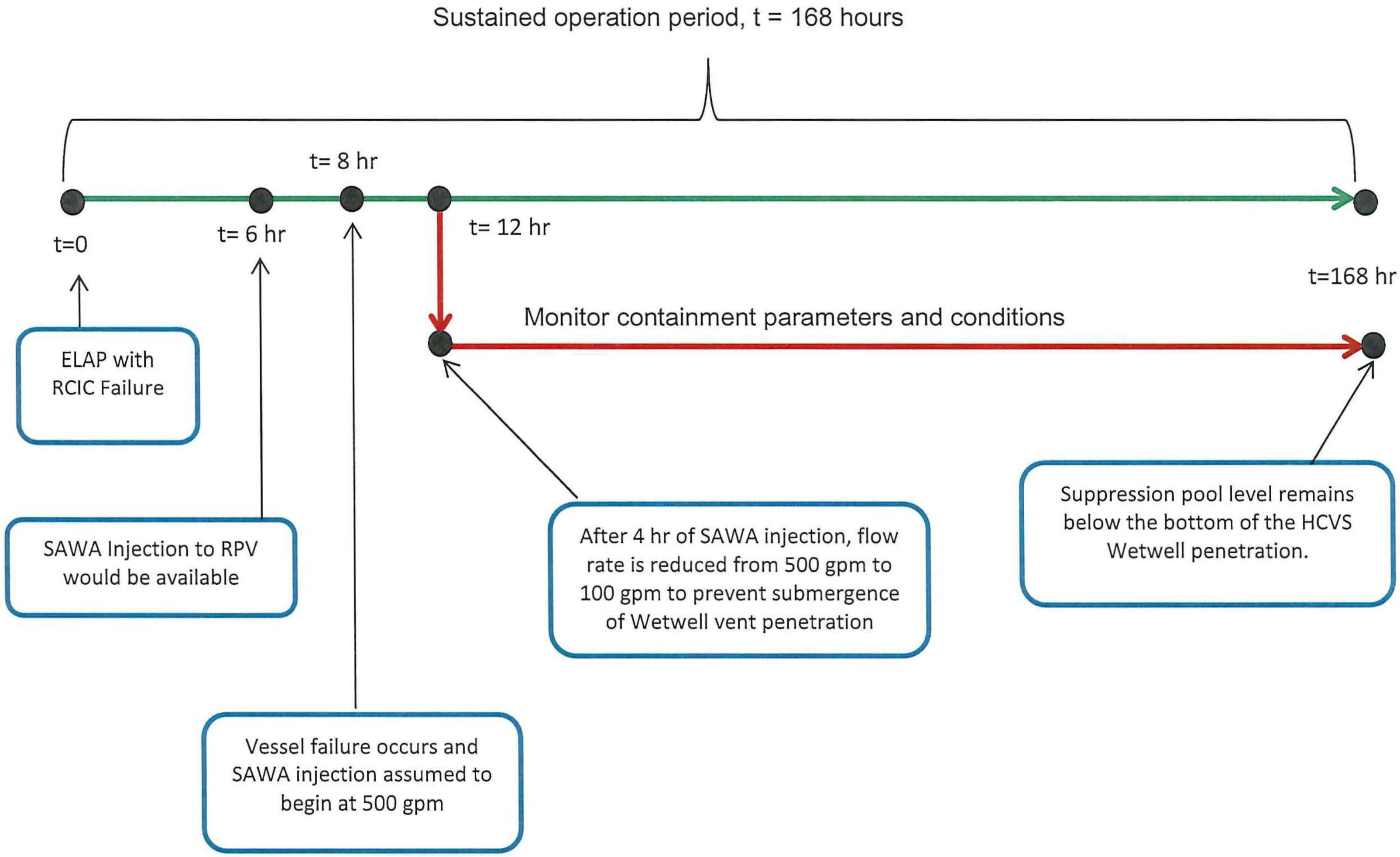
Attachment 1: HCVS/SAWA Portable Equipment

List portable equipment	BDBEE Venting	Severe Accident Venting	Performance Criteria	Maintenance / PM requirements
Gas Cylinders	X	X	TBD	Check periodically for pressure, replace or replenish as needed
FLEX Generators (and associated equipment)	X	X	TBD	Per Response to EA-12-049
SAWA Pump (and associated equipment)	X	X	500 gpm for first 4 hours and 100 gpm for rest of first 7 days	Per Response to EA-13-109

Attachment 2A: Sequence of Events Timeline – Wetwell HCVS



Attachment 2.1.A: Sequence of Events Timeline – SAWA / SAWM

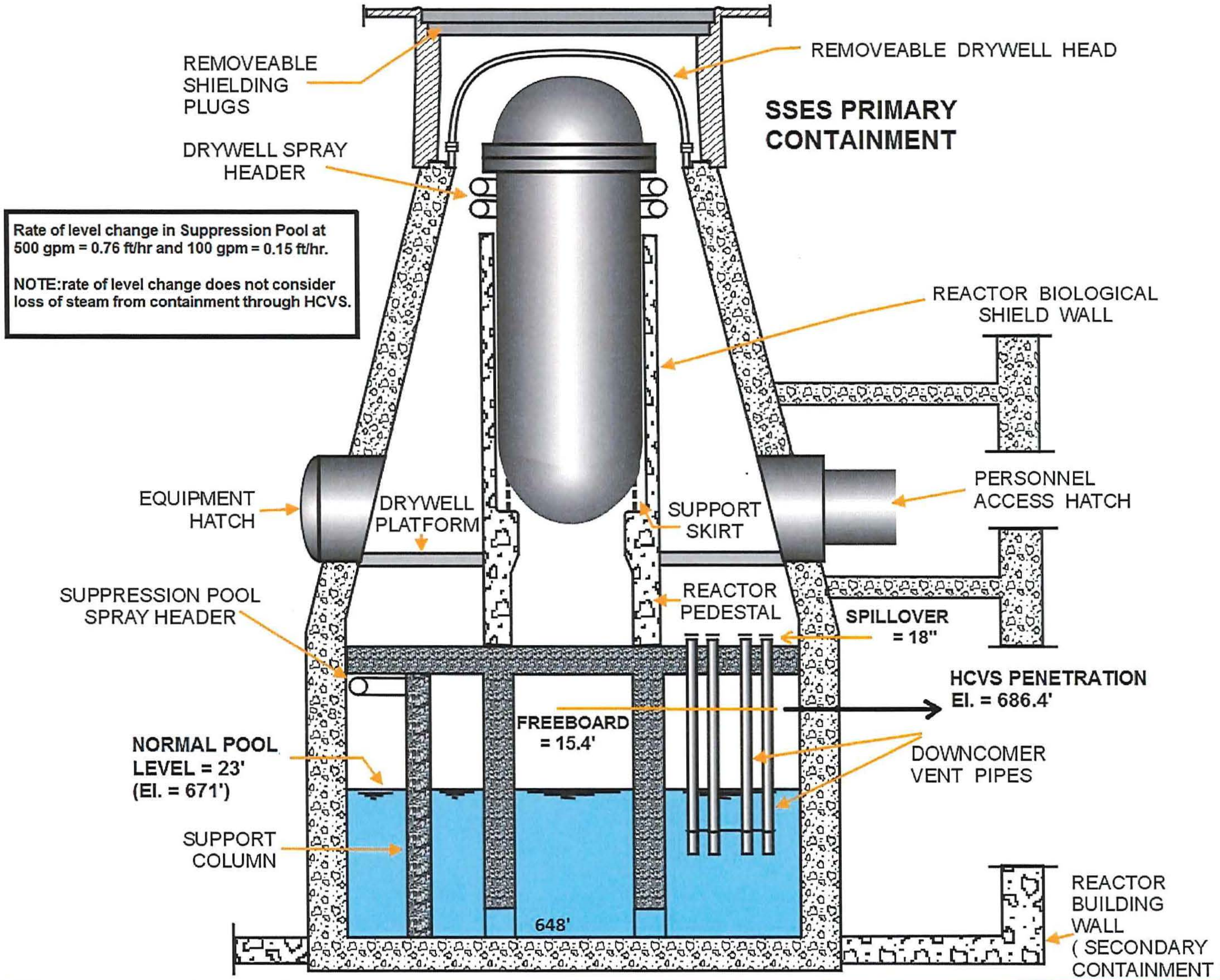


Attachment 2.1.B: Sequence of Events Timeline – SADV

[If SAWA/SADV is chosen by a Plant Site then site specific detail to be provided in OIP]

This attachment is not applicable for Susquehanna Units 1 and 2.

Attachment 2.1.C: SAWA / SAWM Plant-Specific Datum



	Susquehanna Data
Wetwell water level instrument	UR15776A(B), UR25776A(B) Range 4.5 to 49 ft. (Elevation 652.5' to 697') Located in Main Control Room
Wetwell HCVS Penetration X-201B-U2 X-201B-U1	Centerline Elevation = 687'-1" Elevation at bottom of penetration = 686.4 ft. Water level at bottom of penetration = 686.4 – 648 = 38.4 ft.
Normal suppression pool water level	23 ft. (El. = 648 ft. + 23 ft. = 671 ft.)
Elevation at bottom of suppression pool	648 ft.
Initial freeboard	686.4 ft. – 671 ft. = 15.4 ft.
SAWA flow rate	• Initiate 500 gpm to RPV at 8 hr. (time of vessel breach). • Maintain 500 gpm for 4 hr. (Ref. BWROG-TP-15-011, Rev. 0, §2). • At 12 hr., reduce flow to 100 gpm. (Ref. NEI 13-02, Rev. 1, p. C-5). • Maintain injection at 100 gpm for up to 7 days. Note: Timing based on ELAP with RCIC failure on demand and no credit for HPCI. Per Susquehanna EA-12-049 OIP Timeline (Ref. 28), SAWA injection to RPV would be available at 6 hr. Assumed 8 hr. for start of SAWA in order to provide consistency with BWROG-TP-15-011, Rev. 0 and NEI 13-02, Rev. 1, §C.7.1.1.
Estimated suppression chamber level response during SAWA	Suppression pool level will be maintained below the wetwell vent elevation when using SAWA flow rates consistent with §C.7.1.1 of NEI 13-02, Rev. 1, (Initial 500 gpm flow rate for 4 hours which is then reduced to 100 gpm and maintained until t = 7 days. The rate of rise is 0.76 feet/hour at 500 gpm and 0.15 feet/hour at 100 gpm (neglects steam loss through vent).

	Susquehanna Data
SP Water Level (ft.) 22.0 (Tech. Spec Low Limit) 24.0 (Tech. Spec. High Limit) 38.4 (Bottom of HCVS Penetration)	Suppression Pool Water Volume (Gal.) 915,627 998,879 1,567,275 Ref. SSES Tech. Spec. Bases §3.6.2.2 and FSAR Table 6.2-23.
SAWA flow rate instrumentation	Two hoses will be routed to separate 5-inch FLEX hose connections in the ESSW Pumphouse. One connection will supply water to Unit 1 RHR loop through RHRSW-to-RHR cross-tie line, and the other connection will supply water to Unit 2 through an independent RHRSW-to-RHR cross-tie line. Each hose will include an in-line flow meter to monitor flow rate to the SAWA unit and to the FLEX unit.

Attachment 2.1.D: SAWM SAMG Approved Language

The following general cautions, priorities and methods will be 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 will be made in a way that maintains the use of SAMGs in a symptom based mode while at the same time addressing those conditions that may exist under extended loss of AC power (ELAP) conditions with significant core damage including ex-vessel core debris.

Actual Approved Language that will be incorporated into site SAMG*

Cautions:

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

Priorities:

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

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

Methods:

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

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

* Actual language may vary by acceptable site procedure standards, but intent and structure should follow this guidance.

Attachment 3: Conceptual Sketches

(Conceptual sketches, as necessary to indicate equipment which is installed or equipment hookups necessary for the HCVS Actions)

Sketch 1: Electrical Layout of System *(preliminary)*

- Instrumentation Process Flow
- Electrical Connections

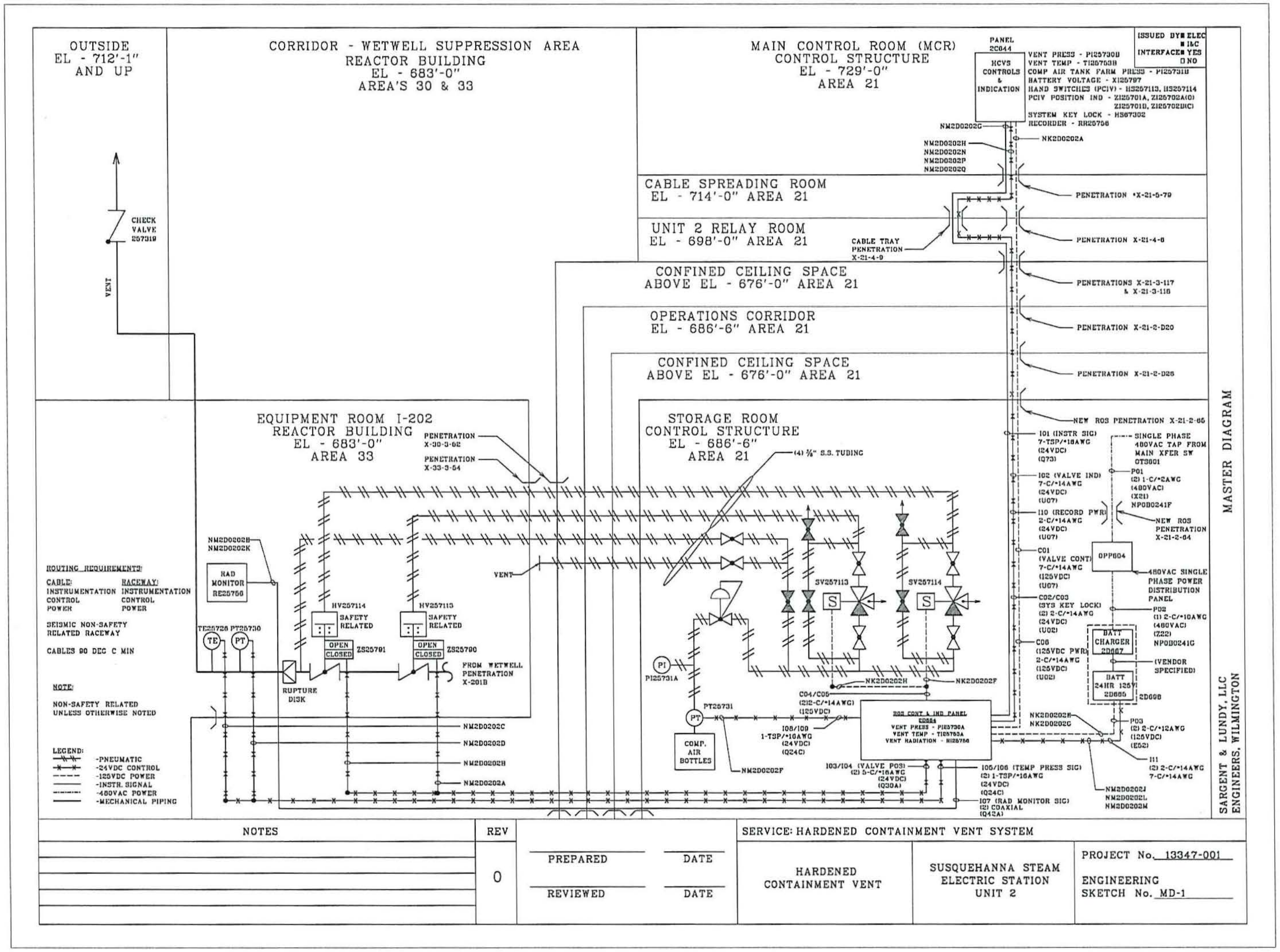
Sketch 2: P&ID Layout of Wetwell Vent *(preliminary)*

- Piping routing for vent path – Wetwell Vent
  - Demarcate the valves (in the vent piping) between the currently existing and new ones
  - Wetwell Vent Instrumentation Process Flow Diagram
  - Egress and Ingress Pathways to ROS, Battery Transfer Switch, DG Connections and Deployment location
  - Site layout sketch to show location/routing of Wetwell vent piping and associated components. This should include relative locations both horizontally and vertically

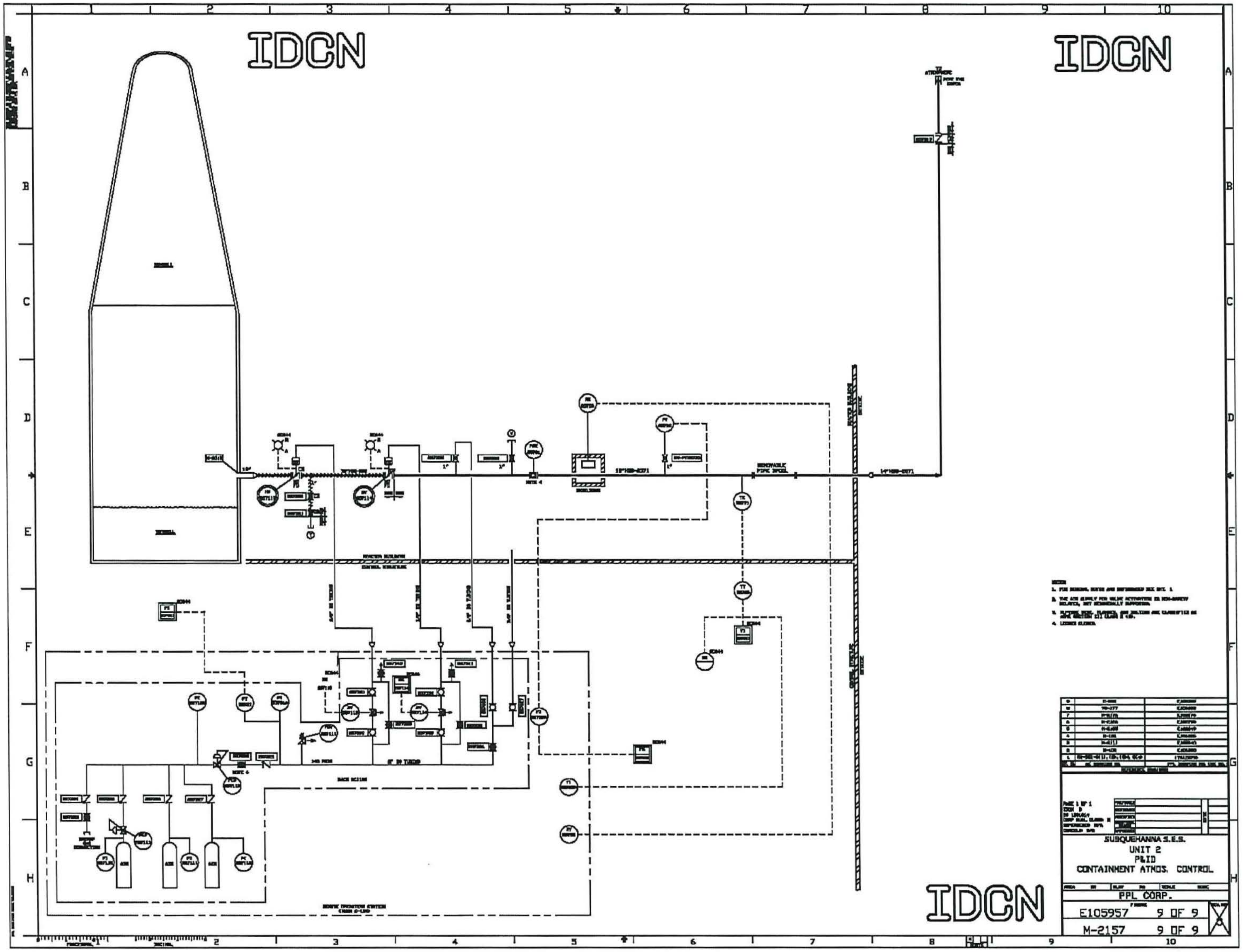
Sketch 3: P&ID Layout of SAWA *(preliminary)*

- Piping routing for SAWA path
  - SAWA instrumentation process paths
  - SAWA connections
  - Include a piping and instrumentation diagram of the vent system. Demarcate the valves (in the vent piping) between the currently existing and new ones.
  - Ingress and egress paths to and from control locations and manual action locations
  - Site layout sketch to show locations of piping and associated components. This should include relative locations both horizontally and vertically

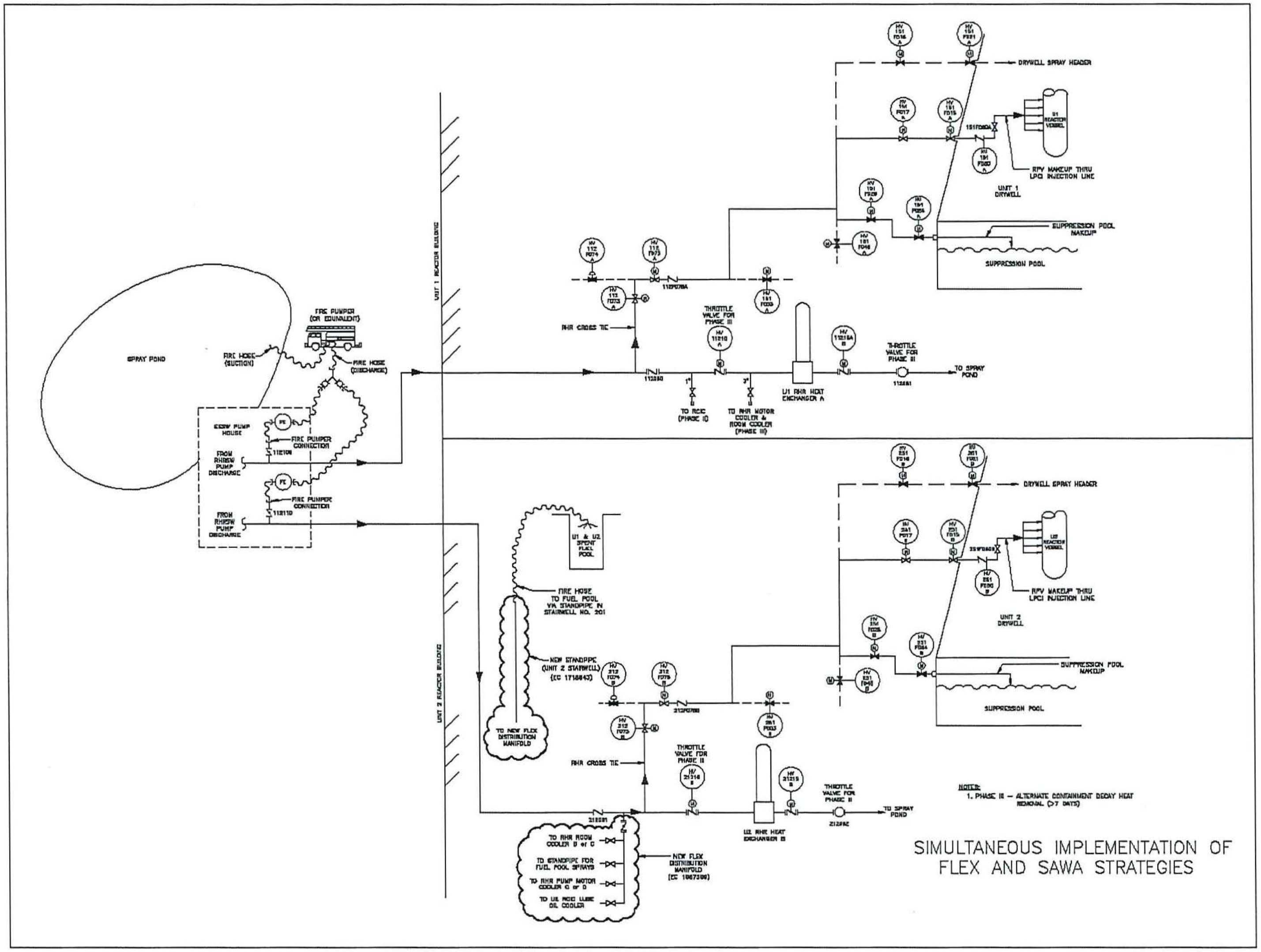
Sketch 1: Electrical Layout of HCVS System (Unit 2, Unit 1 similar) *(preliminary)*



Sketch 2: Physical Layout of HCVS, Unit 2 (Unit 1 similar) - *preliminary*



Sketch 3: Layout of SAWA (*preliminary*)



Attachment 4: **Failure Evaluation Table**

Functional Failure Mode	Failure Cause	Alternate Action	Failure with Alternate Action Impact on Containment Venting?
Failure of Vent to Open on Demand	Solenoid Valves fail to open due to loss of DC power to solenoid valves or complete loss of HCVS power supply	Open 2 manual valves at ROS to bypass solenoid valves. This action directs gas supply to the PCIVs.	No
Failure of Vent to Open on Demand	Solenoid Valve fails to open due to mechanical failure of solenoid valve	Open manual valves at ROS to bypass solenoid valves. This action directs gas supply to the PCIVs.	No
Failure of Vent to Open on Demand	Valves fail to open due to loss of HCVS power supply (long term)	Recharge station service batteries with 4160 vac FLEX generators, considering severe accident conditions.	No
Failure of Vent to Open on Demand	Valves fail to open due to loss of alternate gas air supply (long term)	Tie-in portable gas supply to gas system at backup gas supply connection to support HCVS valve operation. Replace portable supply, as needed.	No
Failure of Vent to Open/close on Demand	Valve fails to open/close due to valve or valve actuator failure	No alternate action credited since valves may not be accessible.	Yes

Attachment 5: References

1. Generic Letter 89-16, Installation of a Hardened Wetwell Vent, dated September 1, 1989
2. Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012
3. Order EA-12-050, Reliable Hardened Containment Vents, dated March 12, 2012
4. Order EA-12-051, Reliable SFP Level Instrumentation, dated March 12, 2012
5. Order EA-13-109, Severe Accident Reliable Hardened Containment Vents, dated June 6, 2013
6. JLD-ISG-2012-01, Compliance with Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated August 29, 2012
7. JLD-ISG-2012-02, Compliance with Order EA-12-050, Reliable Hardened Containment Vents, dated August 29, 2012
8. JLD-ISG-2013-02, Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents, dated November 14, 2013
9. NRC Responses to Public Comments, Japan Lessons-Learned Project Directorate Interim Staff Guidance JLD-ISG-2012-02: Compliance with Order EA-12-050, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents, ADAMS Accession No. ML12229A477, dated August 29, 2012
10. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012
11. NEI 13-02, Industry Guidance for Compliance with Order EA–13–109, Revision 1, Dated April 2015
12. NEI 13-06, Enhancements to Emergency Response Capabilities for Beyond Design Basis Accidents and Events, Revision 0, dated March 2014
13. NEI 14-01, Emergency Response Procedures and Guidelines for Extreme Events and Severe Accidents, Revision 0, dated March 2014
14. NEI HCVS-FAQ-01, HCVS Primary Controls and Alternate Controls and Monitoring Locations
15. NEI HCVS-FAQ-02, HCVS Dedicated Equipment
16. NEI HCVS-FAQ-03, HCVS Alternate Control Operating Mechanisms
17. NEI HCVS-FAQ-04, HCVS Release Point
18. NEI HCVS-FAQ-05, HCVS Control and 'Boundary Valves'
19. NEI HCVS-FAQ-06, FLEX Assumptions/HCVS Generic Assumptions
20. NEI HCVS-FAQ-07, Consideration of Release from Spent Fuel Pool Anomalies
21. NEI HCVS-FAQ-08, HCVS Instrument Qualifications
22. NEI HCVS-FAQ-09, Use of Toolbox Actions for Personnel
23. NEI White Paper HCVS-WP-01, HCVS Dedicated Power and Motive Force

24. NEI White Paper HCVS-WP-02, HCVS Cyclic Operations Approach

25. NEI White Paper HCVS-WP-03, Hydrogen/CO Control Measures

26. NEI White Paper HCVS-WP-04, Missile Evaluation for HCVS Components 30 Feet Above Grade

27. IEEE Standard 344-1975, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power *Generating Stations*,

28. Susquehanna EA-12-049 (FLEX) Overall Integrated Implementation Plan, Rev 0, February 2013, PLA-6981

29. Susquehanna EA-12-050 (HCVS) Overall Integrated Implementation Plan, Rev 0, February 2013, PLA-6982

30. Susquehanna EA-12-051 (SFP LI) Overall Integrated Implementation Plan, Rev 0, February 2013, PLA-6980

31. JLD-ISG-2015-01, Compliance with Phase 2 of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions, dated March 2015

32. Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments, SECY-12-0157, ML12344A030

33. NUREG/CR-7110, V1, R1, State-of-the-Art Reactor Consequence Analyses (SOARCA) Project: Peach Bottom Integrated Analysis, ML13150A053

34. NEI HCVS-FAQ-10, Severe Accident Multiple Unit Response

35. NEI HCVS-FAQ-11, Plant Response During a Severe Accident

36. NEI HCVS-FAQ-12, Radiological Evaluations on Plant Actions Prior to HCVS Initial Use

37. NEI HCVS-FAQ-13, Severe Accident Venting Actions Validation

Attachment 6: Changes/Updates to this Overall Integrated Implementation Plan

This Overall Integrated Plan has been updated in format and content to encompass both Phase 1 and Phase 2 of Order EA-13-109. Any significant changes to this plan will be communicated to the NRC staff in subsequent 6 Month Status Reports.

Attachment 7: List of Overall Integrated Plan Open Items

OIP Open Item	Action	Comment
1	Confirm suppression pool heat capacity	In Progress (EC-073-1019, Rev. 1)
2	Deployment under severe accident conditions will be confirmed for the deployment of the FLEX generators credited to re-energize battery chargers.	In Progress
3	Deployment under severe accident conditions will be confirmed for deployment of the supplemental gas bottles.	In Progress
4	The gas supply will be sized to support HCVS operation for a minimum of 24 hours (a minimum of 8 valve cycles of valve operation is assumed, consistent with recommendations in HCVS-WP-02). This design assumption will require future validation in the design phase of this project.	In Progress (EC-073-1018, Rev. 0)
5	An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the remote operating station, based on time constraints listed in Attachment 2 of the Overall Integrated Plan.	In Progress
6	Evaluate viable options to address Hydrogen detonation concerns in HCVS piping to meet the requirements of EA-13-109, Section 1.2.11 and incorporate in HCVS design. SSES will determine the method to be deployed once NRC review of HCVS-WP-03 is complete.	In Progress
7	An evaluation will be performed to confirm the HCVS power supply can support HCVS operation for a minimum of 24 hours.	In Progress
8	Revise EC-016-1043 to include simultaneous SAWA and FLEX case.	In Progress
9	Ensure the SAWA flow instrument will operate in the conditions expected.	In Progress

Interim Staff Evaluation Open Item Status

ISE Open Item	Action	Comment (refers to original HCVS OIP Sections)	Status
1.	Make available for NRC staff audit an evaluation that confirms that all load stripping to support HCVS operation can be accomplished within forty five minutes of event initiation.	Section 3.1.2	Not Started
2.	Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX Generator loading calculation.	Section 3.2.1 Section 3.2.2.4 Section 3.2.3.1 Section 3.2.3.2 Section 3.2.4.1 Section 3.2.4.2 Section 3.2.5.1 Section 3.2.5.2 Section 3.2.6	Not Started
3.	Make available for NRC staff audit documentation of the HCVS pneumatic system design including sizing and location.	Section 3.2.1 Section 3.2.2.4 Section 3.2.3.1 Section 3.2.3.2 Section 3.2.4.1 Section 3.2.4.2 Section 3.2.5.1 Section 3.2.5.2 Section 3.2.6	Not Started
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,	Section 3.2.1 Section 3.2.2.3 Section 3.2.2.4 Section 3.2.2.5 Section 3.2.2.10 Section 3.2.4.1 Section 3.2.4.2 Section 3.2.5.2 Section 3.2.6	Not Started

ISE Open Item	Action	Comment (refers to original HCVS OIP Sections)	Status
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.	Section 3.2.2.1 Section 3.2.2.2	Not Started
6.	Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.	Section 3.2.2.3	Not Started
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, electronic, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions.	Section 3.2.2.3 Section 3.2.2.5 Section 3.2.2.9 Section 3.2.2.10	Not Started
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.	Section 3.2.2.5 Section 3.2.2.10	Not Started
9.	Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.	Section 3.2.2.6	Not Started
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.	Section 3.2.2.6	Not Started

ISE Open Item	Action	Comment (refers to original HCVS OIP Sections)	Status
11.	Provide a justification for deviating from the instrumentation seismic qualification guidance specified in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109.	Section 3.2.2.9	Not Started
12.	Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.	Section 3.2.2.10	Not Started