December 22, 2015

NG-15-0361

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

Duane Arnold Energy Center
Docket No. 50-331
Renewed Facility Operating License No. DPR-49

NextEra Energy Duane Arnold, LLC's Six-Month Status Report and Phase 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)

References:
1. Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, dated June 6, 2013 (ML13130A067)
2. NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109 BWR Mark I & II Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 1, dated April 2015 (ML15113B318)
3. 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, Revision 1, dated April 2015 (ML15104A118)
4. NextEra Energy Duane Arnold, LLC's Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), NG-14-0151 dated June 25, 2014 (ML14182A423)
5. NextEra Energy Duane Arnold, LLC's 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), NG-14-0285 dated December 10, 2014
6. NextEra Energy Duane Arnold, LLC's 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), NG-15-0169 dated June 18, 2015
7. NEI document, Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan Template (ML15272A336)
8. NRC letter dated October 8, 2015 regarding NEI document, HCVS Phase 1 and 2 Overall Integrated Plan Template (ML15271A148)

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On June 6, 2013, the Nuclear Regulatory Commission ("NRC" or "Commission") issued Order EA-13-109 (Reference 1) to NextEra Energy Duane Arnold, LLC. The Order was immediately effective and directed the Duane Arnold Energy Center (DAEC) to install a reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris. Specific requirements are outlined in Attachment 2 of Reference 1.

Section IV, Condition D.1 of the Order required submission of an overall integrated plan (OIP) including a description of how compliance with Phase 1 requirements would be achieved. Section IV, Condition D.3 required submission of status reports at six-month intervals thereafter. Section IV, Condition D.2 required submission of an overall integrated plan including information regarding Phase 2 requirements, compliance and schedule.

The enclosed plan document satisfies the requirements of Section IV, Conditions D.2 and D.3. The enclosed plan document incorporates the third six-month update for Phase 1 of the Order into the HCVS Phase 1 and Phase 2 overall integrated plan document, in accordance with NEI 13-02, Industry Guidance for Compliance with Order EA-13-109, Revision 1 (Reference 2). NEI 13-02 Revision 1 was endorsed, with exceptions and clarifications, by the NRC Staff in Reference 3. The enclosed plan document provides an update of milestone accomplishments since the second six-month status update, a list of the Phase 1 OIP open items, and addresses the NRC Interim Staff Evaluation open items for Phase 1.

The enclosed plan document provides a complete updated Phase 1 OIP. The Phase 1 OIP for DAEC was submitted by letter dated June 25, 2014 (Reference 4); the first and second six-month updates were provided by References 5 and 6, respectively. As discussed in Reference 6, the planned HCVS design was changed subsequent to the submittal of the Phase 1 OIP in June of 2014. The HCVS design will use an existing spare penetration off of the suppression pool and route vent piping through the reactor building (RB) and out of the RB roof, rather than the design reported in the June 2014 OIP. This change necessitated revisions in several sections of the Phase 1 OIP which are reflected in the enclosed plan document. Additional design details have been modified in the enclosed document plan as required. The enclosed document plan represents the combined Phase 1 and Phase 2 Overall Integrated Plan (combined OIP). The combined OIP provides our Phase 2 implementation plan including information regarding Phase 2 requirements, compliance and schedule. The enclosed combined OIP was developed using the NEI template (Reference 7) as endorsed by the NRC Staff in Reference 8.

Future six-month status reports will provide the updates for both Phase 1 and Phase 2 OIP implementation in a single status report, in accordance with NEI 13-02, Revision 1.

This letter contains no new regulatory commitments. If you have any questions regarding this submittal, please contact Curt Bock at 319-851-7645.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on December 22, 2015.

Steven P. Brown

FOR T. A. Vehec
Vice President, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosure

cc: Director, Office of Nuclear Reactor Regulation
USNRC Regional Administrator Region III
USNRC Project Manager, Duane Arnold Energy Center
USNRC Resident Inspector, Duane Arnold Energy Center

Enclosure to NG-15-0361

NextEra Energy Duane Arnold, LLC's Six-Month Status Report and Phase 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)

63 pages follow

Duane Arnold Energy Center Hardened Containment Venting System (HCVS)
Phase 1 and 2 Overall Integrated Plan

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 ISG endorses 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 EA13-109.

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.

Note: At the Licensee's option, the December 2015 six month update for Phase 1 may be independent of the Phase 2 OIP submittal, but will require separate six month updates for Phase 1 and 2 until each phase is in compliance.

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

- The HCVS will be initiated via manual action from the either the Main Control Room (MCR) (some plants have a designated Primary Operating Station (POS) that will be treated as the main operating location for this order) 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, 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 or a shorter time if justified.

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.
- Ensure that the decay heat can be removed from the containment for seven (7) days using the HCVS or describe the alternate method(s) to remove decay heat from the containment from the time the HCVS is no longer functional until alternate means of decay heat removal are established that make it unlikely the drywell vent will be required for DW pressure control.
- The SAWA and SAWM actions will be manually activated and controlled from areas that are accessible during severe accident conditions.
- Parameters measured should be Drywell pressure, Suppression Pool level, SAWA flowrate and the HCVS parameters listed above.

- Alternatively SAWA and a Severe Accident Capable Drywell Vent (SADV) strategy may be implemented to meet Phase 2 of Order EA-13-109.

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

Compliance will be attained for Duane Arnold Energy Center (DAEC) 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 Pool to the top of the Reactor Building (RB).
  - Severe Accident Water Addition (SAWA) – A combination of permanently installed and portable equipment to provide a means to add water to the RPV 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 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 4th quarter 2016.
- 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 4th quarter 2018.

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 following extreme external hazards screen-in for DAEC

- Seismic, External Flooding, Extreme Cold, High Wind, Extreme High Temperature

The following extreme external hazards screen out for DAEC

- None

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

Part 1: General Integrated Plan Elements and Assumptions

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.

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 approximately one hour, 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. 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. 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. An example is use of FLEX portable air supply equipment that is credited to recharge air lines for HCVS components after 24 hours. The FLEX portable air supply used must be demonstrated to meet the "SA Capable" criteria (Severe Accident) that are defined in NEI 13-02 Section 4.2.4.2 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

Part 1: General Integrated Plan Elements and Assumptions

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 nitrogen 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 will require more than minimal operator action.

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 requires changes to the EPG/SAGs per approved issue from 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 EPGs in all cases prior to entry into the SAGs. (reference NEI 13-02 Rev 1, section 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 ensure the capability to protect containment exists for each unit. (HCVS-FAQ-10)

<u>Plant Specific HCVS Related Assumptions/Characteristics:</u>

PLT-1. The rupture disk will be manually breeched if desired for anticipatory venting to allow establishing a containment

Part 1: General Integrated Plan Elements and Assumptions

vent path when containment pressure is approximately 10 psig (approximately 3.3 hours).

PLT-2. The existing torus hard pipe vent system (discharging to the offgas stack) will be decommissioned. A new HCVS will be installed off of existing (capped) 12" torus nozzle N230A. The new vent will be routed from the Torus Room to the Southwest Corner Room, up through Reactor Building (RB) South Stairwell #6 to the RB Refuel Floor, and vent to atmosphere through the roof of the RB. The piping from the 12" torus nozzle will be reduced to 10" and remain at 10" for the entire vent length. The HCVS will include two Containment Isolation Valves (CV-4360 and CV-4361) and a rupture disc (PSE-4362).

Part 2: Boundary Conditions for Wet Well 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

Part 2: Boundary Conditions for Wet Well Vent

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. Breach the rupture disk (PSE-4362) by pressurizing the piping between control valve CV-4361 and rupture disc PSE-4362.	MCR / Nitrogen supply valve key lock hand switch at Panel 1C14.	Not required during SA event Only required if performing early venting for FLEX
2. Open HCVS PCIVs CV-4360 and CV-4361	MCR / key lock hand switch located in MCR at 1C14	
3. Confirm Vent is open.	MCR / PCIV Position Indication, Temperature Indication and Radiation Monitor in MCR	
4. Replenish pneumatics with replaceable nitrogen bottles	Nitrogen bottles can be placed in an area that is accessible to operators (ROS)	Prior to depletion of the pneumatic sources actions will be required to connect replacement Nitrogen bottles at a time greater than 24 hours.
5. Re-align power supplies for all valves and instruments to portable sources or restore normal power supplies.	*Control Building 1A3 Switchgear Room*	*Prior to depletion of the installed power sources actions will be required to connect back-up sources at a time greater than 24 hours.*

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.

Part 2: Boundary Conditions for Wet Well Vent

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

- At approximately 3.3 hours, initiate use of Hardened Containment Vent System (HCVS) 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 meets the seismic requirements identified in NEI 13-02 and will be powered by the HCVS uninterruptible power supply, with motive force supplied to HCVS valves from an installed bank of nitrogen storage bottles. Critical HCVS controls and instruments associated with containment will be DC powered and operated from the MCR or a Remote Operating Station. The DC power for HCVS will be available as long as the HCVS is required. HCVS uninterruptable power supply battery capacity will be available to extend past 24 hours. In addition, when available the Phase 2 FLEX Diesel Generator (DG) can provide power before battery life is exhausted. Thus, initiation of the HCVS from the MCR or the Remote Operating Station within approximately 3.3 hours is acceptable because the actions can be performed any time after declaration of an ELAP and prior to reaching containment pressure limits. For purposes of analysis, a containment pressure of 10 PSIG was selected for initiation of venting and initiation after 10 PSIG but prior to reaching containment pressures of 53 PSIG (greater than 7 hours) is also acceptable for BDBEE venting. This action can also be performed for SA HCVS operation which occur at a time further removed from an ELAP declaration as shown in Attachment 2A.
- At approximately 24 hours, portable nitrogen bottles will be valved-in at the ROS to supplement the Nitrogen bank supply, if needed. This can be performed at any time prior to 24 hours to ensure adequate capacity is maintained so this time constraint is not limiting.
- Under the FLEX program, one of two portable diesel generators can be connected to station 480 Volt electrical distribution at MCC 1B32. From this motor control center, electrical power can be supplied to the planned uninterruptable power supply (UPS) for HCVS prior to depletion of the UPS batteries. For purposes of compliance with order EA-13-109 no credit is taken for this action until after 24 hours. Thus, the DG will be available to be placed in service at any point after 24 hours as required to supply power to HCVS critical components/instruments. A DG will be maintained in on-site FLEX storage buildings. The DG will be transferred and staged via haul routes and staging areas evaluated for impact from external hazards. Connection points will be installed to facilitate the connections and operational actions required to supply power for days 2-7 of the ELAP. For Phase 2 applicability, the 8-10 hours will change to 6-8 hours and will be validated by the Phase 2 Verification and Validation thus providing power by 8 hours, since it provides power to the SAWA components.

Discussion of radiological and temperature constraints identified in Attachment 2A

- All actions required in the first 24 hours to vent the containment can be performed from the Main Control Room.
- At approximately 24 hours, portable nitrogen bottles will be valved-in to supplement the Nitrogen bank supply if needed, as stated for the related time constraint item. Nitrogen bottles will be located in an area that is accessible to operators. Connection points and valves will be located at the ROS.
- At approximately 24 hours, portable generators will have been moved to a location in or adjacent to the Turbine Building and connected to MCC 1B32 to allow supply of power to the HCVS UPS. - Time sensitive after 24 hours for HCVS operation and at 8 hours for SAWA operation (refer to section 3.1 of this OIP). The UPS battery duration is calculated to last greater than 24 hours. A FLEX portable DG will be staged beginning at approximately 6 hours. Within Two (2) hours of deployment the DG will be in service. Thus the DG will be available to be placed in service at any point after 24 hours as required to supply power to HCVS critical components/instruments. DG connections, location, and access for refueling will be in an area that is accessible to any operators working in the Control Building, North Turbine Building or outside yard area North and East of the Turbine Building. These areas are expected to be accessible because the HCVS pipe routing is entirely within the South Reactor Building until it exits the Reactor Building roof.

Part 2: Boundary Conditions for Wet Well Vent

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.

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)

Part 2: Boundary Conditions for Wet Well Vent

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.

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 suppression pool path is designed for venting steam/energy at a nominal capacity of 1% or greater of 1912 MWt thermal power (Current Licensed Power) at a containment pressure of 53 psig (PCPL). No additional Power Uprates are currently planned. This pressure is the lower of the containment design pressure (56 psig) and the PCPL value (53 psig). The nominal size of the wetwell portion of the HCVS will be 10 inches in diameter which provides adequate capacity to meet or exceed the Order criteria.

Vent Capacity

The 1% value at DAEC 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. It was verified in the GE Safety Analysis Report for DAEC Extended Power Uprate Analysis (EPU) that the drywell and suppression pool temperatures remain below the design temperatures.

Vent Path and Discharge

The existing hard pipe vent system (discharging to the offgas stack) will be decommissioned. A new HCVS will be installed off of existing capped 12″ torus nozzle N230A. The new vent will be routed from the Torus Room to the Southwest Corner Room, up through Reactor Building (RB) South Stairwell #6 to the RB Refuel Floor, and vent to atmosphere through the roof of the RB. The piping from the 12″ torus nozzle will be reduced to 10″ and remain at 10″

Part 2: Boundary Conditions for Wet Well Vent

for the entire vent length. The HCVS will include two Containment Isolation Valves (CV-4360 and CV-4361) and a rupture disc (PSE-4362).

The HCVS discharge path will be routed to a point above any adjacent structure (excluding the off gas stack). This discharge point is above the Reactor Building such that the release point will not directly vent into the emergency ventilation system intake and exhaust openings, main control room location, location of HCVS portable equipment, access routes required following a ELAP and BDBEE, and emergency response facilities; however, these must be considered in conjunction with other design criteria (e.g., flow capacity) and pipe routing limitations, to the degree practical.

The detailed design will address missile protection as directed in HCVS-WP-04 related to limited evaluation above 30 feet. The pipe routing will be within the Class 1 structure of the Reactor Building until it exits the building through the roof. Based on criteria in HCVS-WP-04, no additional missile protection is required for the HCVS piping above the 833′-6″ elevation (i.e. the RB concrete structure provides adequate missile protection to this elevation). (reference HCVS-FAQ-04; HCVS-WP-04) (See Attachment 7, Open Item 3.)

Power and Pneumatic Supply Sources

All electrical power required for operation of HCVS components will be routed through an uninterruptible power supply with batteries sufficient for 24 hours of service.

Pneumatic power will be provided by a bank of multiple bottles of compressed Nitrogen. The Nitrogen can be supplied to the valve operators by either energizing a solenoid valve to port Nitrogen to the valve cylinders or by opening a bypass valve located near the Nitrogen bottles.

1. The HCVS flow path valves will be two 10″ pneumatically-operated, normally-closed, primary containment isolation valves. The valves will be installed in a new vent line off of spare torus penetration N-230A. The PCIVs will normally be closed and will fail closed on either loss of nitrogen or loss of power. Therefore, the only way to open the valves will be to take manual action. A safety related rupture disk will be installed downstream of the two PCIVs. The rupture disk is installed to provide a zero-leakage barrier to prevent PCIV leakage from becoming an unfiltered release to the environment. The rupture disk also acts as a redundant barrier in the event of inadvertent PCIV actuation. The set point of the rupture disk will be greater than the maximum expected primary containment pressure for the design basis LOCA. Therefore, it would not rupture during and following a design basis LOCA. FLEX is credited to sustain DC power for >24 hours. The initial stored motive air/gas will allow for a minimum of eight valve operating cycles for the HCVS valves for the first 24-hours.
2. 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 2A (See Attachment 7, Open Item 2).
3. All permanently installed HCVS equipment, including any connections required to supplement the HCVS operation during an ELAP (i.e., electric power, N2/air) will be located in areas reasonably protected from defined hazards listed in Part 1 of this report.
4. All valves required to open the flow path will be designed for remote manual operation following a ELAP, such that the primary means of valve manipulation does not rely on use of a hand wheel, reach–rod or similar means that requires close proximity to the valve (reference FAQ HCVS-03). Any supplemental connections will be pre-engineered to minimize man-power resources and address environmental concerns. Required portable equipment will be reasonably protected from screened-in hazards listed in Part 1 of this OIP.
5. Access to the locations described above will not require temporary ladders or scaffolding.

Part 2: Boundary Conditions for Wet Well Vent

Location of Control Panels

The HCVS design allows initiating and then operating and monitoring the HCVS from the Main Control Room (MCR). A remote control station will be established in the 1A3 essential Switchgear Room, but use of this remote control station is not required in the first 24 hours. The MCR and the essential switchgear locations are protected from adverse natural phenomena and the normal control points for Plant Emergency Response actions.

The ROS will serve as the alternate control location for manual operation of the HCVS in the event that the control room is unavailable or if control room HCVS actuation operability is lost following a BDBEE. The design allows for HCVS operation either from the control room or locally at the ROS to actuate the new PCIVs, breach the rupture disk, and perform HCVS purging. The ROS will consist of a connection point for nitrogen bottles, tubing, pressure reducing and solenoid valves, as well as various manual isolation valves. A bank of Nitrogen bottles will be located in the Control Rod Drive (CRD) Repair Room in the RB.

Hydrogen

As is required by EA-13-109, Section 1.2.11, the HCVS must 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 must 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).

The DAEC HCVS will use a Nitrogen purge system to provide assurance that a combustible gas mixture will be avoided.

An evaluation will be performed of the system design for hydrogen/carbon monoxide control measures (See Attachment 7, Open Item 4).

Unintended Cross Flow of Vented Fluids

The HCVS is a new, stand-alone system that does not interface with any existing plant systems. The HCVS connects at a spare torus penetration (N230A) with PCIVs CV-4360 and CV-4361, rupture disc PSE-4362, then routes through and out of the Reactor Building. There are no interconnections with other components or ventilation systems. The only potential for cross flow exists at the nitrogen purge line connection to the vent pipe. Dual check valves (V43-0645/ V43-0646) are provided to prevent backflow from the vent stream into the purge system.

Prevention of Inadvertent Actuation

For design bases accidents and transients, containment cooling is available and EOP guidance would not require use of the HCVS. In addition, the HCVS will be designed to provide features to prevent inadvertent actuation due to a design error, equipment malfunction, or operator error such that any credited containment accident pressure (CAP) that would provide net positive suction head to the emergency core cooling system (ECCS) pumps will be available (inclusive of a design basis loss-of-coolant accident (DBLOCA)). DAEC credits containment over pressure for DBLOCA as described in UFSAR Section 5.4 and shown in UFSAR figures 5.4-15 sheet 1 and 5.4-15 sheet 2. However the ECCS pumps will not have normal power available because of the starting boundary conditions of an ELAP.

- The features that prevent inadvertent actuation are two normally closed PCIVs in series with a rupture disk. The PCIVs are controlled by one key-lock switch. The rupture disc setpoint provides burst margin over the maximum postulated wetwell pressure at LOCA pressure and temperature conditions to ensure that the disc cannot rupture due to PCIV leakage during the LOCA event, therefore precluding the possibility of creating a bypass leakage path in the secondary containment boundary during "normal" design basis operation of the plant.

Component Qualifications

The HCVS components downstream of the second containment isolation valve are routed in seismically qualified

Part 2: Boundary Conditions for Wet Well Vent

structures. HCVS components that directly interface with the pressure boundary will be considered safety related. 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 controls 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 containment isolation and/or a 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 seismic margin earthquake (SME) back to their isolation boundaries. Electrical and controls 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, but will not directly quantify effluents.

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:

1. 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.
2. Demonstration of seismic reliability via methods that predict performance described in IEEE 344-2004.
3. Demonstration that instrumentation is substantially similar to the design of instrumentation previously qualified.

Instrument	**Qualification Method***
HCVS Effluent Temperature	ISO9001 / IEEE 344-2004** / Demonstration
HCVS Radiation Monitor	ISO9001 / IEEE 344-2004** / Demonstration
HCVS Valve Position Indication	ISO9001 / IEEE 344-2004** / Demonstration
HCVS Pneumatic Supply Pressure	ISO9001 / IEEE 344-2004** / Demonstration
HCVS Electrical Power Supply Availability	ISO9001 / IEEE 344-2004** / Demonstration

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

** The qualification method used for each HCVS instrument will be to the IEEE 344-2004 standard or a substantially similar industrial standard.

Monitoring of HCVS

The DAEC wetwell HCVS will be capable of being manually operated during sustained operations from a control panel located in the main control room (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 conforms 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 Remote Operating Station (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

Part 2: Boundary Conditions for Wet Well Vent

and dose impact on operator exposure, extended loss of AC power (ELAP), and inadequate containment cooling. An evaluation will be performed to determine accessibility to the location, habitability, staffing sufficiency, and communication capability with Vent-use decision makers.

The wetwell HCVS will include means to monitor the status of the vent system in both the MCR and the ROS (via communication with the MCR). The ability to open/close the vent system valves multiple times during the event's first 24 hours will be provided by a bank of Nitrogen Bottles and the HCVS uninterruptible power supply. Beyond the first 24 hours, the ability to maintain these valves open or closed will be provided with portable replaceable nitrogen bottles and FLEX generators.

The wetwell HCVS will include indications for vent temperature, and effluent radiation levels in the MCR. Other important information on the status of supporting systems, such as local power source status and pneumatic supply pressure, will also be included in the design. 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 from the MCR as per Requirement 1.2.4 and will be 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 power supply, valve actuator pneumatic supply, and instrumentation (local and remote) components, will be designed/analyzed to conform to the requirements consistent with the applicable design codes for the plant and to ensure functionality following a design basis earthquake.

Additional modifications required to meet the Order will be reliably functional at the temperature, pressure, and radiation levels consistent with the vent pipe conditions for sustained operations. The instrumentation/power supplies/cables/connections (components) will be qualified for temperature, radiation level, and total integrated dose radiation for the Effluent Vent Pipe.

Conduit design will be installed to Seismic Class 1 criteria. Missile protection will be provided when required (reference HCVS-WP-04). Augmented quality requirements 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. These qualifications will be bounding conditions for DAEC.

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 are 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 instrument component use 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

Part 2: Boundary Conditions for Wet Well Vent

location

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW 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 a ELAP and BDBEE hazards identified in part 1 of this OIP.

Initial operator actions can be completed by Operators from the HCVS control station 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 are 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 Remote Operating Station (ROS) in the 1A3 Essential Switchgear Room (except monitoring). This location minimizes plant operators' exposure to adverse temperature and radiological conditions and is protected from hazards assumed in Part 1 of this report.

Permanently installed power and motive air/gas capability will be available to support operation and monitoring of the HCVS for 24 hours.

System control:

i. Active: Control valves and/or PCIVs will be operated in accordance with EOPs/SAGs to control containment pressure. The HCVS will be designed for eight open/close cycles under ELAP conditions over the first 24 hours following an ELAP. Controlled venting is permitted in the revised EPGs and associated implementing EOPs.

ii. Passive: Inadvertent actuation protection is provided by a rupture disk.

Part 2: Boundary Conditions for Wet Well Vent

A rupture disk will be provided in the vent line downstream of the PCIVs. The rupture disk can be intentionally breached from the Main Control Room or ROS as directed by applicable procedures. The PCIVs must be open to permit vent flow. The set point of the rupture disk is greater than the maximum expected primary containment pressure during the design basis LOCA. Therefore, it would not rupture during and following a design basis LOCA. The rupture disk is installed to provide a zero-leakage barrier to prevent PCIV leakage from becoming an unfiltered release to the environment. The rupture disk also acts as a redundant barrier in the event of inadvertent PCIV actuation.

Greater Than 24 Hour Coping Detail

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

After 24 hours, available personnel will be able to connect supplemental motive air/gas to the HCVS. 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 will be pre-engineered quick disconnects to minimize manpower resources. Electrical power will be supplemented consistent with NRC Order EA-12-049.

These actions 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

EOP 2 Primary Containment Control Flowchart exists to direct operations in protection and control of containment integrity, including use of the existing containment vent system. Other site procedures for venting containment using the HCVS will include: TSG-Appendix C, Technical Support Guidelines "Containment Venting Guidelines" and SEP 301.3 "Torus Vent via Hardpipe Vent".

Identify modifications*:*

List modifications and describe how they support the HCVS Actions.

EA-12-049 Modifications

- EC 280488 constructed storage facilities for portable equipment storage to protect FLEX equipment from external hazards.
- EC 280490 will add connection points for the 480 volt portable FLEX generator to connect to Motor Control Center 1B32. This will allow restoring power to the HCVS uninterruptible power supply.

Part 2: Boundary Conditions for Wet Well Vent

EA-13-109 Modifications

EC 281991 is being developed for the following changes to the plant:

- Install the dedicated UPS and the disconnect switches needed to supply power to HCVS.
- Install a Remote Operation Station including connection points for portable Nitrogen bottles to supplement HCVS pneumatics.
- Install required HCVS instrumentation and controls in the MCR, and controls in the ROS.
- Install new piping, containment isolation valves and rupture disc; and eliminate the existing Hardened Vent System.

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 indicators:

Key Parameter	Component Identifier	Indication Location
HCVS System Effluent Temperature	New	MCR
HCVS Pneumatic Supply Pressure	New	ROS
HCVS System Valve Position Indication	New	MCR
HCVS System Radiation Monitor	New	MCR
HCVS UPS Status Indication	New	In vicinity of ROS
Torus Pressure	PI4395A/B (0-100 psig) (Existing)	MCR 1C03

Initiation, operation and monitoring of the HCVS system will rely on existing Main Control Room key parameters and indicators which are qualified per the existing plant design:

Key Parameter	Component Identifier	Indication Location
Drywell pressure	PI4396C/D	MCR 1C03
Torus level	LI4397A/B	MCR 1C09

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

Notes:

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW 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 events. Severe accident event assumes that specific core cooling actions from the FLEX strategies identified in the response to Order EA12-049 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 Main Control Room (MCR) or at the HCVS Remote Operating Station (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 power and motive air/gas 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: Same as for BDBEE Venting Part 2.

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

Specifics are the same as for BDBEE Venting Part 2 except the location and refueling actions for the FLEX DG and replacement Nitrogen Bottles will be evaluated for SA environmental conditions resulting from the proposed damaged Reactor Core and resultant HCVS vent pathway.

Perform severe accident evaluation for FLEX DG and replacement gas to confirm accessibility for use for post 24 hour actions (See Attachment 7, Open Item 2).

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

First 24 Hour Coping Detail

Part 2: Boundary Conditions for Wet Well Vent
Part 2 Boundary Conditions for WW Vent: **Severe Accident Venting**
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 in the same manner for SA conditions as for BDBEE conditions. Existing guidance in the Technical Support Guidelines Appendix C 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 Wet Well Vent

Part 2 Boundary Conditions for WW 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 will require support from the planned dedicated uninterruptable power supply. Before the dedicated UPS is depleted, portable FLEX diesel generators, as detailed in the response to Order EA-12-049, will be credited to charge the UPS. A bank of Nitrogen bottles, with back-up from portable Nitrogen bottles, will provide sufficient motive force for all HCVS valve operations.

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. To ensure power for 24 hours, a dedicated HCVS uninterruptable power supply will be available to feed HCVS loads. At 24 hours, power will be backed up by FLEX generators evaluated for SA accessibility. Portable Nitrogen bottles will be available as supplemental pneumatic sources.

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 is permanently installed. The key portable items will be the SA Capable/FLEX DGs and portable Nitrogen bottles. These will be staged in position for the duration of the event.

Identify modifications:

List modifications and describe how they support the HCVS Actions.

Part 2: Boundary Conditions for Wet Well Vent
Part 2 Boundary Conditions for WW Vent: **HCVS Support Equipment Functions**
Same as Part 2 HCVS connections required for portable equipment 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 DG* electrical load and fuel supply (NEW) UPS Status Indication (NEW) Pressure gauge on supplemental Nitrogen bottles at ROS (NEW)
Notes:

Part 2: Boundary Conditions for Wet Well Vent

Part 2 Boundary Conditions for WW 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.

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 is 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 EA12-049 (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)

3.1.B: Severe Accident DW Vent (545 deg F) (not used)

DAEC will implement SAWA and SAWM in accordance with subpart 3.1.A.

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

SAWA and SAWM or SADV 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 DW 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/SADV 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 using control switches, at MCC/Busses in the Control Building and locally in the Turbine Building and the pumphouse. In addition, HCVS operation may occur at the ROS at the 757'elevation in the Control Building (1A3 essential switchgear room).

Timelines (see Attachment 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.	■ MCR or ROS	■ Applicable to SAWA/SAWM strategy
2. Establish RPV flow path: manually open FLEX RPV injection valves V20-0126 and V20-0127, manually (partially) open MO2003 to pass the required SAWA flow.	■ RB SECR- FLEX RPV injection valves V20-0126 and V20-0127. ■ RB RHR valve room-MO2003.	Actions are required within 1 hour after initiation of the event (SBO with no injection source) due to RB accessibility.
3. Strip electrical loads from MCC 1B34. Leave breakers closed for MO2003 A LPCI Inject Valve, MO2005 A RHR Torus Spray/ Torus Cooling Isolation Valve, and MO2010 RHR Cross-tie Isolation Valve.	■ RB 786' MCC 1B34	■ This action will allow power to be restored to 1B34 without an overcurrent trip. This action shall be performed within 1 hour due to RB accessibility. ■ Closing breakers for MO2003, MO2005, and MO2010 will ensure that the RHR injection path can be aligned from the MCR for all conditions.
4. Connect FLEX (SAWA) pump to water source	■ Circulating Water Pit at Pumphouse (non-flood condition) or Condenser Hotwell (flood condition).	Non-flood condition, portable diesel pump is staged at the Pumphouse with suction from the Circulating Water Pit. Flood condition, portable diesel pump is staged in the Turbine Building south rail bay, with suction connected to the Condenser Hotwell.
5. Connect FLEX (SAWA) pump discharge to injection piping	■ Route flexible hose from pump discharge to hard pipe connection in Turbine Building Heater Bay (757')	
6. Power up RHR valves with EA-12-049 (FLEX) generator. Provide power to 1B03, close breaker 1B303 to supply power to 1B34.	■ Control Building 757', 1A3 Switchgear Room. ■ RHR valves may be operated from the main control room	■ Should be done as soon as possible ■ Due to load stripping at 1B34, MO2003, MO2005, and MO2010 can be operated from the MCR.

Part 3.1: Boundary Conditions for SAWA

7. Align 'A' RHR injection path as required- open MO2003.	■ MCR handswitches.	If torus cooling was operating at the time of the event, isolate A loop by closing MO2005; isolate B Loop by closing MO2010.
8. Inject to RPV using FLEX (SAWA) pump	Local flow indicator at FLEX (SAWA) pump.	■ Initial SAWA injection rate is *272* gpm. (Flowrate is determined by scaling, a ratio of the plant specific thermal power rating to the reference plant power level, multiplied by 500 gpm).
9. Monitor SAWA indications	Locally at FLEX (SAWA) pump.	Pump flow and flow control valve position
10. Use SAWM to maintain availability of the WW vent (Part 3.1.A)	■ MCR and locally at FLEX (SAWA) pump.	■ Monitor DW Pressure and Suppression Pool Level in MCR ■ Control SAWA flow at pump skid

Discussion of timeline SAWA identified items

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

- Within 1 hour, implement required manual actions in the Reactor Building. Specifically, open RPV injection valves V20-0126 and V20-0127 in SECR, open (approximately 25%) MO2003 'A' LPCI Injection Valve in RHR Valve Room, and strip loads on 1B34 at RB 786'.
- Less than 8 Hours – Establish electrical power and other EA-12-049 actions 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.
- Less than 8 Hours – Initiate SAWA flow to the RPV. Having the HCVS in service will assist in minimizing the peak DW 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

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 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

Part 3.1: Boundary Conditions for SAWA

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. RHR LPCI injection mode has installed ECCS backflow prevention devices (V20-0082 A RHR LPCI Injection Loop Check Valve) qualified for 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 in the RB are:
  - RB SECR- manually open FLEX RPV injection valves V20-0126 and V20-0127.
  - RB RHR valve room- manually open MO2003 approximately 25%.
  - RB 786' south side, strip electrical loads from MCC 1B34. Leave breakers closed for MO2003 A LPCI Inject Valve, MO2005 A RHR Torus Spray/ Torus Cooling Isolation Valve, and MO2010 RHR Cross-tie Isolation Valve.

T=1 – 8 hr:

- Evaluation of core gap and early in vessel release impact to <u>reactor building</u> 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:
  - No actions are expected in the RB.
- Establish electrical power for SAWA systems and indications using FLEX strategies (EA-12-049).
  - Step 6 of table 3.1 above
- Establish flow to the RPV using SAWA systems. Begin injection at a maximum rate, not to exceed 272 gpm.
  - Steps 3, 4, 7, and 8 of table 3.1 above
- Monitor SAWA indications
  - Step 9 of table 3.1 above

T≤8 –12 hr:

- Continue injection for 4 hours after SAWA injection begins at initial SAWA rate.

T≤12 hrs:

- Proceed to SAWM actions (Part 3.1.A)
  - Step 10 of table 3.1 above.
  - Reduce RPV injection flow to approximately 55 gpm.
  - Monitor DW pressure and Suppression Pool level in MCR; adjust RPV injection flow as needed to maintain a stable or lowering Suppression Pool level.

Greater Than 24 Hour Coping Detail

Part 3.1: Boundary Conditions for SAWA

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,

SAWA Operation is the same for the full period of sustained operation. If SAWM is employed flow rates will be directed 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 an RPV injection rate of 272 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.

Equipment staging locations and system configuration will be different, depending on flood vs. non-flood conditions.

In a Non-Flood Condition:

In the non- flood condition, the FLEX (SAWA) pump is staged at the Pumphouse. The pump has minimum flow capability, which also provides freeze protection. The pump suction is connected to an existing standpipe in Circulation Water pit on the east side of the Pumphouse. The discharge hose is connected to a flow indicator in the pump outlet, routed to the Turbine Building north truck bay, through the Turbine Building to the connection point in the Turbine Building Heater Bay. This connection will have a mating connector and a manual isolation valve. This piping routes through the Turbine Building/ Reactor Building wall, into the RB Southest Corner Room (SECR), and ties into the "A" RHR Loop via two 4" manual isolation valves (FLEX RPV injection point). Refer to Sketch 3 for the conceptual layout of the SAWA flowpath and connections. Once the SAWA components are deployed and connected, the SAWA flow path is completed by opening the A RHR LPCI Injection Valve (MO2003). MO2003 is the normally closed injection valve, and will be manually or electrically opened in SAWA conditions. Backflow prevention is provided by the A RHR LPCI Injection Loop Check Valve V20-0082.

Cross flow into other portions of the RHR system will be isolated by ensuring closure of the other Motor Operated Valves (MOVs). Select RHR MOVs will be powered from the FLEX DG via 1B03/ 1B303/ 1B34. This will provide the capability to realign RHR if needed (i.e. if torus cooling mode was operating at the time of the event).

DW pressure and Suppression Pool level will be monitored and flowrate will be adjusted by use of the

Part 3.1: Boundary Conditions for SAWA

flow control valve at the FLEX (SAWA) pump. Communication will be established between the MCR and the FLEX (SAWA) pump location.

MOVs and containment instrumentation required for SAWA will be powered by the FLEX diesel generators, connected at the Control Building essential switchgear room as described in the EA-12-049 compliance documents. The FLEX DGs will be located on the north side of the Turbine Building, which is a significant distance from the HCVS (> 200 feet) and are on the opposite side of the buildings (vent is located on the south side of the Reactor Building). Refueling of the FLEX DG and FLEX (SAWA) pump will be accomplished using the established FLEX procedures, and will account for dose rates and area accessibility. The Pumphouse is a significant distance away from the HCVS, and substantial structural shielding is provided at this location.

In a Flood Condition:

In a flood condition, the FLEX (SAWA) pump is staged in the south Turbine Building rail bay. The flow path takes suction from the Main Condenser Hotwell. The pump suction is connected to the Hotwell condenser bypass line via a hard pipe branch, manual isolation valve, and connection point in the TB 1st floor Heater Bay. Hose will be run from this connection point to the south Turbine Building Rail bay area and connected to the pump inlet. The pump discharge hose will be connected and routed to the FLEX RPV injection point, at the TB 1st floor Heater Bay. Refer to Sketch 3 for the conceptual layout of the SAWA flowpath and connections.

At this point, the injection flow path is the same as the Non-Flood condition (through the A RHR LPCI injection line), as described above. Available electrical power and instrumentation are the same as described for the non-flood condition.

The location of the FLEX (SAWA) pump in the rail bay is such that radiation shielding is provided by the RB and TB structures. Note that in the flood condition, the pump will be staged in advance. Operation and refueling will be performed in relatively low dose areas (i.e. < 100 mrem/hr).

Evaluations for projected SA conditions (radiation / temperature) will be performed to ensure 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)

Electrical equipment and instrumentation will be powered from the existing station batteries, and from AC distribution systems that are powered from the EA-12-049 generator(s). The battery chargers are also powered from the EA-12-049 generator(s) to maintain the battery capacities during the Sustained Operating period. The indications include (* are minimum)

Parameter	Instrument	Location	Power Source / Notes
*DW Pressure	PI4396C/D	MCR, 1C03	Instrument AC (Station batteries via EA-12-049 generator)
*Suppression Pool Level	LI4397A/B (1.5'-16') LR4396A/B (Narrow range 1.5'-16'	MCR, 1C03, 1C09	Instrument AC (Station batteries via

Part 3.1: Boundary Conditions for SAWA

	Wide range 0'-98')		EA-12-049 generator)
*SAWA Flow	FLEX (SAWA) Pump Flow indicator	FLEX (SAWA) Pump Skid	FLEX (SAWA) pump (skid mounted device, mechanical, no electrical power required)
Motor Operated Valve controls	MCR Panels	MCR and Control Building	MO2003 MO2005 MO2010

The instrumentation and equipment being used for SAWA and supporting equipment has been evaluated to perform for the Sustained Operating period under the expected radiological and temperature conditions.

Equipment Protection

The FLEX (SAWA) pump suction and injection connections are in the Turbine Building Heater Bay and Condenser Bay. The concrete shield wall on the south side of the Heater Bay provides a substantial and robust barrier to wind generated missiles. The Turbine Building is not a seismic Class 1 structure. DAEC UFSAR section 3.8.4.3.3 states: "Although the turbine building, with the exception of that portion which houses the emergency diesel generators, is classified as Non-seismic, the criteria for Seismic Category I structures were used for the structural design of the entire building. A complete dynamic analysis has been conducted for the turbine building to ensure the integrity of Seismic Category I equipment within the building and Seismic Category I equipment and structures adjacent to it." Therefore, the SAWA connection points in the Turbine Building are expected to be available after a seismic event. Portable equipment used for SAWA implementation will meet the protection requirements for storage in accordance with the criteria in NEI 12-06.

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

[Provide a brief description of Procedures / Guidelines: to be used for SAWA, likely an FSG]

Procedures will be developed to provide instructions for implementing SAWA. These procedures address the following actions:

- Perform 1 hour required actions in Reactor Building:
    - Open manual valves at RPV injection point (V20-0126, V20-0127)
    - Manually open MO2003 A RHR LPCI Inject Valve
    - Strip loads on 1B34
- Stage FLEX (SAWA) pump, run hoses, connections at suction and injection points (use FLEX procedure)
- Stage FLEX diesel generators for power to instruments and 1B03 (use FLEX procedure)
- Close breaker 1B303 to power 1B34

Part 3.1: Boundary Conditions for SAWA
• Align RHR system MOVs as required • Start FLEX (SAWA) pump, initiate injection, adjust flow to 272 gpm using skid mounted flow control valve and flow indicator • Sustain RPV injection of 272 gpm for 4 hours • Monitor DW pressure and SP water level, adjust injection rate to 55 gpm or flowrate required to maintain stable SP level.
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**
A modification will be required to route the planned RHR FLEX injection point to an accessible location outside of the Reactor Building. The conceptual design is to add 4" piping to the existing injection line (leaving V20-0126 and V20-0127 in place), route the line from the RB SECR to the TB Heater Bay (via core bore through RB/TB wall), terminated at a new manual isolation valve and mating connector.
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. SAWA components are not required to meet NEI 13-02, Table 2-1 design conditions.
Notes: **None**

Part 3.1.A: Boundary Conditions for SAWA/SAWM

Time periods for the maintaining SAWM actions such that the WW vent

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 WW 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

For DAEC, SAWM can be maintained for >7 days without the need for a drywell vent to maintain pressure below PCPL (53 psig).

Basis for SAWM time frame

Option 1 - SAWM can be maintained for greater than 7 days: DAEC is bounded by the evaluations performed in BWROG TP-15-008 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. All of the required instruments are initially powered by the station batteries and then by the FLEX (EA-12-049) generator which is placed in-service prior to RPV breach. The DG will provide power throughout the Sustained Operation period (7 days). FLEX (SAWA) pump flow is monitored using a mechanical flow element/ indicator. DW 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)

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

Part 3.1.A: Boundary Conditions for SAWA/SAWM

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	FLEX (SAWA) Pump Skid (Pumphouse or TB south rail bay)	■ Control to maintain containment and WW parameters to ensure WW vent remains functional. ■ *55* gpm minimum capability is maintained for greater than *7* days
2. Control to SAWM flowrate for containment control / decay heat removal	FLEX (SAWA) Pump Skid and MCR	■ SAWM flow rates will be monitored using the following instrumentation o FLEX (SAWA) pump Flow (mechanical) o Suppression Pool Level o DW pressure ■ SAWM flow rates will be controlled using the manual flow control valve at the FLEX (SAWA) pump
3. Establish alternate source of decay heat removal	Replenishment of water sources is accomplished in accordance with SAMP 728	■ >7 days
4. Secure SAWA / SAWM	FLEX (SAWA) Pump Skid, TB suction and injection points	■ When reliable alternate containment decay heat removal is established.

SAWM Time Sensitive Actions

Time Sensitive SAWM Actions:

1 Hour- Complete required actions in Reactor Building to establish RHR flow path.

Less than 8 Hours- Initiate RPV injection flow of 272 gpm.

Less than 12 Hours (i.e. after 4 hours of injection at 272 gpm) – Initiate actions to maintain the Wetwell (WW) vent capability by lowering injection rate, while maintaining the cooling of the core debris (SAWM). Monitor SAWM critical parameters while ensuring the WW vent remains available.

SAWM **Severe Accident Operation**

Part 3.1.A: Boundary Conditions for SAWA/SAWM

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 described 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 DW pressure and Suppression Pool level. SAWM flowrate can be lowered to maintain containment parameters and preserve the WW 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 uses the SAWA flow path. No additional modifications are being made for SAWM.

Details:

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 (DW 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.

Part 3.1.A: Boundary Conditions for SAWA/SAWM

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 is the same as the SAWA control location. Local indication of SAWM flow rate is provided at the pump skid by a portable flow instrument qualified to operate under the expected environmental conditions. The SAWA flow instrument is mechanical, and does not require electrical power. Communications will be established between the SAWM control location and the MCR.

Injection flowrate is controlled by the manual valve located on the FLEX (SAWA) pump skid.

Suppression Pool level and DW pressure are read in the control room using indicators powered by the FLEX DG installed under EA-12-049. These indications are used to control SAWM flowrate to the RPV.

Key Parameters:

List instrumentation credited for the SAWM Actions.

Parameters used for SAWM are:

- DW 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 when needed. Instruments are powered from Instrument AC which is supplied from station batteries, and have extended operation with FLEX DG.

Notes:

None

Part 3.1.B: Boundary Conditions for SAWA/SADV
Applicability of WW Design Considerations
[If SAWA/SADV is chosen by a Plant Site then site specific detail to be provided in OIP] N/A
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

For design bases events, DAEC credits containment overpressure to support NPSH for AC powered emergency core cooling system pumps as shown in UFSAR figures 5.4-15 sheet 1 and 5.4-15 sheet 2. The AC powered pumps are not available during an ELAP. Procedures for operation of the containment vent will address potential impacts on NPSH.

Provisions for out-of-service requirements will be established for the HCVS and compensatory measures. The following provisions will be documented in site administrative controls:

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:

Part 4: Programmatic Controls, Training, Drills and Maintenance

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

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).*
  - *Testing should be done to verify design requirements and/or basis. The basis should be documented and*

Part 4: Programmatic Controls, Training, Drills and Maintenance

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

DAEC 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.

DAEC 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 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}*
Issue preliminary/conceptual design Report	Jun, 2014	Complete	
Submit Overall Integrated Implementation Plan	Jun 2014	Complete	
Initial Outage for Phase 1 Planning	Nov, 2014	Complete	
Submit 6 Month Status Report	Dec. 2014	Complete	
Submit 6 Month Status Report	Jun. 2015	Complete	
Submit 6 Month Status Report	Dec. 2015	Complete with this submittal	Simultaneous with Phase 2 OIP
Design Complete Phase 1	Mar. 2016	Started	
Submit 6 Month Status Report	Jun. 2016	Not Started	This status report will include both Phase 1 and 2 scope.
Operations Procedure Changes Developed	Oct. 2016	Not Started	
Site Specific Maintenance and Testing Procedures Developed	Oct. 2016	Not Started	
Training Complete	Oct. 2016	Not Started	
Implementation Outage	End of RFO25	Not Started	

Part 5: Milestone Schedule

Procedure Changes Active	End of RFO25	Not Started	
Walk Through Demonstration/Functional Test	End of RFO25	Not Started	
Submit Completion Report	60 days after RFO25	Not Started	

Phase 2 Milestone Schedule:

Phase 2 Milestone Schedule

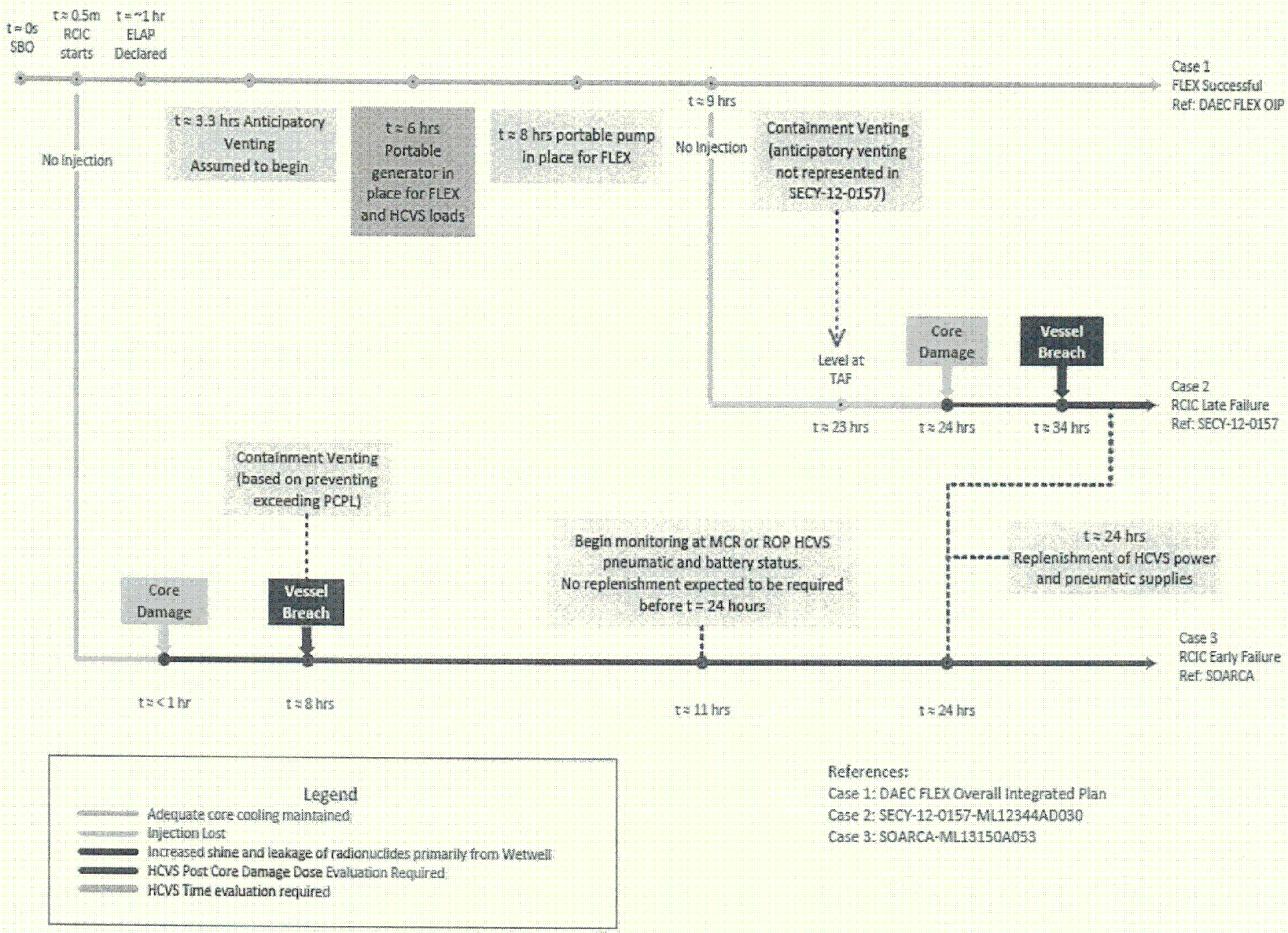
Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
Submit Overall Integrated Implementation Plan	Dec 2015	Complete with this submittal	Simultaneous with Phase 1 OIP
Hold preliminary/conceptual design meeting	June 2016		
Submit 6 Month Status Report	June 2016		This status report will include both Phase 1 and 2 scope.
Submit 6 Month Status Report	Dec 2016		
Submit 6 Month Status Report	June 2017		
Design Engineering On-site/Complete	Jan 2018		
Submit 6 Month Status Report	Dec 2017		
Submit 6 Month Status Report	June 2017		
Operations Procedure Changes Developed	Oct 2018		
Site Specific Maintenance Procedure Developed	Oct 2018		
Training Complete	Oct 2018		
Implementation Outage	RFO 26		
Procedure Changes Active	RFO26		
Walk Through Demonstration/Functional Test	RFO 26		
Submit Completion Report	RFO 26		

Notes:

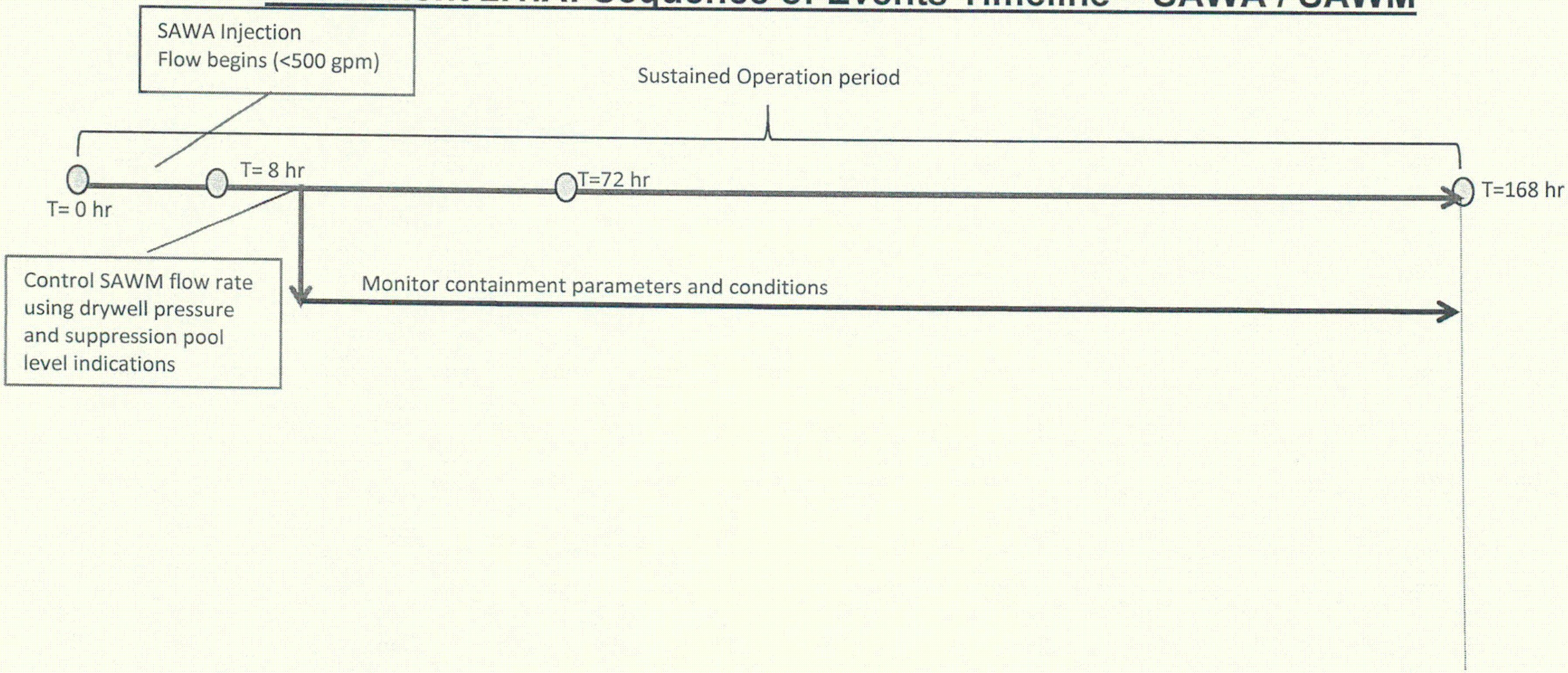
Attachment 1: HCVS/SAWA Portable Equipment

List portable equipment	*BDBEE Venting*	*Severe Accident Venting*	*Performance Criteria*	*Maintenance / PM requirements*
Nitrogen Cylinders	X	X	Required volume is 11 bottles assuming replenishment after first 24 hours using estimated number of valve openings and purge of vent line	Check periodically for pressure, replace or replenish as needed
FLEX DG (and associated equipment)	X	X	TBD	Per Response to EA-12-049
FLEX (SAWA) Pump (and associated equipment)	X	X	272 gpm for first 4 hours and 55 gpm for the sustained operating period	Per Response to EA-13-109

Attachment 2A: Sequence of Events Timeline – HCVS



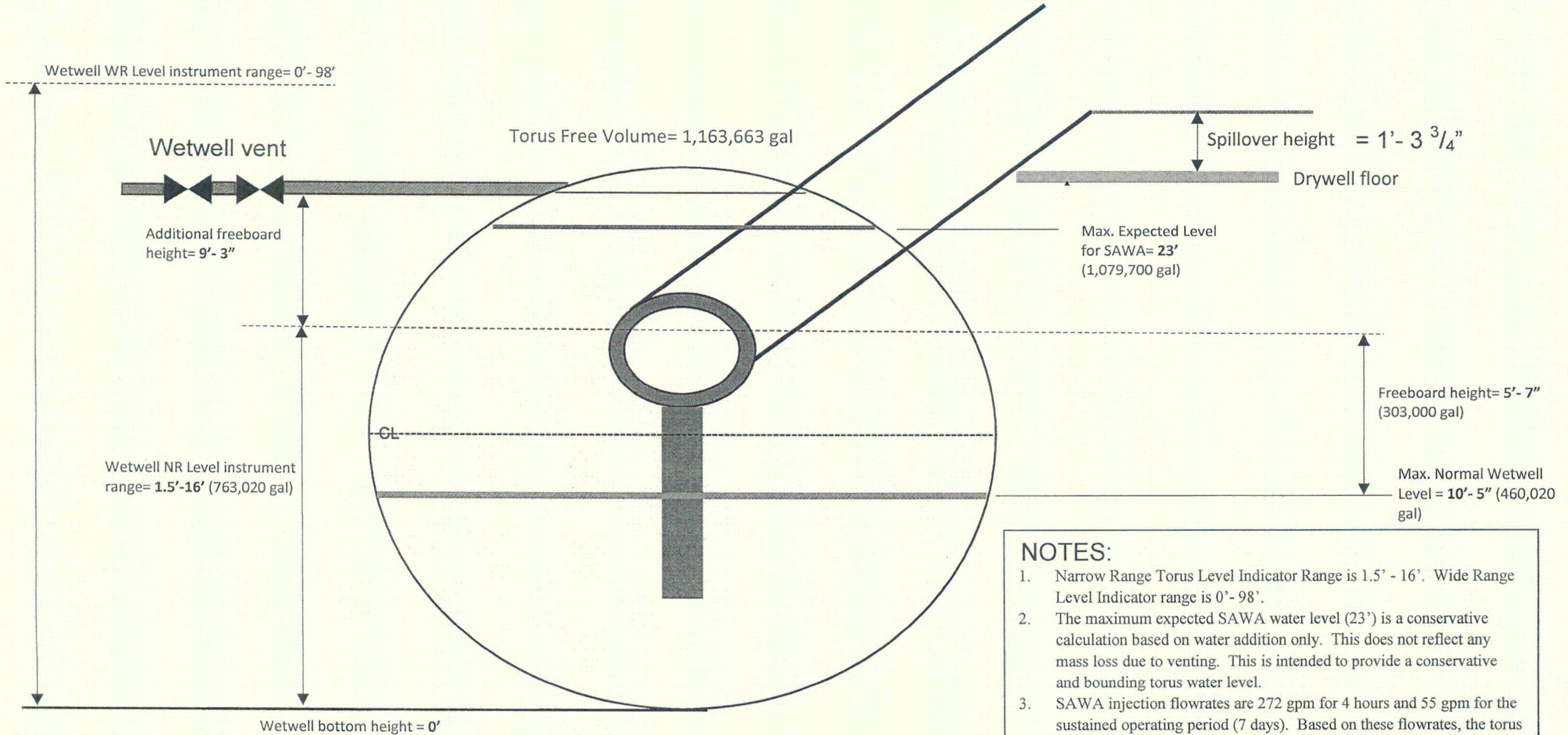
Attachment 2.1.A: Sequence of Events Timeline – SAWA / SAWM



Attachment 2.1.B: Sequence of Events Timeline – SADV

N/A

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



NOTES:

1. Narrow Range Torus Level Indicator Range is 1.5' - 16'. Wide Range Level Indicator range is 0'- 98'.
2. The maximum expected SAWA water level (23') is a conservative calculation based on water addition only. This does not reflect any mass loss due to venting. This is intended to provide a conservative and bounding torus water level.
3. SAWA injection flowrates are 272 gpm for 4 hours and 55 gpm for the sustained operating period (7 days). Based on these flowrates, the torus level is expected to change as follows:
   - Flowrate of 272 gpm results in a rate of rise of approx. 0.285 ft/ hr.
   - Flowrate of 55 gpm results in a rate of rise of approx. 0.058 ft/ hr.
4. Calculated volumes are preliminary, and will be validated by analysis.

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

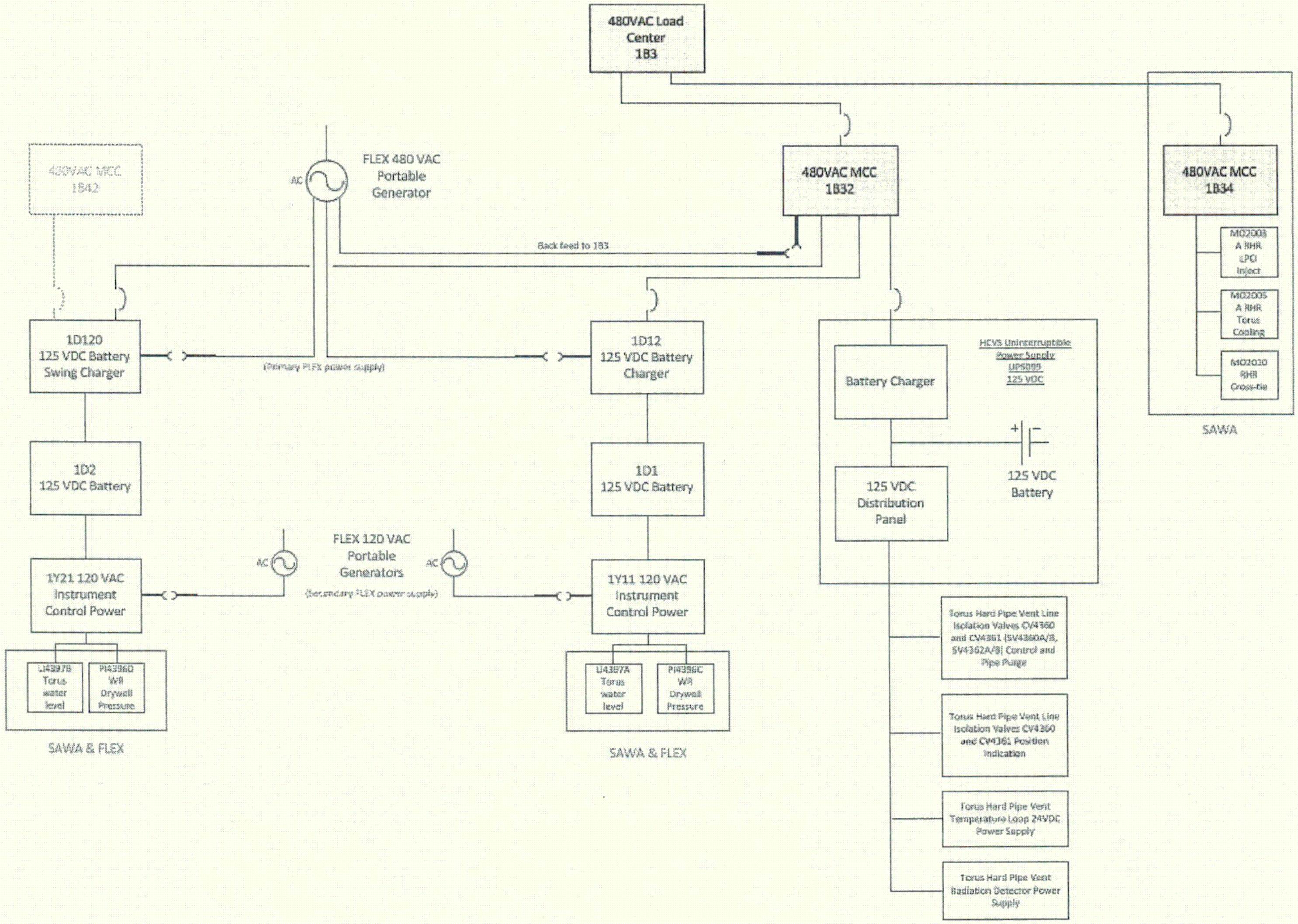
Sketch 2: P&ID Layout of WW Vent *(preliminary)*

- Piping routing for vent path – WW Vent
  - Demarcate the valves (in the vent piping) between the currently existing and new ones
  - WW 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 WW 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

Duane Arnold Energy Center Hardened Containment Venting System (HCVS)
Phase 1 and 2 Overall Integrated Plan

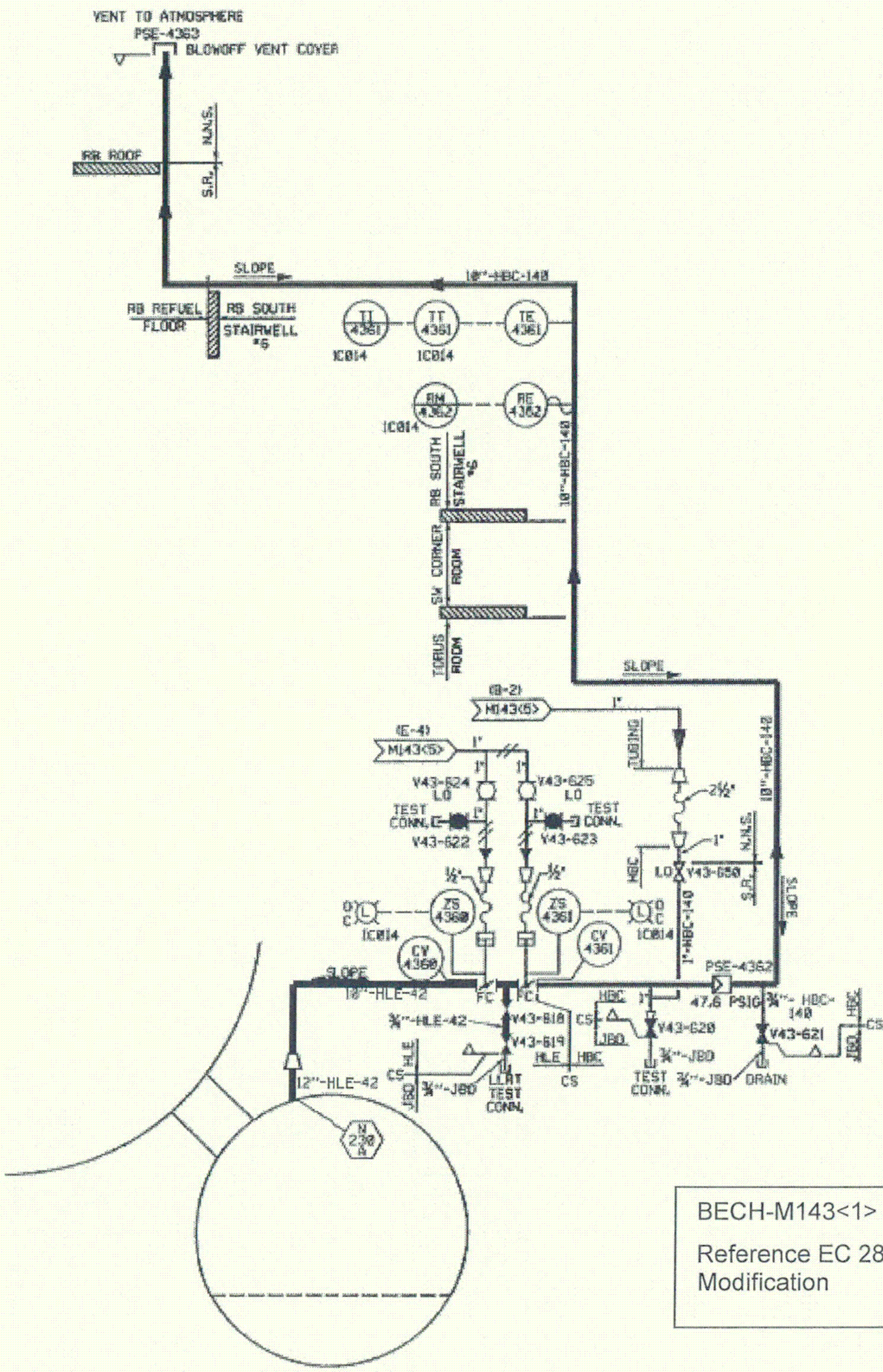


Sketch 1: Electrical Layout of System

References:

EC 281991, HCVS Modification

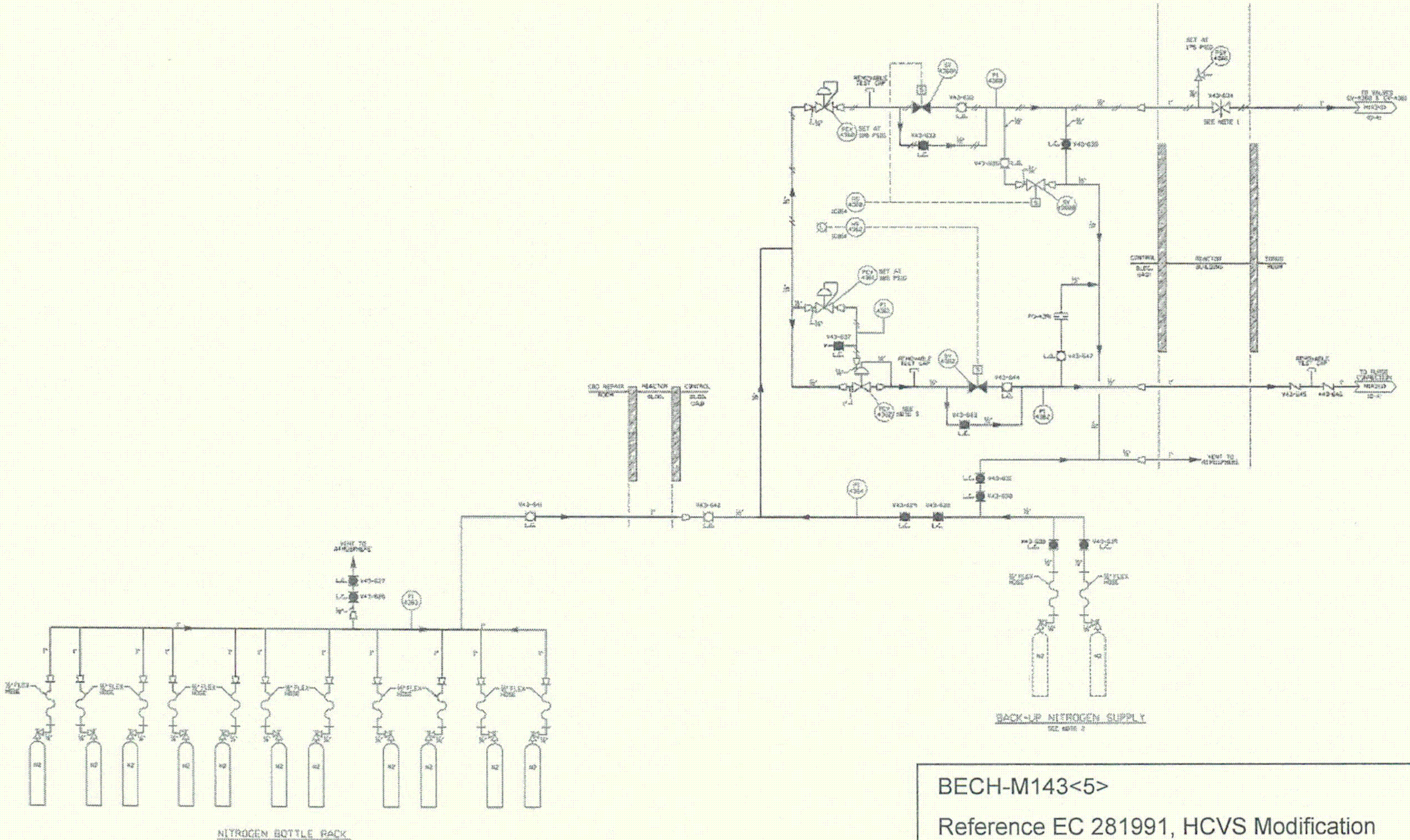
EC 280490, FLEX Electrical Modification



BECH-M143<1>

Reference EC 281991, HCVS Modification

Sketch 2a: Layout of Planned HCVS



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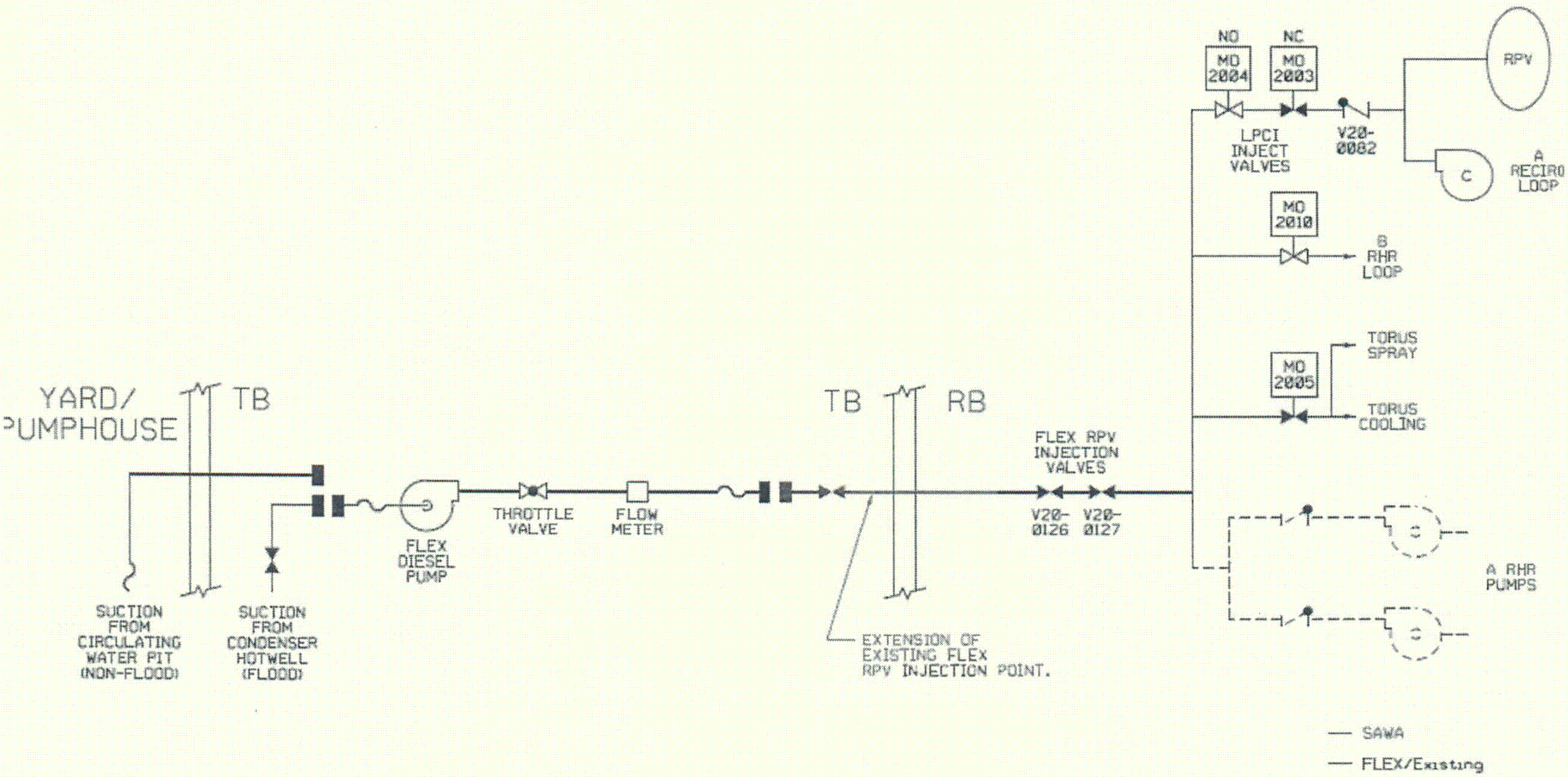
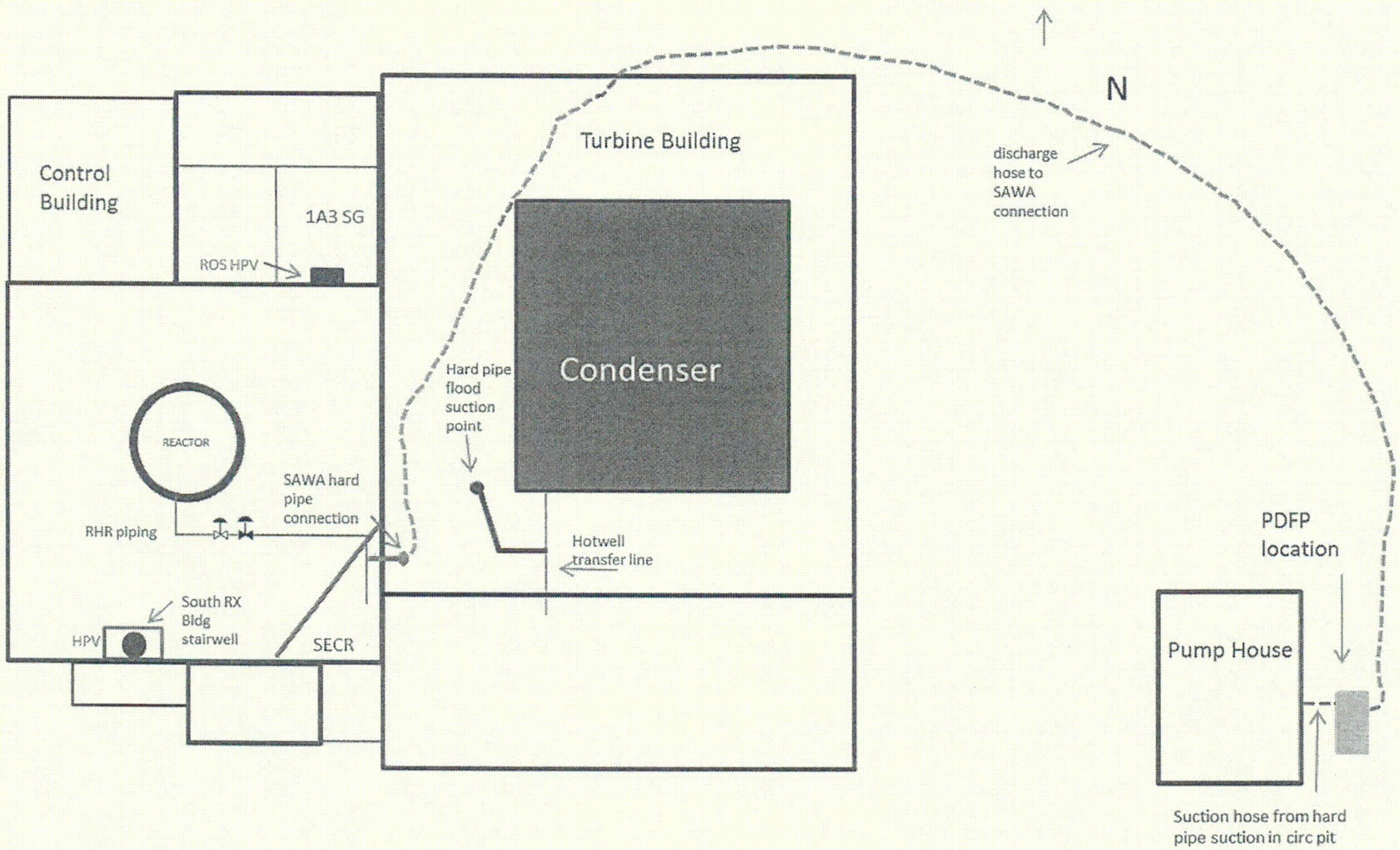
Reference EC 281991, HCVS Modification

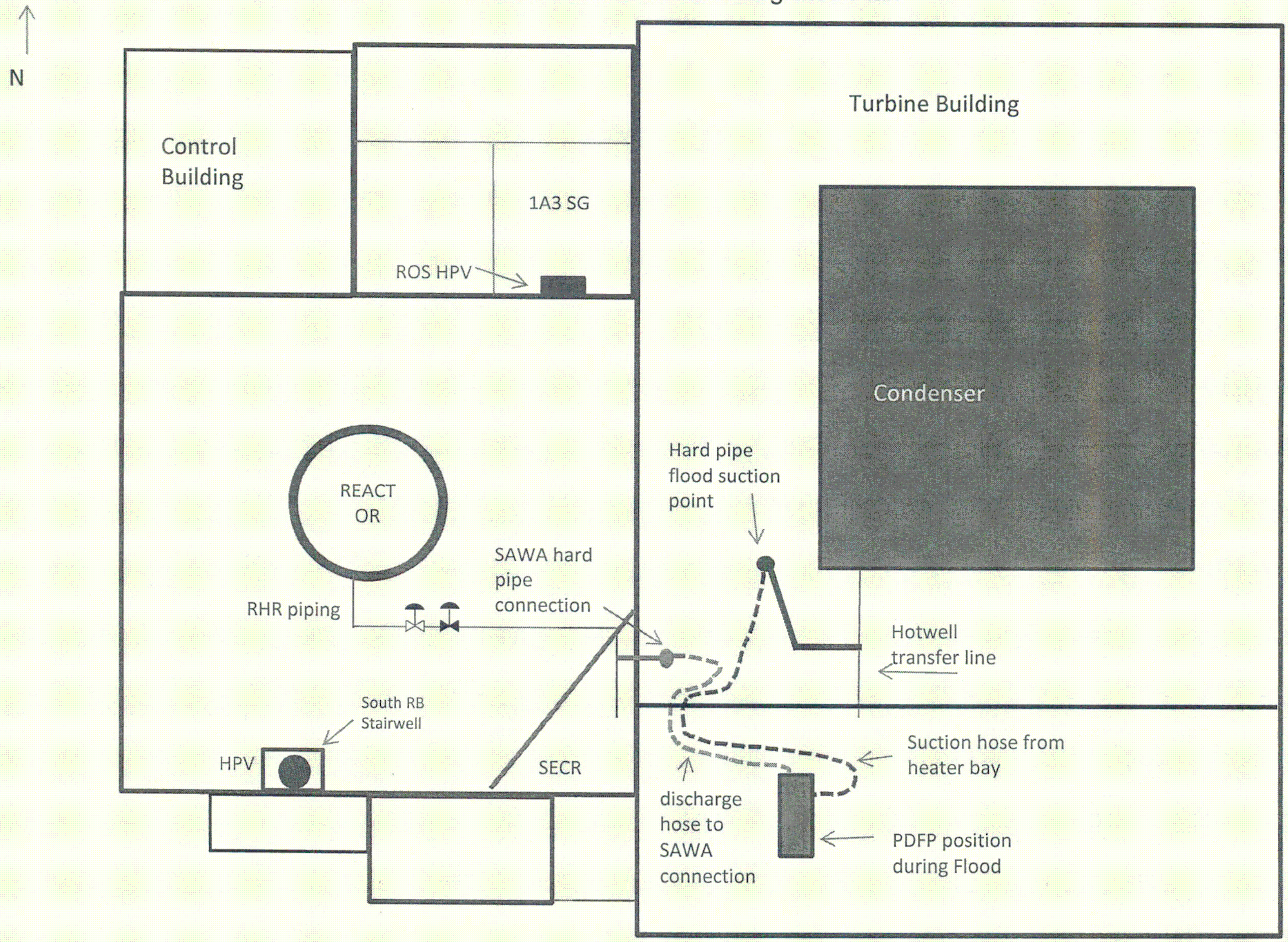
Sketch 2b: Layout of Planned HCVS- HCVS Control Valve Supply Pressure and Purge Gas System



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



Sketch 3b: Site Layout Sketch of SAWA Equipment- Non Flood Condition



Sketch 3c: Site Layout Sketch of SAWA Equipment- Flood Condition

Attachment 4: Failure Evaluation Table

Table 4A: Wet Well HCVS 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	Control Valves fail to open due to complete loss of dedicated power supply (UPS) (long term)	Recharge UPS batteries with FLEX provided generators via 1B32, considering severe accident conditions. In addition, the PCIVs can be manually opened from the ROS with backup pneumatics, no electrical source is needed.	No
Failure of solenoid valves (SVs) to actuate (do not change state)	Mechanical or electrical failure causing loss of pneumatic supply to HCVS CVs and/ or loss of purge capability	SVs have manual bypass valves located at the ROS that allow pneumatic supply to be restored. In this case the CVs are opened and closed by manual action. Purge flow is established with manual action.	No
Failure of Vent to Open on Demand	Control Valves fail to open due to loss of normal pneumatic nitrogen supply	The bank of eleven nitrogen bottles is sized to fully cycle the HCVS valves eight times during for the first 24 hours. If the normal pneumatic supply is lost, nitrogen bottles can be connected at the ROS to provide the pneumatic supply for PCIV operation and system purging.	No
Failure of Vent to Open on Demand	Control Valves fail to open due to loss of alternate pneumatic nitrogen supply (long term)	Additional nitrogen bottles can be connected at the ROS to provide long term pneumatic supply.	No
Failure of Vent to Open on Demand	CVs fail to open due to a local mechanical or electrical failure (i.e. binding).	Alternate vent path that is not hardened.	Yes. Vent location would likely not be elevated.

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 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power *Generating Stations*,
28. DAEC EA-12-049 (FLEX) Overall Integrated Implementation Plan, Rev 0, February 2013
29. DAEC EA-12-050 (HCVS) Overall Integrated Implementation Plan, Rev 0, February 2013
30. DAEC EA-12-051 (SFPLI) Overall Integrated Implementation Plan, Rev 0, February 2013
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

38. NRC Endorsement of *"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 (ADAMS Accession No. ML15273A141), dated October 8, 2015

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 the 6 Month Status Reports.

Attachment 7: List of Overall Integrated Plan Open Items

OIP Open Item	Action	Comment
1	Confirm secondary containment bypass leakage is acceptable without an installed rupture disk or retain an appropriate disk.	Completed. Appropriate rupture disk is included in design of modification.
2	Perform severe accident evaluation for FLEX DG and replacement gas to confirm accessibility for use for post 24 hour actions.	Started
3	Evaluate tornado/missile effects on HCVS components above the protected area of the Reactor Building.	Started
4	Evaluate the system design for H2/CO measures to be taken.	Started
ISE Open Items	**Action (OIP section reference)**	**Comment**
1	Make available for NRC staff audit documentation of licensee confirmation that secondary containment leakage is acceptable without an installed rupture disk or that an appropriate rupture disk, including procedures for rupture during HCVS operation, is included in the HCVS design. (Section 3.1.2, Section 3.2.2.8)	Started
2	Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one (1) percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit. (Section 3.2.2.1, Section 3.2.2.2)	Started
3	Make available for NRC staff audit evaluations of tornado missile effects on HCVS components above the protected area of the reactor building. (Section 3.2.2.3)	Started
4	Make available for NRC staff audit additional detail on the design features that minimize unintended cross flow of vented fluids within a unit, including a one line diagram containing sufficient detail to confirm the description in the OIP. (Section 3.2.2.7)	Started
5	Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration. (Section 3.2.2.6)	Started

6	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)	Started
7	Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions. (Section 3.2.2.5)	Not Started
8	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 and Section 3.2.6)	Started
9	Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation. (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 and Section 3.2.5.2)	Started
10	Make available for NRC staff audit the final sizing evaluation for pneumatic N2 supply. (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 and Section 3.2.5.2)	Started
11	Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting. (Section 3.2.2.9)	Eliminated As stated in NG-15-0169, Six Month Status Update, due to design changes in vent location and routing, existing containment isolation valves will no longer be used for venting. New vent design will utilize a spare torus penetration with two new primary containment isolation valves and a rupture disk. An evaluation will be done to ensure the two new containment isolation valves will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.
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)	Started
13	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,	Started

	transmitters, indicators, electronics, 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)	
14	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)	Eliminated As stated in NG-15-0169, Six Month Status Update, the qualification method used for each HCVS instrument will be to the IEEE 344-2004 standard or a substantially similar industrial standard and therefore will not be deviating from NEI 13-02 or JLD-ISG-2013-02.