Exelon Generation®

Order No. EA-13-109

RS-15-303

December 15, 2015

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

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

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

References:

1. NRC Order Number EA-13-109, "Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," dated June 6, 2013
2. NRC Interim Staff Guidance JLD-ISG-2015-01, "Compliance with Phase 2 Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions", Revision 0, dated April 2015
3. 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
4. Exelon Generation Company, LLC's Answer to June 6, 2013, Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 26, 2013
5. Exelon Generation Company, LLC Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2014 (RS-14-062)
6. Exelon Generation Company, LLC First Six-Month Status Report Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 19, 2014 (RS-14-305)
7. Exelon Generation Company, LLC Second Six-Month Status Report Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 30, 2015 (RS-15-151)

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8. NRC letter to Exelon Generation Company, LLC, Peach Bottom Atomic Power Station, Units 2 and 3 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4416 and MF4417), dated February 12, 2015

On June 6, 2013, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directs EGC to require their BWRs with Mark I and Mark II containments to take certain actions to ensure that these facilities have a hardened containment vent system (HCVS) to remove decay heat from the containment, and maintain control of containment pressure within acceptable limits following events that result in loss of active containment heat removal capability while maintaining the capability to operate under severe accident (SA) conditions resulting from an Extended Loss of AC Power (ELAP). Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 requires submission of an Overall Integrated Plan (OIP) by June 30, 2014 for Phase 1 of the Order, and an OIP by December 31, 2015 for Phase 2 of the Order. The interim staff guidance (Reference 2) provides direction regarding the content of the OIP for Phase 1 and Phase 2. Reference 2 endorses industry guidance document NEI 13-02, Revision 1 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided the EGC initial response regarding reliable hardened containment vents capable of operation under severe accident conditions. Reference 5 provided the Peach Bottom Atomic Power Station, Units 2 and 3, Phase 1 OIP. References 6 and 7 provided the first and second six-month status reports pursuant to Section IV, Condition D.3 of Reference 1 for Peach Bottom Station.

The purpose of this letter is to provide both the third six-month update for Phase 1 of the Order pursuant to Section IV, Condition D.3, of Reference 1, and the OIP for Phase 2 of the Order pursuant to Section IV, Condition D.2 of Reference 1, for Peach Bottom Atomic Power Station, Units 2 and 3. The third six-month update for Phase 1 of the Order is incorporated into the HCVS Phase 1 and Phase 2 overall integrated plan document which provides a complete updated Phase I OIP, a list of the Phase 1 OIP open items, and addresses the NRC Interim Staff Evaluation open items for Phase 1 contained 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.

Reference 3, Section 7.0 contains the specific reporting requirements for the Phase 1 and Phase 2 OIP. The information in the Enclosure provides the Peach Bottom Atomic Power Station, Units 2 and 3 HCVS Phase 1 and Phase 2 OIP pursuant to Reference 2. The enclosed Phase 1 and Phase 2 OIP is based on conceptual design information. Final design details and associated procedure guidance, as well as any revisions to the information contained in the Enclosure, will be provided in the six-month Phase 1 and Phase 2 OIP updates required by Section IV, Condition D.3, of Reference 1.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David P. Helker at 610-765-5525.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 15th day of December 2015.

Respectfully submitted,

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

Enclosure:

Peach Bottom Atomic Power Station, Units 2 and 3, Overall Integrated Plan for Phase 1 and Phase 2 Requirements for Reliable Hardened Containment Vent System (HCVS) Capable of Operation Under Severe Accident Conditions

cc: Director, Office of Nuclear Reactor Regulation
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Enclosure 1

Peach Bottom Atomic Power Station, Units 2 and 3

Overall Integrated Plan for Phase 1 and Phase 2 Requirements for Reliable Hardened Containment Vent System (HCVS) Capable of Operation Under Severe Accident Conditions

(63 pages)

Table of Contents:

Introduction

In 1989, the NRC issued Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," (Reference 2) to all licensees of Boiling Water Reactors (BWRs) with Mark I containments to encourage licensees to voluntarily install a hardened wetwell (WW) vent. In response, licensees installed a hardened vent pipe from the suppression pool (SP) 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 (Reference 26) 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 (SA) conditions." In response, the NRC issued Order EA-13-109, *Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accidents*, June 6, 2013 (Reference 4). 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 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 WW to provide reliable, SA capable hardened vents to assist in preventing core damage and, if necessary, to provide venting capability during SA 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 SA conditions through installation of a reliable, SA 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 SA 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 (Reference 6) and JLD-ISG-2015-01 issued in April 2015 (Reference 31). These ISGs endorse the compliance approach presented in NEI 13-02 Revisions 0 and 1, *Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents* (Reference 9), 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 these 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 (OIP) which will provide a description of how the requirements of the Order will be achieved. This document provides the OIP for complying with Order EA-13-109 using the methods described in NEI 13-02 and endorsed by NRC JLD-ISG-2013-02 and JLD-ISG-2015-01. Six month progress reports will be provided consistent with the requirements of Order EA-13-109.

The submittals required are:

- OIP for Phase 1 of EA-13-109 was required to be submitted by Licensees to the NRC by June 30, 2014. The NRC requires periodic (6 month) updates for the HCVS actions being taken. The first update for Phase 1 was due December 2014, with the second due June 2015.
- OIP for Phase 2 of EA-13-109 is required to be submitted by Licensees to the NRC by December 31, 2015. It is expected the December 2015 six month update for Phase 1 will be combined with the Phase 2 OIP submittal by means of a combined Phase 1 and 2 OIP.
- Thereafter, the 6 month updates will be for both the Phase 1 and Phase 2 actions until complete, consistent with the requirements of Order EA-13-109.

Note: Per the Generic OIP, 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 Phases 1 and 2 until each phase is in compliance. Exelon has not selected this option.

The Peach Bottom Atomic Power Station (PBAPS) venting actions for the EA-13-109, Phase 1 SA capable venting scenario can be summarized by the following:

- The Hardened Containment Vent System (HCVS) will be initiated via manual action from either the Main Control Room (MCR) or from a Remote Operating Station (ROS) at the appropriate time based on procedural guidance in response to plant conditions from observed or derived symptoms. The ROS capabilities are limited to the Order EA-13-109 Requirement 1.2.5. Specifically, in case the HCVS flow path valves or the Argon purge flow valves cannot be opened from the MCR, the ROS provides a back-up means of opening the valve(s) that does not require electrical power or control circuitry.
- The vent will utilize containment pressure and SP level parameters from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation will be monitored by effluent temperature and radiation levels, and HCVS valve position.
- The HCVS motive force (electric and pneumatic supply) will be monitored and have the capacity to operate for 24 hours with installed equipment. Replenishment of the motive force will be by use of portable equipment prior to the installed motive force being exhausted.
- Venting actions will be capable of being maintained for a sustained period of up to 7 days.

The PBAPS Phase 2 actions can be summarized as follows:

- Utilization of Severe Accident Water Addition (SAWA) to inject water into the Reactor Pressure Vessel (RPV). Although SAWA to the Drywell (DW) is an option, Exelon has selected SAWA injection to the RPV.
- Utilization of Severe Accident Water Management (SAWM) to control injection and SP level to ensure the HCVS (Phase 1) WW 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 a DW vent will be required for containment pressure control.
- The SAWA and SAWM actions will be manually activated and controlled from areas that are accessible during SA conditions.
- Parameters measured will be containment pressure, SP level, SAWA flow, and the HCVS parameters listed above.

Note: Although EA-13-109 Phase 2 allows selecting SAWA and a Severe Accident Capable Drywell Vent (SADV) strategy, Exelon has selected SAWA and SAWM.

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 PBAPS to the guidelines in JLD-ISG-2013-02, JLD-2015-01, and NEI 13-02 for each phase as follows:

- The HCVS will be comprised of installed and portable equipment and operating guidance:
  - SAWV – Permanently installed vent from the SP to greater than three feet above the Reactor Building (RB).
  - SAWA – A combination of permanently installed and portable equipment to provide a means to add water to the RPV following a SA and monitor system and plant conditions.
  - SAWM strategies and guidance for controlling the water addition to the RPV for the sustained operating period. (reference attachment 2.1.D).
- Unit 2 Phase 1 (WW): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for 4Q2016.
- Unit 3 Phase 1 (WW): by the startup from the second refueling outage that begins after June 30, 2014, or June 30, 2018, whichever comes first. Currently scheduled for 4Q2017.
- Unit 3 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 4Q2017.
- Unit 2 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 4Q2018.

The current design of the circuits for the upstream Primary Containment Isolation Valve (PCIV) used in the torus vent pathway requires the installation of jumpers to by-pass the containment high drywell pressure isolation logic. The jumpers also bypass the reactor water low-level, RB and Refuel Floor vent exhaust hi-rad, and Main Stack hi-rad isolations. The design of the HCVS includes a control switch in the MCR for transferring power to the solenoid valve (SV) that does not include a PCIS isolation signal, eliminating the need for jumpers.

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 PBAPS:

- Seismic, external flooding, high winds, extreme cold, and extreme high temperature

The following extreme external hazards screen out for PBAPS:

- None

Part 1: General Integrated Plan Elements and Assumptions

Key Site assumptions to implement NEI 13-02 strategies.
Provide key assumptions associated with implementation of HCVS Phase 1 Strategies.

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

Mark I/II Generic HCVS Related Assumptions:

Applicable EA-12-049 (Reference 3) assumptions:

049-1. Assumed initial plant conditions are as identified in NEI 12-06, §3.2.1.2, items 1 and 2 (Reference 8).

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

049-3. Assumed reactor transient boundary conditions are as identified in NEI 12-06, §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 the failure of Reactor Core Isolation Cooling (RCIC) or High Pressure Coolant Injection (HPCI) (Reference NEI 12-06, §3.2.1.3, item 9 [8]).

049-5. At time = 0 the event is initiated and all rods insert and no other event beyond a common site Extended Loss of AC Power (ELAP) is occurring at any or all of the units.

049-6. At time = 1 hour (time sensitive at a time greater than 1 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, (greater than approximately 5 hours with a calculation limiting value of approximately 7.2 hrs.) (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 EA-12-049 (FLEX) that are not specific to implementation of the HCVS, including such items as debris removal, communication, notifications, Spent Fuel Pool (SFP) level and makeup, security response, opening doors for cooling, and initiating conditions for the events, 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 (Reference 4) generic assumptions:

109-1. Site response activities associated with EA-13-109 actions are considered to have no access limitations associated with radiological conditions while RPV level is above 2/3 core height (core damage is not expected). This is further addressed in HCVS-FAQ-12.

109-2. 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 Diesel Generator (DG) that is credited to repower HCVS solenoid valves after 24 hours. The FLEX DG must be demonstrated to meet the "SA Capable" criteria that are defined in NEI 13-02 Section 4.2.4.2 and Appendix D Section D.1.3 (Reference 9). 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).

Part 1: General Integrated Plan Elements and Assumptions

109-3. 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 [18]).

109-4. Existing containment components design and testing values are governed by existing plant containment criteria (e.g., Appendix J) and are not subject to the testing criteria from NEI 13-02 (Reference HCVS-FAQ-05 [16] and NEI 13-02, §6.2.2 [9]).

109-5. Classical design basis evaluations and assumptions are not required when assessing the operation of the HCVS. The reason that this is not required is that the order postulates an unsuccessful mitigation of an event such that an ELAP progresses to a SA with ex-vessel core debris that classical design basis evaluations are intended to prevent (Reference NEI 13-02, §2.3.1 [9]).

109-6. HCVS manual actions require minimal operator steps and can be performed in the postulated thermal radiological environment at the location of the step(s) (e.g., load stripping, control switch manipulation, valving-in pneumatic supply bottles) are acceptable to obtain HCVS venting dedicated functionality (Reference HCVS-FAQ-01[12]). 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.

109-7. 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 [13] and White Paper HCVS-WP-01 [21]). 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.

109-8. 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 Beyond Design Basis External Event (BDBEE) and SA HCVS operation (Reference FLEX MAAP Endorsement ML13190A201 [29]). Additional analysis using RELAP5/MOD 3, GOTHIC, and MICROSHIELD, etc., are acceptable methods for evaluating environmental conditions in other portions of the plant, provided that 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 SA conditions.

109-9. NRC Published Accident evaluations (e.g., SOARCA, SECY-12-0157, NUREG 1465) as related to Order EA-13-109 conditions are acceptable as references (Reference NEI 13-02, §8 [9]).

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

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

109-12. Under the postulated scenarios of Order EA-13-109, the MCR is adequately protected from excessive radiation dose as 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

Part 1: General Integrated Plan Elements and Assumptions

issues (Reference HCVS-FAQ-01 [12] 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 §I.1.3)

109-15. The SA 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-01) This is further addressed in HCVS-FAQ-10.

Plant Specific HCVS Related Assumptions/Characteristics:

PBAPS-1 EA-12-049 (FLEX) actions to restore power are sufficient to ensure continuous operation of non-dedicated containment instrumentation identified on Page 22 of the OIP.

PBAPS-2 PBAPS Probable Maximum Flood warning time provides sufficient time to perform plant shutdown and cooldown and there is significantly more time and staffing to deploy FLEX/SAWA equipment. Flood levels impede access to the east side (river side) of the plant and a portion of the north and south sides. Flooding does not reach the RB and does not affect HCVS venting capabilities.

PBAPS-3 Modifications that allow a FLEX DG to recharge the HCVS battery are assumed to have been installed such that a FLEX DG can be credited for HCVS operation beyond the initial 24-hour sustained operational period.

PBAPS-4 The rupture disk will be manually breached, using the Argon purge system, if required for anticipatory venting during an ELAP.

PBAPS-5 The PBAPS layout of buildings and structures is depicted in Attachment 3, Sketch 4B. Note the MCR is located in the control structure within the Radwaste Building. This location has substantial structural walls and features independent of the RB. The HCVS vent routing external to the RB is vertical with the exception of the point at which it exits the RB.

PBAPS -6 The HCVS external piping exits the RB at ground level, at the RB west wall facing the cliff and is routed to above the RB roof level. PBAPS has performed a TORMIS evaluation and determined the probability of tornado generated missiles. This piping consists of large bore (16-inches nominal diameter) piping and its piping supports, and the pipe has less than 300 square feet of cross section. Note that the original radiation monitoring system detector and associated cabling, that was mounted externally, will be located with the revised design to inside the RB.

Part 2: Boundary Conditions for Wetwell Vent

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

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

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

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

See attached sequence of events timeline (Attachment 2A).

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

The existing WW HCVS at each PBAPS unit has a containment penetration that is shared with the Standby Gas Treatment System (SGTS). The upstream PCIV is common to the HCVS and the SGTS flow paths. Each system has a dedicated downstream PCIV. Downstream of the HCVS PCIV is a rupture disc, which is credited for preventing secondary containment bypass leakage during a Design Basis Loss of Coolant Accident (DB LOCA). Each unit's HCVS flow path is entirely separate from the other unit. The vent pipe from each unit is routed separately and discharges above the unit's RB roof.

The PCIVs have DC powered solenoid valves and redundant, pneumatic supplies from the non-safety related Instrument Air (IA), and nitrogen (N2) from the Safety Grade Instrument Gas (SGIG). In addition, dedicated HCVS N2 bottles will be provided to ensure a permanently installed capacity for the first 24 hours is available to the HCVS PCIVs. Although the power to the DC solenoid valves will be maintained by the FLEX DG implemented for EA-12-049, each unit will add dedicated DC power for HCVS components that only relies on the FLEX DG for recharging. The existing containment instrumentation (containment pressure and SP level) are not considered HCVS components and power will be maintained through the actions for EA-12-049.

The operation of the HCVS will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1. Immediate operator actions will be completed by plant personnel and will include the capability for remote-manual initiation from the HCVS ROS. 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 ELAP Failure Evaluation table, which shows alternate actions that can be performed, is included in Attachment 4.

Part 2: Boundary Conditions for Wetwell Vent

Table 2-1 HCVS Remote Manual Actions

Primary Action	Location	Notes
1. If required, enable the dedicated DC power and pneumatic supply for the HCVS valves.	MCR or ROS	One solenoid on these valves is DC powered from safety-related DC battery. Compliance with EA-13-109 will provide dedicated DC power for first 24 hours of ELAP without recharging. Back-up pneumatic supply is from SGIG. Compliance with EA-13-109 will provide dedicated N2 pneumatic supply for first 24 hours of ELAP without replenishment.
2. Breach the rupture disc by opening the Argon Purge line for the specified amount of time.	MCR or ROS	Prior to breaching rupture disc, reposition Argon purge line 3-way valve at the ROS. Breaching the rupture disc is required for anticipatory venting.
3. Over-ride the containment isolation signal and open the WW PCIVs.	MCR	A new control switch in the MCR for transferring power to HCVS does not include a PCIS isolation signal that closes the PCIVs.
4. Connect FLEX DG.	ROS	Prior to the depletion of the HCVS battery supply (24 hours), FLEX DG will be connected to plant systems.
5. Replenish HCVS N2 supply bottles (24 hours).	ROS	Prior to depletion of the pneumatic sources (24 hours), actions will be required to replace N2 supply bottles.
6. Replenish Argon Purge gas supply bottles (24 hours).	ROS	Prior to depletion of the Argon sources (24 hours), actions will be required to replace Argon supply bottles. This is only required if SA conditions are reached.

Attachment 2A, Sequence of Events Timeline, was developed to identify required operator response times and potential environmental constraints. This timeline is based upon the following three sequences:

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

Part 2: Boundary Conditions for Wetwell Vent

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

- Initiate use of HCVS per site procedures to maintain containment parameters below design limits and within the limits that allow continued use of RCIC. Reliable operation of HCVS will be met because HCVS meets the seismic requirements identified in NEI 13-02, will be powered by DC power from Station IE battery backed up by a dedicated power source, and HCVS valves are supplied with pneumatic supply from IA/SGIG backed up by a dedicated N2 supply. HCVS instrumentation and controls will be DC powered. Valves will be operable from the HCVS control panel in the MCR, or from the ROS. DC power and pneumatic supply will be available for 24 hours from permanently installed sources. Containment pressure and SP level indication will be powered from existing IE Station battery and maintained by FLEX DG. The initiation of the HCVS from the MCR or the ROS within 7.6 hours is acceptable because the actions can be performed any time after declaration of an ELAP until 7.6 hours, when the venting is needed to ensure RCIC operation. This action can also be performed for SA HCVS operation which occurs at a time further removed from an ELAP declaration as shown in Attachment 2A.

- The SGIG can provide safety-grade pneumatic supply in an ELAP. Dedicated N2 bottles will be added to ensure compliance with the 24-hour duration required by EA-13-109.

- Current PBAPS IE battery durations are calculated to last 7.2 hours. FLEX DG will be staged and providing power to Safety Related IE equipment within 5 hours. Thus, the FLEX DGs will be available to be placed in service at any point after 5 hours as required to supply power to containment instrumentation (containment pressure and SP level) and to the solenoid valves for the HCVS PCIVs.

- There are no site specific actions that are time critical for initiation of the HCVS. The HCVS initiation itself is time critical to maintain RCIC operation. Only one action is time critical for FLEX response implementation: declaration of ELAP (at 60 minutes).

- Within 24 hours, the permanently installed N2 bottles at the ROS will be replaced, if required, to maintain sustained operation. This can be performed at any time prior to 24 hours to ensure adequate capacity is maintained; therefore, this time constraint is not limiting.

- Within 24 hours, the FLEX DG will be used to recharge the HCVS dedicated battery at the ROS. This can be performed at any time prior to 24 hours to ensure adequate capacity is maintained. Therefore, this time constraint is not limiting.

- Within 24 hours, the permanently installed Argon bottles at the ROS will be replaced, if required, to maintain sustained operation. This can be performed at any time prior to 24 hours to ensure adequate capacity is maintained. Therefore, this time constraint is not limiting.

Discussion of radiological, temperature, other environmental constraints identified in Attachment 2A

- Actions to initiate HCVS operation are taken from the MCR or from the ROS in the Radwaste Building, elevation 150'. Both locations have significant shielding and/or distance from radiological sources. Non-radiological habitability for the MCR has been addressed as part of the PBAPS FLEX response.

- Before the end of the initial 24-hour period, replenishment of the HCVS dedicated DC power, Argon purge gas, and PCIV pneumatic supply will occur at the ROS. The design will allow replenishment with minimal actions. The ROS location will be evaluated for SA temperature and radiation conditions to

Part 2: Boundary Conditions for Wetwell Vent

ensure access to the ROS is maintained.

ISE Open Item - 09: Confirm that the ROS will be in an area accessible following a SA.

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, 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)
Provide 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.

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, and 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?

Part 2: Boundary Conditions for Wetwell Vent

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)
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, Section 4.1.3, 4.2.2, 4.2.4, and Appendix F/G)
Provide 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 JLD-ISG-2012-01 and JLD-ISG-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.

Part 2: Boundary Conditions for Wetwell Vent

Vent Size and Basis

The nominal diameter of the WW penetration piping is 18-inches until the branch line for the HCVS, which is 16-inches nominal diameter.

The HCVS WW vent path was designed for venting steam/energy at a nominal capacity of 1% of 3293 MWt thermal power at a pressure of 60 psig. The original PBAPS WW vents were sized with significant margin for this power rating. PBAPS Calculation PM-0546 demonstrates adequacy for current station power rating of 3951 MWt at a PCPL rating of 60 psig, with flow margin of 26%. PM-0546 tabulates flow for a variety of pressures between 10 psig and 60 psig, which encompasses the design pressure rating of 56 psig. PM-0546 concludes that at torus pressures of 20 psig or greater, the vent flow exceeds flow required to assure depressurization.

Vent Capacity

The PBAPS WW pressure suppression capacity is sufficient to absorb the decay heat generated beyond the first 8 to 10 hours, by which time decay heat is well below 1% thermal power. The vent is not needed in this initial period to prevent containment pressure from increasing above the containment design pressure. PBAPS has used the Modular Accident Analysis Program (MAAP) to support its FLEX/HCVS strategy.

PB-MISC-010 Case 16, which includes anticipatory venting is applicable to the PBAPS FLEX strategy: RPV rapid cooldown to 500 psig followed by 100° F/hr cooldown with SRVs to 250 psig, RPV maintained 200 - 300 psig after cooldown; WW vent opened at t = 1 hour. However, PB-MISC-010 Case 7 is bounding for containment pressure. Under Case 7: RPV 80° F/hr cooldown with SRVs to 125 psig starting at t = 20 minutes; WW vent opened when torus pressure exceeds 60 psig. Case 7 shows there is sufficient capacity such that the WW vent can remain closed for greater than 10 hours and containment pressure still would not exceed containment design pressure.

PBAPS Calculation PM-0428, Primary Containment Conditions during Station Blackout, makes assumptions that are slightly different from the MAAP runs, but its conclusion is similar: containment pressure is approximately 44 psig after 8 hours, lower than containment design pressure of 56 psig. The calculation result is very comparable to the MAAP pressure value graph at T = 8 hours.

PBAPS Vendor Document G-080-VC-314, PBAPS Units 2 and 3 - GE SIL 636 Evaluation Project - Containment Response During SBO Event, results in a peak containment airspace pressure of 46 psig during an 8 hour coping period, which is comparable to both the PM-0546 and the MAAP runs.

The three independent analytical methods yield similar results, and affirm that suppression pool capacity is sufficient to absorb decay heat generated during the first three hours.

Vent Path and Discharge

The current PBAPS HCVS vent path consists of a WW vent on each unit. The flow path starting at the second PCIV is dedicated to the HCVS and there is no sharing of any component with the other unit. The only interconnected system is the SGTS which is isolated by a fail-closed air-operated PCIV on each unit. The WW vent is routed horizontally above the top of the torus, exits the torus room roof (secondary containment) at 135' (ground elevation on west side of RB), and then runs vertically on the outside of the RB to a point above the top of the RB. The vertical run is on the west side of the RB.

The HCVS discharge point is above any building in the PBAPS protected area. The RB roof parapet is 294'. The HCVS discharge point is at 300'. The only higher structure in the protected area is the RB ventilation

Part 2: Boundary Conditions for Wetwell Vent

exhaust discharge point at 305', on the east side of the RB, approximately 150 feet away (east-west). The RB ventilation exhaust fans will not be powered during an ELAP; however, chimney effect would preclude an inward pressure gradient. The HCVS release point is away from Control Room ventilation system intake, which is below 177'. The PBAPS Main Stack is at a higher elevation, but is not in the PBAPS protected area. The HCVS discharge does not adversely impact any ventilation intake or exhaust openings, MCR location, location of HCVS portable equipment, access routes required following an ELAP and BDBEE, or emergency response facilities.

The following is provided for information purposes regarding the layout of the plant. On each unit, the HCVS vent vertically runs up the RB west side, which faces a steeply rising slope of exposed bedrock. The slope width encompasses both RBs in the North-South direction. The slope base begins at approximately elevation 135' and 70 feet west of the RB. At approximately elevation 200' and 100 feet west of the RB, the slope becomes more gradual, to approximately elevation 240' and 200 feet west of the RB; and then even more gradual to elevation 270' and 300 feet west of the RB. Above this elevation, the slope continues an even more gradual ascent. On top of the slope, to the north, is PBAPS's north transmission substation. The top of the slope, including the substation, is an Owner Controlled Area. There is no other industrial facility or residence in this area. In the event of forecast hurricanes, or severe storms with winds in excess of 40 mph, or tornado warnings issued for the immediate area; then the duty station manager takes procedurally directed actions as necessary to minimize missile hazard risk by removing potential missile hazards from the protected area or securing them in place.

The RB is a Seismic Category I structure, which provides its own wind and missile protection for the portion of the WW vent inside the RB. PBAPS has reviewed the portion of the WW vent outside of the RB per the guidance of NEI 12-06 as endorsed by JLD-ISG-12-001 for Order EA-12-049, and concluded that reasonable protection from tornado wind and tornado missiles is provided. The existing piping, external to the RB is designed for tornado wind speed of 300 mph vs. FLEX OIP peak tornado wind speed of 165 mph. Therefore, tornado wind loading is not a concern.

For tornado missiles, per NEI 12-06, section 7.3, tornados travel from the West or West Southwesterly direction. NEI 12-06 section 7.3 requires either 1) tornado missile protection for a single FLEX Equipment Storage Building; or 2) multiple (diverse) unprotected FLEX Equipment Storage Buildings that are axially separated in the North-South direction. The PBAPS DG Building is a Seismic Category I structure, protected against tornado missiles. The PBAPS DG Building and the WW vents are axially separated in the North-South direction, by a distance of approximately 300 feet for the U2 WW vent and 600 feet for the U3 WW vent. The corridor between the RB and the bedrock slope is approximately 70 feet wide in the due north-south direction.

The reasonable protection guidance of NEI 12-06, afforded by this North-South separation, is applicable to the tornado missile-protected DG Building and the WW vents. Per NEI 12-06 guidance, it is unreasonable that tornado missiles could impact an unprotected FLEX Storage Building and then travel north-south to impact a second FLEX Storage Building. By similarity, it is unreasonable that tornado missiles could impact the protected DG Building to initiate the ELAP, and then travel due north to impact a seismically supported WW vent. Therefore, the existing PBAPS WW vents are partially within a Seismic Category I structure and otherwise are reasonably protected against potential tornado missiles.

Power and Pneumatic Supply Sources

The electrical circuit for the existing HCVS PCIVs is powered from the Station IE battery that will be maintained by the FLEX DG. Electrical power required for operation of HCVS components will be from a dedicated HCVS DC battery source with permanently installed capacity for the first 24 hours and design

Part 2: Boundary Conditions for Wetwell Vent

provisions for recharging to maintain sustained operation. The design will repower this circuit from the FLEX DG.

Pneumatic supply to the HCVS valves will be provided by IA, backed up by SGIG. SGIG is an existing safety-related system located within a Seismic Class I structure. The stored volume will allow for a minimum of 8 vent cycles for the HCVS valves for the first 24 hours. The 8 vent cycles is defined as initially opening all valves in the WW flow path, and then shutting and reopening one of the valves in the flow paths. PBAPS Calculation PM-0375 shows the SGIG tank has sufficient supply to meet HCVS opening and closing cycles.

1. The HCVS flow path valves are air-operated valves (AOV) with air-to-open and spring-to-shut. Opening the valves from the HCVS control panel located in the MCR requires energizing DC powered SVs and IA/SGIG pneumatic supply, or new dedicated N2 supply.
2. An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the ROS based on time constraints listed in Attachment 2A.
3. All permanently installed HCVS equipment, including any connections, required to supplement the HCVS operation (i.e., DC power and pneumatic supply) during a SA, 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 an ELAP, such that the primary means of valve manipulation does not rely on use of a handwheel, reach-rod or similar means that requires close proximity to the valve (FAQ HCVS-03). The preferred method is opening from the MCR through the control switch that energizes the AOVs' SVs. The back-up method is from the ROS by repositioning valves on the pneumatic line; this allows opening and closing of a valve from the ROS without reliance on any electrical power or control circuit. Accessibility to the ROS will be verified during the detailed design.
5. 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.
6. Access to the locations described above will not require temporary ladders or scaffolding.

Location of Control Panels
The HCVS design allows initiating and then operating and monitoring the HCVS from the MCR and in addition, opening valves from the ROS in case of a DC circuit failure. The ROS location is Radwaste Building elevation 150'. The MCR location is protected from adverse natural phenomena and it is the normal control point for Plant Emergency Response actions. The ROS will be evaluated to ensure acceptable temperature and dose consequences.

Hydrogen
As required by EA-13-109, Section 1.2.11, the HCVS design will include an Argon purge system to prevent hydrogen detonation. The Argon purge system will have switches for the control valve in the MCR and will be operable from the ROS, in case of a DC power or control circuit failure. The Argon purge will only be utilized following SA conditions when hydrogen is being vented. The installed capacity for the Argon purge system will be sized for at least 8 purges within the first 24 hours of the ELAP. This number of vent cycles is the same value used for sizing the PCIV pneumatic supply. The design will allow for Argon bottle replacement for continued operation past 24 hours.

The Argon purge system can also be used to breach the rupture disc if venting is required before reaching the

Part 2: Boundary Conditions for Wetwell Vent

rupture disc set-point.

Unintended Cross Flow of Vented Fluids

The existing WW HCVS at each PBAPS unit has a containment penetration that is shared with the Standby Gas Treatment System (SGTS). The upstream PCIV is common to the HCVS and the SGTS flow paths. Each system has a dedicated downstream PCIV. PBAPS has a common SGTS. The HCVS flow path does not have any other connected systems and does not share any flow path with the opposite unit. The discharge from each unit is routed above each unit's RB roof. The HCVS discharge points, from unit to unit, are separated by approximately 300 feet in the North-South direction.

Prevention of Inadvertent Actuation

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

There is no Containment Accident Pressure (CAP) credit for operation of the ECCS, or the HPCI, or the RCIC pumps. However, PB procedure T-102 sheet 3 provides RCIC pump NPSH limits at elevated torus temperature and pressure.

Component Qualifications

HCVS components up to the secondary containment pressure boundary are 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 10CFR100. HCVS components outside of the RB secondary containment pressure boundary (i.e., outside the RB) are not required to be safety-related but are seismically rugged.

Except for the two existing PCIVs, the other HCVS components will be powered from a dedicated power supply that will not be safety-related but will be Augmented Quality. However, any HCVS electrical or controls component that interfaces with Class 1E power sources will be considered safety-related up to and including appropriate isolation devices, as their failure could adversely impact a safety-related power source. Electrical and controls components will have the ability to handle harsh environmental conditions, although they will not be considered part of the site Environmental Qualification (EQ) program. Unless otherwise required to be safety-related, Augmented Quality requirements will be applied to the components installed in response to this Order.

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 progression from no core damage to core damage. 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 include:

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.

Part 2: Boundary Conditions for Wetwell Vent

Instrument	Qualification Method*
HCVS Process Temperature	ISO9001 / IEEE 344-2004 / Demonstration
HCVS Process 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.

Monitoring of HCVS

The PBAPS WW HCVS will be capable of being remote-manually operated during sustained operations from a control panel located in the MCR and will meet the requirements of Order element 1.2.4. The MCR is a readily accessible location with no further evaluation required (Generic Assumption 109-12). Additionally, to meet the requirement of EA-13-109 Section 1.2.5, an accessible ROS will also be incorporated into the HCVS design as described in NEI 13-02 section 4.2.2.1.2.1. The controls and indications at the ROS location will be accessible and functional under a range of plant conditions, including SA with due consideration to source term and dose impact on operator exposure, ELAP, and inadequate containment cooling.

The WW HCVS will include means to monitor the status of the vent system in the MCR and to monitor DC power, and N2 pressure at the ROS. The existing design for the HCVS includes control switches in the MCR with valve position indication. The new HCVS controls will meet the environmental and seismic requirements of the Order for the plant SA with an ELAP. The ability to open/close these valves multiple times during the event's first 24 hours will be provided by the IA/SGIG (backed-up by the dedicated N2 supply system) and DC power. Beyond the first 24 hours, the ability to maintain these valves open or closed will be maintained by sustaining the DC power and pneumatic supply.

The WW HCVS will include indications for vent pipe temperature, valve position indication and effluent radiation levels at the MCR. Other important information on the status of supporting systems (i.e., DC power source status, and pneumatic supply pressure), will also be included in the design and located to support HCVS operation.

The design will rely on existing containment pressure and SP level indication in the MCR to monitor containment parameters. This monitoring instrumentation provides the indication from the MCR as per Requirement 1.2.4. This instrumentation is not required to validate HCVS function and is therefore not powered from the dedicated HCVS batteries. However, these instruments are expected to be available since the FLEX DG supplies the station battery charger for these instruments and will be installed prior to depletion of the station batteries.

Component reliable and rugged performance

The HCVS components and components that interface with the HCVS are routed in seismically qualified

Part 2: Boundary Conditions for Wetwell Vent

structures. Newly installed piping and valves will be seismically qualified to handle the forces associated with the PBAPS Safe Shutdown Earthquake (SSE) back to their isolation boundaries. New electrical and controls components will be seismically qualified.

The HCVS downstream of the second containment isolation valve, electrical power supply, valve actuator pneumatic supply, and instrumentation (local and remote) components, are designed/analyzed to conform to the requirements consistent with the applicable design codes (e.g., Non-safety, Seismic Category 1, B31.1) for the plant and to ensure functionality following a design basis earthquake. Piping and supports are safety-related up to Reactor Building penetration (i.e., secondary containment function), and non-safety related but augmented outside of Reactor Building.

Additional modifications required to meet the Order will provide reliability at the postulated vent pipe conditions (temperature and radiation levels). The instrumentation/power supplies/cables/connections (components) will be qualified for temperature, pressure, radiation level, total integrated radiation dose appropriate for that location (e.g., near the effluent vent pipe or at the HCVS ROS location).

If the instruments are purchased as commercial-grade equipment, they will be qualified to operate in the SA environment as required by NRC Order EA-13-109 and the guidance of NEI 13-02. The equipment will be qualified seismically, environmentally (IEEE 323-1974), and for electro-magnetic compatibility.

For the dedicated HCVS instruments required after a potential seismic event, the design and installation will be 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 SA 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 28) or a substantially similar industrial standard;
- demonstration that proposed devices are substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges); or
- seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location.

Part 2: Boundary Conditions for WW Vent – ELAP Venting

Determine venting capability 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 reliance on operator actions for response to an ELAP and BDBEE hazards identified in Part 1 of this OIP. Immediate operator actions will be completed by Operators from the HCVS control stations, and include remote-manual initiation. The operator actions required to open a vent path are as described in Table 2-1.

Remote-manual is defined in this report as a non-automatic power operation of a component and does not require the operator to be at or in close proximity to the component. No other operator actions 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 MCR. 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 electrical power, N2, and Argon will be available to support operation and monitoring of the HCVS for 24 hours.

System control:

i. Active: The PCIVs will be operated in accordance with EOPs/SOPs to control containment pressure. The HCVS will be designed for at least 8 vent cycles under ELAP conditions over the first 24 hours following an ELAP. Controlled venting will be permitted in the revised EPGs and associated implementing EOPs.

ii. Passive: Inadvertent actuation protection is provided by:

A key locked switch for the dedicated downstream PCIV located in the MCR locked controls at the ROS, and controlled by procedures
AND
Disabling the HCVS DC power, the dedicated N2 and Argon supplies, except when required by procedures to initiate containment venting
AND
A rupture disc downstream of the PCIVs with a design pressure of 30 psid.

Part 2: Boundary Conditions for Wetwell Vent

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 / NEI 13-02, Section 4.2.2

Before the end of the 24 hours initial phase, available personnel will be able to sustain HCVS operation. Connections for supplementing electrical and pneumatic supply 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.

During an ELAP, FLEX is credited to sustain power to containment instruments used to monitor the containment (e.g., containment pressure and SP level). It will provide the preferred power to the PCIV circuit. The response to NRC EA-12-049 will demonstrate the capability for FLEX efforts to maintain the power source. The dedicated HCVS power source will be available as a back-up. The FLEX DG maintains power to the Station Battery and the HCVS power source. 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(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.

Primary Containment Control Flowchart will be provided to direct operations in protection and control of containment integrity, including use of the existing HCVS.

These flowcharts are being revised as part of the EPG/SAGs Revision 3 updates and associated EOP/SAP implementation. HCVS-specific procedure guidance will be developed and implemented to support HCVS implementation.

Identify modifications:

List modifications and describe how they support the HCVS Actions.

<u>EA-12-049 Modifications</u>

- EA-12-049 modifications are addressed in the OIP for that order. No additional FLEX modifications have been identified to support HCVS.

<u>EA-13-109 Modifications</u>

- PBAPS Unit 2 Engineering Change 15-00148 (AR A1893549) is scheduled for installation in P2R21 (4th Quarter 2016).
- PBAPS Unit 3 Engineering Change # TBD (AR A1893548) is scheduled for installation in P3R21 (4th Quarter 2017).
- Modifications on both units will include similar, if not identical, scopes:
    - Existing WW vent and components will be evaluated to function under SA Conditions, and modified if required.
    - A 24-hour dedicated HCVS power supply with indication, backed by Division 1 power, which

Part 2: Boundary Conditions for Wetwell Vent

is backed by the FLEX DG, will be installed.

- A 24-hour dedicated N2 supply with indication, replenished by replacing N2 bottles, will be installed.
- A 24-hour dedicated Argon supply with indication, replenished by replacing Argon bottles (only required under SA conditions) will be installed. The Argon supply prevents hydrogen detonation during a SA, and has capability to breach the rupture disc to allow anticipatory venting.
- A ROS with devices to prevent inadvertent actuation will be installed.
- HCVS flow path instrumentation consisting of radiation monitoring and temperature in the MCR will be installed.

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 Effluent temperature (new)	TBD	MCR – TBD
HCVS Effluent radiation (existing, to be replaced)	RIS-80291 (Unit 2) RIS-90291 (Unit 3)	MCR - Panel 20C010 MCR - Panel 30C010
HCVS valve position indication (existing)	Unit 2: POS-80290-1(2) to 16A-DS258 and 16A-DS259 Unit 3: POS-90290-1(2) to 16A-DS258 and 16A-DS259	MCR – Panel 20C003 MCR – Panel 30C003
HCVS DC Power (new)	TBD	TBD
HCVS N2 Supply Pressure (new)	TBD	TBD

Initiation and cycling of the HCVS will rely on several existing MCR key parameters and indicators which are qualified to the existing plant design: (Reference NEI 13-02 Section 4.2.2.1.9 [9]):

Key Parameter	Component Identifier	Indication Location
Containment Pressure (existing)	Unit 2: PR/TR-4805 Unit 3: PR/TR-5805	MCR – Panel 20C003 MCR – Panel 30C003
SP Level (existing)	Unit 2: LI- 8123A (wide range) Unit 3: LI- 9123A (wide range)	MCR – Panel 20C003 MCR – Panel 30C003

Note:

HCVS Radiation Indicating Switches RIS-80291 and RIS-90291; POS-80290-1(2) and POS-90290-1(2) and associated lights; Containment Pressure Recorders PR/TR-4805 and PR/TR-5805; and Torus Water Level Indicators LI-8027, LI-8123A, LI-9027, and LI- 9123A already exist. All other instruments will be new. RIS-90291 and RIS-80291 will have power supplies modified from Division 2 to Division 1, such that FLEX DG will provide backup power.

Part 2: Boundary Conditions for WW Vent – SA 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 SA. SA assumes that specific core cooling actions from the FLEX strategies identified in the response to Order EA-12-049 were not successful. Access to the RB will be restricted as determined by the SA conditions. Immediate actions will be completed by Operators in the MCR and will include remote-manual actions. The ROS provides back-up capability to open HCVS valve(s) in case of a valve circuit or SV failure. The operator actions required to open a vent path were previously listed in the ELAP Venting Part 2 section of this report (Table 2-1).

Permanently installed, dedicated power, N2, and Argon will be available to support operation and monitoring of the HCVS for 24 hours, with exception that power supply to existing Containment pressure and SP level indication is FLEX backed. Specifics are the same as for ELAP Venting Part 2 with the clarification that replenishment of the Argon purge system would be required with SA conditions.

System control:

i. Active: Same as for ELAP Venting Part 2.
ii. Passive: Same as for ELAP Venting Part 2

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

Specifics are the same as for ELAP Venting Part 2. FLEX strategy assumes the ability to cope for as long as required (in FLEX Phase 2, reliance on on-site portable equipment) using FLEX equipment.

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(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.

The operation of the HCVS will be governed under the same procedures / guidelines for SA conditions as for ELAP conditions. Existing guidance in the SAMGs directs the plant staff to consider changing radiological conditions in a SA.

Part 2: Boundary Conditions for WW Vent – SA Venting
Identify modifications: *List modifications and describe how they support the HCVS Actions.*
Modifications are the same as for ELAP 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).*
Key venting parameters are the same as for ELAP Venting Part 2.
Notes: None

Part 2: Boundary Conditions for WW Vent – Support 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

ELAP Venting

Provide a general description of the ELAP 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

All containment venting functions will be performed from the MCR or ROS.

Venting to prevent containment over-pressurization will be performed using permanently installed equipment. The HCVS dedicated DC power supply, N2 and Argon supply is adequate for the first 24 hours. Power supply will be backed by the FLEX DG. The N2 and Argon bottles can be replaced to support sustained operation.

Existing safety related station batteries will provide sufficient electrical power for MCR containment instrumentation and the HCVS PCIV circuits for greater than 7.2 hours. Before station batteries are depleted, portable FLEX DG, as detailed in the response to Order EA-12-049, will be credited to charge the station batteries and maintain DC bus voltage (after 5.0 hours).

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 ELAP scenario would be used for SA venting. The ROS (the location of the HCVS DC power supply, and dedicated N2 and Argon supply), and the FLEX DG location will be evaluated to confirm accessibility under SA conditions.

Details:

Provide a brief description of Procedures / Guidelines:
Confirm that procedure/guidance exists or will be developed to support implementation.

The operation of the HCVS will be governed the same for SA conditions as for ELAP conditions. Existing guidance in the SAMG directs the plant staff to consider changes in radiological conditions in a SA.

Identify modifications:
List modifications and describe how they support the HCVS Actions.

The same as for ELAP Venting Part 2.

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).

The same as for ELAP Venting Part 2

Notes:
None

Part 2: Boundary Conditions for WW Vent – 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 developed for compliance with Order EA-12-049 are acceptable without further evaluation needed except in areas around the RB or in the vicinity of the HCVS piping.

Before the end of the initial 24-hour period, replenishment of the HCVS dedicated DC power, N2 and Argon will occur. The selection of the FLEX DG and ROS locations will take into account the SA temperature and radiation condition to ensure access is available. The design will allow replenishment with minimal actions.

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. Radiological conditions will be considered.

Strategy	Modifications	Protection of connections
Per compliance with Order EA-12-049 (FLEX)	N/A	Per compliance with Order EA-12-049 (FLEX)

Notes:
None

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 degree F)*

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 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. In addition, HCVS valve operation, as required by EA-13-109 Requirement 1.2.5, may occur at the ROS on the 150' elevation of the Radwaste Building.

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

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

Part 3.1: Boundary Conditions for SAWA

Table 3.1 – SAWA Manual Actions
(PBAPS flood scenario is less time limiting since there is sufficient warning time, equipment can be fully deployed before flood, and plant will be in Cold Shutdown Mode 4)

Primary Action	Primary Location/ Component	Notes
1. Establish HCVS capability in accordance with Part 2 of this OIP.	■ MCR or ROS.	■ Applicable to SAWA/SAWM strategy.
2. Connect FLEX (SAWA) pump discharge to injection piping.	■ Injection piping will connect to the RHR System, Loop A.	■ HCVS piping is on west side of the RB. ■ Connection will be made early, but can be made any time before HCVS vent is opened. ■ Perform hose connections at the FLEX (SAWA) pump.
3. Connect FLEX (SAWA) pump to water source.	■ Water source is the Emergency Cooling Tower (ECT) basin. ■ FLEX (SAWA) pump at grade level on the north side of the RB.	■ ECT is a seismic structure, evaluated to withstand all BDBEEs. The ECT basin contains 3.5 million gallons. ■ Location of the FLEX (SAWA) pump and suction source has significant distance and shielding from radiological sources.
4. Power SAWA/HCVS components with EA-12-049 (FLEX) DG	■ FLEX DG deployment areas are north and south sides of the RB for Units 3 and 2, respectively. ■ Connections are inside the RB 135', northeast corner for Unit 3 and southeast corner for Unit 2.	■ Confirming accessibility after greater than 1 hour (but before HCVS pipe flow initiated). ■ Evaluating DG refueling capability under flood conditions.
5. Inject to RPV using FLEX (SAWA) pump (diesel).	■ Align RHR system valves to establish flow path to RPV. ■ Flow is controlled by pump speed and valve throttling if required.	■ RHR valves include motor-operated valves (MOVs), which are powered by the FLEX DG. MOVs are not throttled for flow control. ■ Initial SAWA flow rate of 500 gpm is being evaluated.
6. Monitor SAWA indications.	■ Mechanical (or self-contained) flow meter on SAWA hose.	■ Pump flow. ■ Valve position indication.
7. Use SAWM to maintain availability of the WW vent (Part 3.1.A).	■ MCR.	■ Monitor containment pressure and SP level.

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

Discussion of timeline SAWA identified items

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

- Less than 7.2 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 RB 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 containment 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 a SA based on presumed failure of injection systems or presumed failure of injection systems in a timely manner. 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 equipment needed to support the SAWA strategy shall be available prior to T=8 hours from the loss of injection (assumed at T=0).

The SAWA flow path includes methods to minimize exposure of personnel to radioactive liquids / gases and potentially flammable conditions by inclusion of backflow prevention. The FLEX (SAWA) pump check valve is integral with the pump skid and will close and prevent leakage when the FLEX (SAWA) pump is secured. RHR Loop A Check Valve AO-2(3)-10-046A is a containment isolation valve, which will prevent reverse flow from the RPV.

Description of SAWA actions for first 24 hours:

Table 3.2 – SAWA Manual Actions Timeline

Time	Action	Notes
T<1 hour	■ Connect SAWA hose *(Step 2 of Table 3.1).*	■ No evaluation required for actions inside RB.
T=1-7 hours *	■ Complete actions started at T<1 hour *(Step 2 of Table 3.1).* ■ Connect FLEX (SAWA) pump to water supply at ECT *(Step 3 of Table 3.1).* ■ Establish electrical power to HCVS and SAWA using EA-12-049 FLEX DG *(Step 4 of Table 3.1).* ■ Establish flow of 500 gpm to the RPV using SAWA systems *(Step 5 of Table 3.1).*	■ Evaluate early in-vessel release impact to RB access for SAWA actions. It is assumed that RB 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 hour timeframe.

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

T≤8-12 hours	■ Monitor and Maintain SAWA flow at 500 gpm for 4 hours (*Step 6 of Table 3.1*).	■ SAWA flow must commence at T=8 hours but should be done as soon as available.
T≤12 hours	■ Proceed to SAWM actions per Part 3.1.A (*Step 7 of Table 3.1*).	■ SAWA flow may be reduced to 100 gpm after 4 hours following SAWA initiation.

* The assumed times of T=1 hour to T=8 hours to establish the bounds of applicability of radiological evaluations have been reduced to T=1 hour to T=7 hours in order to provide sufficient margin to inform operator action feasibility evaluations and will be further informed by emergency response dose assessment activities during an actual event. This accounts for the one hour gap between 7 and 8 hours in this time line.

Greater Than 24 Hour Coping Detail

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

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

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 WW vent (see 3.1.A).

Details:

Details of Design Characteristics/Performance Specifications

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

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

Equipment Locations/Controls/Instrumentation

PBAPS was the referenced plant used for the SOARCA study and has not yet performed a site specific MAAP evaluation to justify the use of a lower site unique initial SAWA flow rate. PBAPS is assuming an initial flow rate of 500 GPM while considering a site specific MAAP evaluation. The initial flow rate will be established within 8 hours of the loss of all RPV injection following an ELAP/SA and will be maintained for 4 hours before reduction to the WW vent preservation flow rate.

The locations of the SAWA equipment and controls, as well as ingress and egress paths will be evaluated for the expected SA 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 be evaluated against the limits for ERO dose and plant safety guidelines for temperature and humidity.

The flow path will be from the FLEX suction at ECT basin through the FLEX pump, which is also the FLEX (SAWA) pump. From this pump, hoses will be routed to the permanent SAWA connection point. The connection is to the RHR System Loop A (LPCI) to the RPV. The connection actions will be done in the first eight hours of the event, and as soon as practical. Backflow in the RHR line is prevented by an existing RHR check valve.

Containment pressure and SP level will be monitored and flow rate will be adjusted by use of the FLEX pump speed and/or throttling valve(s). Containment instrumentation and RHR MOV alignment required for SAWA will

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

be powered from the FLEX DGs connected as described in the EA-12-049 compliance documents. Refueling of the FLEX DG will be accomplished from the EDG fuel oil tanks as described in the EA-12-049 compliance documents.

The ECT is a significant distance from the discharge of the HCVS pipe with substantial structural shielding between the HCVS pipe and the pump deployment location. FLEX (SAWA) pump refueling will also be accomplished from the EDG fuel oil tanks as described in the EA-12-049 compliance documents. See mechanical and electrical sketches in attachments, plant layout sketches in the assumptions part and a list of actions elsewhere in this part.

Actions outside the RB during SA conditions will be evaluated to determine 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 SA Conditions). Evaluation of actions inside the RB for projected SA conditions (radiation/temperature) will be performed to determine that personnel can complete the initial and support activities without exceeding the ERO-allowable dose for equipment operation or site safety standards (reference HCVS-FAQ-12).

Electrical equipment and instrumentation will be powered from the power sources noted in the table below with FLEX DG replenishing battery capacity during the Sustained Operating period. The indications include (* are required):

Parameter	**Instrument**	**Location**	**Power Source / Notes**
Containment Pressure*	Unit 2: PR/TR-4805 Unit 3: PR/TR-5805	MCR – Panel 20C003 MCR – Panel 30C003	20Y050 (Unit 2) and 30Y050 (Unit 3), both backed by safety-related battery and FLEX DG RG 1.97 qualified
SP Level*	Unit 2: LI- 8123A (wide range) Unit 3: LI- 9123A (wide range)	MCR – Panel 20C003 MCR – Panel 30C003	E/S-8124-1 (Unit 2) and E/S-9124-1 (Unit 3), both backed by safety-related battery and FLEX DG RG 1.97 qualified
SAWA Flow*	SAWA (FLEX) Pump Flow Indicator	FLEX (SAWA) pump discharge	Mechanical Flow Meter
Valve indications and controls	Existing MCR Panels	MCR	FLEX DG for all required RHR Loop A valves via safety-related electrical Division I

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.

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

Equipment Protection

SAWA installed component and connections external to protected buildings will be protected against the screened-in hazards of EA-12-049 for the station. Portable equipment used for SAWA implementation will meet the protection requirements for storage in accordance with the criteria in NEI 12-06 Revision 0.

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

Provide a brief description of Procedures / Guidelines:

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

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

Procedures and guidance will be provided for the required actions including:

1. Connect FLEX (SAWA) pump discharge to RHR piping.
2. Connect FLEX (SAWA) pump to intake using FSG*.
3. Power SAWA/HCVS components with EA-12-049 FLEX DG using FSG.
4. Verify other RHR modes are isolated using Control Room switches.
5. Open RHR MOVs to lineup injection to RPV using FLEX (SAWA) pump.
6. Start FLEX (SAWA) pump to establish SAWA flow.
7. Adjust SAWA flow to establish and maintain 500 gpm.

*Where an FSG is referenced, it will be the same FSG reference with the same steps used for FLEX.

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

The list of modifications, below, is limited to those required to upgrade EA-12-049 equipment to meet EA-13-109 Phase 2 requirements.

Electrical Modifications (includes electrical instrumentation and controls):

- Modifications are currently being scoped, contingent on in-progress analyses and evaluations

Mechanical Modifications (includes mechanical flow meter at FLEX (SAWA) pump, if modification process is required):

- Modifications are currently being scoped, contingent on in-progress analyses and evaluations

Component Qualifications:

State the qualification used for equipment supporting SAWA.

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

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

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

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

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

Basis for SAWM time frame

SAWM can be maintained >7 days:

PBAPS was the referenced plant used for the SOARCA study and has not yet performed a site specific MAAP evaluation to justify the use of a lower site unique initial SAWA flow rate. PBAPS is assuming an initial flow rate of 500 GPM while considering a site specific MAAP evaluation. This initial flow rate will be established within 8 hours of the loss of all RPV injection following an ELAP/SA and will be maintained for four hours before reduction to the WW vent preservation flow rate. Each PBAPS unit will have a FLEX (SAWA) pump.

Instrumentation relied upon for SAWM operations is containment pressure, SP level and SAWA flow. Except for SAWA flow, SAWM instruments are initially powered by station batteries and then by the FLEX DG, which is

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

placed in-service prior to core breach. The FLEX DG will provide power throughout the Sustained Operation period (7 days). The SAWA flow instrument will be a mechanical flow meter that does not require external power. 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 SA and provide confirmation to adjust SAWA flow rates. (C.7.1.4.2, C.8.3.1)

SP 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 >7 days using SAWM flowrates. (C.6.3, C.7.1.4.3)

Procedures will be developed that control the SP level, while ensuring the containment pressure indicates the core is being cooled, whether in-vessel or ex-vessel. Procedures will dictate conditions during which SAWM flowrate should be adjusted (up or down) using containment pressure and SP level as controlling parameters to remove the decay heat from the containment. (This is similar to the guidance currently provided in the BWROG SAMGs.) (C.7.1.4.3)

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

Table 3.1.B – SAWM Manual Actions

Primary Action	Primary Location/ Component	Notes
1. Lower SAWA injection rate to control SP level and decay heat removal.	FLEX (SAWA) pump.	• Control to maintain containment and WW parameters to ensure WW vent remains functional. • 100 gpm minimum capability will be maintained for greater than 7 days.
2. Control SAWM flowrate for containment control/decay heat removal.	MCR Containment Instrument monitoring. SAWA flow on the FLEX pump.	• SAWM flowrate will be monitored using the following instruments: – Containment pressure – SP level – SAWA flow • SAWM flowrate will be controlled by pump speed and / or a throttling valve.
3. Establish alternate decay heat removal.	Various locations.	SAWM strategy can preserve the WW vent path for >7 days.
4. Secure SAWA / SAWM.	FLEX (SAWA) pump valve manifold.	When alternate decay heat removal is established.

SAWM Time Sensitive Actions

Time Sensitive SAWM Actions:

12 Hours – Initiate actions to maintain the 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.

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

SAWM Severe Accident Operation

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

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

It is anticipated that SAWM will only be used in SA conditions 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, Section 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 low rate has been established for 4 hours, the flow will be reduced while monitoring containment pressure and SP 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

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

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

Equipment Locations/Controls/Instrumentation

Describe location for SAWM monitoring and control.

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

The SAWM control location is the same as the SAWA control location. Local indication of SAWM flow rate is provided at the FLEX pump's mechanical flow meter that does not require external power.

Injection flowrate is controlled by pump speed or by using a throttling valve.

Containment pressure and SP level are MCR 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:

- Containment Pressure
- SP Level
- SAWM Flowrate

The containment pressure and SP level instruments are qualified to RG 1.97 and are the same as listed in Part 2 of this OIP. The SAWM flow instrumentation will be qualified for the expected environmental conditions expected when needed.

Notes:

None

Part 3: Boundary Conditions for EA-13-109, Option B.2
Part 3.1.B: **Boundary Conditions for SAWA/SADV**
Applicability of WW Design Considerations
This section is not applicable to PBAPS.
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 3.1, 3.20 / NEI 13-02, Section 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 SA 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 accessible when the HCVS is required to be functional including during SAs.

Procedures:

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

The HCVS and SAWA procedures will be developed and implemented following plant processes for initiating or revising procedures and contain the following details:

- appropriate conditions and criteria for use of the HCVS and SAWA
- when and how to place the HCVS and SAWA in operation
- location of system components
- instrumentation available
- normal and backup power supplies
- directions for sustained operation (Reference 9), including the storage and location of portable equipment
- location of the remote operating station
- training on operating the portable equipment
- testing of portable equipment

Provisions will be established for out-of-service requirements of the HCVS and compensatory measures that comply with the criteria from NEI 13-02 (Reference 9).

PBAPS will establish provisions for out-of-service requirements of the HCVS and compensatory measures. The following provisions will be documented in the HCVS Program Document:

The provisions for out-of-service requirements for HCVS/SAWA 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 non-functional, no compensatory actions are necessary.

Part 4: Programmatic Controls, Training, Drills and Maintenance

- If the out of service times exceed 30 or 90 days as described above, the following actions will be performed through the site corrective action program:
  - Determine the cause(s) of the non-functionality,
  - Establish the actions to be taken and the schedule for restoring the system to functional status and to 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 suing 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 in drills, tabletops, or exercises for HCVS operation 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

PBAPS will utilize the guidance provided in NEI 13-06 and 14-01 (References 10 and 11) for guidance related to drills, tabletops, or exercises for HCVS operation. In addition, PBAPS will integrate these requirements with compliance to any rulemaking resulting from the NTTF Recommendations 8 and 9.

Part 4: Programmatic Controls, Training, Drills and Maintenance

Describe 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 and expected use (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 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

PBAPS will utilize the standard EPRI industry PM process 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.

PBAPS 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 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 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:

Refer to Generic Assumption 109-4. PCIVs are required for containment integrity during Modes 1-3 and thus are excluded from EA-13-109 testing requirements. However, these PCIVs are tested per by the PBAPS design basis requirements to ensure valve operability and leakage tightness.

Part 5: Implementation Schedule Milestones

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 13-0,2 Section 7.2.1

The following milestone schedule is 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 Milestones:

Milestone	Target Completion Date	Activity Status	Comments
Hold preliminary/conceptual design meeting	Apr 2014	Complete	
Submit OIIP	Jun 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
U2 Design Engineering Complete	Apr 2016	Started	
U2 Implementation Outage	Nov 2016	Not Started	
U2 Maintenance and Operation Procedure Changes Developed, Training Complete, & Walk-Through Demonstration/Functional Test	Nov 2016	Not Started	
U3 Design Engineering Complete	Sep 2016	Not Started	
U3 Implementation Outage	Oct 2017	Not Started	
U3 Maintenance and Operation Procedure Changes Developed, Training Complete, & Walk-Through Demonstration/Functional Test	Oct 2017	Not Started	
Submit Completion Report	Dec 2017	Not Started	

Part 5: Implementation Schedule Milestones

Phase 2 Milestone Schedule:

Phase 2 Milestone Schedule

Milestone	Target Completion Date	Activity Status	Comments
Submit OIP	Dec 2015	Complete with this submittal	Simultaneous with Phase 1 Updated OIP
Hold preliminary/conceptual design meeting	Oct 2015	Completed	
Submit 6 Month Status Report	Jun 2016	Not Started	
Submit 6 Month Status Report	Dec 2016	Not Started	
Submit 6 Month Status Report	Jun 2017	Not Started	
Submit 6 Month Status Report	Dec 2017	Not Started	
Submit 6 Month Status Report	Jun 2018	Not Started	
Submit 6 Month Status Report	Dec 2018	Not Started	
U3 Design Engineering Complete	Sep 2016	Not Started	
U3 Implementation Outage	Oct 2017	Not Started	Concurrent with U3 Phase 1 implementation
U3 Maintenance and Operation Procedure Changes Developed, Training Complete, & Walk-Through Demonstration/Functional Test	Oct 2017	Not Started	Concurrent with U3 Phase 1 procedure changes, training, walk-through, and test
U2 Design Engineering Complete	Sep 2017	Not Started	
U2 Implementation Outage	Nov 2018	Not Started	
U2 Maintenance and Operation Procedure Changes Developed, Training Complete, & Walk-Trough Demonstration/Functional Test	Nov 2018	Not Started	
Submit Completion Report	Dec 2018	Not started	

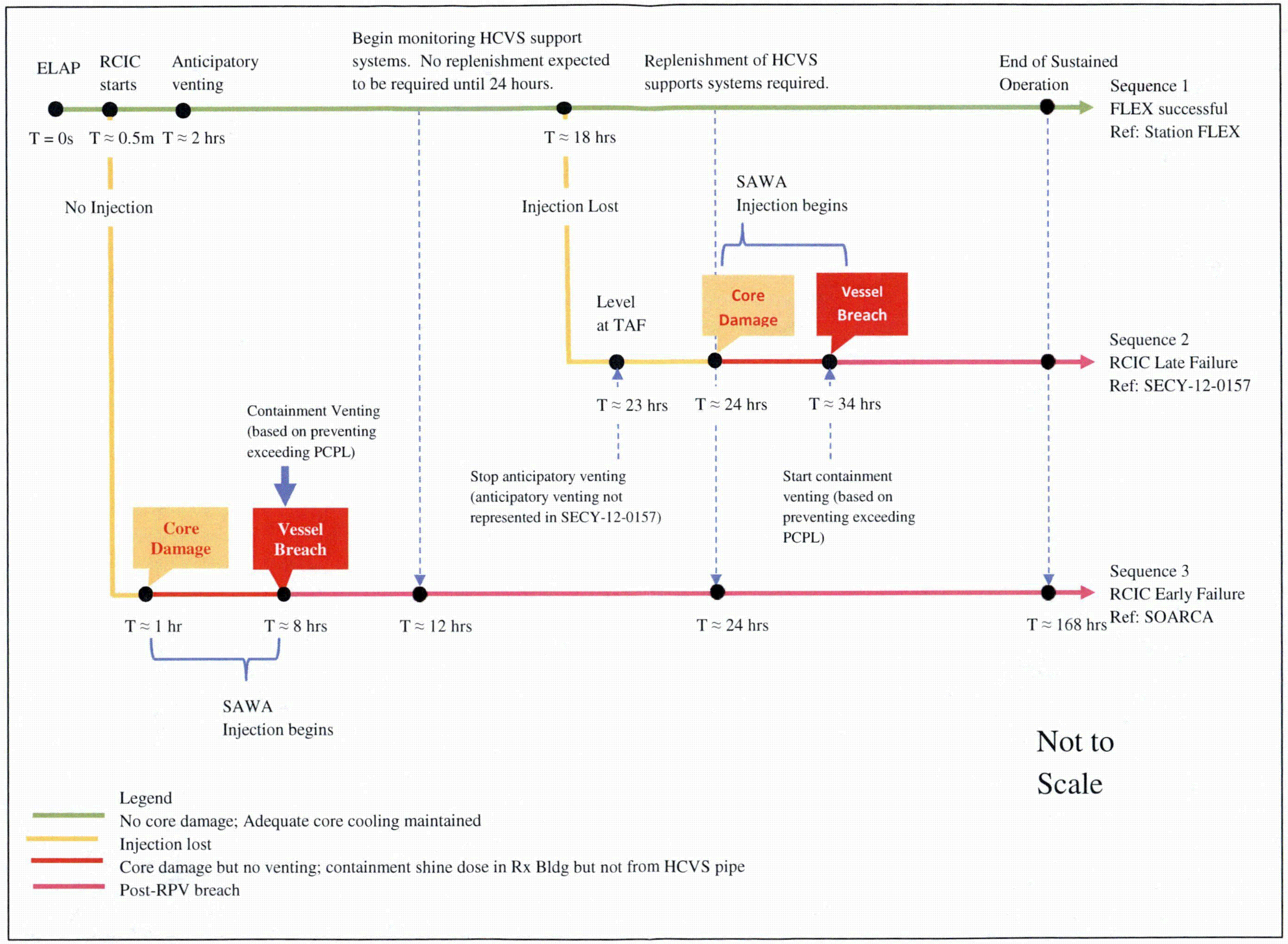
Notes:

None

Attachment 1: HCVS/SAWA/SADV Portable Equipment

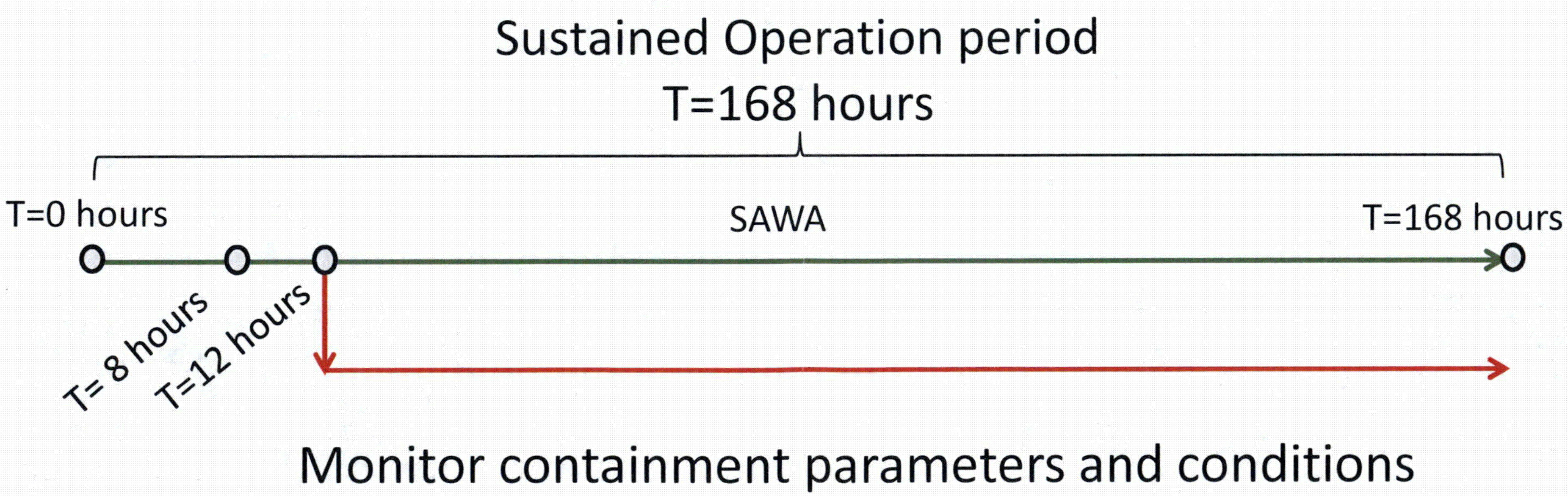
List portable equipment	*ELAP Venting*	*SA Venting*	*Performance Criteria*	*Maintenance / PM requirements*
Nitrogen Cylinders	X	X	N2 Pressure	Check periodically for pressure, replace or replenish as needed.
FLEX DG	X	X	500 kW	Per response to EA-12-049.
FLEX (SAWA) pump	X	X	500 gpm	Per response to EA-12-049.
Argon Cylinders	NA	X	Argon Pressure	Check periodically for pressure, replace or replenish as needed.

Attachment 2A: Sequence of Events Timeline - HCVS



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

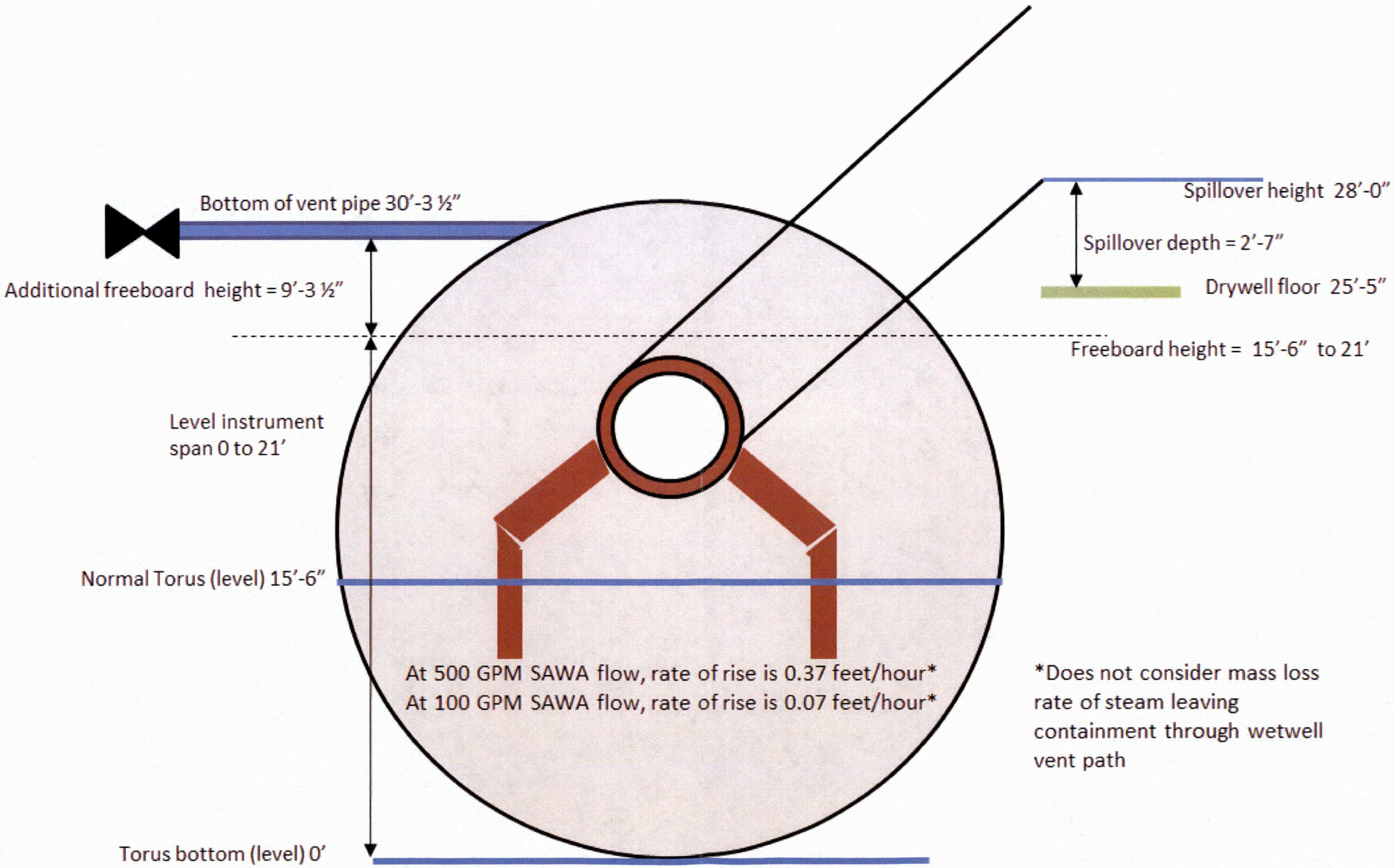
Time	Action
T=0 hours	Start of ELAP
T=8 hours	Initiate SAWA flow at 500 gpm as soon as possible but no later than 8 hours
T=12 hours	Throttle SAWA flow to 100 gpm 4 hours after initiation of SAWA flow
T=168 hours	End of Sustained Operation



Attachment 2.1.B: Sequence of Events Timeline – SADV

Not applicable to PBAPS

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



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 (WW 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 DW, 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 strategies)

Sketch 1: Master Diagram ***(preliminary)***

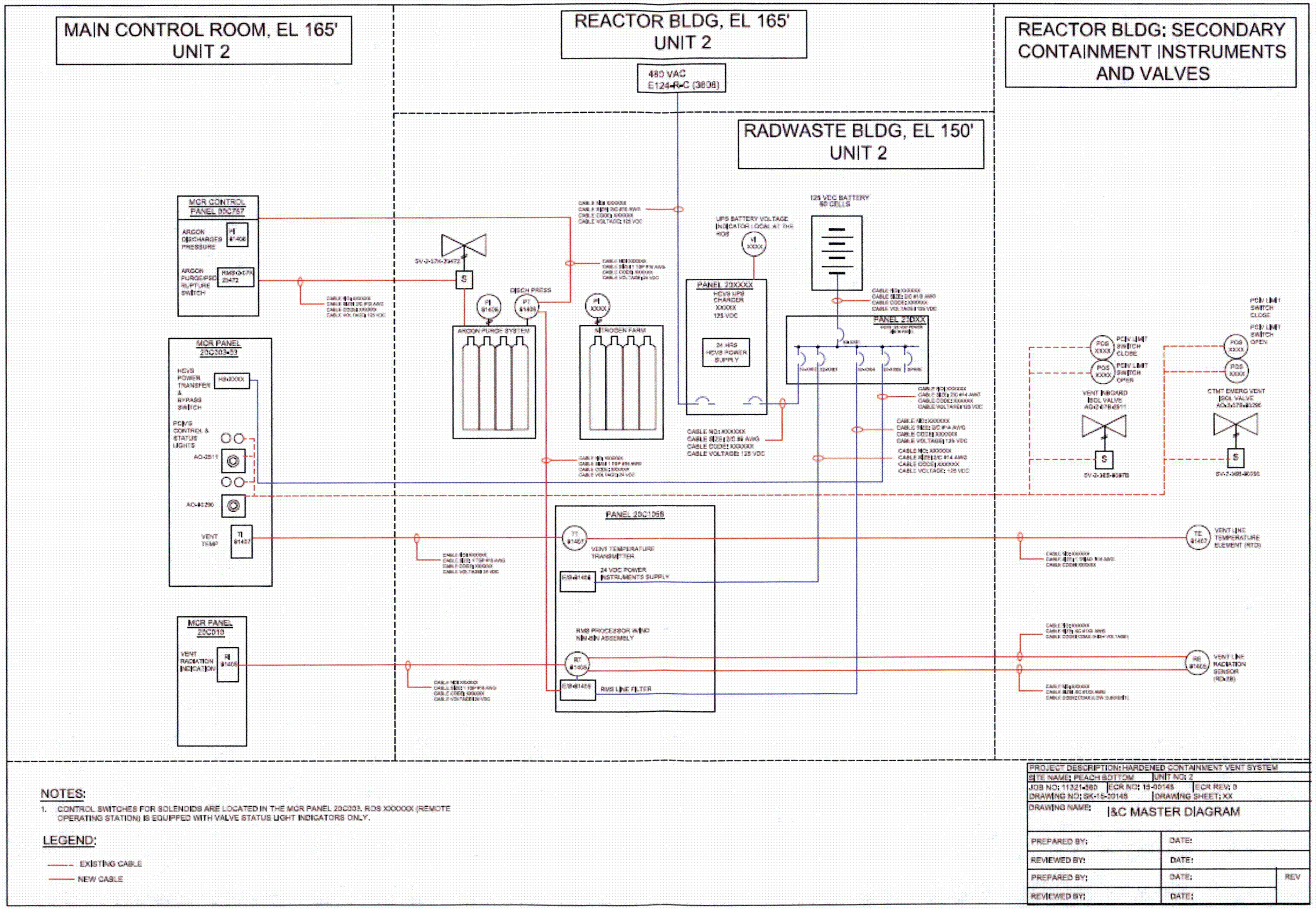
Sketch 2: Electrical Connections – HCVS and SAWA ***(preliminary)***

Sketch 3A: P&ID Layout of WW Vent – Inboard PCIV ***(preliminary)***
Sketch 3B: P&ID Layout of WW Vent – Outboard PCIV ***(preliminary)***
Sketch 3C: P&ID Layout of WW Vent – N2 and Argon Supply ***(preliminary)***

Sketch 4A: SAWA Flow Path ***(preliminary)***
Sketch 4B: Plant Layout ***(preliminary)***

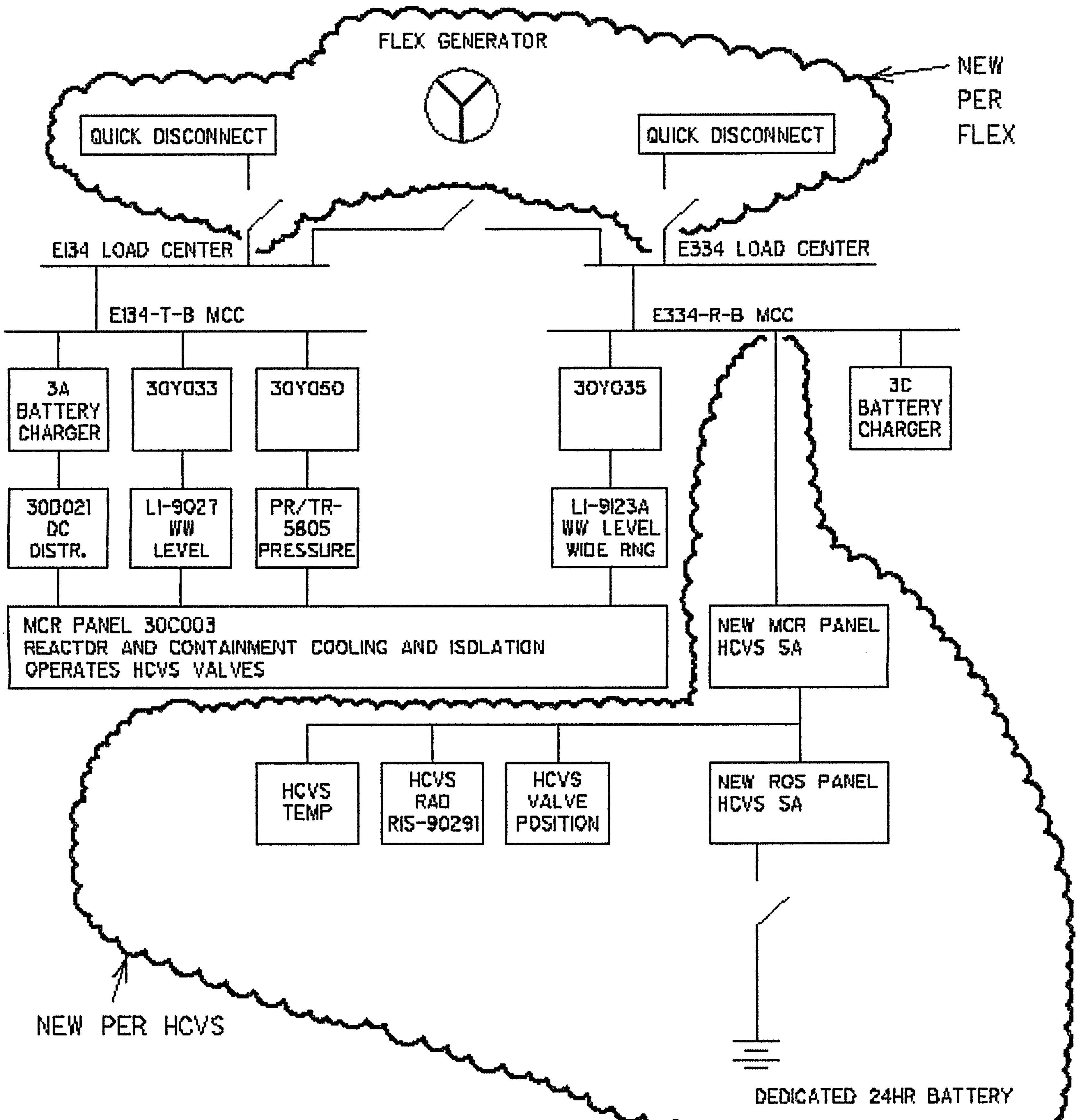
Attachment 3: Conceptual Sketches

Sketch 1: Master Diagram – HCVS and SAWA (preliminary)



Attachment 3: Conceptual Sketches

Sketch 2: Electrical Connections – HCVS and SAWA (preliminary)

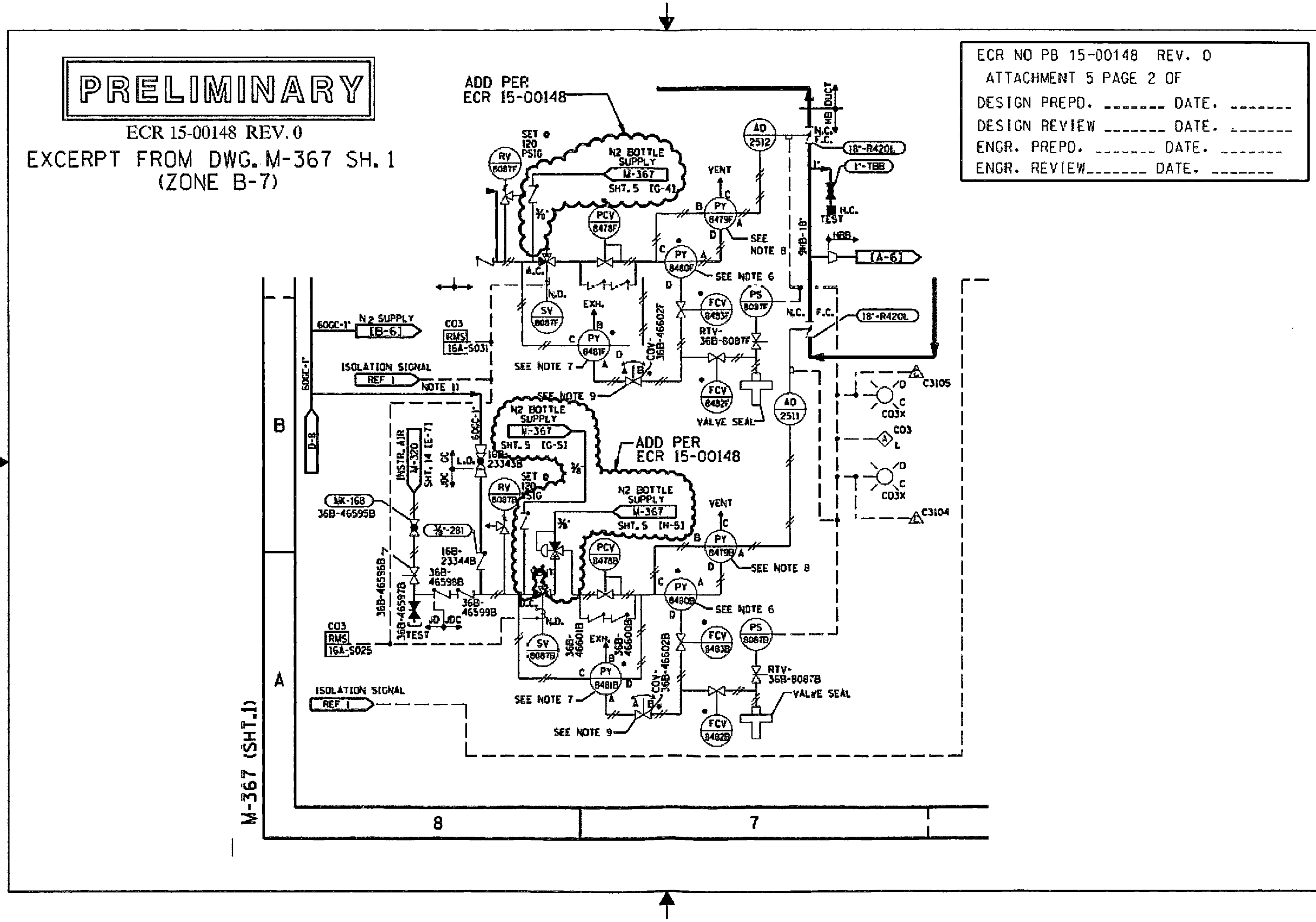


NOTES:

1) ONE (1) FLEX GENERATOR PER UNIT
2) RELOCATE RIS-9D291 FROM DIVISION 2 POWER SUPPLY TO DIVISION 1

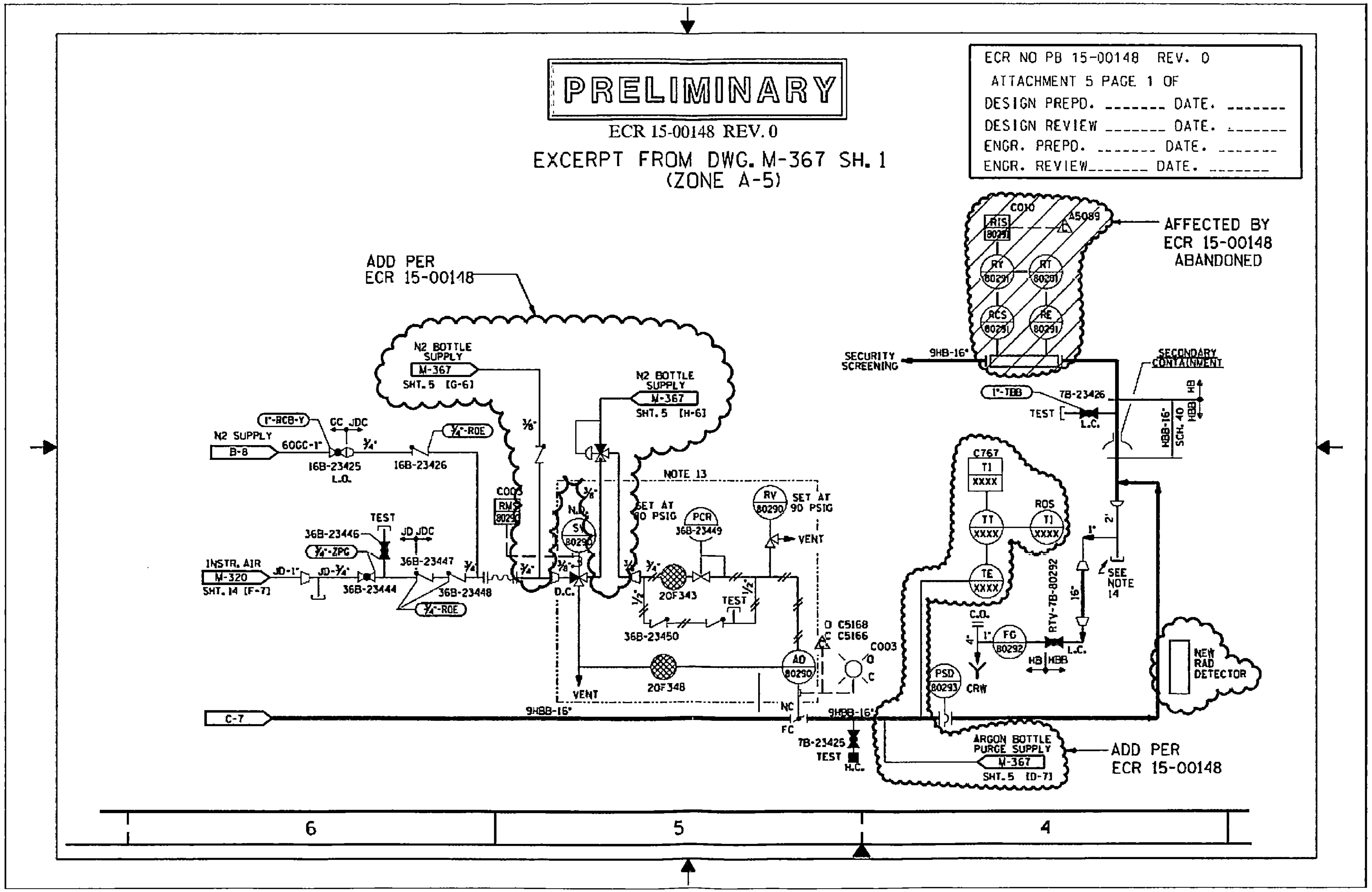
Attachment 3: Conceptual Sketches

Sketch 3A: P&ID Layout of WW Vent – Inboard PCIV (preliminary)



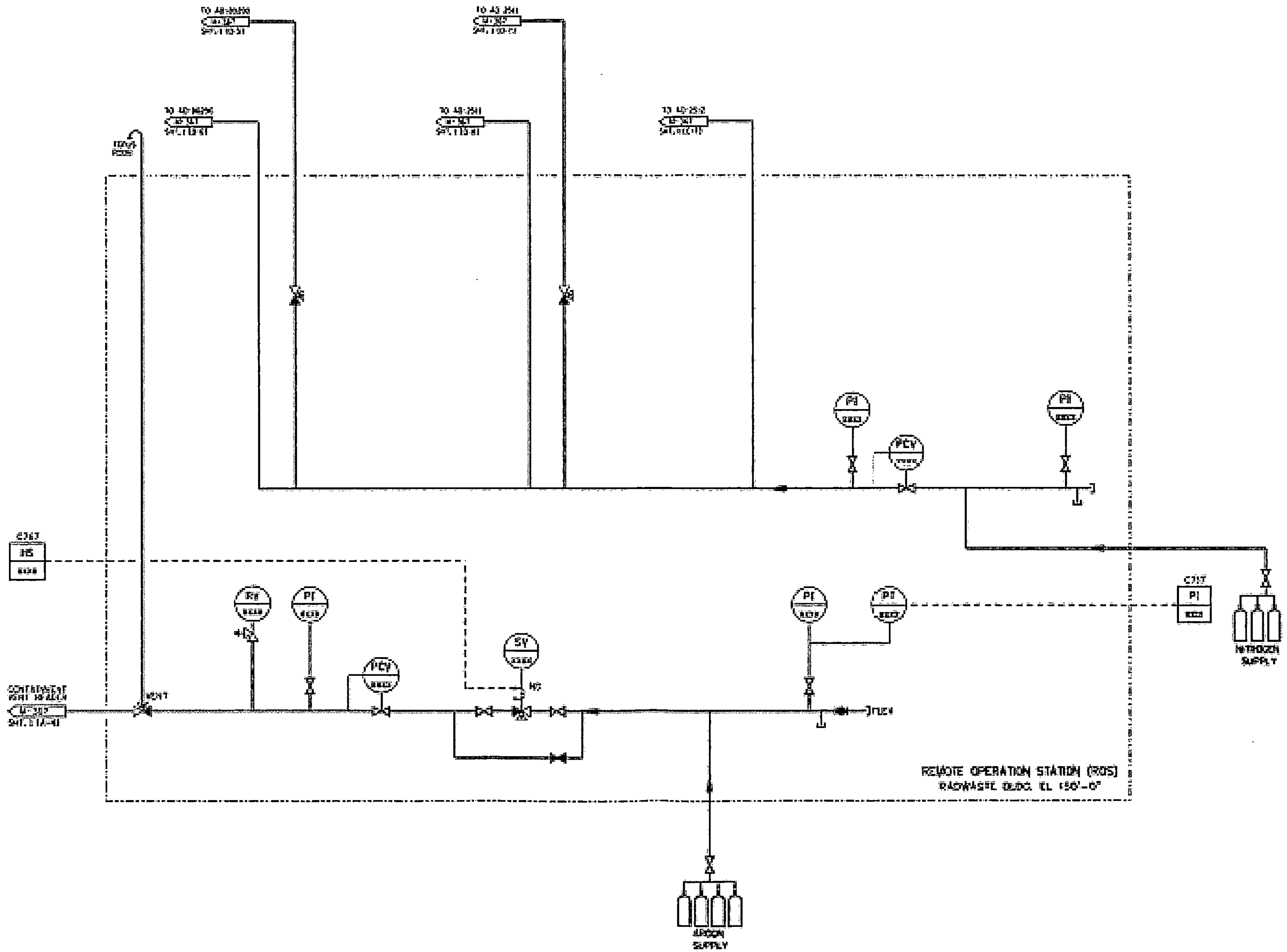
Attachment 3: Conceptual Sketches

Sketch 3B: P&ID Layout of WW Vent – Outboard PCIV (preliminary)



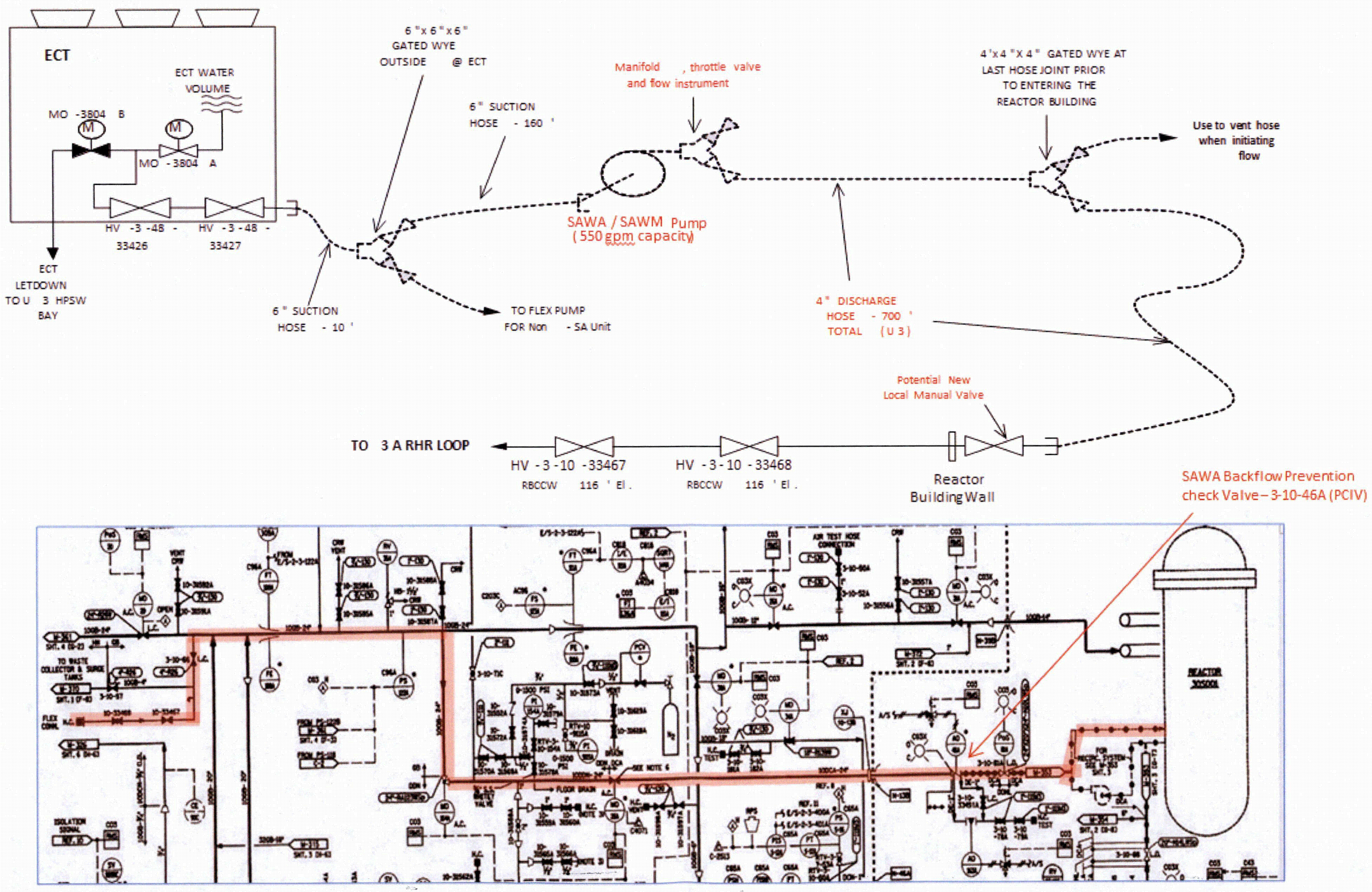
Attachment 3: Conceptual Sketches

Sketch 3C: P&ID Layout of WW Vent – N2 and Argon Supply (preliminary)



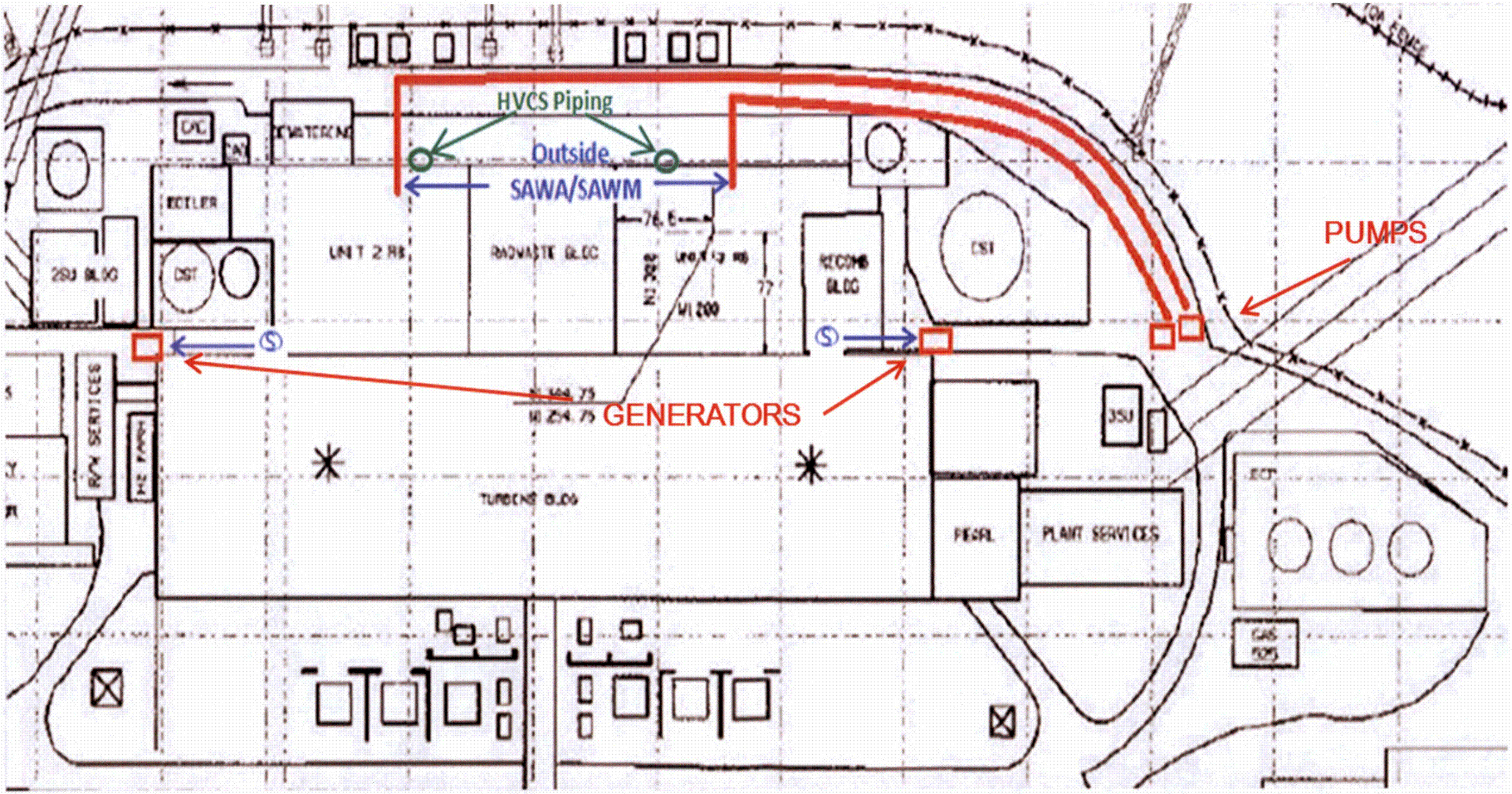
Attachment 3: Conceptual Sketches

Sketch 4A: SAWA Flow Path (preliminary)



Attachment 3: Conceptual Sketches

Sketch 4B: Plant Layout (preliminary)



Attachment 4: Failure Evaluation Table

Table 4A: WW HCVS Failure Evaluation Table

Functional Failure Mode	Failure Cause	Alternate Action	Failure with Alternate Action Prevents Containment Venting?
Fail to Vent (Open) on Demand	Valves fail to open/close due to loss of normal AC power/DC batteries.	None required – system SVs utilize dedicated 24-hour power supply.	No
	Valves fail to open/close due to depletion of dedicated power supply.	Recharge system with FLEX DG.	No
	Valves fail to open/close due to complete loss of power supplies.	Manually operate backup pneumatic supply/vent lines at ROS.	No
	Valves fail to open/close due to loss of normal (IA/SGIG) pneumatic supply.	No action needed. Valves are provided with dedicated N2 supply, capable of 24-hour operation.	No
	Valves fail to open/close due to loss of alternate pneumatic supply (long term).	Replace bottles as needed.	No
	Valve fails to open/close due to SV failure.	Manually operate backup pneumatic supply/vent lines at ROS.	No
Fail to stop venting (Close) on demand	Not credible as there is not a common mode failure that would prevent the closure of at least 1 of the 2 valves needed for venting. Both valves designed to fail shut.	N/A	No
Spurious Opening	Not credible as key-locked switch and fuses removed from circuit prevent spurious opening of the downstream HCVS PCIV. Additionally, the solenoid valve is normally de-energized.	N/A	No
Spurious Closure	Valves fail to remain open due to depletion of dedicated power supply.	Recharge system with FLEX DG.	No
	Valves fail to remain open due to complete loss of power supplies.	Manually operate backup pneumatic supply/vent lines at ROS.	No
	Valves fail to remain open due to loss of alternate pneumatic supply (long term).	Replace bottles as needed and/or recharge with portable air compressors.	No

Attachment 5: References

1. Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 28, 2013 (ML 1305/ML 13059A391) for Peach Bottom Atomic Power Station
2. Generic Letter 89-16, Installation of a Hardened Wetwell Vent, dated September 1, 1989
3. Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012
4. Order EA-13-109, Severe Accident Reliable Hardened Containment Vents, dated June 6, 2013
5. JLD-ISG-2012-01, Compliance with Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, dated August 29, 2012
6. JLD-ISG-2013-02, Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents, dated November 14, 2013
7. 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
8. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, August 2012
9. NEI 13-02, Industry Guidance for Compliance with Order EA–13–109, Revision 1, Dated April 2015
10. NEI 13-06, Enhancements to Emergency Response Capabilities for Beyond Design Basis Accidents and Events, Revision 0, dated March 2014
11. NEI 14-01, Emergency Response Procedures and Guidelines for Extreme Events and Severe Accidents, Revision 0, dated March 2014
12. NEI HCVS-FAQ-01, HCVS Primary Controls and Alternate Controls and Monitoring Locations
13. NEI HCVS-FAQ-02, HCVS Dedicated Equipment
14. NEI HCVS-FAQ-03, HCVS Alternate Control Operating Mechanisms
15. NEI HCVS-FAQ-04, HCVS Release Point
16. NEI HCVS-FAQ-05, HCVS Control and 'Boundary Valves'
17. NEI HCVS-FAQ-06, FLEX Assumptions/HCVS Generic Assumptions
18. NEI HCVS-FAQ-07, Consideration of Release from Spent Fuel Pool Anomalies
19. NEI HCVS-FAQ-08, HCVS Instrument Qualifications
20. NEI HCVS-FAQ-09, Use of Toolbox Actions for Personnel
21. NEI White Paper HCVS-WP-01, HCVS Dedicated Power and Motive Force
22. NEI White Paper HCVS-WP-02, HCVS Cyclic Operations Approach
23. NEI White Paper HCVS-WP-03, Hydrogen/CO Control Measures
24. Not Used
25. NUREG/CR-7110, Rev. 1, State-of-the-Art Reactor Consequence Analysis Project, Volume 1: Peach Bottom Integrated Analysis
26. SECY-12-0157, Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments, 11/26/12
27. PBAPS Updated Final Safety Analysis Report, Revision 25, April 2015
28. IEEE Standard 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations
29. FLEX MAAP Endorsement ML13190A201
30. PB-MISC-010 revision 1, MAAP Analysis to support FLEX Initial Strategy
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 April 2015
32. NEI White Paper HCVS-WP-04, Missile Evaluation for HCVS Components 30 Feet Above Grade, Revision 0, dated August 17, 2015
33. NEI HCVS-FAQ-10, Severe Accident Multiple Unit Response
34. NEI HCVS-FAQ-11, Plant Response During a Severe Accident
35. NEI HCVS-FAQ-12, Radiological Evaluations on Plant Actions Prior to HCVS Initial Use
36. NEI HCVS-FAQ-13, Severe Accident Venting Actions Validation

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

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

Attachment 7: List of Overall Integrated Plan Open Items

The following tables provide a summary of the open items documented in the Phase 1 Overall Integrated Plan or the Interim Staff Evaluation (ISE) and the status of each item.

Open Item	*Open Items from OIP*	*Status*
1	*Confirm that the Remote Operating Station (ROS) will be in an accessible area following a Severe Accident (SA).*	*Deleted. Closed to ISE Open Item number 09.*
2	*Provide procedures for HCVS Operation.*	*Deleted. Closed to ISE Open Item number 01.*
3	*Identify site specific controlling document for HCVS out of service and compensatory measures.*	*Deleted. Closed to ISE Open Item number 02.*
4	*Determine the approach for combustible gases.*	*Deleted. Closed to ISE Open Item number 08.*
5	*Perform radiological evaluation for Phase 1vent line impact on ERO response actions.*	*Not Started*

Open Item	*Interim Staff Evaluation (ISE) Open Items*	*Status*
1	*Make available for NRC staff audit guidelines and procedures for HCVS operation (Section 3.2.3.1).*	*Not Started.*
2	*Make available for the NRC staff audit the site specific controlling document for HCVS out of service and compensatory measures. (Section 3.4.1)*	*Not Started.*
3	*Make available for NRC staff audit a technical justification for use of jumpers in the HCVS strategy. (Section 3.1 .3)*	*Not Started.*

4	*Make available for NRC staff audit analyses demonstrating that the HCVS has the, capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit. (Sections 3.2.2.1 and 3.2.2.2)*	*Complete - Calculation PM-0546, Torus Hardened Vent-Flow demonstrates that the HCVS has the capacity to vent the steam/energy equivalent of one percent licensed/rated thermal power. The primary containment design pressure is 56 psig (UFSAR 5.2.3.1). The primary containment pressure limit is 60 psig (UFSAR 5.2.3.6). PM-0546 shows that the HCVS capacity exceeds one percent of licensed/rated thermal power at the lower of these values, and capacity exceeds one percent power at significantly lower pressure values, down to approximately 20 psig.*
5	*Make available for NRC staff audit descriptions or diagrams of reactor building ventilation including exhaust dampers failure modes to support licensee justification for the HVAC release point being below and 150 feet from the reactor building ventilation release point. (Section 3.2.2.3)*	*Complete - Reference drawing M-395: The Reactor Building Exhaust System. The RB Exhaust System Fans, including the Refuel Floor Exhaust Fans, RB Exhaust Fans, and RB Equipment Exhaust Fans, have Fail-Close dampers in exhaust ducts to prevent uncontrolled or unmonitored release from the RB in the event of loss of power to the fan's solenoid valves. Fail-Close dampers will eliminate pathway into the RB in the event of use of the HCVS in an ELAP.*
6	*Make available for NRC staff audit details to justify the deviation from tornado protection standards provided in NEI 13-02 or make available a description of how the HCVS will comply with the tornado protection standards provided in NEl-13-02. (Section 3.2.2.3)*	*Started - Exelon is preparing an analysis to demonstrate that the location of the existing external piping already provides reasonable protection from tornado generated missiles.*
7	*Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident condition. (Section 3.2.2.5)*	*Complete – FLEX modification ECR 15-00126 improved the PBAPS communication system, to be functional in the event of an ELAP.*
8	*Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration. (Section 3.2.2.6)*	*Complete – Peach Bottom will utilize an Argon purge system to address combustible gases in the HCVS piping. A summary of the design features is included in the December 2015 OIP.*
9	*Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment. (Sections 3.2.1, 3.2.2.3, 3.2.2.4, 3.2.2.5, 3.2.2.10, 3.2.4.1, 3.2.4.2, 3.2.5.2, and 3.2.6)*	*Started.*

10	*Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods. (Sections 3.2.2.9 and 3.2.2.10)*	*Started.*
11	*Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation. (Sections 3.2.2.4, 3.2.3.1, 3.2.3.2, 3.2.4.1, 3.2.4.2, 3.2.5.1, 3.2.5.2, and 3.2.6)*	*Started.*
12	*Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions. (Sections 3.2.2.3, 3.2.2.5, 3.2.2.9, and 3.2.2.10)*	*Started.*
13	*Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting. (Section 3.2.2.9)*	*Started - Isolation valve analysis in progress.*
14	*Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings. (Section 3.2.2.6 and 3.2.2.7)*	*Complete Reference drawing M-367, Sheet 1: As described in the OIP, the HCVS torus vent path in each unit, starting at and including the downstream PCIV, will be a dedicated HCVS flow path. There are no interconnected systems downstream of the downstream, dedicated HCVS PCIV. Interconnected systems are upstream of the downstream HCVS PCIV and are isolated by normally shut, fail shut PCIVs which, if open, would shut on an ELAP. There is no shared HCVS piping between the two units.* *The vent path will rely on an Argon purge system to prevent line failure due to hydrogen deflagration and detonation.*
15.	*Make available for NRC audit documentation confirming that HCVS will remain isolated from standby gas treatment system during ELAP and severe accident conditions. (Section 3.2.2.7)*	*Started - Isolation valve analysis in progress.*