Exelon Generation.

Order No. EA-13-109

RS-15-304

December 16, 2015

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

Quad Cities Nuclear Power Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

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-14-063)
6. Exelon Generation Company, LLC First Six-Month Status Report Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 17, 2014 (RS-14-306)
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-15-152)

8. NRC letter to Exelon Generation Company, LLC, Quad Cities Nuclear Power Station, Units 1 and 2 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Phase 1 of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC Nos. MF4460 and MF4461), dated April 1, 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 Quad Cities Nuclear Power Station, Units 1 and 2, 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 Quad Cities 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 Quad Cities Nuclear Power Station, Units 1 and 2. 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 Quad Cities Nuclear Power Station, Units 1 and 2 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 16th day of December 2015.

Respectfully submitted,

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Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure:

Quad Cities Nuclear Power Station, Units 1 and 2, 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
NRC Regional Administrator - Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station
NRC Project Manager, NRR – Quad Cities Nuclear Power Station
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Enclosure 1

Quad Cities Nuclear Power Station, Units 1 and 2

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

(75 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 vent. In response, licensees installed a hardened vent pipe from the suppression pool to some point outside the secondary containment envelope (usually outside the reactor building). Some licensees also installed a hardened vent branch line from the Drywell.

On March 19, 2013, the Nuclear Regulatory Commission (NRC) Commissioners directed the staff per Staff Requirements Memorandum (SRM) for SECY-12-0157 (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 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 severe accident (SA) conditions resulting from an Extended Loss of AC Power (ELAP).

The Order requirements are applied in a phased approach where:

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

The NRC provided an acceptable approach for complying with Order EA-13-109 through Interim Staff Guidance (JLD-ISG-2013-02) issued in November 2013 (Reference 6) and JLD-ISG-2015-01 issued in April 2015 (Reference 31). The 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 which will provide a description of how the requirements of the Order will be achieved. This document provides the Overall Integrated Plan (OIP) for complying with Order EA-13-109 using the methods described in NEI 13-02 and endorsed by NRC JLD-ISG-2013-02 and JLD-ISG-2015-01. Six month progress reports will be provided consistent with the requirements of Order EA-13-109.

The submittals required are:

- OIP for Phase 1 of EA-13-109 was required to be submitted by Licensees to the NRC by June 30, 2014. The NRC requires periodic (6 month) updates for the HCVS actions being taken. The first update for Phase 1 was due December 2014, with the second due June 2015.
- OIP for Phase 2 of EA-13-109 is required to be submitted by Licensees to the NRC by December 31, 2015. It is expected the <u>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.</u>
- 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.

<u>Note</u>: 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 Phase 1 and 2 until each phase is in compliance. Exelon has not selected this option.

The Quad Cities venting actions for the EA-13-109, Phase 1 severe accident 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 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 Parameters of Pressure and Suppression Pool Level from the MCR instrumentation to monitor effectiveness of the venting actions.
- The vent operation will be monitored by HCVS valve position, temperature and effluent radiation levels.
- The HCVS motive force will be monitored and have the capacity to operate for 24 hours with installed equipment. Replenishment of the motive force will be by use of portable equipment prior to the installed motive force being exhausted.
- Venting actions will be capable of being maintained for a sustained period of up to 7 days.

The Phase 2 actions can be summarized as follows:

- Utilization of Severe Accident Water Addition (SAWA) to initially inject water into the Reactor Pressure Vessel (RPV). 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 Suppression Pool level to ensure the HCVS (Phase 1) Wetwell vent (SAWV) will remain functional for the removal of decay heat from containment.
- Ensure that the decay heat can be removed from the containment for seven (7) days using the HCVS or describe the alternate method(s) to remove decay heat from the containment from the

time the HCVS is no longer functional until alternate means of decay heat removal are established that make it unlikely the Drywell vent will be required for DW pressure control.

- The SAWA and SAWM actions will be manually activated and controlled from areas that are accessible during severe accident conditions.
- Parameters measured should be Drywell pressure, Suppression Pool level, SAWA flowrate and the HCVS parameters listed above.

<u>Note:</u> 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 Quad Cities with no known deviations to the guidelines in JLD-ISG-2013-02, JLD-ISG-2015-01,and NEI 13-02 for each phase as follows:

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

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

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

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

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

The following extreme external hazards screen in for Quad Cities:

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

The following extreme external hazards screen out for Quad Cities:

- 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 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 8 hours with a calculation limiting value of approximately 10.6 hrs). (NEI 12-06, section 3.2.1.3 item 8, and Ref. 40)

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 109-2 below for clarity on SAWA)(HCVS-FAQ-11)

Part 1: General Integrated Plan Elements and Assumptions

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 Reactor Pressure Vessel (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 portable air supply equipment that is credited to recharge air lines for HCVS components after 24 hours. The FLEX portable air supply used must be demonstrated to meet the "SA Capable" criteria 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).

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 component's 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 this is not required is the order postulates an unsuccessful mitigation of an event such that an ELAP progresses to a severe accident 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 nitrogen 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 severe accident conditions.

Part 1: General Integrated Plan Elements and Assumptions

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 Overall Integrated Plan 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 Main Control Room 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 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 Severe Accident impacts are assumed on one unit only due to the site compliance with NRC Order EA-12-049. However, each BWR Mk I and II under the assumptions of NRC Order EA-13-109 ensure the capability to protect containment exists for each unit. (HCVS-FAQ-01) This is further addressed in HCVS-FAQ-10.

Part 1: General Integrated Plan Elements and Assumptions

Plant Specific HCVS Related Assumptions/Characteristics:

Quad Cities-1	EA- 12-049 (FLEX) actions to restore power are sufficient to ensure continuous operation of non-dedicated containment instrumentation identified in the section titled Part 2: Boundary Conditions for WW Vent – BDBEE Venting. FLEX DG power is also credited with the back-up capability stipulated in EA-13-109 requirement 1.2.5 for opening the upstream Torus PCIV.
Quad Cities -2	Although Quad Cities screens in for the Combined Maximum River Flood, HCVS will not be required due to the Station's response to this event. The Station will have advanced warning of the River Flood, and will be in cold shutdown via normal procedures, with the two Reactor Vessels disassembled and flooded up to the refueling cavity and combined with the Spent Fuel Pool, prior to water going above plant grade. Therefore, since Primary Containment will no longer be intact during this event, the HCVS and SAWA will not be required.
Quad Cities -3	Modifications that allow a FLEX generator to recharge the HCVS battery are assumed to have been installed such that a FLEX generator can be credited for HCVS operation beyond the initial 24-hour sustained operational period.
Quad Cities -4	Actions from the MCR will be initiated to manually breach the rupture disk if required for anticipatory venting during an ELAP. Anticipatory venting only to be done during non-Severe Accident conditions.
Quad Cities -5	The Plant layout of buildings and structures are depicted in Sketches 3.2.C and 3.3.B. The MCR is located on the third floor of the Service Building. The Turbine Building is between the Reactor Building and the MCR. The Turbine Building has substantial structural walls and features independent of the Reactor Building, and the Unit 1 Drywell is between the vent path and the MCR. The HCVS vent routing external to the Reactor Building is indicated on Sketch 3.3.D, and runs horizontally to a tower structure, and then vertically to a height above the Reactor Building.
Quad Cities -6	The HCVS external piping is all above 30-feet from ground level, except for two berms that will not have potential tornado missiles. The piping consists solely of large bore (12-inches nominal diameter) piping and its piping supports, and the pipe has less than 300 square feet of vertical cross section. The HCVS external piping meets the reasonable protection requirements of HCVS-WP-04. The external support structure used to support the HCVS piping is analyzed to the Quad Cities design basis tornado missiles to preclude a failure of the tower due to tornado winds and missiles.

Part 2: Boundary Conditions for Wetwell Vent – General

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 containment purge exhaust at each Quad Cities unit consists of a Wetwell Primary Containment Isolation Valve (PCIV), a DW PCIV, and a common downstream PCIV. The HCVS flow path will utilize portions of this system. The HCVS will connect between the two containment purge exhaust PCIVs. Consequently, the HCVS flow path will share the upstream PCIVs with the containment purge system, but it will have a downstream PCIV dedicated to the HCVS flow path. The new HCVS flow path will have a rupture disc downstream of the last PCIV on the HCVS line to serve as the secondary containment leakage barrier.

Each unit will have piping that is totally separate from the other unit and with no interconnected systems downstream of the new PCIV. The discharge from each unit is routed separately, and discharges above the Reactor Building roof.

Each of the two Quad Cities units will have a dedicated motive power (Pressurized N_2) for HCVS valves, dedicated Argon Purge system, and a common DC power supply for HCVS components that are not shared with any other function, and do not rely on FLEX, with the clarifications that (1) existing containment instrumentation (pressure and Suppression Pool level) are not considered HCVS components, and power will be maintained through the actions for EA-12-049 and (2) a FLEX DG may be used for recharging the HCVS battery after the 24-hour design mission time.

The operation of the HCVS will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1. Initial operator actions will be completed by trained plant personnel and will include the capability for remote-manual initiation from the HCVS control station. A list of the remote manual actions performed by plant personnel to open the HCVS vent path can be found in the following table (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 – General

Table 2-1 HCVS Remote Manual Actions

Primary Action	Primary Location / Component	Notes
1. Energize the HCVS power supply to the HCVS components.	Main Control Room (MCR)	This action is not required for operation at the Remote Operating Station (ROS).
2. Enable the N_2 motive gas for the HCVS valves and enable Argon purge supply.	ROS	Alternate control via manual valves at the ROS.
3. Check shut the DW PCIV 1(2)-1601-23, the downstream PCIV to the containment purge exhaust 1(2)-1601-24, and downstream PCIV to the SGTS 1(2)-1601-63.	MCR	Precautionary steps; these valves are normally shut and fail shut.
4. Breach the Rupture Disc by opening the Argon Purge Line for the specified amount of time.	MCR	
5. Open Wetwell PCIV 1(2)-1601-60.	MCR	Alternate control via manual valves at the ROS.
6. Open the downstream PCIV AO 1(2)-1699-98 on the HCVS line.	MCR	Alternate control via manual valves at the ROS.
7. Align FLEX Generator to maintain power to Station Battery.	As described in response to EA-12-049	Prior to depletion of Station Battery. Required to maintain power to containment instrumentation. Also, credited for satisfying Requirement 1.2.5 of the SACV order.
8. Align generator to HCVS battery charger.	At ROS	Generator may be aligned by selecting battery charger alternate power supply from MCC 19-3.
9. Replace N_2 motive power bottles or align portable compressor. Replace Argon purge gas bottles.	ROS	Prior to 24 hours. Argon replenishment required only following severe accident conditions.

Part 2: Boundary Conditions for Wetwell Vent – General

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 a based upon the action response times developed for FLEX when utilizing anticipatory venting in a BDBEE 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.

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

- At 5.3 hours, initiate use of Hardened Containment Vent System (HCVS) per site procedures to maintain containment parameters below design limits and within the limits that allow continued use of RCIC. 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 a dedicated power source, and HCVS valves are supplied with motive force from portable nitrogen bottles. HCVS controls and instrumentation will be DC powered. Valves will be operable from the HCVS control panel in the MCR, or at the ROS. DC power and motive air will be available for 24 hours from permanent sources. Containment pressure and WW level indication will be initially powered from existing 1E Station battery and maintained by FLEX generators. Thus, initiation of the HCVS from the MCR or the ROS within 5.3 hours is acceptable because the actions can be performed any time after declaration of an ELAP until the venting is needed for BDBEE venting. This action can also be performed for SA HCVS operation, which occurs at a time shown in Attachment 2A.
- "Anticipatory Venting" refers to the action of venting Primary Containment before a containment limit requiring venting is reached (i.e., Primary Containment Pressure Limit) in anticipation of a future need to vent containment. EPG Revision 3 permits "Anticipatory Venting" when primary containment pressure cannot be maintained below the Drywell pressure scram setpoint, if the action is needed either to "maintain adequate core cooling" OR to "reduce the total offsite radiation dose." As discussed in the BWROG Appendix B "Technical Bases", venting below the Primary Containment Pressure Limit may be appropriate to restore and maintain adequate core cooling if:

  1) Pressure must be reduced to permit RPV injection.

  2) The suppression pool approaches saturation conditions and can no longer effectively condense steam discharged from RCIC.
- The response for a Local Intense Precipitation (LIP) event will delay the deployment of the FLEX equipment from the storage building due to the water levels surrounding the Turbine, Reactor, and FLEX buildings. As the water levels drop, operators will be dispatched to perform the necessary actions to connect the FLEX support equipment. Based on the LIP studies it is anticipated that the connections of the FLEX equipment will be completed at T= 10 hours. This is only for a BDBEE that does not progress to a Severe Accident, which will require water injection at 8 hours. See the section 3.1 detailing Boundary Conditions for SAWA.

Part 2: Boundary Conditions for Wetwell Vent – General

- Within 24 hours, the permanently installed nitrogen bottles at the ROS will be replaced, as required, to maintain sustained operation or alternatively a portable compressor will be connect 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, as required, to maintain sustained operation. Note that purging is only required if venting hydrogen following Severe Accident conditions.
- Current Quad Cities' IE battery durations are calculated to last at least 8 hours (Ref. 40). FLEX DG will be staged with 480VAC power restored at approximately 5 hours (Ref. 1 Timeline). Thus, the FLEX DGs will be available to be placed in service at any point after staging as required to supply power to containment parameters (containment pressure and WW level). A FLEX DG (one per unit) will be maintained in on-site FLEX storage buildings. DG will be transferred and staged via haul routes and staging areas evaluated for impact from external hazards.
- The FLEX Diesel Generators are expected to be available within 24 hours from the start of the event and after charging the Station Batteries, allowing the dedicated HCVS battery charger to be connected via transfer switch through MCC 19-3 to the generators, maintaining sustained operation. This can be performed any time prior to 24 hours; therefore, this time constraint is not limiting. Modifications will be implemented to facilitate the connections and operational actions required to supply power any time after declaration of an ELAP until the repowering is needed at greater than 24 hours.

<u>Discussion of radiological, temperature, other environmental constraints identified in Attachment 2A</u>

- Actions to initiate HCVS operation are taken from the MCR or from the ROS in the Turbine Building. Both locations have significant shielding and/or physical separation from radiological sources. Non-radiological habitability for the MCR is being addressed as part of the Quad Cities FLEX response.
- Before the end of the initial 24-hour period, replenishment of the HCVS dedicated DC power, Argon purge gas, and PCIV motive power (pressurized gas) will occur at the ROS. The selection of the ROS location will take into account the Severe Accident temperature and radiation conditions to ensure access to the ROS is maintained. The design will allow replenishment with minimal actions.

ISE Open Item - 4: Confirm that the ROS will be in an area accessible following a SA (Attachment 7).

Part 2: Boundary Conditions for Wetwell Vent – General

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 – General

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 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 – General

Vent Size and Basis

The HCVS flow path is designed for venting steam/energy from the suppression pool at a nominal capacity of 1% of the currently licensed power, 2957 MWt thermal power at pressure of 53 psig. This pressure is the lower of the containment design pressure and the Primary Containment Pressure Limit (PCPL) value assuming nominal Suppression Pool water level.

The nominal diameter is 18 inches through the upstream PCIV that is shared with the containment purge exhaust, and 12 inches for the downstream portion. The 12-inch diameter portion includes the downstream PCIV and rupture disc. Refer to Sketch 3.2.A, the P&ID. This line will be verified to meet the Order criteria for 1%.

ISE Open Item - 6: Provide analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (Attachment 7).

Vent Capacity

The 1% value at Quad Cities assumes that the Suppression Pool pressure suppression capacity is sufficient to absorb the decay heat generated during the first 3 hours. The vent would then be able to prevent containment pressure from increasing above the PCPL. As part of the detailed design, the duration of Suppression Pool decay heat absorption capability was confirmed to exceed 3 hours (Ref. 24).

Vent Path and Discharge

The Quad Cities Station HCVS vent path will consist of a separate Wetwell vent for each unit. The upstream portion consists of 18-inch nominal diameter piping and the upstream PCIV that is shared with the containment purge exhaust path and exhaust to the Standby Gas Treatment system (SGTS). The downstream portion consists of 12-inch nominal diameter piping and includes the downstream PCIV and the rupture disc. The downstream PCIV and rupture disc are dedicated to the HCVS function. The rupture disc is credited as the secondary containment isolation barrier. The 12-inch diameter vent lines (one per unit) are initially routed horizontally through the Reactor Building to penetrate side-by-side through the east wall at approximately 49 feet above nominal plant ground elevation (Ref. 38). This line is then routed vertically on the outside of the Reactor Building to a point above the top of the Reactor Building. There are no interconnected systems downstream of the first PCIV and there is no sharing of any flow path between the two units.

The HCVS discharge path is being routed to a point above any adjacent structure. This discharge point is just above that unit's Reactor Building and will follow the guidance of FAQ- HCVS-04 (Reference 15) to the extent reasonably possible such that the release point will vent away from the Main Control Room location, location of HCVS portable equipment, access routes required following a ELAP and BDBEE, and emergency response facilities; however, these must be considered in conjunction with other design criteria (e.g., flow capacity) and pipe routing limitations, to the degree practical.

The external vertical piping for the two units will be run in close proximity to each other to allow a common external support structure. The external piping meets the criteria for tornado missile protection (refer to Quad Cities HCVS Assumption Quad Cities -6).

Part 2: Boundary Conditions for Wetwell Vent – General

Power and Pneumatic Supply Sources

All electrical power required for operation of HCVS components will be from a dedicated HVCS DC battery source with permanently installed capacity for the first 24 hours, and design provisions for recharging to maintain sustained operation.

Motive (pneumatic) power to the HCVS valves is provided by two dedicated banks of N_2 gas bottles with permanently installed capacity for the first 24 hours, and design provisions for replacing bottles and/or connecting a portable compressor to maintain sustained operation. The initial stored motive air/gas will allow for at least 8 vent cycles for the HCVS valves for the first 24 hours. The at least 8 vent cycles are defined as initially opening all valves in the Wetwell flow path, and then shutting and reopening one of the valves in the flow paths 7 times.

1. The HCVS flow path valves are air-operated valves (AOV). The existing, upstream PCIV is air-to-open and spring-to-shut. The new downstream PCIV will be air-to-open and spring-to-shut. Opening the valves from the HCVS control panel located in the MCR requires energizing a DC powered solenoid operated valve (SOV) and providing motive air/gas.
2. An assessment of temperature and radiological conditions will be performed to ensure that operating personnel can safely access and operate controls at the Remote Operating Station based on time constraints listed in Attachment 2A.
3. All permanently installed HCVS equipment, including any connections required to supplement the HCVS operation during an ELAP (i.e., DC power, argon purge gas, and motive force [pressurized N_2/air]) will be located in areas reasonably protected from defined hazards listed in Part 1 of this report. 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 (reference FAQ HCVS-03). The preferred method is opening from the MCR through the control switch which energizes the SOVs, in turn providing motive air to the AOVs. The back-up method for operating new and existing valves is from the ROS, by repositioning valves on the pneumatic supply; 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.
4. 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 Main Control Room (MCR) and in addition, opening PCIVs and the Argon purge system from the ROS in case of a DC circuit failure. The location for the ROS is Turbine Building Mezzanine Floor (619' elevation in Unit 1, 611' elevation in Unit 2) near the centerline. The MCR location is protected from adverse natural phenomena, and is the normal control point for Plant Emergency Response actions. The ROS will be evaluated to ensure acceptable temperature and dose consequences.

Part 2: Boundary Conditions for Wetwell Vent – General

Hydrogen

As required by EA-13-109, Section 1.2.11, the HCVS design will include an Argon purge system that will be connected just downstream of the second PCIV. It will be designed to prevent hydrogen detonation downstream of the second PCIV. The Argon purge system will have a switch for the control valve in the MCR to allow opening the purge for the designated time, but it will also allow for local operation in the ROS in case of a DC power or control circuit failure. The Argon purge will only be utilized following severe accident conditions when hydrogen is potentially 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 motive air 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 rupture disc setpoint. The MCR panel will include an indication of Argon pressure to the HCVS path to verify that the Argon purge system flow is occurring.

Unintended Cross Flow of Vented Fluids

Refer to Sketch 3.2.A, the HCVS P&ID. The HCVS piping in each unit is totally independent of the other unit's HCVS flow path. The upstream 18-inch nominal diameter portion isolates any interconnected, non-HCVS systems in that unit through normally shut, air-operated PCIVs that, if open, will automatically shut. The new downstream PCIVs are AOVs that are air-to-open and spring-to-shut. The downstream dedicated 12-inch portion does not have any interconnected systems. This precludes unintended cross flow of vented fluids.

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, such that any credited containment accident pressure (CAP) that would provide net positive suction head to the emergency core cooling system (ECCS) pumps will be available (inclusive of a design basis loss-of-coolant accident (DBLOCA)). However, the ECCS pumps will not have power available, because of the starting boundary conditions of an ELAP. Note that Quad Cities credits CAP for its DBLOCA.

The features that prevent inadvertent actuation are integral to two PCIVs in series with a downstream rupture disc. They are air-to-open / spring-to-shut, fail-shut AOVs that require energizing (or manually overriding) a SOV to allow the motive air to open the valve. The power to the SOVs is normally disabled by key-locked switch. The motive air (N_2) is normally isolated by a locked closed valve. HCVS operation of each PCIV will require unlocking and opening the isolation valve to the motive air, followed by either dedicated operation of a key-locked switch or manual override of several SOVs in sequence.

Part 2: Boundary Conditions for Wetwell Vent – General

Component Qualifications

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

HCVS components that are part of the containment pressure boundary will be 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. During normal or design basis operations, this means serving as a pressure boundary to prevent release of radioactive material. HCVS components downstream of the containment pressure boundary (i.e., downstream of the downstream PCIV) will not be Safety Related.

The HCVS components (SOVs and new instrumentation) will be powered from a normally de-energized, dedicated power supply that will not be Safety Related, but will be considered Augmented Quality. HCVS electrical or controls components that interface with Class 1E power sources will be considered Safety Related up to and including appropriate isolation devices such as fuses or breakers, since their failure could adversely impact containment isolation and/or a Safety Related power source. The installation of the remaining equipment will be considered Augmented Quality. Newly installed piping and valves will be seismically qualified to handle the forces associated with the Safe Shutdown Earthquake (SSE) back to their isolation boundaries. Electrical and controls components will be seismically qualified and will include the ability to handle harsh environmental conditions (although they will not be considered part of the site Environmental Qualification (EQ) program).

HCVS instrumentation performance (e.g., accuracy and precision) need not exceed that of similar plant installed equipment. Additionally, radiation monitoring instrumentation accuracy and range will be sufficient to determine core conditions (i.e., no core damage thru severe 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.

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
HCVS Argon System Purge Pressure	ISO9001 / IEEE 344-2004 / Demonstration

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

ISE Open Item – 13 : Complete evaluation for HCVS instrumentation qualification

Part 2: Boundary Conditions for Wetwell Vent – General

Monitoring of HCVS

The Quad Cities Wetwell HCVS will be capable of being remote-manually operated during sustained operations from a control panel located in the main control room (MCR), and will meet the requirements of Order element 1.2.4. The MCR is a readily accessible location with no further evaluation required (Generic Assumption 109-12). Additionally, to meet the requirement of EA-13-109, Section 1.2.5, an accessible Remote Operating Station (ROS) will also be incorporated into the HCVS design as described in NEI 13-02, Section 4.2.2.1.2.1. The controls and indications at the ROS location will be accessible and functional under a range of plant conditions, including Severe Accident conditions, with due consideration to source term and dose impact on operator exposure, Extended Loss of AC Power (ELAP), and inadequate containment cooling. An evaluation will be performed to determine accessibility to the ROS location, habitability, staffing sufficiency, and communication capability with Vent-use decision makers.

The Wetwell HCVS will include means to monitor the status of the vent system in the MCR, and to monitor DC power, Argon pressure, and N_2 pressure at the ROS. The proposed design for the HCVS includes control switches in the MCR with valve position indication. The HCVS controls will meet the environmental and seismic requirements of the Order for the plant Severe Accident with an ELAP. The ability to open/close these valves multiple times during the event's first 24 hours will be provided by dedicated motive air and DC power. Beyond the first 24 hours, the ability to maintain these valves open or closed will be maintained by sustaining the motive air and DC power.

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

Other instrumentation that supports HCVS function will be provided in the MCR. This includes existing containment pressure and Suppression Pool level indication. 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

Unless otherwise required to be Safety Related, Augmented Quality requirements will be applied to the components installed in response to this Order.

Non-Safety Related piping, electrical power supply, valve actuator pneumatic supply, and instrumentation (local and remote) components, will be designed/analyzed to conform to the requirements consistent with the applicable design codes (e.g., Non-Safety, Seismic Category 1, B31.1) for the plant and to ensure functionality following a design basis earthquake.

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

Conduit design and/or cable trays will be installed to Seismic Class 1 criteria.

If the instruments are purchased as commercial-grade equipment, they will be qualified to operate under Severe Accident environment as required by NRC Order EA-13-109 and the guidance of NEI 13-02. These qualifications will be bounding conditions for Quad Cities.

Part 2: Boundary Conditions for Wetwell Vent – General

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

- 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).
- Seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location.

Part 2: Boundary Conditions for WW Vent – BDBEE Venting (FLEX Support)

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

Ref: EA-13-109 Section 1.1.4 /NEI 13-02 Section 2.2

First 24-Hour Coping Detail

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

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

The operation of the HCVS will be designed to minimize reliance on operator actions for response to an ELAP and Severe Accident events. Immediate operator actions will be completed by qualified plant personnel from either the MCR or the HCVS ROS using remote-manual actions. 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, Argon purge gas, and motive air/gas capability 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 Main Control Room and controlled by procedures,
AND
Disabling the HCVS DC power to the SOVs and disabling the motive power (pressurized N_2) for the dedicated PCIV, except when required by procedures to initiate containment venting,
AND
A rupture disc downstream of the PCIVs with a design pressure of 10 psid or more.

Part 2: Boundary Conditions for WW Vent – BDBEE Venting (FLEX Support)

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-hour initial phase, available personnel will be able to connect supplemental air/gas for the motive air and purge systems. Connections for supplementing electrical power and air/gas required for HCVS will be located in accessible areas with reasonable protection per NEI 12-06 that minimize personnel exposure to adverse conditions for HCVS initiation and operation. Connections will be pre-engineered quick disconnects to minimize deployment time.

FLEX is credited solely to sustain power for a BDBEE ELAP to containment instruments used to monitor the containment (e.g., pressure and Wetwell level). The response to NRC EA-12-049 will demonstrate the capability for FLEX efforts to maintain the power source. Habitability of FLEX equipment locations shall be verified for Severe Accident conditions.

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.

A Primary Containment Control Flowchart will be provided to direct Operations in protection and control of containment integrity, including use of the existing Hardened Containment Vent System.

These flowcharts were 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.

ISE Open Item – 14: Provide procedures for HCVS Operation. (Attachment 7)

Part 2: Boundary Conditions for WW Vent – BDBEE Venting (FLEX Support)

Identify modifications:

List modifications and describe how they support the HCVS Actions.

EA-12-049 Modifications

- FLEX modifications provide connection points to allow a FLEX diesel generator to be connected to the 480V MCC busses. This will allow the DG via a transfer switch to MCC 19-3 to power the HCVS battery charger.

EA-13-109 Modifications

- A modification will be required to install the new Wetwell vent piping, including the new downstream PCIV and rupture disc. A leak path upstream of the rupture disc controls primary containment leakage during a design basis LOCA through a three-way ball valve, which is positioned to route Argon to the space between the rupture disc and the PCIV during a BDBEE. The new PCIV valve will include valve position indication and remote-manual control only. There is no sharing of any flow paths with the opposite unit.
- A modification will be required to allow operation of the existing upstream Wetwell PCIV. This includes the capability to override a containment isolation signal. Reopening the valves following a BDBEE will be remote-manual.
- A modification will be required to install the dedicated battery needed to supply power to both units' HCVS for the first 24 hours, including capability for recharging from a battery charger powered from MCC 19-3 at or before 24 hours. The battery will be located at the ROS.
- A modification will be required to install the dedicated motive power (pressurized N_2 gas) needed to open the HCVS valves for the first 24 hours, including capability for replacing N_2 bottles or connection to a portable compressor after 24 hours. The N_2 bottles will be located at the ROS.
- A modification will be required to install the dedicated Argon purge system needed to prevent hydrogen detonation in the piping, with sufficient installed capacity for the first 24 hours, including capability for replacing Argon bottles or refilling from an Argon supply after 24 hours. The Argon bottles will be located at the ROS. Note that the Argon purge system is only required following Severe Accident conditions. It is not required if core damage is prevented.
- A modification will be required to add (a) HCVS flow path instrumentation consisting of temperature and effluent radiation in the MCR and (b) Motive power, Nitrogen gas pressure, Argon Purge gas pressure, and DC battery Indication in the MCR and the ROS.

Part 2: Boundary Conditions for WW Vent – BDBEE Venting (FLEX Support)

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. Indication for these parameters will be installed in the MCR or ROS to comply with EA-13-109:

Key Parameter	Component Identifier	Indication Location
HCVS Effluent temperature	TI 1(2)-1603-12 (new)	MCR
HCVS Effluent radiation	RI 1(2)-1603-22 (new)	MCR
HCVS upstream valve position indication	1(2)-1601-60 (existing)	MCR
HCVS downstream valve position indication	1(2)-1699-98 (new)	MCR
HCVS DC Power Voltage/Conditions	1-1606-24 (new)	ROS Batt Chrgr
HCVS Pneumatic supply pressure	PI 1(2)-1604-40 (new)	ROS
HCVS Purge System pressure	PI 1(2)-1605-47/45 (new)	MCR/ROS

Initiation and cycling of the HCVS will be controlled based 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
Drywell pressure (existing)	PI 1(2)-1640-11A/B	MCR
Wetwell level (existing)	LI 1(2)-1640-10A/B	MCR

Notes: None

Part 2: Boundary Conditions for WW Vent – Severe Accident Venting

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

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

First 24 Hour Coping Detail

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

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

The operation of the HCVS will be designed to minimize the reliance on operator actions for response to an ELAP and Severe Accident events. A Severe Accident event assumes that specific core cooling actions from the FLEX strategies identified in the response to Order EA-12-049 were not successfully initiated. Access to the Reactor Building will be restricted as determined by the RPV water level and core damage conditions. Immediate actions will be completed by operators in the MCR, and will include remote-manual actions. The ROS provides back-up capability to open HCVS valve(s) in case of a valve circuit or SOV failure. The operator actions required to open a vent path were previously listed in the BDBEE Venting Part 2 section of this report (Table 2-1).

Permanently installed power, Argon purge, and motive air/gas capable will be available to support operation and monitoring of the HCVS for 24 hours. Specifics are the same as for BDBEE Venting Part 2.

System control:

i. Active: Same as for Part 2: Boundary Conditions for WW Vent – BDBEE Venting.
ii. Passive: Same as for Part 2: Boundary Conditions for WW Vent – BDBEE Venting

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 BDBEE Venting Part *2*.

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

Part 2: Boundary Conditions for WW Vent – Severe Accident Venting

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 Severe Accident conditions as for BDBEE conditions. Existing guidance in the SAMGs directs the plant staff to consider changing radiological conditions in a Severe Accident.

Identify modifications*:*

List modifications and describe how they support the HCVS Actions.

Modifications are the same as for Part 2: Boundary Conditions for WW Vent – BDBEE Venting.

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 Part 2: Boundary Conditions for WW Vent – BDBEE Venting.

Notes: None

Part 2: Boundary Conditions for WW Vent – Support Equipment Functions

Determine venting capability support functions needed

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

BDBEE Venting

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

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

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

Venting to prevent a containment overpressure condition will be maintained by permanently installed equipment. The HCVS dedicated DC power source, Argon purge gas, and dedicated valve motive force is adequate for the first 24 hours, but can be replenished to support sustained operation.

Existing Safety Related Station Batteries will provide sufficient electrical power for MCR containment instrumentation for greater than 8 hours. Before the Station Batteries are depleted, the response detailed in Order EA-12-049 will be credited to maintain DC bus voltage.

Severe Accident Venting

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

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

The same support functions that are used in the BDBEE scenario would be used for Severe Accident venting. The ROS (the location of the HCVS DC power source, Argon purge, and motive force) and the FLEX DG location will be evaluated to confirm accessibility under severe accident 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 Severe Accident conditions as for BDBEE conditions. Existing guidance in the SAMG directs the plant staff to consider changes in radiological conditions in a Severe Accident.

Identify modifications*:*

List modifications and describe how they support the HCVS Actions.

The same as for Part 2: Boundary Conditions for WW Vent – BDBEE Venting.

Part 2: Boundary Conditions for WW Vent – Support Equipment Functions

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 Part 2: Boundary Conditions for WW Vent – BDBEE Venting.

Notes: None

Part 2: Boundary Conditions for WW Vent – Venting Portable Equipment Deployment

Determine venting capability portable equipment deployment needed

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 Reactor Building or in the vicinity of the HCVS piping.

Before the end of the initial 24-hour period, replenishment of the HCVS dedicated DC power, Argon purge gas, and motive power (pressurized gas) will occur at the ROS. The selection of the ROS location will take into account the Severe Accident temperature and radiation condition to ensure access to the ROS is maintained. 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 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 °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 in conjunction with 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 619' (Unit 1) or 611' (Unit 2) elevation of the Turbine Building.

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

Part 3.1: Boundary Conditions for SAWA – General

Table 3.1 – SAWA Manual Actions

Primary Action	**Primary Location/ Component**	**Notes**
1. Establish HCVS capability in accordance with Part 2 of this OIP.	• MCR and ROS.	• Applicable to SAWA/SAWM strategy.
2. Align flow path from SAWA pump discharge to injection piping.	• ½ Unit Reactor Building Trackway (ground level) valve manifold. • FLEX Storz connections in Reactor Building.	• Underground buried pipe from Seismic Deep Well head necessary as a result of time for deployment during Local Intense Precipitation (LIP). • Function of radiological assessment ***(ISE-4, Attachment 7)***.
3. Connect SAWA pump to power source.	• Seismic Deep Well head (added by EA-12-049). • FLEX DG inside robust FLEX building for LIP and tornado.	• Deep Well includes electrical submersible FLEX (SAWA) pump. • Submersible pump powered by dedicated FLEX DG. • Dedicated underground cable.
4. Power SAWA/HCVS components with second EA-12-049 (FLEX) generator.	• FLEX DG alternate deployment location at the northwest corner of the Turbine Building.	• FLEX primary deployment location in direct line-of-sight to the HCVS vent line.
5. Inject to RPV using SAWA pump.	• Remote-manually open motor operated RHR valves (MOV)s. • Flow control is by fire hose valves at Trackway manifold.	• MOVs energized through FLEX diesel. MOVs are not throttled for flow control. • Initial SAWA flow rate is 400 gpm starting 8 hours after event.
6. Monitor SAWA indications.	• Mechanical flow meters on SAWA hose at ½ Unit Trackway distribution manifold.	• Pump flow. • MOV valve position indication as per normal MCR RHR indicators.
7. Use SAWM to maintain availability of the WW vent (Part 3.1.A).	• RB ½ Unit Trackway at valve manifold.	• Monitor DW pressure and Suppression Pool level. • Control SAWA flow at valve manifold. • Vent line tap at top of Suppression Pool.

Part 3.1: Boundary Conditions for SAWA – General

Discussion of timeline SAWA identified items
HCVS operations are discussed under Phase 1 of EA-13-109 (Part 2 of this OIP).

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

Severe Accident Operation

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

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

It is anticipated that SAWA will be used in Severe Accident Events based on presumed failure of injection systems or presumed failure 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 motive force equipment needed to support the SAWA strategy shall be available prior to T = 8 hours from the loss of injection (assumed at T = 0).

The SAWA flow path includes methods to minimize exposure of personnel to radioactive liquids / gases and potentially flammable conditions by inclusion of backflow prevention. RHR LPCI injection mode has an installed ECCS check valve qualified for accident scenarios to prevent reverse flow from the RPV.

Quad Cities has acquired a MAAP analysis specific to comparison of venting during a Severe Accident with SAWA versus without SAWA (Ref. 30). A review of the two cases shows that Wetwell airspace temperature (the temperature at which the existing upstream PCIV would be exposed) initially peaks at 328°F, but remain at or below 300°F for the duration of the event in both cases. Due to the short duration of the initial peak, and the upstream PCIV remaining open for the duration of the event, no changes or modification to the upstream PCIV are warranted to increase reliability during a Severe Accident.

Part 3.1: Boundary Conditions for SAWA – General

Description of SAWA actions for first 24 hours:

Table 3.2 – SAWA Manual Actions Timeline

Time	Action	Notes
T < 1 hour	• Perform internal hose and valve Reactor Building alignment. *(Step 2 of Table 3.1)*.	• No evaluation required for actions inside Reactor Building.
T = 1-7* hours	• Complete actions started at T<1 hour *(Step 2 of Table 3.1)*. • Connect SAWA pump to power source *(Step 3 of Table 3.1)*. • Establish electrical power to HCVS and SAWA using EA-12-049 generator *(Step 4 of Table 3.1)*. • Establish flow of at least 400 gpm to the RPV using SAWA systems *(Step 5 of Table 3.1)*.	• Evaluate core gap and early in-vessel release impact to Reactor Building access for SAWA actions. It is assumed that Reactor Building access is limited due to the source term at this time unless otherwise noted. (Refer to HCVS-FAQ-12 for actions in T=1-7 hour timeframe.)
T ≤ 8-12 hours	• Monitor and maintain SAWA flow at 400 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 motive force is 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 80 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 Wetwell vent (see 3.1.A).

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

Part 3.1: Boundary Conditions for SAWA – General

Equipment Locations/Controls/Instrumentation

Quad Cities has not performed a site specific MAAP evaluation to justify the use of a lower site unique initial SAWA flow rate. Consequently, Quad Cities will assume an initial flow rate of 400 gpm. This is based on the value equivalent to RCIC rated flow. This initial flow rate will be established within 8 hours of the loss of all RPV injection following an ELAP/Severe Accident and will be maintained for 4 hours before reduction to the Wetwell 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 severe accident conditions (temperature, humidity, radiation) for the Sustained Operating period. Equipment will be evaluated to remain operational throughout the Sustained Operating period. Personnel exposure and temperature / humidity conditions for operation of SAWA equipment will not exceed the limits for ERO dose and plant safety guidelines for temperature and humidity.

The flow path will be from the FLEX suction and the FLEX (SAWA) pump at the Seismic Deep Well, and through a valve manifold at the ½ Unit Trackway. The valve manifold will include valves with throttle capability and separate lines for Quad Cities Unit 1 RPV and Quad Cities Unit 2 RPV. This valve manifold will also provide minimum flow and freeze protection for the pump. This valve manifold is in a suitable location to allow access under severe accident conditions.

From this valve manifold, hose routes to the FLEX/SAWA injection points located in the Reactor Building 595' elevation, each isolated by a gate valve. The connection in the Reactor Building location are into the Condensate Transfer lines to the RHR/LPCI line to the RPV, and the Spent Fuel Pool assist line to the SFP. The gate valves will be opened within 4 hours to align water injection control at the valve manifold. Backflow in the LPCI line is prevented by an existing LPCI check valve.

Drywell (DW) pressure and Suppression Pool level will be monitored at existing MCR instrumentation, and SAWA flow rate will be adjusted by use of the control valve at the valve manifold, which also contains the SAWA flow indication. Communication will be established between the MCR and the SAWA flow control location at the ½ Unit Trackway.

Containment instrumentation required for SAWA will be powered from the Station Batteries via the Essential Services Bus. The Station Batteries are recharged by FLEX diesel generators connected in outside of the Unit 2 Turbine Building Trackway (the alternate deployment) as described in the EA-12-049 compliance documents. The MOVs will be operated in a load sequence with other loads to limit the potential for overloading the FLEX DGs. Refueling of the FLEX DG will be accomplished from the EDG fuel oil tanks as described in the EA-12-049 Fuel Oil Plan. The Seismic Deep Well is a significant distance from the HCVS pipe. Pump refueling will also be accomplished from the Unit 1 and Unit 2 EDG fuel oil tanks as described in the EA-12-049 Fuel Oil Plan, since both of these tanks have corners of the Reactor Building blocking line-of-sight to the HCVS external pipe. See mechanical and electrical sketches in the Attachments, plant layout sketches in the assumptions, and the list of actions elsewhere in this part.

Evaluations of actions outside the Reactor Building for projected Severe Accident conditions (radiation / temperature) will determine how 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 Reactor Building for projected Severe Accident conditions (radiation/temperature) will be performed to determine any time limit for personnel to complete the initial and support activities without exceeding the ERO-allowable dose for equipment operation or site safety standards (reference HCVS-FAQ-12).

Part 3.1: Boundary Conditions for SAWA – General

ISE Open Item - 4: Determine outside areas accessible following a SA, and determine where shielding may be needed (Attachment 7).

Electrical equipment and instrumentation will be powered from the power sources noted in the table below with portable generators to maintain battery capacities during the Sustained Operating period. The indications include (* are minimum required instruments):

Parameter	Instrument	Location	Power Source / Notes
DW Pressure*	PI 1(2)-1640-11A/B	MCR	ESS bus, initially powered by 250VDC battery and later via EA-12-049 generator and battery charger. RG 1.97 Cat. I
Suppression Pool Level*	LI 1(2)-1640-10A/B	MCR	ESS bus, initially powered by 250VDC battery and later via EA-12-049 generator and battery charger. RG 1.97 Cat. I
SAWA Flow*	FLEX (SAWA) Pump Flow indicator	½ Unit Trackway valve manifold	Mechanical flow meter.
Valve indications and controls	Existing MCR Panels	MCR	ESS bus, initially powered by 250VDC battery and later via EA-12-049 generator and battery charger.

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

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

Portable equipment will be protected by the robust FLEX Building built as part of EA-12-049 response, and is therefore already evaluated for all screened-in hazards.

Part 3.1: Boundary Conditions for SAWA – General

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. Alignment of SAWA pump discharge to RHR piping.
   - Open gate valves downstream of the ½ Unit Trackway manifold *(Step 2 of Table 3.1)*.
2. Connect SAWA pump to EA-12-049 (FLEX) generator using FSG*.
3. Power SAWA/HCVS components to EA-12-049 (FLEX) generator using FSG.
4. Verify other RHR modes are isolated using Control Room switches.
5. Open RHR MOVs to lineup injection to RPV using SAWA pump.
6. Start SAWA pump to establish SAWA flow.
7. Adjust SAWA flow at valve manifold and using SAWA flow indication to establish and maintain 400 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:

- FLEX (SAWA) power supply from EA-12-049 generator when access to well head precluded by Local Intense Precipitation.

Mechanical Modifications:

- Hard pipe discharge of FLEX (SAWA) Pump to permanently mounted ½ Unit Trackway valve manifold.

Instrument Modifications:

- SAWA flow instrument.

Structural Modifications:

- Protection of Seismic Deep Well head from Tornado Missiles.

Part 3.1: Boundary Conditions for SAWA – General

Component Qualifications:

State the qualification used for equipment supporting SAWA.

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

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

Notes:

None

Part 3.1.A: Boundary Conditions for SAWA/SAWM

Time periods for the maintaining SAWM actions such that the WW vent is not obstructed

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 Drywell vent to maintain pressure below PCPL.

Basis for SAWM time frame:

SAWM can be maintained >7 days:

Quad Cities has not performed a site specific evaluation to justify the use of a lower site unique initial SAWA flow rate. Consequently, Quad Cities will assume an initial flow rate of 400 gpm, based on equivalence to RCIC rated flow.

This initial flow rate will be established within 8 hours of the loss of all RPV injection following an ELAP/Severe Accident, and will be maintained for 4 hours before reduction to the Wetwell vent preservation flow rate of 80 gpm. The reason for this approach is to be within the capacity of the FLEX (SAWA) pump, so that the deployment time can be reduced as short as possible and within 8 hours.

Part 3.1.A: Boundary Conditions for SAWA/SAWM

Instruments relied upon for SAWM operations are Drywell Pressure, Suppression Pool level, and SAWA flow. Except for SAWA flow, SAWM instruments are initially powered Station Batteries, and then by the FLEX (EA-12-049) generator, which is placed in-service prior to core breach. The FLEX generator will provide power throughout the Sustained Operation period (7 days). The SAWA flow instruments are mechanical flow meters that do not require external power. Drywell Temperature monitoring is not a requirement for compliance with Phase 2 of the order, but some knowledge of temperature characteristics provides information for the Operations staff to evaluate plant conditions under a severe accident, and provide confirmation to adjust SAWA flow rates (C.7.1.4.2, C.8.3.1).

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

Procedures will be developed that control the Suppression Pool level, while ensuring the Drywell 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 Suppression Pool level and Drywell pressure 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 Suppression Pool Level and decay heat removal.	RB Trackway at valve manifold	• Control to maintain containment and WW parameters to ensure WW vent remains functional. • 80 gpm minimum capability is 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 (SAWA) pump	• SAWM flowrate and Suppression Chamber conditions will be monitored using the following instruments: – SAWA Flow – Suppression Pool Level – Drywell Pressure • SAWM flowrate will be controlled using the manual valve at the ½ Unit Trackway valve manifold.
3. Establish alternate decay heat removal.	Various locations	SAWM strategy can preserve the WW vent path for >7 days.
4. Secure SAWA / SAWM.	RB Trackway at valve manifold	When alternate decay heat removal is established.

<u>SAWM Time Sensitive Actions</u>

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

Part 3.1.A: Boundary Conditions for SAWA/SAWM

SAWM Severe Accident Operation

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

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

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

First 24 Hour Coping Detail

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

Given the initial conditions for EA-13-109:

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

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

SAWA will be established as described 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 DW pressure and Suppression Pool level. SAWM flowrate can be lowered to maintain containment parameters and preserve the WW vent path. SAWM will be capable of injection for the period of Sustained Operation.

Greater Than 24 Hour Coping Detail

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

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

SAWM can be maintained >7 days:

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 of Design Characteristics/Performance Specifications

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

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

Part 3.1.A: Boundary Conditions for SAWA/SAWM

Equipment Locations/Controls/Instrumentation

Describe location for SAWM monitoring and control.

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

The SAWM control location is the same as the SAWA control location. Local indication of SAWM flow rate is provided at the FLEX (SAWA) pump's mechanical flow meter that does not require external power. Communications will be established between the SAWM control location and the MCR.

Injection flowrate is controlled by manual valve located on the ½ Unit Trackway valve manifold.

Suppression Pool level and DW pressure are read in the control room using indicators powered by the Essential Services Bus from the 250 VDC Station Batteries, which are recharged via 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:

- Drywell Pressure
- Suppression Pool Level
- SAWM Flowrate

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

Notes: None

Part 3.1.B: Boundary Conditions for SAWA/SADV
Applicability of WW Design Considerations
This section is not applicable to Quad Cities.
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 Severe Accident defined in NRC Order EA-13-109 and the hazards applicable to the site per Part 1 of this OIP.
- Routes for transporting portable equipment from storage location(s) to deployment areas will be developed as the response details are identified and finalized. The identified paths and deployment areas will be accessible when the HCVS is required to be functional including during Severe Accidents.

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 control HCVS operating station (panel)
- training on operating the portable equipment
- testing of portable equipment

Quad Cities credits Containment Accident Pressure (CAP) for ECCS pump NPSH.

Part 4: Programmatic Controls, Training, Drills and Maintenance

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).

Quad Cities 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.
- 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 using the Systematic Approach to Training (SAT) process.

Part 4: Programmatic Controls, Training, Drills and Maintenance

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

Quad Cities 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, Quad Cities 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

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

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

Part 4: Programmatic Controls, Training, Drills and Maintenance

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.
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. PCIVs are maintained under Tech Spec Surveillances, a separate testing program.

Notes:
Per generic assumption 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]).

Part 5: Milestone Schedule

Provide a milestone schedule.
This schedule should include:

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

The dates specifically required by the order are obligated or committed dates. Other dates are planned dates subject to change. Updates will be provided in the periodic (six month) status reports.
Ref: EA-13-109 Section D.1, D.3 / NEI 13-02 Section 7.2.1

The following milestone 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	June 2014	Complete	
Submit Overall Integrated Implementation Plan	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.
U1 Design Engineering Complete	March 2016	Started	
U1 Implementation Outage	April 2017	Not Started	
U1 Maintenance and Operation Procedure Changes Developed, Training Complete, & Walk-Through Demonstration/Functional Test	April 2017	Not Started	
U2 Design Engineering Complete	March 2017	Not Started	
U2 Implementation Outage	April 2018	Not Started	
U2 Maintenance and Operation Procedure Changes Developed, Training Complete, & Walk-Through Demonstration/Functional Test	April 2018	Not Started	
Submit Completion Report	May 2018	Not Started	

Part 5: Milestone Schedule

Phase 2 Milestone Schedule

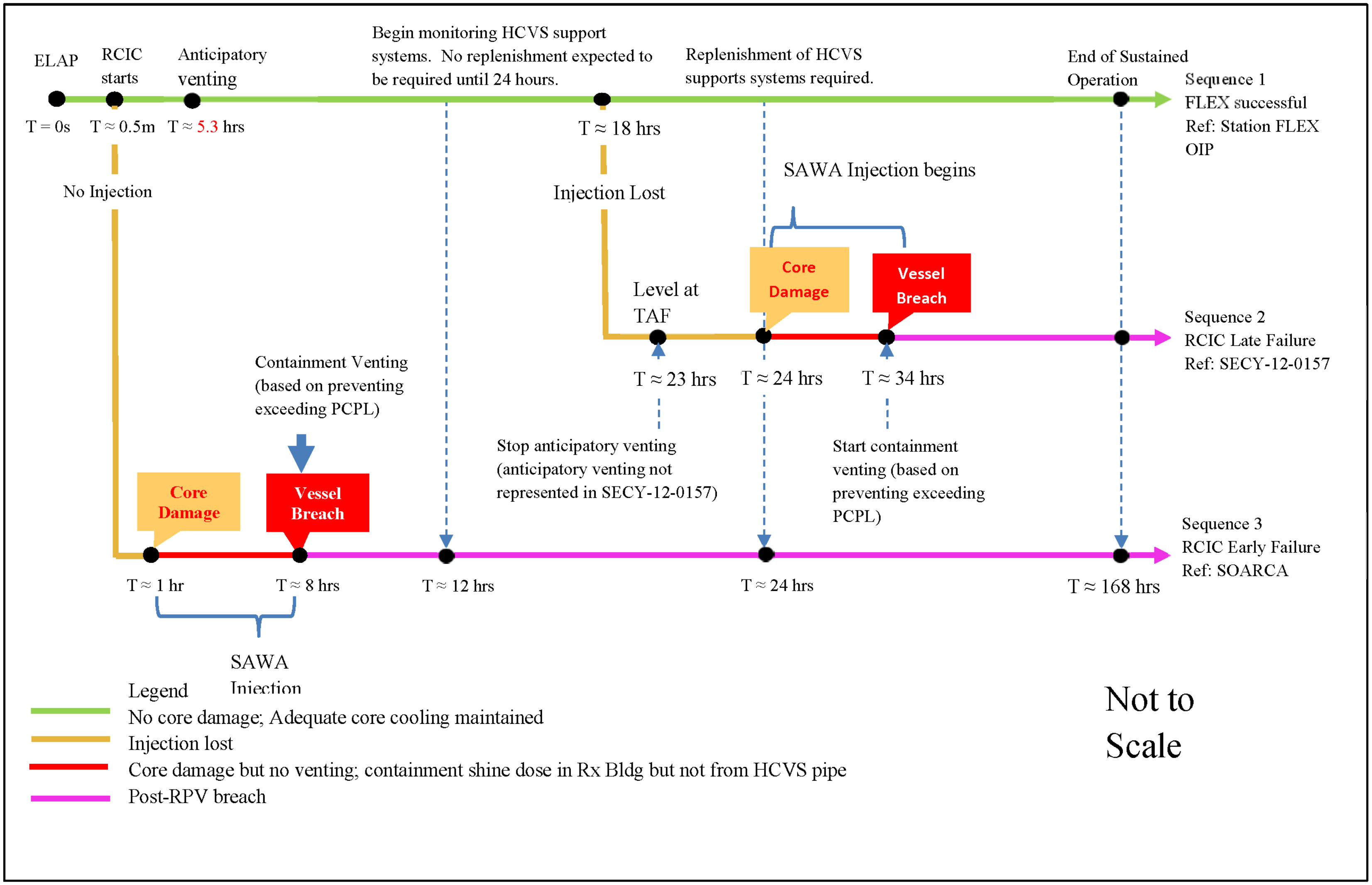
Milestone	Target Completion Date	Activity Status	Comments
Submit Overall Integrated Implementation Plan	Dec 2015	Complete with this submittal	Simultaneous with Phase 1 Updated OIP.
Hold preliminary/conceptual design meeting	Jan 2016	Not Started	Expect modifications.
Submit 6 Month Status Report	June 2016	Not Started	
Submit 6 Month Status Report	Dec 2016	Not Started	
Submit 6 Month Status Report	June 2017	Not Started	
Submit 6 Month Status Report	Dec 2017	Not Started	
Submit 6 Month Status Report	June 2018	Not Started	
Submit 6 Month Status Report	Dec 2018	Not Started	
U2 Design Engineering Complete	March 2017	Not Started	Conceptual design completed.
U2 Implementation Outage	April 2018	Not Started	Concurrent with Unit 1 Phase 1.
U2 Maintenance and Operation Procedure Changes Developed, Training Complete, & Walk-Through Demonstration/Functional Test	April 2018	Not Started	SAMG Revision; Concurrent with Unit 1 Phase 1.
U1 Design Engineering Complete	March 2018	Not Started	
U1 Implementation Outage	April 2019	Not Started	
U1 Maintenance and Operation Procedure Changes Developed, Training Complete, & Walk-Through Demonstration/Functional Test	April 2019	Not Started	
Submit Completion Report	May 2019	Not Started	

Notes:
None

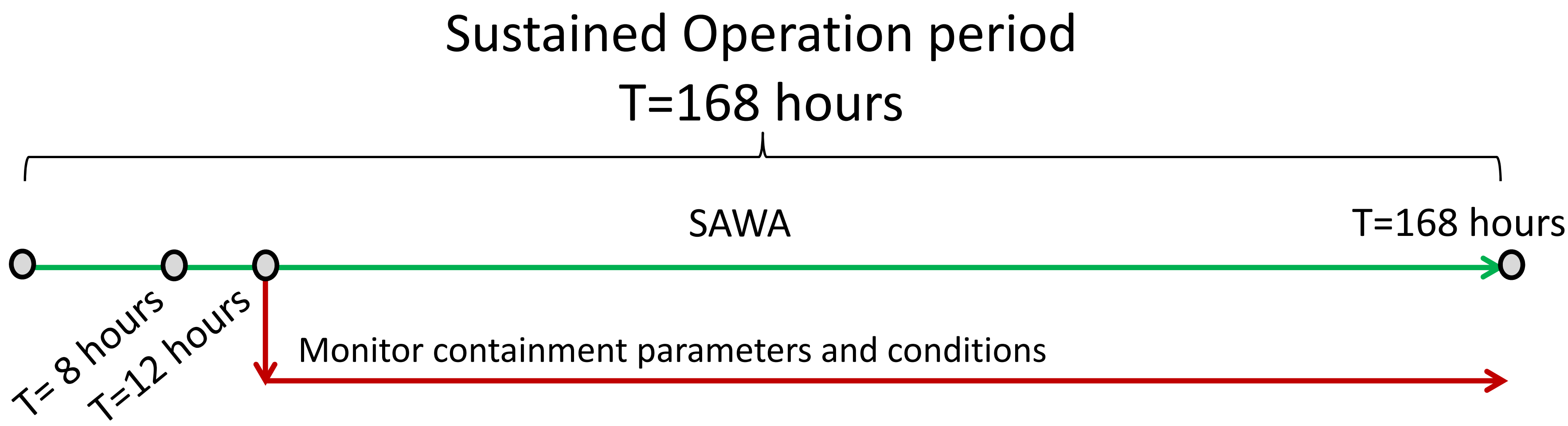
Attachment 1: HCVS/SAWA/SADV Portable Equipment

List portable equipment	*BDBEE Venting*	*Severe Accident Venting*	*Performance Criteria*	*Maintenance / PM requirements*
Nitrogen Cylinders	X	X	Two cylinders at 2640 psig (nominal), size TBD	Check periodically for pressure, replace or replenish as needed.
FLEX DG	X	X	500 kW @ 480 VAC	Per response to EA-12-049.
FLEX/SAWA Pump	X	X	400 gpm @ 200 psig	Per response to EA-12-049.
Argon Cylinders	X	X	16 cylinders at 2640 psig (nominal), size TBD	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



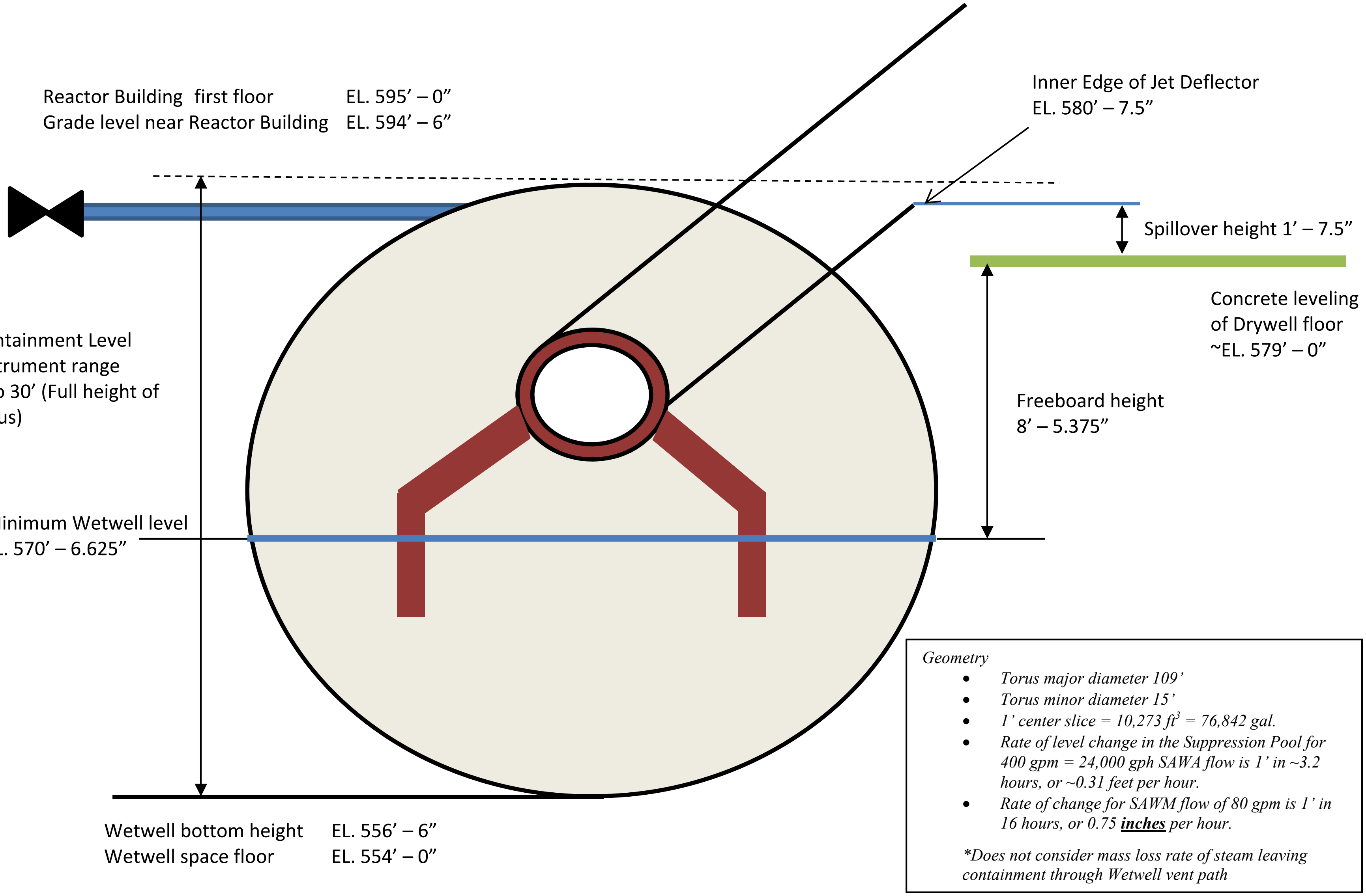
Time	Action
T=0 hours	Start of ELAP
T=8 hours	Initiate SAWA flow at 400 gpm as soon as possible but no later than 8 hours
T=12 hours	Throttle SAWA flow to 80 gpm 4 hours after initiation of SAWA flow
T=168 hours	End of Sustained Operation

Attachment 2.1.B: Sequence of Events Timeline – SADV

Not applicable to Quad Cities

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

(Unit 2 Geometry from Dwgs B-400 and B-404, Section A-A; Unit 1 similar)



Attachment 2.1.D: SAWM SAMG Approved Language

The following general cautions, priorities and methods will be evaluated for plant specific applicability and incorporated as appropriate into the plant specific SAMGs using administrative procedures for EPG/SAG change control process and implementation. SAMGs are symptom based guidelines and therefore address a wide variety of possible plant conditions and capabilities while these changes are intended to accommodate those specific conditions assumed in Order EA-13-109. The changes will be made in a way that maintains the use of SAMGs in a symptom based mode while at the same time addressing those conditions that may exist under extended loss of AC power (ELAP) conditions with significant core damage including ex-vessel core debris.

Actual Approved Language that will be incorporated into site SAMG*

Cautions:

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

Priorities:

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

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

Methods:

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

- Use controlled injection if possible.
- Inject into the RPV if possible.

Maintain injection from external sources of water as low as possible to preserve suppression chamber vent capability.

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

Attachment 3: Conceptual Sketches

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

Sketch 1A and 1B: Electrical Layout of System *(preliminary)*

- Instrumentation Process Flow.
- Electrical Connections.

Sketch 2A, 2B and 2C: P&ID Layout of WW Vent, Pathways and Site Layout *(preliminary)*

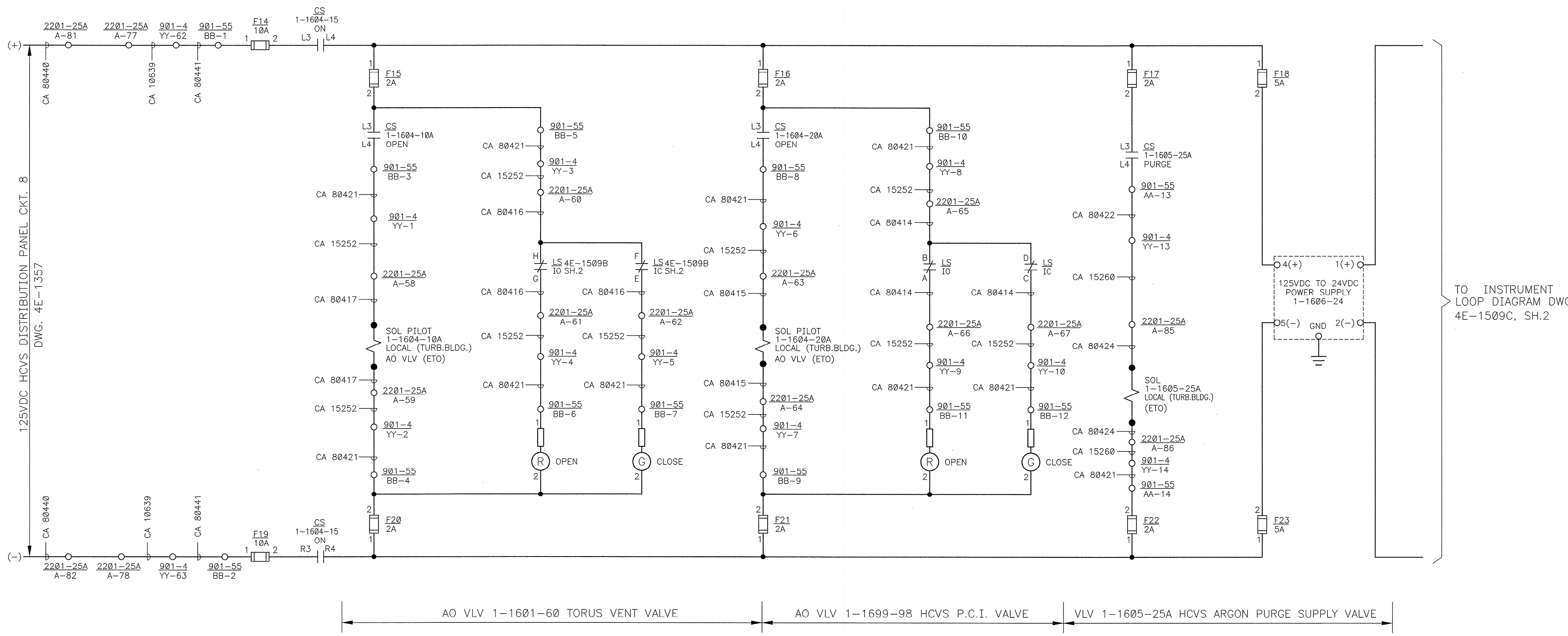
- Piping routing for vent path – WW Vent.
  - Demarcate the valves (in the vent piping) between the currently existing and new ones.
  - WW Vent Instrumentation Process Flow Diagram.
  - Egress and Ingress Pathways to ROS, Battery Transfer Switch, DG Connections and Deployment location.
  - Site layout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

Sketch 3: P&ID Layout of SAWA, Pathways and Site Layout *(preliminary)*

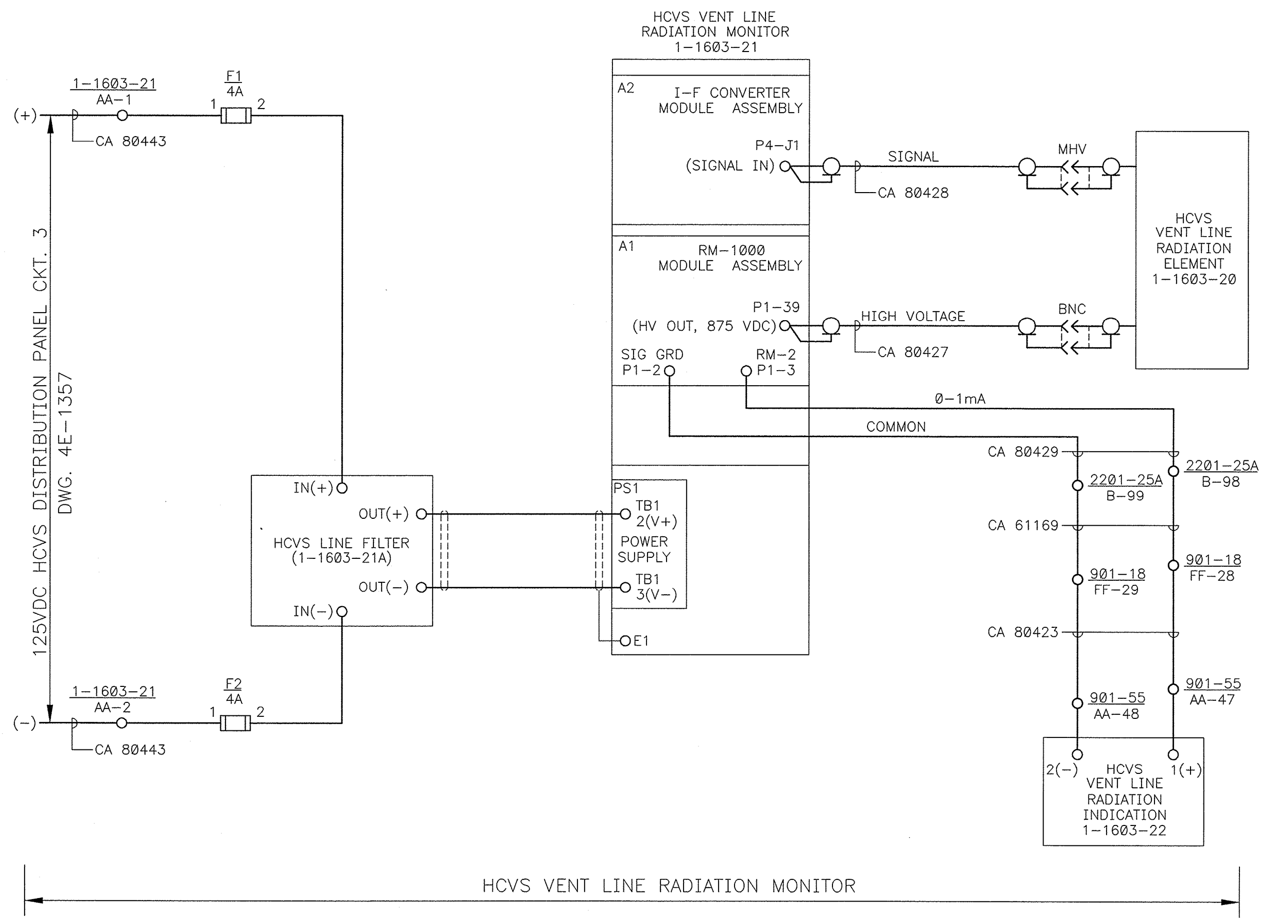
- Piping routing for SAWA path.
  - SAWA instrumentation process paths.
  - SAWA connections.
  - Include a piping and instrumentation diagram of the vent system. Demarcate the valves (in the vent piping) between the currently existing and new ones.
  - Ingress and egress paths to and from control locations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

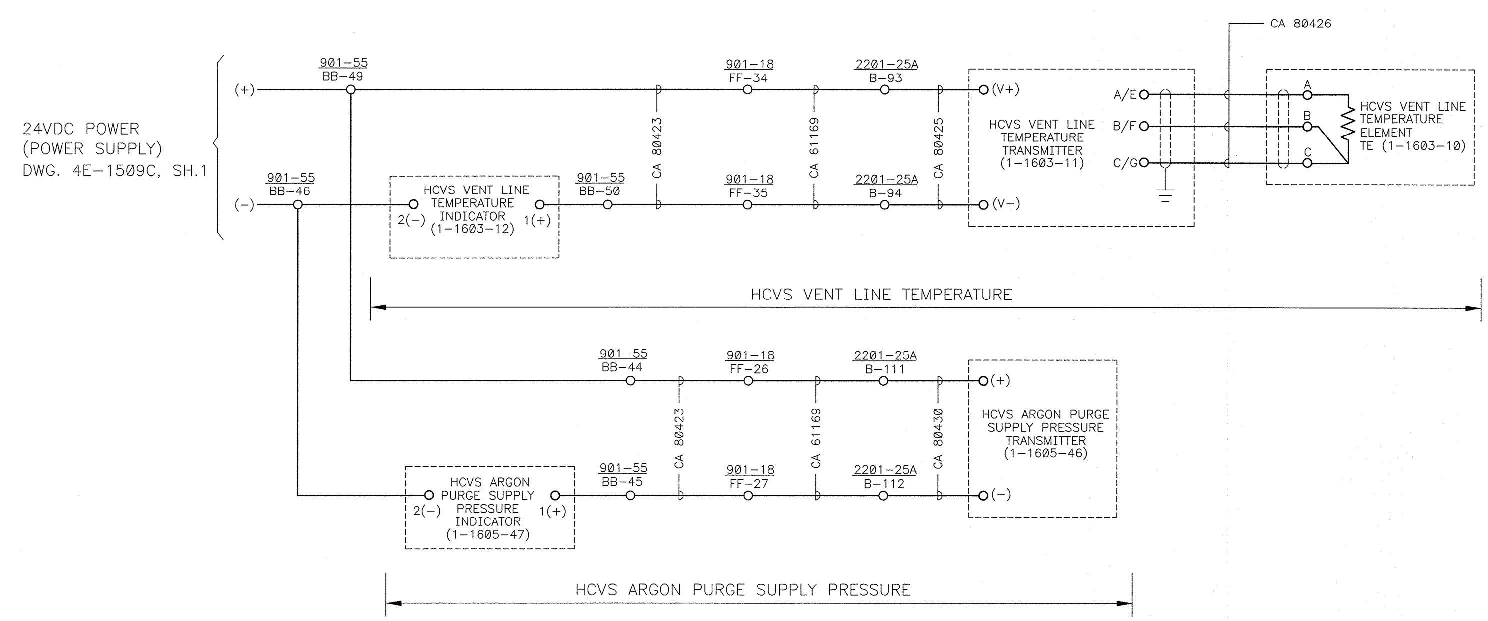
Sketch 3.1.A: Instrumentation – HCVS

(Unit 1 from 4E-1509C, Sh. 1; Unit 2 similar)



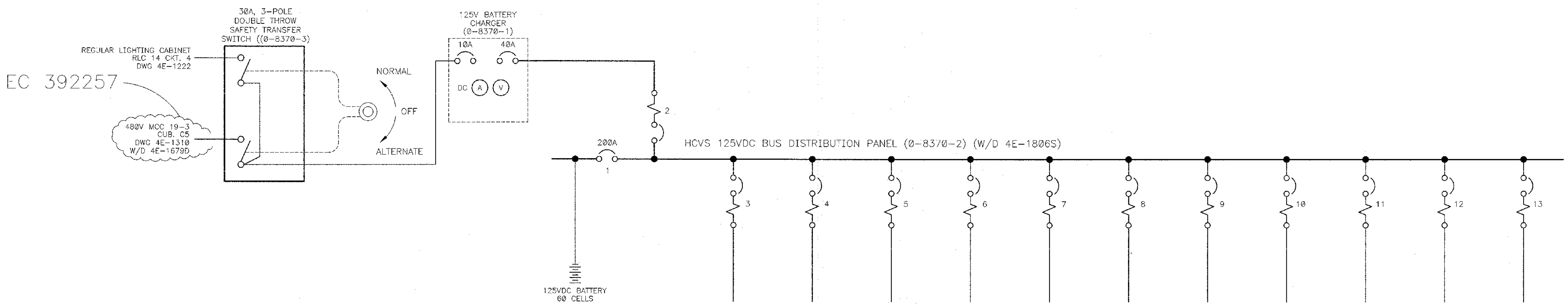
(Unit 1 from 4E-1509C, Sh. 2; Unit 2 similar)





Sketch 3.1.B: Electrical Connections – HCVS

(From EC 392256, Drawing 4E-1357; Common to both units)



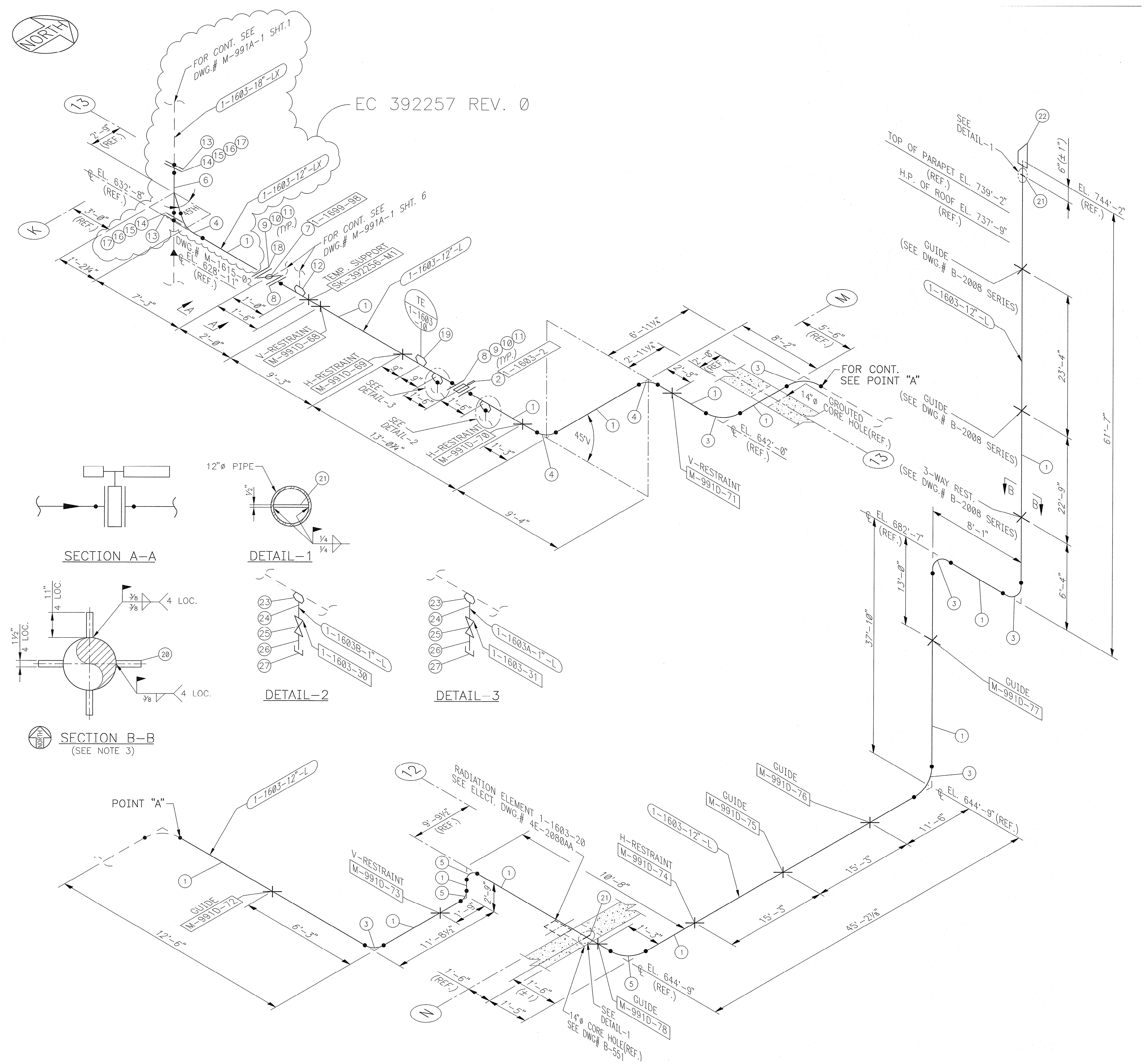
SCHEMATIC DIAGRAM	——	——	4E-1509C SH.2					4E-1509C SH.1					
WIRING DIAGRAM	4E-1806S	4E-1806S	4E-1806R					4E-1806S					
ACB TRIP RATING (AMP)		40A	15A	15A	15A	15A	15A	20A	20A	20A	20A	20A	60A
LOAD RATING													
SERVICE	125VDC BATTERY (0-8370)	125V BATTERY CHARGER (0-8370-1)	HCVS RADIATION MONITOR (1-1603-21)	SPARE (SEE NOTE 1)	SPARE	SPARE	SPARE	HCVS PANEL (901-55)	SPARE	SPARE (SEE NOTE 2)	SPARE	SPARE	BATTERY TESTING LOAD CART CONNECTION

NOTES

1. CKT. 4 IS RESERVED FOR UNIT 2 HCVS RADIATION MONITOR (2-1603-21)
2. CKT. 10 IS RESERVED FOR UNIT 2 HCVS PANEL (902-55)

Sketch 3.2: Layout of HCVS, Quad Cities

(From Unit 1 Isometric, M-991A-1, Sh. 3)

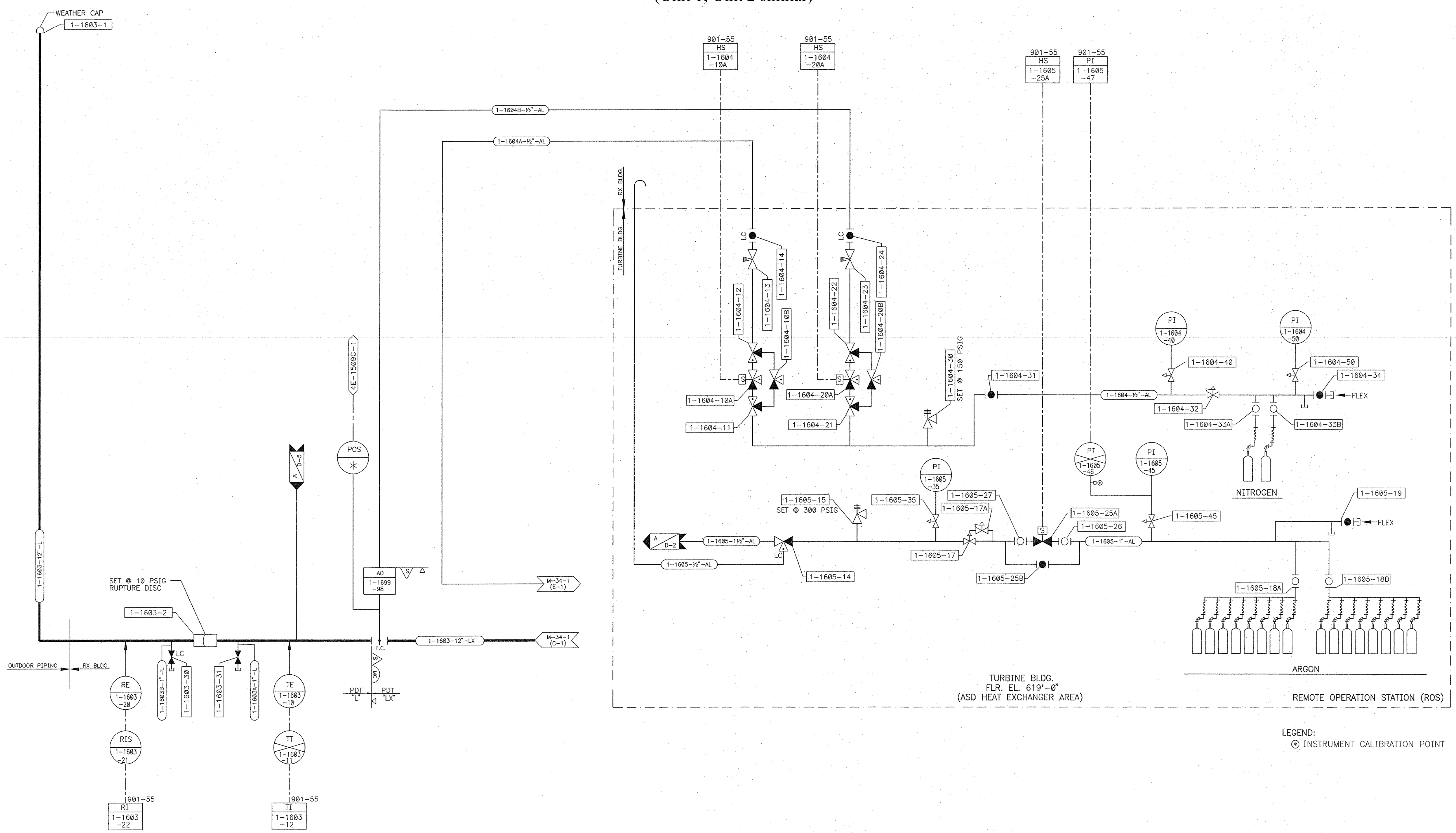


Quad Cities Nuclear Power Station Units 1 and 2

Overall Integrated Plan for Reliable Hardened Vents

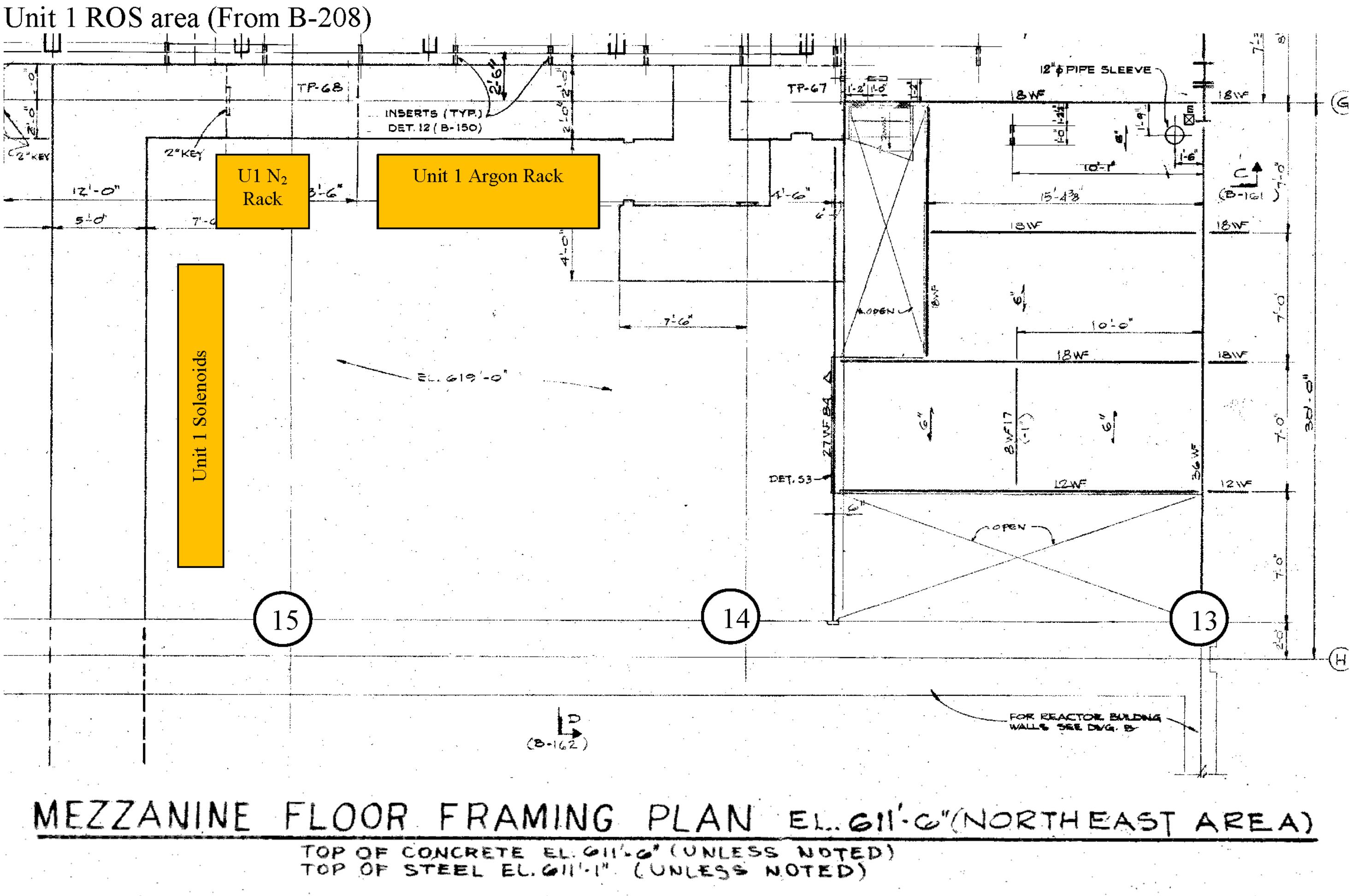
Sketch 3.2.A: P&ID Layout of WW Vent

(Unit 1; Unit 2 similar)

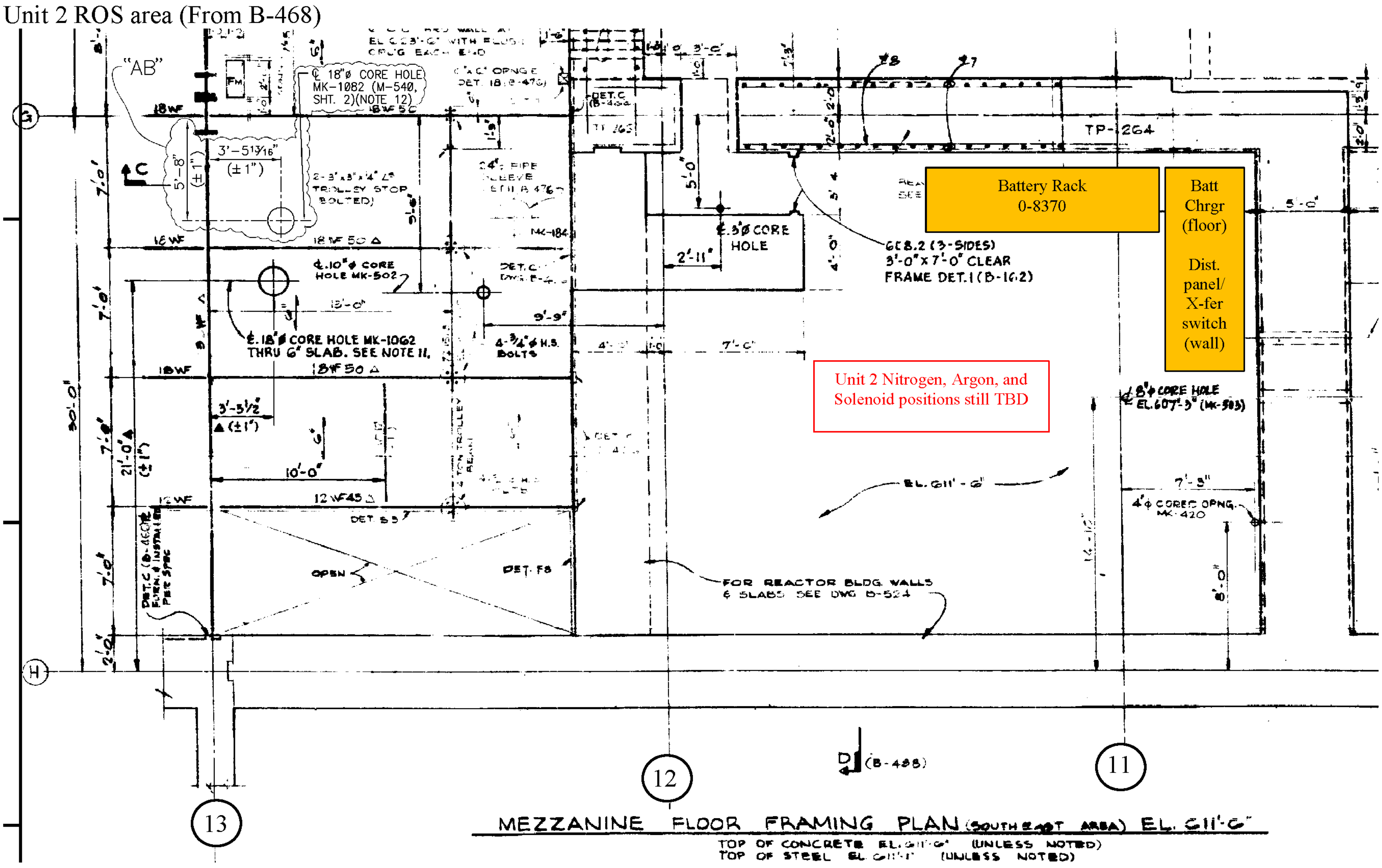


Sketch 3.2.B: Remote Operating Station

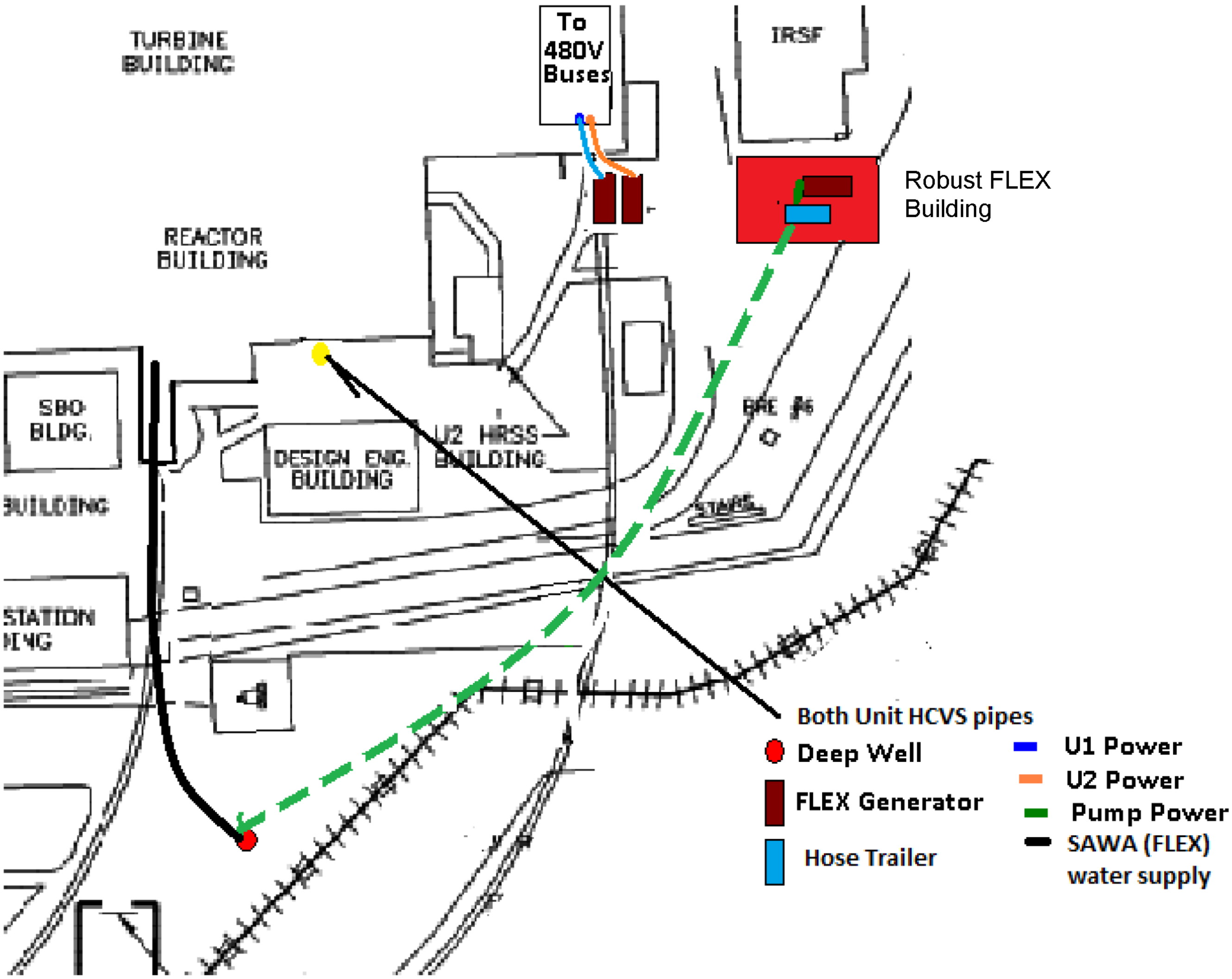
Unit 1 ROS area (From B-208)



Unit 2 ROS area (From B-468)

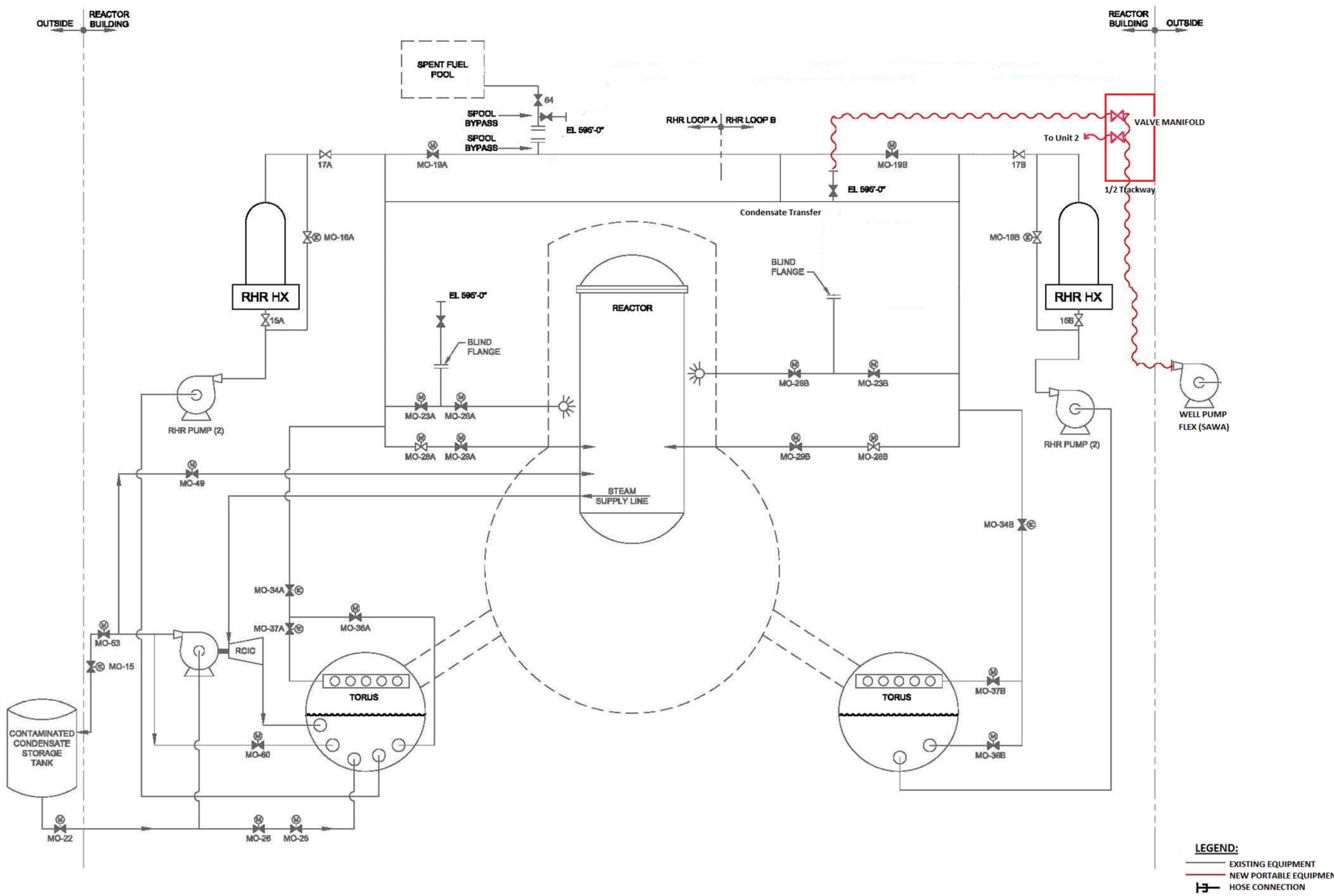


Sketch 3.2.C: HCVS Site Plan Overview

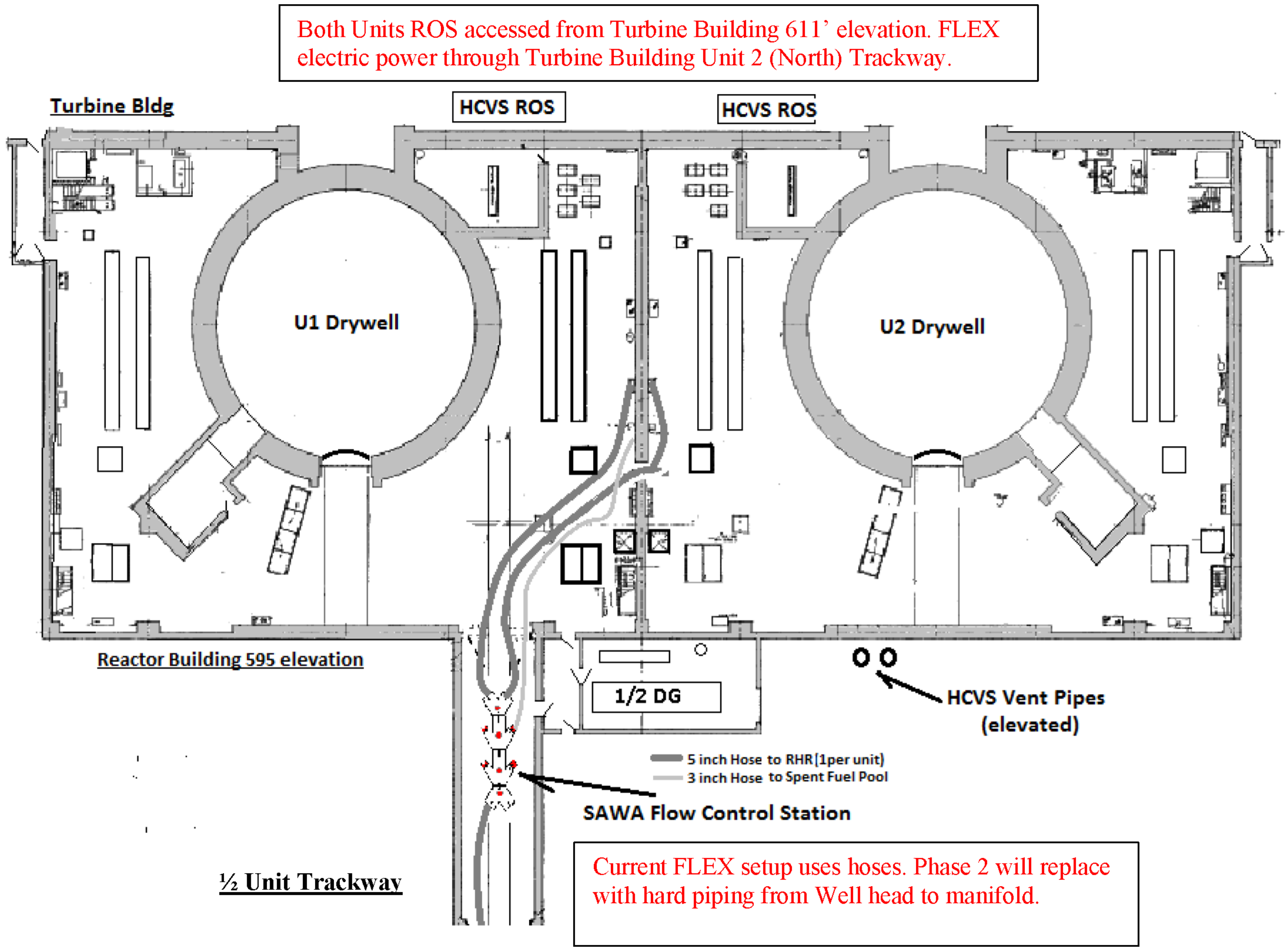


Sketch 3.3.A: P&ID Layout of SAWA

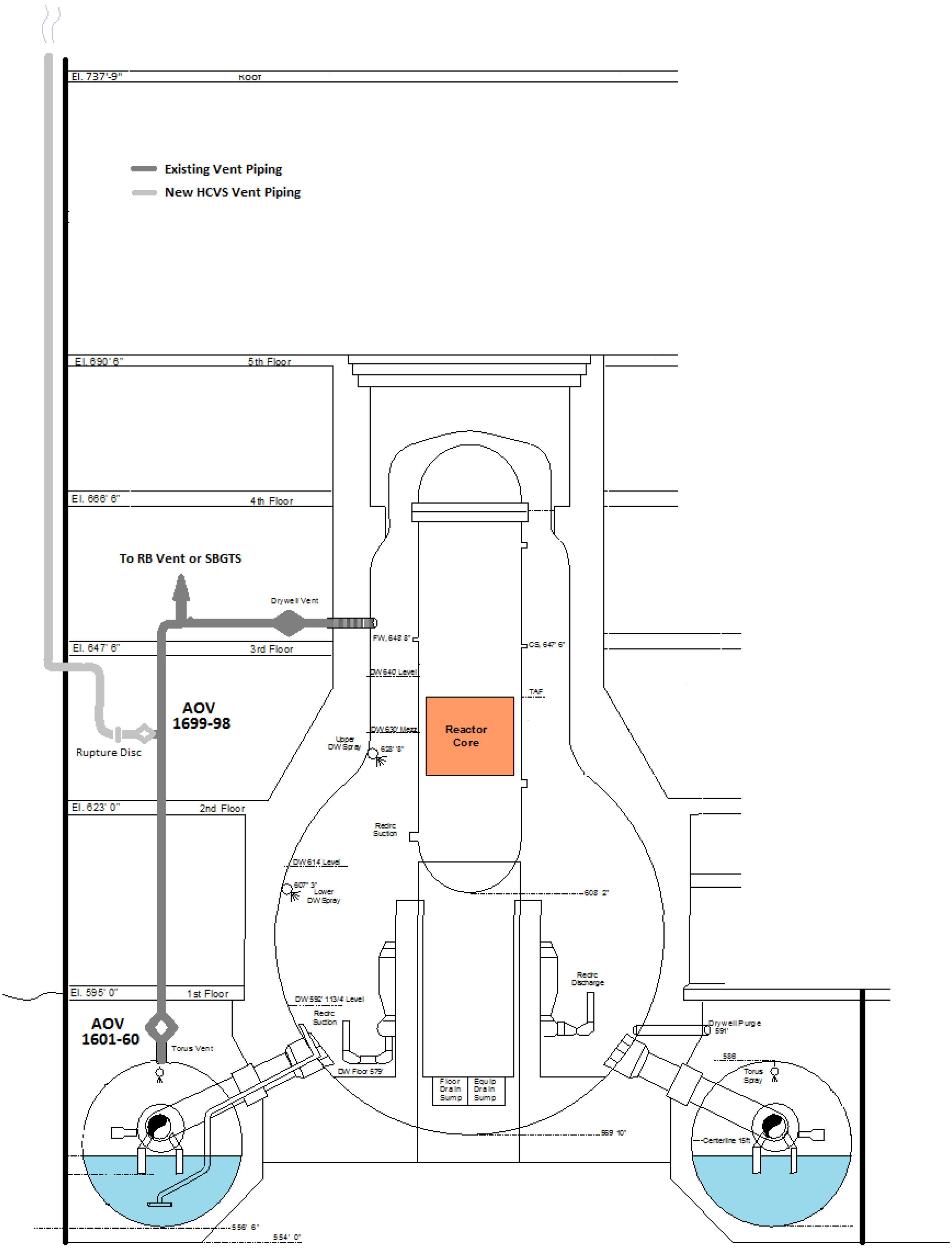
(Preliminary; Based on FLEX OIP Second Six-Month Update, February 28, 2014)



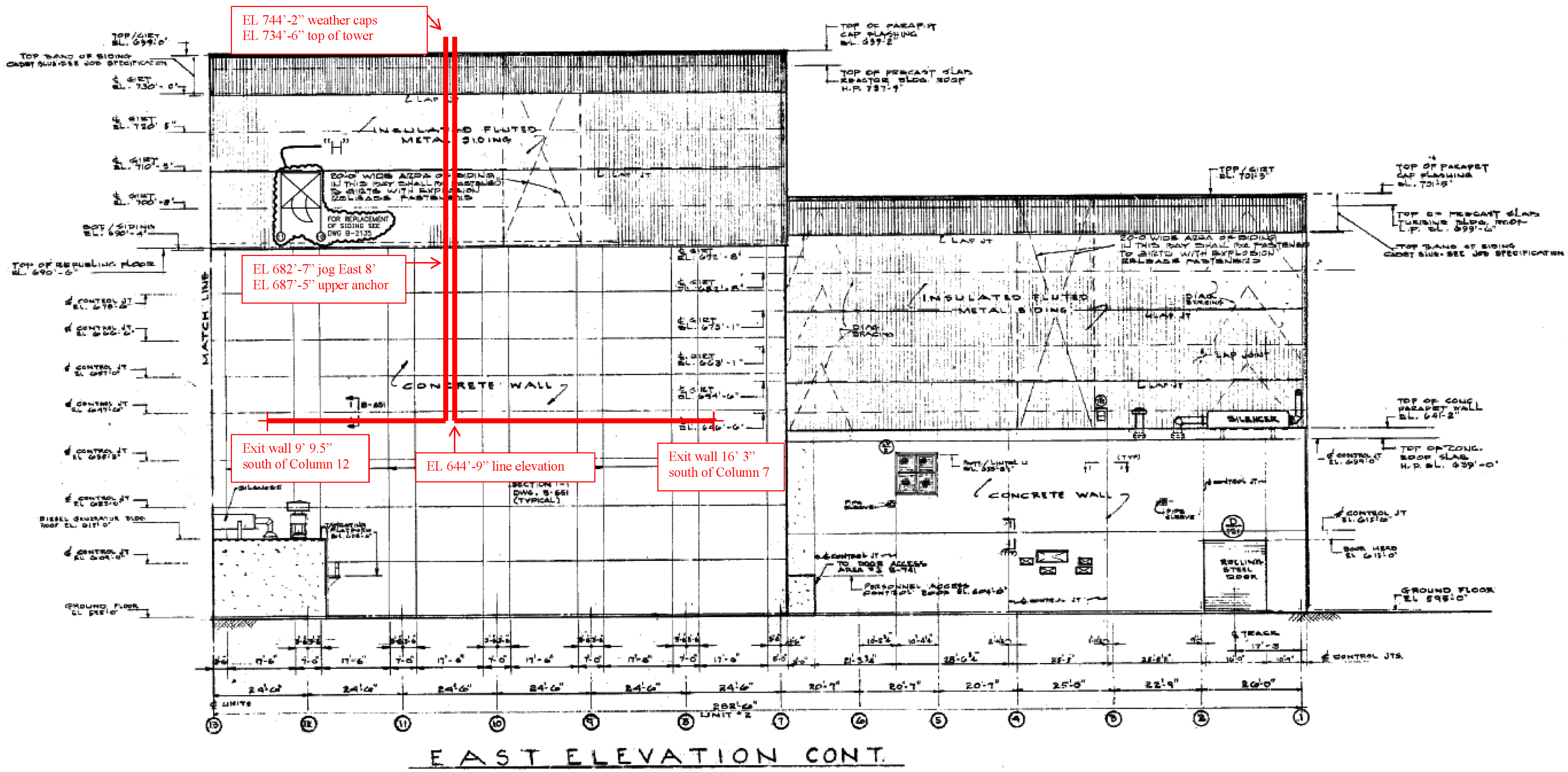
Sketch 3.3.B: Site Layout, Ingress and Egress Pathways (SAWA)



Sketch 3.3.C: Quad Cities Reactor Building Elevation View (Internal)



Sketch 3.3.D: Quad Cities Reactor Building Elevation View (External)
(Reactor Building 2 East Elevation based on DWGC B-651)



Attachment 4: Failure Evaluation Table

Table 4A: Wetwell 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 SOVs utilize dedicated 24-hour power supply	No
	Valves fail to open/close due to depletion of dedicated power supply	Recharge system with FLEX portable generators	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 pneumatic supply	No action needed. Valves are provided with dedicated motive force capable of 24 hour operation	No
	Valves fail to open/close due to loss of alternate pneumatic supply (long term)	Replace bottles as needed and/or recharge with portable air compressors	No
	Valve fails to open/close due to SOV 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 prevents mispositioning of the downstream HCVS PCIV and additionally, power and DC power for 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 provided portable generators	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 for Mitigation Strategies for Beyond-Design-Basis External Events, dated February 28, 2013 (ML 13063A320) for Quad Cities Nuclear 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, dated 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 FHCVS-AQ-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. QC-MISC-013, Rev. 2, MAAP Analysis to Support Initial FLEX Strategy
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. Quad Cities UFSAR, Rev. 13, Quad Cities Nuclear Power Station Updated Final Safety Analysis Report, License Nos. DPR-29 (Unit 1) and DPR-30 (Unit 2), Docket Nos. STN 50-254 (Unit 1) and 50-265 (Unit 2)
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. QC-MISC-015, Rev. 0, MAAP Analysis to Support HCVS Design
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
37. EC 402439, Fukushima Phase 2 – Quad Cities Preliminary On-Site Evaluation for Severe Accident Water Addition
38. EC 392256 - Unit 1 Hardened Containment Vent System (Non-Outage Portion) as Required by NRC Order EA-13-109
39. EC 392257 - Unit 1 Hardened Containment Vent System (Outage Portion) as Required by NRC Order EA-13-109
40. Exelon Calculation QDC-8300-E-2100, Unit 1(2) 125 VDC Battery Coping Calculation for Beyond Design Basis FLEX Event, 09/26/2014
41. Interim Staff Evaluation (ML 15089A421), dated April 1, 2015

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

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

Attachment 7: List of Overall Integrated Plan Open Items

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 01P*	*Status*
OI-1	*Determine how Motive Power and/or HCVS Battery Power will be disabled during normal operation.*	*Complete - Conceptual design determined that the HCVS primary control panel will be provided with a key lock switch to activate the system. This must be unlocked prior to performing any actuations of the DC powered components. Since the panel will be located in the MCR, unlocking and turning the switch can be performed in an ELAP with minimal operator action.*
OI-2	*Confirm that the Remote Operating Station (ROS) will be in an accessible area following a Severe Accident (SA).*	*Deleted. Closed to ISE Open Item number 4.*
OI-3	*Confirm diameter on new common HCVS Piping.*	*Deleted. Closed to ISE Open Item number 5.*
OI-4	*Confirm suppression pool heat capacity.*	*Complete - The MAAP analysis verifies that the vent is not required for at least 5 hours (Reference 24). At 5 hours, the decay heat will be less than 1 %.*
OI-5	*Determine the approach for combustible gases.*	*Deleted. Closed to ISE Open Items 10 and 11.*
OI-6	*Develop a procedure for HCVS out-of-service requirements and compensatory measures.*	*Started.*
OI-7	*Provide procedures for HCVS Operation.*	*Deleted. Closed to ISE Open Item No.14.*
OI-8	*Confirm 125 Volt DC Station Battery Life.*	*Complete - QDC-8300-E-2100 (Reference 40) confirms that the 125 VDC Station Battery will continue to supply necessary power during the 8-hour duration prior to aligning the FLEX diesel generator. Also, refer to NRC ISE Open Item No. 1.*
OI-9	*Supply Part 3 Drywell Boundary Condition.*	*Complete – the Phase 2 Alternate option (SAWA/SAWM) was added to the December 2015 OIP.*
OI-10	*Perform radiological evaluation for Phase 1vent line impact on ERO response actions.*	*Not Started*

Open Item	*Interim Staff Evaluation (ISE) Open Items*	*Status*
ISE-1	*Make available for NRC staff audit the calculation (QDC-8300-E-2100) that confirms that Order EA-12-49 actions to restore power are sufficient to ensure continuous operation of non-dedicated containment instrumentation.*	*Complete - Supplied to NRC Audit team during onsite FLEX evaluation (Jan 2015). (Reference 40).*
ISE-2	*Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation.*	*Started- HCVS Battery design in progress (References 38 and 39)*
ISE-3	*Make available for NRC staff audit documentation of the HCVS nitrogen pneumatic system design including sizing and location.*	*Started- HCVS Nitrogen system design in progress (References 38 and 39)*
ISE-4	*Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment.*	*Started - Temperature evaluation (Calculation 2014-02948) was made available to NRC Audit team during onsite FLEX evaluation (Jan 2015). Radiological evaluation in progress. (References 38 and 39)*
ISE-5	*Make available for NRC staff audit documentation of the licensee design effort to confirm the diameter on the new common HCVS piping.*	*Started. Refer to the response to ISE Open Item No. 6.*
ISE-6	*Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and primary containment pressure limit.*	*Started. The required 1% vent capacity at the lower of PCPL or containment design pressure is being verified using RELAP which models the line size and routing.* *In addition, MAAP analysis (Reference 24) is credited to verify that (1) venting can be delayed for at least three (3) hours and (2) anticipatory venting sufficiently limits the suppression pool heat up to maintain RCIC functional (References 38 and 39).*
ISE-7	*Make available for NRC staff audit the seismic and tornado missile final design criteria for the HCVS stack.*	*Started –The HCVS stack seismic design is the Station's design basis earthquake. The December 2015 OIP demonstrates that the external piping meets the tornado missile protection criteria of HCVS-WP-04.*
ISE-8	*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.*	*Started. Component location design and local conditions impact are in progress. The HCVS primary control panel will be located in the MCR (References 38 and 39).*

ISE-9	*Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions.*	*Not Started.*
ISE-10	*Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration.*	*Complete – as stated in the December 2015 OIP, Quad Cities 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.*
ISE-11	*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.*	*Completed - As described in the OIP, the HCVS torus vent path in each Quad Cities 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 (References 38 and 39).*
ISE-12	*Make available for NRC staff audit documentation of a determination of seismic qualification evaluation of the HCVS components.*	*Started – the Quad Cities seismic evaluation will be based on the Quad Cities design basis earthquake.*
ISE-13	*Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods.*	*Started. Instrument design in progress (References 38 and 39).*
ISE-14	*Make available for NRC staff audit the procedures for HCVS operation.*	*Not Started.*