Vent FIP Checklist for NRC Safety Evaluations (SEs) by JLD

Vent FIP Content Guidelines

1. The following list is intended to ensure that the Vent FIP contains a sufficient level of information for the NRC staff to complete its review. Responses to remaining audit items (i.e., open and confirmatory items not previously closed) should be provided on the e-portal as an aid to the staff.
2. This discussion assumes that the licensee will use an appropriate level of detail to discuss the topics and give responses that allow for the reviewer to write an SE based on appropriately docketed information.
3. This list assumes it is a “standard” plant using a typical strategy and is not all inclusive. Additional information may be needed for plants with unique designs or hazards, plants using alternatives to NEI 13-02 or other unique strategies, plants with multi-unit interdependencies, and plants that deviate from Owners Group recommendations, etc.

<u>Technical Evaluation of Order EA-13-109, Phase 1 (SE Section 3.0)</u>
Provide a brief summary description of the HCVS design and associated actions for the Phase 1 severe accident capable venting scenario. Include a discussion of operation during normal conditions, ELAP, and severe accidents.

<u>Performance Objectives – Operator Actions (SE Section 3.1.1.1)</u>
Describe the operator actions required for operation of the HCVS. Ensure:
1) Operation of the HCVS is readily accessible to operators under all operational conditions without the need of ladders, scaffolding, etc.
2) Operation does not require disassembly/reassembly such as installing jumpers or lifting leads.
3) System is composed of installed equipment.
4) Replenishment of pneumatic supply (as applicable).

<u>Performance Objectives – Personnel Habitability – Environmental (Non-Radiological) (SE Section 3.1.1.2)</u>
1) Identify locations in which operators will be accessing and operating the HCVS (e.g. including but not limited to the MCR and ROS).
2) Discuss how these locations remain habitable during an ELAP event with loss of ventilation and cooling with reference to ventilation calculations (place on ePortal). Reference back to FLEX (if the same).
3) Describe and provide the basis for any actions to reduce temperatures (e.g., portable fans, opening doors, etc.) based on the expected temperature response.
4) Provide procedures on the ePortal.

<u>Performance Objectives – Personnel Habitability - Radiological (SE Section 3.1.1.3)</u>
1) Identify locations (both manual and remote) in which operators will be accessing and operating the HCVS during a severe accident.
2) Confirm that operator actions post core damage do not result in doses that exceed the ERO guidance (dose calculations place on ePortal).

3) If shielding is used, confirm equipment and procedures are available such that they support the licensee's timeline.

Performance Objectives – HCVS Controls and Indications Qualifications (SE Section 3.1.1.4)

Demonstrate that the HCVS controls and indications can survive in ELAP and severe accident conditions. Refer to I&C table in FIP Appendix if applicable.

1) Provide a list of all HCVS controls and indications (include location information – bldg./elevation/cabinet).
2) Include the acceptance criteria (i.e. range, accuracy, functionality, etc.).
3) Provide qualification methods.
4) Describe the power source for all I&C components.

Design Features – Vent Characteristics (SE Section 3.1.2.1)

1) Describe, thermal-hydraulic analyses, including methodology and results that shows that the HCVS has the capacity to vent the steam equivalent of decay heat rate of 1% of the RTP at a pressure equivalent to the lessor of containment design pressure or the PCPL.
2) Place calculation on e-portal

Design Features – Vent Path and Discharge (SE Section 3.1.2.2)

Describe the HCVS vent path and location of the discharge.

1) Statement that the release point is higher than the nearest power block building and situated away from ventilation system intake and exhaust openings used in both normal situations and during an ELAP.
2) Discuss the seismic adequacy of the HCVS piping.
   a. Confirm at a minimum that the design and construction meets the plant's design basis earthquake seismic requirements.
   b. If applicable, place engineering evaluation on the ePortal.
3) Discuss the missile protection adequacy of the outside portion of the HCVS.
   a. Confirm the use of HCVS-WP-04.
   b. If applicable, place missile evaluation on the ePortal.

Design Features – Unintended Cross Flow of Vented Fluids (SE Sections 3.1.2.3)

Describe any interfacing systems with the HCVS and the design features installed to minimize unintended cross flow of vented fluids within a unit and between units on site.

1) Describe the evaluation performed for the environmental conditions at the flow path interface locations during venting operations to ensure the interface valves are qualified to remain sufficiently leak-tight. (Place evaluation on ePortal, if applicable) Note. HCVS-FAQ-05 addresses valve integrity relative to leakage.
2) Statement of periodic testing of the leak-tightness of any such barrier. (ex. standard methodology – Appendix J)

Design Features – Control Panels (SE Section 3.1.2.4)

Describe the location of the control panel(s) and the capability to perform HCVS functions at the control panel(s). Ensure the following criteria for HCVS primary controls and monitoring location are considered:

1) Requirement for sustained operation of the HCVS.
2) Requirements for assessment of temperature and radiological condition. (Refer to previous sections, if applicable)
3) Reasonable protection of required equipment.
4) Required design criteria for indications.

Design Features – Manual Operation (SE Section 3.1.2.5)

List the design features to facilitate manual operation of the HCVS valves. (ex. reach rods, chain links, hand wheels, alternate control locations, portable equipment to provide motive force as needed (e.g. compressed gas bottles, diesel powered compressors, and DC batteries)).

Design Features – Power and Pneumatic Supply Sources (SE Section 3.1.2.6)

1) Describe the power source(s) for motive force HCVS operation. Include:
   a. Batteries used for HCVS (dedicated vs. plant batteries)
      1. State their location and are they protected from all external hazards.
      2. State battery coping time and the battery standard used. Provide the battery coping analysis (sizing calculation and battery capacity) showing that the HCVS battery is capable of providing power for 24 hours without charging (place on eportal).
      3. Battery room ventilation – discuss battery functionality at elevated temperatures and actions to maintain temperatures (calculations/procedures on eportal).
      4. Battery room - Strategy for maintaining hydrogen below explosive limits.
   b. DG used for HCVS (dedicated, plant, FLEX, for motive force)
      1. Place loading calculations on eportal)
   c. Describe how electrical isolation is maintained such that Class 1E equipment is protected from faults in HCVS equipment.
2) Describe the pneumatic supply for the AOVs.
   a. Include sizing and location of pneumatic supply.
   b. Confirm that there is enough compressed gas for the required number of vent cycles in a 24-hr period place analysis on ePortal.

Design Features – Prevention of Inadvertent Actuation (SE Section 3.1.2.7)

Describe the design features that prevent an inadvertent HCVS flow path actuation (e.g. rupture diaphragm in the HCVS flow path, key lock for HCVS valve switches, administrative controls for energizing HCVS components/controls).

Design Features – Monitoring of HCVS (SE Section 3.1.2.8)

Describe the indications available to monitor the status of the HCVS. Refer to I&C table in FIP Appendix if applicable.

1) Describe the power supply(s) for these indications.

Design Features – Monitoring of Effluent Discharge (SE Section 3.1.2.9)

Describe the means to monitor the radiological conditions that exist during venting operations of the HCVS. Include:

1) Type of radiation monitor
2) Range of the instrument

Design Features – Equipment Operability – Environmental/Radiological (SE Section 3.1.2.10)

1) Identify locations in which HCVS equipment will be operating (e.g., existing installed equipment, pre-staged equipment, portable equipment, including but not limited to MCR and ROS).
2) Discuss how equipment remains functional during ELAP and severe accident conditions with loss of ventilation and cooling, including expected dose fields (shine) from a severe accident. (Place dose calculation on the ePortal)
3) Describe actions to reduce temperatures (e.g., portable fans, opening doors, etc.) based on the expected temperature response.

Design Features – Hydrogen Combustible Control (SE Section 3.1.2.11)

Describe whether the HCVS is designed to ensure the flammability limits of gases passing through the system are not reached or whether the HCVS can withstand dynamic loading resulting from hydrogen deflagration and/or detonation.

1) Strategies and options that "ensure the flammability limits of gases passing through the system are not reached" should provide:
    a. Option or options selected (HCVS-WP-03)
    b. Any deviations relative to the selected option(s) along with justification
    c. Synopsis of venting operation and design
    d. One-line diagram of vent path from associated PCIVs to release point, with delineation of which option applies to each portion of the vent system (place in FIP and on ePortal)
2) Strategies and options that are "designed to withstand dynamic loading resulting from hydrogen deflagration and/or detonation" should provide:
    a. Synopsis of venting operation and design utilizing Option 1 and/or 2 (HCVS-WP-03)
    b. One-line diagram of vent path, with delineation of which option applies to each portion of the vent system (place on ePortal)
    c. Tabulation of the design parameters used for design of each portion of the vent system
    d. Justification for selection of design parameters

Design Features – Hydrogen Migration and Ingress (SE Section 3.1.2.12)

If not already discussed in Section 3.1.2.3, describe the licensee's design of the HCVS to address hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or other buildings.

Design Features – Operation/Testing/Inspection/Maintenance (SE Section 3.1.2.13)

1) Provide confirmation of implementation of the testing and inspection requirements outlined in Section 6.2.4 of NEI 13-02.
2) Provide confirmation of implementation of the maintenance requirements outlined in Section 5.4 of NEI 13-02.

HCVS Quality Standards – Component Qualifications (SE Section 3.2.1) (Refer to previous sections, if applicable)

1) Provide a list of all HCVS components (I&C components were addressed in Section 3.1.1.4).
2) Include the acceptance criteria.
3) Provide qualification methods.
4) Provide any evaluations on the ePortal.

HCVS Quality Standards – Component Reliability and Rugged Performance (SE Section 3.2.2)

Confirm that HCVS components and instrumentation that are required to be seismically designed to the design basis of the plant are designed for reliable and rugged performance that is capable of ensuring HCVS functionality following a seismic event. (Refer to NEI 13-02, Appendix A)

1) Provide qualification/evaluation documentation on the ePortal.

Severe Accident Water Addition (SE Section 4.1)

Describe the water addition strategy, including operator actions and the time to establish the water addition. Discuss hardware requirements necessary to support SAWA including:

1) Water addition point
2) Flow path
3) RPV pressure control
4) Water source(s)

SAWA – Water Addition Source (SE Section 4.1.1.1)

1) Describe plant connection points and installed or portable pump(s) used for the SAWA strategy.
2) Describe the analyses that determined the SAWA flow rate and pressures needed for water addition, including the time to establish this capability.
3) Provide on the e-Portal the hydraulic evaluation for the SAWA pump(s).
4) Describe the method of backflow prevention in the SAWA flow path.

SAWA – Motive Force (SE Section 4.1.1.2)

Describe the motive force (electrical, pneumatic, diesel, etc.) source(s) used for powering components and instrumentation needed to establish a flow path from the water source to the addition point. Discuss whether this uses plant equipment or dedicated equipment

1) DG loading calculations (provide on eportal).
2) Provide calculations for any other credited motive force.

SAWA – Instrumentation (SE Section 4.1.1.3)

1) List the specific instruments credited for SAWA. (Provide in FIP)
2) Describe the instruments and guidance used to support SAWA pump operation and determination of SAWA pump flow.
3) Qualifications of instrumentation (temperature/radiation/seismic).
4) Describe the means to provide power (e.g., skid mounted diesel engine/alternator, batteries or small portable AC generators) to these instruments for the Sustained Operation period.
5) Describe how wetwell level instrumentation will be repowered through the Sustained Operation period.

SAWA – Severe Accident Considerations (SE Section 4.1.1.4)

Discuss if the thermal and radiological impacts on the installed or portable equipment and instrumentation would affect the functionality of these components or operators performing necessary actions for the SAWA strategy. Place the calculation on the ePortal.

Severe Accident Water Management (SE Section 4.2)

Describe the water management strategy, including operator actions and the time to reduce the water addition. Discuss factors in SAWM success including:

1) The means of controlling the SAWA flow rate (e.g., controlling pump speed or use of a throttle valve).
2) Freeboard volume to determine plant capability to maintain wetwell vent availability.

Thermal Hydraulic Analyses – SAWM for 7 day Sustained Operation Period (SE Section 4.2.1.1)

Refer to the Phase 2 Open Item response:

1) Describe how the available freeboard volume is used for the SAWM strategy.
2) Provide the upper wetwell level indication (i.e. maximum level elevation).
3) Describe the analyses that determined the action times for reducing SAWA flow to achieve a successful SAWM strategy. (provide on eportal)

SAWM – Motive Force (SE Section 4.2.1.2)

Describe the motive force (electrical, pneumatic, diesel, etc.) source(s) used to support equipment and instrumentation needed to support SAWM through the Sustained Operation period.

SAWM – Instrumentation (SE Section 4.2.1.3)

1) Provide a listing of instrumentation that will be utilized to implement the SAWM strategy.
2) Qualification of instrumentation (temperature/radiation/seismic).
3) Describe how containment pressure and wetwell level instrumentation will be repowered through the period of Sustained Operation.
4) Provide an evaluation of the installed temperature instrumentation. (Refer to NEI 13-02, Section C.8.3.1)

SAWM – Severe Accident Considerations (SE Section 4.2.1.4)

Discuss if the thermal and radiological impacts on the installed or portable equipment and instrumentation would affect the functionality of these components or operators performing necessary actions for the SAWM strategy. Place the calculation on the ePortal.

HCVS/SAWA/SAWM Programmatic Controls – Procedures (SE Section 5.1)

1) Briefly describe procedures for testing, and maintenance for the severe accident capable HCVS and SAWA/SAWM strategy during ELAP conditions.
2) Describe how for HCVS and SAWA/SAWM operation are coordinated with other site procedures (i.e. SAGs, etc.)
3) Briefly describe use in drills, tabletops, or exercises.

HCVS/SAWA/SAWM Programmatic Controls – Training (SE Section 5.2)

Provide confirmation that the training program will ensure all personnel expected to operate the HCVS/SAWA/SAWM receive initial and continuing training in the use of plant procedures developed for HCVS operation during normal operations, an ELAP with a loss of the ultimate heat sink (UHS) and an ELAP/lost of UHS with core damage and vessel breach.

1) The use of a Systematic Approach to Training (SAT) based training program to determine required training and frequency may be used to demonstrate compliance with the training requirements.