David A. Swank
Columbia Generating Station
P.O. Box 968, PE23
Richland, WA 99352-0968
Ph. 509-377-2309 | F. 509-377-2354
daswank@energy-northwest.com

February 28, 2013
GO2-13-035

10 CFR 2.202
10 CFR 50.4

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

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397 ENERGY NORTHWEST'S RESPONSE TO NRC ORDER EA-12-050 – OVERALL INTEGRATED PLAN FOR RELIABLE HARDENED CONTAINMENT VENTS**

References:
1. NRC Order EA-12-050, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents," March 12, 2012
2. NRC Interim Staff Guidance JLD-ISG-2012-02, "Compliance with Order EA-12-050, Reliable Hardened Containment Vents," Revision 0, August 29, 2012
3. Letter GO2-12-150 dated October 25, 2012, DA Swank (Energy Northwest) to the Nuclear Regulatory Commission, "Energy Northwest's Initial Status Report In Response To March 12, 2012 Commission Order Modifying Licenses With Regard To Reliable Hardened Containment Vents"

Dear Sir or Madam,

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-050 (Reference 1) to Energy Northwest. The Order was immediately effective and directs licensees operating boiling water reactors (BWRs) with Mark II containments to take certain actions to implement requirements for a reliable hardened vent (RHV) system to remove decay heat and maintain control of containment pressure following events that result in loss of active containment heat removal capability or prolonged Station Blackout (SBO). Specific requirements are outlined in Attachment 2 of the Order.

The Order requires Energy Northwest to submit an Overall Integrated Plan by February 28, 2013. Interim staff guidance (Reference 2) was issued August 29, 2012, to provide additional direction regarding the content of the Overall Integrated Plan. The receipt of the guidance was confirmed by Energy Northwest in its initial status report provided in Reference 3.

A001
NRR

Attachment 1 to this letter contains the Overall Integrated Plan required by Section IV, Condition C.1, of the Order. The submittal provides Energy Northwest's initial description of its plan to install a new dedicated containment vent system with both wetwell and drywell connections. Information provided in the plan reflects the current conceptual design status of the project. Accordingly, the plan is subject to change as detailed design information becomes available. Significant changes to the plan or the proposed schedule will be communicated to the NRC in subsequent status reports.

This letter does not contain any new or revised Regulatory Commitments.

If you have any questions or require additional information, please contact Ms. L. L. Williams at (509) 377-8148.

On the date of this letter, I declare under penalty of perjury that the foregoing is true and correct.

Respectfully,

D. A. Swank
Assistant Vice President, Engineering

Attachment 1: Overall Integrated Plan for Reliable Hardened Containment Vent

cc: NRC Region IV Administrator
NRC NRR Project Manager
NRC Senior Resident Inspector/988C
AJ Rapacz – BPA/1399

ENERGY NORTHWEST

COLUMBIA GENERATING STATION
RICHLAND, WASHINGTON

Overall Integrated Plan for Reliable Hardened Containment Vent

February 2013

Table of Contents:

References:

Generic Letter 89-16, Installation of a Hardened Wetwell Vent, dated September 1, 1989

Order EA-049, Order to Modify License with regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012

Order EA-050, Order to Modify Licenses with regard to Reliable Hardened Containment Vents, dated March 12, 2012

JLD-ISG-2012-02, Compliance with Order EA-12-050, Reliable Hardened Containment Vents, dated August 29, 2012

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

NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012.

Section 1: System Description

ISG Staff Position:

Licensees shall provide a complete description of the system, including important operational characteristics. The level of detail generally considered adequate is consistent with the level of detail contained in the licensee's Final Safety Analysis Report. In addition the staff expects the licensee's submittal will provide the following information:

- *A description of how the design objectives contained in Attachment 2, Requirements 1.1.1, 1.1.2, and 1.1.3 are met*
- *Description of major system components, including applicable quality requirements*
- *Operational characteristics and a description of how each of the Order's technical requirements are being met*
- *A piping and instrumentation diagram or a similar diagram that shows system components and interfaces with plant systems and structures is acceptable.*

Response:

System Overview:

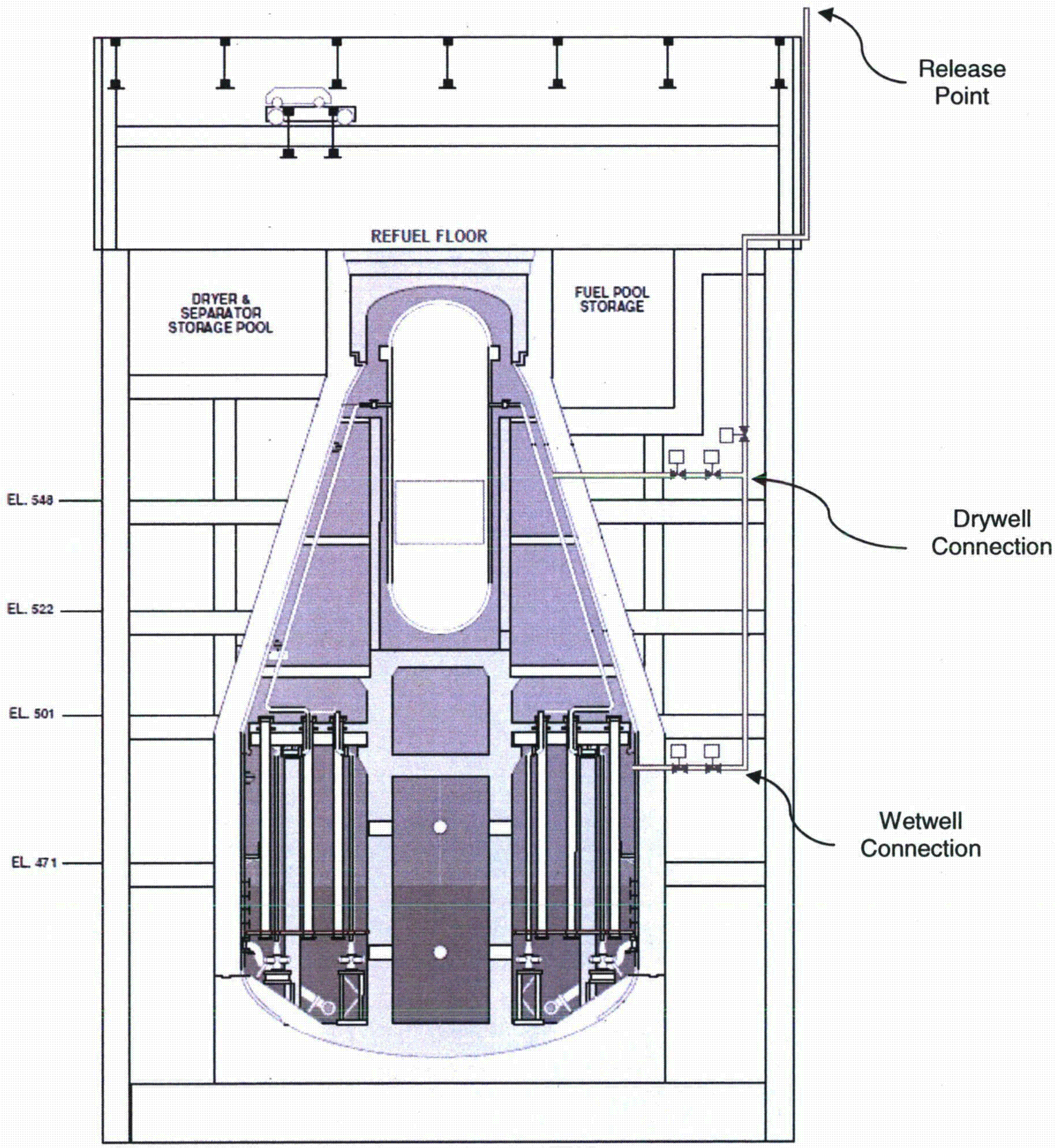
The Containment Hardened Vent (CHV) System will be designed to mitigate loss-of-decay-heat removal by providing sufficient containment venting capability to limit containment pressurization and maintain core cooling capability. The vent is designed with two pathways (from wetwell and drywell). The wetwell vent will have sufficient capacity to accommodate decay heat equivalent to 1% of 3556 MWt, which accounts for a 2% power uprate above the current licensed thermal power of 3486 MWt. Thus, the hardened vent capacity will be adequate to remove decay heat during an extended loss of alternating current (AC) power (ELAP) event. The CHV System is intended for use as one element of core damage prevention strategies.

The CHV System flow paths from the containment (wetwell and drywell) to a dedicated elevated release point are shown in the simplified diagram below. The entire flow path will be hard-piped; no ductwork will be used in the flow path. The primary containment penetrations will be isolated by two isolation valves, both located exterior to the containment, similar to the existing containment ventilation supply and exhaust system isolation valves.

The remainder of the report addresses each requirement of NRC Order EA-12-050 and the related Staff Position from ISG JLD-ISG-2012-02: Compliance with Order EA-12-050.

- Section 2 addresses design objectives.
- Section 3 addresses operational characteristics.
- Section 4 addresses quality requirements.
- Section 8 contains drawings of the CHV System and its subsystems

Simplified Vent Line Connections to Wetwell, Drywell, and Other Systems



Equipment and components:

The following equipment and components will be provided:

i. CHV System Mechanical Components
   a) Containment isolation piping, valves and controls - The CHV System vent piping, containment isolation valves (CIVs), and supports will be designed in accordance with Columbia's existing design basis. The valves will be air-operated valves (AOVs) operated by a direct current (DC) powered solenoid operated valve (SOV). The valves will be operated from switches in the Main Control Room. Backup operation can be performed by manual operation of the SOVs at a remote operating station in the Diesel Generator Building.
   b) Other system valves and piping - The CHV System piping and supports downstream of the second containment isolation valve, including valve actuator pneumatic supply components, will be designed to conform to the requirements consistent with the applicable design codes for the plant and to ensure functionality during an ELAP.

ii. Instrumentation to monitor the status of the CHV System
   a) Instrumentation to monitor key operating parameters will be available in the Main Control Room.
   b) The effluent radiation detector will be located outside the vent line with radiation level indicated in the Main Control Room.
   c) Valve position indication, temperature, system pressure and flow instrumentation will be used to monitor the status of the CHV System. These indications aid the operator in verification of proper venting operation. A failure of the position indication instrumentation would not prevent opening and closing a valve. Valve position indication will also be available at the remote operating station near the nitrogen bottle storage bank in the Diesel Generator Building to provide valve position feedback to operators during local operation.
   d) Indications to monitor the status of the electrical and pneumatic supplies will also be available in the Main Control Room.

iii. Support systems
   a) Power for the CHV System valve solenoids and instrumentation will be provided from a permanently installed, dedicated battery charger and DC battery source. The normal power to the battery charger is from a plant AC bus. This battery will be designed to support at least 24 hours of operation without any outside power source.
   b) Motive air/gas supply for CHV System operation will be adequate for at least the first 24 hours during operation under ELAP conditions. The pneumatic supply will be provided from a dedicated nitrogen bottle storage bank located in the Diesel Generator Building.
   c) FLEX equipment will have the capability to provide back-up support equipment for extended (beyond 24 hours) CHV System operation. Power will be supplied from a portable AC generator that will have connection capability to the CHV System battery charger. Motive air/gas for CHV System operation can be supplied from replacement bottles or a portable air compressor that can be connected to the pneumatic supply through an installed cross-connect fitting.

System control:

i. Active: System valves will be operated in accordance with plant procedures to control containment pressure. The CHV System will be designed for a minimum of 4 open/close cycles during the first 24 hours of ELAP conditions. Controlled early venting at reduced pressure will be permitted in the revised Emergency Procedure Guidelines (EPGs). This will allow extended operation of the Reactor Core Isolation Cooling (RCIC) System during the ELAP event.

ii. Passive: Inadvertent actuation protection is provided by key lock switches located in the Main Control Room. Inadvertent operation from the remote operating station in the Diesel Generator Building will be prevented by providing a locked cabinet to enclose the SOVs that can be manually operated.

Section 2: Design Objectives

Order EA-050 1.1.1 Requirement:

The HCVS shall be designed to minimize the reliance on operator actions.

ISG 1.1.1 Staff Position:

During events that significantly challenge plant operations, individual operators are more prone to human error. In addition, the plant operations staff may be required to implement strategies and/or take many concurrent actions that further places a burden on its personnel. During the prolonged SBO condition at the Fukushima Dai-ichi units, operators faced many significant challenges while attempting to restore numerous plant systems that were necessary to cool the reactor core, including the containment venting systems. The difficulties faced by the operators related to the location of the HCVS valves, ambient temperatures and radiological conditions, loss of all alternating current electrical power, loss of motive force to open the vent valves, and exhausting dc battery power. The NRC staff recognizes that operator actions will be needed to operate the HCVS valves; however, the licensees shall consider design features for the system that will minimize the need and reliance on operator actions to the extent possible during a variety of plant conditions, as further discussed in this ISG.

The HCVS shall be designed to be operated from a control panel located in the main control room or a remote but readily accessible location. The HCVS shall be designed to be fully functional and self sufficient with permanently installed equipment in the plant, without the need for portable equipment or connecting thereto, until such time that additional on-site or off-site personnel and portable equipment become available. The HCVS shall be capable of operating in this mode (i.e., relying on permanently installed equipment) for at least 24 hours during the prolonged SBO, unless a shorter period is justified by the licensee. The HCVS operation in this mode depends on a variety of conditions, such as the cause for the SBO (e.g., seismic event, flood, tornado, high winds), severity of the event, and time required for additional help to reach the plant, move portable equipment into place, and make connections to the HCVS.

When evaluating licensee justification for periods less than 24 hours, the NRC staff will consider the number of actions and the cumulative demand on personnel resources that are needed to maintain HCVS functionality (e.g., installation of portable equipment during the first 24 hours to restore power to the HCVS controls and/or instrumentation) as a result of design limitations. For example, the use of supplemental portable power sources may be acceptable if the supplemental power was readily available, could be quickly and easily moved into place, and installed through the use of pre-engineered quick disconnects, and the necessary human actions were identified along with the time needed to complete those actions. Conversely, supplemental power sources located in an unattended warehouse that require a qualified electrician to temporarily wire into the panel would not be considered acceptable by the staff because its installation requires a series of complex, time-consuming actions in order to achieve a successful outcome. There are similar examples that could apply to mechanical systems, such as pneumatic/compressed air systems.

Response (ref. ISG Item 1.1.1):

The operation of the CHV System will be designed to minimize the reliance on operator actions in response to hazards identified in NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*. Operator actions to initiate venting can be completed by Reactor Operators in the Main Control Room. In addition, remote-manual initiation by Equipment Operators from the CHV System remote operating station is also available. The operator actions required to open a vent path are:

Operator Actions Necessary to Open a Vent Path
1. Open CHV System 1st Primary Containment Isolation Valve (PCIV) from Main Control Room or remote operating station

Operator Actions Necessary to Open a Vent Path
2. Open CHV System 2nd PCIV from Main Control Room or remote operating station
3. Open CHV System Secondary Containment Isolation Valve (SCIV) from Main Control Room or remote operating station

Remote-manual is defined in this report as a non-automatic power operation of a component and does not require the operator to be at or in close proximity to the component. No other operator actions will be required to initiate venting under procedural guidance. The CHV System valves will be normally locked closed with no automatic interlocks and therefore no additional operator actions are required to override containment isolation signals.

Permanently installed battery power and motive air/gas sources will be available to support operation and monitoring of the CHV System for at least 24 hours.

After 24 hours, available personnel will be able to connect supplemental motive air/gas to the CHV System if required. Connections for supplementing electrical power and motive air/gas required for CHV System will be located in accessible areas with reasonable protection per NEI 12-06 that minimize personnel exposure to adverse conditions following an ELAP and venting. Connections will be pre-engineered quick disconnects to minimize manpower resources.

Table 1 located in Section 8 shows various failure modes and their effects. This table describes alternate actions which allow for completion of the venting under credible failure conditions.

Order EA-050 1.1.2 Requirement:

The HCVS shall be designed to minimize plant operators' exposure to occupational hazards, such as extreme heat stress, while operating the HCVS system.

ISG 1.1.2 Staff Position:

During a prolonged SBO, the drywell, wetwell (torus), and nearby areas in the plant where HVCS components are expected to be located will likely experience an excursion in temperatures due to inadequate containment cooling combined with loss of normal and emergency building ventilation systems. In addition, installed normal and emergency lighting in the plant may not be available. Licensees should take into consideration plant conditions expected to be experienced during applicable beyond design basis external events when locating valves, instrument air supplies, and other components that will be required to safely operate the HCVS system. Components required for manual operation should be placed in areas that are readily accessible to plant operators, and not require additional actions, such as the installation of ladders or temporary scaffolding, to operate the system.

When developing a design strategy, the NRC staff expects licensees to analyze potential plant conditions and use its acquired knowledge of these areas, in terms of how temperatures would react to extended SBO conditions and the lighting that would be available during beyond design basis external events. This knowledge also provides an input to system operating procedures, training, the choice of protective clothing, required tools and equipment, and portable lighting.

Response (ref. ISG Item 1.1.2):

The CHV System design will allow for operating, and monitoring of the system from the Main Control Room, in order to minimize plant operators' exposure to adverse temperature and radiological conditions. The Main Control Room is protected from hazards assumed in NEI 12-06. Backup operation is available from the remote operating station located in the Diesel Generator Building, which is also protected from occupational hazards.

In order to minimize operator exposure to temperature excursions due to the impact of the ELAP (i.e., loss of normal and emergency building ventilation systems and/or containment temperature changes), procedures will not require access to suppression pool (wetwell) or Reactor Building areas. This will prevent any exposure to extreme occupational hazards for normal and backup operation of electrical and pneumatic systems.

Connections for supplemental equipment needed for sustained operation beyond 24 hours will be located in accessible areas protected from severe plant conditions. This will minimize exposure to occupational hazards such as temperature or radiological hazards. Tools required for sustained operation, such as portable lighting and connection specific tooling will be pre-staged in the NEI 12-06 storage locations. No temporary ladders or scaffold will be required to access these connections or storage locations.

Order EA-050 1.1.3 Requirement:

The HCVS shall also be designed to minimize radiological consequences that would impede personnel actions needed for event response.

ISG 1.1.3 Staff Position:

The design of the HCVS should take into consideration the radiological consequences resulting from the event that could negatively impact event response. During the Fukushima event, personnel actions to manually operate the vent valves were impeded due to the location of the valves in the torus rooms. The HCVS shall be designed to be placed in operation by operator actions at a control panel, located in the main control room or in a remote location. The system shall be deigned to function in this mode with permanently installed equipment providing electrical power (e.g., dc power batteries) and valve motive force (e.g., N2/air cylinders). The system shall be designed to function in this mode for a minimum duration of 24 hours with no operator actions required or credited, other than the system initiating actions at the control panel. Durations of less than 24 hours will be considered if justified by adequate supporting information from the licensee. To ensure continued operation of the HCVS beyond 24 hours, licensees may credit manual actions, such as moving portable equipment to supplement electrical power and valve motive power sources.

In response to Generic Letter (GL) 89-16, a number of facilities with Mark I containments installed vent valves in the torus room, near the drywell, or both. Licensees can continue to use these venting locations or select new locations, provided the requirements of this guidance document are satisfied. The HCVS improves the chances of core cooling by removing heat from containment and lowering containment pressure, when core cooling is provided by other systems. If core cooling were to fail and result in the onset core damage, closure of the vent valves may become necessary if the system was not designed for severe accident service. In addition, leakage from the HCVS within the plant and the location of the external release from the HCVS could impact the event response from on-site operators and off-site help arriving at the plant. An adequate strategy to minimize radiological consequences that could impede personnel actions should include the following:

1. Licensees shall provide permanent radiation shielding where necessary to facilitate personnel access to valves and allow manual operation of the valves locally. Licensee may use alternatives such as providing features to facilitate manual operation of valves from remote locations, as discussed further in this guidance under Requirement 1.2.2, or relocate the vent valves to areas that are significantly less challenging to operator access/actions.

2. In accordance with Requirement 1.2.8, the HCVS shall be designed for pressures that are consistent with the higher of the primary containment design pressure and the primary containment pressure limit (PCPL), as well as including dynamic loading resulting from system actuation. In addition, the system shall be leak-tight. As such, ventilation duct work (i.e., sheet metal) shall not be utilized in the design of the HCVS. Licensees should perform appropriate testing, such as hydrostatic or pneumatic testing, to establish the leak-tightness of the HCVS.

3. The HCVS release to outside atmosphere shall be at an elevation higher than adjacent plant structures. Release through existing plant stacks is considered acceptable, provided the guidance under Requirement 1.2.6 is satisfied. If the release from HCVS is through a vent stack different than the plant stack, the elevation of the stack should be higher than the nearest building or structure.

Response (ref. ISG Item 1.1.3):

The CHV System will be designed for reliable operation from the Main Control Room or the remote operating station in the Diesel Generator Building. Operators will not be required to access the suppression pool (wetwell) or Reactor Building area. The CHV System is an independent system and is designed to minimize system cross flow, prevent steam flow into unintended areas, provide containment isolation, and provide reliable and rugged performance as discussed below for NRC Order requirements 1.2.6.

Dose rates in the Main Control Room and Diesel Generator Building are expected to be low enough to allow operator access to operate the system. Shielding or other alternatives to facilitate remote-manual actions are not required for operation of the vent under these conditions since remote operation is conducted from the Diesel Generator Building or the Main Control Room.

The responses to ISG 1.1.3 Staff Position 2 and 3 are addressed in the responses to ISG Items 1.2.7 (design pressure and testing requirements) and 1.2.9 (elevation of release point).

Section 3: Operational Characteristics

Order EA-050 1.2.1 Requirement:

The HCVS shall have the capacity to vent the steam/energy equivalent of 1 percent of licensed/rated thermal power (unless a lower value is justified by analyses), and be able to maintain containment pressure below the primary containment design pressure.

ISG 1.2.1 Staff Position:

Beyond design basis external events such as a prolonged SBO could result in the loss of active containment heat removal capability. The primary design objective of the HCVS is to provide sufficient venting capacity to prevent a long-term overpressure failure of the containment by keeping the containment pressure below the primary containment design pressure and the PCPL. The PCPL may be dictated by other factors, such as the maximum containment pressure at which the safety relief valves (SRVs) and the HCVS valves can be opened and closed.

The NRC staff has determined that, for a vent sized under conditions of constant heat input at a rate equal to 1 percent of rated thermal power and containment pressure equal to the lower of the primary containment design pressure and the PCPL, the exhaust-flow through the vent would be sufficient to prevent the containment pressure from increasing. This determination is based on studies that have shown that the torus suppression capacity is typically sufficient to absorb the decay heat generated during at least the first three hours following the shutdown of the reactor with suppression pool as the source of injection, that decay heat is typically less than 1 percent of rated thermal power three hours following shutdown of the reactor, and that decay heat continues to decrease to well under 1 percent, thereafter. Licensees shall have an auditable engineering basis for the decay heat absorbing capacity of their suppression pools, selection of venting pressure such that the HCVS will have sufficient venting capacity under such conditions to maintain containment pressure at or below the primary containment design pressure and the PCPL. If required, venting capacity shall be increased to an appropriate level commensurate with the licensee's venting strategy. Licensees may also use a venting capacity sized under conditions of constant heat input at a rate lower than 1 percent of thermal power if it can be justified by analysis that primary containment design pressure and the PCPL would not be exceeded. In cases where plants were granted, have applied, or plan to apply for power uprates, the licensees shall use 1 percent thermal power corresponding to the uprated thermal power. The basis for the venting capacity shall give appropriate consideration of where venting is being performed from (i.e., wetwell or drywell) and the difference in pressure between the drywell and the suppression chamber. Vent sizing for multi-unit sites must take into consideration simultaneous venting from all the units, and ensure that venting on one unit does not negatively impact the ability to vent on the other units.

Response (ref. ISG Item 1.2.1):

The CHV System will be designed such that the wetwell path will be capable of venting steam/energy at a nominal capacity of 1% of 3556 MWt thermal power at a pressure of 45 psig. This power level corresponds to the current licensed rated power plus a possible future 2% power uprate. For Columbia, this pressure is containment design pressure, which is lower than primary containment pressure limit (PCPL).

The vent will then be able to prevent containment pressure from increasing above the containment design pressure. The detailed design will confirm the decay heat absorbing capacity of the suppression pool and that the CHV System has sufficient venting capacity to maintain containment pressure at or below the primary containment design pressure.

Order EA-050 1.2.2 Requirement:

The HCVS shall be accessible to plant operators and be capable of remote operation and control, or manual operation, during sustained operations.

ISG 1.2.2 Staff Position:

The preferred location for remote operation and control of the HCVS is from the main control room. However, alternate locations to the control room are also acceptable, provided the licensees take into consideration the following:

1. *Sustained operations mean the ability to open/close the valves multiple times during the event. Licensees shall determine the number of open/close cycles necessary during the first 24 hours of operation and provide supporting basis consistent with the plant-specific containment venting strategy.*
2. *An assessment of temperature and radiological conditions that operating personnel may encounter both in transit and locally at the controls. Licensee may use alternatives such as providing features to facilitate manual operation of valves from remote locations or relocating/reorienting the valves.*
3. *All permanently installed HCVS equipment, including any connections required to supplement the HCVS operation during a prolonged SBO (electric power, N2/air) shall be located above the maximum design basis external flood level or protected from the design basis external flood.*
4. *During a prolonged SBO, manual operation/action may become necessary to operate the HCVS. As demonstrated during the Fukushima event, the valves lost motive force including electric power and pneumatic air supply to the valve operators, and control power to solenoid valves. If direct access and local operation of the valves is not feasible due to temperature or radiological hazards, licensees should include design features to facilitate remote manual operation of the HCVS valves by means such as reach rods, chain links, hand wheels, and portable equipment to provide motive force (e.g., air/N2 bottles, diesel powered compressors, and dc batteries). The connections between the valves and portable equipment should be designed for quick deployment. If a portable motive force (e.g., air or N2 bottles, dc power supplies) is used in the design strategy, licensees shall provide reasonable protection of that equipment consistent with the staff's guidance delineated in JLD-ISG-2012-01 for Order EA-12-049.*
5. *The design shall preclude the need for operators to move temporary ladders or operate from atop scaffolding to access the HCVS valves or remote operating locations.*

Response (ref. ISG Item 1.2.2):

The CHV System design allows initiating and then operating and monitoring the CHV System from the Main Control Room. This location is also protected from adverse natural phenomena and occupational hazards.

1. The CHV System flow path valves are AOVs with air-to-open and spring-to-shut operators. Opening the valves requires energizing a DC powered SOV and providing motive air/gas. The detailed design will provide a permanently installed DC power source and motive air/gas supply adequate for the first 24 hours. The preliminary design will allow for a minimum of four valve operating cycles. The detailed design will finalize the number of required valve cycles for the first 24-hours and the initial stored motive air/gas will be designed to support the required number of valve cycles. Each of the valves that must be opened will be provided with a single SOV. The SOVs will be of a design that allows for local manual override operation to open the CHV System valves in the event of an SOV failure or loss of DC power. The SOVs will be located in the Diesel Generator Building, which is an area that would be accessible during an ELAP.
2. An assessment of temperature and radiological conditions that operating personnel may encounter both in transit and at the remote operating station in the Diesel Generator Building will be performed.

3. Maximum flood elevation for Columbia is 433.3 ft. mean sea level (MSL). All equipment will be located in the Reactor Building, Diesel Generator Building or on the exterior of the Diesel Generator Building, which have nominal grade elevation of 441 ft. MSL; thus equipment and access pathways are above analyzed floodwater elevations.
4. All valves required to open the vent flow path are designed for remote manual operation from two locations during an ELAP, i.e., no valve operation via handwheel, reach–rod or similar means that requires operators to be in close proximity to the valve. Remote operation of the valves from the Diesel Generator Building will be accomplished by manual operation of the SOV which provides motive gas to the CHV System valve(s). Supplemental connections will be pre-engineered to minimize man-power resources and any needed portable equipment will be reasonably protected from defined hazards in accordance with NEI 12-06.
5. Access to the locations described above will not require ladders or scaffolding. Both operating locations (Main Control Room and remote operating station) are located at floor level.

Order EA-050 1.2.3 Requirement:

The HCVS shall include a means to prevent inadvertent actuation.

ISG 1.2.3 Staff Position:

The design of the HCVS shall incorporate features, such as control panel key-locked switches, locking systems, rupture discs, or administrative controls to prevent the inadvertent use of the vent valves. The system shall be designed to preclude inadvertent actuation of the HCVS due to any single active failure. The design should consider general guidelines such as single point vulnerability and spurious operations of any plant installed equipment associated with HCVS.

The objective of the HCVS is to provide sufficient venting of containment and prevent long-term overpressure failure of containment following the loss of active containment heat removal capability or prolonged SBO. However, inadvertent actuation of HCVS due to a design error, equipment malfunction, or operator error during a design basis loss-of-coolant accident (DBLOCA) could have an undesirable effect on the containment accident pressure (CAP) to provide adequate net positive suction head to the emergency core cooling system (ECCS) pumps. Therefore, prevention of inadvertent actuation, while important for all plants, is essential for plants relying on CAP. The licensee submittals on HCVS shall specifically include details on how this issue will be addressed on their individual plants for all situations when CAP credit is required.

Response (ref. ISG Item 1.2.3):

The features that prevent inadvertent system actuation are having two PCIVs and one SCIV all in series. Each valve will be controlled with a separate key lock control switch. The CHV System CIVs are normally closed AOVs that are air-to-open and spring-to-shut. The valves will fail closed on loss of pneumatic pressure and fail as-is on loss of DC power. The DC SOV must be momentarily energized to allow the motive air to open the valve. By locating the manually operated SOVs in a locked cabinet, inadvertent operation from the remote operating station will be prevented. No accident isolation logic will be provided for the CHV System CIVs because they will be locked closed and administratively controlled.

Emergency Operating Procedures (EOPs) or other applicable emergency response procedures will be revised to provide guidance as to what conditions require use of the CHV System. This procedural guidance will prevent a compromise of containment integrity during a design basis transient or accident.

Order EA-050 1.2.4 Requirement:

The HCVS shall include a means to monitor the status of the vent system (e.g., valve position indication) from the control room or other location(s). The monitoring system shall be designed for sustained operation during a prolonged SBO.

ISG 1.2.4 Staff Position:

Plant operators must be able to readily monitor the status of the HCVS at all times, including being able to understand whether or not containment pressure/energy is being vented through the HCVS, and whether or not containment integrity has been restored following venting operations. Licensees shall provide a means to allow plant operators to readily determine, or have knowledge of, the following system parameters:

(1) HCVS vent valves' position (open or closed),

(2) system pressure, and

(3) effluent temperature.

Other important information includes the status of supporting systems, such as availability of electrical power and pneumatic supply pressure. Monitoring by means of permanently installed gauges that are at, or nearby, the HCVS control panel is acceptable. The staff will consider alternative approaches for system status instrumentation; however, licensees must provide sufficient information and justification for alternative approaches.

The means to monitor system status shall support sustained operations during a prolonged SBO, and be designed to operate under potentially harsh environmental conditions that would be expected following a loss of containment heat removal capability and SBO. Power supplies to all instruments, controls, and indications shall be from the same power sources supporting the HCVS operation. "Sustained operations" may include the use of portable equipment to provide an alternate source of power to components used to monitor HCVS status. Licensees shall demonstrate instrument reliability via an appropriate combination of design, analyses, operating experience, and/or testing of channel components for the following sets of parameters:

- *radiological conditions that the instruments may encounter under normal plant conditions, and during and after a prolonged SBO event.*
- *temperatures and pressure conditions as described under requirement 1.2.8, including dynamic loading from system operation.*
- *humidity based on instrument location and effluent conditions in the HCVS.*

Response (ref. ISG Item 1.2.4):

The design of the CHV System will have temperature, pressure and flow monitoring downstream of the last PCIV. Each of the vent flow path or drain valves will have open and closed position indication. These CHV System indications will be at or near the same location as the valve control switches in the Main Control Room. Valve position indication will also be provided at the remote operating location in the Diesel Generator Building. Motive air/gas pressure and battery charger level will also have indications in the Main Control Room.

Power for the instrumentation will be from the same source as for the SOVs. Refer to the response to 1.2.2 for discussion on sustainability of power.

The various instrument ranges will be finalized when the detailed design and equipment specifications are prepared.

The detailed design will address the radiological, temperature, pressure, flow induced vibration (if applicable) and internal piping dynamic forces, humidity/condensation and seismic qualification requirements. Assumed radiological conditions will be those expected after an ELAP.

Order EA-050 1.2.5 Requirement:

The HCVS shall include a means to monitor the effluent discharge for radioactivity that may be released from operation of the HCVS. The monitoring system shall provide indication in the control room or other location(s), and shall be designed for sustained operation during a prolonged SBO.

ISG 1.2.5 Staff Position:

Licensees shall provide an independent means to monitor overall radioactivity that may be released from the HCVS discharge. The radiation monitor does not need to meet the requirements of NUREG 0737 for monitored releases, nor does it need to be able to monitor releases quantitatively to ensure compliance with Title 10 of the Code of Federal Regulations (10 CFR) Part 100 or 10 CFR Section 50.67. A wide-range monitoring system to monitor the overall activity in the release providing indication that effluent from the containment environment that is passing by the monitor is acceptable. The use of other existing radiation monitoring capability in lieu of an independent HCVS radiation monitor is not acceptable because plant operators need accurate information about releases coming from the containment via the HCVS in order to make informed decisions on operation of the reliable hardened venting system.

The monitoring system shall provide indication in the control room or a remote location (i.e., HCVS control panel) for the first 24 hours of an extended SBO with electric power provided by permanent DC battery sources, and supplemented by portable power sources for sustained operations. Monitoring radiation levels is required only during the events that necessitate operation of the HCVS. The reliability of the effluent monitoring system under the applicable environmental conditions shall be demonstrated by methods described under Requirement 1.2.4.

Response (ref. ISG Item 1.2.5):

The dedicated CHV System radiation monitoring system will be provided to monitor the effluent stream. The system will be qualified for harsh environmental conditions applicable to ELAP. The range of the radiation monitoring system will be determined during the detailed design of the system.

The radiation level will be indicated in the Main Control Room. The radiation monitoring system will be powered from the same dedicated DC power source as other powered CHV System components. This power source will provide power for the first 24 hours of an event without any additional actions. Beyond 24 hours, FLEX equipment can provide power for extended operation.

Order EA-050 1.2.6 Requirement:

The HCVS shall include design features to minimize unintended cross flow of vented fluids within a unit and between units on the site.

ISG 1.2.6 Staff Position:

At Fukushima, an explosion occurred in Unit 4, which was in a maintenance outage at the time of the event. Although the facts have not been fully established, a likely cause of the explosion in Unit 4 is that hydrogen leaked from Unit 3 to Unit 4 through a common venting system. System cross-connections present a potential for steam, hydrogen, and airborne radioactivity leakage to other areas of the plant and to adjacent units at multi-unit sites if the units are equipped with common vent piping. In this context, a design that is free of physical and control interfaces with other systems eliminates the potential for any cross-flow and is one way to satisfy this requirement. Regardless, system design shall provide design features to prevent the cross flow of vented fluids and migration to other areas within the plant or to adjacent units at multi-unit sites.

The current design of the hardened vent at several plants in the U.S. includes cross connections with the standby gas treatment system, which contains sheet metal ducts and filter and fan housings that are not as leak tight as hard pipes. In addition, dual unit plant sites are often equipped with a common plant stack. Examples of acceptable means for prevention of cross flow is by valves, leak-tight dampers, and check valves, which shall be designed to automatically close upon the initiation of the HCVS and shall remain closed for as long as the HCVS is in operation. Licensee's shall evaluate the environmental conditions (e.g. pressure, temperature) at the damper locations during venting operations to ensure that the dampers will remain functional and sufficiently leak-tight, and if necessary, replace the dampers with other suitable equipment such as valves. If power is required for the interfacing valves to move to isolation position, it shall be from the same power sources as the vent valves. Leak tightness of any such barriers shall be periodically verified by testing as described under Requirement 1.2.7.

Response (ref. ISG Item 1.2.6):

The CHV System vent flow path piping is independent and has no interfacing systems. This eliminates any potential for inter-system leakage through valves and dampers and it eliminates the need to isolate interfacing system valves.

Order EA-050 1.2.7 Requirement:

The HCVS shall include features and provision for the operation, testing, inspection and maintenance adequate to ensure that reliable function and capability are maintained.

ISG 1.2.7 Staff Position:

The HCVS piping run shall be designed to eliminate the potential for condensation accumulation, as subsequent water hammer could complicate system operation during intermittent venting or to withstand the potential for water hammer without compromising the functionality of the system. Licensees shall provide a means (e.g., drain valves, pressure and temperature gauge connections) to periodically test system components, including exercising (opening and closing) the vent valve(s). In situations where total elimination of condensation is not feasible, HCVS shall be designed to accommodate condensation, including applicable water hammer loads.

The HCVS outboard of the containment boundary shall be tested to ensure that vent flow is released to the outside with minimal leakage, if any, through the interfacing boundaries with other systems or units. Licensees have the option of individually leak testing interfacing valves or testing the overall leakage of the HCVS volume by conventional leak rate testing methods. The test volume shall envelope the HCVS between the outer primary containment isolation barrier and the vent exiting the plant buildings, including the volume up to the interfacing valves. The test pressure shall be based on the HCVS design pressure. Permissible leakage rates for the interfacing valves shall be within the requirements of American Society of Mechanical Engineers Operation and Maintenance of Nuclear Power Plants Code (ASME OM) – 2009, Subsection ISTC – 3630 (e) (2), or later edition of the ASME OM Code. When testing the HCVS volume, allowed leakage shall not exceed the sum of the interfacing valve leakages as determined from the ASME OM Code. The NRC staff will consider a higher leakage acceptance values if licensees provide acceptable justification. When reviewing such requests, the NRC staff will consider the impact of the leakage on the habitability of the rooms and areas within the building and operability of equipment in these areas during the event response and subsequent recovery periods. Licensees shall implement the following operation, testing and inspection requirements for the HCVS to ensure reliable operation of the system.

Testing and Inspection Requirements

Description	***Frequency***
Cycle the HCVS valves and the interfacing system valves not used to maintain containment integrity during operations.	*Once per year*
Perform visual inspections and a walkdown of HCVS components	*Once per operating cycle*

Description	*Frequency*
Test and calibrate the HCVS radiation monitors.	*Once per operating cycle*
Leak test the HCVS.	*(1) Prior to first declaring the system functional;* *(2) Once every five years 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 logic from its control panel and ensuring that all interfacing system valves move to their proper (intended) positions.	*Once per every other operating cycle*

Response (ref. ISG Item 1.2.7):

The detailed design for the CHV System will address condensation accumulation resulting from intermittent venting. In situations where elimination of condensation is not feasible, the CHV System will be designed to accommodate condensation, including allowance for applicable water hammer loads. The preliminary design incorporates drain valves at appropriate locations to remove condensation.

The CHV System PCIVs will be tested or inspected in accordance with the licensing and design basis for the plant. The CHV System past the outboard PCIVs will be tested in conformance with one of the ISG methods. The test pressure shall be based on the CHV System design pressure, 92 psig. Permissible leakage rates will be determined during the development of the test procedures for the system.

The test types and frequencies will conform to the ISG 1.2.7 Table "Testing and Inspection Requirements" with the clarification that "Leak test the CHV System" applies to the CHV System boundary valves. The determination to perform individual valve leak tests or an overall system leak test will be made during the detailed design of the system and development of test procedures.

Order EA-050 1.2.8 Requirement:

The HCVS shall be designed for pressures that are consistent with maximum containment design pressures, as well as, dynamic loading resulting from system actuation.

ISG 1.2.8 Staff Position:

The vent system shall be designed for the higher of the primary containment design pressure or PCPL, and a saturation temperature corresponding to the HCVS design pressure. However, if the venting location is from the drywell, an additional margin of 50 °F shall be added to the design temperature because of the potential for superheated conditions in the drywell. The piping, valves, and the valve actuators shall be designed to withstand the dynamic loading resulting from the actuation of the system, including piping reaction loads from valve opening, concurrent hydrodynamic loads from SRV discharges to the suppression pool, and potential for water hammer from accumulation of steam condensation during multiple venting cycles.

Response (ref. ISG Item 1.2.8):

The CHV System design pressure is 92 psig and design temperature is 383°F. The CHV System design pressure is equal to the PCPL at 92 psig, which is higher than the 45 psig primary containment design pressure. The CHV System design temperature is the saturation temperature corresponding to the design pressure plus 50 degrees of superheat.

The piping, valves, and valve actuators will be designed to withstand the dynamic loading resulting from the actuation of the CHV System, including piping reaction loads from valve opening, concurrent hydrodynamic loads from safety relief valve discharges to the suppression pool, and potential for water hammer from accumulation of condensation during multiple venting cycles.

Order EA-050 1.2.9 Requirement:

The HCVS shall discharge the effluent to a release point above main plant structures.

ISG 1.2.9 Staff Position:

The HCVS release to outside atmosphere shall be at an elevation higher than adjacent plant structures. Release through existing plant stacks is considered acceptable, provided the guidance under Requirement 1.2.6 is satisfied. If the release from HCVS is through a stack different than the plant stack, the elevation of the stack should be higher than the nearest building or structure. The release point should be situated away from ventilation system intake and exhaust openings, and emergency response facilities. The release stack or structure exposed to outside shall be designed or protected to withstand missiles that could be generated by the external events causing the prolonged SBO (e.g., tornadoes, high winds).

Response (ref. ISG Item 1.2.9):

The CHV System discharge path will be routed to a point above any adjacent structure. This discharge point is just above the Reactor Building roof such that the release point will vent away from ventilation system intake and exhaust openings, Main Control Room location, location of FLEX access routes required following an ELAP, and emergency response facilities.

The detailed design will address wind loading and missile protection from external events assumed in the plant design basis for the outside portions of the selected release stack or structure.

Section 4: Applicable Quality Requirements

Order EA-050 2.1 Requirement:

The HCVS vent path up to and including the second containment isolation barrier shall be designed consistent with the design basis of the plant. These items include piping, piping supports, containment isolation valves, containment isolation valve actuators and containment isolation valve position indication components.

ISG 2.1 Staff Position:

The HCVS design, out to and including the second containment isolation barrier, shall meet safety-related requirements consistent with the design basis of the plant. The staff notes that in response to GL 89-16, in many cases, the HCVS vent line connections were made to existing systems. In some cases, the connection was made in between two existing containment isolation valves and in others to the vacuum breaker line. The HCVS system design shall not preclude the containment isolation valves, including the vent valve from performing their intended containment isolation function consistent with the design basis for the plant. The design shall include all necessary overrides of containment isolation signals and other interface system signals to enable the vent valves to open upon initiation of the HCVS from its control panel

Response (ref. ISG Item 2.1):

The CHV System vent path piping and supports up to and including the second PCIV will be designed in accordance with existing design basis. The independent CHV System design will not preclude the other dedicated PCIVs from performing their intended containment isolation function consistent with the design basis for the plant. The CHV System will provide a dedicated flow path with passive (locked closed) CIVs. Associated actuators, position indication, and power supplies are designed consistent with the design basis of the plant as required to maintain their design basis function of maintaining the valves closed. The valve control circuit will allow operation of the CHV System from its control panel entirely independent of any containment isolation signals. No accident isolation signals will be provided to the CHV System PCIVs because they are administratively controlled and locked closed during normal plant operation.

Order EA-050 2.2 Requirement:

All other HCVS components shall be designed for reliable and rugged performance that is capable of ensuring HCVS functionality following a seismic event. These items include electrical power supply, valve actuator pneumatic supply, and instrumentation (local and remote) components.

ISG 2.2 Staff Position:

All components of the HCVS beyond the second containment isolation barrier shall be designed to ensure HCVS functionality following the plant's design basis seismic event. These components include, in addition to the hardened vent pipe, electric power supply, pneumatic supply and instrumentation. The design of power and pneumatic supply lines between the HCVS valves and remote locations (if portable sources were to be employed) shall also be designed to ensure HCVS functionality. Licensees shall ensure that the HCVS will not impact other safety-related structures and components and that the HCVS will not be impacted by non-seismic components. The staff prefers that the HCVS components, including the piping run, be located in seismically qualified structures. However, short runs of HCVS piping in non-seismic structures are acceptable if the licensee provides adequate justification on the seismic ruggedness of these structures. The hardened vent shall be designed to conform to the requirements consistent with the applicable design codes for the plant, such as the American Society of Mechanical Engineers Boiler and Pressure Vessel Code and the applicable Specifications, Codes and Standards of the American Institute of Steel Construction.

To ensure the functionality of instruments following a seismic event, the NRC staff considers any of the following as acceptable methods:

- *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.*

Response (ref. ISG Item 2.2):

The CHV System components downstream of the second PCIV and components that interface with the CHV System will be routed in seismic category 1 structures or attached to seismic category 1 structures by seismic category 1 supports. The CHV System downstream of the second PCIV, including piping and supports, electrical power supply, valve actuator pneumatic supply, and instrumentation (local and remote) components, will be designed/analyzed to conform to the requirements consistent with the applicable design codes for the plant and to ensure functionality following a design basis earthquake.

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

1. Purchase of instruments and supporting components with known operating principles from manufacturers with commercial quality assurance programs (e.g., ISO 9001) where the procurement specifications include the applicable seismic requirements, design requirements, and applicable testing.
2. Demonstration of seismic reliability via methods that predict performance as described in IEEE 344-2004.
3. Demonstration that instrumentation is substantially similar to the design of instrumentation previously qualified.

Instrument	**Qualification Method**
CHV System Process Temperature	Later (to be provided in future status report)
CHV System Process Pressure	Later (to be provided in future status report)
CHV System Process Flow	Later (to be provided in future status report)
CHV System Process Radiation Monitor	Later (to be provided in future status report)
CHV System Process Valve Position	Later (to be provided in future status report)
CHV System Pneumatic Supply Pressure	Later (to be provided in future status report)
CHV System Electrical Power Supply Monitor	Later (to be provided in future status report)

Section 5: Procedures and Training

Order EA-050 3.1 Requirement:

Licensees shall develop, implement, and maintain procedures necessary for the safe operation of the HCVS. Procedures shall be established for system operations when normal and backup power is available, and during SBO conditions.

ISG 3.1 Staff Position:

Procedures shall be developed describing when and how to place the HCVS in operation, the location of system components, instrumentation available, normal and backup power supplies, directions for sustained operation, including the storage location of portable equipment, training on operating the portable equipment, and testing of equipment. The procedures shall identify appropriate conditions and criteria for use of the HCVS. The procedures shall clearly state the nexus between CAP and ECCS pumps during a DBLOCA and how an inadvertent opening of the vent valve could have an adverse impact on this nexus. The HCVS procedures shall be developed and implemented in the same manner as other plant procedures necessary to support the execution of the Emergency Operating Procedures (EOPs).

Licensees shall establish provisions for out-of-service requirements of the HCVS and compensatory measures. These provisions shall be documented in the Technical Requirements Manual (TRM) or similar document. The allowed unavailability time for the HCVS shall not exceed 30 days during modes 1, 2, and 3. If the unavailability time exceeds 30 days, the TRM shall direct licensees to perform a cause assessment and take the necessary actions to restore HCVS availability in a timely manner, consistent with plant procedures and prevent future unavailability for similar causes.

Response (ref. ISG Item 3.1):

Procedures will be established for CHV System operations when normal and backup power is available, and during ELAP conditions. The CHV System procedures will be developed and implemented following the plant's process for initiating or revising procedures. The new/revised procedures will contain details on the appropriate conditions and criteria for use of the CHV System.

Periodic maintenance and testing will be established according to the normal plant maintenance processes.

Training requirements are addressed in ISG Response 3.2 below.

Energy Northwest will establish provisions for out-of-service requirements of the CHV System and compensatory measures. Details of the out of service requirement will be determined during development of the Licensee Controlled Specifications (LCS) revision.

Order EA-050 3.2 Requirement:

Licensee shall train appropriate personnel in the use of the HCVS. The training curricula shall include system operations when normal and backup power is available, and during SBO conditions.

ISG 3.2 Staff Position:

All personnel expected to operate the HVCS shall receive training in the use of plant procedures developed for system operations when normal and backup power is available, and during SBO conditions consistent with the plants systematic approach to training. The training shall be refreshed on a periodic basis and as any changes occur to the HCVS.

Response (ref. ISG Item 3.2):

Personnel expected to perform direct operation of the CHV System 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 CHV System. The training will utilize the systematic approach to training.

Section 6: Implementation Schedule Milestones

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.

Target Date	Activity	Status
Oct. 2012	Hold preliminary/conceptual design meeting	Complete
Oct. 2012	Submit 60 Day Status Report	Complete
Feb. 2013	Submit Overall Integrated Implementation Plan	Complete
Aug 2013	Submit 6 Month Status Report	Not yet started
Dec 2013	100% Design Complete	In progress
Jan. 2014	Start Online Installation	Not yet started
Feb. 2014	Submit 6 Month Status Report	Not yet started
June 2014	Procedure Changes Complete	Not yet started
Aug. 2014	Major Material On-site	Not yet started
Aug. 2014	Submit 6 Month Status Report	Not yet started
Feb. 2015	Submit 6 Month Status Report	Not yet started
May 2015	Start Outage Installation	Not yet started
June 2015	Installation Complete, R22 Outage	Not yet started
June 2015	Demonstration/Functional Test	Not yet started
June 2015	Procedure Changes Active	Not yet started
June 2015	Turnover to Operations	Not yet started
Aug 2015	Submit Completion Report (6 Month Status Report)	Not yet started

Section 7: Changes/Updates to this Overall Integrated Implementation Plan

This is the Overall Integrated Plan for the project. Information provided is based upon the conceptual study, because no detailed design work has been completed to date. Proposed construction and implementation dates are subject to equipment and material availability at time of purchase. Any significant changes to this plan will be communicated to the NRC staff in subsequent Six-Month Status Reports.

Section 8: Figures/Diagrams

Figure 1: Basic Flow Diagram

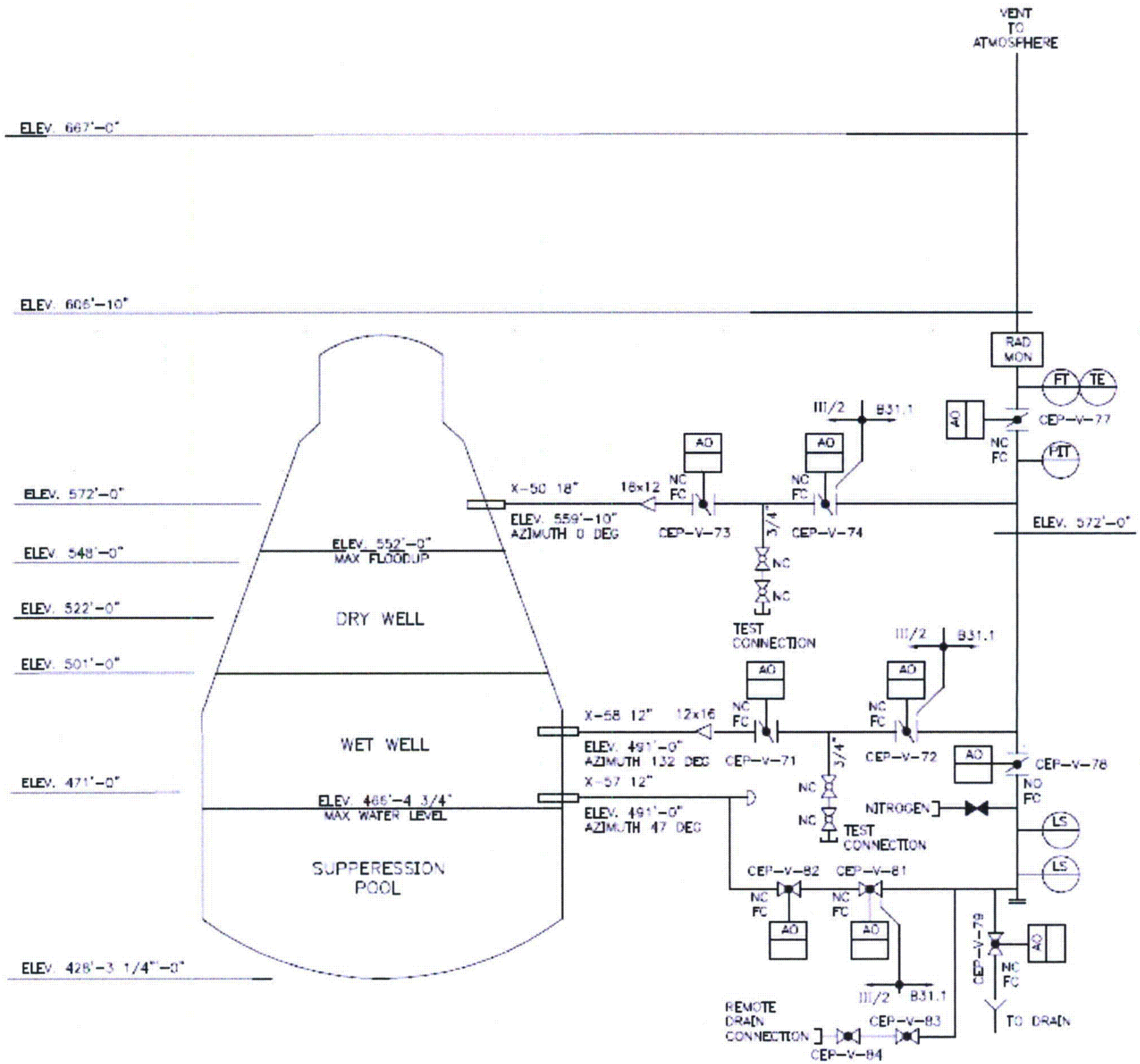


Figure 2: Actuating Nitrogen System

LATER (future Six-Month Status report)

Figure 3: DC Power Distribution

LATER (future Six-Month Status report)

Table 1

CHV System Fault Analysis

Functional Failure Mode	Failure Cause	Alternate Action	Does Failure with Alternate Action Prevent Containment Venting?
Fail to Vent (Open) on Demand	Valves fail to open due to complete loss of DC batteries (long term)	Open valves by local manual operation of the latching SOVs	No
	Valves fail to open due to loss of dedicated pneumatic air supply (long term)	Replace bottles or provide pneumatic supply via FLEX portable air compressor	No
	Valves fail to open due to loss of alternate pneumatic air supply (long term)	Replace bottles or provide pneumatic supply via FLEX portable air compressor	No
	Valve fails to open due to SOV failure	Open SOV by manual operation from remote operating station. SOV will remain latched open to provide pneumatic actuation	No
	PCIV fails to open from mechanical binding or damage	Vent using the redundant pathway from drywell or wetwell	No
	SCIV fails to open from mechanical binding or damage	Local manual (handwheel) operation if access to valve is allowed by plant conditions	No* * if access is available
Fail to stop venting (Close) on demand	All three valves in the vent flow path fail open from loss of DC power when SOVs are latched open	Manually close at least one SOV from the remote operating station	No

Table 1

CHV System Fault Analysis

Functional Failure Mode	Failure Cause	Alternate Action	Does Failure with Alternate Action Prevent Containment Venting?
Spurious Opening	Not credible as key locked switches prevent mis-positioning of the CHV System isolation valves Manual SOV operation is precluded by preventing access to the valves by key locked physical barrier. Valves are normally closed, fail closed.	N/A	No
Spurious Closure	Valve fails to stay open due to failure of latching SOV to remain latched	Relatch SOV by manual action at the remote operating station in the DG building	No
	Valve fails to stay open due to complete loss of DC batteries (long term)	Not credible, as SOVs latch open, so they will remain open for any length of time without DC power. No action required.	No
	Valve fails to stay open due to loss of normal pneumatic air supply	Replace bottles or provide pneumatic supply via FLEX portable air compressor	No
Automatic isolation from other systems	Not credible as no isolation signals are provided to the CHV System valves	N/A	No