HCVS Guidance Inquiry Form

A. TOPIC: HCVS Primary and Alternate Controls and Monitoring locations  
Inq. No.: HCVS-FAQ-01

Source document: NEI 13-02 Sections: Order EA-13-109, Element 1.2.4, 1.2.5, 1.2.6, NEI 13-02 Section 4.2.2 and 4.2.3

B. DESCRIPTION:

What radiological and thermal conditions have to be considered in the design and location of the Primary (1.2.4) and Alternate (1.2.5) Controls locations?

Order Element 1.2.4 states, “The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.”

Order Element 1.2.5 states, “The HCVS shall, in addition to meeting the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.

C. PROPOSED ANSWER (Include additional pages if necessary. Total pages: 2)

Primary and/or Alternate Control locations located in the Main Control Room are readily accessible locations with no further evaluation required since only radiation dose is a concern for this order not contamination. Not having power for MCR ventilation is not a factor. Thus no evaluation is required for use of the MCR as the preferred location because the MCR is designed to conform to GDC 19/Alternate Source Term (AST) for radiation shielding considerations. In addition, adequate protective clothing and respirators are available near the MCR if required to address contamination issues.

Primary and/or Alternate Control locations located outside the main control room must be determined to be readily accessible locations by performing an evaluation that includes:

- Accessibility
- Habitability
- Staffing sufficiency
- Communication capability with vent use decision makers

When evaluating accessibility and habitability of control locations outside the Control Room, consider the following:

Environmental Conditions:

Thermal Considerations: (Response support Order Elements 1.1.2 and 1.1.4):

- Temperature and heat load that exist from operation of the HCVS system
- Temperature and heat load that exist due to proximity to the undercooled containment including under severe accident conditions.
- Temperature and heat load that exists due to the ELAP condition (loss of ventilation). Action taken to provide ventilation may be considered when evaluating habitability.
- Thermal impact to the Spent Fuel Pool Area caused by the ELAP condition, but full core off load need not be considered since HCVS operation is not required when a reactors core is off loaded into the SFP.

Radiological Considerations: (Response support Order Elements 1.1.3)

- Radiological conditions that exist from operation of the HCVS system

The specific event progression that leads to the Severe Accident is NOT specified and does not have to include source
terms from loss of Spent Fuel Pool Cooling as this would presume that the event progression that leads to the Severe Accident also prevents or causes the mitigating measures for loss of Spent Fuel Pool Cooling to fail. Order element 1.1.3 does discuss the requirement to consider the dose and radiological conditions caused by operation of the HCVS system but not failure of Mitigating systems related to Spent Fuel Pool Cooling.

Operator conditions: This would be governed by the above environmental conditions. Temperature conditions should be such that occupancy stay times consistent with the time to conduct HCVS operation and monitoring (instrumentation controls and displays) functions from the primary and/or alternate locations.

Communication capability does not necessarily have to be direct between the operator performing the HCVS operations and the decision maker but must be reliable and accessible while HCVS operation is required.

Time frame:

Time frames are typically associated with pre and post 24 hour actions as illustrated in Order element 1.2.6, which states: “The HCVS shall be capable of operating with dedicated and permanently installed equipment for at least 24 hours following the loss of normal power or loss of normal pneumatic supplies to air operated components during an extended loss of AC power.”

This means that with minimal operator action the equipment should be capable of operating in the thermal and radiological environment for at least 24 hours. Other provisions of NEI-13-02 such as the definition of “Sustained Operations” extend this time but do NOT preclude mitigating measures from FLEX or offsite support for reduction of thermal impacts (e.g. portable fans, AC power for ventilation, possible cooling water supplies to the area coolers if part of the FLEX mitigating measures). The restriction on permanently installed equipment only exists for the 24 hour period to ensure HCVS functionality for at least a 24 hour mission time without significant operator action to maintain functionality. See FAQ HCVS-02 on Order Element 1.2.6 use of “dedicated equipment”. This time frame concept may be applied to operator accessibility and habitability for primary control locations outside of the control room. The HCVS OIP should include the actions relied upon for HCVS initiation and if the actions are coming from some other guidance such as FLEX, provide a cross reference to where the information can be found.

Radiological conditions will also vary with the source term over time and could either drop or rise depending on deposition of source term in the HCVS system and vent system use. This will have to be accounted for over the time frame during which the HCVS system is being used. The definition of “sustained operation” prescribes this time frame based on when other containment cooling measures are put in place and when HCVS system operation ceases.

**D. RESOLUTION:** (Include additional pages if necessary. Total pages: 2)

The proposed resolution is correct. Discussed with NRC in Public meetings in January, February and March 2014

Revision: 2 Date: April 14, 2014

**E. NRC Review:**

Not Necessary X Interpretation Agency Position

Explanation: Discussed at NEI-NRC Public Meeting 3/26/2014 with specific NRC comments incorporated.

Incorporated additional comments from NEI workshop on April 10, 2014

**F. Industry Approval:**

Documentation Method: FAQ Date: 04/14/2014
## A. TOPIC:

<table>
<thead>
<tr>
<th>HCVS Dedicated Equipment</th>
<th>Inq. No.: HCVS-FAQ-02</th>
</tr>
</thead>
</table>

Source document: EA-13-109 / NEI 13-02  
Sections: EA-13-109, Element 1.2.6, NEI 13-02 Sec 4.1.2, 4.2.1.1, 4.2.6.1.2.

## B. DESCRIPTION:

What is the meaning of “Dedicated” in order element 1.2.6, **Order Reference: 1.2.6** - The HCVS shall be capable of operating with dedicated and permanently installed equipment for at least 24 hours following the loss of normal power or loss of normal pneumatic supplies to air operated components during an extended loss of AC power.”?

This FAQ does not address “dedicated” motive force which is addressed in white paper HCVS-WP-01.

## C. PROPOSED ANSWER (Include additional pages if necessary. Total pages: 2)

The classical definition of “dedicated” is “used only for one particular purpose [function].”

- Dictionary.com – set apart or reserved for a specific use or purpose
- Merriam-webster.com – used only for one particular purpose, given over to a particular purpose

Using this literal interpretation, the words of Order element 1.2.6 means that all equipment associated with the HCVS should be permanently installed and only serve the HCVS function. This is inconsistent with other Order elements that permit shared component functions as discussed below:

- HCVS components may serve multiple functions described in the plant Current License Basis (CLB). Examples include:
  - Piping, valves and penetrations for both Drywell and Wetwell may be used for Drywell/Wetwell vent and purge prior to or following refueling outages or for pressure control during normal plant operation.
  - Containment Isolation valves in the HCVS system may provide a containment isolation function independent of the HCVS function.
  - Containment Isolation valve position indication for valves in the HCVS may be used for post-accident indications.
  - Instrumentation supporting HCVS and non HCVS functions.

- Some components in the HCVS system are powered electrically or pneumatically by non-dedicated sources to support non-HCVS functions as described in the plant CLB documents. Examples include:
  - Power to solenoids for Primary Containment Isolation valves.
  - Plant safety related air or nitrogen systems to operate isolation valves.
  - DC power from station batteries to instrumentation and indications for valves.

In summary, the correct interpretation of the word “dedicated” in the context of the HCVS order is essential for the proper implementation of the order.

The following components are examples of what does not have to be dedicated to the HCVS function and may be shared with other systems and support functions:

- Containment penetrations
- Containment isolation valves
- System boundary valves
- Piping
- Instrumentation
- Wiring, conduit and connection points used to service non-dedicated components
While the above components need not be dedicated, they need to be available to support HCVS function when containment venting using the HCVS system is required. Compliance with NEI 13-02 guidance will ensure that this condition is met.

**D. RESOLUTION:** (Include additional pages if necessary. Total pages: ___2___)

The proposed resolution is correct and discussed with NRC in Public meetings in January and February 2014.

Revision: 0  Date: March 11, 2014

**E. NRC Review:**

Not Necessary______  Interpretation__ X ___  Agency Position______________

Explanation:_________________________________________________________________

**F. Industry Approval:**

Documentation Method: ___________ FAQ_________________________  Date: __March 11, 2014___
**A. TOPIC:** HCVS Alternate Control Operating Mechanisms  
Inq. No.: HCVS-FAQ-03  
Source document: NEI 13-02  
Sections: Order EA-13-109, Element 1.2.5, 1.2.6, NEI 13-02 Section 4.2.3

**B. DESCRIPTION:**
What means of alternate manual operation is allowable for use in the HCVS system?

Order Element 1.2.5 states, “The HCVS shall, in addition to meeting the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.”

**C. PROPOSED ANSWER** (Include additional pages if necessary. Total pages: 1)

The examples of alternate operating mechanisms provided in Order element 1.2.5 (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location) are only intended to be examples. Other means of alternate manual operation are acceptable including but not limited to:

- Separate electrical components with diverse and flexible power supplies (such as the normal valve operators with FLEX power)*
- Solenoid valves with manual overrides that may be used to manually operate vent valves without electrical power
- Manual valves in pneumatic supply and vent lines that may be used to manually operate vent valves independent of solenoid valves or electrical power
- Hydraulic operators

The inclusion of direct operation capability for valves is acceptable.

* NEI 13-02 Section 6.1 – “…At least one method of operation of the HCVS should be capable of operating with permanently installed equipment for at least 24 hours during the extended loss of AC power. The system should be designed to function in this mode with permanently installed equipment providing electrical power (e.g., DC power batteries or electrical or pneumatic operation) valve motive force (e.g., N₂/air cylinders)” A method (primary or alternate) of HCVS operation may use an alternative method to that described by the 1.2.5 requirement.

**D. RESOLUTION:** (Include additional pages if necessary. Total pages: 1)

The proposed resolution is correct. Discussed with NRC in Public meetings in January, February and March 2014.

Revision: 1  Date: April 2, 2014

**E. NRC Review:**

Not Necessary______  Interpretation____ X____  Agency Position________

Explanation: Discussed at NEI-NRC Public Meeting 3/26/2014 with specific NRC comments incorporated.

**F. Industry Approval:**

Documentation Method: FAQ__________  Date: 04/02/2014
HCVS Guidance Inquiry Form

**A. TOPIC:** HCVS Release Point

**Source document:** NEI 13-02

**Inq. No.:** HCVS-FAQ-04

**Sections:** Order EA-13-109, Element 1.2.2, and NEI 13-02 Section 4.1.5

**B. DESCRIPTION:**

What is the meaning of “release point above main plant structures” in order element 1.2., “Order Reference: 1.2.2 – The HCVS shall discharge the effluent to a release point above main plant structures.”?

To be more specific, how high should the vent release point be above the building that it is based upon/emanates from and what considerations apply with respect to adjacent buildings/structures?

**C. PROPOSED ANSWER** (Include additional pages if necessary. Total pages: 4)

As is stated in Attachment 2 to the Order, “the HCVS shall be designed for those accident conditions (before and after core damage) for which containment venting is relied upon to reduce the probability of containment failure...”.

To paraphrase, the vent is designed to protect the containment against overpressurization in a beyond design basis accident such that the release of radioactive effluent will be maintained as a controlled process. This control would be lost if primary containment fails.

It is understood that the existing Plant Stack provides an acceptable release point. This is considered valid so long as it is the highest release point existing at the site. It is also understood that, if the Plant Stack is used for this purpose, measures to prevent combustible gas cross-flow between plant units must be adequately evaluated and corrective measures must be in place (if shared with another unit’s HCVS).

This response is written to address plants that have a single independent release pipe/vent per unit. This would be typically mounted onto (or emanating from) the Reactor Building, the Turbine Building, or other adjacent building convenient for the HCVS routing. This release point should only be used when venting during events which are outside of the design basis of the plant (i.e., venting for conditions from normal operation up to and including design basis accidents should be performed using ‘normal’ containment venting systems rather than the severe accident capable hardened containment venting system).

Guidance for HCVS elevated release points is separated out into a series of topics which are presented below. A synopsis of the bases for each recommendation is presented with each topic. The individual sites are encouraged to utilize this guidance as seen fit but also understand that they may take exception to any such guidance they choose with reasonable basis. This is also applicable to site specific conditions which are outside the bounds of this guidance. Note that in the case of multi-unit sites with single vents for each unit, adjacent unit emergency intake and exhaust pathways should also be considered relative to each of these 3 topics separately.

1. **Release Point Height**

   The elevated release point should be at least 3’ above the roof and related structures of the building that it emanates from. Related structures, in this case, is intended to be any appurtenances associated with the building proper (e.g., parapet walls, etc.). This value agrees with accepted industry practice for roof vents. This is also considered as reasonable based on the minimal frequency at which this system is considered to be used along with the relative buoyancy, relative temperature and potentially high flowrate of the released effluent (would tend to be minimally affected by building and structure effects). Exhaust stack design considerations are dependent on the purpose for containment venting.

   a) **Anticipatory venting to maintain core cooling**

   - When venting is performed at low containment pressure to maintain core cooling using FLEX strategies, there is no minimum required exhaust stack exit velocity, since without core damage there will be negligible levels of radionuclides and/or combustible gas in the effluent. Therefore, there is no concern with entrainment of the stack effluent into the roof or downstream recirculation zones associated with airflow around the building.
b) Severe accident venting to maintain containment integrity
   • The potential presence of significant quantities of radionuclides and/or combustible gas in the vent stack effluent requires additional restrictions to be applied to the design and operation of the vent under severe accident conditions.
   • ASHRAE HVAC Applications and Fundamental Handbooks discuss design requirements of exhaust vent stacks, but over the years the focus of the design of the vent stack was changed from the perspective of an ‘Industrial Exhaust System’ to that of a ‘Building Exhaust System’. The 2003 ASHRAE HVAC Applications was the last edition that emphasized the design of the vent stack from an industrial ventilation perspective. Hence, the 2003 ASHRAE HVAC Applications Handbook Chapter 26 is used as the guidance document, and it says that an effluent release velocity of 8000 fpm will assure that the effluent plume will not be entrained into the roof recirculation zone of a given building. Vent pipe design (e.g., pipe diameter at the exit) and conditions under which the vent is operated (e.g., minimum containment pressure at which the vent is operated; use of flow control devices) should be considered to ensure this is the predominant minimum release velocity under severe accident conditions.

   o It should be noted at this point however that strict adherence to all available guidance is not considered practical or reasonable for all aspects of the beyond design basis venting operation. It is realized that, at some point during the venting process, the containment pressure may continue to drop such that effluent flow will be reduced and effluent release velocity may drop below the stated 8000 fpm value.

   o However it must also be realized that venting of the containment volume at the accident pressures is considered to be predominately a high velocity evolution such that for the vast majority of time the effluent will be jetted up beyond the affected building recirculation zone. Effluent will not simply waft across a building roof as if released by a predominantly buoyancy driven exhaust stack but will be jetted upward from the vent due to momentum. Hence, it should be understood that by nature of any venting strategy there may be times when the effluent release velocity may drop below the stated 8000 fpm.

   o Under severe accident conditions the main purpose of the vent is to protect the containment function and use of the vent should not be limited by an effluent release velocity of 8000 fpm (e.g., venting at low pressure may be required to optimize the timing of a release or to optimize a venting strategy). In such cases, the margin in containment pressure gained by venting is more important than dispersion of the effluent.

   • This value is supported by an evaluation based on several references (e.g., “Turbulent Jets and Plumes: A Lagrangian Approach,” Lee & Chu, 2003, “Evaluation of the Effects and Consequences of Major Accidents in Industrial Plants,” Casal, 2008) and this provides further basis that the momentum driven flow from a vent will neither be appreciably affected by the roof recirculation zone nor will the effluent be effectively entrained into air in the recirculation zone.

2. Release Point Structural Requirements -
   Missile protection evaluation is required for piping segments outside of Seismic Class I structures. For those portions of the system that are elevated at least 30’ above grade, the elevation above grade provides reasonable protection from wind driven missiles such that no further evaluation or protection is required. This provision applies to the main process valves, piping and pipe supports. Valve actuators, instrument lines and instruments should be evaluated for and protected from wind driven missiles when protection from wind driven missiles is deemed necessary even if the 30’ above grade elevation criteria is met. This value (30’ from ground elevation) must be used with reasonable engineering judgment. If there is an obvious source of tornado missiles which could potentially strike the piping higher than the stated 30’, the vent should be protected accordingly.

3. Distance from Release Point to Nearest Structure -
   Typical points of vent exit from the power block are the reactor building or turbine building. As such, this
topic is intended to address distances from adjacent buildings and/or structures associated with the building the vent is emanating from (e.g., equipment housings such as for elevator equipment, tanks, etc.). The distance from the vent release point to such a structure should be at least 25' (horizontal distance). This value is based on the ability of the effluent stream to overcome wind effects above the roof (and cited appurtenances) elevation and agrees with accepted industry practice for roof vents. The same additional basis as stated above (for Topic 1), relative to effluent release, are considered to apply in this case.

4. Potential for Damage due to Deflagration/Detonation in Effluent Plume -

Although momentum and buoyancy will work to drive the vented effluent upward once it has exited the release point, there is the possibility that any vented hydrogen may deflagrate or possibly detonate if an ignition source is available. Based on the guidance and philosophy presented in Topics 1 and 2, there is reasonable assurance that such an event would occur well away from building equipment. However, flammable or heat sensitive equipment should not be located in the general vicinity of the release point.

5. Distance and Elevation Relative to Emergency Filtration Intake and exhaust pathways -

This topic is written relative to intake and exhaust pathways for systems which may be powered up from emergency power associated with facilities used in accident mitigation (e.g., EOF/TSC filter trains, CBEAF). It should not be considered applicable to normal building (such as reactor building HVAC) intake and exhaust pathways. A general “rule of thumb” of 1:5 zone of influence (5’ of horizontal travel versus 1’ of vertical drop) of the effluent from the release point to the potential downwind vortices/ recirculation zones is a reasonable method of release point configuration determination (2011 ASHRAE HVAC Applications Handbook, Cpt. 45). Although this approach is more conservative than the vent/jet philosophy established in topic 1, it does provide a reasonable set of guidelines that the industry can use in siting their release points. This “rule of thumb” should be applied to such intake and exhaust pathways associated with the power block. For example, if a subject intake or exhaust is 100’ away from the release point, it should be situated such that it is at least 20’ below the tip of the release point. As is stated, this is considered as conservative guidance which may be used with no further engineering justification. Based on Topic 1, there is reasonable leeway such that plants may deviate from this guidance with adequate engineering justification.

Good engineering judgment should be applied (relative to this ratio) for such intake and exhaust pathways located away from the power block. There is reasonable assurance (considering good engineering judgment) that no appreciable intake of HCVS effluent will occur for intake or exhaust pathways outside 100’ of the vent release point that are 20’ below the tip of the release point. It must be noted that this information should also be applied to changes made (such as open doors) to facilitate Control Room ventilation. The considerations listed above relative to the buoyancy, temperature, and flowrate of the effluent should be included in associated basis. It should be considered, along with this, that such systems are qualified to remove the vast majority of radionuclides associated with such releases.

Notes relative to this guidance –

- Buildings outside of the site’s main power block should not be considered relative to the above. Administrative buildings, warehouses, and other support buildings would typically not be staffed during a BDBE unless they house an accident mitigation type emergency facility (in which case the aforementioned information should be used as stated).
- Cooling towers, by nature of their location requirements, are situated well away from the power block such that they are not able to detrimentally affect HCVS effluent flow.

D. RESOLUTION: (Include additional pages if necessary. Total pages: 4)

The proposed resolution is correct. Discussed with NRC in Public meetings in February and March 2014.

Revision: 1 Date: April 14, 2014
### E. NRC Review:

Not Necessary ______ Interpreta­tion X ______ Agency Position _________

Explanation: Discussed at NEI-NRC Public Meeting 3/26/2014 with specific NRC comments incorporated.
Incorporated additional comments from NEI workshop on April 10, 2014

### F. Industry Approval:

Documentation Method: __________ FAQ ____________________________ Date: __04/14/2014________
A. TOPIC: HCVS Control and ‘Boundary Valves’

Source document: NEI 13-02

Sections: Order EA-13-109, Element 1.2.3, 1.2.12 & 1.2.13, NEI 13-02 Section 4.1.4, 4.1.6 & 6.2

Inq. No.: HCVS-FAQ-05

B. DESCRIPTION:

The cited NEI-13-02 sections address the prevention of cross flow between units, the prevention of effluent migration between systems (HCVS to connected systems) in a common unit, and testing of the HCVS to assure continued functionality. This FAQ addresses valving integrity relative to leakage as applicable to these Order elements.

More specifically, this FAQ addresses the operational philosophy, HCVS specific requirements and testing of those valves which include; Primary Containment Isolation Valves (PCIVs) associated with the HCVS, PCIVs not associated with HCVS (e.g., purge lines not associated with the HCVS, piping routed to an independent set of SGTS trains), control valves (if other than PCIVs), and boundary valves (which isolate other systems from the HCVS).

Questions to be answered are:
- Which valves are considered as control valves and which are boundary valves, and why?
- What are the testing criteria for the various valves cited?

C. PROPOSED ANSWER (Include additional pages if necessary. Total pages: 3)

Valve Definitions as related to HCVS function (see sketch below) -

1. Control Valve – Any valve used to open the containment to the HCVS vent path such that venting may commence. This valve will also have the function of closing thereby effectively halting the venting process. This may be either of the two (PCIVs) associated with the vent system penetration or it may be a single valve installed downstream of the PCIVs used for the purpose of commencing and ceasing the venting process. Note that these downstream valves may also be pressure control valves.

2. Boundary Valve – Any valve which serves to isolate the HCVS from another system. Depending on the application these valves may be safety related or (potentially in limited cases) non-safety related. The most typical instance of a boundary valve such as this would be to isolate the Standby Gas Treatment System (SGTS) from the HCVS vent path (in which case such valves would be safety related). This category also applies to valves which isolate the vent system of one plant from that of another.

Testing Criteria to be Used for Valve Types -

Valve Types by Design Function (see sketch below) -

Several types of valves have been discussed in the definitions but there are two fundamental valve types (not yet differentiated) which must be considered when addressing leakage testing. These 2 types are (1) PCIVs and (2) all others cited. Note that these types are not directly related to the Control or Boundary function (as related to the HCVS) but to the safety function (or potentially non-safety function) of the valve as related to the licensing of the plant.

1. All PCIV – These valves have a safety related function and are tested for that function as required by 10 CFR 50, Appendix J. Their safety related function is to maintain the containment pressure boundary (within a site-specific prescribed leakage range) during a design bases accident.

2. Non-PCIV HCVS Control and Boundary valves – This category includes all valves that are not PCIVs and provide a boundary function or a control function for the HCVS to be effectively operated. Basically they may be expected, at some point in the use of the HCVS, to prevent the leakage of effluent from containment to an undesirable location in the affected unit (or other unit on the plant site), or prevent leakage of effluent to the atmosphere surrounding the affected unit. These valves will typically be safety related (although there may be exceptions). The safety function of these valves is typically to open and allow flow for the reactor building ESF (engineered safety feature) system. This is typically known as the Standby Gas Treatment System (SGTS). These valves may fail open during a loss of power based on their current license base function (for example, in order to align for
SGTS operation once power has been restored). As such, they must be closed and secured closed in order to be credited as an HCVS boundary valve.

Testing Criteria and Valve Requirements by Valve Type –

1. PCIVs – Testing criteria for PCIVs will not change. They will continue to be tested per Appendix J criteria.

2. Non-PCIVs HCVS valves (boundary or control) – Testing criteria for these valves will be based on the individual site’s Appendix J test criteria for PCIVs associated with the HCVS. The allowable leakage may be set equal to the allowable leakage for the PCIV of the valve pair associated with the HCVS containment penetration which exhibits the highest accepted leakage rate during current Appendix J testing cycle or to the leakage of the single PCIV which is to serve as a control valve for the HCVS (if a PCIV is used as such). In this way, expectations set for boundary valves will not be set higher than those for the existing safety related Primary Containment Isolation Valves. Another option which a site may consider is to test such valves in accordance with the criteria listed in the ISG, Section 6.2.3.3. Note that although minimal leakage may be expected, such leakage would be into a stagnant environment (an unused pipe or a SGTS train). Leakage into a stagnant environment such as an unused pipe or SGTS train (filter, fan housing, ducting) may be more potentially problematic than into the general reactor building environment. A small leakage of steam and combustible gas into the reactor building would likely see some condensation of the steam and a mixing of the hydrogen such that there is no large volume combustible atmosphere mixture while a small leak rate of steam and combustible gas into a "dead end" pipe or ducting run may have the steam condense and the combustible gas concentration rise to combustible levels over time along with having the air originally in the "dead end" or stagnant volume. When determining an acceptable leakage rate for these boundary valves, this possibility should be considered.

These valves should be purchased or modified such that they are or can be qualified to operate and/or remain closed (depending on their function, either control or purely isolation) at HCVS design temperature and pressure. They should be tested at a frequency as specified in ISG, Section 6.2.4. They need not be tested at HCVS design temperature and pressure but at ambient temperature and per Appendix J as formerly stated. Note that leakage requirements are to be applied separately to each valve such that cumulative consideration of the leak testing of the individual valves will suffice as leak testing of the system. As an example, consider that an HCVS is connected both upstream and downstream of the SGTS (2 isolation valves, one on either side of SGTS), is opened to containment during HCVS operation by the 2 associated PCIVs, and has a downstream control valve which controls venting and acts as an extension to containment upon halting of venting (with the upstream PCIVs remaining open during HCVS operation and isolation). The worst case leakage from that system with the vent system isolated by the control valve would be the combined leakage values of both boundary valves plus that of the control valve. Again the allowable leakage of each of these valves would be that of the associated HCVS PCIV with the highest measured leakage (of the last Appendix J applicable test cycle). Note that this total leakage would not typically be going to the same location or attached system.

It is understood that this may require evaluation and possible modification of existing site systems besides the HCVS itself (including Boundary Valves associated with those systems). System modifications such as flanged connections (for temporary blind flange installation) or maintenance valves may be required to facilitate leak testing. Test taps may also be required in the existing piping system to support boundary valve testing.

**SUMMARY OF THE VALVES NEEDED FOR HCVS OPERATION**

<table>
<thead>
<tr>
<th>VALVE TYPE/ LIST</th>
<th>FUNCTION</th>
<th>NORMAL POSITION</th>
<th>POSITION FOR HCVS OPERATION</th>
<th>TESTING CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCIV</td>
<td>Isolates primary Containment on Isolation signal</td>
<td>Normal Close, Fail Close</td>
<td>Open</td>
<td>Per Appendix J (No change)</td>
</tr>
<tr>
<td>Control Valve</td>
<td>Operates to activate HCVS Operation</td>
<td>Normal Close, Fail Close</td>
<td>Open and Close as needed</td>
<td>Per Appendix J (New Criteria)</td>
</tr>
<tr>
<td>Boundary Valve</td>
<td>Isolates SGTS or the other system</td>
<td>Plant Specific</td>
<td>Close</td>
<td>Per Appendix J (New Criteria)</td>
</tr>
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</table>
D. RESOLUTION: (Include additional pages if necessary. Total pages: _____3_____

The proposed resolution is correct. Discussed with NRC in Public meetings in January, February and March 2014.

Revision: 2  Date: April 14, 2014

E. NRC Review:

Not Necessary_______  Interpretation ___ X ___  Agency Position ____________

Explanation: Discussed at NEI-NRC Public Meeting 3/26/2014 with specific NRC comments incorporated

F. Industry Approval:

Documentation Method: ______ FAQ ________________  Date: 04/14/2014
## HCVS Guidance Inquiry Form

**A: TOPIC:** HCVS FLEX and Generic Assumptions  
**Inq. No.:** HCVS-FAQ-06

**Source document:** EA-13-109/NEI 12-06  
**Sections:** Various in 13-02 and 3.2.1.2, 3.2.1.3 and 3.2.1.4 in 12-06

**B. DESCRIPTION:**

Provide key assumptions and characteristics associated with implementation of HCVS Phase 1 actions in a durable reference source.

**C. PROPOSED ANSWER**  
(Include additional pages if necessary. Total pages: 2)

While certain core cooling features of the site response to EA-12-049 are assumed to not function such that core damage occurs, many of the diverse and flexible actions planned for the mitigation actions (FLEX) have a high confidence of being performed and should be assumed to be available unless directly stated as not available in order EA-13-109.

### Applicable EA-12-049 assumptions:

049-1. Assumed initial plant conditions are as identified in NEI 12-06 section 3.2.1.2 items 1 and 2  
049-2. Assumed initial conditions are as identified in NEI 12-06 section 3.2.1.3 items 1, 2, 4, 5, 6 and 8  
049-3. Assumed reactor transient boundary conditions are as identified in NEI 12-06 section 3.2.1.4 items 1, 2, 3 and 4  
049-4. No additional events or failures are assumed to occur immediately prior to or during the event, including security events except for failure of RCIC or HPCI. (Reference NEI 12-06 3.2.1.3 item 9)  
049-5. At Time=0 the event is initiated and all rods insert and no other event beyond a common site ELAP is occurring at any or all of the units. (NEI 12-06, section 3.2.1.3 item 9 and 3.2.1.4 item 1-4)  
049-6. At {Site Specific Time} (time critical at a time greater than {Site Specific time}) 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, ({Site Specific Time}) (NEI 12-06, section 3.2.1.3 item 8)  
049-8. Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours  
049-9. All activities associated with plant specific EA-12-049 FLEX strategies that are not specific to implementation of the HCVS, including such items as debris removal, communication, notification, SFP level and makeup, security response, opening doors for cooling, and initiating conditions for the event, can be credited as previously evaluated for FLEX.

### Applicable EA-13-109 generic assumptions:

109-1. Site response activities associated with EA-13-109 actions are considered to have no access limitations associated with radiological impacts while RPV level is above 2/3 core height (core damage is not expected).  
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.  
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)  
109-4. Existing containment components design and testing values are governed by existing plant primary containment criteria (e.g., Appendix J) and are not subject to the testing criteria from NEI 13-02
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 that the order postulates an unsuccessful mitigation of an event such that an ELAP progresses to a severe accident with ex-vessel core debris which classical design basis evaluations are intended to prevent. (Reference NEI 13-02 section 2.3.1).

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

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 and White Paper HCVS-WP-01)

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 BDBEE and SA HCVS operation. (Reference FLEX MAAP Endorsement ML13190A201) Additional analysis using RELAP5/MOD 3, GOTHIC, PCFLUD, LOCADOSE and SHIELD are acceptable methods for evaluating environmental conditions in areas of the plant provided the specific version utilized is documented in the analysis.

109-9. Utilization of 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 section 8)

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

109-11. This Overall Integrated Plan is based on Emergency Operating Procedure changes consistent with EPG/SAGs Revision 3 as incorporated per the sites EOP/SAMG procedure change process.

109-12. Under the postulated scenarios of order EA-13-109 the Control Room is adequately protected from excessive radiation dose due to its distance and shielding from the reactor (per General Design Criterion (GDC) 19 in 10CFR50 Appendix A) and no further evaluation of its use as the preferred HCVS control location is required. In addition, adequate protective clothing and respiratory protection is available if required to address contamination issues. (Reference HCVS-FAQ-01)

D. RESOLUTION: (Include additional pages if necessary. Total pages: 2)

The proposed resolution is correct. Discussed with NRC in Public meetings in January, February and March 2014.

Revision: 2 Date: April 14, 2014

E. NRC Review:

Not Necessary_______ Interpretation____ X _______ Agency Position___________

Explanation: Discussed at NEI-NRC Public Meeting 3/26/2014 with specific NRC comments incorporated.
Incorporated additional comments from NEI workshop on April 10, 2014

F. Industry Approval:

Documentation Method: FAQ Date: 04/14/2014
**A. TOPIC:** HCVS Source Term from SFP

Inq. No.: HCVS-FAQ-07

Source document: EA-13-109/NEI 13-02/NEI 12-02/NEI 12-06

Sections: Various

**B. DESCRIPTION:**

What impact of the SFP source term is required to be considered for environmentally sensitive actions supporting HCVS operation?

**C. PROPOSED ANSWER** (Include additional pages if necessary. Total pages: 1)

SFP Level is maintained above EA-12-051 Level 2 with either on-site or off-site resources such that no contribution to analyzed source term need be considered.

The following statements support this position:

- Actions under Order EA-12-049 provides multiple mitigation actions to protect SFP cooling and Order EA-12-051 provides redundant instrumentation to plant decision makers to allow correct prioritization of any action needed for the SFP. Every site has to be in compliance with these Orders.

- There is no assumption or criteria in the EA-13-109 Order that relates to a “SFP accident”. The Order only mentions core damage and protection of Mk I & II containments, i.e., “reactor severe accident”.

If action is required for HCVS in the SFP area then the environment (i.e., temperature and humidity) in the vicinity and ingress/egress must be evaluated as identified in FAQ HCVS-01.

**D. RESOLUTION:** (Include additional pages if necessary. Total pages: 1)

The proposed resolution is correct and discussed with NRC in Public meetings in January and February 2014.

Revision: 0 Date: March 11, 2014

**E. NRC Review:**

Not Necessary_______ Interpretation__ X ___ Agency Position___________

Explanation:__________________________

**F. Industry Approval:**

Documentation Method:_________________ FAQ________________________ Date: ___ March 11, 2014 ___
**A. TOPIC:** HCVS Instrument Qualification

**Inq. No.:** HCVS-FAQ-08

**Source document:** Order EA-13-109 and NEI 13-02

**Sections:** Order EA-13-109, Element 1.1.1, 1.1.2, 1.1.3, 1.2.4, 1.2.5, 1.2.6, NEI 13-02 Section 4.2.2, 4.2.3, 4.2.4

**B. DESCRIPTION:**

**Note:** This FAQ addresses the environmental and radiological impacts on the ability of HCVS instrumentation to remain functional during the sustained operational period. Environmental and radiological impacts on accessibility and habitability for system operation are addressed in HCVS-FAQ-01, HCVS Primary Controls and Alternate Controls and Monitoring Locations.

What conditions have to be considered in the design and siting of HCVS Controls and monitoring equipment?

Order Element 1.2.4 states, “The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location.”

Order Element 1.2.5 states, “The HCVS shall, in addition to meeting the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations.”

Order Element 1.2.6 states, “The HCVS shall be capable of operating with dedicated and permanently installed equipment for at least 24 hours following the loss of normal power or loss of normal pneumatic supplies to air operated components during an extended loss of AC power.”

**C. PROPOSED ANSWER** (Include additional pages if necessary. Total pages: 2)

**Environmental Conditions:**

The Primary/Alternate controls and monitoring equipment design must consider the following:

**Thermal Considerations:** (See Order Elements 1.1.2 and 1.1.4):

- Main Control Room (MCR) temperature and heat load that exist for operation of the HCVS.
  - Temperature and heat load that exist due to proximity to the undercooled containment.
    - MCR Temperatures considered for Order EA-12-049 (FLEX) are reasonable to use since any changes as the result of a severe accident are not expected to have an adverse impact on the MCR due to Control Room location in a separate air space and FLEX ventilation methods applied to the MCR
  - Temperature and heat load that exists due to the ELAP condition (loss of ventilation).
    - Utilize toolbox actions (e.g., portable fans, opening of doors, etc.) and EA-12-049 (FLEX) mitigation strategies. (Ref HCVS-FAQ-09)
    - HCVS controls and instrumentation will be similar to other instrumentation and controls found in most MCRs. Unless the licensee uses controls and instrumentation in the HCVS system that are known to be susceptible to failure from elevated temperatures but within habitability limits, no evaluation of temperature effects needs to be performed for HCVS components located in the MCR
  - No portable equipment should be required to operate the HCVS within the first 24 hours per the criteria in order EA-13-109.

- Primary or Alternate Control location (if other than MCR) temperature and heat load that exist for operation of the HCVS.
  - Temperature and heat load that exist due to proximity to the undercooled containment and spent fuel pool.
  - Temperature and heat load that exists due to the ELAP condition (loss of ventilation).
    - If this location is NOT in the Reactor Building or other buildings where HCVS piping is located then
the heat load impact is similar to the MCR when the location is in a separate air space.

- HCVS controls and instrumentation located outside the MCR will be similar to other instrumentation and controls found in plant locations outside the MCR. Unless the licensee uses controls and instrumentation in the HCVS system that are known to be susceptible to failure from elevated temperatures but within habitability limits, no evaluation of temperature effects needs to be performed for HCVS components located outside of the Reactor Building or other buildings where HCVS piping is located.

Radiological Considerations: (See Order Elements 1.1.3)

- Main Control room radiological conditions that exist from operation of the HCVS system.
  - MCR complies with the intent of General Design Criteria (GDC) 19 or the Alternate Source Term (AST) which provides reasonable assurance of protection from radiological consequences.

- Primary or Alternate Control location (if other than Control Room) radiological conditions that exist for operation of the HCVS system.
  - This analysis may be bounded by the required dose considerations for Control Room design in General Design Criteria (GDC) 19 or the Alternate Source Term (AST) analysis if this location is outside the Reactor Building due to Reactor Building to Auxiliary Building Shielding design.
  - If the location is inside the Reactor Building, then it will need to be evaluated for radiological impact due to HCVS system operation under severe accident conditions.

- The specific event progression that leads to the Severe Accident is NOT specified and does not have to include multiple path source terms from loss of Spent Fuel Pool Cooling as this would presume that the event progression that leads to the Severe Accident also prevents or causes the mitigating measures for loss of Spent Fuel Pool Cooling to fail. Order element 1.1.3 does discuss the requirement to consider the dose and radiological conditions caused by operation of the HCVS system but not failure of Mitigating Strategies related to Spent Fuel Pool Cooling.

Time frame:

The instrumentation should be capable of operating in the thermal and radiological environment for at least 24 hours without significant operator action (see HCVS-FAQ-02, HCVS Dedicated Equipment, for a discussion of significant operator action considerations for the first 24 hours of the sustained operational period). Other provisions of NEI-13-02 such as the definition of “Sustained Operations” extend this time but do NOT preclude mitigating measures from FLEX or offsite support for reduction in thermal or radiological impacts (e.g. portable fans, AC power for ventilation, possible cooling water supplies to the area coolers if part of the FLEX mitigating measures. The restriction on permanently installed equipment and operator actions only exists for the 24 hour period to ensure HCVS viability for at least a 24 hour mission time. See HCVS-FAQ-02 on Order Element 1.2.6 use of “dedicated equipment” and HCVS-WP-01, HCVS Dedicated Power and Motive Force.

D. RESOLUTION: (Include additional pages if necessary. Total pages: 2)

The proposed resolution is correct. Discussed with NRC in Public meetings in February and March 2014.

Revision: 1  Date: 04/14/2014

E. NRC Review:

Not Necessary________  Interpretation__ X ______  Agency Position________

Explanation: Discussed at NEI-NRC Public Meeting 3/26/2014 with specific NRC comments incorporated.

F. Industry Approval:

Documentation Method: _______ FAQ_________  Date: _04/14/2014_
HCVS Guidance Inquiry Form

A. **TOPIC:**  
HCVS Toolbox Approach for Collateral Actions  
Inq. No.: HCVS-FAQ-09

Source document: NEI 13-02  
Sections: Order EA-13-109, Element 1.2.4, 1.2.5, 1.2.6, NEI 13-02 Section 4.2.2, 4.2.3 4.2.4

B. **DESCRIPTION:**

Document the use of Toolbox approach for collateral actions that will be symptom based but are within the skill of the craft or general personnel knowledge.

Order Element 1.2.4 states, "The HCVS shall be designed to be manually operated during sustained operations from a control panel located in the main control room or a remote but readily accessible location."

Order Element 1.2.5 states, "The HCVS shall, in addition to meeting the requirements of 1.2.4, be capable of manual operation (e.g., reach-rod with hand wheel or manual operation of pneumatic supply valves from a shielded location), which is accessible to plant operators during sustained operations."

Order Element 1.2.6 states, "The HCVS shall be capable of operating with dedicated and permanently installed equipment for at least 24 hours following the loss of normal power or loss of normal pneumatic supplies to air operated components during an extended loss of AC power."

C. **PROPOSED ANSWER** (Include additional pages if necessary. Total pages: 1)

Examples of acceptable toolbox approach for collateral actions are:

- Opening doors when room temperatures become elevated
- Using flashlights to supplement pathway use
- Exchange of personnel, use of ice vests, etc. when action is in degrading levels of heat and humidity environment, not life threatening
- Utilizing small fans for air movement, possibly powered from small portable generators and extension cords
- Utilization of protective clothing and respirators to address localized contamination concerns

D. **RESOLUTION:** (Include additional pages if necessary. Total pages: 1)

The proposed resolution is correct. Discussed with NRC in Public meetings in February and March 2014

Revision: 1  Date: 04/14/2014

E. **NRC Review:**

Not Necessary  Interpretation X  Agency Position

Explanation: Discussed at NEI-NRC Public Meeting 3/26/2014 with specific NRC comments incorporated.  
Incorporated additional comments from NEI workshop on April 10, 2014

F. **Industry Approval:**

Documentation Method: FAQ  Date: 04/14/2014