NEI 13-02
Guidance to Implement
EA-13-109

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BWR OWNERS' GROUP

NUCLEAR ENERGY INSTITUTE

INTRODUCTION

The new severe accident Hardened Containment Venting System (HCVS) Order contains historical information and decision making insights in sections I, II and III that provide useful information, but do not contain the legally binding actions which licensees are required to comply with, which are in sections IV and Attachment 2.

PURPOSE

To assist nuclear power reactor licensees with the identification of measures needed to comply with the requirements of Order EA-13-109

Some continuous improvement work items derived from lessons learned from the Fukushima Daiichi event

HCVS GUIDING PRINCIPLES

- Hardened vents have been in place in U.S. plants with BWR Mark I containments for many years but a variance exists with regard to the capability of the vents for a broad spectrum of events.
- BWR Mark II containments have containment venting capability but they typically are not hardened vent paths.

HCVS GUIDING PRINCIPLES

- The severe accident capable HCVS function is to **help prevent severe accidents from occurring** and to add the capability of helping to mitigate the consequences of a severe accident should one occur.
- The wetwell and drywell vent pathways are not required to be in operation at the same time.
- A reliable strategy to limit the possible need to vent from the drywell during severe accident conditions is acceptable phase 2 compliance

PROCEDURE INTERFACE

- Command and Control for accident response is governed by the suite of Emergency Preparedness guidelines and procedures. Accident response is controlled by the plant specific Emergency Operating Procedures (EOPs), severe accident management guidelines (SAMGs), and Emergency Preparedness procedures.

PROCEDURE INTERFACE

- The importance of reliable operation of hardened vents during conditions involving loss of containment heat removal capability is well established and this understanding has been reinforced by the lessons learned from the accident at Fukushima Dai-ichi.

PROCEDURE INTERFACE

- The BWROG standard emergency operating procedures and severe accident guides (EOP/SAG) (revision 2 and 3) both provide direction for BWR Mark I and II plants to leave EOP/SAG flowcharts at any point where adequate containment heat removal methods are in effect (enter Recovery steps) , i.e., they are not predisposed to have to use drywell venting.

PROCEDURE INTERFACE

- For venting from EOPs the wetwell vent is expected to be used to protect containment and will be venting mostly saturated steam
- Once fuel damage occurs and transfer to plant specific SAMGs is made, containment venting will depend on what other plant conditions exist.

OVERVIEW

- Industry guidance will provide an integrated set of considerations for the design and implementation of a severe accident capable hardened containment venting system (HCVS).
- Licensees may propose other methods for satisfying these requirements. The NRC staff can review such methods and determine their acceptability on a case-by-case basis.

SUSTAINED OPERATION

- Sustained Operation: The ability to operate 7 days or a shorter time if an alternative method of containment heat removal is put in place by using installed or portable equipment (e.g., a means of shutdown cooling aligned directly to the RPV, drywell or a means of suppression pool cooling). Such method should allow restoration of the Containment Source term control function.

VENT OPERATION & MONITORING

- The ELAP creates a need to operate the HCVS with manual actions (either from remote stations or locally) and the design concepts espoused in NEI 13-02 protect that operational capability.
- The design of the HCVS should incorporate features to prevent the inadvertent use of the vent valves.

VENT OPERATION & MONITORING

- One or more of the following criteria are acceptable approaches for inadvertent actuation features of the HCVS.
  - Rupture disc in flowpath
  - Key lock for valve switches
  - Administrative Controls for energizing components/controls
  - Interface with Technical Specification Components (such as current primary containment isolation valve (PCIV) controls).

VENT OPERATION & MONITORING

- Prevention of inadvertent actuation, while important for all plants, is essential for plants relying on containment accident pressure (CAP)
- 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.

VENT OPERATION & MONITORING

- The control location should take into consideration the following:
  - The ability to open/close the valves multiple times during the event, i.e., sustained operations.
  - The temperature and radiological conditions that operating personnel may encounter both in transit and locally at the controls.
  - Availability of permanently installed HCVS equipment, including any connections required to supplement the HCVS operation during an ELAP (e.g., electric power, N2/air) consistent with the staff’s guidance in JLD-ISG-2012-01 for Order EA-12-049.
  - The controls/control location design should preclude the need for operators to move temporary ladders or operate from atop scaffolding to access the HCVS valves or remote operating locations.

VENT OPERATION & MONITORING

- The control location should take into consideration the following:
  - HCVS valve position indication should be available at the primary controlling location.
  - HCVS valve position indicators should be capable of operating under the temperature/radiation conditions existing at the valve locations.
  - HCVS valve position indicators and indications should be powered from sources that will be available during the appropriate mission time of the HCVS system.
  - The HCVS system should include indications for the Containment Pressure and Wetwell level for determination of vent operation. These indications may be either at the controlling location for the HCVS or at another location with communication to the HCVS controlling location.

VENT OPERATION & MONITORING

- During an ELAP, manual operation/action from alternate control locations 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.

VENT OPERATION & MONITORING

- Plant operators must be able to readily monitor the radiological conditions that exist during venting operations of the HCVS at all times.
- The HCVS design should provide a means to allow plant operators to readily determine, or have knowledge of, the following system parameters:
  - HCVS vent valves position (open or closed).
  - HCVS vent pipe radiation levels. The range of the instrument should be consistent with the dose rates anticipated during severe accident venting.
  - Other important information includes the status of supporting systems, such as availability of electrical power and pneumatic supply pressure

VENT OPERATION & MONITORING

- The means to monitor system status should support sustained operations during an ELAP, and be designed to operate under potentially environmental conditions that would be expected following a loss of containment heat removal capability and an ELAP. “Sustained operations” may include the use of portable equipment to provide an alternate source of power to components used to monitor HCVS status.

VENT OPERATION & MONITORING

- Instrument reliability should be demonstrated via an appropriate combination of design, analyses, operating experience, and/or testing of channel components for the conditions described in Section 2 of this guide.

VENT OPERATION & MONITORING

- HCVS controls should be located in areas where sustained operation is possible accounting for expected temperatures and radiological conditions in the HCVS vent pipe and attached components without extreme heat stress or radiological over exposure to the operators.

VENT OPERATION & MONITORING

- HCVS system should be designed to maximize the probability of successful operator action to operate vents when required.
- Design features consistent with this approach include:
  - Environmental considerations
  - Sustained operational capability
  - Ease of vent valve operation