

  
**MITSUBISHI HEAVY INDUSTRIES, LTD.**  
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TOKYO, JAPAN

October 5, 2009

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

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021  
MHI Ref: UAP-HF-09481

**Subject: MHI's Responses to US-APWR DCD Draft Open Item SRSB 5.4.12**

**References:** 1) "Draft Open Item SRSB 5.4.12, SRP Section: 05.04.12 - Reactor Coolant System High Point Vents, Application Section: 5.4.12," dated June 2, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document as listed in Enclosure.

Enclosed is the response to one Draft Open item contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is provided below.

Sincerely,



Yoshiaki Ogata,  
General Manager- APWR Promoting Department  
Mitsubishi Heavy Industries, LTD.

Enclosures

1. Response to Draft Open Item SRSB 5.4.12 Revision 0

CC: J. A. Ciocco  
C. K. Paulson

Contact Information

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NRC

Docket No. 52-021  
MHI Ref: UAP-HF-09481

Enclosure 1

UAP-HF-09481  
Docket Number 52-021

Responses to Draft Open Item SRSB 5.4.12 Revision 0

October, 2009

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**RESPONSE TO DRAFT OPEN ITEM SRSB 5.4.12**

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10/2/2009

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

**OPEN ITEM NO.:** SRSB 5.4.12  
**SRP SECTION:** 05.04.12- REACTOR COOLANT SYSTEM HIGH POINT VENTS  
**APPLICATION SECTION:** 5.4.12  
**DATE OF RAI ISSUE:** 6/2/2009

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**Open Item 05.04.12-1**

The acceptance criteria of Section 5.4.12 of the SRP specify that procedures should be developed to use the vent paths to remove gases that may inhibit core cooling from the U-tubes of the SGs. In addition, the procedures to operate the vent system should consider when venting is needed and when it is not needed, taking into account a variety of initial conditions, operator actions, and necessary instrumentation). In response to the staff RAI 5.4.12-5 (RAI 48-840 dated 8/11/08; MHI response dated 9/22/08) regarding the need of operating procedures for the RCS high point vent system, MHI provided discussion on the high level guidelines for the required operating procedures. However, detailed operating procedures have not made available for the staff review. If MHI could not provide detailed operating procedure for the RCSHPVS in response to the staff RAI 5.4.12-5, the staff will accept that MHI propose a COL action item to require COL applicants to provide detailed operating procedures in their applications to fulfill this acceptance criterion.

**ANSWER:**

RV vent valves are assumed to be used at severe accident. In the TMI-2 accident, non-condensable hydrogen gases generated from metal-water reaction accumulated in the vessel head. There was concern that these non-condensable gases would inhibit core cooling. Without RV vents, it took almost four days to collapse the bubbles in the RV upper head. After the accident, it was recognized that high point vents would have been useful to cope with the severe accident at TMI-2 where means for core cooling is restored after core damage and in-vessel-retention is achieved.

As stated above, the procedures to operate the RV vent system are effective when means for core cooling is restored after core damage and in-vessel-retention is achieved. However, since it is difficult to judge the RV failure, the entry condition for this procedure is provided by availability of borated water injection to RCS.

The operation procedure is shown in Figure-1. Whatever the initial condition may be, non-condensable hydrogen gases can accumulate in the RV upper head as long as break size of the RCS boundary is small or in-vessel-retention is achieved. If RV vent operation is judged to be effective for core cooling, operator manually opens the RV vent

valves and removes non-condensable gases from the RV upper head. After RV water level recovery, operator manually closes RV vent valves. If non-condensable gases accumulated in SG U-tubes exist, they are collected in the RV upper head and RV water level decreases after RCP operation. At this case, RCP jog operation and RV vent should be performed several times manually by operator to remove non-condensable gases accumulated in SG U-tubes.

(Note)

As shown below, RV vent valve operation is not credited for the US-APWR DBAs and severe accidents.

- The US-APWR does not require elimination of non-condensable gases for core cooling following design based accidents. (See DCD subsection 5.4.12)
- Also, RV vent is not credited for the US-APWR severe accident mitigation measures. The fundamental design concept of the US-APWR for severe accident termination is to flood the reactor cavity with coolant water when a severe accident occurs, to keep the molten fuel ejected from RV within the reactor cavity, and to maintain the core debris in a stabilized state for the long-term. (See DCD subsection 19.2.3.3) In-vessel-retention is not expected also in the PRA. Therefore, core cooling using the RV vent valves is a lower-priority procedure in severe accident mitigation measures.

**Impact on DCD**

There is no impact on DCD.

**Impact on COLA**

There is no impact on COLA.

**Impact on PRA**

There is no impact on PRA.

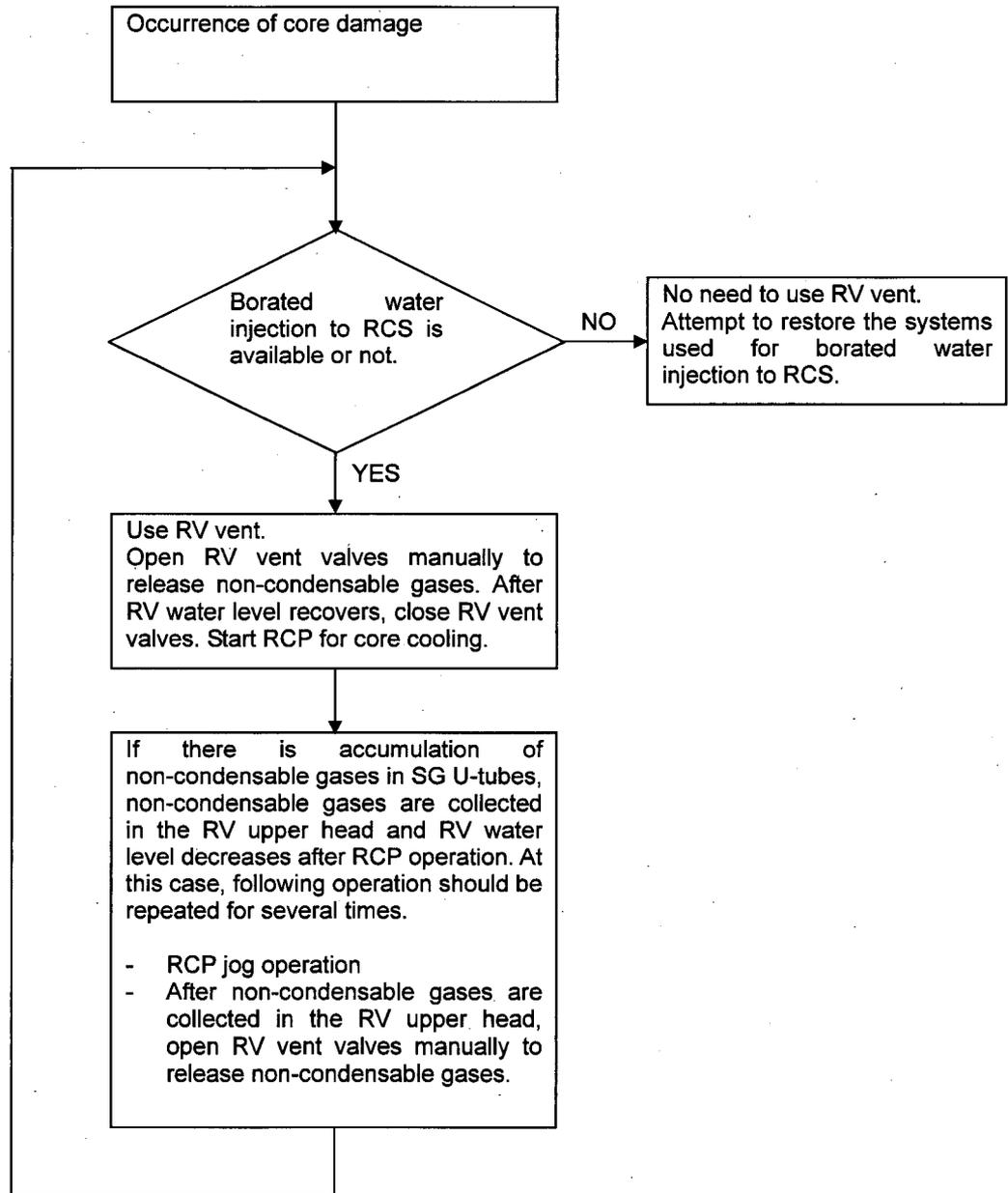


Figure-1 Operation procedure of RV vent valves