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August 9, 2012

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-12224

Subject: **MHI's Response to US-APWR DCD RAI No. 924-6352 Revision 3 (SRP 19)**

Reference: 1) "Request for Additional Information No. 924-6352 REVISION 3, SRP Section: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation, Application Section: 19," dated April 24, 2012.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Response to Request for Additional Information No. 924-6352 Revision 3."

Enclosed is the response to one RAI question (19-569) contained within Reference 1. Two RAI questions, Question 19-568 and 19-570, are not answered within this package and will be submitted separately as discussed with the NRC.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
Director- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosures:

1. Response to Request for Additional Information No. 924-6352 Revision 3

D081
NRO

CC: J. A. Ciocco
J. Tapia

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Enclosure 1

UAP-HF-12224
Docket No. 52-021

Response to Request for Additional Information No. 924-6352
Revision 3

August 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

08/09/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO. 924-6352 REVISION 3**

SRP SECTION: **19 – Probabilistic Risk Assessment and Severe Accident Evaluation**

APPLICATION SECTION: **19**

DATE OF RAI ISSUE: **4/24/2012**

QUESTION NO.: 19-569

Based on MHI's responses to RAI Number 06.02.05-46, it appears that for full power severe accident scenarios, hydrogen has the potential to accumulate in the RWSP to detonable levels. In response to staff RAIs, MHI has proposed a design change for the hydrogen igniters in which each train will be powered by dedicated batteries having a capacity of at least 24 hours following the onset of a complete SBO. The staff has two requests regarding a severe accident during shutdown conditions.

1. Please update Chapter 19 of the DCD to include whether the hydrogen igniters need to be operable for the containment to remain intact and provide an effective barrier against the postulated release of fission products following a severe accident at shutdown. Please provide the justification for your response (e.g, results of analyses, etc.).

2. Please update Chapter 19 of the DCD to include other severe accident design features that need to be operable for the containment to remain intact and provide an effective barrier against the postulated release of fission products given a severe accident at shutdown (e.g, results of analyses, etc.).

ANSWER:

Item 1: In its response to RAI 873-6168, Question 06.02.05-46 (provided via UAP-HF-12180 dated 27June2012), MHI referred to the design change described in the response to 871-6121 Question 19-560 (provided in UAP-HF-12181 dated 27June2012). The response to Question 19-560 did not explicitly address the shutdown condition, but the analysis insights are applicable to shutdown conditions because hydrogen generation behavior does not depend on the plant operating state. I.e., if the core is uncovered, resulting in the potential for a zirconium reaction with high temperature steam, hydrogen is presumed to be generated. Thus, the hydrogen igniters must be available to manage the resultant hydrogen and prevent a challenge to containment integrity for both at-power and low power, shutdown (LPSD) conditions. DCD Subsection 19.2.5 will be

revised to reflect that the accident management functions applicable to preventing containment failure during power operations are fundamentally applicable to LPSD. (Note that the safety goal is met without credit for igniter function to protect containment during shutdown because the US-APWR Level 2 shutdown PRA assumes that the large early release frequency equals the core damage frequency.)

Item 2: There are no other severe accident mitigation features provided for LPSD operation other than those described in DCD Revision 3 Chapter 19.

Impact on DCD

DCD Subsection 19.2.5 will be revised as shown in the attached markup.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical / Technical Report

There is no impact on topical and technical reports.

vessel atmosphere to combustible condition under high hydrogen concentration. In such case containment depressurization is suspended at a relatively high containment pressure. It is widely known that the low inert limit of steam concentration is approximately 55% and the low flammability limit of hydrogen concentration is approximately 4%. Hydrogen impact when depressurizing containment is evaluated and a material, such as a map of hydrogen concentration vs. containment pressure to show if hydrogen burn is safe or potential danger, is prepared to support the containment depressurization operation. MCR alarm for hydrogen concentration is also provided through the containment hydrogen monitoring system when the hydrogen concentration reaches 4% and 8%. The control room operators are required to carefully monitor the condition of containment.

- ~~Firewater can be utilized to fill the RWSP in the case when no decay heat removal function is available. This will eliminate the possibility of high hydrogen concentration in the RWSP.~~ DCD_06.02.05-44

(During LPSD operations)

It is likely that containment is not isolated during LPSD operations in order for various maintenance activities. The accident management functions to maintain containment integrity during LPSD include firstly recovery of containment isolation from the environment, and secondary heat removal from the isolated containment. However, the ability to close the containment and to recover heat removal without ac power is minimal and may not be possible. It is evaluated for the LPSD PRA that the losses of offsite power contribute approximately 30% of shutdown risk in total. As a result any period in which the RCS level is low should be planned to be undertaken with maximum confidence in offsite and onsite power reliability. Maintenance activities in the switchyard are minimal or precluded by risk management during mid-loop for example. It may also be preferable to limit undertaking the maintenance activities which require opening the equipment hatch during the inventory is low in the reactor. This limitation will fundamentally eliminate the necessary operator actions for containment closure during mid-loop, and will significantly contribute for LPSD risk reduction.

- According to the identification of some symptoms, such as loss of decay heat removal capability and onset of boiling in core, operators are required to take actions of containment isolation.

- For decay heat removal, accident management functions are fundamentally same with the ones for operations at power, i.e. reactor cavity flooding, activation of CSS or alternate containment cooling by natural circulation, or otherwise firewater injection to spray header.

- For prevention of containment failure if containment isolation is established, accident management functions are fundamentally the same as those for at-power operation, i.e., RCS depressurization for preventing HPME and temperature induced SGTR as well as combustible gas control using the hydrogen ignition system. DCD_19-569

4. To minimize offsite release