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June 20, 2013

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-13148

Subject: MHI's Second Response to US-APWR DCD RAI No.1020-7081 (SRP 19)

References:
1) "Request for Additional Information No.1020-7081, SRP Section: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation, Application Section: 19," dated April 22, 2013.
2) MHI Ref. UAP-HF-13124, "MHI's Responses to US-APWR DCD RAI No.1020-7081 (SRP 19)," dated June 7, 2013.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") the document entitled "Second Response to Request for Additional Information No.1020-7081."

Enclosed are the responses to one RAI question (19-586) contained within Reference 1. Two RAI questions, 19-584 and 19-585, were previously responded to in Reference 2.

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

Sincerely,

Joseph Tapia for

Yoshiki Ogata,
Executive Vice President
Mitsubishi Nuclear Energy Systems, Inc.
On behalf of Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Second Response to Request for Additional Information No.1020-7081

D081
NRO

CC: J. A. Ciocco
J. Tapia

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Enclosure 1

UAP-HF-13148
Docket Number 52-021

Second Response to Request for Additional Information
No.1020-7081

June 2013

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/20/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO. 1020-7081**

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

APPLICATION SECTION: 19

DATE OF RAI ISSUE: **04/22/2013**

QUESTION NO. : 19-586

The staff has reviewed the applicant's response to RAI 983-6953, Question 19-580. The staff understands that, "the igniters are required to mitigate a challenge to containment integrity from hydrogen detonation from both at-power and LPSD severe accident sequences". The staff also learned from inspections that licensees cover igniters to protect them during outage work in containment. To help the COL licensee maintain a containment closure capability consistent with GL 88-17 and 10CFR52.47(a)(4) "adequacy of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents". Please clarify in the risk insights table (Table 19.1-119), Chapter 19 of the DCD, and DCD Section 5.4.7 how many igniters are needed to keep the conditional containment failure probability below 0.1 due to hydrogen deflagration and detonation at shutdown. Is the success criteria 11/20 as referenced in RAI 871-6121?

ANSWER:

The success criterion for hydrogen igniters during low power shutdown (LPSD) plant operating states (POS) 1 through 4 and 8 through 13 is assumed to be the same as for at-power. This criterion is the result of considering that the potential hydrogen release locations are the same during LPSD POS as at-power. At-power, to address the full spectrum of hydrogen release paths for the different accident scenarios, the success criterion is 20 out of 20 igniters. During LPSD POS 5 through 7, the success criterion is qualitatively taken to be 0 out of 20 due to the extra inventory and longer time to core damage, making the importance of the igniters negligibly small. The failure probability of the hydrogen control system, based on the success of 20 out of 20 igniters, is calculated as 4.08×10^{-3} as documented in Chapter 6, Attachment 6A.15.3B of MUAP-07030, Rev. 3. With this failure probability of the hydrogen control system, the safety goal of a conditional containment failure probability (CCFP) less than approximately 0.1 is met.

With respect to the evaluation performed to determine the subset of igniters that would benefit from a battery backed up power supply, the success criterion would be 11 of 11. This is explained in the revised response to RAI 871-6121, Question 19-560 (provided in UAP-HF-13103, dated April 25, 2013). This response demonstrated that the CCFP is less than approximately 0.1 and the containment can maintain its role as a reliable leak-tight barrier approximately 24 hours following onset of core damage under the more likely severe accident challenges. In that response, the number and location of igniters with battery backup, for the very specific accident sequence scenario of an SBO with RCP seal LOCA at power was evaluated. The response to that scenario required a reduced number of igniters because the hydrogen release pathways were limited.

The insight on the importance of the igniters to the success of containment for at-power and LPSD was addressed in Table 19.1-119, as modified by the response to RAI 983-6953 Question 19-580 (provided by UAP-HF-13055 dated March 8, 2013). The response to RAI 871-6121 Question 19-560 added the insight regarding the 11 strategically located igniters. Table 19.1-119 will be further modified to clarify that 20 of 20 igniters are required to mitigate the spectrum of potential hydrogen generation scenarios at any point in containment.

Impact on DCD

Table 19.1-119 will be modified as indicated in the attachment.

Impact on R-COLA

R-COLA Part 2 FSAR Table 19.1-119R will be revised to be consistent with the attached DCD markups.

Impact on PRA

There is no impact on PRA.

Impact on Topical/Technical Report

There is no impact on Topical and Technical Reports.

Table 19.1-119 Key Insights and Assumptions (Sheet 17 of 50)

Key Insights and Assumptions	Dispositions	
16. Containment System		
- The containment prevents or limits the release of fission products to the environment.	3.1.2.7 3.8.1	
- Hydrogen control system that consists of igniters is provided to limit the combustible gas concentration. ~~The~~Twenty igniters are required to mitigate a challenge to containment integrity from the spectrum of potential hydrogen detonation scenarios for both at-power and LPSD severe accident sequences. The igniters start with the ECCS actuation signal and are powered by two non-class 1E buses with non-class 1E GTGs as well as dedicated batteries to 11 strategically located igniters.	6.2.5.2	DCD_19-580 DCD_19-586 DCD_19-560 DCD_19-560 S01
- Alternate containment cooling system using the containment fan cooler units is provided to prevent containment over pressure even in case of containment spray system failure.	9.4.6.2.1 19.2.5 COL 13.5(6) COL 19.3(6)	
- Reactor cavity flooding system by firewater injection is provided to enhance heat removal from molten core ejected into the reactor cavity. This system is available as a countermeasure against severe accidents even in case of fire.	9.5.1.2.2 19.2.5 COL 13.5(6) COL 19.3(6)	
- The FSS is also utilized to promote condensation of steam. The FSS is lined up to the containment spray header when the CSS is not functional, and provides water droplet from top of containment. This will temporarily depressurize containment.	9.5.1.2.2 19.2.5 COL 13.5(6) COL 19.3(6)	
- A set of drain ~~lines~~paths from SG compartment to the reactor cavity is provided in order to achieve reactor cavity flooding. Spray water which flows into the SG compartment drains to the cavity and cools down the molten core after reactor vessel breach.	3.4.1.5.1	DCD_14.03.11-45 S01
- Reactor cavity has a core debris trap area to prevent entrainment of the molten core to the upper part of the containment.	3.8.1 19.2.3.3.4	
- Reactor cavity is designed to ensure thinly spreading debris by providing sufficient floor area and appropriate depth.	3.8.1 19.2.3.3.3	
- Reactor cavity floor concrete is provided to protect against challenge to liner plate melt through.	3.8.1 19.2.3.3.3	
- Main penetrations through containment vessel are isolated automatically with the containment penetration signal even in case of SBO.	6.2.4	