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

August 22, 2011

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

Attention: Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-11268

**Subject:** MHI's Responses to US-APWR DCD RAI No.773-5646 (SRP 19)

**References:** 1) "Request for Additional Information No. 773-5646 Revision 2, SRP Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation Application Section: Appendix A," dated (June 23, 2011).

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "MHI's Responses to US-APWR DCD RAI No.773-5646."

Enclosed are the responses to RAI contained within Reference 1.

Enclosure 1 includes certain information, designated pursuant to the Commission guidance as sensitive unclassified non-safeguards information, referred to as security-related information ("SRI"), that is to be withheld from public disclosure under 10 C.F.R. § 2.390. The information that is SRI is identified by brackets. Enclosure 2 omits the SRI and is suitable for public disclosure. In the public version of the DCD, the SRI is replaced by the designation "[Security-Related Information - Withheld Under 10 CFR 2.390]".

Please contact Dr. C. Keith Paulson, Senior Technical Manager, 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,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

D081
NRO

Enclosures:

1. MHI's Responses to US-APWR DCD RAI No.773-5646
   – Version That Contains SRI Information

2. MHI's Responses to US-APWR DCD RAI No.773-5646
   – Version That Does Not Contain SRI Information

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

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Enclosure 2

UAP-HF-11268
Docket No. 52-021

MHI's Responses to US-APWR DCD RAI No.773-5646

August 2011
(Security-Related Information Excluded)

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**RAI NO.:** **773-5646 REVISION 2**

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

**Application Section:** **Appendix A**

**DATE OF RAI ISSUE:** **6/23/2011**

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**QUESTION NO.:** 19-532

Does the US-APWR design certification aircraft impact assessment take any exceptions to NEI 07-13 guidance or methodology? If so, the applicant must identify and provide brief justifications for those exceptions in the DCD. A detailed justification for each exception should be included in the applicant's AIA documentation. Also, in Section 19A.3, it is stated that methods described in NEI 07-13 were followed and a reference 19D-2 (should be reference 19A-2) is cited but not listed in Appendix 19A. Please provide the correct reference and clarify if assessment methodology different from the NEI 07-13, Rev. 7 has been used.

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**ANSWER:**

The US-APWR design certification aircraft impact assessment does not take any exceptions to the NEI 07-13 guidance or methodology. Section 19A.1 of the DCD will be revised to clearly state that the NEI guidelines were fully followed with no exceptions taken.

Reference 19D-2 was previously corrected to 19A-2 in DCD, Revision 3. Also see response to Question No. 19-02.

Impact on DCD

See attached marked up pages 19A-1 and 19A-4.

Impact on R-COLA

None.

Impact on S-COLA

None.

Impact on PRA

None.

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| **SRP SECTION:** | **19 – Probability Risk Assessment and Severe Accident Evaluation** |
| **Application Section:** | **Appendix A** |
| **DATE OF RAI ISSUE:** | **6/23/2011** |

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**QUESTION NO.:** 19-533

In DCD Section 19A.3, please identify all other buildings or structures, if any, which were analyzed in addition to the Pre-stressed Concrete Containment Vessel (PCCV) and Spent Fuel Pit (SFP) external walls. Also, correct typo (Reference 19D-2 should be 19A-2).

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**ANSWER:**

DCD Section 19A.3 will be revised to reflect that the methods described in NEI 07-13 were used to assess the physical, fire and vibration effects of the aircraft impact on SSCs in the reactor building and the power source buildings in order to determine the continued core cooling capability of the existing and enhanced design.

Reference 19D-2 was previously corrected to 19A-2 in DCD, Revision 3. See response to Question No. 19-01.

Impact on DCD

See attached marked up page 19A-2.

Impact on R-COLA

None.

Impact on S-COLA

None.

Impact on PRA

None.

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| **Application Section:** | **Appendix A** |
| **DATE OF RAI ISSUE:** | **6/23/2011** |

**QUESTION NO.:** 19-534

As stated in DCD Section 19A.2, perforation of the SFP is not predicted. However, the applicant did not address the potential for leakage through the SFP liner below the required minimum water level of the pool due to aircraft impact scenarios per NEI 07-13. Please provide information to address this issue in Appendix 19A.

**ANSWER:**

DCD Section 19A.4.1 will be revised to add the following paragraph at the end of the section:

Security-Related Information - Withheld Under 10 CFR 2.390

In addition, the title of DCD Section 19A.4.1 will be revised to "PCCV and SFP." Also, the sixth item in Section 19A.4.2 will be deleted since the information currently contained in this item will now be included in the new paragraph being added to DCD Section 19A.4.1.

Impact on DCD

See attached marked up page 19A-2 of DCD Tier 2 Revision 3.

Impact on R-COLA

None.

Impact on S-COLA

None.

Impact on PRA

None.

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| **Application Section:** | **Appendix A** |
| **DATE OF RAI ISSUE:** | **6/23/2011** |

**QUESTION NO.:** 19-535

In DCD Section 19A.4.3, the applicant credits the use of 3-hour fire barriers, including fire door and watertight fire doors for separating the safety divisions within the Reactor Building (R/B) and the east and west Power Source Buildings (PS/Bs). Please clarify that all intervening penetration seals and dampers also have 3-hour ratings. Please also clarify that all elements (i.e., wall, doors, dampers, penetration seals) of fire barriers that are key design features and are credited for the "one-barrier" option in NEI 07-13, have both a 3-hour fire rating and are able to withstand 5psid overpressure to prevent fire spread. The US-APWR DCD should identify and describe the specific fire barriers credited for the "one-barrier" option.

**ANSWER:**

The design and location of 3-hour fire barriers, including fire doors, watertight fire doors, penetration seals and dampers which separate the safety divisions within the R/B and the east and west PS/Bs are key design features for the protection of safety equipment within these buildings from the impact of a large commercial aircraft. The aircraft impact assessment credited the design and location of fire barriers (including doors) as depicted on DCD Figures 9A-1 through 9A-12 to limit the effects of internal fires created by the impact of a large commercial aircraft. In addition, certain 3-hour fire barriers, including doors, dampers that are fast-acting blast resistant dampers, and penetration seals, are credited for 5psid pressure resistance.

DCD Revision 3 reflects a revision to Section 19A.4.3 which states that "certain fire barriers, including doors and penetrations seals are credited for 5 psid" and that "[t]hese 5 psid barriers are identified on Figures 9A-1 through 9A-12." DCD Revision 3 also reflects a revision to Figures 9A-1 through 9A-12 which identifies the location of the fire barriers credited for 5 psid

pressure resistance. These fire/pressure barriers corresponded to those barriers credited for the "one-barrier" option in the US-APWR aircraft impact analysis.

The DCD will be revised to include the pressure resistance capability of penetration seals and dampers by the following changes:

The first sentence of DCD Section 19A.4.3 will be revised to state that penetration seals and dampers in three hour fire barriers within the R/B and PS/B also have three hour fire ratings.

The second to last sentence in DCD Section 19A.4.3 will be revised to state that those three hour fire rated fire barriers credited for 5 psid pressure resistance, in addition to having 5 psid credited doors and penetration seals, also have fast acting blast resistant dampers that are credited for 5 psid pressure resistance.

In addition, DCD Section 9.5.1.2.1, Plant Arrangement, sixth paragraph, will be revised to add the following to the end of the paragraph:

> "Certain 3-hour fire barriers are protected to a 5 psid pressure requirement. This differential pressure criterion is based on the results of the aircraft impact analysis provided in Appendix 19A and applies to fire rated doors, dampers and fire barrier penetrations seals. The fire barriers with 5 psid requirements are identified in Figures 19A-1 through 19A-12."

The legend for identifying the 5 psid barriers on page 9A-610 of DCD, Revision 3, will be revised as follows:

> "FIRE AREA BOUNDARY [3 HOUR FIRE AND 5 PSID PRESSURE BARRIER WITH 3 HOUR FIRE AND 5 PSID PRESSURE DOORS, DAMPERS, AND PENETRATION SEALS"

Impact on DCD

See attached marked-up pages 9.5-8, 19A-3 and 9A-610.

Impact on R-COLA

None.

Impact on S-COLA

None.

Impact on PRA

None.

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

**Application Section:** **Appendix A**

**DATE OF RAI ISSUE:** **6/23/2011**

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**QUESTION NO.:** 19-536

The US-APWR DCD Appendix 19A submittal reviewed by the NRC should accurately reflect the results of the Aircraft Impact Assessment (AIA) performed by the applicant as required by 10 CFR 50.150. The submittal should include all key design features and functional capabilities credited in the AIA to meet the acceptance criteria. As such, the applicant is requested to verify that the submittal fully identified and described all key design features and functional capabilities credited in the AIA. The applicant must revise the submittal if it is found that there are key design features and functional capabilities credited in the AIA that are not identified or described in the US-APWR DCD Appendix 19A currently being reviewed by the NRC.

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**ANSWER:**

DCD Sections 19A.4.1 through 19A 4.3 of DCD Revision 3 identify key design features credited in the US-APWR aircraft impact analysis (AIA) to meet the acceptance criteria of 10 CFR 50.150. DCD Section 19A.4.4, which was added to Revision 3, identifies the core cooling functional capabilities credited in the AIA to meet the acceptance criteria of 10 CFR 50.150.

DCD Sections 19A.4.1 through 19A 4.4 are being revised as described in various other responses to RAI No. 5646, which describe key design features and functional capabilities credited in the AIA.

Impact on DCD

See attached marked up pages 19A-2 through 19A-4 of DCD Tier 2 Revision 3 which are being revised as described in various other responses to RAI No. 5646 so as to describe the key design features and functional capabilities credited in the AIA.

Impact on R-COLA

None.

Impact on S-COLA

None.

Impact on PRA

None.

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**SRP SECTION:** **19 – Probability Risk Assessment and Severe Accident Evaluation**
**Application Section:** **Appendix A**
**DATE OF RAI ISSUE:** **6/23/2011**

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**QUESTION NO.:** 19-537

It is stated in Section 19A.1 of the U.S. APWR DCD, Revision 2 that the methodology used for assessing effects of aircraft impact is described in NEI 07-13, "Methodology for Performing Aircraft Impact Assessments for New Plant Designs," Revision 7 (NEI 07-13). NEI 07-13 describes the guidelines for assessing the effects of an aircraft impact that could occur while the plant is producing power. Contrary to the requirements of paragraph (b)(1) of 10 CFR 50.150, Section 19A.4 does not contain a description of design features nor functional capabilities relied upon to ensure that the assessment requirements in paragraph (a)(1) of 10 CFR 50.150 are met while the plant is producing power. Please modify Section 19A.4 to include a description of (1) design features and/or functional capabilities relied upon to ensure that the assessment requirements in paragraph (a)(1) of 10 CFR 50.150 are met while the plant is producing power, and (2) how these design features and/or functional capabilities meet the assessment requirements in paragraph (a)(1) of 10 CFR 50.150. Specifically, please describe how these key design features are capable of assuring core cooling following a beyond-design-basis aircraft impact event for a sufficient period of time to allow implementation of measures that will assure long term core cooling. The staff considers 24 hours to be a sufficient amount of time to implement mitigation measures for long-term core cooling. Please provide the staff with marked-up copy of Section 19A.4 that shows the required descriptions and include the descriptions in the next Revision of the DCD. If detailed descriptions of the subject design features are described in sections of the DCD other than 19A.4. Then, in section 19A.4, identify the features and the sections of the DCD containing the descriptions. Please, include descriptions of any success criteria in the U.S. APWR design PRA that are associated with the key design features.

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**ANSWER:**

A new section 19A.4.4, "Core Cooling Features," was added to Revision 3 of the DCD, which describes in part the design features and functional capabilities relied upon for assuring core cooling while producing power following a beyond design basis aircraft impact event. DCD Section 19A.4.4 is being further revised to provide additional description of the key design features and functional capabilities of the US-APWR that assure long term cooling (for 24 hours or more) following a beyond design basis aircraft impact event while producing power:

Security-Related Information - Withheld Under 10 CFR 2.390

Security-Related Information - Withheld Under 10 CFR 2.390

These functional capabilities and key design features are credited in the US-APWR probabilistic risk assessment (PRA) described in DCD Section 19. The success criteria for the PRA are specified in DCD Section 19.1.4.1.1. Included in the success criteria is achieving and maintaining a stable plant condition within 24 hours.

The first two paragraphs of current DCD Section 19A.4.4 are revised, as shown below, to describe these design features and functional capabilities of the US-APWR that assure long term cooling (for 24 hours or more) while the plant is producing power:

Security-Related Information - Withheld Under 10 CFR 2.390

Security-Related Information - Withheld Under 10 CFR 2.390

Additionally, a new sentence is being added at the end of Section 19A.4.3, "Fire Barriers and Fire Protection Features," which provides as follows:

> These key design features ensure that at least one division of safety-related equipment within the R/B and east and west PS/Bs is available to provide core cooling following the impact of a large commercial aircraft.

Responses to other RAIs describe how the other assessment requirements in paragraph (a)(1) of 10 CFR 50.150 are met.

Impact on DCD

See attached mark-up pages 19A-3 and 19A-4.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

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

**Application Section:** **Appendix A**

**DATE OF RAI ISSUE:** **6/23/2011**

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**QUESTION NO.:** 19-538

It is stated in Section 19A.1 of the U.S. APWR DCD, Revision 2 that the methodology used for assessing effects of aircraft impact is described in NEI 07-13, "Methodology for Performing Aircraft Impact Assessments for New Plant Designs," Revision 7 (NEI 07-13). Tables 3-4 and 3-5 of NEI 07-13 describe the guidelines for assessing the effects of an aircraft impact that could occur while the plant is shutdown and the reactor is being cooled via the shutdown cooling system. Contrary to the requirements of paragraph (b)(1) of 10 CFR 50.150, Section 19F.4 does not contain a description of design features nor functional capabilities relied upon to ensure that the assessment requirements in paragraph (a)(1) of 10 CFR 50.150 are met while the plant is shutdown and the reactor is being cooled via the shutdown cooling system. Please modify Section 19A.4 to include a description of (1) design features and/or functional capabilities relied upon to ensure that the assessment requirements in paragraph (a)(1) of 10 CFR 50.150 are met while the plant is shutdown and the reactor is being cooled via the shutdown cooling system, and (2) how these design features and/or functional capabilities meet the assessment requirements in paragraph (a)(1) of 10 CFR 50.150. Specifically, please describe how these key design features are capable of assuring core cooling following a beyond-design-basis aircraft impact event for a sufficient period of time to allow implementation of measures that will assure long term core cooling. The staff considers 24 hours to be a sufficient amount of time to implement mitigation measures for long-term core cooling. Please provide the staff with marked-up copy of Section 19A.4 that shows the required descriptions and include the descriptions in the next Revision of the DCD. If detailed descriptions of the subject design features are described in sections of the DCD other than 19A.4. Then, in section 19A.4, identify the features and the sections of the DCD containing the descriptions. Please, include descriptions of any success criteria in the U.S. APWR design PRA that are associated with the key design features.

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**ANSWER:**

A new section 19A.4.4, "Core Cooling Features," was added to Revision 3 of the DCD, which describes, in part, the design features and functional capabilities relied upon for assuring core cooling while the plant is shutdown following a beyond design basis aircraft impact event. Section 19A.4.4 is being further revised to provide additional description of the design features and functional capabilities of the US-APWR that assure long term cooling (for 24 hours or more) following a beyond design basis aircraft impact event while the plant is shutdown with the reactor head removed and the reactor water level at or near the reactor vessel head flange:

Security-Related Information - Withheld Under 10 CFR 2.390

The last paragraph of current DCD Section 19A.4.4 is revised, as shown below, to describe these design features and functional capabilities of the US-APWR that assure long term cooling (for 24 hours or more) while the plant is shutdown with the reactor head removed and the reactor water level at or near the reactor vessel head flange:

Security-Related Information - Withheld Under 10 CFR 2.390

Security-Related Information - Withheld Under 10 CFR 2.390

Impact on DCD

See attached mark-up page 19A-4.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

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

**Application Section:** **Appendix A**

**DATE OF RAI ISSUE:** **6/23/2011**

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**QUESTION NO.:** 19-539

It is stated in Section 19A.1 of the U.S. APWR DCD, Revision 2 that the methodology used for assessing effects of aircraft impact is described in NEI 07-13, "Methodology for Performing Aircraft Impact Assessments for New Plant Designs," Revision 7 (NEI 07-13). Tables 3-4 and 3-5 of NEI 07-13 describe the guidelines for treating reactor scram in the assessment. In this regard, please describe those design features that assure the reactor will be shutdown following an aircraft impact, including any features that protect equipment in the Reactor Protection System.

Please provide the staff with marked-up copy of Section 19A.4 that shows the required descriptions and include the descriptions in the next Revision of the DCD. If detailed descriptions of the subject design features are described in sections of the DCD other than 19A.4. Then, in section 19A.4, identify the features and the sections of the DCD containing the descriptions. Please, include descriptions of any success criteria in the U.S. APWR design PRA that are associated with the key design features

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**ANSWER:**

NEI 07-13, Rev. 8, in Table 3-4 provides guidance with respect to reactor scrams as follows:

> The baseline assumption will be successful reactor scram prior to damage. <u>However, in reviewing damage footprints in areas with equipment essential to reactor scram an assessment will be made of the potential for damage to prevent a scram should it have not occurred</u>. For designs (some passive designs) where a scram MUST occur for decay heat removal systems to perform their fuel cooling function, both physical damage to equipment and damage to the control room, remote shutdown panel, egress pathways to the remote shutdown pathway and

survivability of the operators should be considered. For active designs, it is assumed that the loss of internal power distribution results in a scram unless physical damage prevents movement of the control rods.

NEI 07-13, Rev. 8, at page 66 (emphasis added).

Security-Related Information - Withheld Under 10 CFR 2.390

DCD Section 19A.6, "References," will be revised to reflect NEI 07-13, Revision 8, April 2011.

Impact on DCD

See attached markup pages 19A-2 and 19A-4.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

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| **Application Section:** | **Appendix A** |
| **DATE OF RAI ISSUE:** | **6/23/2011** |

**QUESTION NO.:** 19-540

It is stated in section 19A.1 that key design features and functional capabilities necessary to maintain spent fuel pool cooling are described in Appendix 19A.4. Contrary to the requirements of paragraph (b)(1) of 10 CFR 50.150, in DCD Section 19A.4, such descriptions were not provided. Please modify Section 19A.4 to include descriptions of the key design features and functional capabilities being credited to maintain spent fuel pool cooling including design features that protect those SSCs credited for the removal of decay heat from the spent fuel pool.

Please provide the staff with marked-up copy of Section 19A.4 that shows the required descriptions and include the descriptions in the next Revision of the DCD. If detailed descriptions of the subject design features are described in sections of the DCD other than 19A.4. Then, in section 19A.4, identify the features and the sections of the DCD containing the descriptions. Please, include descriptions of any success criteria in the U.S. APWR design PRA that are associated with the key design features.

**ANSWER:**

The statement in Section 19A.1 that Appendix 19A describes the key design features and functional capabilities necessary to maintain spent fuel pool cooling has been deleted in DCD, Revision 3. Also, the references to spent fuel cooling in the two introductory paragraphs of Section 19A.4 to spent fuel cooling have been deleted in DCD, Revision 3.

Because maintaining spent fuel cooling is not relied upon to meet the requirements of 10 CFR 50.150, Appendix 19A does not provide information concerning spent fuel cooling.

Impact on DCD

None.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

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**Application Section:** **Appendix A**

**DATE OF RAI ISSUE:** **6/23/2011**

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**QUESTION NO.:** 19-541

In Revision 2 of DCD, Appendix 19A, "US-APWR Beyond Design Basis Aircraft Impact Assessment," Section 19A.1, you refer to the NRC provided loading function of the impacting aircraft and list this as Reference 19A-1, and in Section 19A.4, you refer to Technical Report UAP-SGI-09001 and list this as Reference 3 in Section 19A.6. In accordance with the statements of consideration for the aircraft impact rule (74 FR 28120; June 12, 2009), the applicant is not required to submit the aircraft impact assessment—as opposed to the "description of the identified design features and functional capabilities" required by 10 CFR 50.150(b), to the NRC in its application. In addition, the NRC's decision on an application subject to 10 CFR 50.150 will be separate from any NRC determination that may be made with respect to the adequacy of the impact assessment which the rule does not require be submitted to the NRC. Therefore, the NRC staff requests that (1) you remove the references to the subject NRC provided loading function of the impacting aircraft in Section 19A.1 and to topical report in Section 19A.4 and (2) remove items 1 and 3 from the References list in Section 19.A.6 of Appendix 19A of the DCD.

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**ANSWER:**

The references to Technical Report UAP-SGI-019001 in Section 19A.4 have been deleted in DCD, Revision 3. Also, Technical Report UAP-SGI-019001 has been deleted from the list of references in Section 19A.6 in DCD, Revision 3.

DCD Section 19A-1 will be revised to delete the sentence and reference referring to the NRC providing the loading function.

DCD Section 19A.6 will be revised to delete Reference 19A-1 to the NRC December 7, 2007 letter.

Impact on DCD

See attached markup pages 19A-1 and 19A-5.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

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**Application Section:** **Appendix A**

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**QUESTION NO.:** 19-542

With regard to the integrity of the PCCV containment, Section 19A.2 concludes that perforation of the containment vessel is not predicted and in Section 19A.4.1, it is concluded that a strike upon the PCCV would not result in the penetration. Please clarify whether a potential strike on the PCCV will result in penetration of the containment and discuss if this has any effect on the identified key design features. Revise the DCD to ensure accurate and consistent conclusions regarding the response of the PCCV to a large, commercial aircraft impact.

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**ANSWER:**

Security-Related Information - Withheld Under 10 CFR 2.390

Impact on DCD

See attached markup page 19A-2.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

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| **Application Section:** | **Appendix A** |
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**QUESTION NO.:** 19-543

In Section 19A.4.2, a description of key design features that limits the location and effects of potential aircraft strike on the R/B and the PS/B is provided. Provide the rationale for limiting potential aircraft strikes on the R/B and PS/B.

**ANSWER:**

The methodology of NEI 07-13, Section 3.2 was used to determine when the screening of intervening structures could be credited for limiting the locations and effects of potential aircraft strikes on the R/B and the PS/B. Each of the structures credited in the US-APWR aircraft impact analysis for screening the R/B or PS/B meet the NEI 07-13 criteria for an intervening structure. Each credited structure has the required number of walls (including the wall of the building being screened) of the required reinforced concrete thickness specified by the NEI 07-13 methodology.

Applying the NEI 07-13 methodology, the following buildings were credited in the analysis for providing screening of either the R/B or the PS/B:

[ ]

Security-Related Information - Withheld Under 10 CFR 2.390

As revised, the first four items in DCD Section 19A.4.2 will now read as follows:

Security-Related Information - Withheld Under 10 CFR 2.390

Impact on DCD

See attached marked up page 19A.3.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**8/22/2011**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No 52-021**

**RAI NO.:** **773-5646 REVISION 2**

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

**Application Section:** **Appendix A**

**DATE OF RAI ISSUE:** **6/23/2011**

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**QUESTION NO.:** 19-544

In Section 19A.4.2, the applicant has identified key design features for maintaining an intact containment but did not describe how the key design features show that the containment will remain intact. In accordance with the10 CFR 50.150(b)(2), the applicant is required to provide a description of how the identified design features and functional capabilities meet the assessment requirements. Sufficiency criteria for the intact containment are provided in Section 2.5.1 of NEI 07-13, Rev. 7. The applicant is requested to provide a description how the identified key design features meet the rule requirement that, with reduced use of operator actions, the containment remains intact, i.e., perforation of concrete containment with steel liner does not occur on impact and that the containment ultimate pressure capability, given a core damage event, would not be exceeded before effective mitigation strategies can be implemented. Provide a description of (1) features that are relied upon to maintain the containment intact following a core damage event and (2) all equipment needed to maintain ultimate pressure capability until effective mitigation strategies can be implemented.

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**ANSWER:**

Security-Related Information - Withheld Under 10 CFR 2.390

Security-Related Information - Withheld Under 10 CFR 2.390

Impact on DCD

See attached markup pages 19A-1, 19A-2, and 19A-5.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**8/22/2011**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No 52-021**

**RAI NO.:** **773-5646 REVISION 2**

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

**Application Section:** **Appendix A**

**DATE OF RAI ISSUE:** **6/23/2011**

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**QUESTION NO.:** 19-545

In Section 19A.4.2(6), the applicant identified 'design and location' of the spent fuel pool (SFP) and its supporting structures as key design features but did not provide description how the key design feature meet the rule requirement for maintaining an Spent fuel pool cooling or integrity. In accordance with the10 CFR 50.150(b)(2), the applicant is required to provide a description of how the identified design features and functional capabilities meet the assessment requirements. Sufficiency criteria for the spent fuel pool integrity are provided in Section 2.5.2 of NEI 07-13, Rev. 7. The applicant is requested to provide a description how the identified key design features meet the spent fuel pool integrity sufficiency criteria.

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**ANSWER:**

As described in the Response to Question No. 19-540 of Request for Additional Information 773-5646, Revision 2 (RAI No. 5646), DCD Revision 3 revised Section 19A to delete the reference to maintaining spent fuel cooling.

Security-Related Information - Withheld Under 10 CFR 2.390

Impact on DCD

See Response to Question No. 19-534 of RAI No. 5646.

Impact on R-COLA

None.

Impact on S-COLA

None

Impact on PRA

None.

system is provided and collection tanks for accumulation of any oil leakage are provided in the lower levels of the primary containment. The tank for each RCP is sized to hold the total oil leakage volume from its RCP motor plus an additional 10%, and is provided with a flame arrestor on the vent. Redundant trains of safe-shutdown components are separated whenever possible by existing structural walls, or by distance. Selected cables of a safety-related division which pass through a fire zone of an unrelated division may be protected by fire barriers or by noncombustible radiant heat shields having a minimum fire rating of 30 minutes. The fire protection system provides appropriate fire detection and suppression capabilities.

Outside of the primary containment and the MCR, the arrangement of plant equipment and routing of cable are such that should a fire occur in any one fire area, safe-shutdown can be achieved and maintained utilizing components from at least two of the other three available safety trains of equipment, which are independently separated by 3-hour fire rated barriers.

Openings and penetrations through fire barriers are protected in accordance with features providing a fire resistance rating compatible with the fire barrier, rating and proven by appropriate independent laboratory testing (i.e., providing 3-hours fire resistance rating). Certain 3-hour fire barriers are protected to a 5psid pressure requirement. This differential pressure criterion is based on the results of the aircraft impact analysis provided in Appendix 19A and applies to fire rated doors, dampers and fire barrier penetrations seals. The fire barriers with 5psid requirements are identified in Figures 19A-1 through 19A-12. DCD_19-535

The FHA (Appendix 9A) contains a description of plant fire areas, fire zones, fire barriers, and the protection of barrier openings, as well as a description of the separation between redundant safe-shutdown components.

**Electrical Cable Design, Routing, and Separation**

Electrical cable (including fiber optic cable) and methods of raceway construction are selected in accordance with RG 1.189 guidance (Ref.9.5.1-12). Metal cable trays are used throughout the plant. Rigid metal conduit or other metal raceways are used for selected cable runs. Flexible metallic tubing may be used in short lengths for equipment connections.

The insulating and jacketing material for electrical cables are selected to meet the fire and flame test requirements of IEEE Standard 1202 (Ref. 9.5.1-19) or IEEE 383 (Ref. 9.5.1-20).

Redundant safety trains are installed in suitable raceways and are generally separated from adjacent safety trains by 3-hour fire rated structural barriers such as reinforced concrete walls with 3-hour fire rated dampers and penetration seals, and 3-hour fire rated doors between compartments. In a limited number of cases, electrical train separation is obtained by enclosing cables trays and conduits within a fire protective envelope such as a fire rated wrap system. In such instances, the cables are appropriately de-rated and the fire wrap system has passed laboratory testing showing that the criteria of RG 1.189, Rev. 1 (Ref.9.5.1-12) and Supplement 1 to NRC Generic Letter 86-10 (Ref.9.5.1-11) are

**LEGEND**

FIRE AREA BOUNDARY
[ 3 HOUR FIRE BARRIER WITH 3 HOUR FIRE DOORS]
[Except Exterior Walls]

FIRE AREA BOUNDARY
[3 HOUR FIRE AND 5 PSID PRESSURE BARRIER WITH 3 HOUR FIRE AND 5 PSID PRESSURE DOORS, DAMPERS AND PENETRATION SEALS]

DCD_19-535

FIRE Zone

NUMBER (＊1)

FIRE AREA NUMBER

NUMBER (＊2)

FIRE Zone NUMBER

(＊1)

FIRE AREA NUMBER is shown as follows.

**FA ○－■××**

**○ : Building Number**

**1 : C/V**
**2 : R/B**
**3 : PS/B**
**4 : A/B**
**5 : AC/B**
**6 : T/B**
**7 : O/B**

(＊2)

**FIRE Zone NUMBER is shown as follows.**
**FIRE AREA NUMBER－××**

# 19A US-APWR Beyond Design Basis Aircraft Impact Assessment

## 19A.1 Introduction and Background

The design of the US-APWR takes into account the potential effects of the impact of a large commercial aircraft, which the NRC has determined is a beyond design basis event. In accordance with 10 CFR 50.150(a), a design-specific assessment has been performed for the US-APWR using realistic analysis to demonstrate that, in the event an US-APWR is struck by a large commercial aircraft, design features and functional capabilities exist to ensure that the following functions are maintained:

- The reactor core remains cooled, ~~or the containment remains intact;~~ and DCD_19-544
- Spent fuel pit integrity is maintained.

The assessment demonstrates the inherent robustness of the US-APWR design with regard to potential large aircraft impacts.

Specific assumptions used in the US-APWR aircraft impact assessment are based on NRC requirements, and guidance provided by the NRC and the Nuclear Energy Institute (NEI). ~~The NRC provided the physical characteristics, including the loading function of the impacting aircraft, in July of 2007 (Reference 19A-1).~~ The methodology for assessing effects for aircraft impact are described in NEI 07-13, "Methodology for Performing Aircraft Impact Assessments for New Plant Designs," Revision 7 (Reference 19A-2). These guidelines were fully followed with no exceptions taken. DCD_19-541 DCD_19-532

This appendix describes the design features and functional capabilities of the US-APWR identified in the detailed assessment that assure the reactor core remains cooled or the reinforced concrete containment vessel (PCCV) remains intact, and spent fuel pit integrity is maintained. These identified design features are designated as "key" design features.

## 19A.2 Scope of the Assessment

[ ] (SRI)

[ ] (SRI)

## 19A.3 Assessment Methodology

[ ] DCD_19-533 (SRI)

## 19A.4 Assessment Results

[ ] DCD_19-544 DCD_19-544 (SRI)

### 19A.4.1 PCCV and SFP

DCD_19-534

[ ] DCD_19-542 (SRI)

DCD_19-539

DCD_19-534
DCD_19-539

(SRI)

## 19A.4.2 Plant Arrangement

DCD_19-543

DCD_19-543

(SRI)

DCD_19-543

DCD_19-543

DCD_19-543

DCD_19-534

(SRI)

### 19A.4.3 Fire Barriers and Fire Protection Features

DCD_19-535

DCD_19-535

(SRI)

### 19A.4.4 Core Cooling Features

DCD_19-537
DCD_19-538

(SRI)

DCD_19-537
DCD_19-538

(SRI)

[ ] (SRI) DCD_19-537 DCD_19-538

## 19A.5 Conclusions of Assessment

This assessment concludes that key design features and functional capabilities of the US-APWR ensure adequate protection of public health and safety in the event of an impact of a large commercial aircraft, as defined by the NRC. The postulated aircraft impacts would not impair the US-APWR's core cooling capability~~, containment integrity,~~ or spent fuel pit integrity. The assessment resulted in identification of key design features and functional capabilities described in Section 19A.4, changes to which are required to be controlled in accordance with 10 CFR 50.150(c). DCD_19-544

## 19A.6 References

19A-1 ~~Letter from D. Matthews, NRC to Dr C. K. Paulson, Mitsubishi Nuclear Energy Systems, Inc, Subject: "Approval of Mitsubishi Nuclear Energy Systems Safeguards Protection Program and Reviewing Official, and Transmittal of Beyond Design Basis, Large Commercial Aircraft Characteristics Specified by Commission," December 7, 2007.~~Deleted DCD_19-541

19A-2 NEI 07-13, "Methodology for Performing Aircraft Impact Assessments for New Plant Designs," Revision ~~7~~8, ~~May 2009~~April 2011. DCD_19-539 DCD_19-532

19A-3 Deleted