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TOKYO, JAPAN

November 20, 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-12299

Subject: **MHI's Response to US-APWR DCD RAI No. 967-6790 (SRP 19)**

Reference: 1) "Request for Additional Information No. 967-6790, SRP Section: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation, Application Section: 19," dated October 9, 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. 967-6790."

Enclosed are the responses to three RAI questions contained within Reference 1.

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,

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

Enclosures:

1. Response to Request for Additional Information No. 967-6790

D081
NRO

CC: J. A. Ciocco
J. Tapia

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Enclosure 1

UAP-HF-12299
Docket No. 52-021

Response to Request for Additional Information No. 967-6790

November 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/20/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO. 967-6790**

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

APPLICATION SECTION: **19**

DATE OF RAI ISSUE: 10/09/2012

QUESTION NO.: 19-573

The staff's review finds that the transferring of plant control from MCR to RSC, including the transfer switches and operator actions, is important to the main control room fire risk model and is the key contributor to the fire risk estimate. Thus, please enhance DCD Table 19.1-119 "Key Insights and Assumptions" to reflect the staff finding associated with the control transfer from MCR to RSC, ensuring that all important assumptions and insights remain valid for future plants.

ANSWER:

MHI concurs that the transfer of plant control from MCR to RSC, including the transfer switches and operator actions, is the key contributor to the MCR fire risk scenario.

DCD Revision 3 Subsection 7.4.1.5, "Normal and Safe Shutdown from Outside the MCR", describes the design associated with the control transfer from the operator console (OC) in the MCR to the RSC in the remote shutdown room (RSR). The operator has the same functional control and monitoring capability at the RSR as in the MCR. The RSC provides equivalent functions of the operational VDUs and the safety VDUs in the MCR. The transfer of control to the RSR has no effect on non-safety or safety-related control functions, including automatic load sequencing to accommodate a loss-of-offsite power. The operator has complete capability to control all manual and automatic modes.

Accordingly, DCD Table 19.1-119 "Key Insights and Assumptions" will be revised to include this transfer function.

Impact on DCD

DCD Table 19.1-119 will be revised to include the transfer function, 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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/20/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.:	**NO. 967-6790**
SRP SECTION:	**19 – Probabilistic Risk Assessment and Severe Accident Evaluation**
APPLICATION SECTION:	**19**

DATE OF RAI ISSUE: 10/09/2012

QUESTION NO.: 19-574

(Follow-up to Questions 19-507, 19-509, 19-559, and 19-564) Currently, in Section 19.3 of the US-APWR DCD Revision 3, there are only three COL Action Items for the entire Chapter 19. During the staff's review, the staff finds that the list of COL action items is incomplete due to the use of generic information and bounding assumptions. The staff requests MHI to finalize the list of COL action items in DCD Section 19.3 to ensure that the COL applicant or holder referencing the certified US-APWR design, in conformance with the guidance provided in the SRP 19.0 and RG 1.206, as minimum, will:

- (COL applicant and holder) evaluate and address the "key sources of uncertainty and key assumptions" identified in US-APWR DCD Table 19.1-38 as new or more detailed information becomes available. The COL holder should also address these items as the site-specific PRA is developed.
- (COL applicant and holder) assess, confirm, and update the "key insights and assumptions" identified in US-APWR DCD Table 19.1-119, ensuring that they are complete and applicable to the plant. The COL holder should also address these items as the site-specific PRA is developed.
- (COL holder) review as-designed and as-built information and conduct walk-downs as necessary to confirm that important assumptions made in the PRA about design features and characteristics (e.g., routing and location of piping and cables, flood propagations, HCLPF fragilities, etc.) and operator actions remain valid with respect to all applicable events and modes of operation.
- (COL holder) upgrade the PRA to industry standards to meet the technical adequacy requirements needed to support certain risk-informed applications during operation (e.g., risk-managed technical specifications).
- (COL applicant) ensure that asymmetric conditions due to modeling simplicity will be addressed or properly accounted for when the PRA is used for decision making.
- (COL holder) revise and update the evaluations of identified operator actions and human error probabilities as detailed design information becomes available and plant-specific EOPs are developed.

ANSWER:

COL Action items 19.3(1) and (6) will be revised and COL Action item 19.3(10) will be added to address the COL applicant and licensee responsibilities, as shown in the attached markup.

Impact on DCD

DCD Table 1.8-2 and Section 19.3 will be revised, as shown in attached markups.

Impact on R-COLA

R-COLA Part 2 FSAR Table 1.8-201 and Subsection 19.3.3 will be revised to be consistent with the attached DCD markups.

Impact on S-COLA

S-COLA Part 2 FSAR Table 1.8-201 and Subsection 19.3.3 will be revised to be consistent with the attached DCD markups.

Impact on PRA

There is no impact on the PRA.

Impact on Topical / Technical Report

There is no impact on topical and technical reports.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/20/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO. 967-6790**

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

APPLICATION SECTION: **19**

DATE OF RAI ISSUE: 10/09/2012

QUESTION NO.: 19-575

Please clarify the statement in Section 19.1.2.3, which says that "The PRA has been developed in accordance with industry consensus standards as described in Section 19.0," since no information regarding the PRA technical adequacy is provided in Section 19.0 of the DCD (e.g., Is this reference to Section 19.0 of the SRP or Section 19.0 of RG 1.206?) and describe how this was verified to be in accordance with the standards (e.g., by a peer review, self assessment, or in-house review, etc.). In addition, clarify the statement in Section 19.1.2.3, which states that "The PRA ...has been subjected to a peer review process as defined in ASME/ANS RA-S-2008 and associated addenda."

ANSWER:

Peer review was conducted to ensure that the technical adequacy of the US-APWR PRA met the requirements in the PRA standard endorsed by the NRC staff before the design certification (DC) application. The peer review results were submitted to NRC in the response to RAI 564-4399 Question 19-426 as proprietary information (Ref. UAP-HF-10125, dated April 28 2010). After the DC application, when the PRA model was revised, MHI performed a self assessment to confirm that the revised PRA model satisfied the requirement in the PRA standard endorsed by NRC.

Peer review will be conducted to assure the PRA model meets the requirement in the PRA standard endorsed by NRC prior to use of the PRA to support risk-informed applications or fuel load. The commitment will be documented in DCD Subsection 19.1.2.3.

Note that the subject wording has been deleted from the DCD, as indicated in the response to RAI 750-5675, Question 19-510 (Ref.UAP-HF-11201, dated 30 June 2011). The only use of Reference 19.1-14 in the DCD was deleted in that RAI response. Accordingly, in Subsection 19.1.9, Reference 19.1-14 will also be deleted from the DCD per the attached markup.

Impact on DCD

DCD Subsections 19.1.2.3 and 19.1.9 will be revised, as shown in 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.

Table 1.8-2 Compilation of All Combined License Applicant Items for Chapters 1-19 (Sheet 35 of 37)

COL ITEM NO.	COL ITEM
COL 17.6(1)	*The COL Applicant must provide in its FSAR a description of the maintenance rule program, and its for implementation, for monitoring the effectiveness of maintenance necessary to meet the requirements of 10 CFR 50.65.*
COL 18.1(1)	*Deleted*
COL 18.1(2)	*Deleted*
COL 18.3(1)	*Deleted*
COL 18.3(2)	*Deleted*
COL 18.4(1)	*Deleted*
COL 18.4(2)	*Deleted*
COL 18.4(3)	*Deleted*
COL 18.5(1)	*Deleted*
COL 18.5(2)	*Deleted*
COL 18.6(1)	*Deleted*
COL 18.6(2)	*Deleted*
COL 18.7(1)	*Deleted*
COL 18.8(1)	*Deleted*
COL 18.9(1)	*Deleted*
COL 18.10(1)	*Deleted*
COL 18.10(2)	*Deleted*
COL 18.11(1)	*Deleted*
COL 18.11(2)	*Deleted*
COL 18.12(1)	*Deleted*
COL 19.3(1)	*The COL Applicant who intends to implement risk~~-managed technical specifications continues to update Probabilistic Risk Assessment and Severe Accident Evaluation to provide PRA input for risk managed technical specifications. Peer reviews for the updated PRA will be performed prior to the use of PRA to risk informed applications~~informed applications will update and upgrade the information in the design-specific PRA to incorporate site-specific, as-built and as-operated information per 10 CFR 50.71(h)(1) for its intended uses and application. The COL Licensee will perform peer reviews of the site-specific PRA in accordance with requirements in PRA standards endorsed by the NRC prior to the use of the PRA to support risk-informed applications and will verify that the PRA model meets the technical adequacy and detail to support the proposed licensee programs and applications.*
COL 19.3(2)	*Deleted*
COL 19.3(3)	*Deleted*

DCD_19-574

Table 1.8-2 Compilation of All Combined License Applicant Items for Chapters 1-19 (Sheet 36 of 37)

COL ITEM NO.	COL ITEM	
COL 19.3(4)	The Probabilistic Risk Assessment and Severe Accident Evaluation is updated as necessary to assess specific site information and ~~associated site-specific external events (high winds and tornadoes, external floods, transportation, and nearby facility accidents)~~all associated potential site-specific external hazards (both natural and man-made hazards) that may affect the facility are screened out or subjected to analysis..	MIC-03-01-0 0010
COL 19.3(5)	~~Deleted~~The COL Applicant will identify a milestone for completing a comparison of the as-built SSC HCLPFs to those assumed in DCD Subsection 19.1.5.1. Deviations from the HCLPF values or other assumptions in the seismic margins evaluation shall be analyzed to determine if any new vulnerability have been introduced.	MIC-03-01-0 0011
COL 19.3(6)	~~The COL Applicant develops an accident management program which includes severe accident management procedures that capture important operator actions. Training requirements are also included as part of the accident management program.~~The COL Applicant develops or describes an accident management program which includes emergency operating procedures, consideration of risk-significant operator actions listed in DCD Table 19.1-119, training, and human reliability related severe accident guidance programs. Insights gained from the design specific PRA, including insights created by the incorporation of site and plant-specific information available at the COL application phase (for aspects of the design which are not bounded by the Standard Plant PRA), are to be reflected appropriately. The COL Applicant reviews that operator actions remain valid with respect to all applicable events and modes of operation. As detailed design information becomes available and site-specific procedures are developed, the human reliability analysis in the PRA is revised and updated.	MIC-03-01-0 0012 DCD_19-508 DCD_19-564 DCD_19-574
COL 19.3(7)	The COL Applicant will provide a milestone for completing the equipment survivability assessment of the as-built equipment required to mitigate severe accidents (electrical penetrations, hydrogen igniters and containment pressure (wide range)) to provide reasonable assurance that they will operate in the environmental conditions resulting from hydrogen burns associated with severe accidents for which they are intended and over the time span for which they are needed.	DCD_06.02. 05-45
COL 19.3(8)	The COL applicant will describe the uses of PRA in support of licensee programs and identify and describe risk-informed applications being implemented during the operational phase.	DCD_19-564
COL 19.3(9)	The COL applicant will describe the PRA maintenance and upgrade programs.	DCD_19-564

Table 1.8-2 Compilation of All Combined License Applicant Items for Chapters 1-19 (Sheet 37 of 37)

COL ITEM NO.	COL ITEM
COL 19.3(10)	*The site-specific PRA will be developed when site-specific information becomes available. The COL Applicant will evaluate and address the key sources of uncertainty and key assumptions listed in DCD Table 19.1-38. By conducting walkdowns during construction, the COL Applicant will assess and update as needed (i) key insights and assumptions (identified in DCD Table 19.1-119), (ii) routing and locations of piping and cables assumed in the internal fire and flooding events, and (iii) fragility values used in the seismic margin analysis that are important to the risk profile of the facility; the COL Applicant will confirm that this information is accurately reflected in the as-built design and construction. Differences between the as-built plant and the design used as the basis for the US-APWR PRA will be reviewed to determine whether there is significant impact on PRA results.*

DCD_19-574

- Use of procedures that ensure appropriate attention and corrective actions are taken if assumptions, analyses, or information used previously are changed or determined to be in error.

19.1.2.1 PRA Scope

The scope of the ~~design-specific and site-specific~~ US-APWR PRA for the DCD and COL application includes a Level 1 and Level 2 PRA ~~for internal and external events (including flooding, fire, and seismic)~~for internal, external events (including flooding and fire) and a PRA-based SMA at full-power, and LPSD conditions. The design-specific PRA refers specifically to the PRA generated by the DC applicant. The site-specific PRA refers specifically to the PRA generated by the COL applicant. DCD_19-564 DCD_1-564 S01

19.1.2.2 PRA Level of Detail

The US-APWR realistically reflects the actual plant design, planned construction, anticipated operational practices, and relevant operational experience. The approach, methods, data, and computer codes that are used, as documented throughout this chapter, are compliant with industry standard codes and practices. The level of detail is sufficient to ensure that the impacts of designed-in dependencies are correctly captured. The level of detail of the PRA is sufficient to provide confidence in the results such that the PRA may be used ~~in regulatory decision-making~~ to support ~~risk-informed applications~~licensee programs and design activities in design phase. DCD_19-564

19.1.2.3 PRA Technical Adequacy

The quality of the methodologies, processes, analyses, and personnel associated with the US-APWR PRA comply with the provisions for nuclear plant quality assurance. Toward this end, the US-APWR PRA adheres to the recommendations provided in RG 1.200 pertaining to quality and technical adequacy. The US-APWR incorporates the technical elements of an acceptable PRA shown in Table 1 of RG 1.200 (Reference 19.1-9), and is consistent with the technical characteristics and attributes given in Table 2 through Table 10 of RG 1.200. ~~The PRA has been developed in accordance with industry consensus standards as described in Section 19.0, and has been subjected to a peer review process as defined in ASME/ANS RA-S-2008 and associated addenda (Reference 19.1-49, 19.1-50) and as outlined in the Nuclear Energy Institute (NEI) peer review guide (Reference 19.1-14).~~ DCD_19-510

A peer review has been conducted to ensure that the technical adequacy of US-APWR PRA meets the requirements in the PRA standard endorsed by NRC. DCD_19-575

19.1.2.4 PRA Maintenance And Upgrade

The objective of the PRA maintenance and upgrade program is to ensure that the PRA will be maintained and upgraded so that its representation of the as designed, as-to-be built, and as-to-be operated plant is sufficient to support the applications for which the PRA is being used. The PRA will be under configuration control and the program will contain the following key elements:

- A process for monitoring PRA inputs and collecting new information

19.1-5 Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants, NUREG-1150, U.S. Nuclear Regulatory Commission, Washington, DC, December 1990.

19.1-6 Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants, NFPA-805, National Fire Protection Association, Quincy, MA2006 Edition.

19.1-7 EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, NUREG/CR-6850, U.S. Nuclear Regulatory Commission, Washington, DC, September 2005.

19.1-8 Deleted

19.1-9 An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities, Regulatory Guide 1.200, Rev. 2, U.S. Nuclear Regulatory Commission, Washington, DC, March 2009.

19.1-10 MAAP4 Modular Accident Analysis Program for LWR Power Plants, Transmittal Document for MAAP4 Code Revision MAAP 4.0.6, Rev. 0, Report Number FAI/05-47, prepared for the Electric Power Research Institute, 2005.

19.1-11 Risk-Informed Technical Specifications Initiative 4b, Risk-Managed Technical Specifications (RMTS) Guidelines, NEI 06-09, Rev. 0, Nuclear Energy Institute, Washington DC, November 2006.

19.1-12 Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants, Title 10, Code of Federal Regulations, Part 50.65, U.S. Nuclear Regulatory Commission, Washington, DC.

19.1-13 Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, Title 10, Code of Federal Regulations, Part 50, Appendix B, U.S. Nuclear Regulatory Commission, Washington, DC.

19.1-14 ~~Probabilistic Risk Assessment Peer Review Process Guidance, NEI 00-02, Nuclear Energy Institute, Washington DC, March 2000.~~Deleted DCD_19-575

19.1-15 Maintenance of Records, Making of Reports, Title 10, Code of Federal Regulations, Part 50.71, U.S. Nuclear Regulatory Commission, Washington, DC.

19.1-16 Industry-Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants, NUREG/CR-6928, U.S. Nuclear Regulatory Commission, Washington, DC, February 2007.

19.1-17 Analysis of Core Damage Frequency: Internal Events Methodology, NUREG/CR-4550 Volume 1, Rev. 1, U.S. Nuclear Regulatory Commission, Washington, DC, January 1990.

Table 19.1-119 Key Insights and Assumptions (Sheet 43 of 48)

Key Insights and Assumptions	Dispositions
5. Significant operator actions of the post fire accident derived from the importance analysis are as follows: - The operator action of connecting a Class 1E bus to the AAC in case of a start-up failure of all four Class 1E gas turbine generators. This operator action is important because this action is necessary to cope with a station blackout resulting from LOOP events, which is the dominant fire-inducing initiating event. - The operator action of the "feed and bleed operation".	19.1.5.2.2
6. The design associated with the control transfer from the operator console (OC) in the main control room (MCR) to the remote shutdown console (RSC) in the remote shutdown room (RSR) if the MCR is uninhabitable for any reason, including fire, is an important risk insight. The control and monitoring of normal and safe shutdown functions can be performed from the RSC, which is located outside the MCR in the reactor building.	7.4.1.5 9.5.1 19.1.5.2.2

DCD_19-573

19.3 Open, Confirmatory, and COL Action Items Identified as Unresolved

The following subsections identify the open, confirmatory and COL action items associated with this Chapter.

19.3.1 Resolution of Open Items

There are no open items associated with this Chapter.

19.3.2 Resolution of Confirmatory Items

There are no confirmatory items associated with this Chapter.

19.3.3 Resolution of COL Action Items

The following are the COL action items associated with this Chapter:

COL 19.3(1)	The COL Applicant who intends to implement ~~risk-managed technical specifications continues to update Probabilistic Risk Assessment and Severe Accident Evaluation to provide PRA input for risk-managed technical specifications. Peer reviews for the updated PRA will be performed prior to the use of PRA to risk-informed applications.~~risk-informed applications will update and upgrade the information in the design-specific PRA to incorporate site-specific, as-built and as-operated information per 10 CFR 50.71(h)(1) for its intended uses and application. The COL Licensee will perform peer reviews of the site-specific PRA in accordance with requirements in PRA standards endorsed by the NRC prior to the use of the PRA to support risk-informed applications and will verify that the PRA model has the technical adequacy and detail to support the proposed licensee programs and applications.	DCD_19-574
COL 19.3(2)	Deleted	
COL 19.3(3)	Deleted	
COL 19.3(4)	The Probabilistic Risk Assessment and Severe Accident Evaluation is updated as necessary to assess specific site information and all associated potential site-specific external ~~events (high winds and tornadoes, external floods, transportation, and nearby facility accidents)~~hazards (both natural and man-made hazards) that may affect the facility are screened out or subjected to analysis.	DCD_19-518
COL 19.3(5)	~~Deleted~~The COL Applicant will identify a milestone for completing a comparison of the as-built SSC HCLPFs to those assumed in DCD Subsection 19.1.5.1. Deviations from the HCLPF values or other assumptions in the seismic margins evaluation shall be analyzed to determine if any new vulnerability have been introduced.	DCD_19-525

COL 19.3(6)	~~The COL Applicant develops an accident management program which includes severe accident management procedures that capture important operator actions. Training requirements are also included as part of the accident management program.~~The COL Applicant develops or describes an accident management program which includes emergency operating procedures, consideration of risk-significant operator actions listed in DCD Table 19.1-119, training, and human reliability related severe accident guidance programs. Insights gained from the design specific PRA, including insights created by the incorporation of site and plant-specific information available at the COL application phase (for aspects of the design which are not bounded by the Standard Plant PRA), are to be reflected appropriately. The COL Applicant reviews that operator actions remain valid with respect to all applicable events and modes of operation. As detailed design information becomes available and site-specific procedures are developed, the human reliability analysis in the PRA is revised and updated.	DCD_19-508 DCD_19-564 DCD_19-574
COL 19.3(7)	The COL Applicant will provide a milestone for completing the equipment survivability assessment of the as-built equipment required to mitigate severe accidents (electrical penetrations, hydrogen igniters and containment pressure (wide range)) to provide reasonable assurance that they will operate in the environmental conditions resulting from hydrogen burns associated with severe accidents for which they are intended and over the time span for which they are needed.	DCD_06.02.05-45
COL 19.3(8)	The COL applicant will describe the uses of PRA in support of licensee programs and identify and describe risk-informed applications being implemented during the operational phase.	DCD_19-564
COL 19.3(9)	The COL applicant will describe the PRA maintenance and upgrade programs.	DCD_19-564
COL19.3(10)	The site-specific PRA will be developed when site-specific information becomes available. The COL Applicant will evaluate and address the key sources of uncertainty and key assumptions listed in DCD Table 19.1-38. By conducting walkdowns during construction, the COL Applicant will assess and update as needed (i) key insights and assumptions (identified in DCD Table 19.1-119), (ii) routing and locations of piping and cables assumed in the internal fire and flooding events, and (iii) fragility values used in the seismic margin analysis that are important to the risk profile of the facility; the COL Applicant will confirm that this information is accurately reflected in the as-built design and construction. Differences between the as-built plant and the design used as the basis for the US-APWR PRA will be reviewed to determine whether there is significant impact on PRA results.	DCD_19-574