MITSUBISHI HEAVY INDUSTRIES, LTD.
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TOKYO, JAPAN

April 3, 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-09144

Subject: MHI's Responses to US-APWR DCD RAI No. 178-1930 Revision 1

Reference: 1) "Request for Additional Information No. 178-1930 Revision 1, SRP Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation, Application Section: 19.1.5.1," dated February 3, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No. 178-1930 Revision 1".

Enclosed are the responses to eight RAIs that are contained within Reference 1.

As indicated in the enclosed materials, this document contains information that MHI considers proprietary, and therefore should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential. A non-proprietary version of the document is also being submitted with the information identified as proprietary redacted and replaced by the designation "[ ]".

And one version 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 CFR § 2.390. The information that is SRI is identified by braces "{ }". On the other hand, another version 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}".

This letter includes a copy of the proprietary and SRI included version (Enclosure 2), a copy of the non-proprietary and SRI excluded version (Enclosure 3), and the Affidavit of Yoshiki Ogata (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials designated as "Proprietary" in Enclosure 2 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

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 below.

D081
NRO

Sincerely,

Y. Ogata

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

Enclosures:

1. Affidavit of Yoshiki Ogata

2. Responses to Request for Additional Information No.178-1930 Revision 1 (proprietary and SRI included version)

3. Responses to Request for Additional Information No.178-1930 Revision 1 (non-proprietary and SRI excluded version)

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

Contact Information
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ENCLOSURE 1

Docket No. 52-021
MHI Ref: UAP-HF-09144

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

I, Yoshiki Ogata, state as follows:

1. I am General Manager, APWR Promoting Department, of Mitsubishi Heavy Industries, LTD ("MHI"), and have been delegated the function of reviewing MHI's US-APWR documentation to determine whether it contains information that should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

2. In accordance with my responsibilities, I have reviewed the enclosed document entitled "Responses to Request for Additional Information No. 178-1930 Revision 1" dated April 2009, and have determined that portions of the document contain proprietary information that should be withheld from public disclosure. Those pages containing proprietary information are identified with the label "Proprietary" on the top of the page and the proprietary information has been bracketed with an open and closed bracket as shown here "[ ]". The first page of the document indicates that all information identified as "Proprietary" should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

3. The information identified as proprietary in the enclosed document has in the past been, and will continue to be, held in confidence by MHI and its disclosure outside the company is limited to regulatory bodies, customers and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and is always subject to suitable measures to protect it from unauthorized use or disclosure.

4. The basis for holding the referenced information confidential is that it describes the unique design and methodology developed by MHI for performing the design of the US-APWR reactor.

5. The referenced information is being furnished to the Nuclear Regulatory Commission ("NRC") in confidence and solely for the purpose of information to the NRC staff.

6. The referenced information is not available in public sources and could not be gathered readily from other publicly available information. Other than through the provisions in paragraph 3 above, MHI knows of no way the information could be lawfully acquired by organizations or individuals outside of MHI.

7. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without incurring the costs or risks associated with the design of the subject systems. Therefore, disclosure of the information contained in the referenced document would have the following negative impacts on the competitive position of MHI in the U.S. nuclear plant market:

    A. Loss of competitive advantage due to the costs associated with development of

methodology related to the analysis.

B. Loss of competitive advantage of the US-APWR created by benefits of modeling information.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 3rd day of April 2009.

Y. Ogata

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

Enclosure 3

UAP-HF-09144
Docket Number 52-021

Responses to Request for Additional Information No. 178-1930
Revision 1

April, 2009
(Non-Proprietary and Security-Related Information Excluded)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

4/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.178-1930 REVISION 1**

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

APPLICATION SECTION: **19.1.5.1**

DATE OF RAI ISSUE: **2/3/2009**

QUESTION NO. : 19-292

DCD FSAR Section 3.2.1.3 describes the classification of the Safety Power Source Buildings (PS/B east and west) as seismic Category I. Further, Table 19.1-51 of the DCD lists the High Confidence of Low Probability of Failure (HCLPF) for the PS/B as 0.5g and indicates that it is an assumed value whereas, HCLPFs for the other Category I structures included in the design certification are stated to be derived per the fragility methodology of EPRI TR-103959, "Methodology for Developing Seismic Fragilities", Reference 19.1-36.

Given that Safety Power Source Buildings are designated as Category I with design details shown in DCD Chapter 3, Figures 3J-3 and 3J-4, the staff requests the applicant to provide a specific fragility derivation for the Safety Power Source Buildings (PS/B).

ANSWER:

Specific fragility for the power source building (PS/B) will be calculated using the seismic margin analysis (SMA) of EPRI TR-103959 by the next revision of the DCD. Also the calculated specific HCLPF value of PS/B will be contained in the Table 19.1-51 of next revision of DCD.

Impact on DCD

Subsection 19.1.5.1 and Table 19.1-51 of the DCD will be amended to reflect the result of SMA for PS/B.

Impact on COLA

No impact on COLA.

Impact on PRA

PRA technical report MUAP-07030(R1) will be amended to reflect the result of SMA for PS/B.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

4/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.178-1930 REVISION 1**

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

APPLICATION SECTION: **19.1.5.1**

DATE OF RAI ISSUE: **2/3/2009**

QUESTION NO. : 19-293

DCD FSAR Section 19.1.5.1, Table 19.1-51 provides specific fragilities (i.e., HCLPFs) for the Reactor Building (R/B), Pre-stressed Concrete Containment Vessel (PCCV) and Interior Containment Structure. The applicant states that the methodology used for developing these specific seismic fragilities is contained in EPRI TR-103959 (Reference 19.1-36). The HCLPFs listed in Table 19.1-51 for these structures are significantly greater than the 1.67 times the safe shutdown earthquake (SSE) target in SECY 93-087 and are also significantly greater than the generic fragilities assigned to other similar structures or equipment.

To address this concern, the staff requests the applicant to provide a summary of assumptions (e.g., failure modes, capacity and response factors, and associated uncertainties) used to develop HCLPFs for the Reactor Building (R/B), PCCV and Interior Containment Structure.

ANSWER:

Detail of fragility analysis for structures are described in the subsection 24.3.3 of the PRA technical report MUAP-07030(R1). Attachment is the information which is excerpted from the PRA report pages 24-7 to 24-19 and 24-25 to 24-32.

Impact on DCD

No impact on DCD.

Impact on COLA

No impact on COLA.

Impact on PRA

No impact on PRA.

Security-Related Information – Withheld Under 10 CFR 2.390

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

4/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.178-1930 REVISION 1**

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

APPLICATION SECTION: **19.1.5.1**

DATE OF RAI ISSUE: **2/3/2009**

QUESTION NO. : 19-294

DCD FSAR Section 19.1.5.1, Table 19-1-51, lists the HCLPFs for USAPWR Structures, Systems and Components (SSCs). Most HCLPF values in this table were derived using the approach referenced in EPRI Utility Requirements Document (URD), Reference 19.1-35. The URD uses local (i.e., actual equipment location) spectral acceleration capacities which are derived from generic equipment ruggedness spectra (GERS) and from generic estimates of capacity based on experience in past seismic probabilistic risk assessments (SPRAs). The fragility and corresponding HCLPF relative to ground motion PGA can vary considerably depending upon the foundation condition, structural stiffness, location of the equipment and details of the structural modeling and structural response analysis. As such, the location of the equipment relative to the ground motion input must be known.

To verify that the HCLPFs, based on generic capacities and generic structural amplifications, are reasonable and achievable for design certification of the US-APWR, the staff requests the applicant to provide equipment locations for the equipment included in the PRA based SMA listed in Table 19.1-51 for the equipment located in the R/B, PCCV, containment internal structure and the PS/B.

ANSWER:

Attached table and figures show the locations of each SSC in Table 19.1-51 of the DCD Revision 1. Equipment locations are described by flood zone numbers defined in the internal flood PRA (Chapter 22 of the PRA technical report MUAP-07030(R1). Please note that the pipes, ducts and cable trays are not involved in the attached figures because they are drawn around many areas.

Impact on DCD

No impact on DCD.

Impact on COLA

No impact on COLA.

Impact on PRA

No impact on PRA.

Security-Related Information – Withheld Under 10 CFR 2.390

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RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.178-1930 REVISION 1**

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

APPLICATION SECTION: **19.1.5.1**

DATE OF RAI ISSUE: **2/3/2009**

QUESTION NO. : 19-295

DCD FSAR Section 19.1.5.1, Table 19-1-51, lists the HCLPFs for the reactor coolant system (RCS). The table indicates that the HCLPFs for the reactor coolant system (RCS) components are generic and are not design specific. The RCS HCLPFs are derived from the EPRI Utility Requirements Document (Reference 19.1-35) and range from 0.62g to 0.67g. In the past, Large Break LOCA loading was combined with earthquake loading and governed the loads on component nozzles and RCS supports. Double ended guillotine break of the main coolant loop (MCL) piping and branch lines greater than 6 inches in diameter can now be eliminated by successfully performing a leak before break analysis. Due to the smaller size of the seismic induced LOCA, lower HCLPFs for RCS components and supports may result.

To address this concern, the staff requests the applicant to describe the methodology for developing the HCLPFs for the RCS components and supports and to describe how LOCA size was taken into consideration.

ANSWER:

LOCA size of US-APWR is considered as bellow.

MHI identified the postulate pipe rapture and provided the results of dynamic analysis in Technical Report MUAP-09005-P Rev.0 'Summary of Seismic and Accident Load Combinations for Primary Components and Piping'. MUAP-09005-P Rev.0 Section 4.1(page 4-1) provides the cases of postulated pipe rapture as follows. MHI applied LBB criteria for Main Coolant Pipe and Main Steam Line. The detail information of LBB evaluation will be provided the Technical Report of stress analysis of main steam line and class 1 piping.

As a results of LBB evaluation, the postulated pipe break events are selected for the reactor coolant system (RCS) loop components and detail geometry of break piping are as follows,

1) Hot Leg Branch Line break at the 10 inch Schedule 160 Residual Heat Removal (RHR)/ Safety Injection (SI) line nozzle

   Nominal pipe diameter: NPS10 inches, Flow area: 56.75 square inches

2) Cold Leg Branch Line break at the 14 inch Schedule 160 accumulator line nozzle

   Nominal pipe diameter: NPS14 inches, Flow area: 98.31 square inches

3) Feedwater Line break at the SG FW nozzle

   Nominal pipe diameter: NPS16 inches, Flow area: 160.88 square inches

4) Main Steam Line break at the SG MS nozzle

   Nominal pipe diameter: NPS32 inches, Flow area: 660.88 square inches

Stress analysis is conducted combining loading by above described LOCA with SSE loading.

The specific fragilities of the RCS will be calculated using the methodology described in EPRI TR103959 and the results of stress analysis of RCS.

Impact on DCD

No impact on DCD.

Impact on COLA

No impact on COLA.

Impact on PRA

No impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

4/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.178-1930 REVISION 1**

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

APPLICATION SECTION: **19.1.5.1**

DATE OF RAI ISSUE: **2/3/2009**

QUESTION NO. : 19-296

DCD Section 19.1.5.1, Table 19-1-51, lists the HCLPFs for the fuel assembly (reactor internals and core assembly). The HCLPF for the fuel assembly was assumed to be 0.5g (PGA) with no basis provided.

Given the safety significance of the fuel assembly, the staff requests the applicant to substantiate the HCLPF value of 0.5g.

ANSWER:

Assumption about the HCLPF value of fuel assembly (reactor internals and core internals) is described in the subsection 24.3.2.1 of the PRA technical report MUAP-07030(R1) as follows.

- Reactor internal and core assembly, chiller (safety related), gas turbine generator and support systems, containment hatch and containment penetrations
  Design information for these components is not available at this time and fragility calculations cannot be conducted. Additionally, the generic fragility data is not available or not appropriate for these components. However, these components are Seismic Category I and they will be designed for SSE of 0.3g PGA with sufficient conservatism. Therefore these components can be expected to have at least the HCLPF capacity of 0.5g PGA.

The specific fragilities of the fuel assembly will be calculated using the methodology described in EPRI TR103959 and the results of stress analysis of fuel assembly.

The assumptions on the HCLPF of the fuel assemblies will be involved in the Table 19.1-115 of DCD next revision as described in the responses to the RAI 19-207.

Impact on DCD

The assumptions will be involved in the Table 19.1-115 of DCD next revision in response to the RAI 19-207.

Impact on COLA

No impact on COLA.

Impact on PRA

No impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

4/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.178-1930 REVISION 1**

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

APPLICATION SECTION: **19.1.5.1**

DATE OF RAI ISSUE: **2/3/2009**

QUESTION NO. : 19-297

DCD FSAR Section 3.10.2.1, "Seismic Qualification of Instrumentation and Electrical Equipment", describes meeting the minimum requirements of IEEE 344 (Reference 3.10-6) for seismic qualification by testing or by type testing. However, IEEE 344 does not explicitly address how equipment testing will address the requirements set forth in SECY-93-087 (i.e., HCLPF target of 1.67 times the SSE).

To address this concern, the staff requests the applicant to demonstrate how seismic qualification by testing or by type testing will satisfy the SECY-093-087 requirement of 1.67 times SSE.

ANSWER:

This question will be related to the RAI 19-290.

As noted in the page 19.1-65 of the DCD Revision 1, the assumption "j. Relay chatters does not occur or does not affect safety functions during and after seismic event " is one of the key assumption. This assumption will be added in the DCD section 19.1.7.1, Table 19.1-115. The descriptions in the subsection 24.3.2.1of the PRA technical report MUAP-07030(R1) are the general requirements for the relays to prevent the functional failures due to seismic.

The specific design requirements for the instrumentations and electrical equipments will include that maintain the functions against the design seismic to satisfy the SECY-093-087 requirement.

The SSC fragilities will be confirmed by the fragility analysis using the methodology described in EPRI TR103959 and the plant specific design features in response to RAI 19-290. Also the assumptions will be added in the DCD section 19.1.7.1, Table 19.1-115 from the responses to the RAI 19-207.

Impact on DCD

The assumptions will be involved in the Table 19.1-115 of DCD next revision in response to the RAI 19-207.

Impact on COLA

No impact on COLA.

Impact on PRA

No impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

4/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.178-1930 REVISION 1**

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

APPLICATION SECTION: **19.1.5.1**

DATE OF RAI ISSUE: **2/3/2009**

QUESTION NO. : 19-298

In DCD FSAR Section 19.1.5.1.2, which discusses SMA insights (insight 5), the applicant states that the HCLPFs for electrical equipment and sensors/transmitters to trip the reactor are above 0.67g to justify not including the analysis of the failure of the reactor trip system when power is available during a seismic event. Table 19.1-51 lists the HCLPF for the equipment use in the SMA analysis along with the basis. Sensors and transmitters are not listed in this table, therefore no basis is provided for the value used in this section.

To address this concern, the staff requests the applicant to provide basis for the assumption that the HCLPFs for electrical equipment and sensors/transmitters to trip the reactor are above 0.67g.

ANSWER:

The HCLPF value 0.67g for the reactor trip stands for the control rod drive as described in the Table 19.1-51 sheet 1 of 4. Other equipments for reactor trip such as electrical panels (HCLPF is 1.13g, Table 19.1-51 sheet 3 of 4) are more robust. For the Instruments such as sensors or transmitters are assumed seismically very rugged.

Assumptions about the HCLPF value of sensors/transmitters is described in the subsection 24.3.2.1 of the PRA technical report MUAP-07030(R1) as follows.

- Instrumentation
  Instruments such as sensors or transmitters are seismically very rugged. Based on the past PRA results in Japanese PWR plants, instruments have high HCLPF capacities and they do not contribute to the core damage frequency.
  Instruments for the US-APWR are also judged to have the same ruggedness. Therefore the instruments are screened out from this evaluation.

The specific fragilities of electrical equipment and sensors/transmitters will be calculated using the methodology described in EPRI TR103959 and the results of stress analysis of fuel assembly.

The assumptions on the HCLPF of electrical equipment and sensors/transmitters will be involved in the Table 19.1-115 of DCD next revision as described in the responses to the RAI 19-207.

Impact on DCD

The assumptions will be involved in the Table 19.1-115 of DCD next revision in response to the RAI 19-207.

Impact on COLA

No impact on COLA.

Impact on PRA

No impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

4/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.178-1930 REVISION 1**

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

APPLICATION SECTION: **19.1.5.1**

DATE OF RAI ISSUE: **2/3/2009**

QUESTION NO. : 19-299

DCD FSAR Section 19.3.3 lists the resolution of COL Action Items relating to Chapter 19. COL Action Item 19.3(5) states that when the design activity progresses and specific design data become available, SSC fragilities are updated during the COLA phase to reflect design data. However, the COL Action Item does not define the point in the COLA phase the item will be addressed and does not provide any guidance to the COL applicant/holder on the methodology to be used for updating SSC fragilities.

To address this concern, the staff request the applicant to define when in the COLA phase COL Action Item 19.3(5) will be addressed and provide guidance or details on how the SSC fragilities will be updated.

ANSWER:

This question will be related to the RAI 19-290.

The updating SSC fragilities will be confirmed by the fragility analysis using the plant specific design features in response to RAI 19-290. Also the assumptions will be added in the DCD section 19.1.7.1, Table 19.1-115 from the responses to the RAI 19-207.

Impact on DCD

The assumptions will be involved in the Table 19.1-115 of DCD next revision in response to the RAI 19-207.

Impact on COLA

No impact on COLA.

Impact on PRA

No impact on PRA.