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August 12, 2011

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-11261

Subject: **MHI's Amended Responses to US-APWR DCD RAI for Chapter 7**

References: 1) "REQUEST FOR ADDITIONAL INFORMATION 733-5650 REVISION 5, SRP Section: 07.01 – Instrumentation and Controls – Introduction, Application Section: Section 07-14 Branch Technical Position – Guidance on Software Reviews for Digital Computer-Based Instrumentation and Controls Systems" dated March 22, 2011.

2) "REQUEST FOR ADDITIONAL INFORMATION 677-5325 REVISION 2, SRP Section: 07.08 – Diverse Instrumentation and Control Systems, Application Section: Technical Report MUAP-07014" dated January 10, 2011.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") amended responses to RAIs contained within Reference 1 and 2. Staffs requested these RAIs to be amended on the public meeting held on July 20th and the conference call held on July 14th.

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.

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NRO

Enclosure:

1. Amended Response to Request for Additional Information for Chapter 7

CC: J. A. Ciocco
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Enclosure 1

Docket No. 52-021
UAP-HF-11261

Amended Response to Request for Additional Information
for Chapter 7

August 2011

This Enclosure includes following response of RAIs

RAI No. 733-5650 Revision 5, Question No.: 07.01-35

RAI No. 677-5325 Revision 2, Question No.: 07.08-11

RAI No. 677-5325 Revision 2, Question No.: 07.08-12

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

08/12/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.733-5650 REVISION 5**
SRP SECTION:	**07.01 – INSTRUMENTATION AND CONTROLS - INTRODUCTION**
APPLICATION SECTION:	**07-14 BRANCH TECHNICAL POSITION - GUIDANCE ON SOFTWARE REVIEWS FOR DIGITAL COMPUTER-BASED INSTRUMENTATION AND CONTROLS SYSTEMS**
DATE OF RAI ISSUE:	**03/22/2011**

QUESTION NO. : 07.01-35

10 CFR 50, Appendix B, Criterion VII addresses control of purchased material, equipment, and services. Criterion VI, also of Appendix B, "Document Control," requires in part that "Measures shall be established to control the issuance of documents . . . which prescribe all activities affecting quality. " Branch Technical Position (BTP) 7-14 of the Standard Review Plan outlines such procedures for the application software. In particular, B.3.1.1.1, Management Characteristics of the Software Management Plan states that the methods by which subcontractors and suppliers will be managed should be described.

The Application Software Program Manual, MUAP-07017, Rev. 3, is inconsistent and does not properly address subcontractor control. Section 3.11.3.6, p.3.11-10, Subcontractor / Vendor Control, states "There are no products or configuration items to be acquired from subcontractors or vendor for the PSMS application software." This is in conflict with Section 3.9.7.12, p.3.9-9, which states "The subcontractor management plan is to comply with Section 3.1.5-11 of NUREG/CR-6101 and Section 4.3.12 of IEEE Std 1228-1994."

The staff requests MHI address the above inconsistency. MHI should include all software received from subcontractors including MELCO. In the case of the MELTAC Basic Software, MELCO is an approved subcontractor of the MHI US-APWR design. The MELTAC Basic Software should be under MHI's configuration control as a safety-related item. MHI should identify this in the Application SPM.

In Section 3.9.7.12, Subcontractor Management, the plan commits to comply with NUREG/CR 6101 and IEEE 1228 with regards to the Basic Software. The method of monitoring and evaluating the subcontractor's software safety plan has yet to be

identified, as stipulated by these references, in the SPM. MHI should identify this in the Application SPM.

ANSWER:

MHI agrees with the staff's requests. MHI will add MELCO to the approved suppliers list in DCD Section 1.4 and add the statement to US-APWR Software Program Manual, MUAP-07017 Rev. 5, that MELCO is the approved supplier of the safety-related digital instrumentation and control (I&C) platform of the MHI US-APWR design.

The fourth paragraph of Section 1.2 of the US-APWR Software Program Manual, MUAP-07017 Rev. 5, will be revised as follows:

The PSMS consists of the application software (project specific) and MELTAC platform. The MELTAC platform includes hardware and basic software for the digital I&C system, and is common to all US-APWR projects. The MELTAC Platform is supplied by MELCO, an approved supplier of the safety-related digital I&C platform of the MHI US-APWR design as described in DCD Section 1.4. ~~However, t~~The MELTAC platform, including the life cycle process for the basic software, is described in MUAP-07005 (Reference 2) and ~~is addressed in this SPM to ensure that the as-built~~ the basic software is developed and controlled by the MELTAC Platform Basic Software Program Manual (Reference 24). The basic software shall be specified, procured and received in accordance with the MHI quality management system and controlled under MHI's configuration control as a safety-related item. The scope of application and basic software is described in Figure 1.2-1. The method of controlling the basic software is described in Sections 3.9.7.12 and 3.11.3.6.

The following description will be added below the first paragraph of Section 2.2.1 of MUAP-07017 Rev. 5.

As described in Section 1.2, the MELTAC Platform including basic software is supplied by MELCO. However, MHI is responsible for specifying the system requirements to develop all PSMS software and confirming that all as-built PSMS software, including basic software supplied by MELCO, meets these requirements. Mitsubishi Nuclear Energy Systems (MNES) shall provide the procurement specification to MHI and MELCO which address the subcontractor control specified in this SPM.

The US-APWR Software Program Manual, MUAP-07017 Rev.4, Sections 3.9.7.12 and 3.11.3.6 was revised as follows:

3.9.7.12 Subcontractor Management
The subcontractor management plan is to comply with Section 3.1.5-11 of NUREG/CR-6101 and Section 4.3.12 of IEEE Std. 1228-1994.

The DT shall ensure that the basic software is maintained in accordance with the

"MELTAC Platform Basic Software Program Manual" (JEXU-1012-1132). The DT shall determine if the output of the basic software SSP adversely impacts on the SSA activities described in this SPM.

The DT shall initiate the corrective actions as needed. If the corrective action requires a change to the basic software SSP or the basic software itself, the DT shall notify MELCO.

The results of the above monitor and evaluation shall be documented by the DT and shall be independently verified by the VVT.

3.11.3.6 Subcontractor / Vendor Control

~~There are no products or configuration items to be acquired from subcontractors or vendor for the PSMS application software.~~ Subcontractor/vendor control is to comply with Section 2.3.6 of IEEE Std. 828-1990.

The basic software shall be controlled to ensure that it is maintained in accordance with the "MELTAC Platform Basic Software Manual" (JEXU-1012-1132) (Reference 24) and the correct version of the basic software is used in the PSMS application software lifecycle.

Impact on DCD

Subsection 1.4.2.4 will be added as follows (See Attachment-1):

1.4.2.4 Mitsubishi Electric Corporation

Mitsubishi Electric Corporation is participant as an approved supplier of the digital instrumentation and control (I&C) platform (MELTAC and HSI system) applied for US-APWR. Mitsubishi Electrical Corporation performs planning, design and analysis of the digital I&C platform (MELTAC and HSI system).

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.

facilities, and related software development. For the US-APWR, it mainly conducts analyses and design activities regarding the reactor and the primary system.

1.4.2.3 Washington Division of URS Corporation

Washington Division of URS Corporation has entered into a contract with MHI to provide consulting assistance in the preparation of the DCD for US-APWR. It has decades of experience in the reactor projects including being the engineer/constructor of 49 nuclear power plants around the world.

1.4.2.4 Mitsubishi Electric Corporation

DCD_07.01-35

Mitsubishi Electric Corporation is participant as an approved supplier of the digital instrumentation and control (I&C) platform (MELTAC and HSI system) applied for US-APWR. Mitsubishi Electrical Corporation performs planning, design and analysis of the digital I&C platform (MELTAC and HSI system).

1.4.3 Combined License Information

COL 1.4(1) *The COL Applicant is to identify major agents, contractors, and participants for the COL application development, construction, and operation.*

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

8/12/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.677-5325 REVISION 2**
SRP SECTION:	**07.08 – DIVERSE INSTRUMENTATION AND CONTROL SYSTEMS**
APPLICATION SECTION:	**TECHNICAL REPORT MUAP-07014**
DATE OF RAI ISSUE:	**1/10/2011**

QUESTION NO. : 07-08-11

Regulatory Guidance: DI&C-ISG-05, Part 3, Section 1.B, last bullet states that, "The analysis of the action sequence identifies credible operator errors and the estimate of time required includes sufficient margin for recovery from any single credible operator error."

Question: MUAP-07014-P(R2), Section 5 outlines the analyses supporting credited manual operator actions. These sections generally state that the time margin for the manual action is sufficient to accommodate operator errors. Credible operator errors are not specifically identified. The time margin is also not addressed.

Identify credible operator errors for the credited manual actions evaluated in MUAP-07014. Identify appropriate time margins for the events or explain why the margin is unnecessary.

ANSWER:

Following sentences will be added after the last sentence in Section 3.4 of MUAP-07014;

The credible operator errors for the credited manual actions are included in the analysis of the DAS manual action. (For the result of the analysis, see Reference 10) The credited operator errors when using DAS are identified in the PRA/HRA process.

All of human actions considered in the PRA/HRA are identified at the beginning of the PRA/HRA and are used as input of PRA/HRA. Then, credited operator errors are identified in the human actions.

Since dependency between operator actions considered in PRA and I&C system such as PCMS/DAS has a large impact on the PRA results, the dependency is adequately estimated. (For results, see Reference 10 Table 9.5-1)

The identification of risk important human actions needs risk importance measures such as FV importance or RAW, therefore the identification is performed after the credited operator errors are identified, i.e., the risk important human actions are one of the PRA results.

Risk important human actions are identified using risk important measures. In the US-APWR, threshold for the identification is either FV importance greater than 5.0E-03 or RAW greater than 2.0. The identified human actions are summarized in DCD Ch. 19 Table 19.1-119, PRA Technical Report (Reference 10). If risk importance measures of human action modeled in the PRA is less than threshold, these actions are not identified as risk importance.

The DAS manual actions considered in the US-APWR PRA/HRA are as follows;

- Manually open safety depressurization valves for RCS depressurization
- Manually start safety injection pump
- Close containment isolation valves

The above actions are identified as credible operator errors, based on the definition. On the other hand, based on PRA results (i.e., FV importance or RAW), the first two actions are identified as risk important human action and summarized in DCD Ch. 19 Table 19.1-119 (sheet 23) and PRA Technical Report (Reference 10). US-APWR PRA/HRA assumes local action to close containment isolation valve as recovery of containment isolation failure by DAS due to the sufficient allowable time, and the third action does not exceed the threshold. Therefore, credited operator errors are different from risk important operator errors identified by the PRA results.

MUAP-07014-P (R2) provides both the time available and the time required for the events concurrent with CCF which require the performance of manual actions. Table 7.11 below summarizes the times from the topical report and lists the corresponding time margin available for correcting potential operator errors. Adequacy of the time margin will be validated in the integrated HSI validation tests. Credited operator actions must meet the timing requirements specified in the validation implementation plan. The training program will be developed to ensure the operators are well trained. The validation and operator training are encompassed by the existing HFE Inspection, Test, Analysis and Acceptance Criteria (ITAACs).

Table 7.11: Time Margin for Each Event Concurrent with CCF

Event	Time Available (minutes)	Time Required (minutes)	Time Margin (minutes)
Boron Dilution	61.2 (PCMS disabled) 73.0 (PCMS unaffected)	31.5	29.7 41.5
CVCS Malfunction	> 60	31.5	> 28.5
Failure of Small Lines with Primary Coolant	180	31.5	148.5
SG Tube Rupture	15	15	(Note 1)

Notes:

1 The time available from initiation of the SGTR event to the manual reactor trip from the DHP is 15 minutes, which is the same as the DCD safety analysis assumption. This is because the operator can perform a manual reactor trip based on equivalent indications and alarms on the DHP using an equivalent SGTR DHP procedure.

Impact on DCD

There is no impact on the DCD.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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RAI NO.:	**NO.677-5325 REVISION 2**
SRP SECTION:	**07.08 – DIVERSE INSTRUMENTATION AND CONTROL SYSTEMS**
APPLICATION SECTION:	**TECHNICAL REPORT MUAP-07014**
DATE OF RAI ISSUE:	**1/10/2011**

QUESTION NO. : 07-08-12

Regulatory Guidance: DI&C-ISG-05, Part 3, Section 2.A states that preliminary validation should provide independent confirmation of the validity of the "time required" estimate derived in the Phase 1 Analysis.

Question: MUAP-07014-P(R2), Section 3.4 indicates final integrated HSI tests will be conducted but does not describe any preliminary validation activity to confirm the "time required" estimate.

Identify and explain any preliminary validation activity or why such activity is unnecessary for operator manual action response times less than 30 minutes and for local control actions where a generic 30-minute response time was assumed.

ANSWER:

Following sentences will be added after the ninth paragraph in Section 3.4 of MUAP-07014, Revision 4;

> <u>The preliminary validation was conducted to confirm the "time required" estimate during the D3 analysis based on the sequence of operator actions as required by ISG-05. The tabletop analysis and walk-through/talk-through analysis has been conducted by experts including operation, system design, I&C/HFE design, safety analysis, and PRA experts. These personnel verified that the analysis is logical for its purpose, contains a sufficient level of detail, and presents no physical or spatial difficulty for performance.</u>

Impact on DCD
There is no impact on the DCD.

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.