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July 20, 2010

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-10212

Subject: MHI's Response to US-APWR DCD RAI No. 599-4756 Revision 2

Reference: 1) "Request for Additional Information No. 599-4756 Revision 2, SRP Section: 14.03.07 – Plant Systems - Inspections, Tests, Analyses, and Acceptance Criteria - Application Section: Tier 1 Section 2.7.1.1 dated June 15, 2010.

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. 599-4756 Revision 2."

Enclosed is the response to Questions 14.03.07-51 and 14.03.07-52 that are contained within Reference 1.

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.

Sincerely,

Y. Ogata

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

Enclosure:

1. Response to Request for Additional Information No. 599-4756 Revision 2

CC: J. A. Ciocco
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Docket No. 52-021
MHI Ref: UAP-HF-10212

Enclosure 1

UAP-HF-10212
Docket No. 52-021

Response to Request for Additional Information No. 599-4756
Revision 2

July 2010

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

07/20/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 599-4756 REVISION 2**
SRP SECTION:	**14.03.07- PLANT SYSTEMS – INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA**
APPLICATION SECTION:	**TIER 1 SECTION 2.7.1.1**
DATE OF RAI ISSUE:	**6/15/2010**

QUESTION NO.:14.03.07-51

Tier 1 Section 2.7.1.1 establishes inspections, tests, analyses, and acceptance criteria for the turbine-generator based on limiting the probability of missile generation to less than 1 x 10-5 per year. This value is specified by SRP Section 3.5.1.3 for turbines that are not favorably oriented. However, it is the staff's understanding that the turbine for USAPWR is favorably oriented, in which case the probability of missile generation should be limited to 1 x 10 -4 per year. Consequently, additional information is needed to explain this apparent inconsistency. Also, as indicated in the fifth bullet of next question of this RAI, the description and proposed ITAAC for this item should be revised to focus on turbine material and other considerations that are necessary to satisfy the Turbine Missile Probability Analysis.

ANSWER:

US-APWR maintains the conservatively lower probability of turbine missile generation of 1.0E-5 per year. This missile generation probability supports an unfavorably oriented layout by maintaining an acceptably low probability of missile damage (1.0E-7) to safety-related SSCs located within the missile strike zone, and is conservative for a COLA that includes a favorably oriented layout. MHI's amended response to RAI 323-2071 dated May 24, 2010 (UAP-HF-10143, ML101470208) reflects this approach to provide flexibility for turbine orientation with respect to site-specific safety-related SSCs.

ITAAC for turbine rotor material and other considerations are addressed below in the response to the fifth bullet item of Question No. 14.03.07-52.

Impact on DCD

There is no impact on the DCD

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

07/20/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 599-4756 REVISION 2**
SRP SECTION:	**14.03.07- PLANT SYSTEMS – INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA**
APPLICATION SECTION:	**14.3**
DATE OF RAI ISSUE:	**6/15/2010**

QUESTION NO.:14.03.07-52

The review procedures in SRP Section 14.3.7 provide guidance for determining the acceptability of proposed inspections, tests, analyses, and acceptance criteria (ITAAC). The SRP guidance specifies in part that all Tier 1 information is consistent with Tier 2 information and that plant systems are clearly described in Tier 1, including key performance characteristics (among other things). Tier 1 Section 2.7.1.1 establishes ITAAC for the turbine generator. However, the staff found the descriptive information and corresponding ITAAC in this section to be inadequate in this regard. In particular, additional information is needed to address the following items:

1. A functional arrangement drawing should be provided to show the relative locations of major components. The description of the functional arrangement that is provided is not sufficient to reflect important design attributes such as double valve isolation for satisfying single failure considerations, and placement of extraction non-return valves necessary to prevent turbine overspeed. The ITAAC as currently provided does not provide sufficient detail to establish unambiguous acceptance criteria for the functional arrangement.

2. An ITAAC is needed to confirm turbine orientation consistent with the description provided for key design features.

3. The description of alarms, displays, and controls should identify specific components such as in a table, and an ITAAC is needed to confirm that these components are included in the design.

4. While ITAAC are established for the electrical and mechanical turbine overspeed trip systems, an ITAAC is not specified for the manual (remote in the control room and locally at the turbine) turbine overspeed trip functions. Consequently, Tier 1 Section 2.7.1.1 should be revised to recognize that these manual turbine trip functions exist and corresponding ITAAC should be established accordingly.

5. The design commitment for Item 2.a is not consistent with the corresponding acceptance criteria, and the acceptance criteria are incomplete for this item. Consequently, the design commitment for this item should be changed to specify: "The as-built turbine material properties, turbine rotor and blade designs, pre-service inspection and testing results, and in-service testing and inspection requirements meet the requirements

defined in the Turbine Missile Probability Analysis." Consistent with this approach, the inspections, tests, and analyses for this item should be revised to state: "An inspection of the as-built turbine material properties, turbine rotor and blade designs, pre-service inspection and testing results, and in-service testing and inspection requirements will be conducted." Finally, for completeness, the acceptance criteria for this item should be revised to state: "The as-built turbine material properties, turbine rotor and blade designs, pre-service inspection and testing results and in-service inspection and testing requirements meet the requirements of the Turbine Missile Probability Analysis."

6. Item 2.b in Tier 1 Table 2.7.1.1-1 should be revised to clearly specify that both the mechanical and electrical turbine trip systems need to be tested, and the acceptance criteria should specify what actions need to occur upon a turbine trip (e.g., turbine stop, control, reheat stop, intercept, and extraction non-return valves go closed); and Item 2.c is not needed since it is addressed by Item 2.b.

7. The acceptance criteria for Item 3 in Tier 1 Table 2.7.1.1-1 should be revised to specify what actions need to occur upon a turbine trip (e.g., turbine stop, control, reheat stop, intercept, and extraction non-return valves go closed). Also, Tier 2 Section 10.2 does not describe how the turbine control system functions to trip the turbine upon a reactor trip. Therefore, Tier 2 Section 10.2 should be revised accordingly.

ANSWER:

1. The turbine generator (T/G) and associated systems and components described in DCD Tier 1 Subsection 2.7.1.1 are non safety-related and the Tier 1 level of detail is relatively simple. The use of a Design Description and functional arrangement ITAAC without a corresponding figure is therefore consistent with the NUREG-0800 Standard Review Plan (SRP) guidance in Section 14.3, Appendix A, Section IV.4.A. The Location and Functional Arrangement and Key Design Features in DCD Tier 1 Subsection 2.7.1.1.1 will be revised to describe manual and automatic turbine trips, and identify the valves which close in response to a turbine trip signal, including the extraction nonreturn valves.

2. As discussed in the amended response to RAI 323 (UAP-HF-10143, ML101470208), the turbine orientation is not a key design feature in terms of turbine missile generation. The standard design allows both favorable and unfavorable orientations for the turbine generator. Therefore no ITAAC are needed for verifying the turbine orientation.

3. T/G alarms and displays are not credited in the safety and transient analysis and are not displayed on the safety visual display unit (VDU), and are therefore not individually specified in DCD Tier 1 Subsection 2.7.1.1. DCD Tier 1 Subsection 2.5.5 addresses control systems not required for safety, and includes monitoring and control of T/G related functions including turbine electro-hydraulic governor control and the turbine supervisory instrumentation system. The "Alarms, Displays and Controls" section in Tier 1 deals primarily with the MCR (not automatic control functions) and therefore the description of instruments, controls and protective devices is being deleted from "Alarms, Displays and Controls." DCD Tier 1 Table 2.7.1.1-1 will be revised to include ITAAC for manual turbine trip controls. Initiation of turbine trip from a reactor trip is being moved from "Alarms, Displays and Controls" (which deals primarily with MCR controls) to "Logic," which pertains to automatic control functions.

4. DCD Tier 1 Subsection 2.7.1.1.1 will be revised to describe the mechanical overspeed device with local manual trip capability, the electrical overspeed system, turbine trip from

reactor trip, and the manual turbine trip from the MCR. These features are addressed by ITAAC as described below in response to item #6.

5. In order to minimize references to external documents, DCD Tier 1 does not specifically refer to "requirements of the Turbine Missile Probability Analysis." ITAAC item 2 in DCD Tier 1 Table 2.7.1.1-1 will be revised to more clearly address the attributes that support a turbine missile generation probability of less than 1.0E-5 per year.

6. ITAAC Table 2.7.1.1-1 will be revised to include separate and specific ITAAC items for mechanical overspeed protection local manual trip, electrical overspeed protection, and manual turbine trip from the MCR. Further, the ITAAC will specifically identify the valves required to close in response to a turbine trip and specify their closure times in the acceptance criteria.

7. DCD Section 10.2.4 states that "The control system initiates a turbine trip upon reactor trip." Further description of the turbine trip upon reactor trip is provided in DCD Chapter 7, Subsection 7.3.1.11. ITAAC items #4 and #5 in revised Table 2.7.1.1-1 test required valve closures in response to a turbine trip. ITAAC #6 tests the initiation of turbine trip in response to reactor trip. Additionally, DCD Section 10.2.2.3.2.6 will be revised to include the turbine trip initiated by reactor trip.

Impact on DCD

The following paragraph will be added to DCD Section 2.7.1.1.1 under "Location and Functional Arrangement":

The MTSVs and MTCVs are arranged in series at the high-pressure turbine inlet, and control the flow of the main steam entering the high-pressure turbine. The RSVs and IVs are also arranged in series in the cross-over pipes at the inlet to the low-pressure turbines, and control steam-flow to the low-pressure turbines. Extraction nonreturn valves serve as steam extraction points for feedwater heating.

The following paragraph will be added to DCD Section 2.7.1.1.1 under "Key Design Features":

The electrical overspeed protection system trips the main turbine in response to an electrical overspeed signal. The main turbine is also equipped with a mechanical overspeed device which can be used to locally initiate a manual turbine trip initiates closure of the following valves:

- Main Turbine Stop Valves (MTSVs)
- Main Turbine Control Valves (MTCVs)
- Intercept Valves (IVs)
- Reheat Stop Valves (RSVs)
- Extraction Nonreturn Valves

DCD Section 2.7.1.1.1 – "Alarms, Displays, and Controls" will be reworded as follows:

~~Instruments, controls, and protective devices are provided to confirm reliable operation. Redundant, fast actuating controls are installed to prevent damage to the T/G resulting from overspeed and/or full load rejection.~~ Manual turbine trip can be initiated from the MCR. ~~The control system initiates turbine trip upon reactor trip.~~

DCD Section 2.7.1.1.1 – "Logic" will be reworded as follows:

There is no logic needed for direct safety functions related to the T/G. A turbine trip signal is initiated in response to a reactor trip.

DCD Section 10.2.2.3.2.6 "Remote Trip" will be reworded as follows:

The emergency trip system can also trip the turbine in response to a signal from the plant control system or plant safety and monitoring system. Turbine trip is initiated when the reactor trips as indicated by the P-4 interlock. The turbine trip upon reactor trip is described in Subsection 7.3.1.11 and Figure 7.3-4.

Tier 1 Table 2.7.1.1-1 will be revised as follows:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The functional arrangement of the as-built main turbine is as described in Subsection 2.7.1.1.1.	1. An inspection of the as-built system will be performed.	1. The as-built main turbine conforms to the functional arrangement as described in Subsection 2.7.1.1.1.
2.~~a The probability of turbine missile generation is less than 1.0E-5 per year.~~ The as-built main turbine rotor material properties, turbine rotor and blade designs, pre-service inspection and testing results, and in-service testing and inspection requirements meet the requirements defined in the Turbine Missile Generation Probability Analysis.	2.~~a Inspections and tests of the as-built LPT rotors will be performed.~~ An inspection of the as-built main turbine rotor material properties, turbine rotor and blade designs, pre-service inspection and testing results, and in-service testing and inspection requirements will be conducted.	2.a The as-built ~~LPT rotor material conforms to the specified requirements as described in Subsection 2.7.1.1.1~~main turbine rotor material properties, turbine rotor and blade designs, pre-service inspection and testing results, and in-service testing and inspection requirements meet the requirements of the Turbine Missile Generation Probability Analysis.
~~2.b~~ 3.a. The main turbine is equipped with a mechanical overspeed device which can be used to locally initiate a manual turbine trip. ~~The turbine generator trips in response to actual or simulated signal from mechanical or electrical overspeed trip system.~~	~~2.b~~ 3.a Testing will be performed on ~~the main turbine using mechanical or electrical overspeed trip system~~ the as-built main turbine mechanical overspeed device.	~~2.b~~ 3.a The main turbine trips after receiving a mechanical overspeed trip signal.
3.b. The electrical overspeed protection system trips the turbine generator in response to an electrical overspeed signal.	3.b Testing will be performed on the as-built main turbine electrical overspeed system.	3.b . The electrical overspeed protection system trips the as-built main turbine in response to an electrical overspeed signal
3.c. Controls exist in the MCR to trip the turbine generator.	3.c Testing will be performed on the as-built turbine generator.	3.c. Controls exist in the MCR to trip the as-built turbine generator.
~~2.c~~ 4. The MTSVs, MTCVs, RSVs and IVs close in response to a turbine trip signal. ~~move smoothly to a fully closed position in the event of emergency.~~	~~2.c~~ 4. ~~Valve testing~~ Testing will be performed on the as-built MTSVs, MTCVs, RSVs and IVs using an actual or simulated turbine trip signal ~~during the main turbine operation~~.	~~2.c~~ 4. Each MTSV, MTCV, RSV and IV closes within 0.3 seconds of receiving a turbine trip signal. ~~valve moves smoothly to a fully closed position.~~
5. The extraction nonreturn valves close in response to a turbine trip signal.	5. Testing will be performed on the as-built extraction nonreturn valves using an actual or simulated turbine trip signal.	5. Each extraction nonreturn valve closes.
~~3~~ 6. ~~The~~ A turbine generator trip~~s~~ is initiated in response to ~~on~~ a reactor trip.	~~3~~ 6. A test of the as-built system will be performed using a simulated test signal.	~~3~~ 6. The as-built control logic provides a ~~simulated~~ turbine generator trip in response to ~~on~~ a simulated reactor trip signal.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.