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June 7, 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-12151

Subject: **MHI's Response to US-APWR DCD RAI No.926-6448 Revision 3 (SRP 14.03.07)**

References: 1) "Request for Additional Information No. 926-6448 Revision 3, SRP Section: 14.03.07 – Control Room Habitability System Application Section: Tier 1" dated May 8, 2012 (ML12135A689).
2) MHI Letter No. UAP-HF-11021 "MHI's Responses to US-APWR DCD RAI 675-5231 Revision 2 (SRP 14.03.07)," dated January 31, 2011 (ML110340019).

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. 926-6448 Revision 3 (SRP 14.03.07)".

Enclosed is the response to 1 RAI question contained within Reference 1, which is a follow-up question to MHI's previous response to Question 14.03.07-54 contained in Reference 2.

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,

Y. Ogata

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

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NRO

Enclosure:

1. Response to Request for Additional Information No. 926-6448 Revision 3 (SRP 14.03.07)

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Enclosure 1

UAP-HF-12151
Docket No.52-021

Response to Request for Additional Information No. 926-6448
Revision 3 (SRP 14.03.07)

June 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/7/2012

US-APWR Design Certification

Mitsubishi Heavy Industries, Ltd.

Docket No. 52-021

RAI NO.:	**NO. 926-6448 REVISION 3**
SRP SECTION:	**14.03.07 - Plant Systems - Inspections, Tests, Analyses, and Acceptance Criteria**
APPLICATION SECTION:	**Tier 1**
DATE OF RAI ISSUE:	**5/8/2012**

QUESTION NO.: 14.03.07-59

This is a follow-up RAI to RAI 675-5231, Question 14.03.07-54.
The applicant responded to 14.03.07-54:
"The specially designed protective gratings, which protect the Main Control Room (MCR) Heating, Ventilation and Air Conditioning (HVAC) system outside air intakes, are structural elements that are fixed to the reinforced concrete exterior wall of the safety-related Reactor Building (R/B) structure. As such, these protective gratings are considered a part of the structure and meet the design-basis loading requirements consistent with the design of the R/B exterior walls. Confirmation that the R/B structure, including the exterior wall mounted protective gratings, are designed and constructed to withstand design basis loads is ensured by Tier 1 DCD Table 2.2-4 "Structural and Systems Engineering Inspections, Tests, Analyses, and Acceptance Criteria," Item 6." The staff notes that the "Acceptance Criteria" of Tier 1 DCD Table 2.2-4 "Structural and Systems Engineering Inspections, Tests, Analyses, and Acceptance Criteria," Item 6." reads "Reports exist and conclude that the as-built seismic Category I buildings identified in Table 2.2-1, other than the PCCV, can with stand design-basis loads." Tier 1 Section 2.2.1 reads in part:
"Seismic Category I structures are designed and constructed to withstand design-basis loads without loss of structural integrity. Design basis loads are:

- Normal plant operation (including dead loads, live loads, lateral earth pressure loads, equipment loads, hydrodynamic loads, temperature, and equipment vibration)
- External events (including rain, snow, flood, tornado, tornado generated missiles, and earthquake)
- Internal events (including flood, pipe rupture, equipment failure, and equipment failure generated missiles)."

Having noted the above, the staff notes that numerous sections of NUREG-0800 points to the safety significance of the MCR air intake gratings in protecting safety related SSCs from externally tornado generated missiles. "Technical Rationale" "1." of SRP 3.5.2 reads in part "*GDC 2 establishes requirements for the capability of important safety-related SSCs to withstand natural phenomena without the loss of their safety functions. This criterion applies directly to the assessment of SSCs as to external missiles generated by natural phenomena.*" "2." reads in part "*RG 1.117 describes a method acceptable to the NRC staff for determining which SSC should be protected from external missiles generated by tornados. The selection of SSCs to be protected is made to keep offsite exposures from exceeding an*

appropriate fraction of 10 CFR Part 100 offsite dose guidelines." The "Appendix" to Regulatory Guide 1.117 entitled "Structures, Systems, And Components Of Light-Water-Cooled Reactors To Be Protected Against Tornadoes" reads "7." "*The control room, including all equipment needed to maintain the control room within safe habitability limits for personnel and safe environmental limits for tornado-protected equipment.*" NUREG-800 SRP 6.4 "Review Procedures" Section III.3.E.iv reads in part "Because damage to the ducting might seriously affect the system capability to protect the operators, the ducting should be seismic Category I and should be protected against tornado missiles." NUREG-800 SRP 9.4.1 "Review Procedures" Section III.3.B reads in part "*The essential portions of the CRAVS are protected from the effects of floods, hurricanes, tornadoes, and internally and externally generated missiles.*" "SRP Acceptance Criteria" #6 of NUREG-800 SRP 14.3.7 reads in part "*Tornado and missile protection may be provided by inlet and outlet dampers in ventilation systems, and through the structural design of buildings.*"
The staff again notes that the current ITAAC Table 2.2-4 already contains Item 21 which ensures that the as-built safety SSC's are protected from credible internal missiles. Similarly, ITAAC Table 2.7.5.1-3 Item 5.f demonstrates the operational integrity of the as-built tornado dampers. These tornado dampers are located immediately next and inline downstream of the safety related Seismic I fresh air intake gratings.
The requirements and guidance of GDC 2, RG 1.117 and numerous SRP sections, clearly establish the basis for the safety significance of the MCR fresh air intake gratings. While Item 6 of Tier 1 Table 2.2-4 implicitly implies that these gratings be installed and inspected to withstand tornado based wind loading, the staff believes that the requirements and guidance of the above regulatory documents requires an elevated emphasis in an ITAAC Table that demonstrates the integrity of the as-built air intake gratings. The staff requests that the applicant provide ITAAC "Design Commitment", "Inspection, Tests, Analyses" and "Acceptance Criteria" specific to these gratings and provide justification why the proposed ITAAC is consistent with all requirements and guidance including what is discussed above.

ANSWER:

The MCR HVAC system's outside air intakes and exhaust outlets are protected from tornado missiles by concrete protective barriers that are built into the outer wall of the R/B structure. These protective barriers hold a "protective grating" but the grating does not actually perform a missile protection function. MHI will revise DCD Tier 1, Table 2.2-4 to include a new ITAAC to verify that as-built protective barriers exterior to the MCR HVAC system's outside air intakes and exhaust outlets are adequate to protect these openings from tornado generated missiles. Tier 1 Section 2.2.3 will be revised to add design description text regarding these barriers. Additionally, DCD Tier 2 Section 9.4.1.3 will be revised to clarify the description of these barriers.

During the development of this response, MHI also noted that similar clarifications were needed for DCD Section 9.4.5.3.2, Class 1E Electrical Room HVAC System, and Section 9.4.5.3.4, Emergency Feedwater Pump Area HVAC System. As a result, MHI will add new ITAAC in Tier 1 Table 2.2-4 for these barriers and new design descriptions in Section 2.2.3, similar to the changes for the MCR HVAC. Tier 2 Sections 9.4.5.3.2 and 9.4.5.3.4 will be revised to clarify the description of these barriers.

Tier 1 and 2 figures that display the outer wall of the R/B structure where these barriers exist will be updated to show these barriers. These figure changes will be implemented in conjunction with changes to these figures for the seismic-related layout changes as described in Attachment 3 of "Final Closure Plan for US-APWR Seismic and Structural Analyses", UAP-HF-12082, dated March 31, 2012 (Accession No.: ML12094A342).

This response supersedes the response to RAI 675-5231, Revision 2, Question 14.03.07-54, UAP-HF-11021, dated January 31, 2011 (Accession No.: ML110340019).

Impact on DCD

See Attachment 1 for changes to DCD Revision 3 Tier 1, Table 2.2-4 and Section 2.2.3, and Tier 2 Sections 9.4.1.3, 9.4.5.3.2 and 9.4.5.3.4. Tier 1 Figures 2.2-6 and 2.2-20, and Tier 2 Figures 1.2-8, 1.2-20, 3.8.1-9, 3K-7, 6.5-8, 9A-7,11.5-2g, 12.3-1 through 12.3-6 and 12.3-11 will be updated and submitted in conjunction with the submittal of changes to these figures for the seismic-related layout changes in accordance with Attachment 3 of "Final Closure Plan for US-APWR Seismic and Structural Analyses", UAP-HF-12082, dated March 31, 2012 (Accession No.: ML12094A342).

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.

This completes the response to NRC's question.

14. Penetrations in the external walls of the R/B and each PS/B, as shown in Figures 2.2-14 through 2.2-25, that are at or below design basis flood level, are fitted with water-tight seals to protect against external flooding.

15. Deleted.

16. Deleted.

17. Redundant safe shutdown components and associated electrical divisions outside the containment and the control room complex are separated by 3-hour rated fire barriers to preserve the capability to safely shutdown the plant following a fire.

18.a. Penetrations and openings, other than ventilation ducts, through fire barriers are protected against fire.

18.b. Ventilation ducts that penetrate fire barriers are protected by fire dampers.

19. Deleted.

20. Deleted.

21. Safety-related SSCs are protected from any credible internal missile sources inside and outside the containment.

22. Deleted.

23.a. The seismic Category II structures identified in Table 2.2-1 will not impair the ability of ~~safety-related~~seismic Category I SSC~~s~~ to perform ~~their safety-related~~ its design basis safety function~~s~~ during or following an SSE. DCD_09.02.02-48

23.b. Seismic Category II systems and components will not impair the ability of seismic Category I SSC to perform its design basis safety function during or following an SSE.

24. SSCs that require evaluation in the seismic fragilities task of a seismic margin analysis have high confidence of low probability of failure (HCLPF) values equal to or greater than the review level earthquake.

25. MCR HVAC system's outside air intakes and exhaust outlets are protected from tornado generated missiles by protective barriers. DCD_14.03.07-59

26. Class 1E electrical room HVAC system's outside air intakes and exhaust outlets are protected from tornado generated missiles by protective barriers.

27. Emergency feedwater pump area HVAC system's outside air intakes and exhaust outlets are protected from tornado generated missiles by protective barriers.

2.2.4 Inspection, Tests, Analyses, and Acceptance Criteria

Table 2.2-4 describes the ITAAC for structural and systems engineering.

Table 2.2-4 Structural and Systems Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 5 of 5)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria	
25. MCR HVAC system's outside air intakes and exhaust outlets are protected from tornado generated missiles by protective barriers.	25. Inspection will be performed of the as-built protective barriers exterior to the MCR HVAC system's outside air intakes and exhaust outlets.	25. The as-built protective barriers exterior to the MCR HVAC system's outside air intakes and exhaust outlets are part of the R/B structure outer wall and have the following dimensions: 1) Thicknesses of greater than or equal to 20 inches for the vertical sections and greater than or equal to 14 inches for the horizontal section. 2) Width and height greater than the corresponding dimension of the respective ventilation opening.	DCD_14.03.07-59
26. Class 1E electrical room HVAC system's outside air intakes and exhaust outlets are protected from tornado generated missiles by protective barriers.	26. Inspection will be performed of the as-built protective barriers exterior to the Class 1E electrical room HVAC system's outside air intakes and exhaust outlets.	26. The as-built protective barriers exterior to the Class 1E electrical room HVAC system's outside air intakes and exhaust outlets are part of the R/B structure outer wall and have the following dimensions: 1) Thicknesses of greater than or equal to 20 inches for the vertical sections and greater than or equal to 14 inches for the horizontal section. 2) Width and height greater than the corresponding dimension of the respective ventilation opening.	DCD_14.03.07-59
27. Emergency feedwater pump area HVAC system's outside air intakes and exhaust outlets are protected from tornado generated missiles by protective barriers.	27. Inspection will be performed of the as-built protective barriers exterior to the emergency feedwater pump area HVAC system's outside air intakes and exhaust outlets.	27. The as-built protective barriers exterior to the emergency feedwater pump area HVAC system's outside air intakes and exhaust outlets are part of the R/B structure outer wall and have the following dimensions: 1) Thicknesses of greater than or equal to 20 inches for the vertical sections and greater than or equal to 14 inches for the horizontal section. 2) Width and height greater than the corresponding dimension of the respective ventilation opening.	DCD_14.03.07-59

Redundant equipment and components are powered by separate Class 1E buses. The air handling units are served by the essential chilled water system. As shown in Table 9.4.1-2, failure of a single active component in one air handling unit cannot result in complete loss of heating or cooling of the CRE.

The MCR HVAC system is capable of maintaining the CRE air temperature within the specified limits (Table 9.4-1) under abnormal plant operation.

Each of the two redundant safety-related emergency filtration units is sized to assure that the MCR operator's radiological dose shall not exceed the limits set by GDC 19. The MCR operator doses are calculated in accordance with the methodology and accidents identified in RG 1.195 (Ref. 9.4.8-4) or 1.183 (Ref. 9.4.8-5) and inleakage value as determined using RG 1.197 (Ref. 9.4.8-6).

The MCR emergency filtration units are engineered safety features that are designed as a part of the fission product removal system.

Redundant safety-related Class 1E radiation monitors are located in the outside air intake duct to automatically switch the MCR HVAC system from the normal operation mode to the emergency pressurization mode upon detection of a radiological level higher than a predetermined value. The habitability of the MCR following design basis accidents is further described in Chapter 6, Section 6.4.

In the event of fire and smoke presence in the CRE, smoke detectors alarms in the MCR. If required, the operator can initiate the smoke purge mode when the emergency mode is not in effect.

System's air supply and exhaust fan housings are designed to resist penetration of internally generated missiles in the event of a fan rotor failure.

The MCR HVAC system equipment and components are protected from tornado-generated missiles by their location inside a seismic category I structure.

The MCR HVAC system's outside air intakes and exhaust outlets are protected from tornado-generated missiles by specially designed protective ~~gratings~~barriers. Refer to Section 3.5.3.1.1. These protective barriers are part of the R/B structure outer wall and have the following dimensions: thicknesses of greater than or equal to 20 inches for the vertical sections and greater than or equal to 14 inches for the horizontal section; and width and height greater than the corresponding dimension of the respective ventilation opening. DCD_14.03.07-59

The adverse effects associated with tornado depressurization of the outside air intakes and exhaust outlets are prevented by the specially designed tornado dampers located at the outside air intakes and exhaust outlets.

The MCR HVAC system is protected against piping failure due to high energy line breaks and is not affected by any of the effect of postulated break of the piping. The basis for protection against postulated piping failure is discussed in Section 3.6.2.

The closest potential source of fresh air contamination is the exhaust from the emergency gas turbine generators (GTGs). For each GTGs, there are two exhaust sources which are

- The redundant units are powered by separate Class 1E buses. As shown in Table 9.4.5-2, failure of a single active component in one of the annulus emergency exhaust filtration units cannot result in a loss of the system's safety function.

- The annulus emergency exhaust system equipment and components are protected from tornado generated missiles by their location inside a seismic category I structure.

- The adverse effects associated with the tornado depressurization of the air exhaust line are prevented by the specially designed tornado damper in the exhaust line.

- All duct penetrations in firewalls are protected by rated fire dampers to prevent the spread of fire from the affected area to the adjacent redundant component areas.

9.4.5.3.2 Class 1E Electrical Room HVAC System

- The continuous operation of the Class 1E electrical rooms HVAC system is assured by the physical separation of its redundant trains and components. All system equipment and components are classified as equipment class 3, seismic category I.

- Redundant equipment and components are powered from separate Class 1E buses. The air handling units are served by the essential chilled water system. As shown in Table 9.4.5-2, failure of a single active component in one air handling unit cannot result in complete loss of heating or cooling of the class 1E electrical rooms.

- The battery rooms are ventilated with sufficient supply and exhaust airflow during all modes of operation in order to limit the hydrogen concentration below 1% percent by volume of battery room. A back up battery room fan starts automatically upon detection of the running fan airflow failure.

- All duct penetrations in fire walls are protected by fire dampers to prevent the spread of fire from the affected area to the adjacent redundant component areas.

- Systems air supply, return and exhaust fan housings are designed to resist penetration of internally generated missiles in the event of fan rotor failure.

- The Class 1E electrical room HVAC system equipment and components are protected from tornado-generated missiles by their location inside a seismic category I structure.

- The system's outside air intakes and exhaust outlets are protected from the externally tornado generated missiles by specially designed protective ~~gratings~~barriers. Refer to Section 3.5.3.1.1. These protective barriers are part of the R/B structure outer wall and have the following dimensions: thicknesses of greater than or equal to 20 inches for the vertical sections and greater than or equal to 14 inches for the horizontal section; and width and height greater than the corresponding dimension of the respective ventilation opening. DCD_14.03.07-59

- The adverse effects associated with the tornado depressurization of the outside air intakes and exhaust openings are prevented by the specially designed tornado dampers located at the outside air intakes and exhaust opening.

9.4.5.3.3 Safeguard Component Area HVAC System

- The operation of the safeguard component area HVAC system is assured by the physical separation of its redundant equipment and components. All system equipment and components are classified as equipment class 3, seismic category I.

- In the event of a design basis accident coincident with a LOOP, the safety-related air handling units receive emergency power from the corresponding safety buses to ensure the availability of cooling of the safeguard component areas. Failure mode and effects analysis Table 9.4.5-2 concludes that no single failure coincident with a LOOP compromise the system's safety functions.

- Air handling unit fan housings are designed to resist penetration of internally generated missiles in the event of fan rotor failure.

- All duct penetrations in firewalls are protected by rated fire dampers to prevent the spread of fire from the affected area to the adjacent redundant component areas.

9.4.5.3.4 Emergency Feedwater Pump Area HVAC System

- The operation of the emergency feedwater pump area HVAC system is assured by the physical separation of its redundant equipment and components. All system equipment and components are classified as equipment class 3, seismic category I.

- In the event of a design basis accident, coincident with a LOOP, the safety-related air handling units receive emergency power from the corresponding safety buses to ensure the availability of cooling of the emergency feedwater pump areas. Failure mode and effects analysis Table 9.4.5-2 concludes that no single failure coincident with a LOOP compromises the system's safety functions.

- Air handling unit fan housings are designed to resist penetration of internally generated missiles in the event of fan rotor failure.

- All duct penetrations in firewalls are protected by rated fire dampers to prevent the spread of fire from the affected area to the adjacent redundant component areas.

- The emergency feedwater pump (turbine-driven) area HVAC system equipment and components are protected from tornado-generated missiles by their location inside a seismic category I structure.

- The system's outside air intakes and exhaust outlets are protected from the externally tornado generated missiles by specially designed protective ~~gratings~~barriers. Refer to Section 3.5.3.1.1. These protective barriers are part of the R/B structure outer wall and have the following dimensions: thicknesses of greater than or equal to 20 inches for the vertical sections and greater than or

DCD_14.03.07-59

equal to 14 inches for the horizontal section; and width and height greater than the corresponding dimension of the respective ventilation opening. DCD_14.03.07-59

9.4.5.3.5 Safety Related Component Area HVAC System

- The operation of the safety related component HVAC system is assured by the physical separation of its redundant equipment and components. All system equipment and components are classified as equipment class 3, seismic category I.
- In the event of a design basis accident coincident with a LOOP, the safety-related air handling units receive emergency power from the corresponding safety buses to ensure the availability of cooling of the safety-related component areas. Failure mode and effects analysis Table 9.4.5-2 concludes that no single failure coincident with a LOOP compromises the system's safety functions.
- Air handling unit fan housings are designed to resist penetration of internally generated missiles in the event of fan rotor failure.
- All duct penetrations in firewalls are protected by rated fire dampers to prevent the spread of fire from the affected area to the adjacent redundant component areas.

9.4.5.4 Inspection and Testing Requirements

The ESF ventilation system is provided with adequate instrumentation, temperature, flows, and differential pressure indicating devices to facilitate testing and verification of equipment heat transfer capability and flow blockage.

Preoperational testing of the ESF ventilation system is performed as described in Chapter 14, Verification Programs, to verify that the system is installed in accordance with applicable programs and specifications. The air handling units airflows are balanced to provided proper air mixing throughout the served areas.

During normal operation, the standby trains are periodically tested for operability or, alternatively, placed in service in place of the train which had been operating.

The ESF ventilation system equipment and components are provided with proper access for initial and periodic inspection and maintenance during normal operation.

Air handling units are factory tested in accordance with Air Movement and Control Association Standard (Ref.9.4.8-16, Ref.9.4.8-17, Ref .9.4.8-18). Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air Conditioning Engineers Standard (Ref.9.4.8-19, Ref.9.4.8-20). Cooling coils are hydrostatically tested in accordance with ASME AG-1 (Ref. 9.4.8-2) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute Standard (Ref.9.4.8-21, Ref.9.4.8-22, Ref .9.4.8-23).

Air distribution ductwork is leak tested in accordance with the Sheet Metal American Contractors' National Association (Ref.9.4.8-24, Ref.9.4.8-25), ASME N510 (Ref.9.4.8-8), and ASME AG-1 Section SA and TA.