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January 31, 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-11021

Subject: MHI's Responses to US-APWR DCD RAI No.675-5231 Revision 2 (SRP 14.03.07)

References: 1) "Request for Additional Information No. 675-5231 Revision 2, SRP Section: 14.03.07 – Plant Systems – Inspections, Tests, Analyses, and Acceptance Criteria Application Section: Tier 1 Sections 2.7.5.1 - 2.7.5.5" dated December 15, 2010.

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. 675-5231 Revision 2".

Enclosed are the responses to 4 RAIs 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. Responses to Request for Additional Information No. 675-5231 Revision 2

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-11021
Docket Number 52-021

Responses to Request for Additional Information
No. 675-5231 Revision 2

January, 2011

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.675-5231 REVISION 2**
SRP SECTION:	**14.03.07 - PLANT SYSTEMS - INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA**
APPLICATION SECTION:	**DCD Tier 1 Sections 2.7.5.1 – 2.7.5.5**
DATE OF RAI ISSUE:	**12/15/2010**

QUESTION NO. : 14.03.07-53

This is a follow-up RAI to OPEN ITEM -- RAI No. 54 Question No. 14.03.07-2, RAI 14.3.7.3.2-3 and RAI No. 381-2806 Question No.14.03.07-35. The staff notes that Regulatory Guide 1.52 System Design Criterion 3.8 reads:

"The power supply and electrical distribution system for the ESF atmosphere cleanup system should be designed in accordance with Regulatory Guide 1.32 (Ref. 13). All instrumentation and equipment controls should be designed to IEEE Standard 603-1991 (Ref. 14)."

IEEE Standard 603-1991 states that "The design basis shall be consistent with the requirements of ANSI/ANS 51.1-1983...". The applicant elected to strike from DCD subsection 9.4.1.5 any reference to ANSI/ANS 51.1-1983 as part of the response to RAI No. 381-2806 Question No.14.03.07-35. Please explain why this is acceptable?

Item 4.4 states ..

4.4 The variables or combinations of variables, or both, that are to be monitored to manually or automatically, or both, control each protective action; the analytical limit associated with each variable, the ranges (normal, abnormal, and accident conditions); and the rates of change of these variables to be accommodated until proper completion of the protective action is ensured.

For the case in point the staff notes that the ESF filter trains are required to be capable of remaining operable for 30 days after the design base accident event. The filer train must be capable of maintaining 3600 cfm (+/-10%) for the entire 30 days to match the criteria of the plant safety analysis. With no safety related instrumentation available, please explain how will plant operations know when the filter train is becoming flow limited by excessive filter media blockage. Please explain how the operators will monitor and control the system during an accident with the safety-related (Class 1E Power supplied) equipment available.

The staff also notes that Tier 1 Table 2.7.5.1-1 only lists temperature switches VRS-TS-146, 156, 166 and 176 as Class 1E which appears to trigger a high temperature alarm and sends a signal to the cooling coil flow control valve. The staff requests additional information about what role TE and TIC 141 through 171 (as displayed Figure 9.4.1-1) play in the control of the CRE temperature and why these components are

not included in Table 2.7.5.1-1.

ANSWER:

DCD Section 9.4.1.5 "Instrumentation Requirements" provides a reference to applicable standards for safety-related instrumentation requirements and a listing of instrumentation available in the main control room for the Main Control Room (MCR) Heating, Ventilation and Air Conditioning (HVAC) System. ANS 51.1, *Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants*, provides guidance for the determination of safety classifications for nuclear plant systems, structures and components. The reference to ANS 51.1 was removed from DCD Section 9.4.1.5 as a clarification, since the standard does not provide specific requirements related to safety-related instrumentation. ANS 51.1-1983 remains a reference applicable to the MCR HVAC system as indicated in DCD Sections 9.4.1 and 9.4.8.

The safety function of the MCR HVAC system is to start upon a MCR isolation signal and pressurize the control room envelope (CRE) to maintain radiation dose to MCR personnel within the limits of GDC 19, as described in DCD Section 9.4.1.1.1 "Safety Design Basis." This safety function is accomplished by the automatic start of the redundant, 100% capacity emergency filtration units powered from separate Class 1E buses. As discussed in DCD Section 9.4.1.3 "Safety Evaluation," each of the two redundant safety-related emergency filtration units is designed to assure that the MCR operator's radiological dose shall not exceed the limits set by GDC 19. The capability of the MCR emergency filtration units to meet the GDC 19 requirements is assured through operability requirements and periodic surveillance testing in accordance with Technical Specification 3.7.10 "Main Control Room HVAC System (MCRVS)" and 5.5.11 "Ventilation Filter Testing Program (VFTP)." Safety-related status indication is provided for operators to confirm that the MCR emergency filtration unit fans are operating (completion of the initial protective action) and are performing their safety function, as indicated in Tier 1 DCD Tables 2.7.5.1-1 "Main Control Room HVAC System Equipment Characteristics" and 2.7.5.1-2 "Main Control Room HVAC System Equipment Alarms, Displays and Control Functions." The MCR HVAC emergency filtration units are designed to operate for their entire mission time without the need to monitor filtration unit flowrate or filter differential pressure. The MCR HVAC system is designed in accordance with IEEE 603-1991. According to IEEE 603, completion of a protective action occurs when, once initiated automatically or manually, the intended sequence of protective actions of the execute features continue until completion. In the case of MCR HVAC, the protective action is to place the system in service to pressurize the control room envelope upon receipt of MCR isolation signal. There are no variables associated with filtration unit flowrate and differential pressure across the emergency filtration units that are part of the initiation of the MCR isolation signal. Upon receipt of the MCR isolation signal, there are no variables required to determine filtration unit flowrate and differential pressure across the emergency filtration unit to place it in service. The only actions to place the filtration unit in service are start of the associated fans. The protective action is completed when the MCR HVAC is placed in service to pressurize the MCR envelope. There are no IEEE 603 requirements associated with monitoring this filtration unit for 30 days after the design basis accident occurs and the unit is placed in service. Therefore, under section 4.4 of IEEE 603, there is no requirement for any safety related instrumentation associated with the emergency filtration unit.

Instruments VRS-TE-141, -151, -161, -171, VRS-TIC-141, -151, -161, and -171 are non-safety related temperature sensing and control instruments that provide a signal to the MCR air handling units chilled water flow control valves and electric heating coil to provide MCR ambient temperature control. In the event of a high temperature condition in the MCR, the safety-related temperature switches VRS-TS-146, -156, -166, and -176 listed on Tier 1 DCD Table 2.7.5.1-1 provide a signal to the chilled water control valves to initiate full flow through the air handling unit cooling coil. The MCR cooling safety function is supported by these temperature switches. Therefore, the temperature sensing and control instruments are not required to be included in Table 2.7.5.1-1.

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

1/31/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	NO.675-5231 REVISION 2
SRP SECTION:	14.03.07 - PLANT SYSTEMS - INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA
APPLICATION SECTION:	DCD Tier 1 Sections 2.7.5.1 – 2.7.5.5
DATE OF RAI ISSUE:	12/15/2010

QUESTION NO. : 14.03.07-54

This a follow-up question to RAI No. 54 Question No. 14.03.07-2, RAI14.3.7.3.2-7.

The staff notes that Tier 1 Item 21 Table 2.2-4 requires an inspection and provides Acceptance Criteria which ensures that safety-related SSCs are protected from internal missile sources. The staff noted in Question No.14.03.07-2, RAI 14.3.7.3.2-7 that specially designed protective gratings protect the MCR HVAC system's outside air intakes from external tornado generated missiles.

Neither Figures 2.2-1 through 2.2-13 nor Table 2.2-2 referenced in Tier 1 Item 1 Table 2.2-4 detail these specially designed protective gratings. This fails to ensure an ITAAC inspection of the gratings.

For Tier 1 Table 2.2-4, the staff requests that the applicant amend either the Figure(s) or Table of Item 1 OR amend Item 21 with words that ensure an ITAAC inspection of the specially designed protective gratings for the MCR HVAC system's outside air intakes.

ANSWER:

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.

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

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DATE OF RAI ISSUE:	**12/15/2010**

QUESTION NO. : 14.03.07-55

This is a follow-up question to RAI #54 Question No. 14.03.07-3, RAI 14.3.7.3.6-6.

The staff notes that SR 3.7.11.4 was revised as part of the resolution to Question No. 14.03.07-3, RAI 14.3.7.3.6-6 but the revision still lacks technical consistency with the Acceptance Criteria of Tier 2 preoperational test 14.2.12.1.70 and Tier 1 Item 4.a.ii of ITAAC Table 2.7.5.2-3. In particular, the staff notes SR 3.7.11.4 reads:

"Verify the associated room can be maintained at a pressure ≤ -0.25 inches water gauge relative to atmospheric pressure using one Annulus Emergency Exhaust System train during the accident condition at a flow rate of ≤ 5600 cfm within 240 seconds after a start signal."

The Acceptance Criteria D.3 of preoperational test 14.2.12.1.70 reads:

"The system can establish a -1/4 inch water gauge pressure in the penetration areas and safeguard component areas with respect to the surrounding areas within 240 sec and maintain that pressure (Subsection 6.5.1)."

The Acceptance Criteria of Tier 1 Item 4.a.ii of ITAAC Table 2.7.5.2-3

reads:

"The as-built annulus emergency exhaust system is capable of drawing down all four penetration areas and all four safeguard component areas to less than or equal to -0.25 inches w.g. relative to adjacent areas within the arrival time identified in Subsection 2.7.5.2.1.1 on both divisions."

The staff asks that the applicant revise the DCD acceptance criterion and/or SR 3.7.11.4 and its Bases to: (a) establish a technical consistency with each other and (b) to establish a technical accuracy with the outcomes of MNES Calculation N0-EE23201 and MNES Calculation N0-EE23201.

ANSWER:

As described in DCD Section 6.5.1.1 "Design Basis," the annulus emergency exhaust system is designed to establish a -0.25 inch water gauge (WG) pressure in the penetration areas and the safeguard component areas relative to the surrounding areas within 240 seconds to mitigate potential leakage to the environment of fission products from the containment following a LOCA.

Technical Specification 3.7.11, Surveillance Requirement 3.7.11.4, will be revised to indicate that the associated room pressure is relative to surrounding areas instead of atmospheric pressure.

Preoperational test 14.2.12.1.70 will be revised to clarify that Annulus Emergency Exhaust System can establish a pressure ≤ -0.25 inch water gauge pressure in the penetration areas and safeguard component areas with respect to the surrounding areas within 240 sec.

Calculation N0-EE23201, Revision 0, *US-APWR Standard Design Annulus Emergency Exhaust System (AEES) Calculations*, uses a -0.25 inch water gauge (WG) pressure arrival time of 180 seconds for the system required airflow calculations to determine a conservative exhaust fan capacity. However, as noted in the calculation, the accident dose analysis input for the arrival time is 240 seconds. The annulus emergency exhaust system design basis is consistent with the dose analysis assumption for negative pressure arrival time. Therefore, the Technical Specifications 3.7.11.4 Surveillance Requirement, DCD Section 14.1.12.1.70 Acceptance Criterion D.3, and Tier 1 DCD Table 2.7.5.2-3, Item 4.a.ii Acceptance Criteria are technically consistent with calculation N0-EE23201 and the system design basis.

Impact on DCD

DCD Revision 2, Chapter 16 Technical Specification, Surveillance Requirement 3.7.11.4, will be revised to indicate that the associated room pressure is relative to surrounding areas instead of atmospheric pressure as follows:
"Verify the associated room can be maintained at a pressure ≤ -0.25 inches water gauge relative to ~~atmospheric pressure~~ **surrounding areas** using one Annulus Emergency Exhaust System train during the accident condition at a flow rate of ≤5600 cfm within 240 seconds after a start signal."

Acceptance Criteria D.3 of preoperational test 14.2.12.1.70 will be revised as follows.
"The system can establish ~~a -1/4~~ **less than or equal to -0.25** inch water gauge pressure in the penetration areas and safeguard component areas with respect to the surrounding areas within 240 sec and maintain that pressure (Subsection 6.5.1)."

Impact on COLA

COLA Part 4 Technical Specification, Surveillance Requirement 3.7.11.4 will be revised as follows.
"Verify the associated room can be maintained at a pressure ≤ -0.25 inches water gauge relative to ~~atmospheric pressure~~**surrounding areas** using one Annulus Emergency Exhaust System train during the accident condition at a flow rate of ≤ 5600 cfm within 240 seconds after a start signal."

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/31/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.675-5231 REVISION 2**
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APPLICATION SECTION:	**DCD Tier 1 Sections 2.7.5.1 – 2.7.5.5**
DATE OF RAI ISSUE:	**12/15/2010**

QUESTION NO. : 14.03.07-56

This is a follow-up question to RAI No. 54 Question No. 14.03.07-5, RAI 14.3.7.3.6-3 and RAI No. 381-2806 Question No. 14.03.07-42.

The staff's review of DCD Revision 2 found that subsection 9.4.5.5 still contains the referencing errors lined out in the amendment specified in the "Impact on DCD" section of RAI No. 381-2806 Question No. 14.03.07-42. In addition "Table 3.D-2" should read "Table 3D-2". The staff requests that the applicant correct these errors in Revision 3 of the DCD.

In addition the applicant has failed to justify that instrumentation used by the Control Room operators to monitor the status and manipulate the annulus emergency exhaust system annulus during an accident need not be safety related.

The staff notes that Regulatory Guide 1.52 System Design Criterion 3.8

reads:

"The power supply and electrical distribution system for the ESF atmosphere cleanup system should be designed in accordance with Regulatory Guide 1.32 (Ref. 13). All instrumentation and equipment controls should be designed to IEEE Standard 603-1991 (Ref. 14)."

The opening paragraph of "4 Safety System Designation" in IEEE Standard 603-1991 reads that "The design basis shall be consistent with the requirements of ANSI/ANS 51.1-1983...". The applicant elected to strike from DCD subsection 9.4.5.5 any reference to ANSI/ANS 51.1-1983 as part of the response to RAI No. 381-2806 Question No. 14.03.07-42. Please explain why this is acceptable?

Item 4.4 states ...

4.4 The variables or combinations of variables, or both, that are to be monitored to manually or automatically, or both, control each protective action; the analytical limit associated with each variable, the ranges (normal, abnormal, and accident conditions); and the rates of change of these variables to be accommodated until proper completion of the protective action is ensured.

It appears that the instrumentation (i.e. flow indication, filter bed differential pressure instrumentation, the four safeguard component area differential pressure monitors and the four penetration area differential

pressure monitors) associated with the annulus emergency exhaust system fits the definition of Safety Class 3 (SC-3) as they support the nuclear safety functions d, i, k, m and p.

Please explain how the plant operations will monitor and operate the system with the safety-related instrumentation during an accident. The four penetration areas, four safeguard component areas impact the Annulus Emergency Exhaust System. Please explain how plant operators, during an accident, will verify the associated room boundary based on each of the eight area differential pressure monitors using safety-related instrumentation.

The staff requests that the applicant provide a justification that the instrumentation associated with the Annulus Emergency Exhaust System does not need to be safety-related Class 1E using the guidance in ANSI/ANS 51.1-1983 and IEEE Standard 603-1991.

ANSWER:

DCD Section 9.4.5.5 "Instrumentation Requirements" will be revised to correct the referencing errors and to change "Table 3.D-2" to read "Table 3D-2".

DCD Section 9.4.5.5 provides a reference to applicable standards for safety-related instrumentation requirements relevant to the engineered safety feature (ESF) ventilation system, which includes the annulus emergency exhaust system. ANS 51.1, *Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants*, provides guidance for the determination of safety classifications for nuclear plant systems, structures and components. The reference to ANS 51.1 was removed from DCD Section 9.4.5.5 as a clarification, since the standard does not provide specific requirements related to safety-related instrumentation. ANS 51.1-1983 remains a reference applicable to the US-APWR ventilation systems as indicated by inclusion of the standard as a reference in DCD Section 9.4.8 "References."

The safety function of the annulus emergency exhaust system is to start upon an ECCS signal and maintain a negative pressure in the penetration and safeguard component areas relative to the adjacent areas to mitigate the consequences of postulated accidents by removing the airborne radioactive material that may leak from containment as described in DCD Section 9.4.5.1.1.1 "Annulus Emergency Exhaust System" safety design basis. This safety function is accomplished by the automatic start of the redundant, 100% capacity annulus emergency exhaust filtration units powered from separate Class 1E buses. The capability of the annulus emergency exhaust filtration units to meet the safety function requirements is assured through operability requirements and periodic surveillance testing in accordance with Technical Specification 3.7.11 "Annulus Emergency Exhaust System" and 5.5.11 "Ventilation Filter Testing Program (VFTP)." Safety-related status indication is provided for operators to confirm that the annulus emergency exhaust filtration unit fans are operating (completion of the initial protective action) and are performing their safety function, as indicated in Tier 1 DCD Table 2.7.5.2-1 "Engineered Safety Features Ventilation System Equipment Characteristics" and Table 2.7.5.2-2 "Engineered Safety Features Ventilation System Equipment Alarms, Displays and Control Functions." The annulus emergency exhaust filtration units are designed to operate for their entire mission time without the need to monitor filtration unit flowrate, filter differential pressure, or area differential pressure. The annulus emergency exhaust system is designed in accordance with IEEE 603-1991. According to IEEE 603, completion of a protective action occurs when, once initiated automatically or manually, the intended sequence of protective actions of the execute features continue until completion. In the case of annulus emergency exhaust system, the protective action is to place the system in service to maintain a negative pressure in the penetration and safeguard component areas relative to the surrounding areas upon receipt of an ECCS actuation signal. There are no variables associated with filtration unit flowrate, differential pressure across the emergency filtration units and area differential pressure that are part of the initiation of the ECCS actuation signal. Upon receipt of the ECCS signal, there are no variables required to determine filtration unit flowrate, differential pressure across the emergency filtration units and area differential pressure to place it in service. The

only actions to place the filtration unit in service are start of the associated fans. The protective action is completed when the annulus emergency exhaust system is placed in service to maintain a negative pressure in the penetration and safeguard component areas. Under section 4.4 of IEEE 603, there is no requirement for any safety related instrumentation associated with the emergency filtration unit. Therefore, the annulus emergency exhaust filtration units flow indication and filter differential pressure instrumentation, and the penetration and safeguard component areas differential pressure monitors, are not required for the annulus emergency exhaust system to perform its safety function and do not meet the definition of Safety Class 3 in ANS 51.1-1983.

Impact on DCD

DCD Section 9.4.5.5 will be revised to correct the referencing errors and to change "Table 3.D-2" to read "Table 3D-2" as follows:

Safety-related instrumentation associated with the ESF ventilation system are identified in Table ~~3.D-2~~ **3D-2** and meet the requirements of IEEE Std. 603 (Ref. 9.4.8-~~12~~**11**) and are qualified in accordance with IEEE Std. 323 (Ref. 9.4.8-~~13~~**12**) and IEEE Std. 344 (Ref. 9.4.8-~~14~~**13**).

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.