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TOKYO, JAPAN

June 19, 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-09323

Subject: MHI's Responses to US-APWR DCD RAI No.327-2401

References: 1) "Request for Additional Information No.327-2401 Revision 1, SRP Section: 09.04.01 – Control Room Area Ventilation System, Application Section: Tier 2 DCD FSAR 9.4.1" dated April 8, 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.327-2401 Revision 1".

Enclosed are the responses to 8 RAIs 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. 327-2401, Revision 1

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

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Enclosure 1

UAP-HF-09323
Docket Number 52-021

Responses to Request for Additional Information No. 327-2401,
Revision 1

June, 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/19/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.327-2401 REVISION 1**
SRP SECTION:	**09.04.01 – Control Room Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD FSAR Section 9.4.1**
DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO. : 09.04.01-2

The staff finds the applicant's response for RAI #63-849/Question No.09.04.01-5 as incomplete. The first paragraph of "Technical Rational" for SRP 6.4 II "Acceptance Criteria" reads:

> "Compliance with GDC 4 requires that structures, systems, andcomponents important to safety be designed to accommodate the effects of, and be compatible with, environmental conditions associated with normal operation, maintenance, testing, and postulated accidents,including loss-of-coolant accidents (LOCAs). These structures,systems, and components shall be appropriately protected against dynamic effects (e.g., the effects of missiles, pipe whipping, and discharging fluids) that may result from equipment failures and from events and conditions outside the nuclear power unit."

An excerpt from GDC 4 reads:

> "Structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-ofcoolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit."

In particular, the staff requests additional information about the safety related SSCs external to the CRE but part of the Main Control Room Heating, Ventilation and Air Conditioning System. In particular, how are these SSCs designed to withstand the dynamic effects of the effects of missiles, pipe whipping, and discharging fluids that may result from equipment failures? What provisions in the building and in the rooms that house these safety related components ensure that the design criteria of GDC 4 is met?

ANSWER:

The safety related SSCs external to the CRE but part of the Main Control Room HVAC System (MCRVS) are located in the duct-space and HVAC equipment room that are located in the Reactor Building (R/B), which is a Seismic Category I Building. The two safety-related HVAC systems are the MCRVS and Class 1E electrical room HVAC systems, both contained in the HVAC equipment room. Each fan housing is designed to resist the penetration of internally generated missiles in the event of fan rotor failure as described in DCD Subsection 9.4.1.3. The each area does not contain the piping that failures due to high energy line breaks. The MCRVS is not affected by any of the effects of postulated break of the piping. DCD Section 3.6.2 also provides the basis for protection against postulated piping failure in fluid systems outside containment. Hence, MHI considers the MCRVS complies with the GDC 4.

Impact on DCD

DCD Subsection 9.4.1.3 will be revised. The following description will be added.

"The MCR HVAC system is protected against piping failures 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."

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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Docket No. 52-021

RAI NO.:	**NO.327-2401 REVISION 1**
SRP SECTION:	**09.04.01 – Control Room Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD FSAR Section 9.4.1**
DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO. : 09.04.01-3

The staff finds the applicant's response for RAI #63-849/Question No.09.04.01-9 as incomplete. SRP 9.4.1 section IV.1 "Evaluation Findings" reads:

> "The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions.
>
> The staff concludes that the design and expected performance of the CRAVS is acceptable and meet the requirements of GDCs 2, 4, 5, 19, and 60 and 10 CFR 50.63. These conclusions are based on the following findings:
>
> 1. The applicant meets the requirements of [regulation] for [limits of review for regulation] by [for each item applicable to the review, how met and why acceptable under the regulation]:
> A. Meeting the regulatory positions in RG(s).
>
> B. Providing and meeting an alternative method to regulatory positions in RG _____, reviewed by the staff and found acceptable.
>
> C. Using calculational methods for [what was evaluated] that have been previously reviewed by the staff and found acceptable; the staff has reviewed the impact parameters in this case and found them suitably conservative or has performed independent calculations to verify acceptability of their analysis."

In this passage, SRP section 9.4.1 IV.1 "Evaluation Findings" creates the expectation that the staff will review the supporting DCD engineering calculations and/or perform confirmatory calculations for parameters important to plant safety.

The second bullet of DCD Section 9.4.1.1.1 "Safety Design Bases" reads" *"Support and maintain CRE habitability and permit personnel occupancy* <u>and proper functioning of instrumentation during normal and design basis</u> <u>accidents,</u> *assuming a single active failure."*

To take this design basis review requirement one step further, the staff notes that Table 9.4.1-1 contains cooling coil capacities for the MCR Air Handling Units. These capacities would have been derived through some model calculation where the inputs (i.e. design temperature values) of Table 9.4-1 where used as desired outcomes. The staff needs to review this model calculation(s) to establish the integrity of the values contained in Tables 9.4-1, 9.4.1-1 etc.

Based on this, the staff repeats its request of the original Question No.09.04.01-9.

·The staff requests that the applicant provide additional details for the following DCD section 9.4.1, Table 9.4-1, sheet 1 values for the control room area ventilation system calculation procedures and methods, including assumptions and margins:

- Main control room area calculations supporting the normal and abnormal condition min max temperatures
- Main control room area calculations supporting the normal and abnormal condition min max relative humidity percentages.

ANSWER:

The calculations of air handling units of the main control room HVAC system (MCRVS) are shown in RAI #63-849/Question No.09.04.01-14. Some input values for calculating the airflow rate are missing from that response. The input values are as follows.

- Design room temperature (ti) is a minimum 73 deg F and a maximum 78 deg F
- Supply air temperature (to) is from 65 deg F (in summer season) to 78 deg F (in winter season)

The calculation shows that the cooling coils of each air handling unit have the ability to remove the heat load generated from the electrical equipment and components that are located in the main control room and the heat gain from the outside air and through the massive concrete walls. These heat load are bounded by the normal plant condition and the abnormal plant condition such as a DBA. Therefore, the maximum room temperature is maintained at 78 deg F by the MCRVS. The minimum room temperature is also maintained at 73 deg F by the MCRVS.

The maximum relative humidity in the main control room (MCR) is controlled by the cooling coils that are provided in the air handling units. The minimum relative humidity in the MCR is controlled by the humidifier that is designed as non-safety related and Seismic Category II. This is installed in the supply air duct. MHI will add the description of humidifier in DCD Subsection 9.4.1.

Impact on DCD

The first paragraph of DCD Subsection 9.4.1.2 will be revised as follow:

"Non-safety related electric in-duct heaters **and a humidifier that are designed as Seismic Category II** are located in the duct branches leading to the MCR."

Table 3.2-2 (under Item 36, Sheets 43 and 44) "Classification of Mechanical and Fluid Systems, Components, and Equipment" will be revised to add the following information on the main control room HVAC system..

System and Components	Equipment Class	Location	Quality Group	10 CFR 50 Appendix B (Reference 3.2-8)	Codes and Standards (3)	Seismic Category	Notes
Humidifier	5	R/B	N/A	N/A	5	II	

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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US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.327-2401 REVISION 1**
SRP SECTION:	**09.04.01 – Control Room Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD FSAR Section 9.4.1**
DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO. : 09.04.01-4

The staff finds the applicant's response for RAI #63-849/Question No.09.04.01-12 as incomplete. In the original RAI, the staff requested that the applicant "*Provide additional details including calculations that establish the one-hour delay basis with associated assumptions and margins and identify any deviations from the recommended calculational procedures in SRP Section 9.4.1, Revision 3, March 2007.*" The staff made this request to support its required review per the guidance of SRP 9.4.1 section III.5 which reads:

> "The reviewer verifies that a suitable environment is demonstrated to be maintained in areas served by the CRAVS for the duration of a station blackout event and the associated recovery period with or without credit for CRAVS operation, as applicable. ..... Where the CRAVS (or portions thereof) is credited to function for coping with a station blackout, the reviewer verifies that the CRAVS has been designed so that system functions will be performed as required in the event of a station blackout, that the CRAVS has sufficient capacity and capability to maintain a suitable environment for the duration of a station blackout event and the associated recovery period, and that failure of non-required portions of the CRAVS will not adversely affect the functioning of required equipment."

The applicant's response indicated that MCR cabinet integrity was addressed in DCD Section 8.4. The staff could find no discussion of MCR cabinet integrity within this section of the DCD. Page 8.4-8 of revision 1 of the DCD does contain the following words:

> "(3) Integrity of electrical cabinets Until AAC GTG restores power to the Class 1E power system within one hour after SBO occurs, Class 1E electrical room HVAC system cannot be operated. However, all Class 1E electrical cabinets and I&C cabinets are rated to keep their integrity up to 50°C temperature. The temperature of Class 1E electrical room and I&C room will not reach 50°C within one hour even without HVAC."

If this passage is discussing MCR cabinets within the CRE it is not obvious from the words.

(1) Are there no control and instrumentation cabinets located within the CRE?

The passage indicates that the cabinets will keep their integrity up to 50ºC (122ºF). The staff can only assume (i.e. this is not clearly stated in the DCD) that for the cabinets to keep their integrity, that all instrumentation and controls within these cabinets are at least rated to this same maximum temperature. According to sheet 1 of 4 of Table 9.4-1, the maximum normal ambient room temperature within the MCR/Class 1E Electrical Room HVAC Equipment Room is 105ºF. If the room temperature is at

105°F, it is safe to assume that the internal cabinet temperature will be higher than this. From plant operation experience, a delta of 5-10°F between room temperature and internal cabinet temperature would be not uncommon. So presumably, with the current DCD design, the instrumentation and controls within the cabinets could already be at 115°F at the outset of the station blackout event. A 7°F margin may or may not be enough to survive the temperature rise during the initial hour after the onset of SBO. Based on this, the staff views the applicant's RAI response statement "The MCR temperature will rise within the one hour before the AAC power source is available, but it is not expected to rise significantly." as suspect (i.e. if not cavalier) given that margins to failure of safety related equipment appear not to be appreciable.

To take this staff concern one step further, Table 9.4-1 for this same MCR/Class 1E Electrical Room HVAC Equipment Room lists a maximum abnormal temperature of 130°F. The staff request additional information about this maximum temperature given that fact that all Class 1E electrical cabinets and I&C cabinets are rated to keep their integrity only up to 122°F".

The staff could find no reference to calculations in section 8.4.4 "References" that might support the applicants statement "The temperature of Class 1E electrical room and I&C room will not reach 50°C within one hour even without HVAC". Obviously, these calculations must exist or the applicant could not make such a definitive statement. The staff needs to review these calculations per the review guidance of SRP 9.4.1.

The Staff is asking the applicant (1) based on model calculation(s) what is the MCR area temperature will rise to during this one-hour SBO event? (2) What will the worse case temperature be inside the electrical panels and I&C panels when this maximum ambient MCR area temperature is reached or the maximum MCR/Class 1E Electrical Room HVAC Equipment Room temperature is reached? (3) Are all MCR instrumentation, controls and alarms qualified to operate at these worse case panel temperatures?

ANSWER:

The electrical cabinets described in DCD Section 8.4 include the MCR cabinets. The electrical cabinets needed during the SBO event are installed in the MCR, the Class 1E I&C Room, the Class 1E Electrical Room, the Class 1E UPS Room, and the Class 1E Battery Room. The HVAC equipment rooms for the MCR and the Class 1E Electrical Rooms contain only the HVAC system equipment. There are no electrical cabinets in these HVAC equipment rooms. Therefore, the maximum abnormal temperature in the MCR/ Class 1E Electrical Room HVAC Equipment Room will remain at 130°F.

The electrical cabinet can keep their integrity on 50°C (122°F) in case of increasing ambient temperature during SBO event.

The MCR area steady state temperature has approximately been calculated as 121 °F. The heat load considered in this calculation is from the electrical loads that are operated during the SBO event and the heat load generated from personnel in the MCR. Actually, the room temperature in the MCR increases gradually during the SBO event. It takes many hours to reach the steady condition of 121 °F. Therefore, the room temperature in the MCR is maintained well below 122 °F during the SBO event.

The calculation procedure and the design basis as follows:

The MCR area steady state temperature is determined by following equation

$$\underbrace{Q_r}_{\text{Heat gain}} - \underbrace{\Sigma (U \times A \times (Ts - T_0))}_{\text{Heat loss to surroundings}} = 0$$

solving for Ts,

$Ts = (\Sigma (U \times A \times T_0) + Q_r) / (\Sigma (U \times A)$

where,

Ts: MCR area temperature (steady state), °F
U_i: overall heat transfer coefficient value of concrete walls enclosing the MCR, Btu/h-ft^2-°F (i =1,2,3...)
A_i: wall surface area, ft^2 (i =1,2,3...)
T_{i0}: surround area temperature (room or outside design air temperature) (i =1,2,3...)
Q_r: heat load in the MCR, 42,200 Btu/h
(i: means the number of walls)

i (wall No.)	U x A	T_0	U x A x T_0
1	140	105	14700
2	240	78	18720
3	140	115	16100
4	240	79	18960
5	440	105	46200
6	440	95	41800
Σ (U x A x T_0)			156480

Therefore,

Ts = (42200 + 156480) / 1647 = 120.63, USE 121°F

All MCR instrumentation, controls and alarms are qualified to operate at SBO event.

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

06/19/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.327-2401 REVISION 1**
SRP SECTION:	**09.04.01 – Control Room Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD FSAR Section 9.4.1**
DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO. : 09.04.01-5

The staff finds the applicant's response for RAI #63-849/Question No.09.04.01-14 as incomplete.

The Staff has the following questions/concerns with the applicant's response:

(a) Note 1 of applicant's response reads "Heat Load of each area is assumed based on existing plant experience".

The head loads in each area need to be specified in the FSAR and need to be verified prior to operation. Please include in the FSAR the design basis heat loads and propose a ITAAC and a startup test to verify the actual heat load are bounded by the analysis.

(b) The Staff requests access to heat load calculations that provide the quantitative numbers for Outdoor Air, Fan Motor etc. in the applicant's response. The staff needs this access to perform of confirmatory calculations to support write up of the SER.

(c) The "Note" that follows the second Table of the applicant's response reads "Each cooling load includes a margin of 15%" By this Note it appears that the actual heat load for the MCR AHUs equals 274,550 Btuh and the "Total" 341,000 Btuh then represents an excess margin of 24.2%. Why would the Heat Load values used in the derivation of needed fan capacities (i.e. first Table of applicants response) not use 341,000 Btuh instead of 236,000 Btuh (i.e. 131,000 + 105,000) to determine needed design flow rates?

From this observation, it appears that the fans may be undersized and not have the 15% margin described in Note 2.

(d) The line item heating coil capacity listed as 45 kW in Revision 0 DCD Table 9.4.1-1 for the Main Control Room AHUs has been removed from the Table in its entirety in Revision 1 of the DCD.

Why is there no line item in Table 9.4.1-1 for the heating coil in Revision 1 of the DCD and designated as a COL information item [i.e. COL 9.4(4)]? If it is not a COL information item, how will the heating coil capacity be determined?

(e) Assuming that the applicant's heat load values of the second Table of the applicant's response numbers are based on design calculations (and not existing plant experience) AND are based on the worst case design basis accident or anticipated operational occurrence (with respect to MCR heat load), does not the 274,550 Btuh then become the "Assumed Heat Load" that needs to be demonstrated in SR 3.7.10.5?

If not, what is the value of the "Assumed Heat Load" that must be demonstrated in SR 3.7.10.5? And, how is this value derived?

ANSWER:

(a) Note1 is deleted in the response for RAI #63-849/Question No.09.04.01-14 because Heat Load of each area is not assumed based on existing plant experience but designed values.

The ITACC to verify the actual heat load is bounded by the analysis has been addressed in MHI's response to RAI No.184 Question No. 14.03.07-26 transmitted by UAP-HF-09166 dated 04/09/2009.

(b) The heat load evaluated for Outdoor Air, Fan Motor etc is calculated by following formula. The following heat loads indicate the 100% cooling requirements for the MCR AHUs except for Fan Motor. These are designed as four 50% capacity supply system. Therefore, the cooling requirements per AHU will be in half.

Outdoor Air:

$q=60 \times \rho \times Q \times Dh \times 1.15=124,821$ BTU/h

Therefore, Outdoor Air load per unit is 62,411 (=q/2), USE 63,000 BTU/h

where,

q : Outdoor air load (BTU/h)
ρ : Density (0.075 lb/ft^3)
Q : Supply airflow rate (1800 CFM)
Dh : enthalpy change (13.4 BTU/lb)

Fan Motor :

$q=2545 \times 0.000157 \times H \times Q / (\eta_f \times \eta_m) \times 1.15=58,349$, USE 59,000 BTU/h

where,

q : Fan motor load (BTU/h)
H : Fan motor total pressure (8.0 in. of water)
Q : Fan flow rate (10,000 CFM)
η_f : Fan efficiency (0.7)
η_m : Motor efficiency (0.9)

Room Internal Load :

$q= (q_1+q_2+q_3+q_4) \times 1.15=235,060$ BTU/h

Therefore, Room Internal Load per unit is 117,530 (=q/2), USE 118,000 BTU/h

where,

q : Room Internal load (BTU/h)
q_1 : Component (45,200 BTU/h)

q_2 : Lighting (67,600 BTU/h)
q_3 : People (9,100 BTU/h)
q_4 : heat load through the concrete walls (82,500 BTU/h)

Moisture :

$q=60 \times \rho \times Q \times \Delta h \times 1.15=165{,}600$ BTU/h

Therefore, Moisture load per unit is 82,800 (=q/2), USE 83,000 BTU/h

where,

q : Moisture load (BTU/h)
ρ : Density (0.075 lb/ft^3)
Q : Room internal flow rate(AHU flow rate) (20,000 CFM)
Δh : enthalpy change (1.6 BTU/lb)

(c) The cooling coil capacity was originally calculated in the early stages of design. Then each heat load capacity changed during detailed design, but the cooling coil capacity was kept constant to be conservative. So the total heat load that the MCR AHUs remove by the cooling coil equals 341,000 Btu/h.

(d) The heating capacity and cooling capacity is calculated by the component heat load and the outside air condition. The design minimum ambient air temperature for the standard plant design (i.e. -40F;for safety-related HVAC system) is the extreme condition. Therefore, the heating capacity changes significantly according to the minimum design outside air condition. So MHI considers that the heating coil capacity in Revision 1 of the DCD is a COL information item as site-specific. The COL information item is also specified in Revision 1 of the DCD Subsection 9.4.1.2.

(e) The heat load values are calculated on the condition that the design condition is the worst case condition. The cooling coil capacity is designed 341,000 Btu/h in the light of the margin. So MHI consider that the values should be confirmed in SR.3.7.10.5 is 341,000 Btu/h that is the cooling coil capacity.

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

06/19/2009

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Docket No. 52-021

RAI NO.:	**NO.327-2401 REVISION 1**
SRP SECTION:	**09.04.01 – Control Room Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD FSAR Section 9.4.1**
DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO. : 09.04.01-6

The staff finds the applicant's response for RAI #63-849/Question No.09.04.01-18 as incomplete. In its response to Question No. 09.04.01-18, the applicant referred to its responses for RAI No. 5 Question No. 08.03.01-2 and RAI No. 5 Question No. 08.03.01-3. The staff has reviewed the applicant's responses to RAI No. 5 Question No. 08.03.01-2 and RAI No. 5 Question No. 08.03.01-3. With these two responses, the applicant takes credit for the statistics based on the fleet history of the AACs.

The operating reliability for each AAC (i.e. at each COL applicant's new nuclear site) can and will vary significantly based on the skills and the maturity level of the each nuclear plant's Operations and Maintenance staff. To invoke fleet history in the derivation of an AAC predicted reliability is meaningless in the licensing of each new nuclear plant.

Based on this, the staff repeats the bases and the principle questions of its original request for additional information in Question No. 09.04.01-18.

The DC applicant takes credit for one-hour restoration of power via the AAC. Per Regulatory Guide 1.155 (i.e. criteria #5 of Section 3.3.5) to take credit for the one-hour alignment of the AAC, the reliability of the AAC power system should meet or exceed 95 percent as determined in accordance with NSAC-108 (Ref. 11) or equivalent methodology. To date, the DC applicant has not demonstrated this reliability. Neither Section 2.6.5 "Alternate AC (AAC) Power Source" nor its related Table 2.6.5-1 of Tier 1 ITAAC testing requirements, contains the acceptance criteria that guarantee the site specific AAC reliability.

Without a guaranteed site specific AAC reliability of > 95%, the coping duration will become the basis for the environmental qualification of MCR electrical controls and instrumentation during the SBO event. To what worst case ambient conditions (i.e. temperature and humidity) are the instrumentation and controls within the MCRE qualified. What is the qualified life of the CRE instrumentation and controls for those conditions?

ANSWER:

Table 2.6.5-1 of Tier 1 is revised to add ITAAC item for guaranteeing the installation of the AAC with a reliability of > 95%.

Required qualified life of the CRE instrumentation and controls is one-hour as required by RG 1.155.

Impact on DCD

Table 2.6.5-1 of Tier 1 ITAAC will be revised to add the following ITAAC item:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. The reliability of the AAC power sources meet or exceed 95 percent.	7. An analysis of the reliability of the as-built AAC power sources will be performed.	7. The reliability of the as-built AAC power sources meet or exceed 95 percent.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO. : 09.04.01-7

The staff finds the applicant's response for RAI #63-849/Question No.09.04.01-24 as incomplete. The applicant responded with the words:

> "the MCR HVAC system is designed such that each space within the CRE will require a certain amount of airflow to satisfy its design heat load, and that ductwork to each space will be sized accordingly and configured to ensure satisfactory mixing and temperature control. Therefore, balancing of system airflows is done primarily to ensure each space receives its design airflow, with mixing and temperature control occurring by default. Once balancing is done, different modes of operation do not affect the settings."

The staff agrees that for each area within the CRE a certain amount (i.e.design value) of air flow is required to remove the areas design heat load. The applicant has only provided the airflow requirements for the main trunk lines of the MCR HVAC system. While the sizing of the branch line's ductwork aids in the configuration of the design flow to a particular CRE area, the actual flow balancing will be accomplished with the manual adjustment of flows to the area. Each COL applicant will need to know the design flow for each area to flow balance the system. The staff again requests that this design basis information be included in the DCD and a means for demonstrating the design basis be provided.

In addition the staff notes about the applicant's original RAI response that the last sentence of the second paragraph of applicant's RAI Answer reads "MHI to demonstrate or document that exfiltration air shall provide for this minimum pressurization level of the CRE." The intent of this sentence is unclear to the staff. The staff requests clarification.

ANSWER:

The design flow rates to the MCR are 11,000cfm and the design flow rates to the other room (i.e. file room, shift supv.room, conference room, break room kitchen and restroom) are 9,000cfm.

"MHI to demonstrate or document that exfiltration air shall provide for this minimum pressurization level of the CRE." means that "MHI is going to demonstrate that the system provide for maintaining the design minimum positive pressure (0.125 inch w.g.) corresponding to a minimum of design exfiltration air.

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.

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DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO. : 09.04.01-8

The staff finds the applicant's response for RAI #63-849/Question No.09.04.01-27 as insufficient.

With respect to the subject of assumed heat load, refer also to the followup request for additional information to RAI #63-849/Question No. 09.04.01-14 (question 4 of this RAI).

The term "assumed heat load" is neither meaningless nor confusing as the applicant implies in their response to Question No. 09.04.01-14. The term assumed heat load is defined in the Bases from NUREG-1431 for SR 3.7.11.1 and is captured below.

Each and every train of the MCR HVAC system must be demonstrated capable of removing ≥ 50% of the "assumed heat load" during acceptance testing in order to meet its design safety related function.

The applicant states in its response that the *"Acceptance testing can only be verified by running the system (with the required minimum number of AHUs operating) to see if the system maintains the design set point temperatures."*

The staff believes this form of acceptance testing (i.e. to meet the design set point temperatures -- normal and abnormal temperatures of DCD Table 9.4-1) fails to demonstrate the capability of the MCR HVAC to fulfill its intended design basis safety function.

The Bases from NUREG-1431 for SR 3.7.11.1 reads:

APPLICABLE SAFETY ANALYSES
The design basis of the CREATCS is to maintain the control room temperature for 30 days of continuous occupancy. The CREATCS components are arranged in redundant, safety related trains. During emergency operation, the CREATCS maintains the temperature between [70]° and [85]°. A single active failure of a component of the CREATCS, with a loss of offsite power, does not impair the ability of the system to perform its design function. Redundant detectors and controls are provided for control room temperature control.

The CREATCS is designed in accordance with Seismic Category I requirements. The CREATCS is capable of removing sensible and latent heat loads from the control room, which include consideration of equipment heat loads and personnel occupancy requirements, to ensure equipment OPERABILITY.

The CREATCS satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).z"

"SR 3.7.11.1 SURVEILLANCE REQUIREMENTS
This SR verifies that the heat removal capability of the system is sufficient to remove the heat load assumed in the [safety analyses] in the control room. This SR consists of a combination of testing and calculations. The [18] month Frequency is appropriate since significant degradation of the CREATCS is slow and is not expected over this time
period."

Explain how the COL applicant will demonstrate that the heat removal capability of the system (with adequate redundancy) is sufficient to remove the heat load assumed in the [safety analyses] in the control room. This assumed heat load would be based on worst case site ambient conditions and based on the worst case design basis accident or anticipated operational occurrence (with respect to MCR heat load).

ANSWER:

It is incorrect that *"Acceptance testing can only be verified by running the system (with the required minimum number of AHUs operating) to see if the system maintains the design set point temperatures."* Each and every train of the MCR HVAC system will be demonstrated by a combination of testing and calculations as is written by DCD Ch16. SR 3.7.10.5.

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

06/19/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.327-2401 REVISION 1**
SRP SECTION:	**09.04.01 – Control Room Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD FSAR Section 9.4.1**
DATE OF RAI ISSUE:	**04/08/2009**

QUESTION NO. : 09.04.01-9

The staff finds the applicant's response for RAI #63-849/Question No.09.04.01-32 as incomplete. The incompleteness of the applicant's response exists in two specific areas as captured in (a) and (b) below.

(a) The applicant in its response to Question No. 09.04.01-32 replied with the words:

> "For each GTG, there are two exhaust sources. One is the GTG enclosure ventilation exhaust and the other is the GTG exhaust. There are also two air inlets for each GTG. One is the GTG room's ventilation supply air inlet and the other is a dedicated combustion air supply inlet for the GTG. The closest GTG room ventilation fan exhaust vent is approximately 26 ft. away horizontally from the CRE air inlet. This is well above the minimum of 10 ft. required according to the International Mechanical Code (Section 401.5.1)"

The response fails to provide the distance of the closest GTG exhaust to the CRE fresh air intakes. This exhaust source would contain the products of combustion and would pose more of a threat to Main Control Room habitability than the exhaust source discussed in the applicant's response (i.e. room ventilation fan exhaust vent). The staff requests that the applicant provide the vertical and horizontal distance of the closest GTG exhaust to the CRE fresh air intakes. In addition, since the DCD is using the International Mechanical Code (Section 401.5.1) as its standard for addressing the issue of external threats to main control room habitability and the positioning of the CRE fresh air intakes, then Mechanical Code (Section 401.5.1) should be listed in the references of DCD section 9.4.8 "References"

(b) The staff also notes that the applicant failed to address the issue identified in section 3.11 of Regulatory Guide 1.29 which reads:

> "If the atmosphere surrounding the plant could contain significant environmental contaminants, such as dusts and residues from smoke cleanup systems from adjacent coal-burning power plants or industry, or is a salty environment near an ocean, the design of the system should consider these contaminants and prevent them from affecting the operation of any ESF atmosphere cleanup system."

The staff noted this apparent deficiency in the original Question No.09.04.01-32 when it wrote *"... the staff noted that since the sighting of a power plant could impact the positioning of the fresh air intakes due local industry (e.g. coal-burning power plants) the wording of COL 9.4.1 (sic) appears to be too limiting."* COL 9.4(1) in Revision 0 of the US APWR DCD read *"COL 9.4(1) The COL Applicant is to provide proper MCR personnel protection against toxic gases if warranted by a site specific chemical survey."*

Revision 1 of the DCD deleted COL 9.4(1) for reasons unknown to the staff.

The staff requests that the applicant address the original concern (i.e. the design of the system should consider these contaminants) of section 3.11 of Regulatory Guide 1.29 as captured in Question No. 09.04.01-32. The staff also requests information as to why the applicant deleted COL 9.4(1) from Revision 1 of the US-APWR DCD.

ANSWER:

(a) The CRE air inlets are located on the east and west wall at elevation in between 50'-2" & 65'-0" in the reactor building (R/B). For reference, see Figure 6.4-5 and 6.4-6 of DCD Section 6.4. There are no potential sources of stored hazardous materials, which can enter the CRE through the two air inlet locations. As recommended by RG 1.78, the storage areas of hazardous chemicals (that include ammonia or organic amines, and hydrazine) are sited at a distance greater than 330 ft. from the air inlets of the CRE (Refer to DCD Subsection 6.4.4.2.).

The closest potential source of fresh air contamination is the exhaust from the Emergency Gas Turbine Generators (GTGs) in the power source buildings (PS/Bs) located adjacent to the R/B along the east and west walls. There are three GTGs in each PS/B. The roofs of the PS/Bs are at elevation 39'-6". For each GTG, there are two exhaust sources. One is the GTG room ventilation exhaust and the other is the exhaust from the GTG. There are also two air inlets for each GTG. One is the GTG room's ventilation supply air inlet and the other is a dedicated combustion air supply inlet for the GTG. The GTG room ventilation exhaust vent is the closest to the CRE air inlet. The GTG exhaust is further away. The horizontal distance of the closest GTG exhaust to the CRE fresh air intakes is 26 feet and the vertical distance is 1 foot below. And the horizontal distance of the closest GTG room ventilation fan exhaust vent to the CRE fresh air intakes is 72 feet and the vertical distance is 1 foot. This is well above the minimum of 10 ft. required according to the International Mechanical Code (Section 401.5.1). This is sufficient to prevent any GTG room ventilation exhaust air and GTG exhaust from entering the supply air inlet for the CRE. The appropriate distances will be maintained between the exhausts discharge points and supply air inlets for the GTG and GTG room to prevent short circuiting of the exhaust into the supply air inlet.

(b) Regulatory Guide 1.52 (not RG 1.29) "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants" recommends that the air intakes for all ESF atmosphere cleanup systems be designed such as to prevent adverse effects from any environmental contaminants. As stated in Section 9.4.1, the Main Control Room HVAC System is compliant with Regulatory Guide 1.52. A full compliance matrix of US-APWR design features which meet RG 1.52 is presented in Section 6.4, Table 6.4-2 "Main Control Room Emergency Filtration System." Included in the safety design bases for the MCR HVAC system is the capacity to withstand the effects of adverse environmental conditions. However, this design requirement will be made more specific in order to encompass the requirements for air intake placement according to RG 1.52. A COL item 6.4(1) addresses, the design and location of air intakes for the MCR HVAC System in case the presence of any potential environmental contaminants following a site-specific survey of local industry and environmental conditions.

In order to avoid duplication of COL 9.4(1) with COL 6.4(1), COL 9.4(1) is deleted from DCD Revision 1. COL 9.4.(1) & COL 6.4.(1) are same or have similar meaning.

COL 6.4(1) in Revision 1 of the USAPWR DCD read "The COL Applicant is responsible to provide details of specific toxic chemicals of mobile and stationary sources within the requirements of RG 1.78 (Ref 6.4-4) and evaluate the control room habitability based on the recommendation of RG 1.78 (Ref 6.4-4).

Impact on DCD

International Mechanical Code (Section 401.5.1) will be listed in the reference DCD section 9.4.8 as following:

"9.4.8-23 International Mechanical Code, 2003 Edition."

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.