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July 17, 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-09385

Subject: MHI's Responses to US-APWR DCD RAI No.355-2492 Revision 1

References: 1) "Request for Additional Information No.355-2492 Revision 1, SRP Section: 09.04.03 – Auxiliary and Radwaste Area Ventilation System, Application Section: DCD Tier 2 Section 9.4.3" dated May 7, 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.355-2492 Revision 1".

Enclosed are the responses to 6 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. 355-2492, Revision 1

CC: J. A. Ciocco
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NRO

Contact Information

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Enclosure 1

UAP-HF-09385
Docket Number 52-021

Responses to Request for Additional Information No. 355-2492,
Revision 1

July, 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

07/17/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.355-2492 REVISION 1**
SRP SECTION:	**09.04.03 –Auxiliary and Radwaste Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD Sections 9.4.3**
DATE OF RAI ISSUE:	**05/07/2009**

QUESTION NO. : 09.04.03-2

The staff finds the applicant's response for RAI #68/Question No. RAI 9.4.3-4 as incomplete. In evaluating the applicant's response to Question No. RAI 9.4.3-4, the staff finds that the statement "...The charging pumps transfer purified water from CVCS purification loop or makeup water from other system, and does not transfer highly radioactive water from RCS under design basis accident. ..." contradicts information contained elsewhere in the DCD. In particular, the staff found that Figure 12.3-1 (Sheet 4 of 34) indicates that the charging pump rooms are located in radiation Zone VII which will receive dose rates of up to 10 rem/hour during normal and shutdown operations. While not nearly as severe with respect to dose, Figure 12.3-1 (Sheet 10 of 34) indicates that the Annulus Emergency Exhaust Filtration Units are located in radiation Zone III (i.e. maximum dose rates up to 2.5 mrem/hour). DCD section 12.3.2.2.3"Reactor Building Shielding Design" reads:

"During normal operations, the major components in the reactor building that contain radioactivity are the RHR, containment spray, safety injection, and charging systems. Under accident conditions, these will contain high levels of radioactivity. ..."

That staff requests that the applicant provide additional information to explain these DCD contradictions and to amend the DCD as appropriate.

ANSWER:

The charging pumps provide the capability for transferring makeup water to the RCS from the volume control tank, and potentially other sources, if necessary. The letdown water is treated by CVCS filters and demineralizers to remove most of the radioactive nuclides, then, is sent to the volume control tank. The charging pump does not perform an ECCS function, but this pump is expected to keep the same radioactive material as contained during normal operation. However, the radiation level of this pump is much smaller than that of the recirculation water in accident condition. The CVCS can be used following an accident, but this system is not operated when high containment radiation levels exist. DCD section 12.3.2.2.3 will be revised as shown in "Impact on DCD" below.
The Annulus Emergency Exhaust Filtration Units are not used during normal operating condition, and do not contain radioactive material during normal operating condition. Therefore, the Annulus Emergency Exhaust Filtration Units are located in radiation Zone III during normal operation (See Figure 12.3-1).

Impact on DCD

The statement in the 1st paragraph in Section 12.3.2.2.3 will be revised to read;

"During normal operations, the major components in the reactor building that contain radioactivity are the RHR~~, containment spray, safety injection,~~ and charging systems. Under accident conditions, ~~these~~ the RHR, containment spray and safety injection systems will contain high levels of radioactivity because these system will be used following an accident. Charging systems will not be used following an accident, but will be expected to continue to contain same radioactive material as contained during normal operation. Shielding is provided for each piece of equipment consistent with its postulated maximum activity (Section 12.2 of this chapter) and with the access and zoning requirements of the adjacent areas (see Figure 12.3-1)."

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

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Docket No. 52-021

RAI NO.:	**NO.355-2492 REVISION 1**
SRP SECTION:	**09.04.03 –Auxiliary and Radwaste Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD Sections 9.4.3**
DATE OF RAI ISSUE:	**05/07/2009**

QUESTION NO. : 09.04.03-3

The staff finds the applicant's response for RAI #68/Question No. RAI 9.4.3-8 as incomplete. The applicant's response to Question No. RAI 9.4.3-8 invoked a passage from SRP 9.4.3, Technical Rationale, 3 (mislabeled as "5" in the applicants response) which states: "*Meeting the GDC 60 requirements provides assurance that release of radioactive materials entrained in gaseous effluents will not exceed the limits specified in 10 CFR Part 20 for normal operation and anticipated operational occurrences.*" From this passage, the applicant concluded "Therefore, MHI believes that the annulus emergency exhaust system is not required to meet the 10 CFR 20". The two accidents cited by the applicant as the basis for this conclusion were the "postulated accidents" of "Fuel Handling Accident" and "Spectrum of Rod Ejection Accidents". For these two "postulated accidents" the guideline limit of 25 Rem identified in 10 CFR 50.34 governs. To invoke the limitations of 10 CFR 20 with respect to a "postulated accident" in the applicant's conclusion is erroneous.

It appears that the applicant did not consider the Anticipated Operationa Occurrence (AOO) of small break LOCA outside Containment (Reference DCD section 15.6.2) and its impact on plant personnel access inside the plant in their response to Question No. RAI 9.4.3-8.

SRP 9.4.3 Technical Rationale 1:

> "GDC 2 as related to the system being capable of withstanding the effects of earthquakes requires that SSCs important to safety be designed to withstand the effects of a design basis earthquake without loss of capability to perform their safety functions.
>
> The function of the ARAVS is to maintain ventilation, to permit personnel access, and to control airborne radioactivity in the auxiliary and radwaste areas during normal operation and anticipated operational occurrences and during and after postulated accidents, including loss of offsite power. This requirement ensures that in the event of a design-basis earthquake, essential portions of the ARAVS will remain functional and the failure of any nonessential portion of the system or of other systems not designed to seismic Category I standards will not result in offsite doses in excess of 5 mSv (0.5 rem) to the whole body or an equivalent dose to any part of the body.
>
> Meeting the GDC 2 requirements provides assurance that the ARAVS will operate as designed, thus protecting against release of radioactivity in excess of regulatory limits."

The applicant noted in their response to Question No. RAI 9.4.3-8 that the Auxiliary Building HVAC system is not used in postulated accidents. The applicant's response does not address the airborne

activity concentrations that would be present in the plant during a small break LOCA outside the Containment. As Chapter 15 notes the EAB dose is 2.5 Rem. Dose values for plant personnel in areas where sweeping ventilation is not present could exceed 10CFR20 occupational dose limits.

An ESF signal is not necessarily available for a SBLOCA outside the Containment in the Auxiliary Building, as would happen for a sample line or CVCS line break in the Auxiliary Building. There is no discussion of the dose consequences for that configuration, because the applicant apparently considered it bounded by the LBLOCA. The applicant needs to show the in plant airborne concentrations for the SBLOCA outside the PC, and the MCR, TSC or EAB dose (which ever is the most limiting).

Based on the requirements of SRP 9.4.3 Technical Rationales 1 & 3, the staff requests that the applicant redress their response to Question No. RAI 9.4.3-8.

ANSWER:

The small break LOCA outside Containment, as evaluated in DCD Section 15.6.2 for the specific bounding case of a reactor coolant system sample line break with critical flow at normal operating reactor enthalpy conditions at the break location, should properly be considered as a Postulated Accident (PA) rather than an anticipated operational occurrence (AOO). Only minor seepage rather than any type of "break" flow would be considered on a frequency of occurrence basis as an AOO, consistent with the statements in DCD Section 15.0.0.1. Standard Review Plan (SRP) 15.0.3 on "Design Basis Accident Radiological Consequences of Analyses for Advanced Light Water Reactors" properly states the Acceptance Criteria for this event as 10 percent of 10 CFR 50.34 (a)(1) exposure guideline values, as utilized by MHI in DCD Tables 15.0-7. SRP 15.0 on "Introduction - Transient and Accident Analyses" confirms the continued validity (as of its March 2007 Revision 3 date) of the frequency of occurrence basis for categorization of initiating events. However, SRP 15.0 does not define the specific Acceptance Criteria for small break LOCA events, and therefore the Acceptance Criteria limits for this event as stated above from SRP 15.0.3 are considered applicable. Any potential impact of this event on plant personnel access inside the plant is not included in these SRP 15.6.2 considerations.

This position is consistent with the current evaluations of other DCD applicants.

Accordingly, MHI will revise the DCD Tier 2 Table 15.0-1 Section 15.6.2 Category for this accident and Subsection 15.6.2.1 second paragraph to indicate the event is a PA rather than an AOO. This will have no effect on the balance of Section 15.6.2, including the conservative assumptions relevant to the question regarding "no credit for depletion or filtration" of the assumed releases.

This response supercedes the previous response for RAI # 68/Question Number RAI 9.4.3-8.

Impact on DCD

MHI will revise the DCD Tier 2 Table 15.0-1 Section 15.6.2 Category from "AOO" to "PA", and Subsection 15.6.2.1, second sentence first paragraph and second paragraph to read;

The cause may be a break~~leak~~ in the instrument, sample, or chemical and volume control system (CVCS) letdown lines due to manufacturing defect, corrosion, or maintenance activities.

This event is classified as a postulated accident (PA) ~~an anticipated operational occurrence (AOO)~~. Minor leakage such as seepage is classified as an anticipated operational occurrence (AOO) that would be detected and corrected by normal plant surveillance and maintenance programs prior to any significant radiological considerations for the plant or off-site, and is not considered as a "break" condition evaluated per SRP 15.6.2. Event frequency conditions are described in Section 15.0.0.1.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

07/17/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.355-2492 REVISION 1**
SRP SECTION:	**09.04.03 –Auxiliary and Radwaste Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD Sections 9.4.3**
DATE OF RAI ISSUE:	**05/07/2009**

QUESTION NO. : 09.04.03-4

The staff finds the applicant's response for RAI #68/Question No. RAI 9.4.3-9 as incomplete. The Auxiliary Building Ventilation System has the function of providing dilution flow for the effluent of the GWMS so that releases (i.e. from the plant) of radioactive gases are below the concentration limits of 10 CFR 20. This design basis function is not captured under the "Key Design Features" attributes of DCD Tier 1 subsection 2.7.5.4.1.1. The staff requests additional clarification on why Tier 1 subsection 2.7.5.4.1.1 "Key Design Features" should not include this system attribute.

ANSWER:

Design capabilities to control gaseous waste releases are described in DCD Tier 1 Subsection 2.7.4.2, "Gaseous Waste Management System." These capabilities include radiation monitor (monitor is listed in Tier 1 Table 2.7.6.6-1) and isolation of the GWMS discharge in response to a high radiation signal. Programmatic control of gaseous effluent releases, in compliance with 10 CFR 20, is established by the Offsite Dose Calculation Manual (ODCM) and Radioactive Effluent Controls Program, which are described in Technical Specifications 5.5.1 and 5.5.4, respectively. Based on the existing Tier 1 requirements and programmatic controls established by Technical Specifications, MHI did not consider it necessary to include the non-safety related capability of the Auxiliary Building Ventilation System (ABVS) to dilute the gaseous effluent stream prior to release from the plant vent. However, MHI will revise Tier 1 Subsection 2.7.5.4.1.1 to acknowledge this function, as shown below.

Impact on DCD

MHI will revise DCD Tier 1 Subsection 2.7.5.4.1.1 as follows:

Add the following paragraph after the first paragraph under "Location and Functional Arrangement."

"The ABVS exhaust flow is aligned to plant vent stack and is capable of providing dilution flow to gaseous effluent stream prior to release."

Add the following bulleted item after the third bullet item under "Key Design Features:"

"The ABVS has the non-safety related capability of providing dilution flow to the gaseous stream prior to its release from the plant vent stack."

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

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Docket No. 52-021

RAI NO.:	**NO.355-2492 REVISION 1**
SRP SECTION:	**09.04.03 –Auxiliary and Radwaste Area Ventilation System**
APPLICATION SECTION:	**Tier 2 DCD Sections 9.4.3**
DATE OF RAI ISSUE:	**05/07/2009**

QUESTION NO. : 09.04.03-5

The staff finds the applicant's response for RAI #68/Question No. RAI 9.4.3-13 as incomplete. By invoking as written passages from section 9.4.3.4, section 14.2.1.12.1.99, section 14.2.1, and section 14.3.4.8 the applicant provides a comprehensive response with a planned start and an expected finish. What the staff finds as missing in the DCD is the details of the roadmap between start and finish.

The applicant responded to RAI 9.4.3-13 with the words ...

"It implies that proper procedure and test method is employed to establish proper air distribution and path flow capacities for all the areas served by the auxiliary building HVAC system 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. However, in the final design the entire system 'will be balanced' to maintain the consistency of negative pressure.

" The staff notes the obvious, that before procedure and testing can be accomplished that the design must be completed and the design must be installed in the plant. "...sized accordingly and configured..." would normally be part of the DCD for safety related systems. For predominately non-safety-related systems such as the Auxiliary Building Ventilation System that must satisfy the four design bases of DCD section 9.4.3.1.2.1 to satisfy the requirements of maintaining proper building environment and of GDC 60, 10CFR20 and ALARA, the guidance of SRP 9.4.3 is less definitive.

Four design bases of section 9.4.3.1.2.1 include:

- Provide and maintain proper operating environment within the required temperature range (Table 9.4-1) for areas housing mechanical and electrical equipment within the A/B, R/B, PS/B and AC/B during normal plant operation.

- Keep dose levels due to the airborne radioactivity below the allowable values set by 10 CFR 20 by supplying and exhausting sufficient airflow.

- Control exhaust fan airflow continuously and automatically at a predetermined value to maintain a slightly negative pressure in the controlled areas relative to the outside atmosphere and minimize exfiltration from the radiological controlled areas during normal plant operation.

- Maintain airflow from areas of low radioactivity to areas of potentially higher radioactivity.

With respect to the first bullet, the staff posits that in some instances there could be a US-APWR plant located in the extreme northern regions of the United States. In an instance such as this, the NSR Auxiliary Building Ventilation System could be required to keep safety related equipment operable. More specifically, to keep the ambient room temperatures within the design basis operating range for safety-related equipment.

From the applicant's response captured above, the staff has to draw the conclusion that the actual Auxiliary Building HVAC system has yet to be designed with respect to area heat loads, duct layout and sizing, and system plant configuration. Therefore, each and every COL applicant will be left to provide the actual plant design for this system.

a. At a minimum the staff recommends that applicant create a COL action item to capture this expectation and commitment. Alternatively or in addition to, the staff requests that the applicant consider establishing an ITAAC or a Condition for Licensing that provides the guarantee that the COL applicant satisfies the four design bases of section 9.4.3.1.2.1.

The staff also notes that the response to question RAI 9.4.3-13 indicates that the Auxiliary Building is maintained under a constant and slightly negative pressure, as compared to the outside environment, to prevent the uncontrolled leakage of potentially contaminated air to the outside environment. The answer appears to be incomplete in that it does not address:

b. The potential flow from a potentially contaminated area to an unmonitored area due to a pressure differential between the Turbine Building (which has its own ventilation system) and the A/B through the interconnection of the two building via the non-radiological sump drain system as noted on Figure 9.3.3-1.

c. No COL actions are identified regarding methods or process controls that are required to prevent an unmonitored release through the Turbine Building.

d. No ITAAC are present for verifying that an unmonitored release will not occur under credible worst case ventilation balance conditions.

The staff requests the applicant provide a complete response to issues a, b, c & d captured with this follow-up RAI.

ANSWER:

a. US-APWR, DCD, Revision 1, Tier 1, Table 2.7.5.4-2 addresses the Auxiliary Building Ventilation System (ABVS) ITAAC. The capability of the Auxiliary Building Ventilation System to satisfy performance requirements specified in the DCD will be demonstrated during system preoperational testing described in section 14.2.12.
   In addition, US-APWR Section 9.4.3.4 identifies a set of inspection and testing requirements for Auxiliary Building Ventilation System. The Auxiliary Building Ventilation System is designed to facilitate in-service inspections and on-line testing of components and controls in accordance with the following:
   - The 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 Auxiliary Building Ventilation System is performed as described in Chapter 14, Verification Programs, to verify that system is installed in accordance with plans and specifications. All HVAC system airflows are balanced in conformance with the design flow, path flow capacity, and proper air mixing temperature throughout the A/B, R/B and PS/B.

- The 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 Standards. Air filters are tested in accordance with the American Society of Heating, Refrigerating and Air-Conditioning Engineers Standards. Cooling coils are hydrostatically tested in accordance with ASME, Section VIII (Ref. 9.4-14) and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute Standards.
- Air distribution ductwork is leak-tested in accordance with the Sheet Metal Air-Conditioning Contractors' National Association.
- System instruments are periodically calibrated and automatic controls are tested for activation at the design set points, in conformance with the design sequence of operation at all system operating modes.

b. Auxiliary Building is maintained under a constant and slightly negative pressure, as compared to the outside environment, to prevent the uncontrolled leakage of potentially contaminated air to the outside environment. The turbine building area is not expected to include airborne radioactive contamination as described in DCD Subsection 9.4.4.1.1. However pressure differential between the Turbine & Auxiliary building will be minimal. So the interconnection of the two building via the non-radiological sump drain system should not have significant impact.

c. The Turbine Building area is not expected to include airborne radioactive contamination as described in DCD Subsection 9.4.4.1.1. Hence No COL items are needed for unmonitored release through the Turbine Building.

d. US-APWR, DCD, Revision 1, Tier 1, Table 2.7.5.5-1 addresses the Turbine Building Area Ventilation System ITAAC.

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.

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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U US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.355-2492 REVISION 1**
SRP SECTION:	**09.04.03 –Auxiliary and Radwaste Area Ventilation System**
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DATE OF RAI ISSUE:	**05/07/2009**

QUESTION NO. : 09.04.03-6

The staff finds the applicant's response for RAI #68/Question Number RAI 9.4.3-14 as incomplete. The staff notes that the applicant cited Regulatory Guide 1.206 C.I.9.4.3.2 and stated in its response that a design basis and capacity description of the in-duct heaters is not required in the DCD because they are not major components. Section C.I.9.4.3.2 of the RG 1.206 states that the system description should include the system major components, key parameters, essential controls and operating modes.

It is not clear to the staff that the applicant's response is consistent with the DCD, given the fact that revision 1 of the DCD in section 9.4.3.2.1 addresses in the first paragraph a COL action item to determine the capacity of the cooling and heating coils. These same DCD section 9.4.3.2.1 paragraphs 6 and 7 describe the cooling and heating coils.

It appears that a design basis description of these heating and cooling coils is in the DCD and the COL applicant will be required to establish their capacity consistent with DCD revision 1 COL item 9.4(4).

In addition, the applicant's response summarily dismisses these in-duct heaters as not major components. The staff posits that in some instances there could be a US-APWR plant located in the extreme northern regions of the United States. In an instance such as this, the in-duct heaters could be required to keep safety-related equipment operable. More specifically, to keep the ambient room temperatures within the design basis operating range for safety-related equipment. In this case, the NSR in-duct heaters may still not constitute a major electrical load but would be vital to the sustained operation of the plant.

The staff requests that the applicant reconsider its response in light of these staff concerns. The staff requests that the applicant clarify/correct its response to Question Number RAI 9.4.3-14 in regard to the in-duct heating and cooling coil issues.

ANSWER:

MHI consideration is that in-duct heaters that are non-safety related equipment and are locally installed are not major component. Hence, those in-duct heaters are not required to describe in DCD.

On the other hand, A COL item 9.4 (4) determines the capacity of cooling and heating coils that are major component. The major component includes the cooling and heating coils that are installed in air handling unit and safety-related cooling and heating coils even though those are locally installed.

The 7th paragraph of DCD Subsection 9.4.3.2.1 will be revised to describe clearly that the in-duct heaters are only non-safety related and located locally.

Impact on DCD

The 7th paragraph of DCD Subsection 9.4.3.2.1 will be revised as follows;

9.4.3.2.1 Auxiliary Building HVAC System

.....

In winter, the supply air is heated by the air handling unit steam heating coil to maintain the supply air temperature at the design set point. Supplemental heating with local unit heaters or in-duct heaters, that are non-safety related equipment and locally installed, is provided in areas with higher heat loss due to their proximity to exterior walls.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

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DATE OF RAI ISSUE:	**05/07/2009**

QUESTION NO. : 09.04.03-7

The staff finds the applicant's response for RAI #68/Question Number RAI 9.4.3-18 as incomplete. The staff notes that the applicant in their response of the fifth bullet indicated that the, "...AHUs will be design to preclude internally generated missiles from the AHU fans if safety related components are located within the vicinity of the two AHUs." However, the applicant did not commit to revising the DCD to include this requirement. The staff recommends that that the applicant amend DCD subsections 9.4.3.1.1.2 and 9.4.3.2.3 and add a Note against the Main Steam/Feedwater piping area air handling unit fans in Table 3.2-2 (Item 41) to establish this requirement.

ANSWER:

Pursuant to previous response to RAI, and follow up answer to this RAI, modifications will be made to DCD Subsection 9.4.3.2.3 (Not 9.4.3.1.1.2, as this Subsection relates to Non-Class 1E Electrical Room HVAC System) to include a description of the Main Steam/Feedwater Piping Area HVAC System AHUs housings that are resistant to penetration of internally generated missiles.

Impact on DCD

Revise Subsection 9.4.3.2.3, Main Steam/Feedwater Piping Area HAVC System by adding a third bullet as follows:

The AHUs will be design to preclude internally generated missiles from the AHU fans if safety related components are located within the vicinity of the two AHUs.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.