**MITSUBISHI HEAVY INDUSTRIES, LTD.**
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**TOKYO, JAPAN**

Septembre 4, 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-09440

**Subject:** MHI's Response to US-APWR DCD RAI No.425-3264 Revision 1

**References:** 1) "Request for Additional Information No.425-3264 Revision 1, SRP Section: 12.03-12.04 – Radiation Protection Design Features, Application Section: 9.4, 12.3" dated July 27, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Response to Request for Additional Information No.425-3264 Revision 1".

Enclosed is the response to one RAI contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

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

Enclosure:

1. Response to Request for Additional Information No. 425-3264, Revision 1

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-09440
Docket Number 52-021

Response to Request for Additional Information No. 425-3264,
Revision 1

September, 2009

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**09/04/2009**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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|---|---|
| **RAI NO.:** | **NO.425-3264 REVISION 1** |
| **SRP SECTION:** | **12.03-12.04 – Radiation Protection Design Features** |
| **APPLICATION SECTION :** | **Tier 2 DCD SBPA Sections 9.4, 12.3** |
| **DATE OF RAI ISSUE:** | **07/27/2009** |

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**QUESTION NO. : 12.03-12.04-21**

Supplemental RAI for USAPWR DC FSAR Sections 12.2.2 and 12.3.3

1. Justify the HVAC System SSC as Described in USAPWR DC FSAR Section 9.4 Applicable to 10 CFR 20.1406.

In DC FSAR Chapter 9, describe the design features provided to prevent or mitigate contamination of the environment from the below grade HVAC Systems, Structures or Components (SSC), and contamination of the environment resulting from pressure differentials in the ventilation system associated with normal or expected operation. If design features are not used, provide a description in DC FSAR Chapter 12 of procedures for operations to be used to prevent or mitigate contamination of the environment and provide the associated justification for not incorporating design features.

2. Justify the HVAC System Configuration as Described in USAPWR DC FSAR Section 9.4 Applicable to 10 CFR 20.1406.

In DC FSAR Chapter 9, describe the design features provided to prevent or mitigate contamination of the environment resulting from equipment configurations such as; 1) the placement of HVAC inlets to prevent contamination by flooding, 2) the provision of moisture or resin traps on tank and vents prior to connection the HVAC system duct, 3) design configuration of system components to minimize the potential for contamination transport resulting from switching ventilation modes, and 4) contamination due to filter element failure. If design features are not used, provide a description in DC FSAR Chapter 12 of procedures for operations to be used to prevent or mitigate contamination of the environment and provide the associated justification for not incorporating design features.

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**ANSWER:**

Regulatory Guide 4.21 provides the guidance that is acceptable to the NRC for the implementation of 10 CFR 20.1406 "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning". The following response consolidated in the attached Table 12.03-1C, update Table 12.03-1C of RAI #91-1496 / Question Number 12.03-12.04-2, is based

on the above question and the regulatory position outlined in section C of RG 4.21 as it applies to DCD Section 9.4 related to the Air Conditioning, Heating, Cooling, and Ventilation Systems.

**Impact on DCD**

Based on the review of the DCD in responding to the question the following DCD sections need to be revised to maintain consistency between sections and for clarity.

1. DCD Subsection 9.4.1.4, the paragraph concerning duct leak testing will be revise as follows:

   "Air distribution ductwork is leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association **(SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Ref. 9.4.8-XX)**, ASME N510 (Ref. 9.4.8-8), **and ASME AG-1 Section SA and TA (Ref. 9.4.8-2).**"

2. DCD Subsection 9.4.3.4, the paragraph concerning duct leak testing will be revise as follows:

   "Air distribution ductwork is leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association **(SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Ref. 9.4.8-XX)**, ASME N510 (Ref. 9.4.8-8), **and ASME AG-1 Section SA and TA (Ref. 9.4.8-2).**"

3. DCD Subsection 9.4.5.4, the paragraph concerning duct leak testing will be revise as follows:

   "Air distribution ductwork is leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association **(SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" (Ref. 9.4.8-XX)**, ASME N510 (Ref. 9.4.8-8), **and ASME AG-1 Section SA and TA (Ref. 9.4.8-2).**"

4. DCD Subsection 9.4.8, the reference section is to be revised to include the following additional references:

   **"9.4.8-xx "HVAC Air Duct Leakage Test Manual" SMACNA Technical Manual"**
   This additional reference is also described on RAI 68 Question No.9.4.3-7.

5. DCD Subsection 9.4.3.1.2.1, the third paragraph is to be revised as follows:

   "Control exhaust fan airflow continuously and automatically at a predetermined value to maintain a slightly negative pressure in the controlled areas **within the A/B, R/B and AC/B** relative to the outside atmosphere. ~~and~~ **This** minimize**s** exfiltration from the radiological controlled areas during normal plant operation."

6. DCD Subsection 9.4.3.2.1, the fifth paragraph is to be revised as follows:

   During normal plant operation, the two air handling units and two exhaust fans are placed into operation. Upon energizing the air handling unit, its isolation dampers automatically open. Upon energizing the two exhaust fans, their airflow is continuously and automatically controlled at a predetermined value to maintain a slightly negative pressure in the controlled areas **within A/B, R/B and AC/B to minimize exfiltration from the radiologically controlled areas**.

7. DCD Subsection 12.3.1.1.1.2.E "Tanks" - the paragraph is to be revised as follows:

"Whenever practicable, tanks are provided with sloped bottoms and bottom outlet connections. Overflow lines are directed to the waste collection system to ~~control any~~ **minimize the potential for the spread of** contamination within plant structures. ~~Tank vents are hard-piped to heating, ventilation, and air conditioning (HVAC) ducts, not to open room spaces~~ **Tanks containing radioactive fluids have overboard lines at least equal in size to the largest inlet line. The tank vent line is either open to the cubicle or connected directly to the ventilation system. The spent resin tank vents are equipped with a break-pot, which separates the air from the moisture and any entrained resin, which are subsequently sent to the A/B sump, and vents the air to the exhaust ductwork. These measures minimize the possible contamination of the area and the ductwork."**

8. Subsection 12.3.3.3, "Design Features" first bulleted item "Guidelines to minimize airborne radioactivity:" this is to be revised to include the following additional paragraphs:

   **"Ventilation openings, in areas where flooding might occur, are located so that water entry is not possible.**

   **HEPA filters are specified not to fail for at least 20 inches wg differential pressure across them. Ventilation systems containing HEPA filters have fans with static pressure capacities well below 20 inches wg."**

**Impact on COLA**

There is no impact on the COLA.

**Impact on PRA**

There is no impact on the PRA.

Table 12.03-1C Process Auxiliaries

Air Conditioning, Heating, Cooling, and Ventilation Systems

| Objective | | | | System Features | DCD Section Reference |
|---|---|---|---|---|---|
| RG 4.21 | RAI 91 Question 12.03-12.04-2 | | **RAI 425 Question 12.03-12.04-21** | | |
| 1.2 | 1 | Minimize leaks and spills and provide containment in areas where such events may occur. | **1,2** | Design features to minimize leaks<br>- All distribution ductwork is leak-tested in accordance with the Sheet Metal and Air Conditioning Contractors' National Association **(SMACNA) technical manual "HVAC Air Duct Leakage Test Manual"** and American Society of Mechanical Engineers, ASME N510, **AG-1 Section SA and TA**.<br>- All **non-safety related** ductwork located in areas containing safety related components (Reactor Building, the Fuel Handing Area and the Power Source Building) ~~will~~ **shall** be designed to seismic category II. ~~and~~ **They** will remain intact and functional **and prevent interaction with safety-related SSC's in these areas**.<br><br>Design features to provide containment<br>- The penetration areas and the safeguard component areas **supply and exhaust ductwork** are isolated in order that the operation of the annulus emergency exhaust system **can** maintain~~s~~ a negative pressure and mitigate~~s~~ the release of airborne fission product to the atmosphere.<br>- The auxiliary building HVAC system exhaust discharge duct is isolated in order to prevent backflow of discharge air from the annulus emergency exhaust system into the auxiliary building HVAC system.<br>- The ventilation systems in potentially contaminated areas maintain airflow from areas of low radioactivity to areas of potentially higher radioactivity.<br>- The auxiliary building HVAC system controls exhaust fan airflow continuously and automatically at a predetermined value **higher than the supply fan airflow** to maintain a slightly negative pressure in the controlled areas relative to the outside atmosphere. ~~and~~ **This** minimize**s** exfiltration from the radiological controlled areas during normal plant operation. **The exhaust airflow through the plant's vent stack is a radiologically monitored path.**<br>- Upon receipt of the ECCS actuation signal, the auxiliary building HVAC system discharge duct is automatically isolated by the equipment class 2, seismic category I isolation dampers in order to prevent backflow of discharge air from the annulus emergency | 9.4.1.4<br>9.4.3.4<br>9.4.5.4<br><br>RAI 68-841, question 9.4.3-5<br><br>9.4.3.1.1.1<br><br>9.4.3.1.1.1<br><br>9.4.3.1.2.1<br>12.3.3.3<br><br>9.4.3.1.2.1<br>12.3.3.3<br><br>9.4.3.3.1 |

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| | | | | exhaust system into the auxiliary building HVAC system.<br>- Ventilation ducts are designed to minimize the buildup of radioactive contamination within the ducts.<br>- Air cleaning systems are utilized.<br>- **The HVAC system design facilitates the replacement of the filter elements.**<br><br>Change to DCD<br>**1. Subsection 9.4.1.4, revise the paragraph concerning duct leak testing to include additional references to (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" and ASME AG-1.**<br>**2. Subsection 9.4.3.4, revise the paragraph concerning duct leak testing to include additional references to (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" and ASME AG-1.**<br>**3. Subsection 9.4.5.4, revise the paragraph concerning duct leak testing to include additional references to (SMACNA) technical manual "HVAC Air Duct Leakage Test Manual" ASME AG-1.**<br>**4. Section 9.4.8 the reference section is to be revised to include the following additional references:**<br>• **"HVAC Air Duct Leakage Test Manual" SMACNA Technical Manual**<br>**5. Subsection 12.3.1.1.1.2.E, "Tanks" – The last sentence is to be revised to state: "The vent piping is routed to be sloped upward throughout the run to the HVAC duct as possible where the moisture can be condensed in order to allow the condensed water in the vent piping goes back to the tank and minimizes HVAC duct from contamination. Depending on routing of vent piping, moisture traps and local drain will be provided where such upward piping is not available. Therefore, the piping is designed not to provide moisture traps and local drain. For resin traps, the Spent Resin Storage Tanks (SRSTs) for receiving, staging and transferring spent resin have vents that are equipped with a screen to capture resin fines and routed to a break-pot tank to minimize the potential of water entering the vent header."**<br>**6. Subsection 12.3.3.3, "Design Features" first bulleted item "Guidelines to minimize airborne radioactivity:" this is to be revised to include the following statements:**<br>• **Preventing contamination by having ventilation openings being located so that flood waters would not be able to enter them.**<br>• **Prevent HEPA filter element failure by specifying that the** | 12.3.3.3<br><br>12.3.3.3<br>12.3.1.1.1.2~~E~~<br>**K** |

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| | | | | **HEPA filter not fail for at least 20 inches wg differential pressure across them.**<br><br>The above design approach fully meets the intent of 10 CFR 20.1406 and RG 4.21. The DCD will be changed to document the additional design features. | |
| 1.3 | 2 | Provide for adequate leak detection capability to provide prompt detection of leakage for any structure, system, or component, which has the potential for leakage. | **1,2** | The auxiliary building HVAC system controls exhaust fan airflow continuously and automatically at a predetermined value **higher than the supply fan airflow** to maintain a slightly negative pressure in the controlled areas relative to the outside atmosphere**.** and **This** minimize**s** exfiltration from the radiological controlled areas during normal plant operation. **The exhaust airflow through the plant's vent stack is a radiologically monitored path.**<br><br>Airborne radiation monitors in the exhaust ductwork from areas like the fuel handling area, reactor building controlled areas, auxiliary building controlled areas and access control building areas will alarm in the control room. ~~Then the~~ **The** control room operators will remotely **from the control room manually** isolate the **supply and** exhaust ductwork from the areas as needed and redirect the airflow to the containment low volume purge exhaust system, filters, which are then vented through the plant vent stack, during normal plant operation. **The exhaust airflow through the plant's vent stack is a radiologically monitored path.**<br><br>The above design approach fully meets the intent of 10 CFR 20.1406 and RG 4.21. ~~No change to the DCD is required.~~<br><br>**Change to DCD**<br>7. **Subsection 9.4.3.1.2.1 bulleted item 3 is revised for clarity by identifying controlled areas that are within the A/B, R/B and AC/B.**<br>8. **Subsection 9.4.3.2.1 paragraph 5 is revised for clarity by identifying controlled areas that are within the A/B, R/B and AC/B which are kept negative to minimize exfiltration from these radiologically controlled areas.** | 9.4.3.1.2.1<br>12.3.3.3<br><br>RAI 68-841, Question 9.4.3-4<br><br>**RAI 328-2436, Question 09.04.02-3 See DCD changes to Section 9.4.3.2.1**<br><br>12.3.4.2 |
| 1.4<br>2.2 | 3 | Use leak detection methods (e.g., instrumentation, Automated samplers) capable of early detection of leaks in areas where | | The MCR HVAC system equipment and components are provided with proper access for initial and periodic inspections and maintenance during normal operation.<br><br>The Auxiliary Building, Non-Class 1 E Electrical Room, Main Steam/Feedwater Piping Area, and TSC HVAC systems are designed to provide accessibility to system components for adjustment, | 9.4.1.4<br><br>9.4.3.1.2.1, 9.4.3.1.2.2 9.4.3.1.2.3, |

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| | | it is difficult or impossible to conduct regular inspections (such as for spent fuel pools, tanks that are in contact with the ground, and buried, embedded, or subterranean piping) to avoid release of contamination of the environment. | | maintenance and periodic inspection and testing of the system components to assure proper equipment function and reliability and system availability.<br><br>The ESF ventilation system is designed to provide accessibility to system components for adjustment, maintenance, and periodic inspection and testing of the system components.<br><br>Therefore, there are no areas, where it is difficult or impossible to conduct regular inspections, ~~as described in Objective #3~~ **testing, maintenance and adjustments.** ~~The leak detection capabilities listed in Objective #2 are adequate.~~ | 9.4.3.1.2.4<br><br>9.4.5.1.2<br>**9.4.5.4** |
| 1.5 | 4 | Reduce the need to decontaminate equipment and structures by decreasing the probability of any release, reducing any amounts released, and decreasing the spread of the contaminant from the source. | **1,2** | Upon receipt of the ECCS actuation signal, the penetration and the safeguard component areas are automatically isolated by the equipment class 2, seismic category I isolation dampers in order that operation of the annulus emergency exhaust system maintains a negative pressure and mitigates the release of airborne fission products to the atmosphere. This low probability of release decreases need to decontaminate equipment and structures, and ensures contaminants do not spread from the source.<br><br>The auxiliary building HVAC system controls exhaust fan airflow continuously and automatically at a predetermined value **higher than the supply fan airflow** to maintain a slightly negative pressure in the controlled areas relative to the outside atmosphere. ~~and~~ **This** minimize**s** exfiltration from the radiological controlled areas during normal plant operation. **The exhaust airflow through the plant's vent stack is a radiologically monitored path.**<br><br>**The containment low volume purge system during normal plant operation maintains the pressure inside containment. This air is treated through a HEPA and charcoal adsorber filter and vented through the plant stack, which is a radiologically monitored path.**<br><br>The above design approach fully meets the intent of 10 CFR 20.1406 and RG 4.21. No change to the DCD is required. | 9.4.3.3.1<br>**9.4.5.1.1.1**<br>**9.4.5.2.1**<br>12.3.3.3<br><br>9.4.3.1.2.1<br>9.4.3.2.1<br>12.3.3.3 |