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October 24, 2008

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-08238

Subject: MHI's Responses to US-APWR DCD RAI No.73

References: 1) "Request for Additional Information No.73 Revision 0, SRP Section: 06.05.01 – ESF Atmosphere Cleanup Systems, Application Section: FSAR Sections 6.4, 9.4.5 and 9.4.6" dated September 24, 2008.

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.73 Revision 0".

Enclosed are the responses to 20 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. 73 Revision 0

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

<u>Contact Information</u>

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Docket No. 52-021
MHI Ref: UAP-HF-08238

Enclosure 1

UAP-HF-08238
Docket Number 52-021

Responses to Request for Additional Information No. 73 Revision 0

October 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

10/24/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-1

The second to last paragraph of Tier 2 FSAR Section 6.2.1.7 "Instrumentation Requirements" reads *"Four area radiation monitors are positioned inside the containment. The containment area radiation monitors detect airborne particulate radioactivity in the containment circulating air. High radiation in the containment isolates the containment ventilation and alarms in the MCR."*

Tier 2 FSAR Section 9.4.6 does not identify this important system interlock and interface with the Radiation Monitor System. It follows that Tier 2 FSAR Section 14.2.12.1.69 "Containment Fan Cooler System Preoperational Test" will not test this interlock given the as written acceptance criteria of the preoperational test (i.e. *"The containment fan cooler system operates as described in Subsection 9.4.6."*). What is meant by *"...isolates the containment ventilation"*? By this statement, it appears that containment isolation valves will close. Are containment ventilation fans shut down through this interlock? If so, which ones? The staff requests more information about this interlock.

The staff requests that the DC applicant amend the both Tier 2 Sections 9.4.6 and 14.2.12.1.69 to ensure the testing of this system interlock and system interface during the preoperational test.

ANSWER:

1) In response to: "The second to last paragraph of Tier 2 FSAR Section 6.2.1.7 "Instrumentation Requirements" reads "*Four area radiation monitors are positioned inside the containment. The containment area radiation monitors detect airborne particulate radioactivity in the containment circulating air. High radiation in the containment isolates the containment ventilation and alarms in the MCR.*" Tier 2 FSAR Section 9.4.6 does not identify this important system interlock and interface with the Radiation Monitor System."

The Containment Area Radiation monitors (RMS-RE-91, RMS-RE-92, RMS-RE-93, and RMS-RE-94) are part of the Area Radiation Monitoring System (ARMS) which are described in Chapter 12. The alarm function and control interlock of the monitors is discussed in Subsections

12.3.4.1.1, 12.3.4.1.8, and 12.3.4.1.9. The interlock is associated with containment isolation. The monitors are tested for operability, and the setpoints, control logic, and annunciation are verified as part of the written preoperational testing described in Subsection14.2.12.1.78. The interlocks with the Containment isolation valves are described in 7.3.1.5.6 and illustrated on Figure 7.2-2 Sheet 12 of 21. However the Subsection 9.4.6 will be revised to clarify the system interlocks and interface with the ARMS.

2) In response to: "It follows that Tier 2 FSAR Section 14.2.12.1.69 "Containment Fan Cooler System Preoperational Test" will not test this interlock given the as written acceptance criteria of the preoperational test (i.e. "*The containment fan cooler system operates as described in Subsection 9.4.6.*")."

As indicated in the response **1)** above, the interlock is associated with containment isolation. The Containment Fan Cooler System has no penetrations through the containment. The Containment Purge System does have penetrations through the containment. This is why the following response is related to the Containment Purge System, which consists of the Containment High Volume Purge and Containment Low Volume Purge Systems. The question is only applicable to the Containment Low Volume Purge System because the Containment High Volume Purge System is used only during an outage, as noted in DCD subsection 9.4.6.3.4. Therefore, during normal plant operation, the High Volume Purge System AHU and exhaust fan will not be running and its associated isolation valves are already closed. In addition, during an outage if there is a fuel handling accident in containment the radiation monitors will alarm in the MCR and containment isolation valves are automatically closed It has already been conservatively analyzed in DCD Subsection 15.7.4 that the doses are well within the guidelines values of 10 FCR 50.34.

The Containment Low Volume Purge air handling unit and exhaust fan coincident with the containment isolation valve closure. Changes will be made to Subsection 9.4.6.2.4.1 to include a trip interlock on the Containment Low Volume Purge air handling unit and exhaust fan coincident with the Containment isolation valve closure.

Hence, it is not necessary to modify Subsection 14.2.1.68 "Containment Low Volume Purge System Preoperational Test" because the existing acceptance criterion, Subsection 14.2.12.1.67.1D and Subsection 14.2.12.1.68.1D ensure that it will operate as described in Subsection 9.4.6.

3) In response to: "What is meant by "*...isolates the containment ventilation*"?"

Isolation of the containment ventilation is defined in Section 9.4.6.3.4. The containment isolation valves, shown on Figure 9.4.6-1 Sheet 2/2, are closed within five seconds upon initiation of the containment purge isolation signal. The containment purge isolation function is described in Subsection 7.3.1.5.6. Isolating the Containment Ventilation is executed by closing the Containment isolation valves.

4) In response to: "By this statement, it appears that containment isolation valves will close. Are containment ventilation fans shut down through this interlock? If so, which ones? The staff requests more information about this interlock."

A fan trip interlock coincident with the Containment isolation valve closure will be made to Section 9.4.6.2.1 to include a trip interlock on the Containment Low Volume Purge AHU and exhaust fans coincident with the Containment isolation valve closure.

Impact on DCD

1) Subsection 9.4.6 will be revised to clarify the system interlocks and interface with the ARMS.

2) The last paragraph of Subsection 9.4.6.3.4, Containment Purge System:

"The containment isolation valves for the containment purge system will close within five seconds upon initiation of the containment purge isolation signal (Chapter 7, Section 7.3)."

Will be modified to read as follows:

"The containment isolation valves for the containment purge system will close within five seconds upon initiation of the containment purge isolation signal (Chapter 7, Section 7.3). The containment low volume purge air handling unit and exhaust fan, and containment high volume purge air handling unit and exhaust fan will trip coincident with the isolation valve closure."

3) The third paragraph of Subsection 9.4.6.4, Inspection and Testing Requirements:

"Preoperational testing of the system is performed as described in Chapter 14, Verification Programs, to verify that system is installed in accordance with applicable programs and specifications. All HVAC system airflows are balanced in conformance with the design flow, path flow capacity, and proper air mixing throughout the containment."

Will be modified to read as follows:

"Preoperational testing of the system is performed as described in Chapter 14, Verification Programs, to verify that the system is installed and operates in accordance with applicable programs and specifications. All HVAC system airflows are balanced in conformance with the design flow, path flow capacity, and proper air mixing throughout the containment. The containment low volume purge air handling unit and exhaust fan interlock with the Containment isolation valve closure will be verified as part of the preoperational testing.

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

10/24/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-2

10CFR50 Appendix A General Design Criterion 42 reads *"**Inspection of containment atmosphere cleanup systems.** The containment atmosphere cleanup systems shall be designed to permit appropriate periodic inspection of important components, such as filter frames, ducts, and piping to assure the integrity and capability of the systems."*

General Design Criterion 43 reads *"**Testing of containment atmosphere cleanup systems.** The containment atmosphere cleanup systems shall be designed to permit appropriate periodic pressure and functional testing to assure (1) the structural and leaktight integrity of its components, (2) the operability and performance of the active components of the systems such as fans, filters, dampers, pumps, and valves and (3) the operability of the systems as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the systems into operation, including operation of applicable portions of the protection system, the transfer between normal and emergency power sources, and the operation of associated systems."*

Tier 2 DCD Section 9.4.6 contains no discussion of how the exhaust filtration units of the Containment Low Volume Purge System and the Containment High Volume Purge System satisfy these criteria.

The staff requests that the DC applicant include a discussion in Section 9.4.6 of how these filtration units satisfy the requirements of GDC 42 and 43.

ANSWER:

The Containment Ventilation System is provided to control and maintain the environment temperature and radioactivity concentration within the containment. The only component, which is safety-related, is the containment penetration isolation assemblies.

The Containment Ventilation System does not contain a safety-related Engineered Safety Feature (ESF) atmospheric cleanup system and is therefore not subject to the requirements of 10CFR50 Appendix A GDC 42 and 43. The ESF atmospheric cleanup system of US-APWR contains Containment Spray System (CSS) and Annulus Emergency Exhaust System.

However, good industry and maintenance practices will be applied to the Containment Ventilation System. These practices have been identified in DCD Section 9.4.6.4, 9.4.6.4.4.1 and 9.4.6.4.4.2. It should be noted that these good industry and maintenance practices are incorporated in accordance with GDC 42 and 43.

Section 9.4.6.4 fourth paragraph states that the containment ventilation systems and components are provided with proper access for initial and periodic inspection and maintenance during normal operation. This meets the intent of GDC 42.

Section 9.4.6.4.4.1 and 9.4.6.4.4.2 state that Containment Low Volume and High volume purge system state that the exhaust filtration unit is tested for housing leakage, filter bypass leakage and air flow performance. Periodic and after each filter and adsorber material replacement the unit is inspected and in-place testing is performed on individual component and the unit as a whole in accordance with the requirements of RG1.140, ASME N510, ASME D3803 and ASME AG-1. This also meets the intent of GDC 42.

The Containment Low Volume Purge system is running only during normal operation and during emergency operation (DBA) the Containment Low Volume Purge system is tripped when the Containment is isolated. The Containment High Volume Purge System is running only during refueling operations. These systems serve no safety function and are classified as non safety-related. The filtration units for both systems are located in the Auxiliary Building, which is not a safety-related structure. No credit is taken for the filtration capability of these systems as stated in DCD section 15.7.4 “Fuel Handling Accident”.

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

10/24/2008

US-APWR Design Certification

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APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-3

10CFR50 Appendix A General Design Criterion 61 reads *"**Fuel storage and handling and radioactivity control.** The fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. These systems shall be designed <u>(1) with a capability to permit appropriate periodic inspection and testing of components important to safety, (2) with suitable shielding for radiation protection, (3) with appropriate containment, confinement, and filtering systems</u>, (4) with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal, and (5) to prevent significant reduction in fuel storage coolant inventory under accident conditions."*

The first three design attributes [i.e. (1), (2) and (3)] of GDC 61 applies to the filtration units of the Containment Low Volume Purge System and the Containment High Volume Purge System.

Tier 2 DCD Section 9.4.6 contains no discussion of how the exhaust filtration units of the Containment Low Volume Purge System and the Containment High Volume Purge System satisfy these three attributes during normal power operations or during a refueling operations (e.g. with respect to a Fuel Handling accident within containment.)

The staff requests that the DC applicant include a discussion in Section 9.4.6 of how these filtration units satisfy the requirements of GDC 61.

ANSWER:

GDC 61 does not apply to the Containment purge system as this system does not serve any safety function and is not safety-related. Also GDC 61 must be satisfied during a refueling operation when only the Containment High Volume Purge system is used. The Containment Low Volume Purge system is used only during normal operation, when there are normally no issues with radioactive contamination.

During a refueling operation if there is a fuel handling accident in containment radiation monitors will alarm in the MCR and all containment purge system containment isolation valve are automatically closed. The fuel handling accident analysis found in DCD section 15.7.4 states that no credit is taken for the exhaust filtration capability of the Containment Purge System. The analysis conservatively assumes that all the gases released during the refueling accident will be exhausted out to the atmosphere and the doses are well within the guideline values of 10 CFR 50.34.

Good industry and maintenance practices will be applied to the Containment Ventilation System. These practices have been identified in DCD Section 9.4.6.4, 9.4.6.4.4.1 and 9.4.6.4.4.2.

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:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-4

10CFR50 Appendix A General Design Criterion 64 reads *"Monitoring **radioactivity releases.** Means shall be provided for monitoring the reactor containment atmosphere, spaces containing components for recirculation of loss-of-coolant accident fluids, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents."*

Tier 2 DCD Section 9.4.6 contains no reference to GDC 64. In addition, Section 9.4.6 contains little discussion about the monitoring of the effluents from the filtration units of the Containment Low Volume Purge System and the Containment High Volume Purge System for radiation during normal operations, including anticipated operational occurrences, and from postulated accidents. For example, what interlocks exist between the radiation monitoring instrumentation and the components of the Containment Ventilation System (i.e. any interlocks other than the CIS with Containment Isolation Valves)?

The staff requests that the DC applicant include more discussion in Section 9.4.6 about the system interface between the Radiation Monitoring System and the Containment Ventilation System.

ANSWER:

Radiation monitoring and gaseous releases are discussed in DCD Chapter 11.3 and Chapter 11.5. Specifically, the last three paragraphs of Subsection 11.3.1.4 address the radiation monitoring requirement to meet GDC 64; and the last two paragraphs of Subsection 11.3.2 and Subsection 11.3.4 provide discussions on radiation monitoring controls and the HVAC ventilation system. Subsection 11.5.2.2 provides detailed discussion as to the type and range of the instruments used for radiation monitoring in the containment atmosphere.

The Containment Radiation Monitors (RMS-RE-40 and RMS-RE-41) is provided to measure the radiation level in the containment atmosphere. When radiation inside the containment reaches the high radiation setpoint, the provided interlocks will initiate containment isolation. A Containment Low Volume Purge Radiation Gas Monitor (RMS-RE-23) is provided to examine the radiation level in the containment air purges. If radiation is detected above the setpoint, an alarm is activated for operator actions. Four Plant Vent Radiation Gas Monitors (RMS-RE-21A/B [for normal operation] and RMS-RE-80A/B [for accident condition]) are provided to measure the concentration of radioactive gases in the plant vent stack. Detection of radiation above a predetermined setpoint activates an alarm in the Main Control Room for operator actions and also activates the closure of the discharge valve in order to isolate the plant releases. High volume purge is normally used during refueling operations. Low volume purge is used during normal plant operation. Radiation monitoring during high volume purge and low volume purge are performed through the use of all the radiation monitoring instruments which are discussed in the response above.

As GDC 64 is captured in Chapter 11, change to the DCD or the FSAR Subsection 9.4.6 is not required.

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.

10/24/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

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SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
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DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-5

Tier 2 DCD Section 9.4.6.4 reads *"Air handling units are factory tested in accordance with the 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 and their performance is rated in accordance with the Air Conditioning and Refrigeration Institute Standard."*

The staff requests that the DC applicant provide specific standards for this testing and include these specific references in the Reference section 9.4.8.

ANSWER:

(1) Air handling units are factory tested in accordance with Air Movement and Control Association (AMCA) standards. Currently the AMCA standards for air handing equipment are as follows:

(a) ANSI / AMCA 210-2007 "Laboratory Methods of Testing Fans for Rating"

(b) ANSI / AMCA 230-1999 "Laboratory Methods of Testing Air Circulator Fans for Rating"

(c) ANSI / AMCA 802-2002 "Industrial Process / Power Generation Fans: Establishing Performance Using Laboratory Models"

(2) Air filters are tested in accordance with American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standards. Currently the ASHRAE standards for testing air filters are as follows:

(a) ASHRAE 52.1-1992 "Gravimetric and Dust Spot procedures for Testing Cleaning Devices Used in General Ventilation for Removing Particulate Matter"

(b) ASHRAE 52.2-2007 "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size".

(3) Cooling Coils are tested in accordance with Air Conditioning and Refrigeration Institute (ARI) standards. Currently the ARI standards for testing cooling coils are as follows:

(a) ARI 410-2001 "Forced-Circulation Air-Cooling and Air-Heating Coils"

(b) ARI 430-1999 "Central Station Air Handling Units"

(c) ARI 440-2005 "Performance Rating of Room Fan-coils"

Impact on DCD

Tier 2 DCD Subsection 9.4.6.4, 5th paragraph and Subsection 9.4.8 will be updated in the next revision.

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

10/24/2008

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QUESTION NO. : 06.05.01-1, RAI 6.5.1-6

10CFR50 Appendix A General Design Criterion 2 reads *"**Design bases for protection against natural phenomena.** Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed."*

Tier 2 DCD Section 9.4.6.1 reads *"The containment ventilation system is classified as a non-safety related, non-seismic Category I system. However, ductwork is supported, as required, to prevent adverse interaction with safety-related systems during a seismic event."*

DCD Sections 9.4.6.3.1, 9.4.6.3.2 and 9.4.6.3.3 contain words that indicate that all ductwork of the relevant system is supported in accordance with seismic Category I requirements so as to remain in place during the SSE and to preclude damage to any safety related SSCs. This description appears to fit the definition of Seismic Category II of DCD Section 3.2.1.1.2. DCD Table 3.2-2 (sheets 37 through 39) lists all components of the for the Containment Purge System; Containment Fan Cooler System, the CRDM Cooling System and the Reactor Cavity Cooling System with the exception of containment isolation valves as "NS" (i.e. Non Seismic per DCD Section 3.2.1.1.3). This is conflicting information.

The staff requests that the DC applicant revise the DCD to remove this conflict. The staff also requests that the DC applicant include a detailed discussion in Section 9.4.6 of how the design of the Containment Ventilation System satisfies the guidance of Regulatory Guide 1.29 and GDC 2. In addition, Tier 1 Section 2.7.5.3 "Containment Ventilation System (CVVS)" indicates for each CVVS subsystem under the attribute of "Seismic and ASME Code Classifications" that each subsystem is "...non seismic category ...". These attributes may need to be changed to read "seismic category II" based on the staff's finding above.

ANSWER:

1) In response to:
10CFR50 Appendix A General Design Criterion 2 reads "***Design bases for protection against natural phenomena.*** *Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3)the importance* of the safety functions to be performed. "Tier 2 DCD Section 9.4.6.1 reads "*The containment ventilation system is classified as a non-safety related, non-seismic Category I system. However, ductwork is supported, as required, to prevent adverse interaction with safety-related systems during a seismic event*."DCD Sections 9.4.6.3.1, 9.4.6.3.2 and 9.4.6.3.3 contain words that indicate that all ductwork of the relevant system is supported in accordance with seismic Category I requirements so as to remain in place during the SSE and to preclude damage to any safety related SSCs. This description appears to fit the definition of Seismic Category II of DCD Section 3.2.1.1.2."

It is agreed that the statement in 9.4.6.1 "The Containment Ventilation system is classified as a non-safety related, non-seismic Category I system", though not untrue, it needs clarification. Almost all of the Containment Ventilation System components located inside of the Reactor Building and the Containment should be classified as seismic Category II, except for the Containment penetration and the penetration isolation valves, which are seismic Category I. The Containment Fan Cooler System, the Control Rod Drive Mechanism Cooling System, and the Reactor Cavity Cooling System are almost seismic Category II systems. The Containment Purge System is almost non-seismic category I system. However, ductwork in the Reactor Building is supported, as required, to prevent adverse interaction with safety-related systems during a seismic event. The locations of Containment Fan Cooler System, the Control Rod Drive Mechanism Cooling System, and the Reactor Cavity Cooling System are indicated on Figure 9.4-6-1 Sheet 1/2, and the location of the Containment Purge System is indicated on Figure 9.4-6-1 Sheet 2/2.

Subsections 9.4.6.1, 9.4.6.2.1, 9.4.6.2.2, 9.4.6.2.3, 9.4.6.2.4.1, and 9.4.6.2.4.2 will be modified to clarify the statements regarding the seismic category. In addition, Subsections 9.4.6.3.1, 9.4.6.3.2, 9.4.6.3.3, and 9.4.6.3.4 will be modified to include the correct seismic category of the components as defined in Subsection 3.2.1.1.

2) In response to:
"DCD Table 3.2-2 (sheets 37 through 39) lists all components of the for the Containment Purge System; Containment Fan Cooler System, the CRDM Cooling System and the Reactor Cavity Cooling System with the exception of containment isolation valves as "NS" (i.e. Non Seismic per DCD Section 3.2.1.1.3). This is conflicting information. The staff requests that the DC applicant revise the DCD to remove this conflict."

It is agreed that clarification is needed and that almost of the components inside Containment listed as 'NS' under item 32, "Containment Fan Cooler System", item 33, "Control Rod Drive Mechanism Cooling System", and item 34 "Reactor Cavity Cooling System, should be changed to 'II' in the seismic category column of Table 3.2-2.

As discussed in 1) above, almost of the components of the "Containment Purge System", item 31, are classified as NS, , excluding the Containment isolation valves and penetration piping, which are seismic Category I. Notes will be added to item 31 to separate the ductwork and dampers that are seismic Category II (ductwork/dampers that is required to prevent adverse interaction) versus seismic Category NS (ductwork/dampers).

3) In response to:
"The staff also requests that the DC applicant include a detailed discussion in Section 9.4.6 of how the design of the Containment Ventilation System satisfies the guidance of Regulatory Guide 1.29 and GDC 2."

Subsections 9.4.6.1, 9.4.6.3.1, 9.4.6.3.2, 9.4.6.3.3, and 9.4.6.3.4 will be modified to include the correct seismic category of the components as defined in Subsection 3.2.1.1 as well as a discussion of how the guidance of Regulatory Guide 1.29 is followed in compliance with GDC 2 of Appendix A to 10CFR Part 50. Regulatory Guide 1.29 and Appendix A to 10CFR Part 50 will also be added to the list of References at the end of Section 9.4.

4) In response to:
"In addition, Tier 1 Section 2.7.5.3 "Containment Ventilation System (CVVS)" indicates for each CVVS subsystem under the attribute of "Seismic and ASME Code Classifications" that each subsystem is "...non seismic category ...". These attributes may need to be changed to read "seismic category II" based on the staff's finding above."

It is agreed that the majority of the Containment Ventilation components listed in Subsection 2.7.5.3 of Tier 1 of the DCD should be classified as seismic Category II. Almost all of the Containment Ventilation System components located inside of the Containment should be classified as seismic Category II, except for the Containment isolation valves, which are Seismic Category I. Almost all of the Containment Ventilation System components located inside of the Reactor Building and the Auxiliary building should be classified as NS.

Impact on DCD

The relevant DCD section will be revised to reflect modifications as stated above.

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

10/24/2008

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DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-7

Tier 2 DCD Figure 9.4.6-1 Containment Ventilation System Flow Diagram (2 of 2) displays an arrow from another drawing labeled as "VAS" providing flow to the A/B Containment Low Volume Purge Exhaust Filtration Units. DCD Section 9.4.6 does not provide an explanation for this system interface.

The staff requests that the DC applicant provided additional information in the DCD about this system interface and amend the DCD to reflect this information.

ANSWER:

Information pertaining to the system interface between the Auxiliary Building HVAC System and the Containment Low Volume Purge System will be added to Subsection 9.4.6.2.4.1.

Impact on DCD

Subsection 9.4.6.2.4.1 "Containment Low Volume Purge System" will have the following sentence added:

"The ductwork from the Auxiliary Building HVAC System is connected to the Containment Low Volume Purge System. Local exhaust duct radiation monitors from various areas (Fuel Handling Area, Reactor Building, Auxiliary Building, and Access Control Building) alarm in the MCR. This allows operators to manually isolate that portion of the Auxiliary Building HVAC System receiving an alarm and divert the exhaust airflow to the Containment Low Volume Purge Exhaust Filtration Unit. This minimizes the potential spread of radioactive contamination for the areas serviced by the Auxiliary Building HVAC System."

(See response to RAI 9.4.3-1)

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

10/24/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-8

GDC 60 requires provisions to be included in the design to ensure suitable controls on the release of radioactive materials in gaseous effluents during normal reactor operation, including anticipated operational occurrences. Three methodologies of satisfying this criterion include:

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

Upon review of the Control Rod Drive Mechanism Cooling System in Tier 2 DCD section 9.4.6, it appears that the first two methodologies are effectively employed. However, the design of the system appears to do just the opposite of the third methodology as displayed on Figure 9.4.6-1 (sheet 1 of 2). More specifically, it directs air from an area of potentially higher radioactivity to an area of lower radioactivity. The area around the control rod drive mechanisms on top of the reactor vessel would appear to be an area that is potentially highly contaminated and could receive high dose rates during power operations.

The staff requests that the DC applicant provide additional information about the design of this ventilation system around the CRDMs with respect to the issue preventing the spread of radioactive contamination throughout containment.

ANSWER:

The Control Rod Drive Mechanism area on top of the reactor head receives radiation shine from the power operation. The reactor head area is generally clean; given the seals maintain their integrity. A stream of air is drawn through the CRDM shroud, over the CRDM, through the leaktight ductwork, through the cooling coil and then discharged by the fan to the containment atmosphere. The stream of air removes the heat dissipated from the CRDM and transfers it to the non-essential chilled water system. The cooled air is discharged by fan into the containment atmosphere. The stream of air also sweeps the shroud to remove any accumulation of stagnant air that may be contaminated.

General Design Criterion 60 addresses the control of releases of radioactive materials to the environment. It requires that "the nuclear power unit design shall include means to control suitably the release of radioactive materials in gaseous and liquid effluents..." The radioactivity which is transferred by the CRDM Cooling System into the containment atmosphere is released into a sealed volume, not into an effluent stream. The Containment Purge System is included in the Containment Ventilation System with the design bases of maintaining low concentrations of radioactivity in the containment atmosphere to allow access during maintenance and inspection activities and of providing relief from pressure build-up caused by instrument air leakage and containment temperature fluctuations. The Containment Purge System consists of a low volume purge system and a high volume purge system each of which contains an exhaust system. The exhaust system of the low volume purge system consists of, in the direction of airflow, a high efficiency filter, an electric heating coil, a HEPA filter, a charcoal adsorber, a high efficiency filter, and an exhaust fan. The high volume purge system consists of, in the direction of airflow, a high efficiency filter, a HEPA filter, and an exhaust fan. The Containment High Volume Purge System is used only during a refueling outage. The containment air is drawn through the Containment Purge System penetration by the exhaust filtration unit and discharged to the atmosphere through the plant vent stack. The gaseous effluent, therefore, leaving the containment volume, is filtered and is discharged at a low concentration of radioactivity. The vent stack airflow is monitored for radiation. The entire Containment Ventilation System including the CRDM Cooling System and the Containment Purge System complies with Criterion 60 as the design includes measures to control the releases of radioactive material to the environment.

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

10/24/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-9

Tier 2 DCD Section 9.4.6.1.2.3 provides design bases for the Reactor Cavity Cooling System. Two of the design bases from this section reads *"...Provide local cooling for the reactor vessel support base plates to limit the interface temperature between the plates and the concrete to 200° F or lower to prevent concrete dehydration."* and *"Provide adequate cooling so that the temperature of the primary shield wall is maintained at or below the 150° F maximum to prevent dehydration of the concrete."*

DCD Section 9.4.6.5.3 indicates that there will be instrumentation for recording concrete temperature.

The staff requests additional information about this recorder. Will it record both the concrete temperature of the shield wall <u>and</u> the temperature of the interface temperature between the reactor vessel support plates and the concrete?

Will the COL applicant be required to track the time durations of temperature excursions above *the 200° F and 150° F to ensure the structural integrity of the concrete for the licensed forty year plant life? In terms of plant life extension, will the tracking of these temperatures limitations be considered as a Time Limited Aging Analysis requirement?*

The staff requests that the DC applicant provide information in response to the above questions and amend the DCD as applicable with the relevant information. An additional COL item may be warranted.

ANSWER:

The design bases listed in Section 9.4.6.1.2.3 state the required temperatures for the concrete of the shield wall and between the reactor vessel support plates and the concrete. Since this system is designed to meet these bases, the instrumentation will support measurement and recording of both of these temperatures. Comprehensive instrument specifications will be determined during detailed design. During that phase, design criteria will be implemented which include recording the temperature at both locations. These criteria will be used to evaluate vendor designs including drawings, calculations, and materials. The detailed design phase will ensure that proper instruments are used so that these two design bases are met.

The COL applicant is not required to track the time durations of temperature excursions, according to current NRC regulatory policy. The consideration of the tracking of these temperature limitations as a Time Limited Aging Analysis (TLAA) will be addressed by the licensee at the time of application for license renewal. However, based on the criteria in 10 CFR 54.3 and operating plant experience, it is not anticipated that these concrete temperatures will be considered as a TLAA.

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

10/24/2008

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Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-10

"Review Procedures" of SRP 6.5.1 section 3.I.ii reads *"If a radioiodine decontamination factor of 10 or less is needed for the calculated dose to be below 10 CFR 100.11 or 10 CFR 100.21, as applicable, an atmosphere cleanup system that meets the design, testing, and maintenance guidelines for HEPA filters and charcoal adsorbers as specified in Regulatory Guide 1.140 are acceptable. ..."* and section 3.I.iii reads *"If a radioiodine decontamination factor of greater than 10 is needed for the calculated dose to be below 10 CFR 100.11 or 10 CFR 100.21, as applicable, the ESF atmosphere cleanup system meeting all of the above acceptance criteria, with the exception of Items 2b and 2c of Part C of Regulatory Guide 1.52, Rev. 2 or Regulatory Positions 3.2 and 3.4 of Regulatory Guide 1.52, Rev. 3, is acceptable."*

The last paragraph of Tier 2 FSAR section 9.4.6.2.4.1 reads *"The capacity of the containment low volume purge system is sized to maintain acceptably low levels of radioactivity, including noble gases, during normal plant operation."* and section 9.4.6.2.4.2 reads *"The capacity of the containment high volume purge system is sized to maintain acceptably low levels of radioactivity, including noble gases, during refueling operations."*

DCD sections 9.4.6.4.4.1 and 9.4.6.4.4.2 indicate that the filtration units of the containment low volume purge system and the containment high volume purge system will be periodically inspected and tested in accordance with RG 1.140, ASME N510, and ASME AG-1.

The staff requests that the DC applicant provide additional information about the sizing of these exhaust filtration units. Additional information is to include calculation procedures and methods, including assumptions and margins. In particular, the staff needs the essential information that the applicant considered in the determination that the exhaust filtration unit of the containment high volume purge system need not satisfy the regulatory guidance of Regulatory Guide 1.52. DCD section 9.4.6 lacks detail with respect to this determination.

ANSWER:

The exhaust filtration unit of the containment high volume purge system is used to maintain acceptably low levels of radioactivity in the containment during the refueling operations. This is not as safety-related system. Therefore, this system is not designed as a post-LOCA atmosphere cleanup system. The guidance provide by Regulatory Guide 1.140 is applicable to the exhaust filtration unit of the containment high volume purge system.

The sizing of these exhaust filtration units is based on following design bases.

a) The sizing of the Containment High Volume Purge System Filtration Unit is based on the RG 1.140.C.3.6. It states: "To ensure reliable in-place testing, the volumetric air-flow of a single cleanup unit should be limited to approximately 30,000 cubic feet per minute." The US-APWR requires one filtration unit on this system to minimize the number of HVAC equipment. Therefore, one exhaust filtration unit is provided and sized to 30,000 cubic feet per minute. The current design of the filtration unit also satisfies the dose evaluation for occupational radiation exposure during a refueling operation as described in DCD revision 1, Subsection 12.4.1.

b) The sizing of the Containment Low Volume Purge System Filtration unit is based on the ANSI/ANS 56.6. It states: "It should have capacity to provide one complete containment air change every forty hours." In case of the US-APWR it will be approximately 2,000 cubic feet per minute. The current design of the filtration unit also satisfies the dose evaluation for occupational radiation exposure during a normal plant operation as described in DCD revision 1, Subsection 12.4.1, and for radioactive effluent release during a normal operation and Anticipated Operational Occurrences (AOO) as described in Subsection 11.3.3.

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

10/24/2008

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Mitsubishi Heavy Industries

Docket No. 52-021

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DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-11

10CFR50 Appendix A General Design Criterion 2 requires that SSCs important to safety be designed to withstand the effects of a design basis earthquake. SRP 9.4.3 section III.2.A indicates that the P&IDs should clearly indicate the physical divisions between essential and nonessential portions and indicate design classification changes. The flow diagrams shown in Figure 9.4.6-1 do not show the boundaries between seismic Category I safety-related components and nonessential components. Provide additional information and clarify if the seismic classification boundaries for the Containment Ventilation System safety related containment isolation valves should be shown in the Figure.

The four subsystems that comprise the Containment Ventilation System either contain Seismic Category I components or have components (e.g. AO valves, ducting etc) in areas where safety-related Seismic Category I components are located. This system attribute is important to plant safety. None of the five preoperational tests (i.e. DCD sections 14.2.12.1- 65 through 14.2.12.1-69) for these four subsystems require verification as a Prerequisite that seismic II/I construction is complete and that design certification walk down is complete before executing the preoperational test. The staff requests the DC applicant add this requirement as a test "Prerequisite." In addition, given the importance to plant safety, the staff requests that a line item be added to ITACC Table 2.7.5.3-1 Containment Ventilation System Inspections, Tests, Analyses, and Acceptance Criteria that seismic II/I construction is complete and that design certification II/I walk down is complete.

ANSWER:

<u>Classification Changes</u>

The classification changes between seismic Category I components, seismic Category II components and nonessential components will be shown on the figures in DCD revision 2.

Seismic II/I Preoperational Test Prerequisites

Verification that system configuration complies with design is performed during the system turnover and initial checkout during Construction testing as described in revision 1 of the DCD, Subsection 14.2.1.2.1, second paragraph:

> "The objective of the construction and preliminary tests and inspections test phase is to verify and document that construction and installation of equipment in the facility have been accomplished in accordance with design, and that the equipment and components are functional and ready for preoperational testing."

Implementation of this commitment is performed programmatically through the test program and is therefore not included as a prerequisite in the preoperational test abstracts.

Seismic qualification of a (ventilation) system does not affect preoperational testing to verify the system-level operational performance. Further, temporary modifications to systems and scaffolding/ladders are frequently required to perform preoperational testing, which may affect the seismic qualification of a system at the time of test performance. Should deficiencies related to the seismic qualification of a system, or portions of a system, be identified following construction completion and turnover, administrative programs ensure that subsequent rework is reviewed for impact on the validity of completed, and remaining, testing as described in Subsection 14.2.4.3. Seismic qualification of systems is a prerequisite for initial fuel loading and subsequent criticality, low power testing and power ascension testing. ITAAC related to seismic qualification of SSCs being completed prior to fuel loading is appropriate.

The requirement for seismic qualification of systems or SSCs as a prerequisite to preoperational testing is not identified in RG 1.68 or RG 1.206, and is not included as a prerequisite in any of the preoperational testing abstracts for ventilation systems.

ITAAC for Seismic II/I Verification of CVVS

SRP Section 14.3.2, II.6 states in part that "For non-seismic Category I SSCs, the need for ITAAC to verify that their failure will not impair the ability of near-by safety-related SSCs to perform their safety-related functions should be assessed based on the specific design." SRP 14.3 II.6 also acknowledges that in certain cases, due to details of final design and layout of SSCs, the non-seismic to seismic (II/I) interaction cannot be evaluated until the plant has been constructed.

Therefore, ITAAC to verify the as-built plant is designed and constructed to avoid adverse II/I interactions may be appropriately addressed as part of the individual ITAAC for as-built verification of the SSCs.

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

10/24/2008

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DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-12

The rotating piece parts of the fans of the Containment Ventilation System potentially all represent internally generated missile hazards to nearby safety related components. Tier 2 DCD Section 9.4.6 fails to address this threat to safety related components.

The staff requests that the DC applicant provide additional information of how this threat to plant safety is negated for each of the fans that comprise the Containment Ventilation System. The applicant should also amend Section 9.4.6 to reflect this information.

ANSWER:

It is agreed that the Containment Ventilation System vane-axial fans need to be properly enclosed to ensure that there is no potential for damage to safety-related SSCs in the event of a fan blade failure.

The CRDM cooling fans will also need to be properly enclosed to ensure that there is no potential for damage to safety-related SSCs in the event of a fan wheel failure. Centrifugal fans do not typically present a missile hazard because they are normally operated at low speeds. The CRDM cooling fans are centrifugal fans, however, the CRDM fans operate at higher speeds because of the high flowrate and high static pressure required by the system. Even at the higher speed the centrifugal fan would still be safe. However, as a conservative measure the CRDM fans will be properly enclosed as well.

Modifications will be made to DCD Subsections 9.4.6.3.1 and 9.4.6.3.3 to include a description of the Containment Ventilation System fan housings that are resistant to penetration of internally generated missiles.

Impact on DCD

1) Subsection 9.4.6.3.1, Containment Fan Cooler System:

"The containment fan cooler system has no safety-related function and therefore requires no safety evaluation. However, a part of ductwork in the containment serving the containment fan cooler system are supported in accordance with seismic Category II requirements so as to remain in place during the SSE and preclude damage to any safety-related structures, systems, or components located in the vicinity of the piping or the ductwork."

Will be modified to read as follows:

"The containment fan cooler system has no safety-related function and therefore does not require a safety evaluation. However, a part of ductwork in the containment serving the containment fan cooler system are supported in accordance with seismic Category II requirements to remain in place during the SSE and preclude damage to any safety-related structures, systems, or components located in the vicinity of the piping or the ductwork. As a further safety feature of the Containment Ventilation System, the fan housings are designed to resist penetration of internally generated missiles in the event of a fan blade failure."

2) Subsection 9.4.6.3.2, Control Rod Drive Mechanism Cooling System:

"The CRDM cooling system has no safety-related function and therefore requires no safety evaluation. However, a part of ductwork in the containment serving the CRDM cooling system are supported in accordance with seismic category II requirements so as to remain in place during the SSE and preclude damage to any safety-related structures, systems, or components located in the vicinity of the piping or the ductwork."

Will be modified to read as follows:

"The CRDM cooling system has no safety-related function and therefore requires no safety evaluation. However, a part of ductwork in the containment serving the CRDM cooling system are supported in accordance with seismic category II requirements so as to remain in place during the SSE and preclude damage to any safety-related structures, systems, or components located in the vicinity of the piping or the ductwork. As a further safety feature of the Containment Ventilation System, the CRDM fans are enclosed in housings designed to resist penetration of internally generated missiles in the event of a fan wheel failure."

3) Subsection 9.4.6.3.3, Reactor Cavity Cooling System:

"The reactor cavity cooling system has no safety-related function and therefore requires no safety evaluation. However, a part of ductwork in the containment is supported in accordance with seismic Category II requirements so as to remain in place during the SSE to preclude damage to any safety-related structures, systems, or components located in the vicinity of the ductwork."

Will be modified to read as follows:

"The reactor cavity cooling system has no safety-related function and therefore does not require a safety evaluation. However, a part of ductwork in the containment is supported in accordance with seismic Category II requirements to remain in place during the SSE to preclude damage to any safety-related structures, systems, or components located in the vicinity of the ductwork. As a further safety feature of the Containment Ventilation System, the fan housings are designed to resist penetration of internally generated missiles in the event of a fan blade failure."

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

10/24/2008

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APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-13

SRP 9.4.3 sections III.1, III.3 and III.4 make reference to use of a failure modes and effects analysis, as appropriate, to confirm that the essential safety-related portions of the system are capable of functioning in spite of the failure of any active component, in the event of an earthquake, during loss of offsite power, or a concurrent single active failure. DCD section 9.4.6 does not contain any references to or COL items for a failure modes and effects analysis for the Containment Ventilation System. Provide additional information and clarify if a failure modes and effects analysis is necessary for the Containment Ventilation System.

ANSWER:

Section III "Review Procedures" of SRP 9.4.1 through 9.4.5 all make reference to use of a failure modes and effects analysis, as appropriate, to confirm that the essential safety-related portions of the system are capable of functioning in spite of the failure of any active component, in the event of an earthquake, during loss of offsite power, or a concurrent single active failure.
Per the guidance of Regulatory Guide 1.206 C.I.9.4 the same considerations for the Containment Ventilation System is required in the DCD as for all the other ventilation systems, including a failure modes and effects analysis for safety related components. Subsection 9.4.6 of DCD revision 2 will be modified to include a failure modes and effects analysis for the safety-related portions of Containment Ventilation System.

Impact on DCD

Subsection 9.4.6 of DCD revision 2 will be modified to include a failure modes and effects analysis for the safety-related portions of Containment Ventilation System.

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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SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-14

The last two paragraphs of Tier 2 DCD Section 9.4.6.2.1, reads

"During the LOOP condition, containment fan cooler system is powered from the alternate AC power source and maintains the average containment air temperature below 150° F.

In addition, the containment fan cooler units provide the cooling to mitigate the consequence of accident by natural circulation under the severe accident condition. Since the chilled water cannot be supplied under the severe accident condition, the cooling water system is switched form the non-essential chilled water system to CCW system to supply the cooling water to the containment fan cooler units"

For this excerpt to be meaningful to the staff and the COL applicants, additional information needs to be added to the DCD. For a LOOP, will nonessential chilled water be available to provide cooling water to any of the containment fan coolers? Or will the AAC power source provide power only to support the mixing of the containment atmosphere and to prevent localized "hot pockets" within containment?

The second paragraph indicates that there is a system interface with the Seismic I safety related component cooling water system. Tier 1 Section 2.7.5.3.1.2 "Interface Requirements" reads *"There are no safety-related interfaces with systems outside the certified design"*

The staff request that the DC applicant provide additional information that provides clarity about the operation containment fan coolers during a LOOP and under a severe accident condition. The applicant is requested to update the relevant sections of the Tier 1 and Tier 2 section to reflect this additional information.

ANSWER:

1) In response to:

"During the LOOP condition, containment fan cooler system is powered from the alternate AC power source and maintains the average containment air temperature below 150° F.

In addition, the containment fan cooler units provide the cooling to mitigate the consequence of accident by natural circulation under the severe accident condition. Since the chilled water cannot be supplied under the severe accident condition, the cooling water system is switched form the non-essential chilled water system to CCW system to supply the cooling water to the containment fan cooler units"

For this excerpt to be meaningful to the staff and the COL applicants, additional information needs to be added to the DCD. For a LOOP, will nonessential chilled water be available to provide cooling water to any of the containment fan coolers? Or will the AAC power source provide power only to support the mixing of the containment atmosphere and to prevent localized "hot pockets" within containment?"

During a LOOP both the Containment fan cooler unit and the Non-Essential Chilled Water System are automatically started and powered by the Alternate AC power source. Refer to DCD, Table 8.3.1-5.

The Containment Fan Cooler System is non-safety related and is not qualified to operate during a severe accident. During a severe accident it is assumed that the Containment Fan Cooler System fans are non-operable and that the Non-essential Service Water System is unavailable. Valves are provided to manually align the CCW to the Containment fan cooler unit cooling coils. This supplies CCW to the coils in the Containment fan cooler unit. The temperature difference between the containment fan cooler and containment atmosphere causes condensation of surrounding steam, promoting more natural circulation and further lowering the Containment temperature and pressure. This system line-up is referred to as "Alternate Containment Cooling" and is described in Subsection 19.1.3.2.

Subsection 9.4.6.2.1 will be modified to provide a clearer description of the Containment Fan Cooler System operation during LOOP and severe accident conditions.

2) In response to:

The second paragraph indicates that there is a system interface with the Seismic I safety related component cooling water system. Tier 1 Section 2.7.5.3.1.2 "Interface Requirements" reads "*There are no safety-related interfaces with systems outside the certified design*"

The staff request that the DC applicant provide additional information that provides clarity about the operation containment fan coolers during a LOOP and under a severe accident condition. The applicant is requested to update the relevant sections of the Tier 1 and Tier 2 section to reflect this additional information.

"Interface requirements" described in Tier 1 is defined as the "design attributes and performance characteristics that ensure that the site-specific portion of the design is in conformance with the certified design."

Section IV.8 of SRP 14.3 Appendix A also states "interface requirements are defined for: (a) systems that are entirely outside the scope of the design, and (b) the out-of-scope portions of those systems are only partially within the scope of the standard design." Thus the definition of the interface requirement in the US-APWR Tier 1 is consistent with SRP 14.3.

Therefore the interface requirements within scope of the certified design need not be specified in the Tier 1 design description of each system. (See the response of RAI No.54, RAI 14.3.7.3.1-1)

Impact on DCD

1) The fourth and fifth paragraph of Subsection 9.4.6.2.1, Containment Fan Cooler System:

"During the LOOP condition, containment fan cooler system is powered from the alternate AC power source and maintains the average containment air temperature below 150° F.

In addition, the containment fan cooler units provide the cooling to mitigate the consequence of accident by natural circulation under the severe accident condition. Since the chilled water cannot be supplied under the severe accident condition, the cooling water system is switched form the non-essential chilled water system to CCW system to supply the cooling water to the containment fan cooler units."

Will be replaced with the following:

"During the LOOP condition, the Containment Fan Cooler System is powered from the alternate AC power source and maintains the average Containment air temperature below 150° F. The Non-Essential Chilled Water System is powered by the alternate AC power source to supply the cooling water to the Containment fan cooler unit cooling coils.

During a severe accident event, it is assumed that the Containment fan cooler unit fans are non-operable and that the Non-essential Chilled Water System is unavailable. Valves are provided to manually align the CCW to the containment fan cooler unit cooling coils. This supplies CCW to the cooling coils in the Containment fan cooler unit. This temperature difference between the Containment fan cooler and Containment atmosphere causes condensation of surrounding steam, promoting more natural circulation and further lowering the Containment temperature and pressure, contributing to the mitigation of the consequences of a severe accident. This system line-up is referred to as "Alternate Containment Cooling" and is described in Subsection 19.1.3.2."

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

10/24/2008

US-APWR Design Certification

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Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-15

The last paragraph of Tier 2 DCD section 9.4.6.2.3 reads *"During the LOOP condition, CRDM cooling system is powered from the alternate ACC power source."*

Should this paragraph read?

"During the LOOP condition, Reactor Cavity cooling system is powered from the alternate ACC power source."

ANSWER:

NRC recommendation to change the word "CRDM" to "Reactor Cavity" in Section 9.4.6.2.3 is correct. The correct wording in Subsection 9.4.6.2.3 has be revised in DCD Revision 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

10/24/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-16

Acceptance Criteria 5 of SRP 9.4.1 reads: *"Control of Releases of Radioactive Material to the Environment. Information that addresses the requirements of GDC 60 regarding the suitable control of the release of gaseous radioactive effluents to the environment will be considered acceptable if the guidance of RGs 1.52 and 1.140 as related to design, inspection, testing, and maintenance criteria for post-accident and normal atmosphere cleanup systems, ventilation exhaust systems, air filtration, and adsorption units of light-water-cooled nuclear power plants are appropriately addressed. For RG 1.52 rev 2, the applicable regulatory position is C.2. For RG 1.52 rev 3, the applicable regulatory position is C.3. ..."*

The staff could find no reference to the replacement of filters used during plant/system construction in Tier 2 DCD Section 9.4.6. Regulatory Guide 1.52 "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" position C 5.2 reads *"The cleanup components (i.e., HEPA filters, prefilters, and adsorbers) that are used during construction of the ventilation systems should be replaced before the system is declared operable."*

The staff requests that the DC applicant amend DCD Section 9.4.6 and the relevant Preoperational Tests (i.e. 14.2.12.1.65, 14.2.12.1.66, 14.2.12.1.67, 14.2.12.1.68, 14.2.12.1.69 and 14.2.12.1.79) to include a test prerequisite to reflect this requirement.

ANSWER:

The Containment Ventilation System is provided to control and maintain the environment temperature and radioactivity concentration within the containment. The only component of the Containment Ventilation System which is safety-related is the containment penetration isolation assemblies. Regulatory Guide 1.52 "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" applies to ESF atmosphere cleanup systems within the design basis accident (DBA) environment. The Containment Ventilation System does not contain any safety-related engineered-safety-feature (ESF) atmosphere cleanup system and is therefore not subject to the requirements of Regulatory Guide 1.52. The Annulus Emergency Exhaust System is the only ESF Ventilation System, utilized for atmosphere cleanup, which services portions of the Reactor Building. This system is discussed in Section 9.4.5.

Regulatory Guide 1.140 "Design, Inspection, And Testing Criteria For Air Filtration And Adsorption Units Of Normal Atmosphere Cleanup Systems In Light-Water-Cooled Nuclear Power Plants" Regulatory Position 5.2 also states, "The cleanup components (i.e., HEPA filters, prefilters, and adsorbers) that are used during construction of the ventilation system should be replaced before the system is declared operable." Of the four sub-systems of the Containment Ventilation System, only the Containment Purge System provides normal atmosphere cleanup functions as its two exhaust filtration units discharge to the atmosphere through the plant stack.

Subsection 9.4.6.4.4.1 "Containment Low Volume Purge System" states: "Periodically and subsequent to each filter or adsorber material replacement, the unit is inspected and tested in-place in accordance with the requirements of RG 1.140 (Ref.9.4.8-15), ASME N510 (Ref. 9.4.8-8) and ASME AG-1 (Ref.9.4.8-2)." And Subsection 9.4.6.4.4.2 "Containment High Volume Purge System" states: "Periodically and subsequent to each filter replacement, the unit is inspected and tested in-place in accordance with the requirement of RG 1.140 (Ref.9.4.8-15), ASME N510 (Ref. 9.4.8-8) and ASME AG-1 (Ref. 9.4.8-2)." Therefore, the DCD Subsection 9.4.6 incorporates the requirements of RG 1.140.

The relevant sections of Chapter 14 discussing Pre-operational testing will be modified to include information pertaining to the replacement of cleanup components prior to plant operation in accordance with Regulatory Guide 1.140.

Impact on DCD

DCD Subsection 14.2.12.1.67 "Containment High Volume Purge System Preoperational Test" will have the following Prerequisite added:

"Replacement of HEPA filters and prefilters used during system construction is completed."

DCD Subsection 14.2.12.1.68 "Containment Low Volume Purge System Preoperational Test" will have the following Prerequisite added:

"Replacement of HEPA filters, prefilters, and adsorber material used during system construction is completed."

DCD Subsection 14.2.12.1.79 "High-Efficiency Particulate Air Filters and Charcoal Absorbers Preoperational Test" will have the following Prerequisite added:

"Replacement of HEPA filters and absorber material used during system construction is completed."

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

10/24/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-17

DCD Section 9.5.1.2.7 reads *"Ventilation system fire dampers close automatically against full airflow, if required, on high temperature to limit the spread of fire and combustion products. Fire dampers serving certain safety-related, smoke-sensitive areas are also closed in response to an initiation signal from the fire detection system. In selected areas, the fire alarm system will provide interface with the HVAC systems such as to shut down HVAC operation upon a fire alarm signal. Where continued HVAC system operation is deemed necessary for radiological control, the HVAC system incorporates design features to allow operation under fire conditions."*

Tier 2 DCD Section 9.4.6 contains no information about the specifics of how the Fire Protection System interfaces with the Containment Ventilation System.

The staff requests that the DC applicant provide additional information about what generic HVAC system attributes contained in the passage from DCD Section 9.5.1.2.7 above are applicable to the operation of four subsystems of the Containment Ventilation System. This information needs to be amended into Section 9.4.6.

ANSWER:

Containment fan cooler system, Control rod drive mechanism (CRDM) cooling system and Reactor cavity cooling system are classified as a non-safety related, non-seismic category I. These systems do not penetrate any fire barrier that constitutes as a fire area boundary within the containment. Therefore, there are no fire dampers installed as a part of these systems inside the containment.

Containment purge system is also classified as a non-safety related, non-seismic category I, with the exception of containment isolation valves. The ductwork for the containment purge system is in the Reactor Building and the Auxiliary Building, its ductwork will be penetrating fire barriers. therefore, fire dampers will be installed in this system. The containment penetration and the containment isolation valves are constructed of stainless steel material and act as a fire barrier and are equivalent to any fire rated damper. They will prevent the spread of a fire from one fire area to another fire area.

The installation of the fire dampers to a specific barrier penetration depends on the duct route, which have not been determined at this time. However, fire dampers will be installed where a fire rated barrier has been penetrated by ductwork. This type of fire damper will be released by a fixed temperature fusible link. It should be noted that there are no gaseous fire suppression systems inside containment and therefore, there will be no automatic closing of fire dampers from a fire detection system.

Impact on DCD

The DCD will be revised to incorporate the above mentioned fire protection attributes for containment purge system of DCD Subsection 9.4.6.

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:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-18

Acceptance Criteria D.3 of Tier 2 Section 14.2.12.1.65 CRDM Cooling System Preoperational Test reads *"The CRDM cooling system performs in accordance with design specifications during hot functional testing"*

The only information that contains design specifications for this subsystem is displayed on Table 9.4.6-1 for the CRDM Cooling Unit (i.e. 4,000,000 btuh at 71,000 cfm) and the CRDM Cooling Fan (i.e. 71,000 cfm). The staff requests that the DC applicant provide additional information in Tier 2 DCD Section 9.4.6 and Table 9.4-1 that indicates the Normal and Abnormal (i.e. LOOP) conditions at the inlet and outlet of the CRDM Cooling Unit. The test method from this Preoperational Test contains the following requirement:

"C. Test Method
1. Simulate start and interlock signals for each cooling fan and cooling unit and verify operation and annunciation.
2. Simulate high temperature signals and high vibration signals and verify alarm annunciation."

Section 9.4.6.5.2 indicates that there are alarms for high CRDM inlet and outlet temperatures; for low air flow and for "motor winding temperature". It does not list a high vibration signal alarm.

What will be the setpoints for these alarms? Are these local alarms?... or MCR alarms? ... or both?

The staff requests that the DC applicant add this missing information to Section 9.4.6, Table 9.4-1 and add a listing of the vibration alarm (for the fans or motors or both) to Section 9.4.6.5.2.

In the light of the above finding, the staff further requests that the DC applicant review in detail Preoperational Tests 14.2.12.1.66, 14.2.12.1.67, 14.2.12.1.68, 14.2.12.1.69 and 14.2.12.1.79 to (1) ensure that all required information to complete the preoperational test is contained either in Section 9.4.6, Table 9.4-1 and/or Table 9.4.6-1 (2) remove any conflicting information that would impair preoperational test completion.

ANSWER:

Part 1) The only information that contains design specifications for this subsystem is displayed on Table 9.4.6-1 for the CRDM Cooling Unit (i.e. 4,000,000 btuh at 71,000 cfm) and the CRDM Cooling Fan (i.e. 71,000 cfm). The staff requests that the DC applicant provide additional information in Tier 2 DCD Section 9.4.6 and Table 9.4-1 that indicates the Normal and Abnormal (i.e. LOOP) conditions at the inlet and outlet of the CRDM Cooling Unit.

The table 9.4-1 indicate the area design temperature condition. MHI thinks that it is not proper to provide the information about inlet and outlet air temperature of the CRDM Cooling Unit in the table 9.4-1. Therefore, MHI will provide the additional information to review the CRDM Cooling Unit specification in Subsection 9.4.6.

Part 2) The test method from this Preoperational Test contains the following requirements:

"C. Test Method

1. *Simulate start and interlock signals for each cooling fan and cooling unit and verify operation and annunciation.*
2. *Simulate high temperature signals and high vibration signals and verify alarm annunciation."*

Section 9.4.6.5.2 indicates that there are alarms for high CRDM inlet and outlet temperatures; for low airflow and for "motor winding temperature". It does not list a high vibration signal alarm.

The CRDM cooling fans are large capacity and are driven by high voltage (6600V) motors. These motors are equipped with motor winding temperature sensors and vibration sensors/monitoring capabilities. The vibration sensor is equipped to alarm and alerts the control room operator upon occurrence of abnormal conditions due to fan failure.

Tier 2 Subsections 9.4.6.5.2 and 9.4.6.5.3 will be revised to add the vibration alarm/monitoring on fan / motor.

Part 3) What will be setpoints for these alarms? Are these local alarms? ...or MCR alarms? ... or both?

Alarms indicated in section 9.4.6.5.2, i.e. high CRDM inlet and outlet temperatures and low air flows, are all MCR alarms. The set points for these alarms have not been determined at this time and will be included in the Detailed Design Phase.

Part 4) In the light of the above finding, the staff further requests that the DC applicant review in detail Preoperational Tests 14.2.12.1.66, 14.2.12.1.67, 14.2.12.1.68, 14.2.12.69 and 14.2.12.1.79 to (1) ensure that all required information to complete the preoperational test is contained either in Section 9.4.6, table 9.4-1 and / or Table 9.4.6-1 (2) remove any conflicting information that would impair preoperational test completion.

The relevant DCD section will be revised to ensure that all required information to complete the preoperational test is contained either in Section 9.4.6, table 9.4-1 and / or Table 9.4.6-1 (2) remove any conflicting information that would impair preoperational test completion.

Impact on DCD

Part 1)

Tier 2 DCD Section 9.4.6 will be revised to provide a clearer description of the CRDM Cooling System operation during normal and abnormal (i.e. LOOP) condition.

Part 2) Tier 2 Subsections 9.4.6.5.2 and 9.4.6.5.3 will be revised to add high vibration alarm/ monitoring on fan / motor.

Part 4) The relevant DCD section will be revised to ensure that all required information to complete the preoperational test is contained either in Section 9.4.6, table 9.4-1 and / or Table 9.4.6-1 (2) remove any conflicting information that would impair preoperational test completion.

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

10/24/2008

US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-19

The third paragraph of Tier 2 DCD Section 9.4.6.4 reads "*... All HVAC system airflows are balanced in conformance with the design flow, path flow capacity, and proper air mixing throughout the containment.*"

Section 9.4.6.4 does not contain any flow balance data that will allow the COL applicants to demonstrate and satisfy the above requirements.

The staff requests that the DC applicant add this information to DCD Section 9.4.6.4.

ANSWER:

The flow balance data for all HVAC systems will be available during the later design phase and will be in conformance with the design flow, path flow capacity, and proper air mixing throughout the containment.

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

10/24/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.73-943 REVISION 0**
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APPLICATION SECTION:	**FSAR Sections 6.4, 6.5.1 and 9.4.6**
DATE OF RAI ISSUE:	**09/24/2008**

QUESTION NO. : 06.05.01-1, RAI 6.5.1-20

Provide additional details for the following section 9.4.6 containment ventilation system calculation procedures and methods, including assumptions and margins. The staff requests this information to satisfy the procedural review requirements of SRP Section 9.4.3, Revision 3, March 2007:

- Containment Ventilation System calculations supporting the normal and abnormal condition min max temperatures shown in Table 9.4-1 sheet 1 of 3.
- Containment Purge System calculations supporting the normal condition min max temperatures shown in Table 9.4-1 sheet 1 of 3.
- Control Rod Drive Mechanism Cooling System calculations supporting the normal and abnormal condition min max inlet and outlet cooler temperatures (to be included in Table 9.4-1; refer to RAI 6.5.1-18)
- Reactor Cavity Cooling System

ANSWER:

The containment fan cooler system maintains the containment ambient air temperature under 120°F (normal plant operation except the refueling operation), and under 150 °F (LOOP condition) as shown in Table 9.4-1. During the refueling operations the containment high volume purge system maintains the containment ambient air temperature between 65 °F to 85 °F. (if required, the containment fan cooler system is operated to maintain the ambient air temperature). Each of containment ventilation system calculations is as following.

<u>Containment Fan Cooler Unit</u>

-Cooling Load (Assumption) : 7,700,000 Btu/h

-Cooling Coil Leaving Temperature : 70 °F

-Cooling Coil Entering Temperature (Containment ambient air temperature) :120 °F

Therefore, Cooling airflow requirement is:

$$Q = \frac{7,700,000}{60 \times 0.075 \times 0.24 \times (120 - 70)} \times 1.15 \times \frac{1}{3}$$

$= 54660$, USE 60,000ft^3/min

Note: the Containment Fan Cooler Unit is sized for 1/3 of total containment heat load.

The above calculation indicates that containment fan cooler system maintains the containment ambient air temperature under 120F.

CRDM Cooling System

The cooling coil is designed to remove the heat dissipated by the CRDMs. The cooling coil capacity of CRDM cooling unit is determined by heat gain from the CRDMs and the motor of the CRDM cooling fan. The total of cooling load is 4,000,000Btu/h (Assumption based on the Japanese PWR Plants). These heat gains are removed by the CRDM cooling unit. Therefore, the outlet temperature of cooling fan is designed 120°F and this system also does not affect the containment air temperature condition.

Reactor Cavity Cooling System

The Reactor Cavity Cooling System provides cooling air for the reactor vessel support, the cavity seal and the nuclear instrumentation area. The cooling air from the cooling fan passes through the gap the between the reactor vessel and the primary shield wall. And then cooling air is distributed to the following areas to maintain the concrete temperature under the limitation temperature.

Nuclear instrumentation	:220 ft^3/min
Cavity seal	:14,900 ft^3/min
Reactor vessel support	:28,300 ft^3/min

The total cooling airflow requirement is 43,420, USE 40,000 ft^3/min.

Note: These airflow values are assumptions based on Japanese PWR plants, but the airflow requirements will be updated based on the concrete temperature distribution analysis.

Containment high volume purge system air handling unit

-Supply air temperature	: 65 °F
-Supply airflow rate	: 30,000ft^3/min

The airflow capacity of the containment high volume purge system is based on the dose analysis and design consideration (Refer to RAI No.6.5.1-10). The Supply air temperature is determined by the outlet temperature of cooling coil and temperature rise across the fan. If this supply airflow condition is not enough to maintain the ambient temperature, the containment fan cooler may be manually operated.

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.