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TOKYO, JAPAN

May 15, 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-09240

Subject: MHI's Responses to US-APWR DCD RAI No.300-2288

References: 1) "Request for Additional Information No.300-2288 Revision 1, SRP Section: 06.05.01 – ESF Atmosphere Cleanup Systems, Application Section: Tier 2 DCD 9.4.6" dated April 1, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No.300-2288 Revision 1".

Enclosed are the responses to 5 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. 300-2288, Revision 1

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

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Enclosure 1

UAP-HF-09240
Docket Number 52-021

Responses to Request for Additional Information No. 300-2288, Revision 1

May, 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

05/15/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.300-2288 REVISION 1**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 9.4.6**
DATE OF RAI ISSUE:	**04/01/2009**

QUESTION NO. : 06.05.01-3

This is a follow-up a RAI

The staff finds the applicant's response to RAI #73 /06.05.01-1 RAI 6.5.1-4 as incomplete. This response was provided to the staff in a letter dated October 24, 2008 (Docket No. 52-021 MHI Ref: UAP-HF-021). NRC Original RAI #943

Figure 11.5-1b and Figure 9.4.6-1 collectively fail to allow the staff to determine where the "Containment Low Volume Purge Radiation Gas Monitor" (RMS-RE-23) is located within the Containment Purge Systems' HVAC system ductwork and with respect to the stack ventilation radiation monitors. Figure 9.4.6-1 should display both radiation monitors.

In addition, the relevant radiation monitor wording in DCD sections 9.4.6.5.4.1 and 9.4.6.5.4.2 reads "Alarm high radiation for the containment purge air" leads the reader to believe that only two radiation monitors (RMS-RE-40 & RMS-RE-41 are associated with the HVAC system operation. While these two radiation monitors can cause a CIS and the Containment Purge System shutdown, the "Containment Low Volume Purge Radiation Gas Monitor" (RMS-RE-23) will also alarm with subsequent operator action. From the DCD sections, figures and tables referred to in the applicant's response and reviewed by the staff, is not clear where RMS-RE-23 alarms at (i.e. local alarm or in the MCR)

The staff requests that the applicant revise the relevant sections of the DCD to add clarity for the issues identified in this follow-up RAI.

ANSWER:

The plant's process gas and particulate radiation monitors are described in DCD Subsection 11.5.2.2.

The radiation monitor RMS-RE-23 is located in a room identified as "Containment Radiation Gas Monitors". This room also contains the radiation monitors RMS-RE-22, 40 and 41. This room is in the reactor building on elevation 76' – 5" near the northwest corner, adjacent to the containment and penetration area; see DCD Figure 11.5-2h for a general arrangement drawing identifying this room. The low volume purge air exhaust from containment is measured for radiation by using tubing to draw a continuous air sample into the radiation monitor RMS-RE-23 from the Containment Low Volume Purge exhaust duct in the reactor building and the sample is returned back downstream from the sample point. This sample point is just downstream of the containment isolation valve on this exhaust duct, which runs near the "Containment Radiation Gas Monitors" room. DCD Figure 11.5-1b is a schematic of a typical HVAC duct gas radiation monitoring sampling configuration. RMS-RE-23 alarms only in the Main Control Room. It does not initiate any automatic actions.

The radiation monitor RMS-RE-22 uses a similar arrangement as above but on the Containment High Volume Purge exhaust duct. The Containment High Volume Purge system is used only during a refueling or maintenance outage. RMS-RE-22 alarms only in the Main Control Room. It does not initiate any automatic actions.

The radiation monitors RMS-RE-40 and 41 are the Containment Radiation Monitors measuring the radiation level in the containment atmosphere. They sample air in the same way as above with sample tubes but directly from inside the containment. DCD Figure 11.5-1a is a schematic of a typical containment atmosphere radiation monitoring sampling configuration. RMS-RE-40 and 41 alarms only in the Main Control Room and automatically close the containment isolation valves on the containment purge system. These radiation monitors are not safety related and do not provide input for containment ventilation isolation. Containment ventilation isolation is also initiated by the safety related area radiation monitors RMS-RE-91A & B, 92A & B, 93A & B, and 94A & B (see DCD Subsection 12.3.4.1).

The radiation monitors RMS-RE-21A, 21B, 80A and 80B are the plant stack vent radiation monitors. The sampling configuration is the same as used for a duct and is shown in DCD Figure 11.5-1h. They are located in a room identified as "Plant Vent Radiation Gas Monitors" and this room is located near the "Containment Radiation Gas Monitors" room; see DCD Figure 11.5-2h.

DCD Figure 9.4.6-1 "Containment Ventilation System Flow Diagram (2 of 2)" will be revised to show the following radiation monitors RMS-RE-22, 23 21A, 21B, 80A and 80B. This revision will clarify the relative position of the radiation monitors with respect to the ventilation system.

DCD Subsection 11.5.2.2.1 "Containment Radiation Monitors (RMS-RE-40 and 41) is to be revised to clarify that these radiation monitors will only automatically close the containment isolation valves on the containment purge ventilation system.

DCD Table 11.5-1 item No. 4 description of the service needs to be revised to clarify that the radiation monitor RMS-RE-22 is sampling from the exhaust duct of the containment high volume purge system.

Impact on DCD

1. Revise DCD Figure 9.4.6-1 "Containment Ventilation System Flow Diagram (2 of 2)" per the attached mark-up drawing.

2. Revise DCD Subsection 11.5.2.2.2 "Containment Low Volume Purge Radiation Gas Monitor (RMS-RE-23)" second paragraph as follows:

   "This monitor is used to examine the radiation level in the containment air purges. During containment purges, an air sample of the airflow is **continuously** drawn into the mixing chamber for monitoring and the sample is returned back downstream of the duct via a small sample blower. If radiation is detected above the setpoint, an alarm is activated **in the MCR** for operator actions."

3. Revise DCD Subsection 11.5.2.2.1 "Containment Radiation Monitors (RMS-RE-40 and 41)" second paragraph last sentence as follows:

   "Detection of radiation above a predetermined setpoint activates an alarm in the MCR for operator actions and ~~also activates~~ **will automatically close the containment isolation valves on the** containment **purge** ventilation **system** ~~isolation~~."

4. Revise DCD Table 11.5-1, for item No. 4, by changing the service description to the following:

"Containment exhaust radiation gas *The concentration of radioactive material in the* ***exhaust*** *duct of the containment* ***high volume purge*** ~~*exhaust*~~ *system*"

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

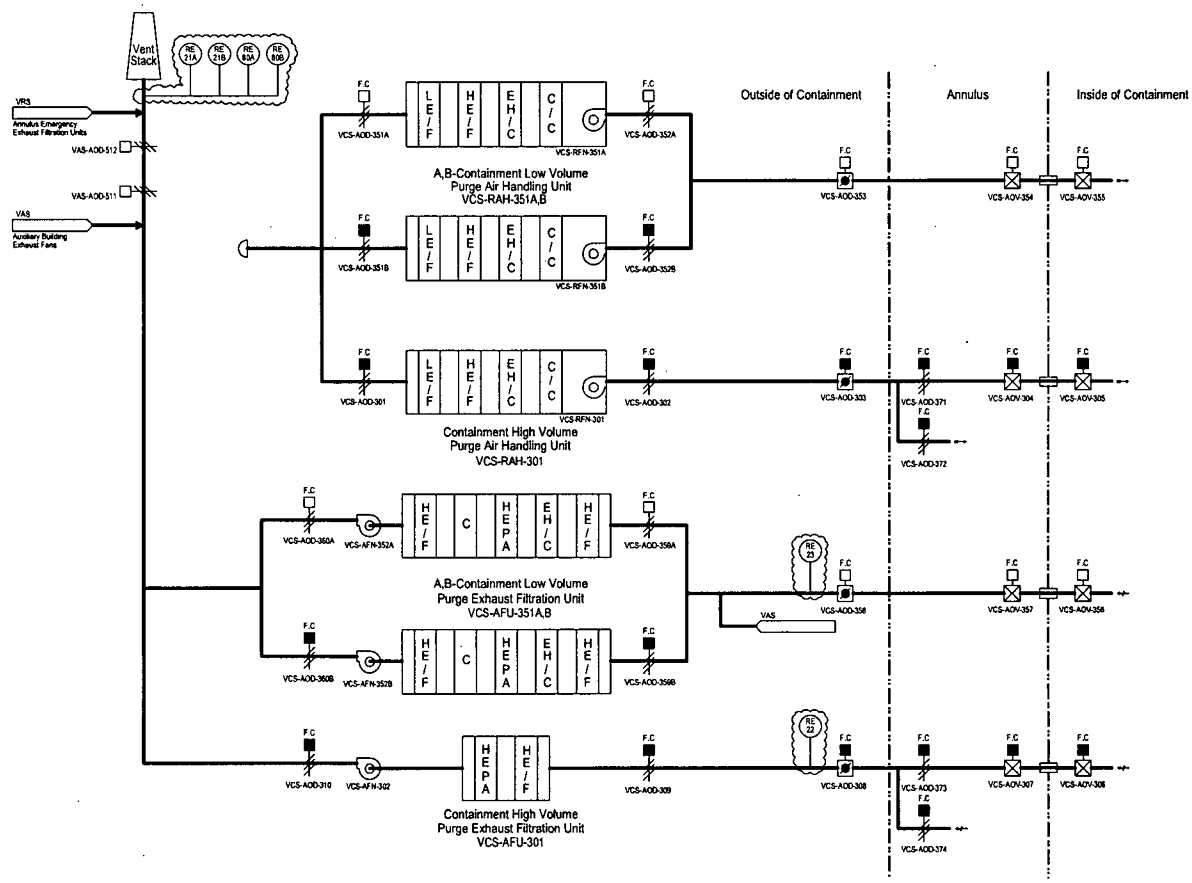

Figure 9.4.6-1 Containment Ventilation System Flow Diagram (2 of 2)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

05/15/2009

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

RAI NO.:	**NO.300-2288 REVISION 1**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 9.4.6**
DATE OF RAI ISSUE:	**04/01/2009**

QUESTION NO. : 06.05.01-4

The staff finds the applicant's response to RAI #73 /06.05.01-1 RAI 6.5.1-12 as incomplete. This response was provided to the staff in a letter dated October 24, 2008 (Docket No. 52-021 MHI Ref: UAP-HF-021). NRC Original RAI #943

The staff finds the applicants response to RAI#73 /06.05.01-1, RAI 6.5.1-12 as acceptable with respect to the amendments for Revision 2 of DCD Section 9.4.6.3.1 through 9.4.6.3.3. These three section amendments are applicable to the fans within the Containment as displayed on DCD Figure 9.4.6-1 "Containment Ventilation System Flow Diagram (1 of 2)". However, the applicant does not make a similar amendment for the fans of the as displayed on DCD Figure 9.4.6-1 "Containment Ventilation System Flow Diagram (2 of 2)". These fans are housed within the Seismic Category I Reactor Building and the Seismic Category II Auxiliary Building (Reference Table 3.2-2, System 31 and Table 3.2-4 of DCD Revision 2). Due to the seismic categories of these two buildings, the staff concludes that at least one these two buildings (i.e. Reactor Building) house safety related SSCs that require protection from the hazards of potential fan blade failure. The staff requests that the applicant amend DCD Section 9.4.6.3.4 "Containment Purge System" with similar words "...designed to resist penetration of internally generated missiles in the event of a fan blade failure."

ANSWER:

The Containment Purge System fans will also 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 Containment Purge System fans are centrifugal fans, however, the Containment Purge System fans operate at higher speeds because of the 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 Containment Purge System fans will be properly enclosed as well.

Modifications will be made to DCD Subsection 9.4.6.3.4 to include a description of the Containment Purge Ventilation System fan housings that are resistant to penetration of internally generated missiles.

Impact on DCD

Subsection 9.4.6.3.4, Containment Purge System by revising the first paragraph as follows:

"Other than the safety-related seismic Category I containment isolation valves, the containment purge system has no safety-related function and therefore requires no safety evaluation. **Ductwork in the reactor building is supported in accordance with seismic Category II requirements to remain in place during an 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 purge ventilation system, the fan housings are designed to resist penetration of internally generated missiles in the event of a fan wheel 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

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US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.300-2288 REVISION 1**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 9.4.6**
DATE OF RAI ISSUE:	**04/01/2009**

QUESTION NO. : 06.05.01-5

This is a follow-up a RAI

The staff finds the applicant's response to RAI #73 /06.05.01-1 RAI 6.5.1-19 as incomplete. This response was provided to the staff in a letter dated October 24, 2008 (Docket No. 52-021 MHI Ref: UAP-HF-021). NRC Original RAI #943

The staff finds the applicants response to RAI#73 /06.05.01-1, RAI 6.5.1-19 as incomplete. From the applicants answer, it appears that the detailed design of the Containment Ventilation System has yet to be completed with respect to area heat loads, duct layout and sizing, and system plant configuration. The applicants response cited operating expeince to establish heat loads within containment. Therefore, the COLs will need to select components that fall within the reference bounds of the analysis. The applicant needs to add to the FSAR the specific design basis for the associated design comitments.

Additionally, please describe a start-up test in chapter 14.2 that would verify that the final design falls within the reference bounds of the anlaysis.

ANSWER:

MHI will add the information on the main air flow balance data that will allow the COL applicants to demonstrate and satisfy the requirements that are stated in DCD subsection 9.4.6.4, i.e., " All HVAC system airflows are balanced in conformance with the design flow, path flow capacity, and proper air mixing through the containment"

Impact on DCD

MHI will revise the 3rd paragraph in DCD Subsection 9.4.6.2.1 as following,

The containment air is cooled by the operating containment fan coolers. The cooling coils are supplied with chilled water from the non-essential chilled water system. Air is distributed inside the containment through the header compartment and the distribution ductwork system. **<u>The cooling airflow that is delivered to each SG compartments and pressurizer compartment through the header</u>**

<u>compartment to maintain each compartment in proper temperature is 19,000 ft^3/min and 13,500 ft^3/min, respectively.</u>

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.300-2288 REVISION 1**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 9.4.6**
DATE OF RAI ISSUE:	**04/01/2009**

QUESTION NO. : 06.05.01-6

This is a follow-up a RAI

The staff finds the applicant's response to RAI #73 /06.05.01-1 RAI 6.5.1-20 as incomplete. This response was provided to the staff in a letter dated October 24, 2008 (Docket No. 52-021 MHI Ref: UAP-HF-021). NRC Original RAI #943

The staff finds the applicants response to RAI#73 /06.05.01-1, RAI 6.5.1-20 as incomplete. Upon further review of DCD Section 9.4.6.2 "Power Generation Design Bases" for the four subsystems that comprise the Containment Ventilation System, the staff draws the conclusion (even though not specifically stated within the DCD) that the heat loads internal to the containment will be removed by the following three subsystems;

1) Containment Fan Cooler System;

2) Control Rod Drive Mechanism Cooling System Cooling System; and

3) Reactor Cavity Cooling System.

Revision 1 of the DCD Sections 9.4.6.2.4.1 and 9.4.6.2.4.2 for both the Containment (i.e. Low and High, respectively) Volume Purge Systems now includes the words "The COL Applicant is to determine the capacity of the cooling and heating coils that are affected by site specific conditions". Therefore, for the containment building itself, the cooling and ventilation fan design values currently contained in the DCD for these three in containment subsystems, become the values approved with design certification.

Based on the above and after reviewing the applicant's response, the staff has the following questions:

1) For the containment fan cooler system, a "Cooling Load" of 7,700.000 Btuh is assumed. Based on what information is this value assumed? What is the reason for assuming this value instead of using a value derived through quality controlled engineering calculations? The multiplier of 1.15 used in the equation appears to represent a engineering margin. What engineering standard is this marginal value based? The staff requests that the applicant provide design values based on engineering calculations and design based heat loads and not based on assumptions.

2) For the CRDM Cooling System the applicant responded that the total cooling load is again based on an assumed value (i.e. 4,000,000 Btuh) and includes the heat gain from the motor of the CRDM cooling fan. It appears that to be accurate, since the fans follow the coolers in the air stream, that the heat load from the fans will be dumped into the large volume of the containment. Therefore, the heat load from these fans will be principally removed by the coolers of the containment fan cooler system. What is the reason for assuming the assumed value instead of using a value derived through quality controlled engineering calculations?

3) For the Reactor Cavity Cooling System the applicant concludes with the fact that the fan air flow rates contained in the current revision of the DCD are assumptions based on Japanese PWR plants and that the actual airflow requirements will be updated based on the concrete temperature distribution analysis. The staff can not base its final SER approval on assumed values, but rather the staff requires the option of reviewing the actual DC plant engineering calculations or to have access to enough design basis information to perform its own independent confirmatory calculation. When will the actual airflow requirement engineering calculations (i.e. based on the final concrete temperature distribution analysis) be available for staff review.

4) For the Contaiment High and Low Volume Purge systems the applicant failed to provide the staff with sufficient information to satisfy the requests of the original RAI #73 /06.05.01-1, RAI 6.5.1-20.

The staff requests that the applicant provide the staff with sufficient information to overcome the RAI response deficiencies identified above.

ANSWER:

a) In response to 1):

A "Cooling Load" of 7,700.000 Btu/h is based on the heat generated by the equipment and components within the containment, except for CRDMs, CRDM cooling fans and CRDM cooling fan motors. This cooling load is the design value. This cooling load is a calculated total value and is not a actual heat load. Therefore, MHI adds the margin to the cooling load in order to satisfy the cooling function. MHI is of the opinion that the phrase "Assumption" had not been appropriate in the answer of RAI #73 /06.05.01-1 RAI 6.5.1-20.

The margin of 1.15 is based on the requirement of Utility Requirement Document (URD) Volume II, Chapter 9: Site Support Systems that states "To accommodate higher than calculated HVAC loads, the process related heat removal capacity shall include the following margins:
-15 percent of the calculated total heat load;
-15 percent of calculated fan differential pressure, excluding pressure drop for filters and heating and cooling coils "

b) In response to 2):

The cooling load generated within the containment is removed by CRDM cooling system and containment fan cooler system. The cooling capacity of CRDM cooling system is designed to remove cooling load generated from the CRDMs, CRDM cooling fan and CRDM cooling fan motors. And cooling capacity of containment fan cooler system is designed to remove other cooling load generated by equipment and components within the containment. Therefore, the cooling load of fan motor is counted for the CRDM cooling system. This cooling load is the design value. MHI thinks that the phrase "Assumption" had not been appropriate.

c) In response to 3):

MHI corrects the answer to RAI #73 /06.05.01-1 RAI 6.5.-20 because the description is not appropriate: "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". The air distribution of the reactor cavity cooling system that are provided in the response to RAI #73 /06.05.01-1 RAI 6.5.-20 is not an assumption but design values. Therefore, MHI remove the above sentence from the answer.

d) In response to 4):

During refueling, the maximum containment air temperature is maintained by the containment high volume purge system and containment fan cooler system. When the containment high volume purge system is operated during refueling, this system removes a 486,000 Btu/h (Note 1) from the containment at containment air temperature of 85 deg-F due to conditioned supply air of 65 deg-F. If the heat generated by the structure, equipment and components exceeds the containment high volume purge system cooling capacity, the containment fan cooler system will be operated manually. The heat load during the refueling is lower than the heat load during power operation. Therefore, the maximum containment air temperature during refueling is maintained lower than 85 deg-F.

When the outside air temperature is low, the incoming outside air is tempered by the heating coil of supply air handling unit and the tempered air maintains the minimum containment air temperature. The heating requirement is depend on the site-specific condition.

Note 1) Cooling capacity of containment purge system at containment air temperature of 85 deg-F is calculated by:
Btu/h = 1.08 x 30,000 x (80 – 65) = 486,000 Btu/h

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

05/15/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.300-2288 REVISION 1**
SRP SECTION:	**06.05.01 – ESF Atmosphere Cleanup Systems**
APPLICATION SECTION:	**FSAR Sections 7.5, 7.7, 9.4.6**
DATE OF RAI ISSUE:	**04/01/2009**

QUESTION NO. : 06.05.01-7

The applicant indicates in its response to RAI#73 /06.05.01-1, RAI 6.5.1-9 that comprehensive instrumentation specifications will be implemented during the design phase. Given the significance of the subject instrumentation in monitoring the temperatures of these important structural members (i.e. to reduce the potential for member degradation over the 40 year licensed life of the plant) the staff believes that a COL action item is warranted that triggers the COL applicant to anticipate completing the design of these temperature recorders. Since this tracking issue is instrumentation related, the staff believes that the appropriate place for this COL action item would be against DCD Section 7.5.or Section 7.7. These two design base issues (i.e. reactor vessel support base plate and primary shield wall limiting temperatures) should also be discussed in Chapter 7, Section 7.5 "Information Systems Important to Safety" or Section 7.7 "Control Systems Not Required for Safety". The staff requests that the applicant amend the DCD accordingly.

ANSWER:

MHI acknowledges that the reactor cavity cooling system (RCCS) instrumentation described in DCD Subsection 9.4.6.5.3 may be useful in monitoring the temperatures of safety related structures, e.g., to support maintenance rule condition monitoring of structures or plant life extension activities. However, the instrumentation is non-safety related and supports a non-safety related HVAC system. It is also considered to be part of the US-APWR standard design, such that MHI considers a COL action item to address details beyond the scope of the DCD to be unnecessary.

Section I.1 of NUREG-0800 Standard Review Plan (SRP) Section 7.1, *Instrumentation and Controls – Introduction*, identifies 9 categories of I&C that fall within the scope of SRP Chapter 7. Based on review of these 9 SRP categories, MHI considers the RCCS instrumentation described in DCD Subsection 9.4.6.5.3 to be outside the scope of SRP Chapter 7, because the instrumentation is not relied upon to:

(a) Perform a reactor trip function
(b) Perform an engineered safety feature function
(c) Perform a safe shutdown function
(d) Provide information to confirm a safety function is being performed, or provide bypassed and inoperable status of any safety system
(e) Perform any interlock function

(f) Perform any control function
(g) Provide any diverse actuation system function
(h) Support data communication systems' functions
(i) Support safety systems in accomplishing their safety functions.

Consistent with the guidance of SRP Section 7.1, the RCCS instrumentation is described in the DCD section that contains the RCCS description. MHI will clarify the description of the RCCS instrumentation as shown below.

Impact on DCD

DCD Subsection 9.4.6.5.3 will be revised as follows:

"The instrumentation serving the reactor cavity cooling system includes:

- Alarm on low airflow.
- Recording~~er~~ of concrete temperature ~~and the nuclear instrumentation system~~.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.