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TOKYO, JAPAN

March 25, 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-09106

Subject: MHI's Responses to US-APWR DCD RAI No.235-2134

Reference: 1) "Request for Additional Information No. 235-2134 Revision 1, SRP Section: 10.04.06 – Condenser Cleanup System, Application section:10.4.6," dated February 26, 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. 235-2134 Revision 1"

Enclosed is the responses to 5 RAIs contained within Reference 0.

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. 235-2134 Revision 1

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-09106
Docket Number 52-021

Responses to Request for Additional Information
No. 235-2134 Revision 1

March 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

03/25/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 235-2134**
SRP SECTION:	**10.04.06 - CONDENSATE CLEANUP SYSTEM**
APPLICATION SECTION:	**10.4.6**
DATE OF RAI ISSUE:	**02/26/2009**

QUESTION NO.: 10.04.06-1

Background

The EPRI guidelines, Table 5-2 recommend a dissolved-oxygen concentration in the feedwater sample of ≤ 10 ppb prior to power escalation above 30%, while DCD Tier 2 Table 10.3.5-3 (sheet 1) specifies a control value of ≤ 10 ppb prior to power under 30%. Also, entries for sodium, chloride, and sulfate in the EPRI guidelines are more stringent than the DCD table (sheet 2).

Requested Information

Provide clarification and/or verification of headings and entries for Table 10.3.5-3.

ANSWER:

In Table 10.3.5-3, sodium, chloride and sulfate have been set by the following concept.

- Control values are set by evaluating pH of concentrated liquid in SG crevice.
- Upper limit values of impurity concentration are so set that pH of SG crevice can be maintained within the area of not generating SCC/IGA as shown in Fig. 2-11 in EPRI guidelines.
- In US-APWR, 690TT is used for SG heat transfer tube. By using 600TT data in safety side, however, pH not generating SCC/IGA shall be 5 to 10.
- In area of power less than 30%, impurity concentration environment in SG crevice is not determined as stringent due to thermal flow rate. However, concentration rate is set to 10^5 (equivalent to round-hole pipe support plate in full power operation) in the safety side.
- In sodium, the upper limit value was set to 50 ppb because pH of SG crevice in the concentration of 50 ppb or more would be evaluated as 10 or more under the concentration rate of 10^5.
- In chloride, the upper limit value was set to 100 ppb because pH of SG crevice in the concentration of 100 ppb or more would be evaluated as 5 or less under the concentration rate of 10^5.
- In sulfate, the upper limit value was set to 100 ppb because pH of SG crevice in the concentration of 100 ppb or more would be evaluated to drop rapidly to 5 or less under the concentration rate of 10^5.

Impact on DCD

There is no impact on DCD

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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Docket No. 52-021

RAI NO.:	**NO. 235-2134**
SRP SECTION:	**10.04.06 - CONDENSATE CLEANUP SYSTEM**
APPLICATION SECTION:	**10.4.6**
DATE OF RAI ISSUE:	**02/26/2009**

QUESTION NO.: 10.04.06-2
Background

In order to meet the requirements of GDC 14, specifically as it relates to prevention of secondary-side corrosion of the steam generator tubing, SRP Section 10.4.6 notes that for indirect cycle (pressurized-water reactors such as the US-APWR), SRP Section 5.4.2.1 provides the criteria for acceptable secondary water chemistry. SRP Section 5.4.2.1 states that the secondary-water chemistry program is acceptable if (1) the coolant chemistry is maintained and monitored as described in the Branch Technical Position, (BTP) 5-1, "Monitoring of Secondary Side Water Chemistry in PWR Steam Generator." BTP 5-1 states that the applicant should address how its program meets industry guidelines (e.g., EPRI's secondary-water chemistry guidelines and Nuclear Energy Institute (NEI) 97-06). NEI 97-06 states that each licensee shall have procedures for monitoring and controlling secondary-side water chemistry to inhibit secondary-side corrosion-induced degradation in accordance with the EPRI PWR Secondary Water Chemistry Guidelines.1

The staff has reviewed the control values for chemistry parameters provided in DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, 10.3.5-3, for various portions of the secondary system and various modes of operation. The staff notes that the parameters provided are generally consistent with the Action Level 1 values specified by the EPRI PWR Secondary Water Chemistry Guidelines, Rev. 6 dated December 2004. However, DCD Tier 2 Section 10.3.5 does not specify the corrective action to be taken if the control values are exceeded. In addition, the staff noted that the EPRI guidelines in some cases provide Action Level 2 and 3 values for some chemical parameters for which the DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, 10.3.5-3 do not provide equivalent control values. The EPRI guidelines define Action Level 1 as the level that, if exceeded, requires corrective action to be initiated. If Action Level 2 is exceeded, the condition must be corrected within 24 hours or the plant must be shut down, and if Action Level 3 is exceeded, the plant must be shut down immediately. Finally, DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, 10.3.5-3, and 10.4.6-2 do not provide a sampling schedule for secondary-water chemistry parameters.

Some of these issues are programmatic issues that may be outside the scope of a standard design certification application and may more appropriately be the responsibility of the applicants for a combined operating license (COL).

Requested Information

The applicant is requested to identify what recommendations can be made to the combined operating license (COL) applicant referencing the US-APWR standard design related to Items 1, 2 and 3 below. Discuss whether one or more COL information items would be appropriate if these items should be addressed by the COL applicant.

Discuss what corrective action(s) are to be taken if the control values listed in DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, and 10.3.5-3 are exceeded. Discuss whether Action Levels 1, 2, and 3 should be implemented consistent with the EPRI PWR Secondary Water Chemistry Guidelines. If an alternative system of corrective actions is recommended, discuss whether the secondary-water parameters exceed specified control values.

Discuss the recommended sampling schedule for secondary- water chemistry parameters provided in DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, and 10.3.5-3.

ANSWER:

Water chemistry parameters should be controlled by the following action levels in three(3) stages. However, as described below, Action Levels 2 and 3 will restrict plant operation. Therefore, it is appropriate to solicit licensee (owner) input during preparation of the plant procedures. Also, EPRI PWR Secondary Water Chemistry Guidelines(Rev.6), 5.1 Introduction, states "All control parameters(including all associated Action Level 1,2 and 3 values, hold values, and monitoring frequencies)and all action level responses in this chapter 5 are "shall" requirements, unless otherwise specially indicated."
Action Levels 2 and 3 will not be presented at the DCD or COL stage. Therefore, in the DCD, as standard design, only the Action Level 1 value has been described as a control value.

(a) Action Level 1
Control level obviously recognized as abnormal even in consideration of sampling and analysis errors, which deviates from the standard value, shall be established as Action Level 1. Once in this Action Level, causes for water quality change shall be investigated swiftly, and appropriate improvement actions shall be taken.

(b) Action Level 2
Although no plant nonconformance occurs immediately, component materials could be damaged if the condition lasts for an extended period of time. By restricting the period of operation to 1 week, therefore, Action Level 2 is established as the control value for water quality to be recovered to within the normal operating range within the 1 week period.

(c) Action Level 3
Faulty condition occurs, making it difficult to adjust water quality. Component materials may be damaged if operation is continued any longer. By restricting operation time to 24 hours, therefore, the value to shut down the plant in case water quality is not recovered within the period is set as the standard control value. If this value is exceeded, Action Level 3 shall be applied.

See the following table for recommended sampling schedule for secondary- water chemistry parameters provided in DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, and 10.3.5-3.

As for sampling schedule of control item, refer to the following table.
(During heat up and power operation)

System Item	Condensate	Feedwater	Water in SG
pH		D	
Cation electric conductivity		D	
Hydrazine		D	
Dissolved oxygen	D	D	
Na			D
Cl			D
SO_4			D
Crevice pHt			W
Total iron		W	
Total copper		F	

Frequency : D Once／day (continuous monitoring by manual analysis or monitoring instrument)
W Once／week
F As required

Once/week shall be applied for water in SG in stagnation/shutdown and wet storage.

Impact on DCD

There is no impact on DCD

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

03/25/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 235-2134**
SRP SECTION:	**10.04.06 - CONDENSATE CLEANUP SYSTEM**
APPLICATION SECTION:	**10.4.6**
DATE OF RAI ISSUE:	**02/26/2009**

QUESTION NO.: 10.04.06-3
Background

In order to satisfy the requirements of GDC 14, specifically as it relates to prevention of secondary-side corrosion of the steam generator tubing, SRP Section 10.4.6 notes that for indirect cycle (pressurized-water reactor plants such as the US-APWR), SRP Section 5.4.2.1 provides the criteria for acceptable secondary water chemistry. SRP Section 5.4.2.1 states that the secondary-water chemistry program is acceptable if (1) the coolant chemistry is maintained and monitored as described in the Branch Technical Position, (BTP) 5-1, "Monitoring of Secondary Side Water Chemistry in PWR Steam Generator." BTP 5-1 states that the applicant should address how its program meets industry guidelines (e.g., EPRI's secondary-water chemistry guidelines and Nuclear Energy Institute (NEI) 97-06). NEI 97-06 states that each licensee shall have procedures for monitoring and controlling secondary-side water chemistry to inhibit secondary-side, corrosion-induced degradation in accordance with the EPRI PWR Secondary Water Chemistry Guidelines.1

The EPRI guidelines specify action levels for certain parameters and operating conditions. The EPRI guidelines define Action Level 1 as the level that if exceeded, requires corrective action to be initiated. If Action Level 2 is exceeded the condition must be corrected within 24 hours or the plant must be shut down, and if Action Level 3 is exceeded, the plant must be shut down immediately. For some of the action levels specified in the EPRI guidelines, DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, and 10.3.5-3 do not specify any corresponding control values.

Requested Information

The applicant is requested to address the following discrepancies from the EPRI Secondary Water Chemistry Guidelines:

- For the steam generator blowdown sample during power operation, the EPRI guidelines include Action Level 1, 2, and 3 for the control parameters for cation conductivity, sodium, chloride, and sulfate. The control values provided in Table 10.3.5-1 for sodium, chloride, and sulfate, are consistent with the Action Level 1 values. However, the DCD defines no equivalent values to the Action Level 2 values. Also, the DCD does not provide any control values for cation conductivity.

- For dissolved oxygen in the condensate sample during power operation, the EPRI

guidelines specify Action Level 1 of >10 ppb and Action Level 2 of >30 ppb. DCD Table 10.3.5-1 specifies a control value of ≤ 10 ppb which is consistent with the EPRI Action Level 1 value. However, there is no control value equivalent to Action Level 2.

- For the feedwater sample during power operation, the EPRI guidelines specify an Action Level 1 of >5 ppb and an Action Level 2 of >10 ppb for dissolved oxygen. DCD Table 10.3.5-1 specifies a control value of ≤ 5 ppb which is consistent with the EPRI action level 1 value. However, there is no control value equivalent to the EPRI action level 2 value.

ANSWER:

Item1) Water chemistry parameters should be controlled by the following action levels in three(3) stages. However, Action Levels 2 and 3 will restrict plant operation. Therefore, it is appropriate to solicit licensee (owner) input during preparation of the plant procedures. Also, EPRI PWR Secondary Water Chemistry Guidelines(Rev.6), 5.1 Introduction, states "All control parameters(including all associated Action Level 1,2 and 3 values, hold values, and monitoring frequencies)and all action level responses in this chapter 5 are "shall" requirements, unless otherwise specially indicated."
Action Levels 2 and 3 will not be presented at the DCD or COL stage. Therefore, in the DCD, as standard design, only the Action Level 1 value has been described as a control value.
As for SGBD Cation Conductivity, any large value could be shown in case organic amine is used for pH regulator, and values should be set only after considering the plant water treatment. Therefore, no value is set in DCD. In consideration of plant water treatment requirements in the future, and at the stage of preparing the detailed plant procedures, values will be determined through discussions with the licensee(owner).

Item2) Water chemistry parameters should be controlled by the following action levels in three(3) stages. However, Action Levels 2 and 3 will restrict plant operation. Therefore, it is appropriate to solicit licensee (owner) input during preparation of the plant procedures. Also, EPRI PWR Secondary Water Chemistry Guidelines(Rev.6), 5.1 Introduction, states "All control parameters(including all associated Action Level 1,2 and 3 values, hold values, and monitoring frequencies)and all action level responses in this chapter 5 are "shall" requirements, unless otherwise specially indicated."
Action Levels 2 and 3 will not be presented at the DCD or COL stage. Therefore, in the DCD, as standard design, only the Action Level 1 value has been described as a control value.

Item3) For the idea of action levels, refer to the response to Item2.

Impact on DCD

There is no impact on DCD

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

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RAI NO.:	**NO. 235-2134**
SRP SECTION:	**10.04.06 - CONDENSATE CLEANUP SYSTEM**
APPLICATION SECTION:	**10.4.6**
DATE OF RAI ISSUE:	**02/26/2009**

QUESTION NO.: 10.04.06-4
Background

GDC 14 requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. The design pressures for various vessels and traps are given, but no means to achieve these limits are provided. However, best engineering practices require equipment or procedures that can ensure no violations of the operating limits.

Requested Information

Provide a description of the equipment needed to ensure that the condensate, holding, and mixing vessels, as well as the resin traps, do not exceed the various design pressures. Indicate any pressure relief systems that will be used.

ANSWER:

The reactor coolant pressure boundary (RCPB) is defined in 10CFR50.2. In addition, 10CFR50.55a requires components which are part of the RCPB to be Class 1. The condensate polishing system (CPS) is not a Class 1 component nor is it connected to the reactor coolant system. Therefore it is not considered part of the RCPB and GDC 14 is not applicable.

Overpressure Protection:

The Prefilters, Mixed Bed Polisher Vessels, and Resin Traps are high pressure vessels which are designed, constructed and hydro tested as per ASME Section VIII, Div. 1 requirements. The design pressures are higher than the Condensate Pump's shutoff head, per ASME Section VIII, Div. 1 code requirement. Therefore, no additional over pressure protection devices are required for these vessels.

Overpressure protection of the Resin Mixing and Holding Vessel: Charging a Mixed Bed Polisher Vessel from the Resin Mixing and Holding Vessel will occur with the particular Mixed Bed Polisher Vessel is isolated, out of service and vented. Therefore, the Resin Mixing and Holding

Vessel will not be over pressurized from the high pressure side. An ASME Section VIII, Div. 1 code relief valve will be installed on the Resin Holding and Mixing Vessel for over pressure protection.

Overpressure protection of Spent Resin Holding Vessel: Due to either inadvertent opening or potential leak past the block valve(s) in the spent resin line to the Spent Resin Holding Vessel, this vessel can be over pressurized. A spring loaded relief valve will be installed in the common spent resin transfer header line between the high pressure Mixed Bed Vessels and the low pressure Spent Resin Holding Vessel which are downstream of the resin transfer block valves. This relief valve is sized to pass the condensate flow, which can be generated by the differential pressure between the Mixed Bed Polisher vessel design pressure and the relief valve set pressure. Typically this set pressure is 10% over the lower system's design pressure.

Impact on DCD

See Attachment 1 for mark-up of DCD tier 2, Figure 10.4.6.-1.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

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SRP SECTION:	**10.04.06 - CONDENSATE CLEANUP SYSTEM**
APPLICATION SECTION:	**10.4.6**
DATE OF RAI ISSUE:	**02/26/2009**

QUESTION NO.: 10.04.06-5

Background

10 CFR 20.1101(b) requires use of procedures and engineering controls that result in personnel exposures as low as reasonably achievable (ALARA). The DCD identifies the potential for air leaks; hence, ALARA considerations require that potential worker exposure be addressed. While the system has provisions to monitor for the potential of atmospheric ingress, the DCD does not describe any monitoring of release of volatile gases from the system.

Requested Information

Provide the safety precautions that will prevent gas exposure from the all-volatile treatment to the workers. Indicate the monitoring systems that will be used to warn workers of a leak.

ANSWER:

When inventory leakage that has the potential to increase worker exposure occurs, it may be indicative of high level in the turbine building sump. A radiation monitor (RMS-RE-58) is located on the discharge side of the sump (See DCD subsection 11.5.2.3.4). At a predetermined setpoint, the monitor will activate an alarm in the main control room and concurrently, route the sump discharge to the liquid waste management system.

Impact on DCD

There is no impact on DCD.

Impact on COLA

There is no impact on COLA.

Impact on PRA

There is no impact on PRA.

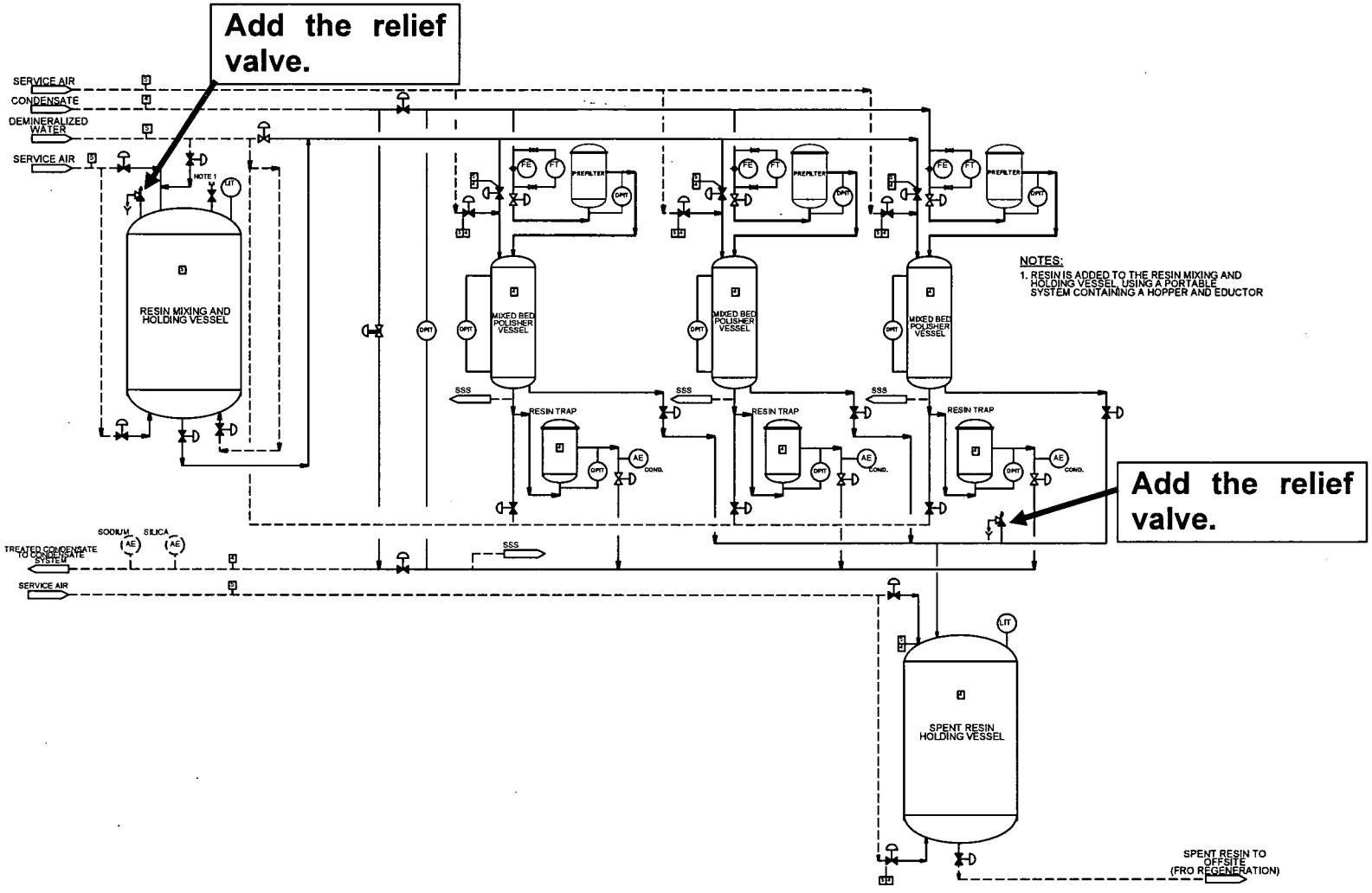

Figure 10.4.6-1 Condensate Polishing System Piping and Instrumentation Diagram