REQUEST FOR ADDITIONAL INFORMATION 383-3002 REVISION 1

6/8/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 10.04.06 - Condensate Cleanup System
Application Section: 10.4.6

QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

10.04.06-6

Background

RAI 10.04.06-1 (Reference 1) requested that the applicant provide clarification and/or verification of headings and entries in Table 10.3.5-3. The applicant's response (Reference 2) did not address our question about the table heading, but did supply the basic reasoning behind the limits for bulk impurity concentrations in the table. The applicant refers to Fig. 2-11 from the EPRI Guidelines (Reference 3) to obtain bulk pH limits for the tube material 690TT. The applicant's reply then states the concentration limits for sodium, chloride, and sulfate as being derived so as to maintain this limit, assuming a concentration factor (CF) of 10^5. (The local crevice concentration is given by multiplying CF by the bulk concentration.)

The details of applicant's derivations were not given, however it is possible to obtain values from the information in Figs. 3-4 through 3-7 of the EPRI Guidelines. These figures plot the change in pH with change in CF. If we assume element limits are derived from worst-case possibilities for each element, then approximate element limits can be derived from the figures in the EPRI Guidelines as follows:

Sodium. Fig. 3-4 indicates pH ≥ 10 when CF ≥ 10^7 (using the bulk concentration of 1 ppb from Table 3-1). Hence, for CF = 10^5 as claimed by applicant, the analogous bulk concentration would be 100 ppb, which is less stringent than applicant's value of 50 ppb for a limit.

Chloride. Fig. 3-6 indicates pH ≤ 5 when CF ≥ 2.5×10^5 (using the bulk concentration of 4.6 ppb from Table 3-1). Hence, for CF = 10^5 as claimed by applicant, the analogous bulk concentration would be 10 ppb, which is much more stringent than applicant's value of 100 ppb for a limit.

Sulfate. Fig. 3-7 indicates pH ≤ 5 when CF ≥ 10^6 (using the bulk concentration of 3[Na]=3 ppb from Table 3-1). Hence, for CF = 10^5 as claimed by applicant, the analogous bulk concentration would be 30 ppb, which is more stringent than applicant's value of 100 ppb for a limit.

Only for the case of sodium, is the applicant's limit more stringent than these calculations using the EPRI Guidelines. In addition, the values calculated above are

remarkably similar to the suggested EPRI limits (see Table 5-3), and both are considerably lower than the applicant's limiting values for DCD Table 10.3.5-3.

Requested Information

1. Clarify the sub-heading under "Control Value" in DCD Table 10.3.5-3. It currently reads "Value Prior to Power Escalation Under 30%". This phrase is ambiguous since "escalation" implies increase, but "Under 30%" implies an upper limit. Also, it is remarkably similar to the analogous Table 5-3 in the EPRI Guidelines, where the heading reads "Value Prior to Power Escalation > 30%."

2. Provide more detail in the calculation of limits for chloride and sulfate to justify the values that are considerably higher than those in the EPRI Guidelines.

References

1. "Request for Additional Information No. 235-2134 Revision 1, SRP Section: 10.04.06 – Condenser Cleanup System, Application Section: DCD Tier 2, Section 10.4.6" dated February 26, 2009. (ADAMS Accession No. ML090610300)

2. Letter from Yoshiki Ogata, MHI, to NRC dated March 25, 2009; Docket No. 52-021 MHI Ref: UAP-HF-09106; Subject: MHI's Response to US-APWR DCD RAI No. 235-2134 (ADAMS Accession No. ML090890519)

3. *Pressurized Water Reactor Secondary Water Chemistry Guidelines*, Rev. 6, Electric Power Research Institute (December 2004).

10.04.06-7

Background

RAI 10.04.06-2 (Reference 1) requested that the applicant provide clarification regarding the limiting values and frequencies for sampling secondary system water. Specifically, the applicant was requested to:

1. Recommend COL information items for issues that should be addressed by the COL applicant.

2. Discuss limiting values and corrective actions, specifically as to how they relate to Action Levels 1, 2, and 3 of the EPRI PWR Secondary Water Chemistry Guidelines.

3. Discuss the recommended sampling schedule (frequency) for parameters from DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, and 10.3.5-3.

In addition, RAI 10.04.06-3 (Reference 1) requested additional clarification and discussion of limiting values for control parameters with respect to the Action Levels 1-3.

In response (Reference 2), the applicant discussed issues that would need to be addressed by a COL applicant or plant operator, but did not identify a COL information item. Also, the applicant discussed Action Levels 1, 2, and 3, but its descriptions of the Action Levels do not match those of the EPRI Guidelines. For example, for Action Level 1 as defined by the EPRI Guidelines, Action Level 2 must be entered if Action Level 1 is exceeded for more than one week. The EPRI Guidelines also require a reduction in power if Action Level 2 is exceeded for 8 hours, and immediate shutdown or reduction in power to less than 5% power if Action Level 3 is exceeded. Finally, the applicant provided a table with recommended sampling frequencies. However, ambiguity still remains with regard to sampling frequency and consistency with the EPRI Guidelines.

The applicant stated that Action Levels 2 and 3 will not be presented at the DCD or COL stage, because these require actions that limit plant operation, and such procedures should only be developed in concert with the eventual plant licensee (owner). However, it it the position of the staff that the DCD applicant should make recommendations to the COL applicant regarding the limits to be followed to ensure materials integrity. If the applicant does not recommend that the COL holder conform to the latest industry (i.e. EPRI) water chemistry guidelines, then the applicant should make alternate recommendations for water chemistry parameter limits to preserve materials integrity. Any differences from the Action Levels from the EPRI Guidelines should be justified.

The design and construction must be undertaken with certain chemistry standards in mind, and it is unclear to the staff what those standards are. In the Tier 2 DCD, Chapter 5 (p. 5.4-13, paragraph 2), it is stated, “The primary and secondary water chemistry is controlled in accordance with industry guidelines.” This implies consistency with the EPRI Guidelines. Further, Tier 2 DCD Section 10.3.5.5 states:

> Appropriate responses to abnormal chemistry conditions provide for the long-term integrity of the secondary cycle components. Remedial actions are taken when chemistry parameters are outside normal operating ranges.
>
> Secondary side water chemistry guidelines are provided in Table 10.3.5-1.

Thus, MHI has declared some guidelines (namely, those in Table 10.3.5-1), and has stated that appropriate actions should be taken if they are violated. If the DCD Table were consistent with EPRI Guidelines, then it would be appropriate to assume that the responses and actions were those specified in the EPRI Guidelines. However, the DCD table(s) are not consistent with the EPRI Guidelines, which include Action Levels 1-3. Hence, “appropriate responses” and “remedial actions” are not well defined.

With regard to the sampling frequencies supplied in the table provided in the response to RAI 10.04.06-2, several are ambiguous and may not match the EPRI Guidelines. The frequency label ‘D’ is used to denote daily grab sampling, but may also imply continuous monitoring. The DCD Tier 2 Section 9.3.2.2.4 mentions continuous monitoring in reference to Table 9.3.2-4, but the measurement description suggests that grab samples are intended. Table 9.3.2-4 itself mentions continuous monitoring only in describing when and where it does not occur. It is not clear to the staff whether the US-APWR design includes the equipment to permit continuous monitoring of secondary water

chemistry parameters, but these parameters are only required to be recorded once per day. Thus, the monitoring frequency for many of the control variables is still unclear to the staff.

Requested Information

1. Identify what recommendations can be made for COL applicants and licensees regarding sampling limits and frequencies, in order to assure consistency with the EPRI Guidelines or other industry standard. If the recommended limits or frequencies differ from those recommended in the EPRI guidelines, provide a technical justification for each difference

2. Justify any inconsistencies of the control values in DCD Tier 2 Tables 10.3.5-1, 10.3.5-2, and 10.3.5-3 with the Action Level 1, 2, and 3 values recommended by the EPRI Guidelines.

3. Clarify the recommended monitoring frequency for the various secondary water chemistry parameters:

a) Clearly identify all secondary water chemistry parameters that are continuously monitored.
b) Clarify which parameters in DCD Tier 2 Table 9.3.2-4 are continuously monitored.
c) Indicate if there are parameters for which continuous monitoring equipment is included in US-APWR design, but the parameter value will only be recorded once per day.
d) Justify any variation from the recommendations in the EPRI Guidelines.

References

1. "Request for Additional Information No. 235-2134 Revision 1, SRP Section: 10.04.06 – Condenser Cleanup System, Application Section: DCD Tier 2, Section 10.4.6" dated February 26, 2009. (ADAMS Accession No. ML090610300)

2. Letter from Yoshiki Ogata, MHI, to NRC dated March 25, 2009; Docket No. 52-021 MHI Ref: UAP-HF-09106; Subject: MHI's Response to US-APWR DCD RAI No. 235-2134 (ADAMS Accession No. ML090890519)

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