REQUEST FOR ADDITIONAL INFORMATION 883-6063 REVISION 3

1/3/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 09.04.01 - Control Room Area Ventilation System
Application Section: 9.4.1

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

09.04.01-29

This is a follow-up RAI to RAI No. 689-4976, Question No. 09.04.01-26 (ML110770284). The applicant responded to this eight part question about the design of MCR emergency filtration system with an eight part response.
The staff found the applicant's response to parts 1 and 8 as acceptable with no further questions.
The staff found the applicant's response to parts 2 & 3 and the resultant proposed DCD changes to DCD Table 6.4-1 and Table 6.4-2 as acceptable. However, Revision 3 of the DCD does not contain the revised Table 6.4-1 and Table 6.4-2. These two issues will be carried forward as NRC Confirmatory Items in the SER. The staff views the lack of incorporation of these two issues into the DCD as a timing issue since the RAI response was dated within a few weeks before DCD Revision 3 was issued. Please advise the staff if this is not the case.
The staff has the following additional requests for additional information about parts 4 through 7.

<u>Part 4</u>

The staff notes that DCD Section 9.4.1 reads that the MCR HVAC system complies with N509. The staff again notes that ASME N509-2002 section 4 "Functional Design" 4.10 reads: " *Where heat of radioactive decay or heat of oxidation or both may be significant, means shall be provided to remove this heat from the adsorbent beds to limit temperatures to values below 300°F (149°C) to prevent significant iodine desorption."*
The applicant responded that ... "*the main control room emergency filtration unit charcoal adsorber is provided with outlet air temperature indication and high, high-high temperature alarms in the control room to alert the operator to an abnormal temperature condition, as described in DCD Section 9.4.1.5 and shown on DCD Figure 9.4.1-1. In the event of a charcoal adsorber high temperature condition, the operator can initiate ventilation flow through the charcoal bed by restarting the filtration unit to remove heat from the adsorber to prevent significant iodine desorption."*
The staff notes that the applicant did not provide calculated values for the maximum component temperatures: (a) in the adsorber section with normal flow conditions <u>and</u> (b) with the unit shutdown & the charcoal adsorbent unit isolated (i.e. post LOCA condition). Based on the applicant's response the staff cannot conclude that the iodine loading post-accident radioactivity-induced heat in the adsorbent will not exceed the design limiting temperature of 300ºF. The staff again requests that the applicant provide this information to the staff.

Part 5
The applicant responded (in part) that… " *the manually actuated fire protection water spray system installed within the filter housing, described in DCD Sections 9A.3.68 and 9A.3.69, is provided as fire suppression for the charcoal bed. Fire protection water spray can be initiated in the event of a high-high temperature (*i.e. alarm) *to prevent charcoal ignition."*
While the applicant adequately answered the question asked, the staff requests additional information about the expected maximum expected post-accident radioactively-induced heat in the charcoal filter beds of both the MCR emergency filter trains and the Annulus Emergency Exhaust System. The staff believes that relying on the fire protection system should be the last line of defense if the filter trains can be adequately sized to prevent such a fire in the design phase. In particular, based on the radioactive iodine loading from the most limiting DBA, what are the maximum expected temperatures within the bed and on the leading edge and trailing edge surfaces?
Part 6
The applicant responded that …. "*the outside air intakes for the main control room emergency filtration units are located on the East and West walls of the Reactor Building. The outside air intake opening is designed to comply with RG 1.52, Regulatory Position 3.11 as shown in DCD Table 6.4-2. Therefore, the HEPA filters and iodine adsorbers are protected from water damage and it is not necessary to include demisters in the design of the main control room emergency filtration units."*
The staff finds that the response did not adequately address the guidance of ASME N509-2002 section 4 "Functional Design" 4.1 (d) reads*: "Moisture separators (demisters) are required when entrained water droplet concentration may be greater than 1 lb (0.45 kg) of water per 1,000 cfm (1,700 m^3/hr) of airflow."*
As an example, from the "1997 ASHRAE Handbook Fundamentals" it can be determined that for a potential US-APWR plant located near Jackson, Mississippi the latent moisture loading contained in the influent air stream for periods of time of 2% of the year or greater (Table 26.15 page 26.15) could contain 1.29 lbs of water per 1,000 $ft^{3/}$/min. This is based on the following Psychrometric Chart properties of 78F WB, 88F MDB Humidity Ratio = 0.0184 lb H_2O/ lb dry air and Specific volume of 14.2 ft^3/lb dry air. The 1.29 lbs of moisture clearly exceeds the threshold criteria of ASME N509-2002.
The staff requests that the applicant redress their response based on the staff's observation. The staff suggests that the applicant change the US-APWR DCD to include demisters in the safety related emergency filter trains within the plant or create a COL item to have the COLA applicant's to evaluate this need on an individual plant basis.
Part 7
The staff noted that there is insufficient design information to determine if the HEPA filters have sufficient design margin to accommodate fission product loading without restricting flow rate.
The applicant responded that …"*Regulatory Guide 1.52, Section 6, In-place Testing Criteria, Regulatory Position 6.3, describes the HEPA filter bank in-place aerosol leak test acceptance criterion of 0.05% or less at rated flow +/- 10%. In accordance with Regulatory Position 6.3, when this criterion is met, a HEPA filter bank can be credited in the accident dose evaluations with 99% removal efficiency for particulate matter. DCD Table 6.4-1 specifies the main control room*

emergency filtration units HEPA particulate removal efficiency as 99%, which is consistent with the allowed credit for filter efficiency in Regulatory Guide 1.52. Excessive loading of the HEPA filter bank by larger airborne particulates in the airstream is prevented by the upstream high-efficiency prefilter as described in DCD Section 6.4.2.2.1."
The staff requests that based on the most limiting DBA in terms of a particulates that the applicant provide the maximum mass loading on the upstream HEPA filters of both the MCR emergency filter trains and the Annulus Emergency Exhaust System filter trains. How do these maximum mass loading values (i.e. in mg) compare with the rated dust loading value of each filter of the filter train and provide a comparison of the magnitude of the impact on the clean versus a fully fouled filter (i.e. maximum design dP)?

09.04.01-30

This is a follow-up to the RAI sequence: RAI No. 63, Question No. 09.04.01-18; RAI No. 327-2401, Question No. 09.04.01-6; RAI 475-3780, Question No. 09.04.01-14; & RAI No. 582-4456, Question 09.04.01-20.

This follow-up RAI is necessitated by changes created by DCD Revision 3 Tier 1 changes to Item 12 of ITAAC Table 2.6.5-1. The staff notes that Revision 3 of the US-APWR DCD Tier 1 deleted Item 12 from Table 2.6.5-1. This change creates a new Open Item from an Phase II SER NRC Confirmatory Item

Please explain why deletion of Item 12 is acceptable.

09.04.01-31

This is a follow-up RAI as RAI No. 689-4976, Question No. 09.04.01-27.
The staff found the applicants response insufficient in that they failed to decide between the two paths towards an acceptable resolution: (1) a minimum credible humidity for the site conditions permitted in the DC with no humidity control to use for the qualification of control room electrical equipment or (2) to change the plant design to include safety-related humidifiers. In addition the staff notes that Revision 3 of the DCD Table 2.7.5.1-3 "Main Control Room HVAC System Inspections, Tests, Analyses and Acceptance Criteria" Item 4.a has been changed to remove any reference to the need of maintaining MCR humidity limits within design specifications.
The staff requests that the applicant redress its response to Question No. 09.04.01-27 and change the DCD to reflect an acceptable resolution per the above. The staff also requests that the applicant reinstate the requirement to demonstrate the capability of the MCR HVAC system to maintain humidity levels within the CRE at acceptable limits during normal operations, abnormal and accident conditions of the plant in Item 4.a of DCD Table 2.7.5.1-3.

09.04.01-32

This is a follow-up RAI to RAI No. 689-4976, Question No. 09.04.01-25. The bases for this follow-up RAI is the review guidance of NUREG-0800 SRP 3.4.1. The staff found that the applicant's response to Question No. 09.04.01-25 provided a lot of useful information as to why a leak from an individual cooling coil tube is unlikely to affect the Main Control Room (MCR). However, the applicant failed to provide sufficient information about the design of the AHU cooling coils and equipment drainage system for the staff to conclude that such a leak, should it occur, will not present a coincidental common mode failure to the instrumentation and controls of the Main Control Room via the common HVAC duct lines (i.e. supply and return).

The staff disagrees with the conclusions of the following passages contained in the applicant's response: "*Therefore, the equipment and floor drain system is not required to be designed for the failure of the main control room air handling unit cooling coils."* The staff believe the leakage from a cooling coil should not result in unacceptable consequences.

The staff notes that the applicant assumes maximum leakage rates based on an individual tube leak occurring in one of the many cooling coil tubes that make up an AHU heat exchanger. What is it about the design of the AHU cooling coil heat exchanger that prevents a more significant leak (up to 45 gpm per DCD Table 9.2.7-2) from occurring in the piping or on the header that feeds these many cooling coil tubes? In particular, what prevents this larger leakage from reaching the MCR other than the non-safety related equipment drain system?

In Question 09.04.01-25, the staff requested that the applicant (1) explain the potential failure of a cooling coil will be directed to the drain system, (2) explain how the bypass of the drain system is precluded and (3) explain how the drain system will be sized, tested and maintained to ensure that it can accommodate the full flow from a cooling coil throughout the life of the plant.

The staff suggests the following as a path to closure of this Open Item. To parts (1) and (2) of the question, the "*robust design of the cooling coils*" should include design provisions to prevent any leakage from carrying over beyond the AHU and into the common (i.e. non-divisional) HVAC supply ductwork to the MCR. For examples, downward air flow across the coils and change of direction of air flows to remove from the airstream any entrained leakage from coil leaks could be part of the robust design. For the part (3) the staff acknowledges that the equipment drain system is not a safety related system but the function of the AHUs is safety related. Therefore, an AHU cooling coil catch basin with a safety related level MCR alarm to annunciate that drain capacity is being exceeded by the flow rate from the coil leak. The alarm if properly designed would give the plant operators time to respond and isolate essential chilled water flow from the coil. Collectively, these staff suggestions provide one (of potentially many) possible remedies.

The staff requests that the applicant amend DCD section 9.4.1 with the relevant design information that would allow this Open Item to be closed.