REQUEST FOR ADDITIONAL INFORMATION 356-2549 REVISION 1

5/7/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 09.04.05 - Engineered Safety Feature Ventilation System
Application Section: DCD Tier 2 Section 9.4.5 and 6.5.1

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

09.04.05-2

The staff finds the applicant's response for RAI #64-735/Question Number RAI 9.4.5-1 as insufficient. The applicant in its response did not provide any additional information for the calculation procedures and methods, including assumptions and margins for four subsystems of the ESF Ventilation System.

The applicant indicated in their response that the design parameters of temperature and relative humidity for each room as displayed in DCD Table 9.4-1 are not decided from calculation. The applicant indicated that the design values are based on the Utility Requirements Document (URD), requirement from I&C system, and the experience of Japanese PWR plants.

From this response, the staff has to draw the conclusion that the detailed design phase of the US-APWR is not complete. If the detailed design phase is delayed and deferred to the COL applicant stage, the staff cannot satisfy the review requirements of SRP 9.4.5 "Areas of Review" section I.2. In particular, section 2, item A.

A. The ability of the heating and cooling systems to maintain a suitable ambient temperature range in the areas serviced, assuming proper performance of equipment contained in these areas;

If the detailed design phase is to be delayed and deferred to the COL applicant, then at a minimum the staff recommends that applicant create a Combined License Information item in DCD section 9.4.7 to capture this expectation and commitment. Alternatively or in addition to, the staff requests that the applicant consider establishing an ITAAC or a Condition for Licensing that provides the guarantee that the COL applicant satisfies the requirements of item A above.

Pursuant to the requirements of RG 1.206 the DCD needs to contain a design of sufficient detail so that the staff can perform its own set of confirmatory calculations (on a select basis) or review the applicant's calculations to support the writing of the Safety Evaluation Report.

The staff requests that the applicant redress its response to RAI 9.4.5-1 to allow the staff to complete its DCD review requirements.

If the applicant's response to this RAI warrants an amendment of the DCD, the staff requests that the applicant include in their response the revision of the DCD that the amendment will appear in.

09.04.05-3

The staff finds the applicant's response for RAI #64-735 / Question Number RAI 9.4.5-3 as incomplete. In its response, the applicant provided two formulas with a supporting calculation that derived the required air flow rates for the Penetration Areas and the Safeguard Component Areas of the plant. The derived value from this calculation for the air flow rate of the Annulus Emergency Exhaust Filtration Unit equals 5,600 ft^3/min. This is consistent with value found in Table 9.4.5-1 for the Annulus Emergency Exhaust Filtration Unit.

The staff requests additional information for the following questions:

a. **In reviewing the calculation it is not obvious to the staff the origin of the equations used. What is the source of these equations?**
b. **In addition, staff could not locate values for the volume of the penetration areas nor the volume of the safeguard component areas within DCD Chapter 3 "Design of Structures,Systems,Components and Equipment". Are these values documented elsewhere in Tier 2 of the DCD?**
c. **What is the basis for the assumptions used in the two equations? In particular, the "Effect of the expansion of CV" and the "Maximum allowable in-leak" for the two areas.**
d. **What amount or percentage of the in-leakage into the Penetration Area and the in-leakage into the Safeguard Component Area comes from the Containment leakage?**
e. **How did the applicant account for effects of the outside environment and associated uncertainty on the drawdown rate?**

09.04.05-4

The staff finds the applicant's response for RAI #64-735 / Question Number RAI 9.4.5-4 as insufficient. The applicant in its response provided a basic formula with no US-APWR plant specific design data for calculating the necessary ventilation airflow for the Class 1E battery rooms.

The staff anticipated that the applicant would respond with a detailed engineering calculation, with relevant and realistic assumptions and margins, based on plant design parameters (e.g. room size, number of

batteries etc). This calculation would yield an air flow value to the Class 1E battery rooms that will ensure hydrogen concentration levels within the battery rooms remain well below a threshold value of 2%. This engineering calculation would provide the basis for the Class 1E Battery Room Exhaust Fan size (with adequate margins) identified in DCD Table 9.4.5-1.

From the applicant's response, the staff has to draw the conclusion that the detailed design phase of the US-APWR is not complete. Should the detailed design phase be delayed and deferred to the COL applicant stage, the staff cannot satisfy the review requirements of SRP 9.4.5 "Areas of Review" section I.2. In particular, item D.

D. The capability of the system to circulate sufficient air to prevent accumulation of flammable or explosive gas or fuel-vapor mixtures from components such as storage batteries and stored fuel;

If the detailed design phase is to be delayed and deferred to the COL applicant, then at a minimum the staff recommends that applicant create a Combined License Information item in DCD section 9.4.7 to capture this expectation and commitment. Alternatively or in addition to, the staff requests that the applicant consider establishing an ITAAC or a Condition for Licensing that provides the guarantee that the COL applicant satisfies the requirements of item D above.

Pursuant to the requirements of RG 1.206 the DCD needs to contain a design of sufficient detail so that the staff can perform its own set of confirmatory calculations (on a select basis) or review the applicant's calculations to support the writing of the Safety Evaluation Report.

The staff requests that the applicant redress its response to RAI 9.4.5-4 to allow the staff to complete its DCD review requirements.

If the applicant's response to this RAI warrants an amendment of the DCD, the staff requests that the applicant include in their response the revision of the DCD that the amendment will appear in.

09.04.05-5

In response to RAI #64-735 / 09.04.05-1, RAI 9.4.5-6, MHI has added many of the subject references in Revision 1 of DCD section 9.4.8. The applicant in its response committed to concise changes to DCD section 9.4.8 "References" that fully address the staff's concerns. The applicant did not indicate which revision of the DCD would contain the committed to changes. The staff reviewed Revision 1 of the DCD and found that it included many of these changes but not all. Therefore, the staff finds this response as insufficient.

The following three references are still missing: ARI 430-1999; SMACNA 1143-1985; SMACNA 1780-2002 in Revision 1 of the DCD.

In addition, Revision 1 DCD section 9.4.5.4 does not identify the particular references in parentheses against the actual standard. This approach is inconsistent with other similar sections of the DCD (e.g. DCD section 9.4.4.4)

The staff requests that the applicant remedy these deficiencies and inconsistencies. If the applicant's response to this RAI warrants an amendment of the DCD, the staff requests that the applicant include in their response the revision of the DCD that the amendment will appear in.

09.04.05-6

The staff finds the applicant's response for RAI #64-735 / Question Number RAI 9.4.5-9 as incomplete. Upon review of the applicant's response against the information contained in the DCD the staff noted additional inconsistencies within the DCD.

US-APWR DCD Tier 2 (Rev 1), section 1.9.1, Table 1.9-1-1 indicates conformance with RG 1.52 (Rev 3) with no exceptions identified. Conformance with RG 1.52 (Rev 3), Regulatory Position 3.1, describes a typical ESF atmosphere cleanup system unit composed of (1) moisture separator, (2) pre-filter, (3) heater, (4) HEPA filter before the adsorbers, (5) iodine adsorber (impregnated activated carbon), (6) HEPA filter or medium efficiency post-filter after the adsorbers, (7) fan, and (8) interspersed ducts, motors, dampers, valves, and related instrumentation.

Section 9.4.5 of the DCD identifies the Annulus Emergency Exhaust System as an ESF ventilation system which functions to support and assure the safe and continuous operation of the ESF equipment during normal and emergency operating conditions. Section 9.4.5.1.1.1 states, "The emergency exhaust filtration units are designed and constructed in accordance with ASME standard N509, AG-1, and with the recommendations of RG 1.52." However, section 9.4.5.2.1, Figure 9.4.5-1, and Table 9.4.5-1 do not describe or include a charcoal adsorber filter (and other filters, components and equipment in RG 1.52) in the design of the Annulus Emergency Exhaust System.

It appears that the applicant is presenting a justification to exclude a charcoal adsorber in the design of the Annulus Emergency Exhaust System because this ESF ventilation system is not used in normal reactor operations and AOOs. In this case, MHI should then:

1) **revise section 9.4.5 and remove the word "normal" from the ESF ventilation system design description, and**

2) **include in the DCD the justification (and exception) for excluding a charcoal adsorber, other filters, and components and equipment**

recommended in the RG 1.52 design criteria for the Annulus Emergency Exhaust System as an ESF ventilation system.

The staff requests that the applicant address these inconsistencies and amend the DCD as appropriate.

In responding to this follow-up RAI, the staff advises the applicant to consider the implications of a related follow-up to RAI #68-841 / Question No. RAI 9.4.3-8 from the SRP 9.4.3 review which pertains to 10CFR20 and the AOO of a SB-LOCA.

If the applicant's response to this RAI warrants an amendment of the DCD, the staff requests that the applicant include in their response the revision of the DCD that the amendment will appear in.

09.04.05-7

The staff finds the applicant's response for RAI #64-735 / Question Number RAI 9.4.5-11 as insufficient. The staff notes that the applicant cited Regulatory Guide 1.206, section C.I.9.4.5.2 and stated in its response that a design basis and capacity description of the in-duct heaters is not required in the DCD because they are not major components. Section C.I.9.4.5.2 of the RG 1.206 states that the system description should include the system major components, key parameters, essential controls and operating modes.

The applicant's response summarily dismisses these in-duct heaters as not major components. The staff posits that in some instances there could be a US-APWR plant located in the extreme northern regions of the United States. In an instance such as this, the in-duct heaters could be required to keep safety related equipment operable. More specifically, to keep the ambient room temperatures within the design basis operating range for safety related equipment. In this case, the non-safety-related in-duct heaters may still not constitute a major electrical load but would be vital to the sustained operation of the plant.

The staff agrees with the applicant's DCD approach in that the capacity of the in-duct heaters need not be described in the DCD because it is a site specific issue. Accordingly, it warrants a COL action item tag. However, as illustrated in the above example there can be cases where it's considered a vital component required to support the operation of safety-related equipment. Accordingly, it should be tracked in DCD Table 9.4.5-1 as a COL item.

The staff requests that the applicant reconsider its response in light of this staff concern. The staff requests that the applicant clarify/correct its response to Question Number RAI 9.4.5-11 with regard to this in-duct heating issue.

If the applicant's response to this RAI warrants an amendment of the DCD, the staff requests that the applicant include in their response the revision of the DCD that the amendment will appear in.

09.04.05-8

The staff finds the applicant's response for RAI #64-735 / Question Number RAI 9.4.5-12 as insufficient. The staff found four issues for resolution associated with the applicant's response:

(1)The first paragraph of the applicant's response committed to revise DCD section 9.4.5.2.5 to incorporate "The above explanation…". However, the "Impact on DCD" section of the applicant's response did not clearly convey "The above explanation….". Specifically, the proposed changes #2 and #3 of the "Impact On DCD" should be more consistent with the explanation provided. Below is how they might appear:

> **"There are two Annulus Emergency Filtration Unit Area AHUs and two Charging Pump Area AHUs. Each area air handling unit contains two 100% capacity cooling coils. Each cooling coil for the Annulus Emergency Filtration Unit Area AHU has a cooling capacity of 4000 Btu/hr. Each cooling coil for the Charging Pump Area AHU has a cooling capacity of 6000 Btu/hr. Each cooling coil is served by a dedicated train of the essential chilled water system. Hence, the loss of one train will not affect the cooling capacity of the Annulus emergency Filtration Unit Area AHUs or the Charging Pump Area AHUs."**

(2) The staff notes that the capacity of 10,000 Btu/hr per coil for the Annulus Emergency Filtration Unit or the Charging Pump Area AHU contained in the table of the applicant's response ("Impact on DCD" proposed change #1) does not agree with the explanation above.

(3) Revision 1 of the DCD revised Figure 9.2.7-1 "Essential Chilled Water System Flow Diagram" sheets 1 and 2. The staff found that revision 1 of this figure does not agree with the above explanation.

(4) For "Impact on DCD" #2 of the applicant's response, the applicant by replacing the paragraph is deleting the last three sentences of the paragraph and removing the (middle) sentence inserted by revision 1 of the DCD. In particular, the applicant is deleting:

> **"The safety-related component area HVAC system is shown in Figure 9.4.5-1 and 9.4.5-5 and the equipment design data is presented in Table 9.4.5-1. The COL Applicant is to determine the capacity of heating coils that are affected by site specific conditions. The cooling coils are supplied with chilled water from the essential chilled water system (section 9.2.7)."**

What is the reason for the deleting this?

The staff requests that the applicant provide additional information and/or a complete resolution to all four of these issues.

If the applicant's response to this RAI warrants an amendment of the DCD, the staff requests that the applicant include in their response the revision of the DCD that the amendment will appear in.

09.04.05-9

The staff finds the applicant's response for RAI #64-735 / Question Number RAI 9.4.5-22 as insufficient. The applicant in its response did not provide any additional information for design flow rates for the four subsystems of the ESF Ventilation System beyond what was already in the DCD.

The applicant indicates in Note 4 of their response that airflows into each individual space will be determined during the detail design phase. If the detailed design phase is delayed and deferred to the COL applicant stage, the staff cannot satisfy the review requirements of SRP 9.4.5 "Areas of Review" section I.2. In particular, items A, D and F.

A. The ability of the heating and cooling systems to maintain a suitable ambient temperature range in the areas serviced, assuming proper performance of equipment contained in these areas;

D. The capability of the system to circulate sufficient air to prevent accumulation of flammable or explosive gas or fuel-vapor mixtures from components such as storage batteries and stored fuel;

F. The capability of the system to control airborne particulate material accumulation.

If the detailed design phase is to be delayed and deferred to the COL applicant, then at a minimum the staff recommends that applicant create a Combined License Information item in DCD section 9.4.7 to capture this expectation and commitment. Alternatively or in addition to, the staff requests that the applicant consider establishing an ITAAC or a Condition for Licensing that provides the guarantee that the COL applicant satisfies the requirements of A, D and F above.

Pursuant to the requirements of RG 1.206, the DCD needs to contain a design of sufficient detail so that the staff can perform its own set of confirmatory calculations (on a select basis) or review the applicant's calculations to support the writing of the Safety Evaluation Report.

The staff requests that the applicant redress its response to RAI 9.4.5-22 to allow the staff to complete its DCD review requirements.

If the applicant's response to this RAI warrants an amendment of the DCD, the staff requests that the applicant include in their response the revision of the DCD that the amendment will appear in.