REQUEST FOR ADDITIONAL INFORMATION 831-6030 REVISION 3

9/26/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 09.04.03 - Auxiliary and Radwaste Area Ventilation System
Application Section: 9.4.3

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

09.04.03-17

Follow-up RAI

This is a follow-up RAI to the RAI sequence RAI No. 68-841, Question No: 09.04.03-1, RAI 9.4.3-9 and RAI #355-2492 Question No. 09.04.03-4.
In Question No. RAI 09.04.03-4, the staff noted that the auxiliary building ventilation system has the function of providing dilution flow for the effluent of the GWMS so that releases (i.e. from the plant) of radioactive gases are below the concentration limits of 10 CFR 20. The staff requested that the applicant add this design basis function to the "Key Design Features" attributes of DCD Tier 1 subsection 2.7.5.4.1.1. The applicant responded (ML092030376) with a commitment to revise Tier 1 Subsection 2.7.5.4.1.1 to acknowledge this function. The applicant committed to also add the dilution function to the system description. The staff found the applicant's response as acceptable. The staff confirmed that the changes described in the applicant's responses have been adequately incorporated in Revision 2 of the DCD.
The staff notes that based on its review of Revision 3 of the DCD, the applicant removed from Tier 1 the very information added to Revision 2 of the DCD that allowed the staff to close these RAI issues in its Phase II SER (ML103120341). Based on this the staff reopens the issues closed issue associated with this RAI sequence, as an Open Item.
The staff requests that the applicant reinstate the information, in some form or fashion, back into Tier 1 to ensure the requirements of 10CFR20 are met.

09.04.03-18

Follow-up RAI

This is a follow-up RAI to the in-sequence RAI 4845, Question 09.04.03-13 (ML102920331) and RAI 779-5865, Question No. 09.04.03-16 (ML11227A045)
In part 1 of Question 09.04.03-13, the staff asked about the automatic system controls that maintain system exhaust flow rates in excess of 10% greater that system supply flow rates thereby maintaining a slight vacuum. In addition the staff inquired about the design pressure of the Turbine Building with respect to the slight vacuum maintained in adjacent areas served by the ABVS. The staff's emphasis was upon ensuring that an unmonitored release was not plausible in the design of the US-APWR. The

applicant provided an incomplete response which necessitated follow-up Question No. 09.04.03-16. In this Question the staff recommended enhanced ITAAC language for ITAAC Table 2.7.5.4-3 line item 10.
The applicant responded that during normal operation, the auxiliary building HVAC system exhaust contains insignificant amounts of radioactive material and is discharged to the atmosphere without filtration, via the plant vent. During normal operating conditions, exfiltration of minimal amounts of this air is expected and represents no significant increase in occupational exposure or offsite dose. The ABVS is also designed to maintain a "slight negative pressure" in the areas it services. This negative pressure "minimizes," but does not prevent, exfiltration from radiological controlled areas during normal plant operation. Minimization of exfiltration is accomplished by maintaining auxiliary building HVAC system exhaust flow at a consistently higher flow rate than supply flow. The applicant did commit to amend the Acceptance Criteria to ITAAC Table 2.7.5.4-3 line item 10 with the words:

> **"A report exists and concludes that the as-built auxiliary building HVAC system maintains exhaust airflow ≥ 216,000 cfm and exhaust airflow greater than or equal to supply air flow, with any two of operating "as-built" auxiliary building exhaust fans, that maintains a negative pressure in the radiological controlled areas under normal operating conditions"**

The staff notes that the applicant's response implies that an unmonitored release (i.e. exfiltration) from the areas served by the ABVS is acceptable based on the fact that the plant emits insignificant amounts of radioactive material through the plant stack during normal operations. The staff notes that there is a key difference between exfiltration and discharge from the plant stack, in that the plant stack release is a monitored release while the exfiltration is not. In addition, the staff notes deficiencies with the proposed ITAAC acceptance criteria wording. Based on the proposed wording the system exhaust flow and the system supply flow could be equal with no motive force to maintain the areas served by the ABVS under a slight vacuum relative to adjacent areas. Based on these observations, the staff concludes that Part 1 of Question 09.04.03-13 remains an Open Item.
As noted above, the staff considers the proposed words for ITAAC Table 2.7.5.4-3 line item 10 as insufficient in that it does not guarantee that all areas served by the ABVS are maintained at a negative pressure relative to all adjacent areas. The staff again suggests words very similar to

> **"A report exists and concludes that any combination of two-of-three as-built auxiliary building exhaust fans maintain a negative pressure (i.e. relative to their adjacent non-radiological areas) throughout all radiological controlled areas served, by exhausting ≥ 10% greater flow than the system supply flow rate of 196,000 cfm."**

Based on the above the staff requests that the applicant redress their response to Part I of the in-sequence RAI 4845, Question 09.04.03-13 (ML102920331) and RAI 779-5865, Question No. 09.04.03-16

09.04.03-19

Follow-up RAI

This is a follow-up RAI to the in-sequence RAI 4845, Question 09.04.03-13 (ML102920331) and RAI 779-5865, Question No. 09.04.03-16 (ML11227A045)

(1)The applicant responded to Part 2 of Question 09.04.03-13 with a commitment to revise preoperational test 14.2.12.1.99 and subsection 9.4.3.4.1 with concise words that address the staff's principle concern identified in Question 09.04.03-13. The applicant stated that determination of the required frequency of periodic confirmation of flow balance is the responsibility of the COL applicant.

The staff requests that the applicant amend DCD subsection 9.4.3.4.1 to clearly assign to the COL applicant the responsibility of establishing the periodicity of ABVS flow balancing such that all unmonitored releases are prevented.

(2) The applicant responded to Question No. 09.04.03-16 with a commitment to add flow damper VAS-AOD-513-N between the interface connection and the three Auxiliary Building Exhaust Fans. In addition the applicant provided the following fundamental system design information with their response.

This flow damper will be installed to adjust the ABVS exhaust airflow rate to design flow rate described in DCD subsection 9.4.3.2.1 regardless of the operation of HVCP and LVCP. HVCP does not operate under 2 psig containment pressure plus the pressure developed across the fan since HVCP operates during refueling operations. During the operation of LVCP under these conditions, the ABVS provides the design exhaust air by the adjustment of the flow damper VAS-AOD-513-N. Therefore, there is no airflow from HVCP and LVCP to ABVS under these conditions.

The applicant continued in their response that the connection from the containment ventilation system (VCS) low volume and high volume purge exhaust to the auxiliary building ventilation system (ABVS) exhaust duct provides a flow path to the vent stack as shown on DCD Figure 9.4.3-1. The ductwork for this connection and the ABVS exhaust duct, and the duct from individual areas in the auxiliary building to the VCS low volume purge exhaust filtration unit inlet, is rated for pressure conditions resulting from containment purge operation, including an initial containment pressure of 2 psig plus the pressure developed across the fans of HVCP and LVCP, since these ducts could be pressurized during purge operation. Airflow is from the VCS to the vent stack during purge operations, and the duct is sized for maximum system flow rate. There is no backflow to the auxiliary building from the VCS because ABVS exhaust fan discharge isolation dampers are closed for non-operating fans. The high volume containment purge and low volume containment purge exhaust fans are interlocked with flow dampers VAS-AOD-511-S and VAS-AOD-512-S such that the fans will not start if the dampers are closed. Therefore, there is no potential for backflow to the ABVS from containment purge exhaust due to the closure of these flow dampers.

The staff requests that the applicant include in the DCD most, the above information in the appropriate subsections of DCD section 9.4.3. The staff finds that this information is required in the DCD because the FSAR is required to include a system description and the safety analyses. The

information is also necessary for the staff to make a satisfactory regulatory finding.
(3) The staff is concerned that the design of the control loop of the recently identified flow damper VAS-AOD-513-N is potentially flawed as displayed in the amended Figure 9.4.3-1 of the applicant's response to RAI 779-5865, Question No. 09.04.03-16 (ML11227A045 pg. 17 of 17). For the flow controller of this flow damper to maintain a negative pressure throughout all areas served by the ABVS, it must guarantee that the system exhaust flow is at least 10% higher than the system supply flow. Figure 9.4.3-1 of the RAI response only has the flow controller sensing the exhaust flow rate of the system.
The staff requests that the applicant revise the design of the flow controller for VAS-AOD-513-N to guarantee that the system exhaust flow is at least 10% higher than the system supply flow by comparing the system exhaust flow rate to the system supply flow rate.

09.04.03-20

Follow-up RAI
This is a follow-up RAI to the in-sequence RAI 4845, Question 09.04.03-13 (ML102920331) and RAI 779-5865, Question No. 09.04.03-16 (ML11227A045)

The applicant responded to Part 5 of Question 09.04.03-13 and then subsequent Question 09.04.03-16. The applicant responded to Question 09.04.03-16 that there are check valves in the sump lines that would prevent backflow from the Auxiliary Building to the Turbine Building through this sump pump discharge pathway. Therefore, there would not be airflow from the Auxiliary Building to the Turbine Building through the interconnection via the non-radiological sump drain system. This level of detail is not shown in the simplified flow diagram in DCD Figure 9.3.3-1. No specific administrative controls are provided for the normally closed valve in the sump pump discharge line that isolates the Turbine Building sump from the Auxiliary Building sump.
The staff could find no mention of check valves in Revision 3 DCD section 9.3.3 "Equipment and Floor Drainage Systems" and their role in preventing an unmonitored release. The staff believes that such a description is warranted in section 9.3.3 to ensure that check valves are installed where appropriate to prevent unmonitored releases. In addition, Figure 9.3.3-1 labels valve from the Turbine Building sump discharge to the Auxiliary Building Waste Holdup Tank as failed closed (i.e. "FC"). Also, the staff believes that if "FC" or "LC" valves are displayed in this simplified flow diagram then the check valves needed to prevent an unmonitored release should also be displayed. These check valves are significant from a system performance perspective.
The staff requests that the applicant revise DCD section 9.3.3 and Figure 9.3.3-1 with the changes identified in the above paragraph.

09.04.03-21

Follow-up RAI (NRC RAI ID 6030, Q#22452)

This is a follow-up RAI to RAI 779-5865 Question No. 09.04.03-15.
The staff reviewed the applicant's response and found it acceptable in that it adequately explained "the how" of maintaining ventilation flows from areas of low radioactivity to areas of potentially high radioactivity.
The applicant response to Question No. 09.04.03-15 read in part "…backdraft dampers are provided in the ventilation duct exhausting uncontrolled areas to prevent backflow from the auxiliary building HVAC system. The backdraft dampers are also provided in the supply duct to uncontrolled areas to prevent backflow when the auxiliary building HVAC system is stopped. DCD Subsection 9.4.3.2.1 will be revised to indicate that backdraft dampers are installed in supply lines to uncontrolled areas and exhaust lines from uncontrolled areas."
The applicant did make a commitment to revising DCD subsection 9.4.3.2.1 with words about the presence of system backdraft dampers. This is an NRC Confirmatory Item. The staff notes that Figure 1.7.4 "Legend for Piping and Instrumentation Diagrams of HVAC System" contains a symbol for backdraft dampers. The staff believes that the backdraft dampers should be displayed on Figure 9.4.3-1 "Auxiliary Building HVAC System Flow Diagram" since these dampers perform a necessary contamination control function and are significant from a system performance perspective.
The staff requests that the applicant also amend DCD Figure 9.4.3-1 to reflect the existence of these backdraft dampers.