

REQUEST FOR ADDITIONAL INFORMATION 917-6272 REVISION 3

4/3/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 06.04 - Control Room Habitability System

Application Section: 6.4 & 9.4.3

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

06.04-15

This is a follow-up RAI to the DCD (MHI) RAI series RAI No. 49-895 Question No. 06.04-19 and RAI 338-2325, Question No. 06.04-6 ([ML091700682](#)); RAI No. 559-4387; Question No. 06.04-13 ([ML101450208](#)) and RAI No. 5410 Question 06.04-14 (ML110740081)

Industry Events involving Refrigerant leaks:

Hope Creek September 29, 1999: see last two pages of press release

<http://www.nrc.gov/reading-rm/doc-collections/event-status/event/1999/19990930en.html>

Quad Cities Unit 1, May 19, 2010: NRC Integrated Inspection Report

05000254/2010003; 05000265/2010003 (page 38)

<http://pbadupws.nrc.gov/docs/ML1021/ML102180023.pdf>

Callaway Unit 1, September 18, 2011 - Preliminary Notification of Event or Unusual Occurrence -- PNO-IV-11-007: ADAMS Accession Number: ML 112620137

ASHRAE Standard 15 Comparison to the US-APWR Design:

The staff requests additional information about the following issues:

(1) Non-Essential Chiller Machinery Room Isolation

The applicant's response in part read "*The US-APWR plant is classified as industrial occupancy in accordance with ANSI/ASHRAE Standard 15, Section 4 since access to the plant is limited to authorized persons and not open to the public.*"

Staff agrees with the applicant's conclusion that the *US-APWR plant is classified as industrial occupancy in accordance with ANSI/ASHRAE Standard 15. This classification applies to both the CRE and the power block as a whole. The whole of the power block will have plant workers performing maintenance activities that need protection from a significant refrigerant/ oil vapor leak. The equipment room in Fire Zone FA4-101-18 for the non-essential chillers will house maintenance activities on a periodic basis for each of the four chillers. In addition, other equipment that share Fire Zone FA4-101-18 (i.e. the ABVS AHUs and the non-Class 1E AHUs) will have periodic maintenance activities.*

The applicant concluded that the ECWS and non-ECWS chillers are indirect closed systems based on the definition in ANSI/ASHRAE Standard 15, Section 5.1.2.3. The applicant went on to conclude that '*This type of refrigeration system is classified as a low probability system in ANSI/ASHRAE Standard 15, Section 5.2, meaning that leakage from a failed connection, seal, or component in the refrigerant system cannot enter the occupied space being cooled by the chilled water systems.*' The staff notes that the closing clause "being cooled by the chilled water systems" is not part of the ANSI/ASHRAE Standard 15, Section 5.2.2 definition for a "Low-Probability System".

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Section 5.2.1 of Standard 15 reads “A high-probability system is any system in which the basic design, or the location of the components, is such that a leakage of refrigerant from a failed connection, seal or component will enter the occupied space.” Given that the equipment room of the non-essential chillers communicates with all of Fire Area FA4-101-18 which is “an industrial occupied space” housing other plant equipment, the non-essential chillers more nearly fit the definition of a “high probability system”. Fire Area FA4-101-18 also houses the A/B Air Handling Units and the non-Class 1E Electrical Room Air Handling Units (Figure 9a-16). These AHUs (including ductwork to the non-Class 1E AHUs) up to the fan will be under negative pressure relative to the room ambient conditions. This violates the guidance provided in Standard 15 Subsections 8.11.7. Therefore to prevent the transmission of a leaking refrigerant/oil fog to other power block areas, the area that houses the non-essential chillers needs to be isolated (e.g. a self closing tight fitting doors) from the rest of Fire Area FA4-101-18 and fire areas above and below to create a Standard 15 compliant “Low-Probability System” machinery room.

The staff notes that DCD Figure 9A-11, Figure 9A-16, Figure 1.2-35, Figure 1.2-26, subsection 9.2.7.2.1 and 9.2.7.2.2 may all need revision to reflect self-closing tight fitting doors. Similarly, the attribute of self-closing doors is not reflected in DCD subsection 9.2.7.2.1 and 9.2.7.2.2. These subsections should also state that alarms are annunciated inside and outside the rooms (Ref. Standard 15, subsection 8.11.2.1).

(2) Essential Chiller and Non-Essential Chiller Machinery Rooms Ventilation
Based on a total amount of refrigerant charge (i.e. approximated at 2,750 lb/non-essential chiller and 1900lb/essential chiller) for four essential chillers and one non-essential chiller, and based on the equation in Standard 15 Subsection 8.11.5, the total combined flow to/from the single non-essential chiller room and four essential chiller rooms would equate to 20,000 to 25,000 cfm. The total design exhaust flow for the ABVS equals 216,000 cfm. It is unclear if the applicant considered this Standard 15 guidance in determining the total design exhaust flow rate for the ABVS?

To ensure Standard 15 conformance, the staff requests that the Acceptance Criteria of 14.2.12.1.99 “Auxiliary Building HVAC System Preoperational Test” and that Section 9.4.3 “Auxiliary Building Ventilation System” be amended to capture the need for adequate ventilation to the machinery rooms of the essential and non-essential chillers. Also, a separate HVAC supply and exhaust is required to/from the non-essential chiller machinery room and to/from the rest of fire area FA4-101-18. However, Figure 9.4.3-1 does not reflect this attribute.

(3) Refrigerant Type and Amounts

The applicant responded that “*The refrigerant type used in ECWS and non-ECWS chillers will be of lower flammability and toxicity level included in Safety Group A1.*” Since compliance with the guidance of Standard 15 depends on the refrigerant type (i.e. Safety Group) and amount per chiller, the staff request that the applicant capture the limits in the DCD to ensure Standard 15 compliance.

(4) Chiller Room Fire Hazard’s Analysis

The staff notes from the “Fire Hazard Analysis Summary” that Fire loading within the Essential Chiller Rooms [Fire Zones FA3-101-01 (page 9A-484), FA3-102-01 (page 9A-485), FA3-108-01 (page 9A-496), FA3-110-01 (page 9A-500)] that potential combustible

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equals lube oil 2.0E+6 Btu per chiller machinery room. From the “Fire Hazard Analysis Summary” (page 9A-537) for the Non–Essential Chiller Rooms: Fire Zone FA4-101-18 that potential combustibles equals lube oil 8.0E+6 Btu for the entire room. The staff request additional information about how these fire loading values were derived.