MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

January 28, 2010

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-10018

Subject: MHI's Response to US-APWR DCD RAI No. 512-3893 Rev. 0

Reference: 1) "Request for Additional Information No. 512-3893 Revision 1, SRP Section: 03.11 – Environmental Qualification of Mechanical and Electrical Equipment, Application Section: 3.11" dated 12/15/2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") documents entitled "Response to Request for Additional Information No. 512-3893 Rev. 0".

Enclosure 1 provides the responses to the 7 questions that are contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No. 512-3893 Revision 0

CC: J. A. Ciocco
C. K. Paulson

Contact Information
C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373-6466

D081
NRO

Enclosure 1

UAP-HF-10018
Docket No. 52-021

Response to Request for Additional Information No. 512-3893
Revision 0

January 2010

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/28/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 512-3893 REVISION 1**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**12/15/2009**

QUESTION NO. RAI 03.11-29:

This Request for Additional Information (RAI) was written prior to the receipt of DCD Revision 2, or MUAP-08015 Revision 1. Rather than delay issuance of the RAI to review the two revisions, the RAI is being issued as written.

The US-APWR DCD, Revision 1, Tier 2 Section 3.11 "Environmental Qualification of Mechanical and Electrical Equipment" and MUAP-08015(R0) "US-APWR Equipment Environmental Qualification Program" describe the equipment qualification process and methodology. Sections 10 CFR 50.49 and 10 CFR 52.79 require licensees to develop an Environmental Qualification program for equipment important to safety. SRP Section 3.11 notes that the applicant is to provide the conceptual approach, including the environmental design bases for identified equipment. SRP Section 3.11 and Regulatory Guide 1.206 note that applicant should identify equipment located in harsh environments.

RAI 358-2642, question03.11-1 Item 1, requested additional information about the methodology and assumptions used to calculate the Total Integrated Dose (TID) to equipment. In their response, the applicant provided a narrative description of the method used to establish the source term, and then stated that MicroShield can be used to calculate the resultant gamma source strength. The applicant also provided a general formula for calculating beta dose rates in water and air. However, the applicant provided insufficient information on the source composition and MicroShield input parameters, to allow the staff to confirm the applicant's conclusions regarding the TID to components.

The applicant should provide the MicroShield input parameter values for calculating the gamma dose component the program used for calculating the integrated beta doses and the associated input parameters, or provide the specific alternative approaches used and the associated justification.

Reference: MHI's Response to US-APWR DCD RAI No. 358-2642, MHI Ref: UAP-HF-09371, dated July 10, 2009, ML091970103.

ANSWER:

In order to calculate gamma dose rates irradiated to the components due to airborne radioactive materials in the CV after a LOCA, the CV is represented by a cylinder with a free volume of 2.74E+6 ft^3 and an inner diameter of 1790 inches as shown in Fig. 1. The dose rate at the center of the cylinder is calculated by assuming a uniform distribution of the containment airborne radioactivity in the cylinder and using the point kernel method. The dose rate at the center is the maximum in the dose rate irradiated to the components located in the CV. MicroShield is used for this calculation. The gamma source strengths of airborne radioactive materials in the CV are as shown in Table 1.

However, MicroShield does not allow evaluation points to be set in the radioactive source. Therefore, a half-height cylinder is assumed, and the surface dose rate of the half-height cylinder is calculated. The air density is assumed for the density in the CV. The use of the same radioactivity for the half-height cylinder, which makes the radioactivity concentration twice that in the full-height cylinder, allows this dose rate to be equivalent to the dose rate at the center of the full-height cylinder. Also MicroShield can not output an absorbed dose rate directly. Therefore, an exposure dose rate is transformed into an air absorbed dose rate. A water absorbed dose rate is transformed from an air absorbed dose rate using an air mass energy-absorption coefficient and a water mass energy-absorption coefficient (ref. NISTIR 5632).

In the calculation of gamma dose rates irradiated to the components from the recirculation water after a LOCA, as in the calculation for the airborne radioactive materials in the CV, the recirculation water is represented by a cylinder with the effective recirculation water volume of 5.68E+4 ft^3. The inner diameter (1790 inches) of the CV is used for the diameter of the cylinder. The dose rate at the center of the cylinder is calculated by assuming a uniform distribution of the radioactivity of the recirculation water in the cylinder and using MicroShield. The gamma source strengths of the recirculation water are as shown in Table 2.

As we explained in our response to RAI 358-2642, question 03.11-1, Item 1, the effective energy of beta radiation is used to calculate beta dose rates irradiated to the components from the airborne radioactive materials in the CV and the recirculation water. The effective energy of beta radiation used is from Appendix A "Nuclear Decay Data" in Federal Guidance Report No.12. The beta source strengths obtained from the effective energy are as shown in Tables 1 and 2.

Table 1 Integrated gamma ray and beta source strengths in the CV after a LOCA

Gamma Ray Energy (MeV)	Source Strength at Time after Release (MeV)									
	0.5 h	1 h	2 h	10 h	1 day	4 days	10 days	30 days	6 months	1 year
0.015	5.1E+19	9.2E+19	1.6E+20	6.0E+20	1.2E+21	3.3E+21	5.8E+21	8.3E+21	9.8E+21	1.0E+22
0.02	9.7E+17	1.8E+18	3.5E+18	1.5E+19	3.0E+19	8.1E+19	1.2E+20	1.3E+20	1.3E+20	1.4E+20
0.03	6.6E+19	1.2E+20	2.2E+20	8.1E+20	1.6E+21	4.7E+21	7.6E+21	1.1E+22	1.4E+22	1.6E+22
0.04	4.4E+20	8.7E+20	1.7E+21	8.2E+21	1.9E+22	6.5E+22	1.2E+23	1.7E+23	1.9E+23	2.0E+23
0.05	5.7E+18	1.1E+19	2.2E+19	1.0E+20	2.3E+20	7.0E+20	1.1E+21	1.3E+21	1.4E+21	1.5E+21
0.06	1.9E+17	3.8E+17	7.5E+17	3.7E+18	8.3E+18	2.7E+19	4.7E+19	7.4E+19	1.1E+20	1.2E+20
0.08	2.4E+19	4.1E+19	6.3E+19	1.6E+20	3.0E+20	9.5E+20	1.8E+21	2.9E+21	3.8E+21	3.8E+21
0.1	7.6E+20	1.5E+21	3.0E+21	1.5E+22	3.5E+22	1.2E+23	2.3E+23	3.2E+23	3.5E+23	3.5E+23
0.15	1.4E+20	2.5E+20	4.0E+20	8.9E+20	1.5E+21	3.4E+21	4.8E+21	6.1E+21	8.1E+21	8.9E+21
0.2	1.2E+21	2.3E+21	4.0E+21	1.2E+22	1.6E+22	1.9E+22	2.3E+22	2.9E+22	3.6E+22	3.7E+22
0.3	3.5E+21	6.1E+21	1.1E+22	4.4E+22	8.8E+22	1.5E+23	1.8E+23	2.1E+23	2.2E+23	2.2E+23
0.4	2.2E+21	4.1E+21	7.4E+21	3.1E+22	6.8E+22	2.3E+23	4.6E+23	7.7E+23	9.4E+23	9.5E+23
0.5	5.2E+21	8.7E+21	1.3E+22	2.2E+22	2.7E+22	4.2E+22	7.0E+22	1.3E+23	2.5E+23	3.1E+23
0.6	8.7E+21	1.6E+22	2.9E+22	1.1E+23	2.1E+23	3.8E+23	4.4E+23	5.6E+23	1.2E+24	2.0E+24
0.8	1.4E+22	2.7E+22	4.8E+22	1.5E+23	2.4E+23	6.0E+23	1.1E+24	2.4E+24	1.1E+25	2.1E+25
1.0	2.2E+22	3.9E+22	6.2E+22	1.3E+23	1.7E+23	2.5E+23	3.6E+23	5.7E+23	1.2E+24	1.7E+24
1.5	3.3E+22	6.1E+22	9.9E+22	2.4E+23	3.4E+23	4.6E+23	5.5E+23	7.3E+23	1.3E+24	1.8E+24
2.0	1.6E+22	2.9E+22	4.9E+22	1.4E+23	1.8E+23	2.5E+23	3.9E+23	6.9E+23	1.0E+24	1.0E+24
3.0	3.5E+22	6.0E+22	9.6E+22	2.2E+23	2.6E+23	2.7E+23	2.8E+23	3.0E+23	3.3E+23	3.3E+23
4.0	9.9E+20	1.7E+21	2.6E+21	4.6E+21	5.0E+21	5.1E+21	5.1E+21	5.3E+21	5.5E+21	5.5E+21
5.0	6.5E+19	1.4E+20	2.6E+20	7.6E+20	9.1E+20	9.1E+20	9.1E+20	9.1E+20	9.1E+20	9.1E+20
Beta	6.2E+22	1.2E+23	2.0E+23	5.8E+23	8.8E+23	1.6E+24	2.3E+24	3.3E+24	5.7E+24	7.8 E+24

Table 2 Integrated gamma ray and beta source strengths in the recirculation water after a LOCA

Gamma Ray Energy (MeV)	Source Strength at Time after Release (MeV)									
	0.5 h	1 h	2 h	10 h	1 day	4 days	10 days	30 days	6 months	1 year
0.015	4.8E+18	9.4E+18	1.8E+19	8.4E+19	1.7E+20	5.5E+20	1.1E+21	1.7E+21	2.8E+21	3.4E+21
0.02	7.5E+17	1.4E+18	2.7E+18	1.2E+19	2.7E+19	7.9E+19	1.1E+20	1.3E+20	1.3E+20	1.3E+20
0.03	4.3E+19	8.1E+19	1.5E+20	5.6E+20	1.1E+21	3.3E+21	5.6E+21	8.2E+21	1.1E+22	1.3E+22
0.04	2.2E+19	4.1E+19	7.6E+19	3.6E+20	9.6E+20	4.5E+21	9.6E+21	1.6E+22	2.8E+22	4.0E+22
0.05	5.7E+18	1.1E+19	2.2E+19	1.0E+20	2.3E+20	7.0E+20	1.1E+21	1.3E+21	1.4E+21	1.5E+21
0.06	1.9E+17	3.8E+17	7.5E+17	3.7E+18	8.3E+18	2.7E+19	4.7E+19	7.4E+19	1.1E+20	1.2E+20
0.08	2.1E+19	3.4E+19	4.9E+19	9.1E+19	1.5E+20	4.2E+20	8.5E+20	1.6E+21	2.3E+21	2.3E+21
0.1	1.7E+19	3.3E+19	6.6E+19	3.7E+20	1.2E+21	7.2E+21	1.6E+22	2.6E+22	2.9E+22	2.9E+22
0.15	1.3E+20	2.3E+20	3.6E+20	8.2E+20	1.4E+21	3.3E+21	4.8E+21	6.0E+21	8.0E+21	8.8E+21
0.2	1.3E+20	2.3E+20	3.5E+20	8.4E+20	1.4E+21	3.8E+21	7.2E+21	1.3E+22	2.0E+22	2.1E+22
0.3	7.6E+20	1.5E+21	2.8E+21	1.6E+22	4.1E+22	9.2E+22	1.2E+23	1.5E+23	1.6E+23	1.6E+23
0.4	1.6E+21	3.1E+21	5.9E+21	2.7E+22	6.3E+22	2.2E+23	4.5E+23	7.6E+23	9.4E+23	9.4E+23
0.5	2.1E+21	3.5E+21	5.2E+21	1.0E+22	1.5E+22	3.0E+22	5.8E+22	1.2E+23	2.4E+23	3.0E+23
0.6	7.3E+21	1.4E+22	2.7E+22	1.1E+23	2.0E+23	3.8E+23	4.4E+23	5.6E+23	1.2E+24	2.0E+24
0.8	1.4E+22	2.6E+22	4.7E+22	1.4E+23	2.4E+23	5.9E+23	1.1E+24	2.4E+24	1.1E+25	2.1E+25
1.0	1.9E+22	3.3E+22	5.2E+22	1.0E+23	1.3E+23	2.2E+23	3.2E+23	5.3E+23	1.2E+24	1.7E+24
1.5	2.7E+22	4.7E+22	7.5E+22	2.0E+23	3.0E+23	4.2E+23	5.1E+23	6.9E+23	1.2E+24	1.7E+24
2.0	7.8E+21	1.4E+22	2.3E+22	6.8E+22	1.0E+23	1.7E+23	3.1E+23	6.0E+23	9.2E+23	9.4E+23
3.0	6.9E+21	1.1E+22	1.5E+22	2.5E+22	3.1E+22	4.1E+22	5.4E+22	7.6E+22	9.8E+22	1.0E+23
4.0	7.4E+20	1.1E+21	1.4E+21	1.6E+21	1.6E+21	1.7E+21	1.8E+21	1.9E+21	2.1E+21	2.1E+21
5.0	3.8E+19	5.4E+19	6.5E+19	7.0E+19	7.0E+19	7.0E+19	7.0E+19	7.0E+19	7.0E+19	7.0E+19
Beta	2.9E+22	4.9E+22	7.8E+22	2.2E+23	3.8E+23	7.5E+23	1.1E+24	1.8E+24	3.9E+24	5.7E+24

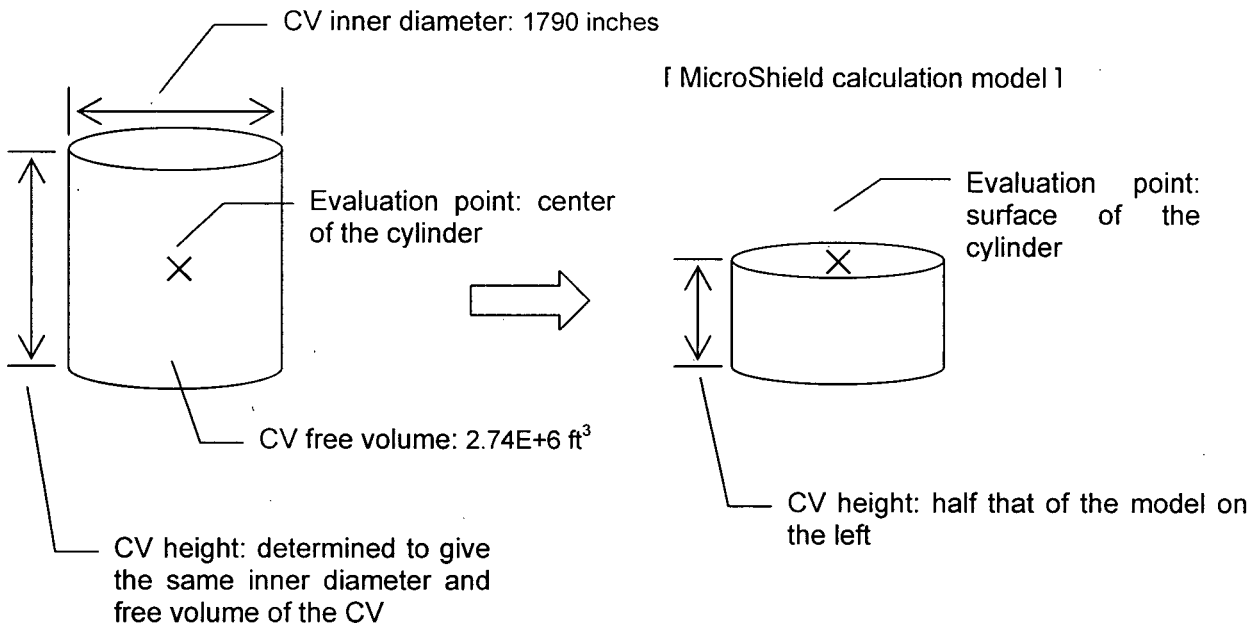

Fig. 1 Model for the calculation of gamma dose rates in the CV after a LOCA

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

1/28/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	NO. 512-3893 REVISION 1
SRP SECTION:	03.11 – Environmental Qualification of Mechanical and Electrical Equipment
APPLICATION SECTION:	3.11
DATE OF RAI ISSUE:	12/15/2009

QUESTION NO. RAI 03.11-30:

The US-APWR DCD, Revision 1, Tier 2 Sections 3.11 "Environmental Qualification of Mechanical and Electrical Equipment" and MUAP-08015(R0) "US-APWR Equipment Environmental Qualification Program" describe the equipment qualification process and methodology. Sections 10 CFR 50.49 and 10 CFR 52.79 require licensees to develop an Environmental Qualification program for equipment important to safety. SRP Section 3.11 notes that the applicant is to provide the conceptual approach, including the environmental design bases for identified equipment. SRP Section 3.11 and Regulatory Guide 1.206 note that applicant should identify equipment located in harsh environments.

RAI 358-2642, question 03.11-1 Item 1, requested additional information about the methodology and assumptions used to calculate the Total Integrated Dose (TID) to equipment. In their response, the applicant provided a narrative description of the method used to establish the source term for the containment airborne activity concentration that is not consistent with the analysis methodology used in DCD Tier 2, Chapter 15. Based on the methodology described in this response, the Containment Airborne Activity values stated in DCD Tier 2 Table 15A-15 "Peak Concentration in Containment During LOCA" would not reflect the activity values used for equipment qualification TID. The applicant did not present containment airborne activity concentrations in this response, in MUAP-08015, or in DCD Tier 2 Chapter 3.11. Also, the applicant noted that the beta ray source strengths can be calculated by multiplying the airborne radioactive concentration in containment and the radioactivity in recirculation water by the effective energy of beta ray. However, in light of the previous discussion, the average beta energy is indeterminate, so insufficient information is available to allow the staff to allow the staff to confirm the applicant's data.

The applicant should revise and update MUAP-08015 or DCD Tier 2 Chapter 3.11 to provide the airborne activity concentrations used to determine equipment gamma and beta TID, or provide the specific alternative approaches used and the associated justification.

Reference: MHI's Response to US-APWR DCD RAI No. 358-2642, MHI Ref: UAP-HF-09371, dated July 10, 2009, ML091970103.

ANSWER:

The reduction effect of factors other than radioactive decay is not considered in the source terms for the calculation of dose rates in the CV. Radioactive decay, as well as CV leakage, CV spray, and the reduction effect of spontaneous deposition, is considered in the calculation of airborne radioactivity in the CV in Table 15A-15 in Chapter 15, making it more realistic. Despite the disagreement with the calculation of CV airborne radioactivity in Table 15A-15 with the reduction effect of various factors considered, the source terms for the calculation of dose rates in the CV are more conservative than those in Table 15A-5. The source terms used are shown in Table 1 in our response to question 03.11-29.

The source terms for the calculation of dose rates from the recirculation water are similar to those for the calculation of dose rates in the CV. While reductions by radioactive decay and leakage are considered in Chapter 15, the reduction effect of factors other than radioactive decay is not considered in the source terms for the dose rate calculation for the recirculation water, making them more conservative than those in Chapter 15. The source terms for the dose rate calculation for the recirculation water are shown in Table 2 in our response to question 03.11-29.

As explained in our response to question 03.11-29, the effective energy of beta radiation used is from Appendix A "Nuclear Decay Data" in Federal Guidance Report No.12. The dose rates are calculated using the source strengths in Tables 1 and 2 in our response to question 03.11-29 obtained from the effective energy.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/28/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 512-3893 REVISION 1**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**12/15/2009**

QUESTION NO. RAI 03.11-31:

The US-APWR DCD, Revision 1, Tier 2 Sections 3.11 "Environmental Qualification of Mechanical and Electrical Equipment" and MUAP-08015(R0) "US-APWR Equipment Environmental Qualification Program" describe the equipment qualification process and methodology. Sections 10 CFR 50.49 and 10 CFR 52.79 require licensees to develop an Environmental Qualification program for equipment important to safety. SRP Section 3.11 notes that the applicant is to provide the conceptual approach, including the environmental design bases for identified equipment. SRP Section 3.11 and Regulatory Guide 1.206 note that applicant should identify equipment located in harsh environments.

RAI 358-2642, question 03.11-1 Item 1, requested additional information about the methodology and assumptions used to calculate the Total Integrated Dose (TID) to equipment. In their response, the applicant provided a narrative description of the methodology (Item 1b) used to establish the source term for the containment airborne activity concentration used for equipment qualification. However, the section of the response for this item entitled "Impact on DCD", does not include this description in DCD Tier 2 Sections 3.11, DCD Tier 2 Section 12.2 or MUAP-08015.

The applicant should revise and update MUAP-08015 or DCD Tier 2 Chapter 3.11 to provide the discussion of the methodology used to determine equipment gamma and beta TID, or provide the specific alternative approaches used and the associated justification.

Reference: MHI's Response to US-APWR DCD RAI No. 358-2642, MHI Ref: UAP-HF-09371, dated July 10, 2009, ML091970103.

ANSWER:

Regarding our response to question 03.11-1 in RAI 358-2642, the inclusions in MUAP-08015 based on the response to item 1 are described in the response to item 1, and those in the DCD

are described in the space below the response to item 3. There is nothing in the response to items 2 and 3 that should be included in MUAP-08015 and the DCD. We decide to include the evaluation method of the source term for calculating dose rates using the core inventory (Chapter 15) in Chapter 12 of the DCD and the dose rate evaluation method using the source term in MUAP-08015. Based on this decision, we describe the inclusions in MUAP-08015 and the DCD in the response to question 03.11-1 in RAI 358-2642.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/28/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 512-3893 REVISION 1**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**12/15/2009**

QUESTION NO. RAI 03.11-32:

The US-APWR DCD, Revision 1, Tier 2 Sections 3.11 "Environmental Qualification of Mechanical and Electrical Equipment" and MUAP-08015(R0) "US-APWR Equipment Environmental Qualification Program" describe the equipment qualification process and methodology. Sections 10 CFR 50.49 and 10 CFR 52.79 require licensees to develop an Environmental Qualification program for equipment important to safety. SRP Section 3.11 notes that the applicant is to provide the conceptual approach, including the environmental design bases for identified equipment. SRP Section 3.11 and Regulatory Guide 1.206 note that applicant should identify equipment located in harsh environments.

RAI 358-2642, question 03.11-1 Item 2, requested additional information about the methodology and assumptions used to calculate the Total Integrated Dose (TID) to equipment. In their response, the applicant provided a narrative description of the methodology used to establish the source term for the Main Steam/Feedwater piping area, during a Main Steam Line Break (MSLB). The response presents a table "Radioactivity Release into the Main Steam/Feedwater piping area during MSLB" that indicates that iodine and other activities in the secondary coolant will be 16% of primary coolant. However, justification for the use of these values is not present in this section or in DCD Tier 2 Chapter 15.

The applicant should revise and update MUAP-08015 or DCD Tier 2 Chapter 3.11 to provide clarification of the methodology used to determine equipment gamma and beta source term for a MSLB in Tier 2 Section 3.11, DCD Tier 2 Section 12.2, or MUAP-08015, or provide the specific alternative approaches used and the associated justification.

Reference: MHI's Response to US-APWR DCD RAI No. 358-2642, MHI Ref: UAP-HF-09371, dated July 10, 2009, ML091970103.

ANSWER:

For the Environmental Qualification Program in US-APWR, the dose rate in the Main Steam/Feedwater piping area during an MSLB is determined to be the same as that in the CV

during a LOCA. However, the dose rate during an MSLB will not increase to the same level as in the CV during a LOCA, making this assumption conservative.

350 gallons of the primary-to-secondary leakage for 14 hours result in a leakage of about 0.5% of the primary coolant into the secondary system. All of the noble gases in the leaked primary coolant are assumed to be released into the Main Steam/Feedwater piping area.

As described in the response to RAI No.358, iodine and other nuclides that account for 16% of the radioactivity in the primary coolant are assumed to be released into the Main Steam/Feedwater piping area. This assumption takes into account contributions from all other radioactive nuclides in the steam generator where the MSLB occurs, as well as in the remaining three steam generators, and therefore is very conservative.

It is assumed that nuclides except noble gases are present in each steam generator at concentrations one-tenth of those in the primary coolant at the beginning of the accident. Therefore, the nuclides in secondary coolant is 15% (= 968000 lbm (secondary coolant) × 0.1 ÷ 646000 lbm (primary coolant)) of nuclides in primary coolant.

In addition, 0.5% of the radioactivity in the primary coolant leaks as a result of the primary-to-secondary leakage. Therefore, the contributions from the iodine and other nuclides present at the beginning of the accident are assumed to be 16% of the iodine and other nuclides in primary coolant by rounding up.

Iodine contributing to an iodine spike is in the gap. Then, the amount of iodine that releases to primary coolant by the iodine spike is 0.05% (= 1% (fuel defect) × 5% (gap fraction)) of core inventory. Since 0.5% of the primary coolant leaks as a result of the primary-to-secondary leakage, the contributions from the iodine spike are assumed to be 0.0003% (=0.05% × 0.5%) of iodine core inventory.

Radioactive decay is not considered in this evaluation.

Therefore, discussion in prior and this responses shows that the dose rate in the CV during a LOCA is not exceeded even if the source term in the Main Steam/Feedwater piping area during an MSLB based on a conservative assumption is used. Based on this, the dose rate in the Main Steam/Feedwater piping area during an MSLB is determined to be the same as that in the CV during a LOCA.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/28/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 512-3893 REVISION 1**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**12/15/2009**

QUESTION NO. RAI 03.11-33:

The US-APWR DCD, Revision 1, Tier 2 Sections 3.11 "Environmental Qualification of Mechanical and Electrical Equipment" and MUAP-08015(R0) "US-APWR Equipment Environmental Qualification Program" describe the equipment qualification process and methodology. Sections 10 CFR 50.49 and 10 CFR 52.79 require licensees to develop an Environmental Qualification program for equipment important to safety. SRP Section 3.11 notes that the applicant is to provide the conceptual approach, including the environmental design bases for identified equipment. SRP Section 3.11 and Regulatory Guide 1.206 note that applicant should identify equipment located in harsh environments.

RAI 358-2642, question03.11-1 Item 3, requested additional information about the methodology and assumptions used to calculate the Total Integrated Dose (TID) to equipment resulting from a loss of ventilation during a LOCA event. The response to this item noted that the HVAC system restoration would occur as soon as possible, so that the TID would be small compared to the 60-year operational TID. However, based on the information provided in MUAP-08015 New Table 5-5 sheet 4 of 7, the Zone 6 beta dose (an indication of airborne activity present in the area), may be higher than the total (operational plus accident) gamma dose in Zone 6, even with the assumption of HVAC operation. Since the applicant does not provide any criteria for the restoration of HVAC, or limits for airborne radioactivity concentration or the resultant dose rates following a loss of HVAC, insufficient information is available to allow the NRC staff to confirm that the loss of HVAC will result in an insignificant impact on equipment TID.

The applicant should revise and update MUAP-08015 or DCD Tier 2 Chapter 3.11 to provide clarification regarding the criteria for equipment TID with respect to allowable HVAC unavailability during design basis events, or provide the specific alternative approaches used and the associated justification.

Reference: MHI's Response to US-APWR DCD RAI No. 358-2642, MHI Ref: UAP-HF-09371, dated July 10, 2009, ML091970103.

ANSWER:

As described in DCD Section 9.4, the HVAC System is designed to control the temperature during normal plant operation and to remove airborne contaminants thereby keeping dose levels from airborne radioactivity below allowable values.

Regarding the calculation of the total integrated radiation dose for equipment qualification, it is MHI's position that it is not necessary to postulate a complete loss of HVAC cooling function during a design basis accident (DBA) because of the redundant, independent safety-related design of the HVAC for areas containing safety-related equipment. This design philosophy prevents a single active failure from resulting in a complete loss of HVAC in these areas. For the purpose of equipment qualification, it is typically assumed that a loss of HVAC disables all safety-related equipment in that train. However, due to the independent and redundant design, the other train of HVAC will continue to operate and protect the remaining train of equipment being relied upon to mitigate the accident. This means that the TID for the equipment assumed to operate to mitigate the accident will not experience an increase in radiation dose due to a loss of HVAC.

The approach utilized for safety-related equipment TID calculations is conservative in considering a combination of radiation sources from piping, RB leakage, and equipment leakage for a conservative DBA duration of up to 1 year. Additional conservatism is provided by using the upper limit for both the normal operational dose and accident dose when determining the TID. Since the increase in dose due to a loss of HVAC filtration is not instantaneous and the duration of the loss of HVAC is short compared to the duration of the accident, the incremental increase in dose due to a loss of HVAC is considered small.

Based on the above discussion, the response to RAI 358-2642, Question 03.11-1 Item 3 (MHI Ref: UAP-HF-09371, dated July 10, 2009) correctly concluded that the expected duration of a loss of HVAC was sufficiently short to have no impact on the resulting TID.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/28/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 512-3893 REVISION 1**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**12/15/2009**

QUESTION NO. RAI 03.11-34:

The US-APWR DCD, Revision 1, Tier 2 Sections 3.11 "Environmental Qualification of Mechanical and Electrical Equipment" and MUAP-08015(R0) "US-APWR Equipment Environmental Qualification Program" describe the equipment qualification process and methodology. Sections 10 CFR 50.49 and 10 CFR 52.79 require licensees to develop an Environmental Qualification program for equipment important to safety. SRP Section 3.11 notes that the applicant is to provide the conceptual approach, including the environmental design bases for identified equipment. SRP Section 3.11 and Regulatory Guide 1.206 note that applicant should identify equipment located in harsh environments.

RAI 358-2642, question03.11-2 Item 3, requested additional information about the location of each piece of equipment addressed in Table 3D-2. This topic is also relevant to Question 358-2642 03.11-3 Item 2. The applicant provided an EQ Zone location in Table 3D-2 in lieu of listing the location of each piece of equipment. However, in some cases, the EQ Zones listed in Table 3D-2 are inconsistent with dose rate data provided in DCD Tier 2 Figures 12.3-1 and 12.3-3. For instance, Table 3D-2 Sheet 4 of 64, shows RHS-PT-610 in EQ Zone 13.3 (Reactor Building Passage), and a Harsh Radiation Condition. In contrast, Figure 12.3-3 Sheet 1 of 10 list the post accident dose rate in the passage as < 15 mrem/h and Figure 12.3-1 Sheet 4 of 34, list the operational dose rate in that same area as < 2.5 mrem/h. The dose rates from Figures 12.3-1 and 12.3-3 do not support the conclusion that the piece of equipment is located in a Harsh Radiation Condition. The applicant has not stated any other criteria (e.g. extra conservatism for some equipment, or other radiation sources), for classification of the Radiation Condition for equipment.

The applicant should revise and update MUAP-08015 or DCD Tier 2 Chapter 3.11 to provide clarification regarding the criteria for equipment Radiation Condition stated in Table 3D-2, or provide the specific alternative approaches used and the associated justification.

Reference: MHI's Response to US-APWR DCD RAI No. 358-2642, MHI Ref: UAP-HF-09371, dated July 10, 2009, ML091970103.

ANSWER:

As you pointed out, there was a problem in some of the dose rate data. More specifically, there is an inconsistency in the dose rate during normal operation in EQ Zone 13.3 (Reactor Building Passage) and Figure 12.3-1 in Sheet 4 of 34. We found no other problems.
MUAP-08015(R1) was issued to include Tables 5-4 and 5-5. We will revise Tables 5-4 and 5-5 in MUAP-08015(R1) and Table 3D-2 in USAPWR FSAR Appendix 3D, as shown in the attachment.

Impact on DCD

Table 3D-2 in USAPWR FSAR Appendix 3D will be revised as shown in the attachment.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1/28/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 512-3893 REVISION 1**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**12/15/2009**

QUESTION NO. RAI 03.11-35:

The US-APWR DCD, Revision 1, Tier 2 Sections 3.11 "Environmental Qualification of Mechanical and Electrical Equipment" and MUAP-08015(R0) "US-APWR Equipment Environmental Qualification Program" describe the equipment qualification process and methodology. Sections 10 CFR 50.49 and 10 CFR 52.79 require licensees to develop an Environmental Qualification program for equipment important to safety. SRP Section 3.11 notes that the applicant is to provide the conceptual approach, including the environmental design bases for identified equipment. SRP Section 3.11 and Regulatory Guide 1.206 note that applicant should identify equipment located in harsh environments.

RAI 358-2642, question03.11-3 Item 3, requested additional information regarding the time based units for determination of the TID. The applicant referenced the response to Question RAI 358-2642 03.11-2 Item 4. While the response to that question contained the information asked for in this question, the DCD Impact statement did not indicate how this information would be presented in DCD Tier 2 Sections 3.11 or DCD Tier 2 or MUAP-08015.

The applicant should revise and update DCD Tier 2 Sections 3.11 or MUAP-08015 to include the TID time base information provided in Question RAI 358-2642 03.11-2 Item 4, or provide the specific alternative approaches used and the associated justification.

Reference: MHI's Response to US-APWR DCD RAI No. 358-2642, MHI Ref: UAP-HF-09371, dated July 10, 2009, ML091970103.

ANSWER:

MUAP-08015(R1) was issued to include the TID time base information provided in Question RAI 358-2642 03.11-2 Item 4.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's responses to the NRC's questions.

Attachment to RAI 512-3893 (Correction on MUAP-08015)

Table 5-4 Radiation Environment (Normal Operation)

Location			radiation (rad/h)			
			γ	n	β	total
Zone 1 Containment	1-1	Reactor Vessel	1.3E+6	1.3E+6	-[1]	2.6E+6
	1-2	Nuclear Instrument System	3.1E+3	1.5E+5	-[1]	1.5E+5
	1-3	Inside Reactor Coolant System	1.7E+3	-[1]	-[1]	1.7E+3
	1-4	Inside Secondary Shield (including Regenerative Hx Room)	5.0E+2	-[1]	-[2]	5.0E+2
	1-5	Under Operation Floor	1.0E+2	-[1]	-[1]	1.0E+2
	1-6	Above Operation Floor (including Refueling Water Storage Pit)	1.0E+0	-[1]	8.0E-2[3]	1.1E+0
Zone 2 MCR and Remote Shutdown Console Room			2.5E-4	-[1]	-[1]	2.5E-4
Zone 3 Class 1E I&C Room			2.5E-4	-[1]	-[1]	2.5E-4
Zone 4 Class 1E I&C Room, UPS Room, Battery Charger Room, and Reactor Trip Breaker Room			2.5E-4	-[1]	-[1]	2.5E-4
Zone 5 Class 1E Battery Room			2.5E-4	-[1]	-[1]	2.5E-4
Zone 6 Penetration Area and Safeguard Components Area(Radiological Area)			1.0E+2	-[1]	-[1]	1.0E+2
Zone 7 Safety Related Component Area(Radiological Area)			1.0E+2	-[1]	-[1]	1.0E+2
Zone 8 Safety Related Component Area (Non-Radiological Area)			2.5E-4	-[1]	-[1]	2.5E-4
Zone 9 Essential Chiller Unit and Pump Room			2.5E-4	-[1]	-[1]	2.5E-4
Zone 10 Main Steam/Feedwater Piping Area			2.5E-4	-[1]	-[1]	2.5E-4
Zone 11 Gas Turbine Area			2.5E-4	-[1]	-[1]	2.5E-4
Zone 12 Fuel Handling Area			1.5E-2	-[1]	4.6E-3[3]	2.0E-2
Zone 13 Reactor Building and Auxiliary Building General Mechanical Area (Radiological Area)	13-1	Auxiliary Building	5.0E+2	-[1]	-[1]	5.0E+2
	13-2	Reactor Building Sample Hx Room	1.0E+2	-[1]	-[1]	1.0E+2
	13-3	Reactor Building Passage	~~2.5E-1~~ 2.5E-3	-[1]	-[1]	~~2.5E-1~~ 2.5E-3
Zone 14 Reactor Building and Turbine Building General Mechanical Area(Non-Radiological Area)			2.5E-4	-[1]	-[1]	2.5E-4

Notes

1: This dose rate is negligible or zero when compared to the total dose rate.

2: Irradiation by beta ray will be negligible as the thermocouple sensor in RCS hot/cold leg manifold is covered with a stainless steel sheath.

3: This dose rate is beta ray from airborne.

Attachment to RAI 512-3893 (Correction on MUAP-08015)

Table 5-5 Total Integrated Dose for Zone (Sheet 7 of 7)

Zone	Operational Duration	Normal Operation Cumulative Dose (rad)				Accident Cumulative Dose (rad)			Total (rad)	Radiation Condition Harsh or Mild	
		γ	n	β	Total	γ	β	Total		Electrical	Mechanical
13-2	5 min	5.3E+07	-	-	5.3E+07	9.2E+01	-	9.2E+01	5.3E+07	Harsh	Harsh
	2 wks [1]					1.9E+05	-	1.9E+05	5.3E+07	Harsh	Harsh
	4 mos					1.7E+06	-	1.7E+06	5.5E+07	Harsh	Harsh
	1 yr					4.9E+06	-	4.9E+06	5.8E+07	Harsh	Harsh
13-3	5 min	~~1.4E+05~~1.4E+03	-	-	~~1.4E+05~~1.4E+03	1.9E-01	-	1.9E-01	~~1.4E+05~~1.4E+03	Harsh	~~Harsh~~Mild
	2 wks [1]					3.3E+01	-	3.3E+01	~~1.4E+05~~1.4E+03	Harsh	~~Harsh~~Mild
	4 mos					7.6E+01	-	7.6E+01	~~1.4E+05~~1.4E+03	Harsh	~~Harsh~~Mild
	1 yr					1.8E+02	-	1.8E+02	~~1.4E+05~~1.4E+03	Harsh	~~Harsh~~Mild
14	5 min	1.4E+02	-	-	1.4E+02	1.9E-04	-	1.9E-04	1.4E+02	Mild	Mild
	2 wks [1]					3.8E-01	-	3.8E-01	1.4E+02	Mild	Mild
	4 mos					3.3E+00	-	3.3E+00	1.4E+02	Mild	Mild
	1 yr					9.7E+00	-	9.7E+00	1.5E+02	Mild	Mild

Notes
1. Including 30 min, 2 hr and 36 hr
2. Cumulative dose in parentheses include dose from recirculation water

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 29 of 64)

Item Num	Equipment Tag	Description	Location		Purpose	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone	RT, ESF, PAM, Pressure Boundary (PB), Other		Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
22	CVS-AOV-192C	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	
23	CVS-AOV-192D	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	
24	CVS-LCV-031B	Level Control Valve	R/B	7	Other	2wks	Mild	Harsh	No (1)	M	I	
25	CVS-LCV-031C	Level Control Valve	R/B	7	Other	2wks	Mild	Harsh	No (1)	M	I	
26	CVS-LCV-031D	Level Control Valve	R/B	7	Other	2wks	Mild	Harsh	No (1)	M	I	
27	CVS-LCV-031E	Level Control Valve	R/B	7	Other	2wks	Mild	Harsh	No (1)	M	I	
28	CVS-AOV-165	Air Operated Valve	R/B	7	Other	2wks	Mild	Harsh	No (1)	M	I	
29	CVS-FCV-048	Flow Control Valve	R/B	7	PB	2wks	Mild	Harsh	No (1)	M	I	
30	CVS-FCV-050	Flow Control Valve	R/B	7	Other	2wks	Mild	Harsh	No (1)	M	I	
31	CVS-FCV128	Flow Control Valve	R/B	13-3	Other	2wks	Mild	~~Harsh~~ Mild	No (1)	M	I	
32	CVS-FCV-129	Flow Control Valve	R/B	13-3	Other	2wks	Mild	~~Harsh~~ Mild	No (1)	M	I	
33	CVS-SRV-002	Safety Valve	PCCV	1-4	ESF	1yr	Harsh	Harsh	No (1)	M	I	
34	CVS-SRV-201	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
35	CVS-AOV-001A	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	
36	CVS-AOV-001B	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	
37	CVS-AOV-001C	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	
38	CVS-HCV-012	Air Operated Valve	PCCV	1-5	PB	1yr	Harsh	Harsh	No (1)	M	I	
39	CVS-HCV-100	Air Operated Valve	PCCV	1-5	PB	1yr	Harsh	Harsh	No (1)	M	I	
40	CVS-AOV-224	Air Operated Valve	PCCV	1-5	PB	1yr	Harsh	Harsh	No (1)	M	I	
41	CVS-LCV-031F	Air Operated Valve	R/B	7	Other	2 wks	Mild	Harsh	No (1)	M	I	
42	CVS-LCV-031G	Air Operated Valve	R/B	7	Other	2wks	Mild	Harsh	No (1)	M	I	
43	CVS-AOV-196A	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	
44	CVS-AOV-196B	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	
45	CVS-AOV-196C	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	
46	CVS-AOV-196D	Air Operated Valve	PCCV	1-4	PB	1yr	Harsh	Harsh	No (1)	M	I	

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 41 of 64)

Item Num	Equipment Tag	Description	Location		Purpose	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone	RT, ESF, PAM, Pressure Boundary (PB), Other		Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
24	NCS-MOV-020D	Motor Operated Valve	R/B	8	ESF	1yr	Mild	Harsh	No (1)	M	I	
25	NCS-RCV-056B	Radiation Control Valve	R/B	8	PB	1yr	Mild	Harsh	No (1)	M	I	
26	NCS-LCV-020	Level Control Valve	R/B	8	PB	1yr	Mild	Harsh	No (2)	M	I	
27	NCS-MOV-145A	Motor Operated Valve	R/B	13-3	ESF	1yr	Mild	~~Harsh~~ Mild	No (1)	M	I	
28	NCS-MOV-436B	Motor Operated Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
29	NCS-MOV-438A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
30	NCS-MOV-145B	Motor Operated Valve	R/B	13-3	ESF	1yr	Mild	~~Harsh~~ Mild	No (1)	M	I	
31	NCS-MOV-145C	Motor Operated Valve	R/B	13-3	ESF	1yr	Mild	~~Harsh~~ Mild	No (1)	M	I	
32	NCS-MOV-145D	Motor Operated Valve	R/B	13-3	ESF	1yr	Mild	~~Harsh~~ Mild	No (1)	M	I	
33	NCS-MOV-232A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
34	NCS-MOV-232B	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
35	NCS-MOV-233A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
36	NCS-MOV-233B	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
37	NCS-MOV-234A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
38	NCS-MOV-234B	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
39	NCS-MOV-316A	Motor Operated Valve	R/B	7	PB	1yr	Mild	Harsh	No (1)	M	I	
40	NCS-MOV-316B	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	~~Harsh~~ Mild	No (1)	M	I	
41	NCS-SRV-406A	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
42	NCS-SRV-406B	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
43	NCS-SRV-406C	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
44	NCS-SRV-406D	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
45	NCS-SRV-435A	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
46	NCS-SRV-435B	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
47	NCS-MOV-436A	Motor Operated Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 43 of 64)

Item Num	Equipment Tag	Description	Location		Purpose	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone	RT, ESF, PAM, Pressure Boundary (PB), Other		Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
72	NCS-FCV-130B	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
73	NCS-MOV-438B	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
74	NCS-FCV-132A	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
75	NCS-FCV-132B	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
76	NCS-SRV-513	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
77	NCS-SRV-533	Safety Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
78	NCS-AOV-601	Air Operated Valve	R/B	13-3	ESF	1yr	Mild	~~Harsh~~ Mild	No (1)	M	I	
79	NCS-AOV-602	Air Operated Valve	R/B	13-3	ESF	1yr	Mild	~~Harsh~~ Mild	No (1)	M	I	
80	NCS-AOV-661A	Air Operated Valve	R/B	14	ESF	1yr	Mild	Mild	No (1)	M	I	
81	NCS-AOV-662A	Air Operated Valve	R/B	14	ESF	1yr	Mild	Mild	No (1)	M	I	
82	NCS-AOV-661B	Air Operated Valve	R/B	14	ESF	1yr	Mild	Mild	No (1)	M	I	
83	NCS-AOV-662B	Air Operated Valve	R/B	14	ESF	1yr	Mild	Mild	No (1)	M	I	
84	NCS-PCV-012	Pressure Control Valve	R/B	8	PB	1yr	Mild	Harsh	No (1)	M	I	
85	NCS-PCV-022	Pressure Control Valve	R/B	8	PB	1yr	Mild	Harsh	No (1)	M	I	
Equipment (Spent Fuel Pit Cooling and Purification System)												
1	SFP-MPP-001A	A-Spent Fuel Pit Pump	R/B	6	ESF	2wks	Mild	Harsh	No (1)	M	I	
2	SFP-MPP-001B	B-Spent Fuel Pit Pump	R/B	6	ESF	2wks	Mild	Harsh	No (1)	M	I	
3	SFP-MHX-001A	A-Spent Fuel Pit Heat Exchanger	R/B	6	ESF	2wks	Mild	Harsh	No (1)	M	I	
4	SFP-MHX-001B	B-Spent Fuel Pit Heat Exchanger	R/B	6	ESF	2wks	Mild	Harsh	No (1)	M	I	
Equipment (Essential Service Water System)												
1	EWS-MPP-001A	A-Essential Service Water Pump	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
2	EWS-MPP-001B	B-Essential Service Water Pump	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
3	EWS-MPP-001C	C-Essential Service Water Pump	UHSRS	-	ESF	1yr	Mild	-	-	M	I	
4	EWS-MPP-001D	D-Essential Service Water Pump	UHSRS	-	ESF	1yr	Mild	-	-	M	I	

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 60 of 64)

Item Num	Equipment Tag	Description	Location		Purpose	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone	RT, ESF, PAM, Pressure Boundary (PB), Other		Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
180	VRS-MEH-561B	B-Spent Fuel Pit Pump Area Air Handling Unit Electric Heating Coil	R/B	7	ESF	1yr	Mild	Harsh	No(1)	M	I	
Equipment (Containment Ventilation System)												
1	VCS-AOV-304	Air Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
2	VCS-AOV-305	Air Operated Valve	PCCV	1-6	ESF	5min	Harsh	Harsh	No (1)	M	I	
3	VCS-AOV-306	Air Operated Valve	PCCV	1-6	ESF	5min	Harsh	Harsh	No (1)	M	I	
4	VCS-AOV-307	Air Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
5	VCS-AOV-354	Air Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
6	VCS-AOV-355	Air Operated Valve	PCCV	1-6	ESF	5min	Harsh	Harsh	No (1)	M	I	
7	VCS-AOV-356	Air Operated Valve	PCCV	1-6	ESF	5min	Harsh	Harsh	No (1)	M	I	
8	VCS-AOV-357	Air Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
Equipment (Auxiliary Building Ventilation System)												
1	VAS-AOD-501A	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
2	VAS-AOD-501B	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
3	VAS-AOD-502A	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
4	VAS-AOD-502B	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
5	VAS-AOD-503A	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
6	VAS-AOD-503B	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
7	VAS-AOD-504A	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
8	VAS-AOD-504B	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
9	VAS-AOD-505A	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
10	VAS-AOD-505B	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
11	VAS-AOD-505C	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
12	VAS-AOD-505D	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
13	VAS-AOD-506A	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
14	VAS-AOD-506B	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
15	VAS-AOD-506C	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
16	VAS-AOD-506D	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
17	VAS-AOD-507A	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 61 of 64)

Item Num	Equipment Tag	Description	Location		Purpose	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone	RT, ESF, PAM, Pressure Boundary (PB), Other		Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
18	VAS-AOD-507B	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
19	VAS-AOD-507C	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
20	VAS-AOD-507D	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
21	VAS-AOD-508A	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
22	VAS-AOD-508B	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
23	VAS-AOD-508C	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
24	VAS-AOD-508D	Air Operated Damper	R/B	13-3	ESF	5min	Mild	~~Harsh~~ Mild	No (1)	M	I	
25	VAS-AOD-511	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
26	VAS-AOD-512	Air Operated Damper	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
Equipment (Chilled Water System)												
1	VWS-MEQ-001A	A-Essential Chiller Unit	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
2	VWS-MEQ-001B	B-Essential Chiller Unit	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
3	VWS-MEQ-001C	C-Essential Chiller Unit	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
4	VWS-MEQ-001D	D-Essential Chiller Unit	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
5	VWS-MPP-001A	A-Essential Chilled Water Pump	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
6	VWS-MPP-001B	B-Essential Chilled Water Pump	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
7	VWS-MPP-001C	C-Essential Chilled Water Pump	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
8	VWS-MPP-001D	D-Essential Chilled Water Pump	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
9	VWS-MTK-001A	A-Essential Chilled Water Compression Tank	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
10	VWS-MTK-001B	B-Essential Chilled Water Compression Tank	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
11	VWS-MTK-001C	C-Essential Chilled Water Compression Tank	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
12	VWS-MTK-001D	D-Essential Chilled Water Compression Tank	PS/B	9	ESF	1yr	Mild	Mild	No (1)	M	I	
13	VWS-TMV-141	Chilled Water Control Valve	R/B	8	ESF	1yr	Mild	Harsh	No (1)	M	I	
14	VWS-TMV-151	Chilled Water Control Valve	R/B	8	ESF	1yr	Mild	Harsh	No (1)	M	I	
15	VWS-TMV-161	Chilled Water Control Valve	R/B	8	ESF	1yr	Mild	Harsh	No (1)	M	I	
16	VWS-TMV-171	Chilled Water Control Valve	R/B	8	ESF	1yr	Mild	Harsh	No (1)	M	I	