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

July 9, 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-10200

Subject: **MHI's Responses to US-APWR DCD RAI 589-4536 Rev.0,**

Reference: 1) "Request for Additional Information No.589-4536 Revision 0, SRP Section: 03.11 – Environmental Qualification of Mechanical and Electrical Equipment, Application Section: 3.11" dates June 8, 2010.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") documents as listed in Enclosures.

Enclosed are the responses to RAIs contained within Reference 1.

As indicated in the enclosed materials, documents (Enclosure 2) contains information that MHI considers proprietary, and therefore should be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential. Non-proprietary versions of the documents are also being submitted in this package (Enclosure 3). In the non-proprietary versions, the proprietary information, bracketed in the proprietary versions, is replaced by the designation "{ }".

And one version includes certain information, designated pursuant to the Commission guidance as sensitive unclassified non-safeguards information, referred to as security-related information ("SRI"), that is to be withheld from public disclosure under 10 CFR § 2.390. The information that is SRI is identified by braces "[ ]". On the other hand, another version omits the SRI and is suitable for public disclosure. In the public version of the DCD, the SRI is replaced by the designation "{Security-Related Information - Withheld under 10 CFR § 2.390}".

This letter includes a copy of the proprietary and SRI included version (Enclosure 2), a copy of the non-proprietary and SRI excluded version (Enclosure 3) and the Affidavit of Yoshiki Ogata (Enclosure 1) which identifies the reasons MHI respectfully requests that all materials designated as "Proprietary" in Enclosure 2 be withheld from public disclosure pursuant to 10 C.F.R. § 2.390 (a)(4).

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

D081
NRO

Sincerely,

Y. Ogata

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

Enclosures:

1. Affidavit of Yoshiki Ogata

2. Responses to Request for Additional Information No.589-4536 Revision 0
   (Proprietary and SRI included version)

3. Responses to Request for Additional Information No.589-4536 Revision 0
   (Non-proprietary and SRI excluded version)

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

ENCLOSURE 1

Docket No.52-021
MHI Ref: UAP-HF-10200

MITSUBISHI HEAVY INDUSTRIES, LTD.

AFFIDAVIT

I, Yoshiki Ogata, being duly sworn according to law, depose and state as follows:

1. I am General Manager, APWR Promoting Department, of Mitsubishi Heavy Industries, Ltd ("MHI"), and have been delegated the function of reviewing MHI's US-APWR documentation to determine whether it contains information that should be withheld from disclosure pursuant to 10 C.F.R. § 2.390 (a)(4) as trade secrets and commercial or financial information which is privileged or confidential.

2. In accordance with my responsibilities, I have reviewed the enclosed "Responses to Request for Additional Information No.589-4536 Rev.0", and have determined that the document and attachment data contain proprietary information that should be withheld from public disclosure.

3. The information in the document and data identified as proprietary by MHI has in the past been, and will continue to be, held in confidence by MHI and its disclosure outside the company is limited to regulatory bodies, customers and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and is always subject to suitable measures to protect it from unauthorized use or disclosure.

4. The basis for holding the referenced information confidential are that the equations described in the response to RAI item 03.11-36 involves MHI's know-how, and to make these input data from a lot of design parameters requires knowledge and know-how.

5. The referenced information is being furnished to the Nuclear Regulatory Commission ("NRC") in confidence and solely for the purpose of supporting the NRC staff's review of MHI's Application for certification of its US-APWR Standard Plant Design.

6. Public disclosure of the referenced information would assist competitors of MHI in their design of new nuclear power plants without the costs or risks associated with the design of new fuel systems and components. Disclosure of the information identified as proprietary would therefore have negative impacts on the competitive position of MHI in the U.S. nuclear plant market.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 9th day of July, 2010.

Y. Ogata

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

Enclosure 3

UAP-HF-10200, Rev.0

Responses to Request for Additional Information No.589-4536
Revision 0

July 2010
(Non Proprietary)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/8/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 589-4536 REVISION 0**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**6/8/2010**

QUESTION NO. 03.11-36:

Question RAI 512-3893 03.11-29, requested additional information, beyond that provided in the response to RAI 358-2642 Question 03.11-1, about the methodology and assumptions used to calculate the Total Integrated Dose (TID) to equipment. In their response, the applicant provided a more detailed narrative description of the method used to establish the source term. The applicant also provided a general formula for calculating beta dose rates in water and air. However the response did not include the MicroShield input parameter data files and insufficient information was available to the NRC staff to allow confirmation of the TID values provided in MUAP-08015 Revision 1, Table 5-5 "Total Integrated Dose for Zone". In addition, the applicant did not justify the use of analytical methods that are not consistent with the guidance provided in Regulatory Guide 1.183 "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors". Examples of inconsistency include the omission of information regarding about how the contribution from the decay chains of the principle radionuclides are considered, how gamma and beta TID was calculated for points located on the surface of the water at the centerline of the large pool of sump water and the effects of activity plated out on containment surfaces on TID. Also, in their response, the applicant referenced NISTIR 5632 "Tables Of X-Ray Mass Attenuation Coefficients and Mass Energy Absorption Coefficients for 1 keV To 20 MeV for Elements Z = 1 To 92 and 48 Additional Substances of Dosimetric Interest" (NISTIR-5632) and Federal Guidance Report 12 "External Exposure To Radionuclides In Air, Water, And Soil" (FGR-12), that are not described in MUAP-08015 Revision 1, FSAR Revision 2 Tier 2 Sections 3.11 or FSAR Revision 2 Tier 2 Chapter 15 "Transient and Accident Analyses".

The applicant is requested to:

- Describe any computer codes, including revisions, besides MicroShield, that were used to calculate dose rates and the resultant Total Integrated Dose (TID) to equipment,
- Provide a sample calculation performed by the applicant to calculated dose rates and the resultant TID resulting from liquids, plated out material and airborne activity, including the input parameter and output data files of MicroShield and any other computer codes used for the analysis.
- Describe the basis for any assumed parameters, such as the Geometry Correction Factor, or the type of surface selected to represent a plate out source.

- Describe the methods for averaging dose rate to obtain TID for the stated intervals, and for interpolating the Source Strength at Time after Release provided in Table 1, and the Operational Durations specified in MUAP-08015(R1) Table 5-5.
- Revise and update either MUAP-08015 Revision 1 or FSAR Revision 2 Tier 2 Section 3.11 to include a complete description of the methods and assumptions, and referenced documents, used to calculate equipment TID.

Reference: MHI's Response to US-APWR DCD RAI No. 512-3893; MHI Ref: UAP-HF-10018; Dated January 28, 2010; ML100330613.

ANSWER:

MUAP-08015 Revision 1, Table 5-5 "Total Integrated Dose for Zone" provides a summary of the cumulative normal and accident doses used to determine the total integrated dose (TID) for each Environmental Zone of the US-APWR. In accordance with the previously provided response to RAI 358-2462 Revision 1 Question 03.11-2 item 5, the cumulative accident dose listed in Table 5.5 for each Environmental Zone excluding the containment, annulus, and main steam piping area outside containment (i.e., Zones 2-5, 7-9, and 11-14) is calculated using the upper limit dose rate of any location within the respective Environmental Zone shown in Figures 12.3-3 through 12.3-6 of US-APWR DCD Section 12.3.

The calculation method for the cumulative accident dose of the containment, annulus, and main steam piping area (Zones 1, 6, and 10) have been provided in the previously submitted responses to RAI 358-2462 Revision 1 Question 03.11-2 item 5, RAI 358-2462 Revision 1 Question 03.11-1 item 1, and RAI 512-3893 Question 03.11-29.

This response provides additional supplemental details of the MicroShield calculation utilized to determine the cumulative accident dose in the containment, annulus, and main steam piping areas (Zones 1, 6, and 10) described in MUAP-08015 Revision 1, Table 5-5. (NOTE: While the dose rates in the annulus and main stream piping area are lower than inside containment, the containment dose is conservatively applied to both zones.) As previously described in the response to RAI 512-3893 Revision 1 Question 03.11-29, the cumulative accident gamma dose in containment is determined using a cylindrical model of containment that corresponds to the actual containment inner diameter and free volume. Since Microshield does not allow estimation of absorbed dose inside the source, the surface dose of a half-height cylinder is calculated. Table-1 shows the main MicroShield input parameters utilized for this calculation method for both the airborne and recirculation water gamma dose contribution to the equipment TID. Appendix A provides the relevant MicroShield output data.

As described in Table-1, the MicroShield calculation assumes an input source term of 1.0E+0 (Photon/sec) for every energy group. With the use of Microsoft EXCEL, the "actual" dose rates are calculated through a process of multiplying the MicroShield output dose rates for each group by the "actual" source term for each group as previously provided in Table-1 and Table-2 of the response to RAI 512-3893 Question 03.11-29. (NOTE: The response to RAI 358-2462 Revision 1 Question 03.11-1 item 1 and the response to RAI 358-2462 Revision 1 Question 03.11-2 item 5 provide the basis for these "actual" source term values.) The Microsoft EXCEL spreadsheets, which are shown in Appendix B, have undergone the process that calculates the "actual" dose rates in water and air at various times after a LOCA. The cumulative gamma accident dose at various times after a LOCA is then calculated by multiplying the "actual" dose rate, calculated through the above-mentioned process, in water and air at various times after a LOCA by the appropriate time interval. Appendix B also demonstrates this calculation process. Table-2 summarizes the cumulative gamma accident dose at various times after a LOCA.

In order to determine the doses associated with the specific post-LOCA time intervals tabulated in MUAP-08015 Revision 1 Table 5-5, one must utilize or interpolate between the appropriate doses tabulated in Table-2 and add a margin of 10%. Examples of this calculation for 5 minutes post-LOCA (called 5 minutes later in MUAP-08015) and 2 weeks post-LOCA are described as follows.

5 min later : 4.3E+5 (0.1 hour cumulative dose from Table-2) $\times$ 1.1 = 4.7E+5 rad

2 weeks later : 7.7E+7 (interpolated 336 hour cumulative dose from Table-2) $\times$ 1.1 = 8.5E+7 rad

The response to RAI 358-2462 Revision 1 Question 03.11-1 item 1 and the response to RAI 358-2462 Revision 1 Question 03.11-2 item 5 explained the calculation method used to determine the source term provided in Table-1 and Table-2 of the response to RAI 512-3893 Question 03.11-29. The initial amount of airborne radioactivity inside containment immediately after a LOCA (0 hours) is established as the amount of radioactivity which is calculated by multiplying the core inventories (no cooling) shown in DCD Table 15A-10 by the total release rate shown in DCD Table 15A-13. (NOTE: Not only the nuclides showed in DCD Table 15A-10 but other nuclides which can contribute to source strength, are used for the calculation.) This initial amount of airborne radioactivity is input to MicroShield and then radioactively decayed for various times post-LOCA. The daughter nuclides generated by radioactive decay are included as part of the source term.

The amount of recirculation water radioactivity immediately after a LOCA is established by eliminating the noble gases from the amount of airborne radioactivity in containment immediately after a LOCA. Similar to the airborne calculation discussed above, the radioactive decay calculation has been made for (properly established) various times after a LOCA with an input of the amount of radioactivity at 0 hour after LOCA into the MicroShield code. The noble gases generated by radioactive decay are considered to be residual gases in the water for the purpose of being conservative, and are included in the source term. Table-3 and Table-4 summarize the airborne radioactivity and the recirculation water radioactivity at typical times after a LOCA in the containment vessel. While Table-3 and Table-4 only shows the main nuclides, other nuclides are considered in the dose calculation.

MHI has not made an estimate of the dose rate which derives from the radioactive material plated out on the surfaces inside the containment vessel. Although this calculation has been mentioned in the Questions before, MHI believes that the current airborne and recirculation water source terms are conservative and that the present doses due to airborne radioactivity and recirculation water contain the dose from activity plated out on containment surfaces, because the decrease due to plate out on containment surfaces is not considered in the calculations of airborne and recirculation water source terms (only decreasing due to radioactive decay).

In accordance with the requirements in this Question, MUAP-08015 Revision 1 will be revised to reflect the above response, the response to RAI 358-2462 Revision 1 Question 03.11-1 item 1, the response to RAI 358-2462 Revision 1 Question 03.11-2 item 5, and the response to RAI 512-3893 Question 03.11-29, including complete references to appropriate external documents such as NISTIR 5632 and FGR-12.

Table-1(1/2) Main MicroShield Input Parameters (for airborne)

Geometry		Cylinder Volume – End Shields
Source Dimensions	Height	78 ft 6.1 in
	Radius	74 ft 7.0 in
Dose Points	X	0.0 in
	Y	78 ft 6.1 in
	Z	0.0 in
Source Density		Air (0.00122 g/cc)
Source Activity		1.0E+0 (Photon/sec) *

* For all 25 energy groups, the actual dose rates are calculated by multiplying the respective MicroSheild group dose rate output by the respective group-related actual source term using Microsoft EXCEL.

Table-1(2/2) Main MicroShield Input Parameters (for recirculation water)

Geometry		Cylinder Volume – End Shields
Source Dimensions	Height	1 ft 7.9 in
	Radius	74 ft 7.0 in
Dose Points	X	0.0 in
	Y	1 ft 7.9 in
	Z	0.0 in
Source Density		Water (1 g/cc)
Source Activity		1.0E+0 (Photon/sec) *

* For all 25 energy groups, the actual dose rates are calculated by multiplying the respective Microshield output by the respective group-related actual source term using Microsoft EXCEL.

Table-2 Accident Cumulative Dose (for gamma ray) at Various Times after LOCA

Time after LOCA (hr)	Airborne (rad)	Recirculation water (rad)
0.02	8.7E+04	3.8E+04
0.03	1.3E+05	5.7E+04
0.05	2.1E+05	9.5E+04
0.1	4.2E+05	1.9E+05
0.2	8.3E+05	3.6E+05
0.3	1.2E+06	5.3E+05
0.4	1.6E+06	6.8E+05
0.5	1.9E+06	8.3E+05
0.6	2.3E+06	9.6E+05
0.8	2.9E+06	1.2E+06
1	3.5E+06	1.5E+06
1.5	4.8E+06	2.0E+06
1.6	5.0E+06	2.1E+06
1.7	5.2E+06	2.2E+06
1.8	5.4E+06	2.2E+06
1.9	5.6E+06	2.3E+06
2	5.8E+06	2.4E+06
2.5	6.7E+06	2.8E+06
3	7.5E+06	3.1E+06
5	1.0E+07	4.3E+06
10	1.6E+07	6.7E+06
20	2.2E+07	9.9E+06
24	2.4E+07	1.1E+07
30	2.6E+07	1.2E+07
48	3.2E+07	1.5E+07
50	3.2E+07	1.5E+07
70	3.8E+07	1.8E+07
96	4.3E+07	2.1E+07
100	4.4E+07	2.1E+07
120	4.8E+07	2.3E+07
150	5.3E+07	2.6E+07
160	5.5E+07	2.7E+07
170	5.6E+07	2.7E+07
180	5.8E+07	2.8E+07
200	6.0E+07	3.0E+07
240	6.6E+07	3.3E+07
300	7.3E+07	3.7E+07
400	8.4E+07	4.3E+07
480	9.1E+07	4.7E+07
500	9.2E+07	4.8E+07
600	1.0E+08	5.2E+07
700	1.1E+08	5.6E+07
720	1.1E+08	5.7E+07
1440	1.5E+08	8.4E+07
2160	1.8E+08	1.1E+08
4320	2.8E+08	1.6E+08
8760	4.6E+08	2.8E+08
10000	5.0E+08	3.0E+08

Table-3(1/2) Radioactivity (Ci) at Typical Times after LOCA (for airborne)

Nuclide	Time after LOCA (hr)					
	0.1	300	400	2160	4320	8760
Br-83	8.4E+06	1.4E-31	3.6E-44	7.5E-266	0.0E+00	0.0E+00
Br-84	1.4E+07	6.3E-164	1.0E-220	0.0E+00	0.0E+00	0.0E+00
Kr-83m	2.1E+07	6.1E-31	1.5E-43	3.2E-265	0.0E+00	0.0E+00
Kr-85	1.7E+06	1.7E+06	1.7E+06	1.7E+06	1.7E+06	1.6E+06
Kr-85m	4.8E+07	3.4E-13	6.4E-20	3.5E-138	2.5E-283	0.0E+00
Kr-87	9.1E+07	9.2E-64	2.0E-87	0.0E+00	0.0E+00	0.0E+00
Kr-88	1.3E+08	2.1E-24	5.4E-35	1.5E-221	0.0E+00	0.0E+00
Rb-88	6.0E+07	2.4E-24	6.0E-35	1.7E-221	0.0E+00	0.0E+00
Rb-89	4.0E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sr-89	3.3E+06	2.8E+06	2.7E+06	9.7E+05	2.8E+05	2.2E+04
Sr-90	2.8E+05	2.8E+05	2.8E+05	2.8E+05	2.7E+05	2.7E+05
Sr-91	4.4E+06	1.4E-03	9.3E-07	1.6E-62	5.7E-131	1.2E-271
Sr-92	4.5E+06	2.2E-27	1.7E-38	5.4E-234	0.0E+00	0.0E+00
Y-90	3.2E+03	2.7E+05	2.7E+05	2.8E+05	2.7E+05	2.7E+05
Y-91	4.2E+04	6.2E+04	5.9E+04	2.5E+04	8.5E+03	9.5E+02
Y-91m	2.3E+05	8.7E-04	5.9E-07	1.0E-62	3.6E-131	7.3E-272
Y-92	1.3E+05	4.7E-19	1.5E-27	3.2E-177	0.0E+00	0.0E+00
Y-93	5.1E+04	5.9E-05	6.2E-08	2.1E-60	9.0E-125	4.2E-257
Y-94	4.1E+04	1.0E-279	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Zr-95	5.2E+04	4.5E+04	4.3E+04	2.0E+04	7.4E+03	9.9E+02
Zr-97	5.1E+04	2.3E-01	3.8E-03	1.7E-34	5.7E-73	4.7E-152
Nb-95	5.2E+04	5.1E+04	5.1E+04	3.3E+04	1.5E+04	2.2E+03
Nb-97	5.1E+04	2.5E-01	4.1E-03	1.8E-34	6.2E-73	5.0E-152
Mo-99	6.8E+05	2.9E+04	1.0E+04	9.6E-05	1.3E-14	7.5E-35
Mo-101	4.6E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99m	6.0E+05	2.8E+04	9.8E+03	9.2E-05	1.3E-14	7.3E-35
Tc-101	5.9E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Ru-103	5.4E+05	4.3E+05	4.0E+05	1.1E+05	2.2E+04	8.6E+02
Ru-105	3.5E+05	1.6E-15	2.7E-22	1.3E-141	4.5E-288	0.0E+00
Ru-106	1.9E+05	1.8E+05	1.8E+05	1.6E+05	1.3E+05	9.5E+04
Rh-103m	4.9E+05	4.3E+05	4.0E+05	1.1E+05	2.2E+04	8.6E+02
Rh-105	3.3E+05	1.1E+03	1.5E+02	1.5E-13	6.3E-32	1.0E-69
Rh-106	1.9E+05	1.8E+05	1.8E+05	1.6E+05	1.3E+05	9.5E+04
Sn-128	1.1E+06	2.4E-86	6.6E-117	0.0E+00	0.0E+00	0.0E+00
Sb-129	2.2E+06	2.8E-15	3.0E-22	6.9E-145	2.1E-295	0.0E+00
Sb-131	5.0E+06	1.5E-229	4.6E-308	0.0E+00	0.0E+00	0.0E+00
Te-129	2.2E+06	1.7E+05	1.6E+05	3.4E+04	5.4E+03	1.2E+02
Te-129m	3.3E+05	2.6E+05	2.4E+05	5.3E+04	8.2E+03	1.8E+02
Te-131	6.2E+06	2.3E+02	2.3E+01	4.9E-17	1.0E-38	2.9E-83
Te-131m	1.0E+06	1.0E+03	1.0E+02	2.2E-16	4.7E-38	1.3E-82
Te-132	1.0E+07	7.2E+05	3.0E+05	5.0E-02	2.4E-10	1.9E-27
Te-133m	5.6E+06	9.3E-92	2.3E-124	0.0E+00	0.0E+00	0.0E+00
Te-134	1.2E+07	3.2E-123	2.0E-166	0.0E+00	0.0E+00	0.0E+00

* The gamma ray source strengths are converted from the above amount of radioactivity using MicroShield.

Table-3(2/2) Radioactivity (Ci) at Typical Times after LOCA (for airborne)

Nuclide	Time after LOCA (hr)					
	0.1	300	400	2160	4320	8760
I-129	2.3E+00	2.3E+00	2.3E+00	2.3E+00	2.3E+00	2.3E+00
I-131	5.8E+07	2.0E+07	1.4E+07	2.5E+04	1.1E+01	1.2E-06
I-132	8.1E+07	7.4E+05	3.0E+05	5.1E-02	2.5E-10	2.0E-27
I-133	1.2E+08	5.5E+03	2.0E+02	6.6E-24	3.6E-55	2.0E-119
I-134	1.2E+08	1.8E-95	8.3E-130	0.0E+00	0.0E+00	0.0E+00
I-135	1.1E+08	2.4E-06	6.8E-11	4.8E-91	2.0E-189	0.0E+00
Xe-131m	1.6E+06	9.7E+05	8.0E+05	1.5E+04	8.2E+01	1.7E-03
Xe-133	3.0E+08	6.3E+07	3.6E+07	2.3E+03	1.5E-02	3.7E-13
Xe-133m	9.2E+06	2.2E+05	5.8E+04	4.8E-06	2.0E-18	7.0E-44
Xe-135	9.2E+07	4.6E-02	2.2E-05	1.2E-63	3.4E-135	3.1E-282
Xe-135m	4.8E+07	3.9E-07	1.1E-11	7.7E-92	3.3E-190	0.0E+00
Xe-138	2.0E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-134	1.0E+07	1.0E+07	1.0E+07	9.4E+06	8.6E+06	7.3E+06
Cs-136	2.8E+06	1.4E+06	1.1E+06	2.4E+04	2.0E+02	1.1E-02
Cs-137	5.8E+06	5.8E+06	5.8E+06	5.8E+06	5.7E+06	5.7E+06
Cs-138	1.0E+08	1.6E-160	1.3E-216	0.0E+00	0.0E+00	0.0E+00
Ba-139	5.3E+06	1.7E-59	2.4E-81	0.0E+00	0.0E+00	0.0E+00
Ba-140	5.3E+06	2.7E+06	2.1E+06	4.0E+04	3.0E+02	1.3E-02
La-140	6.3E+04	3.1E+06	2.5E+06	4.6E+04	3.4E+02	1.5E-02
La-141	1.3E+05	5.0E-18	1.1E-25	1.7E-160	0.0E+00	0.0E+00
La-142	2.3E+05	1.8E-53	5.4E-73	0.0E+00	0.0E+00	0.0E+00
Ce-141	1.3E+05	9.8E+04	9.0E+04	1.9E+04	2.7E+03	5.3E+01
Ce-143	1.2E+05	2.3E+02	2.8E+01	2.4E-15	4.8E-35	1.5E-75
Ce-144	9.5E+04	9.2E+04	9.1E+04	7.6E+04	6.1E+04	3.9E+04
Pr-144	5.0E+04	9.2E+04	9.1E+04	7.6E+04	6.1E+04	3.9E+04
Pr-147	1.5E+04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Nd-147	2.0E+04	9.0E+03	6.9E+03	6.8E+01	2.3E-01	2.0E-06
Nd-149	1.1E+04	6.9E-49	2.7E-66	0.0E+00	0.0E+00	0.0E+00
Nd-151	4.0E+03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-149	1.7E+04	3.5E+02	9.4E+01	9.8E-09	5.5E-21	3.7E-46
Pm-151	5.5E+03	3.7E+00	3.2E-01	7.1E-20	9.0E-43	7.8E-90
Sm-151	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01
Sm-153	1.3E+04	1.5E+02	3.5E+01	1.6E-10	1.9E-24	4.5E-53
U-233	3.5E-07	3.6E-07	3.6E-07	4.0E-07	4.4E-07	5.3E-07
U-235	4.7E-03	4.7E-03	4.7E-03	4.7E-03	4.7E-03	4.7E-03
U-238	2.3E-02	2.3E-02	2.3E-02	2.3E-02	2.3E-02	2.3E-02
Np-239	1.4E+06	3.4E+04	1.0E+04	8.0E-01	8.0E-01	8.0E-01
Pu-238	3.7E+02	3.8E+02	3.8E+02	3.8E+02	3.8E+02	3.8E+02
Pu-239	2.8E+01	2.9E+01	2.9E+01	2.9E+01	2.9E+01	2.9E+01
Pu-240	4.4E+01	4.4E+01	4.4E+01	4.4E+01	4.4E+01	4.4E+01
Pu-242	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01
Am-241	5.3E+00	5.8E+00	6.0E+00	9.1E+00	1.3E+01	2.1E+01
Cm-242	1.3E+03	1.2E+03	1.2E+03	9.0E+02	6.1E+02	2.8E+02
Cm-243	8.3E-01	8.3E-01	8.3E-01	8.2E-01	8.2E-01	8.1E-01
Cm-244	1.6E+02	1.6E+02	1.6E+02	1.6E+02	1.6E+02	1.5E+02

* The gamma ray source strengths are converted from the above amount of radioactivity using MicroShield.

Table-4(1/2) Radioactivity (Ci) at Typical Times after LOCA (for recirculation water)

Nuclide	Time after LOCA (hr)					
	0.1	300	400	2160	4320	8760
Br-83	8.4E+06	1.4E-31	3.6E-44	7.5E-266	0.0E+00	0.0E+00
Br-84	1.4E+07	6.3E-164	1.0E-220	0.0E+00	0.0E+00	0.0E+00
Kr-83m	3.2E+05	6.1E-31	1.5E-43	3.2E-265	0.0E+00	0.0E+00
Kr-85	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Kr-85m	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Kr-87	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Kr-88	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Rb-88	3.3E+07	1.6E-297	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Rb-89	4.0E+07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sr-89	3.3E+06	2.8E+06	2.7E+06	9.7E+05	2.8E+05	2.2E+04
Sr-90	2.8E+05	2.8E+05	2.8E+05	2.8E+05	2.7E+05	2.7E+05
Sr-91	4.4E+06	1.4E-03	9.3E-07	1.6E-62	5.7E-131	1.2E-271
Sr-92	4.5E+06	2.2E-27	1.7E-38	5.4E-234	0.0E+00	0.0E+00
Y-90	3.2E+03	2.7E+05	2.7E+05	2.8E+05	2.7E+05	2.7E+05
Y-91	4.2E+04	6.2E+04	5.9E+04	2.5E+04	8.5E+03	9.5E+02
Y-91m	2.3E+05	8.7E-04	5.9E-07	1.0E-62	3.6E-131	7.3E-272
Y-92	1.3E+05	4.7E-19	1.5E-27	3.2E-177	0.0E+00	0.0E+00
Y-93	5.1E+04	5.9E-05	6.2E-08	2.1E-60	9.0E-125	4.2E-257
Y-94	4.1E+04	1.0E-279	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Zr-95	5.2E+04	4.5E+04	4.3E+04	2.0E+04	7.4E+03	9.9E+02
Zr-97	5.1E+04	2.3E-01	3.8E-03	1.7E-34	5.7E-73	4.7E-152
Nb-95	5.2E+04	5.1E+04	5.1E+04	3.3E+04	1.5E+04	2.2E+03
Nb-97	5.1E+04	2.5E-01	4.1E-03	1.8E-34	6.2E-73	5.0E-152
Mo-99	6.8E+05	2.9E+04	1.0E+04	9.6E-05	1.3E-14	7.5E-35
Mo-101	4.6E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Tc-99m	6.0E+05	2.8E+04	9.8E+03	9.2E-05	1.3E-14	7.3E-35
Tc-101	5.9E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Ru-103	5.4E+05	4.3E+05	4.0E+05	1.1E+05	2.2E+04	8.6E+02
Ru-105	3.5E+05	1.6E-15	2.7E-22	1.3E-141	4.5E-288	0.0E+00
Ru-106	1.9E+05	1.8E+05	1.8E+05	1.6E+05	1.3E+05	9.5E+04
Rh-103m	4.9E+05	4.3E+05	4.0E+05	1.1E+05	2.2E+04	8.6E+02
Rh-105	3.3E+05	1.1E+03	1.5E+02	1.5E-13	6.3E-32	1.0E-69
Rh-106	1.9E+05	1.8E+05	1.8E+05	1.6E+05	1.3E+05	9.5E+04
Sn-128	1.1E+06	2.4E-86	6.6E-117	0.0E+00	0.0E+00	0.0E+00
Sb-129	2.2E+06	2.8E-15	3.0E-22	6.9E-145	2.1E-295	0.0E+00
Sb-131	5.0E+06	1.5E-229	4.6E-308	0.0E+00	0.0E+00	0.0E+00
Te-129	2.2E+06	1.7E+05	1.6E+05	3.4E+04	5.4E+03	1.2E+02
Te-129m	3.3E+05	2.6E+05	2.4E+05	5.3E+04	8.2E+03	1.8E+02
Te-131	6.2E+06	2.3E+02	2.3E+01	4.9E-17	1.0E-38	2.9E-83
Te-131m	1.0E+06	1.0E+03	1.0E+02	2.2E-16	4.7E-38	1.3E-82
Te-132	1.0E+07	7.2E+05	3.0E+05	5.0E-02	2.4E-10	1.9E-27
Te-133m	5.6E+06	9.3E-92	2.3E-124	0.0E+00	0.0E+00	0.0E+00
Te-134	1.2E+07	3.2E-123	2.0E-166	0.0E+00	0.0E+00	0.0E+00

Table-4(2/2) Radioactivity (Ci) at Typical Times after LOCA (for recirculation water)

Nuclide	Time after LOCA (hr)					
	0.1	300	400	2160	4320	8760
I-129	2.3E+00	2.3E+00	2.3E+00	2.3E+00	2.3E+00	2.3E+00
I-131	5.8E+07	2.0E+07	1.4E+07	2.5E+04	1.1E+01	1.2E-06
I-132	8.1E+07	7.4E+05	3.0E+05	5.1E-02	2.5E-10	2.0E-27
I-133	1.2E+08	5.5E+03	2.0E+02	6.6E-24	3.6E-55	2.0E-119
I-134	1.2E+08	1.8E-95	8.3E-130	0.0E+00	0.0E+00	0.0E+00
I-135	1.1E+08	2.4E-06	6.8E-11	4.8E-91	2.0E-189	0.0E+00
Xe-131m	1.6E+02	1.9E+05	1.9E+05	6.5E+03	3.7E+01	7.8E-04
Xe-133	6.4E+04	4.6E+06	2.7E+06	1.7E+02	1.1E-03	2.7E-14
Xe-133m	4.6E+03	4.4E+04	1.2E+04	9.5E-07	3.9E-19	1.4E-44
Xe-135	7.3E+05	3.5E-02	1.7E-05	8.8E-64	2.6E-135	2.4E-282
Xe-135m	4.1E+06	3.9E-07	1.1E-11	7.7E-92	3.3E-190	0.0E+00
Xe-138	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cs-134	1.0E+07	1.0E+07	1.0E+07	9.4E+06	8.6E+06	7.3E+06
Cs-136	2.8E+06	1.4E+06	1.1E+06	2.4E+04	2.0E+02	1.1E-02
Cs-137	5.8E+06	5.8E+06	5.8E+06	5.8E+06	5.7E+06	5.7E+06
Cs-138	7.6E+07	4.6E-161	3.7E-217	0.0E+00	0.0E+00	0.0E+00
Ba-139	5.3E+06	1.7E-59	2.4E-81	0.0E+00	0.0E+00	0.0E+00
Ba-140	5.3E+06	2.7E+06	2.1E+06	4.0E+04	3.0E+02	1.3E-02
La-140	6.3E+04	3.1E+06	2.5E+06	4.6E+04	3.4E+02	1.5E-02
La-141	1.3E+05	5.0E-18	1.1E-25	1.7E-160	0.0E+00	0.0E+00
La-142	2.3E+05	1.8E-53	5.4E-73	0.0E+00	0.0E+00	0.0E+00
Ce-141	1.3E+05	9.8E+04	9.0E+04	1.9E+04	2.7E+03	5.3E+01
Ce-143	1.2E+05	2.3E+02	2.8E+01	2.4E-15	4.8E-35	1.5E-75
Ce-144	9.5E+04	9.2E+04	9.1E+04	7.6E+04	6.1E+04	3.9E+04
Pr-144	5.0E+04	9.2E+04	9.1E+04	7.6E+04	6.1E+04	3.9E+04
Pr-147	1.5E+04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Nd-147	2.0E+04	9.0E+03	6.9E+03	6.8E+01	2.3E-01	2.0E-06
Nd-149	1.1E+04	6.9E-49	2.7E-66	0.0E+00	0.0E+00	0.0E+00
Nd-151	4.0E+03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Pm-149	1.7E+04	3.5E+02	9.4E+01	9.8E-09	5.5E-21	3.7E-46
Pm-151	5.5E+03	3.7E+00	3.2E-01	7.1E-20	9.0E-43	7.8E-90
Sm-151	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01	1.5E+01
Sm-153	1.3E+04	1.5E+02	3.5E+01	1.6E-10	1.9E-24	4.5E-53
U-233	3.5E-07	3.6E-07	3.6E-07	4.0E-07	4.4E-07	5.3E-07
U-235	4.7E-03	4.7E-03	4.7E-03	4.7E-03	4.7E-03	4.7E-03
U-238	2.3E-02	2.3E-02	2.3E-02	2.3E-02	2.3E-02	2.3E-02
Np-239	1.4E+06	3.4E+04	1.0E+04	8.0E-01	8.0E-01	8.0E-01
Pu-238	3.7E+02	3.8E+02	3.8E+02	3.8E+02	3.8E+02	3.8E+02
Pu-239	2.8E+01	2.9E+01	2.9E+01	2.9E+01	2.9E+01	2.9E+01
Pu-240	4.4E+01	4.4E+01	4.4E+01	4.4E+01	4.4E+01	4.4E+01
Pu-242	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01	1.4E-01
Am-241	5.3E+00	5.8E+00	6.0E+00	9.1E+00	1.3E+01	2.1E+01
Cm-242	1.3E+03	1.2E+03	1.2E+03	9.0E+02	6.1E+02	2.8E+02
Cm-243	8.3E-01	8.3E-01	8.3E-01	8.2E-01	8.2E-01	8.1E-01
Cm-244	1.6E+02	1.6E+02	1.6E+02	1.6E+02	1.6E+02	1.5E+02

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.

Appendix A MicroShield Output Data

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/8/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 589-4536 REVISION 0**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**6/8/2010**

QUESTION NO. 03.11-37:

Question RAI 512-3893 03.11-30, requested additional information, beyond that provided in the response to RAI 358-2642 Question 03.11-1, about the source term used to calculate the Total Integrated Dose (TID) to equipment. In their response, the applicant stated that, except for radiological decay, the effects of other removal mechanisms for reducing containment source terms used to calculate the concentrations presented in FSAR Revision 2 Tier 2 Table 15A-15 "The Peak Concentration in Containment During LOCA" were not used for calculating TID. The applicant noted that the source terms used were provided in Table 1 of the response to Question RAI 512-3893 03.11-29. However, since the effective beta energy is dependent on the assumed isotopic concentration, insufficient information has been provided by the applicant to allow confirmation of the reported energy distributions and resultant dose rates and TID.

The applicant should revise and update MUAP-08015 Revision 1 or FSAR Revision 2 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.

References:
MHI's Response to US-APWR DCD RAI No. 512-3893; MHI Ref: UAP-HF-10018;
Dated January 28, 2010; ML100330613.

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

ANSWER:

The beta ray source term in Table-1 and Table-2 of the response to RAI 512-3893 Question 03.11-29 is calculated by multiplying the amount of radioactivity in Table-3 and Table-4 of the response to RAI 512-3893 Question 03.11-36 by the effective energy of each beta ray.

In accordance with the requirements in the Question, MUAP-08015 Revision 1 will be revised to include and reflect the above response, the response to RAI 358-2462 Revision 1 Question 03.11-1 item 1, the response to RAI 358-2462 Revision 1 Question 03.11-2 item 5, and the response to RAI 512-3893 Question 03.11-29.

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

7/8/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 589-4536 REVISION 0**
SRP SECTION:	**03.11 – Environmental Qualification of Mechanical and Electrical Equipment**
APPLICATION SECTION:	**3.11**
DATE OF RAI ISSUE:	**6/8/2010**

QUESTION NO. 03.11-38:

US-APWR DCD Tier 2 Revision 2 Table 3D-1 "Equipment Post-Accident Operability Times" notes that some equipment required to be operable for 2 weeks is located outside containment, is accessible, and can be repaired, replaced, or recalibrated. This table also notes that some equipment is located inside containment, is inaccessible and is required for post-accident monitoring is required to be operable for 4 months. Table 3D-2 "US-APWR Environmental Qualification Equipment List" was revised in response to DCD RAI 358-2462 Question 03.11-2. This question asked for information regarding the location of equipment requiring qualification and additional details regarding the radiation dose to which the equipment must be qualified. RAI 262-1972 Question 12.03-12.04-16 asked the applicant to identify any entries required into vital areas for the event duration and to provide the associated mission doses in DCD Tier 2 Section 12.4.

However, based on the information provided by the applicant, the NRC staff is unable to: (1) determine the event duration, and the basis for the selection of that duration, (2) determine if any equipment listed in Table 3D-2 is expected to need replacement, recalibration or repair for the duration of the event. Also, in light of the high dose rates experienced inside the containment building following the accident at Three Mile Island Unit 2, and the resultant effort required to reenter the containment building, the NRC staff would like the applicant to provide additional information describing why accessing equipment inside containment for calibration, repair or replacement, within the 4 months service time noted in Table 3D-1, meets the requirements of 10 CFR 20.1101(b) for maintaining Operational Radiation Exposure ALARA.

The applicant is requested to revise the US-APWR DCD Appendix 3D, Section 12.4 and other sections as necessary, to include information regarding the event duration and methods, basis and assumptions used to determine that interval, especially as it relates to areas which will have radiologically harsh environments. The applicant is also requested to clearly describe in Table 3D-1, those pieces of equipment located in the radiologically controlled vital areas of the plant that will require replacement, calibration, or repair for the duration of the event, and to provide Mission Doses for the identified pieces of equipment in DCD Chapter 12.4.

References:

MHI's Response to US-APWR DCD RAI No. 262-1972; MHI Ref: UAP-HF-09226; Dated May 7, 2009; ML091320442.

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 US-APWR DCD Tier 2 Revision 2 Table 3D-1 "Equipment Post-Accident Operability Times", some equipment required to be operable for 2 weeks is located outside the containment vessel, and is accessible, and therefore can be repaired, recalibrated, or replaced, as needed to maintain long-term post-accident functionality.
The 2 weeks service time is established based on the assumptions stated below.

- Environmental conditions (temperature, pressure, and humidity) become mild within 2 weeks time after the accident so that maintenance and repair are considered to be possible. Therefore, 2 weeks is an appropriate required service time for the equipment located outside the containment vessel.
- The target equipment is the equipment that requires functional maintenance to ensure operability for a long period of time after the accident.

As answered for Question 03.11-5 of RAI 358-2462 Revision 1 (UAP-HF-09371), repairing, replacement, and recalibration are not required for the PAM equipment located inside the CV or inaccessible area with operability of 4 months, with access inside the CV required after 4 months (post accident). So, the description of Table 3D-1 "This number is based on an acceptable amount of time to be repaired, replaced, or recalibrated, or for an equivalent indication to be obtained." will be deleted.

Table-1 describes the selected equipment whose service time duration is 2 weeks and that requires potential recalibration, repair or replacement under harsh radiation conditions. The estimation method for the mission dose associated with these activities is the same as described in DCD Section 12.3.1.2.2. The new Figure-12.3-11(Attachments 3) shows the installed location and the access route for each piece of equipment described in Table-1. The new Table 12.3-8(Attachments 2) summarizes the projected dose rates and total mission dose for the equipment shown in Table-1 at 1 week after the accident. Although the required service time for this equipment is two weeks, the mission dose estimation conservatively assumes the dose rate corresponding to a time one week after an accident.

Impact on DCD

DCD Tables 3D-1 and 3D-2 will be revised as described in Attachment 1. In addition, since the radiation conditions of some of the equipment located in Zone14 shown in Table 3D-2 were harsh, they were collected to be mild. As well, vice versa happens for the equipment located in Zone 7 shown in Table 3D-2. Some parts of its radiation condition were mild there, so the conditions were collected to be harsh.

The following additional clarification text will be added after the 3rd paragraph in DCD Section 12.3.1.2.2:

Table 3D-2 shows the equipment which can be repaired, replaced, or recalibrated after 2 weeks from the accident, if required. Some of this equipment is installed in a location that remains under harsh radiation conditions; therefore, mission doses associated with the maintenance of this equipment are estimated. Figure 12.3-11 shows the equipment location and the associated

personnel access routes. Table 12.3-8 summarizes the projected dose rates and mission doses for the equipment maintenance activities. Note that these doses are conservatively based on the estimates for 1 week after the accident even though the actual maintenance activity will not occur until after 2 weeks.

The new Table 12.3-8 and the new Figure 12.3-11 will be added as described in Attachments 2 and 3.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

Table 1 Equipment With 2 Week Operational Duration Requiring Potential Recalibration, Repair and Replacement Under Harsh Post-Accident Radiation Conditions

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	
Instruments (Transmitters)												
29	CVS-FT-128	Primary Makeup Water Supply Flow	R/B	13-3	Other	2wks	Mild	Harsh	No (1)	E	I	(1)
30	CVS-FT-129	Primary Makeup Water Supply Flow	R/B	13-3	Other	2wks	Mild	Harsh	No (1)	E	I	(1)
31	SIS-FT-062	A - Safety Injection Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
32	SIS-FT-063	B - Safety Injection Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
33	SIS-FT-064	C - Safety Injection Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
34	SIS-FT-065	D - Safety Injection Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
59	RHS-FT-011	A - Containment Spray / Residual Heat Removal Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
60	RHS-FT-014	A - Containment Spray / Residual Heat Removal Pump Minimum Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
61	RHS-FT-021	B – Containment Spray / Residual Heat Removal Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
62	RHS-FT-024	B – Containment Spray / Residual Heat Removal Pump Minimum Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
63	RHS-FT-031	C – Containment Spray / Residual Heat Removal Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
64	RHS-FT-034	C – Containment Spray / Residual Heat Removal Pump Minimum Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
65	RHS-FT-041	D – Containment Spray / Residual Heat Removal Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
66	RHS-FT-044	D – Containment Spray / Residual Heat Removal Pump Minimum Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)

Notes:

1. Identification number for "Influence of Submergence for Total Integrated Dose"

(1) Components with no possibility of submergence.
(2) Components that can be submerged in case of HELB, however these components are not required to assure the safety function (including components with alternativeness).
(3) Non-safety related components.

2. Identification number for "Comments"
(1) If required, this equipment can be repaired, replaced, or recalibrated after 2 weeks post-accident.

Attachment1
to RAI 589-4536

Table 3D-1 Equipment Post-Accident Operability Times

Equipment	Required Post-Accident Operability	
Equipment necessary to perform trip functions	5 minutes	(Envelopes trip time requirements)
Equipment located outside containment~~,~~ potentially requiring long-term functional maintenance post-accident (parts of the equipment are~~is~~ accessible, and can be repaired, replaced, or recalibrated, as needed)	2 weeks	
Equipment located inside containment that is inaccessible and is required for post-accident monitoring	4 months	~~(This number is based on an acceptable amount of time to be repaired, replaced, or recalibrated, or for an equivalent indication to be obtained.)~~
Equipment located inside containment, is inaccessible, or cannot be repaired, replaced, recalibrated or equivalent indication cannot be obtained	1 year	
Equipment located in a mild environment following an accident	Various	(Specific as to function, maximum of 1 year)

Brief Description of Section Headings

Item Number

Numerical sequence item numbering of the US-APWR Environmental Qualified Equipment.

Equipment Tag

Electrical equipment numbering system that uniquely identifies the item/device/component per acronyms/ abbreviations with sequential serial numbering system.

Description 1

Item/device/component brief description justifying the abbreviation/acronyms of the equipment tag references.

Location

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 2 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	
21	RCS-PT-020	Loop A - Reactor Coolant Pressure	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
22	RCS-PT-030	Loop B - Reactor Coolant Pressure	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
23	RCS-PT-040	Loop C - Reactor Coolant Pressure	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
24	RCS-PT-050	Loop D - Reactor Coolant Pressure	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
25	RCS-PT-061	Pressurizer Pressure	PCCV	1-6	RT, ESF Other	5min, 4mos, 36hr*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
26	RCS-PT-062	Pressurizer Pressure	PCCV	1-6	RT, ESF Other	5min, 4mos, 36hr*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
27	RCS-PT-063	Pressurizer Pressure	PCCV	1-6	RT, ESF Other	5min, 4mos, 36hr*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
28	RCS-PT-064	Pressurizer Pressure	PCCV	1-6	RT, ESF Other	5min, 4mos, 36hr*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
29	CVS-FT-128	Primary Makeup Water Supply Flow	R/B	13-3	Other	2wks	Mild	Harsh	No (1)	E	I	(1)
30	CVS-FT-129	Primary Makeup Water Supply Flow	R/B	13-3	Other	2wks	Mild	Harsh	No (1)	E	I	(1)
31	SIS-FT-062	A - Safety Injection Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
32	SIS-FT-063	B - Safety Injection Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
33	SIS-FT-064	C - Safety Injection Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
34	SIS-FT-065	D - Safety Injection Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
35	SIS-FT-072	A - Safety Injection Pump Minimum Flow	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
36	SIS-FT-073	B - Safety Injection Pump Minimum Flow	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
37	SIS-FT-074	C - Safety Injection Pump Minimum Flow	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
38	SIS-FT-075	D - Safety Injection Pump Minimum Flow	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
39	SIS-LT-010	A - Accumulator Water Level	PCCV	1-5	PAM	4mos	Harsh	Harsh	No (1)	E	I	
40	SIS-LT-020	B - Accumulator Water Level	PCCV	1-5	PAM	4mos	Harsh	Harsh	No (1)	E	I	
41	SIS-LT-030	C - Accumulator Water Level	PCCV	1-5	PAM	4mos	Harsh	Harsh	No (1)	E	I	

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 3 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	
42	SIS-LT-040	D - Accumulator Water Level	PCCV	1-5	PAM	4mos	Harsh	Harsh	No (1)	E	I	
43	SIS-PT-010	A - Accumulator Pressure	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
44	(Deleted)											
45	SIS-PT-020	B - Accumulator Pressure	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
46	(Deleted)											
47	SIS-PT-030	C - Accumulator Pressure	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
48	(Deleted)							Harsh	No (1)			
49	SIS-PT-040	D - Accumulator Pressure	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
50	(Deleted)											
51	SIS-PT-060	A - Safety Injection Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
52	SIS-PT-061	B - Safety Injection Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
53	SIS-PT-062	C - Safety Injection Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
54	SIS-PT-063	D - Safety Injection Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
55	SIS-PT-064	A - Safety Injection Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
56	SIS-PT-065	B - Safety Injection Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
57	SIS-PT-066	C - Safety Injection Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
58	SIS-PT-067	D - Safety Injection Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
59	RHS-FT-011	A - Containment Spray / Residual Heat Removal Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
60	RHS-FT-014	A - Containment Spray / Residual Heat Removal Pump Minimum Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 4 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	
61	RHS-FT-021	B – Containment Spray / Residual Heat Removal Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
62	RHS-FT-024	B – Containment Spray / Residual Heat Removal Pump Minimum Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
63	RHS-FT-031	C – Containment Spray / Residual Heat Removal Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
64	RHS-FT-034	C – Containment Spray / Residual Heat Removal Pump Minimum Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
65	RHS-FT-041	D – Containment Spray / Residual Heat Removal Pump Discharge Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
66	RHS-FT-044	D – Containment Spray / Residual Heat Removal Pump Minimum Flow	R/B	13-3	PAM, Other	2wks, 36hr	Mild	Harsh	No (1)	E	I	(1)
67	RHS-PT-010	A – Containment Spray / Residual Heat Removal Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
68	RHS-PT-011	A – Containment Spray / Residual Heat Removal Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
69	RHS-PT-020	B – Containment Spray / Residual Heat Removal Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
70	RHS-PT-021	B – Containment Spray / Residual Heat Removal Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
71	RHS-PT-030	C – Containment Spray / Residual Heat Removal Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
72	RHS-PT-031	C – Containment Spray / Residual Heat Removal Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 5 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	
73	RHS-PT-040	D - Containment Spray / Residual Heat Removal Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
74	RHS-PT-041	D - Containment Spray / Residual Heat Removal Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh	No (1)	E	I	
75	EFS-FT-016	A - Emergency Feedwater Flow	R/B	8	PAM, Other	4mos, 36hr	Mild	Harsh	No (1)	E	I	
76	EFS-FT-026	B - Emergency Feedwater Flow	R/B	8	PAM, Other	4mos, 36hr	Mild	Harsh	No (1)	E	I	
77	EFS-FT-036	C - Emergency Feedwater Flow	R/B	8	PAM, Other	4mos, 36hr	Mild	Harsh	No (1)	E	I	
78	EFS-FT-046	D - Emergency Feedwater Flow	R/B	8	PAM, Other	4mos, 36hr	Mild	Harsh	No (1)	E	I	
79	EFS-LT-060	A - Emergency Feedwater Pit Water Level	R/B	14	PAM, Other	2wks, 36hr	Mild	Mild	No (1)	E	I	(1)
80	EFS-LT-061	A - Emergency Feedwater Pit Water Level	R/B	14	PAM, Other	2wks, 36hr	Mild	Mild	No (1)	E	I	(1)
81	EFS-LT-070	B - Emergency Feedwater Pit Water Level	R/B	14	PAM, Other	2wks, 36hr	Mild	Mild	No (1)	E	I	(1)
82	EFS-LT-071	B - Emergency Feedwater Pit Water Level	R/B	14	PAM, Other	2wks, 36hr	Mild	Mild	No (1)	E	I	(1)
83	EFS-PT-052	A - Emergency Feedwater Pump Discharge Pressure	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
84	EFS-PT-050	B - Emergency Feedwater Pump Discharge Pressure	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
85	EFS-PT-051	C - Emergency Feedwater Pump Discharge Pressure	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
86	EFS-PT-053	D - Emergency Feedwater Pump Discharge Pressure	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
87	FWS-LT-510	A - Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
88	FWS-LT-511	A - Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
89	FWS-LT-512	A - Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
90	FWS-LT-513	A - Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
91	FWS-LT-514	A - Steam Generator Water Level (Wide Range)	PCCV	1-6	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 6 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	
92	FWS-LT-520	B – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
93	FWS-LT-521	B – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
94	FWS-LT-522	B – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
95	FWS-LT-523	B – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
96	FWS-LT-524	B – Steam Generator Water Level (Wide Range)	PCCV	1-6	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
97	FWS-LT-530	C – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
98	FWS-LT-531	C – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
99	FWS-LT-532	C – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
100	FWS-LT-533	C – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
101	FWS-LT-534	C – Steam Generator Water Level (Wide Range)	PCCV	1-6	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
102	FWS-LT-540	D – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
103	FWS-LT-541	D – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
104	FWS-LT-542	D – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
105	FWS-LT-543	D – Steam Generator Water Level (Narrow Range)	PCCV	1-6	RT,ESF, PAM	5min, 30min, 4mos	Harsh	Harsh	No (1)	E	I	
106	FWS-LT-544	D – Steam Generator Water Level (Wide Range)	PCCV	1-6	PAM, Other	4mos, 36 hr	Harsh	Harsh	No (1)	E	I	
107	MSS-PT-515	A – Main Steam Line Pressure	R/B	14	ESF,PAM, Other	30min, 2wks, 36 hr	Mild	Mild	No (1)	E	I	(1)
108	MSS-PT-516	A – Main Steam Line Pressure	R/B	14	ESF,PAM	30min, 2wks	Mild	Mild	No (1)	E	I	(1)
109	MSS-PT-517	A – Main Steam Line Pressure	R/B	14	ESF,PAM	30min, 2wks	Mild	Mild	No (1)	E	I	(1)
110	MSS-PT-518	A – Main Steam Line Pressure	R/B	14	ESF,PAM, Other	30min, 2wks, 36hr	Mild	Mild	No (1)	E	I	(1)
111	MSS-PT-525	B – Main Steam Line Pressure	R/B	14	ESF,PAM, Other	30min, 2wks, 36hr	Mild	Mild	No (1)	E	I	(1)
112	MSS-PT-526	B – Main Steam Line Pressure	R/B	14	ESF,PAM	30min, 2wks	Mild	Mild	No (1)	E	I	(1)

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 7 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	
113	MSS-PT-527	B – Main Steam Line Pressure	R/B	14	ESF,PAM	30min, 2wks	Mild	~~Harsh~~Mild	No (1)	E	I	(1)
114	MSS-PT-528	B – Main Steam Line Pressure	R/B	14	ESF,PAM, Other	30min, 2wks, 36hr	Mild	~~Harsh~~Mild	No (1)	E	I	(1)
115	MSS-PT-535	C – Main Steam Line Pressure	R/B	14	ESF,PAM, Other	30min, 2wks, 36hr	Mild	Mild	No (1)	E	I	(1)
116	MSS-PT-536	C – Main Steam Line Pressure	R/B	14	ESF,PAM	30min, 2wks	Mild	Mild	No (1)	E	I	(1)
117	MSS-PT-537	C – Main Steam Line Pressure	R/B	14	ESF,PAM	30min, 2wks	Mild	Mild	No (1)	E	I	(1)
118	MSS-PT-538	C – Main Steam Line Pressure	R/B	14	ESF,PAM, Other	30min, 2wks, 36hr	Mild	Mild	No (1)	E	I	(1)
119	MSS-PT-545	D – Main Steam Line Pressure	R/B	14	ESF,PAM, Other	30min, 2wks, 36hr	Mild	~~Harsh~~Mild	No (1)	E	I	(1)
120	MSS-PT-546	D – Main Steam Line Pressure	R/B	14	ESF,PAM	30min, 2wks	Mild	~~Harsh~~Mild	No (1)	E	I	(1)
121	MSS-PT-547	D – Main Steam Line Pressure	R/B	14	ESF,PAM	30min, 2wks	Mild	~~Harsh~~Mild	No (1)	E	I	(1)
122	MSS-PT-548	D – Main Steam Line Pressure	R/B	14	ESF,PAM, Other	30 min, 2wks, 36hr	Mild	~~Harsh~~Mild	No (1)	E	I	(1)
123	MSS-PT-555	Turbine Inlet Pressure	T/B	14	RT	5min	Mild	Mild	No (3)	E	Non	
124	MSS-PT-556	Turbine Inlet Pressure	T/B	14	RT	5min	Mild	Mild	No (3)	E	Non	
125	MSS-PT-557	Turbine Inlet Pressure	T/B	14	RT	5min	Mild	Mild	No (3)	E	Non	
126	MSS-PT-558	Turbine Inlet Pressure	T/B	14	RT	5min	Mild	Mild	No (3)	E	Non	
127	CSS-PT-010	Containment Pressure	PCCV, R/B	6	ESF,PAM	30min, 4mos	Harsh / Mild	Harsh	No (1)	E	I	Transmitter is located in RB
128	CSS-PT-011	Containment Pressure	PCCV, R/B	6	ESF,PAM	30min, 4mos	Harsh / Mild	Harsh	No (1)	E	I	Transmitter is located in RB
129	CSS-PT-012	Containment Pressure	PCCV, R/B	6	ESF,PAM	30min, 4mos	Harsh / Mild	Harsh	No (1)	E	I	Transmitter is located in RB
130	CSS-PT-013	Containment Pressure	PCCV, R/B	6	ESF,PAM	30min, 4mos	Harsh / Mild	Harsh	No (1)	E	I	Transmitter is located in RB
131	NCS-FT-034	A – Component Cooling Water Header Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
132	NCS-FT-035	B – Component Cooling Water Header Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
133	NCS-FT-037	C – Component Cooling Water Header Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
134	NCS-FT-038	D – Component Cooling Water Header Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
135	NCS-FT-129A	A- Reactor Coolant Pump Thermal Barrier Component Cooling Water Flow	PCCV	1-5	Other	5min*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 9 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	
152	EWS-FT-035	B - Component Cooling Water Heat Exchanger Essential Service Water Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
153	EWS-FT-036	C - Component Cooling Water Heat Exchanger Essential Service Water Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
154	EWS-FT-037	D - Component Cooling Water Heat Exchanger Essential Service Water Flow	R/B	8	Other	36hr	Mild	Harsh	No (1)	E	I	
155	EWS-PT-015	A - Essential Service Water Header Pressure	UHSRS	-	PAM, Other	2wks, 36hr	Mild	-	-	E	I	(1)
156	EWS-PT-016	B - Essential Service Water Header Pressure	UHSRS	-	PAM, Other	2wks, 36hr	Mild	-	-	E	I	(1)
157	EWS-PT-017	C - Essential Service Water Header Pressure	UHSRS	-	PAM, Other	2wks, 36hr	Mild	-	-	E	I	(1)
158	EWS-PT-018	D - Essential Service Water Header Pressure	UHSRS	-	PAM, Other	2wks, 36hr	Mild	-	-	E	I	(1)
159	RWS-LT-010	Refueling Water Storage Pit Water Level (Narrow Range)	PCCV	1-5	PAM	4mos	Harsh	Harsh	No (1)	E	I	
160	RWS-LT-011	Refueling Water Storage Pit Water Level (Wide Range)	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
161	RWS-LT-012	Refueling Water Storage Pit Water Level (Narrow Range)	PCCV	1-5	PAM	4mos	Harsh	Harsh	No (1)	E	I	
162	RWS-LT-013	Refueling Water Storage Pit Water Level (Wide Range)	PCCV	1-5	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
163	LMS-LT-093A	Containment Sump Water Level A	PCCV	1-5	Other	36hr*	Harsh	Harsh	No (2)	E	I	*Not Required Post Accident
164	LMS-LT-093B	Containment Sump Water Level B	PCCV	1-5	Other	36hr*	Harsh	Harsh	No (2)	E	I	*Not Required Post Accident
Instruments (Resistance Temperature Detectors)												
1	RCS-TE-020	Loop A - Reactor Coolant Hot Leg Temperature (Wide Range)	PCCV	1-3	PAM, Other	4mos, 36hr	Harsh	Harsh	No (1)	E	I	
2	RCS-TE-021A	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
3	RCS-TE-021B	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
4	RCS-TE-021C	Loop A - Reactor Coolant Hot Leg Temperature (Narrow Range)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	
5	RCS-TE-021D	Loop A - Reactor Coolant Cold Leg Temperature (Narrow Range)	PCCV	1-3	RT	5min	Harsh	Harsh	No (1)	E	I	

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 18 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	
45	VRS-TS-525	C - Component Cooling Water Pump Area Temperature	R/B	8	Other	1yr	Mild	Harsh	No (1)	E	I	
46	VRS-TS-531	D - Component Cooling Water Pump Area Temperature	R/B	8	Other	1yr	Mild	Harsh	No (1)	E	I	
47	VRS-TS-534	D - Component Cooling Water Pump Area Temperature	R/B	8	Other	1yr	Mild	Harsh	No (1)	E	I	
48	VRS-TS-535	D - Component Cooling Water Pump Area Temperature	R/B	8	Other	1yr	Mild	Harsh	No (1)	E	I	
49	VRS-TS-541	A - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
50	VRS-TS-544	A - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
51	VRS-TS-545	A - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
52	VRS-TS-551	B - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
53	VRS-TS-554	B - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
54	VRS-TS-555	B - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
55	VRS-TS-561	C - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
56	VRS-TS-564	C - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
57	VRS-TS-565	C - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
58	VRS-TS-571	D - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
59	VRS-TS-574	D - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
60	VRS-TS-575	D - Essential Chiller Unit Area Temperature	PS/B	9	Other	2wks	Mild	Mild	No (1)	E	I	(1)
61	VRS-TS-581	A - Charging Pump Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
62	VRS-TS-584	A - Charging Pump Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 19 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	
63	VRS-TS-585	A - Charging Pump Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
64	VRS-TS-591	B - Charging Pump Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
65	VRS-TS-594	B - Charging Pump Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
66	VRS-TS-595	B - Charging Pump Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
67	VRS-TS-601	A - Annulus Emergency Exhaust Filtration Unit Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
68	VRS-TS-604	A - Annulus Emergency Exhaust Filtration Unit Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
69	VRS-TS-605	A - Annulus Emergency Exhaust Filtration Unit Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
70	VRS-TS-611	B - Annulus Emergency Exhaust Filtration Unit Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
71	VRS-TS-614	B - Annulus Emergency Exhaust Filtration Unit Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
72	VRS-TS-615	B - Annulus Emergency Exhaust Filtration Unit Area Temperature	R/B	7	Other	1yr	Mild	Harsh	No (1)	E	I	
73	VRS-TS-210	A - Class 1E Electrical Room Temperature	R/B	4	Other	2wks	Mild	Mild	No (1)	E	I	(1)
74	VRS-TS-230	B - Class 1E Electrical Room Temperature	R/B	4	Other	2wks	Mild	Mild	No (1)	E	I	(1)
75	VRS-TS-250	C - Class 1E Electrical Room Temperature	R/B	4	Other	2wks	Mild	Mild	No (1)	E	I	(1)
76	VRS-TS-270	D - Class 1E Electrical Room Temperature	R/B	4	Other	2wks	Mild	Mild	No (1)	E	I	(1)
77	VRS-TS-146	Main Control Room Temperature	R/B	2	Other	2wks	Mild	Mild	No (1)	E	I	(1)
78	VRS-TS-156	Main Control Room Temperature	R/B	2	Other	2wks	Mild	Mild	No (1)	E	I	(1)
79	VRS-TS-166	Main Control Room Temperature	R/B	2	Other	2wks	Mild	Mild	No (1)	E	I	(1)
80	VRS-TS-176	Main Control Room Temperature	R/B	2	Other	2wks	Mild	Mild	No (1)	E	I	(1)
81	VRS-TS-661	A-Spent fuel pit pump area temperature	R/B	7	Other	1yr	Mild	~~Mild~~Harsh	No (1)	E	I	
82	VRS-TS-664	A-Spent fuel pit pump area temperature	R/B	7	Other	1yr	Mild	~~Mild~~Harsh	No (1)	E	I	
83	VRS-TS-665	A-Spent fuel pit pump area temperature	R/B	7	Other	1yr	Mild	~~Mild~~Harsh	No (1)	E	I	
84	VRS-TS-671	A-Spent fuel pit pump area temperature	R/B	7	Other	1yr	Mild	~~Mild~~Harsh	No (1)	E	I	
85	VRS-TS-674	A-Spent fuel pit pump area temperature	R/B	7	Other	1yr	Mild	~~Mild~~Harsh	No (1)	E	I	

Attachment1
to RAI 589-4536

Table 3D-2 US-APWR Environmental Qualification Equipment List
(Sheet 20 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	
86	VRS-TS-675	A-Spent fuel pit pump area temperature	R/B	7	Other	1yr	Mild	~~Mild~~Harsh	No (1)	E	I	
Cables												
1	N/A	Optical Cable	R/B	8	RT,ESF,PAM	1yr	Mild	Harsh	No (1)	E	I	
2	N/A	Instrumentation Cable (Harsh Specification)	PCCV, R/B	1-4 6	RT,ESF,PAM	1yr	Harsh	Harsh	No (1)	E	I	
3	N/A	Instrumentation Cable (Mild Specification)	R/B	7	RT,ESF,PAM	1yr	Mild	Harsh	No (1)	E	I	
4	N/A	Control Cable (Harsh Specification)	PCCV, R/B	1-4 6	ESF,PAM	1yr	Harsh	Harsh	No (1)	E	I	
5	N/A	Control Cable (Mild Specification)	R/B	7	RT,ESF,PAM	1yr	Mild	Harsh	No (1)	E	I	
6	N/A	Medium Voltage Power Cable (Harsh Specification)	PCCV, R/B	6	ESF	30min	Harsh	Harsh	No (1)	E	I	
7	N/A	Medium Voltage Power Cable (Mild Specification)	R/B	7	ESF	30min	Mild	Harsh	No (1)	E	I	
8	N/A	Low Voltage Power Cable (Harsh Specification)	PCCV, R/B	1-4 6	ESF	30min	Harsh	Harsh	No (1)	E	I	
9	N/A	Low Voltage Power Cable (Mild Specification)	R/B	7	ESF	30min	Mild	Harsh	No (1)	E	I	
10	N/A	Other Specific Cables	PCCV, R/B	1-4 6	RT,ESF,PAM	1yr	Harsh	Harsh	No (1)	E	I	
11	N/A	Other Specific Cables	R/B	7	RT,ESF,PAM	1yr	Mild	Harsh	No (1)	E	I	
Electrical Component												
1	A-EGTG	A-Class 1E Gas Turbine Generator	PS/B	11	ESF	2wks	Mild	Mild	No (1)	E	I	
2	B-EGTG	B-Class 1E Gas Turbine Generator	PS/B	11	ESF	2wks	Mild	Mild	No (1)	E	I	
3	C-EGTG	C-Class 1E Gas Turbine Generator	PS/B	11	ESF	2wks	Mild	Mild	No (1)	E	I	
4	D-EGTG	D-Class 1E Gas Turbine Generator	PS/B	11	ESF	2wks	Mild	Mild	No (1)	E	I	
5		Containment Electrical Penetration	PCCV	1-5	RT, ESF, PAM, PB	1yr	Harsh	Harsh	No (1)	E, M	I	
6		Raceway(Tray, Conduit)	PCCV, R/B, PS/B	1-4 6 7	RT, ESF, PAM	1yr	Harsh/Mild	Harsh	No (1)	M	I	

Attachment1
to RAI 589-4536

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

Notes:

1. Identification number for "Influence of Submergence for Total Integrated Dose"
   (1) Components with no possibility of submergence.
   (2) These components can be submerged in case of HELB, however these components are not required to assure the safety function (including components with alternativeness).
   (3) Non-safety related components.

2. Identification number for "Comments"
   (1) If required, this equipment can be repaired, replaced, or recalibrated after 2 weeks post-accident.

Table 12.3-8 Projected Dose Rates for the Access Areas 1 week after an Accident (sheet 1 of 3)

POST ACCIDENT Access Areas	Dose Rate 1 week after an Accident
CS/RHR,SI Pump Discharge Flow Access Area	≦15 mrem/h
CS/RHR Pump Minimum Flow Access Area	≦15 mrem/h
Primary Makeup Water Supply Flow Access Area	≦15 mrem/h

Table 12.3-8 Mission Dose for the Access Areas access route 1 week after an Accident (sheet 2 of 3)

Access Area	Task description	Time when access required [h]	Max dose rate [rem/h]	Mission dose [rem]	Access route zone map No.
CS/RHR,SI Pump Discharge Flow Access Area	Access to A-CS/RHR,SI Pump Discharge Flow Access Area from AC/B (round trip)	3.0E-02	2.5E-03	7.4E-05	Figure 12.3-11 Sheet 1,2,3
		6.1	1.5E-02	9.2E-02	
		Total		9.2E-02	
	Access to B-CS/RHR,SI Pump Discharge Flow Access Area from AC/B (round trip)	3.0E-02	2.5E-03	7.4E-05	Figure 12.3-11 Sheet 1,2,3
		6.2	1.5E-02	9.2E-02	
		Total		9.2E-02	
	Access to C-CS/RHR,SI Pump Discharge Flow Access Area from AC/B (round trip)	5.6E-02	2.5E-03	1.4E-04	Figure 12.3-11 Sheet 1,2,3
		6.1	1.5E-02	9.1E-02	
		Total		9.1E-02	
	Access to D-CS/RHR,SI Pump Discharge Flow Access Area from AC/B (round trip)	3.0E-02	2.5E-03	7.4E-05	Figure 12.3-11 Sheet 1,2,3
		6.1	1.5E-02	9.1E-02	
		Total		9.1E-02	
CS/RHR Pump Minimum Flow Access Area	Access to A-CS/RHR, Pump Minimum Flow Access Area from AC/B (round trip)	3.0E-02	2.5E-03	7.4E-05	Figure 12.3-11 Sheet 3
		6.1	1.5E-02	9.1E-02	
		Total		9.1E-02	
	Access to B-CS/RHR, Pump Minimum Flow Access Area from AC/B (round trip)	3.0E-02	2.5E-03	7.4E-05	Figure 12.3-11 Sheet 3
		6.1	1.5E-02	9.1E-02	
		Total		9.2E-02	
	Access to C-CS/RHR, Pump Minimum Flow Access Area from AC/B (round trip)	3.0E-02	2.5E-03	7.4E-05	Figure 12.3-11 Sheet 3
		6.1	1.5E-02	9.1E-02	
		Total		9.1E-02	
	Access to D-CS/RHR, Pump Minimum Flow Access Area from AC/B (round trip)	3.0E-02	2.5E-03	7.4E-05	Figure 12.3-11 Sheet 3
		6.1	1.5E-02	9.1E-02	
		Total		9.1E-02	

(Note) Walk speed is usually about 13000 ft/h (4 km/h) and stairs are about 6500 ft/h (2 km/h). Replacement, calibration, or repair time is conservatively assumed to require 6 hours.

Table 12.3-8 Mission Dose for the Access Areas access route 1 week after an Accident (sheet 3 of 3)

Access Area	Task description	Time when access required [h]	Max dose rate [rem/h]	Mission dose [rem]	Access route zone map No.
Primary Makeup Water Supply Flow Access Area	PMW Supply Flow Access Area from AC/B (round trip)	3.0E-02	2.5E-03	7.4E-05	Figure 12.3-11 Sheet 3,4,5
		6.1	1.5E-02	9.1E-02	
		Total		9.1E-02	

(Note) Walk speed is usually about 13000 ft/h (4 km/h) and stairs are about 6500 ft/h (2 km/h). Replacement, calibration, or repair time is conservatively assumed to require 6 hours.

Attachment3
to RAI 589-4536

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 1 of 10) Power Block at Elevation -26'-4" (SRI)

Attachment3
to RAI 589-4536

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 2 of 10) Power Block at Elevation -8'-7" (SRI)

Attachment3
to RAI 589-4536

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 3 of 10) Power Block at Elevation 3'-7" (SRI)

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 4 of 10) Power Block at Elevation 13'-6" (SRI)

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 5 of 10) Power Block at Elevation 25'-3" (SRI)

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 6 of 10) Power Block at Elevation 35'-2" (SRI)

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 7 of 10) Power Block at Elevation 50'-2" (SRI)

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 8 of 10) Power Block at Elevation 76'-5" (SRI)

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 9 of 10)
Power Block at Elevation 101'-0"

(SRI)

Attachment3
to RAI 589-4536

[Security-Related Information – Withheld Under 10 CFR 2.390]

Figure 12.3-11 Post Accident Radiation Zone MAP:1week After Accident (Sheet 10 of 10) Power Block at Elevation 115'-6" (SRI)