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September 5, 2012

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-12229

Subject: MHI's Amended Response to US-APWR DCD RAI No. 512-3893 Revision 1 (SRP 03.11)

- 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 December 15, 2009
2) "MHI's Response to US-APWR DCD RAI No. 512-3893 Revision 1", UAP-HF-10018, dated January 28, 2010.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Amended Response to Request for Additional Information No. 512-3893 Revision 1."

Enclosed is the amended response to a question contained within Reference 1.

MHI amends the previous response to Question 03.11-34 of RAI No. 512-3893 (Reference 2) to update the markups of DCD Appendix 3D and MUAP-08015.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,



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

Enclosure:

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

DOB
NRC

CC: J. A. Ciocco
J. Tapia

Contact Information

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Docket No. 52-021
MHI Ref: UAP-HF-12229

Enclosure 1

UAP-HF-12229
Docket No. 52-021

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

September 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

9/5/2012

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.: 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, question 03.11-2 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 stated, there is an inconsistency in the dose rate during normal operation in EQ Zone 13-3 (Reactor Building Passage) and Figure 12.3-1, Sheet 4 of 34. No other problems were found.

Technical Report (TR) MUAP-08015(R1) was issued to include Tables 5-4 and 5-5. Tables 5-4 and 5-5 in TR MUAP-08015(R1) and Table 3D-2 in DCD Tier 2 Appendix 3D are revised as shown in the attachments.

In addition, DCD Subsection 3.D.1.7 is revised to clarify that the 60 year design expected doses are not assumed to determine the radiation dose for certain electrical equipment whose replacement is expected during the life of the plant (i.e., electrical equipment located in Zone 13-3). The assumed operating period is identified in Table 5-5 of MUAP-08015.

Impact on DCD

DCD Subsection 3.D.1.7 and Table 3D-2 in DCD Tier 2 Appendix 3D will be revised as shown in Attachment 1.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Topical Report / Technical Report

TR MUAP-08015 Tables 5-4 and 5-5 will be revised as shown in Attachment 2.

3D.1.5 Determination of Operating Times

The accident and post accident operating times given in Table 3D-1 are conservatively determined based on the safety-related function(s) the equipment performs to mitigate a design basis event. These actions include:

- Trip and monitor functions of sensors and instruments
- Operability requirements for electro-mechanical equipment

3D.1.6 Determination of Seismic Requirements

The seismic analysis and requirements are described in Section 3.10. The seismic class of mechanical and fluid systems, components, and equipment are shown in Table 3.2-2 of Section 3.2. The seismic class of safety-related mechanical, electrical, and instrumentation and control are shown in Table 3D-2. 10 CFR 50, Appendix B requirements will be applied to seismic category I electrical, instrumentation and control, and mechanical equipment contained in Table 3D-2, as discussed in Subsections 3.2.1.1.1 and 3.2.1.1.2. The pertinent requirements of 10 CFR 50, Appendix B will be applied to seismic category II SSCs.

3D.1.7 Determination of Radiation Exposure Requirements

The normal operating dose rates and consequent 60 year design expected doses at various locations inside containment are derived from theoretical calculations assuming an expected 60 years of continuous operations with reactor power of 4,451 mega watts-thermal and steady state operating conditions. Radiation doses associated with postulated accidents are determined by the methods, models and assumptions as described in Chapter 12 and 15, and MUAP-08015. Source term calculation methods are described in Chapter 12 Subsection 12.2.1.3 and Appendix 15A.1.1.3, dose calculation methods are described in Subsection 5.5.1.1 of MUAP-08015.

The 60 year design expected doses are not assumed to determine the radiation dose for certain electrical equipment whose replacement is expected during the life of the plant (i.e., electrical equipment located in Zone 13-3). The assumed operating period is identified in Table 5-5 of MUAP-08015.

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3D.2 Equipment Identification

Subcomponents to be qualified are identified through the design basis requirements on each main component. The criterion for environmental qualification is that the property of the subcomponents with regard to its application is not degraded during the specified qualified life to the point that the main component is unable to perform its intended safety function.

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In regards to the functionality or pressure boundary integrity function of mechanical equipment, the non-metallic subcomponents are the weak points for environmental qualification. Typical non-metallic items that are subject to the qualification process include gaskets and O-rings, diaphragms, diaphragm support sheets, lubricants, hoses,

3. DESIGN OF STRUCTURES, SYSTEMS,
COMPONENTS, AND EQUIPMENT

Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 2 of 62)

Item Num	Equipment Tag	Description	Location		Purpose RT, ESF, PAM, Pressure Boundary (PB), Other ⁽¹⁾	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone			Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
16	RCS-FT-055	Loop D - Reactor Coolant Flow	PCCV	1-5	RT	5min*	Harsh	Harsh	No (1)	E	I	*Not Required Post Accident
17	RCS-LT-061	Pressurizer Water Level	PCCV	1-5	RT, PAM, Other	5min, 4mos, 36hr	Harsh	Harsh	No (1)	E	I	
18	RCS-LT-062	Pressurizer Water Level	PCCV	1-5	RT, PAM	5min, 4mos	Harsh	Harsh	No (1)	E	I	
19	RCS-LT-063	Pressurizer Water Level	PCCV	1-5	RT, PAM	5min, 4mos	Harsh	Harsh	No (1)	E	I	
20	RCS-LT-064	Pressurizer Water Level	PCCV	1-5	RT, PAM, Other	5min, 4mos, 36hr	Harsh	Harsh	No (1)	E	I	
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 Mild	No (1)	E	I	(1)
30	CVS-FT-129	Primary Makeup Water Supply Flow	R/B	13-3	Other	2wks	Mild	Harsh Mild	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 Mild	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 Mild	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 Mild	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 Mild	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	

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3. DESIGN OF STRUCTURES, SYSTEMS,
COMPONENTS, AND EQUIPMENT

US-APWR Design Control Document
Appendix 3D

Attachment 1 to
RAI 512-3893

Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 3 of 62)

Item Num	Equipment Tag	Description	Location		Purpose RT, ESF, PAM, Pressure Boundary (PB), Other ⁽¹⁾	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone			Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
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	
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)											
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/Mild	No (1)	E	I	
52	SIS-PT-061	B - Safety Injection Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh/Mild	No (1)	E	I	
53	SIS-PT-062	C - Safety Injection Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh/Mild	No (1)	E	I	
54	SIS-PT-063	D - Safety Injection Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh/Mild	No (1)	E	I	
55	SIS-PT-064	A - Safety Injection Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh/Mild	No (1)	E	I	
56	SIS-PT-065	B - Safety Injection Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh/Mild	No (1)	E	I	
57	SIS-PT-066	C - Safety Injection Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh/Mild	No (1)	E	I	
58	SIS-PT-067	D - Safety Injection Pump Discharge Pressure	R/B	13-3	Other	36hr	Mild	Harsh/Mild	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/Mild	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/Mild	No (1)	E	I	(1)

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3. DESIGN OF STRUCTURES, SYSTEMS,
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Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 4 of 62)

Item Num	Equipment Tag	Description	Location		Purpose RT, ESF, PAM, Pressure Boundary (PB), Other ⁽¹⁾	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Sismic Category	Comments
			Building	Zone			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/Mild	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/Mild	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/Mild	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/Mild	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/Mild	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/Mild	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/Mild	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/Mild	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/Mild	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/Mild	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/Mild	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/Mild	No (1)	E	I	
73	RHS-PT-040	D - Containment Spray / Residual Heat Removal Pump Suction Pressure	R/B	13-3	Other	36hr	Mild	Harsh/Mild	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/Mild	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	

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Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 16 of 62)

Item Num	Equipment Tag	Description	Location		Purpose RT, ESF, PAM, Pressure Boundary (PB), Other ⁽¹⁾	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone			Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
26	ICT-TE-024	Core Exit Temperature	PCCV	1-3	PAM	4mos	Harsh	Harsh	No (1)	E	I	(spare)
27	ICT-TE-025	Core Exit Temperature	PCCV	1-3	PAM	4mos	Harsh	Harsh	No (1)	E	I	(spare)
28	ICT-TE-026	Core Exit Temperature	PCCV	1-3	PAM	4mos	Harsh	Harsh	No (1)	E	I	(spare)
Instruments (Radiation Monitors)												
1	RMS-RE-083A	Main Control Room Outside Air Intake Particulate Radiation	R/B	14	ESF	5min	Mild	Mild	No (1)	E	I	
2	RMS-RE-083B	Main Control Room Outside Air Intake Particulate Radiation	R/B	14	ESF	5min	Mild	Mild	No (1)	E	I	
3	RMS-RE-084A	Main Control Room Outside Air Intake Gas Radiation	R/B	14	ESF	5min	Mild	Mild	No (1)	E	I	
4	RMS-RE-084B	Main Control Room Outside Air Intake Gas Radiation	R/B	14	ESF	5min	Mild	Mild	No (1)	E	I	
5	RMS-RE-085A	Main Control Room Outside Air Intake Iodine Radiation	R/B	14	ESF	5min	Mild	Mild	No (1)	E	I	
6	RMS-RE-085B	Main Control Room Outside Air Intake Iodine Radiation	R/B	14	ESF	5min	Mild	Mild	No (1)	E	I	
7	RMS-RE-091A	Containment High Range Area Radiation	PCCV	1-6	ESF, PAM	5min, 4mos	Harsh	Harsh	No (1)	E	I	
8	RMS-RE-091B	Containment High Range Area Radiation	PCCV	1-6	ESF, PAM	5min, 4mos	Harsh	Harsh	No (1)	E	I	
9	RMS-RE-092A	Containment High Range Area Radiation	PCCV	1-6	ESF, PAM	5min, 4mos	Harsh	Harsh	No (1)	E	I	
10	RMS-RE-092B	Containment High Range Area Radiation	PCCV	1-6	ESF, PAM	5 min, 4 mos	Harsh	Harsh	No (1)	E	I	
11	RMS-RE-093A	Containment High Range Area Radiation	PCCV	1-6	ESF, PAM	5min, 4mos	Harsh	Harsh	No (1)	E	I	
12	RMS-RE-093B	Containment High Range Area Radiation	PCCV	1-6	ESF, PAM	5 min, 4 mos	Harsh	Harsh	No (1)	E	I	
13	RMS-RE-094A	Containment High Range Area Radiation	PCCV	1-6	ESF, PAM	5min, 4mos	Harsh	Harsh	No (1)	E	I	
14	RMS-RE-094B	Containment High Range Area Radiation	PCCV	1-6	ESF, PAM	5 min, 4 mos	Harsh	Harsh	No (1)	E	I	
15	RMS-RE-40	Containment Airborne Particulate Radiation	R/B	13-3	Other	36hr*	Mild	Harsh/Mild	No (1)	E	I	*Not Required Post Accident
Instruments (Switches)												
1	VRS-TS-621	A - Penetration Area Temperature	R/B	6	Other	1yr	Mild	Harsh	No (1)	E	I	
2	VRS-TS-624	A - Penetration Area Temperature	R/B	6	Other	1yr	Mild	Harsh	No (1)	E	I	

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3. DESIGN OF STRUCTURES, SYSTEMS,
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Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 40 of 62)

Item Num	Equipment Tag	Description	Location		Purpose RT, ESF, PAM, Pressure Boundary (PB), Other ⁽¹⁾	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone			Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
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	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
40	NCS-MOV-316B	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	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	
48	NCS-FCV-131A	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
49	NCS-FCV-131B	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
50	NCS-MOV-511	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
51	NCS-TCV-013	Temperature Control Valve	PCCV	1-5	PB	1yr	Harsh	Harsh	No (1)	M	I	
52	NCS-MOV-517	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
53	NCS-MOV-401A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
54	NCS-MOV-402A	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	
55	NCS-MOV-531	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
56	NCS-MOV-537	Motor Operated Valve	R/B	6	ESF	5min	Mild	Harsh	No (1)	M	I	
57	NCS-FCV-129A	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
58	NCS-FCV-129B	Flow Control Valve	PCCV	1-5	ESF	1yr	Harsh	Harsh	No (1)	M	I	
59	NCS-MOV-401B	Motor Operated Valve	R/B	6	ESF	1yr	Mild	Harsh	No (1)	M	I	

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3. DESIGN OF STRUCTURES, SYSTEMS,
COMPONENTS, AND EQUIPMENT

Table 3D-2 US-APWR Environmental Qualification Equipment List (Sheet 42 of 62)

Item Num	Equipment Tag	Description	Location		Purpose RT, ESF, PAM, Pressure Boundary (PB), Other ⁽¹⁾	Operational Duration	Environmental Conditions	Radiation Condition	Influence of Submergence for Total Integrated Dose	Qualification Process	Seismic Category	Comments
			Building	Zone			Harsh or Mild	Harsh or Mild	Yes/No	E=Electrical M=Mechanical	I, II, Non	
82	NCS-AQV-664B(Deleted)	Air Operated Valve	R/B	44	ESF	4yr	Mild	Mild	No (4)	M	I	
83	NCS-AQV-662B(Deleted)	Air Operated Valve	R/B	44	ESF	4yr	Mild	Mild	No (4)	M	I	
84	NCS-PCV-012	Pressure Control Valve	R/B	8	PB	1yr	Mild	Harsh	No (1)	M	I	
86	NCS-MOV-321A	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
87	NCS-MOV-321B	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
88	NCS-MOV-322A	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
89	NCS-MOV-322B	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
90	NCS-MOV-323A	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
91	NCS-MOV-323B	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
92	NCS-MOV-324A	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
93	NCS-MOV-324B	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
94	NCS-MOV-325A	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
95	NCS-MOV-325B	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
96	NCS-MOV-326A	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
97	NCS-MOV-326B	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
98	NCS-MOV-241	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
99	NCS-MOV-242	Motor Operated Valve	R/B	13-3	PB	1yr	Mild	Harsh/Mild	No (1)	M	I	
100	NCS-AQV-057A	Air Operated Valve	R/B	13-3	ESF	1yr	Mild	Harsh/Mild	No (1)	M	I	
101	NCS-AQV-057B	Air Operated Valve	R/B	13-3	ESF	1yr	Mild	Harsh/Mild	No (1)	M	I	
102	NCS-AQV-058A	Air Operated Valve	R/B	13-3	ESF	1yr	Mild	Harsh/Mild	No (1)	M	I	
103	NCS-AQV-058B	Air Operated Valve	R/B	13-3	ESF	1yr	Mild	Harsh/Mild	No (1)	M	I	
104	NCS-LCV-010B	Level Control Valve	R/B	8	PB	1yr	Mild	Harsh	No (1)	M	I	
105	NCS-LCV-010D	Level Control Valve	R/B	8	PB	1yr	Mild	Harsh	No (1)	M	I	

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Table 5-4 Radiation Environments (Normal Operation)

Attachment 2 to
RAI 512-3893

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-4 2.5E-3	- ¹	- ¹	2.5E-4 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 to Table 5-4

- 1: This dose rate is negligible or zero when compared to the total dose rate.
- 2: Irradiation by beta radiation 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 radiation from airborne.

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	
		γ	n	β	Total	γ	β	Total		Harsh or Mild	
										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	$\frac{1.4E+05}{(7.7E+02)^3}$	-	-	$\frac{1.4E+05}{(7.7E+02)^3}$	1.9E-01	-	1.9E-01	$\frac{1.4E+05}{(7.7E+02)^3}$ $\frac{1.4E+03}{(7.7E+02)^3}$	Harsh (Mild) ³	Harsh Mild
	2 wks ¹					3.3E+01	-	3.3E+01	$\frac{1.4E+05}{(8.0E+02)^3}$ $\frac{1.4E+03}{(8.0E+02)^3}$	Harsh (Mild) ³	Harsh Mild
	4 mos					7.6E+01	-	7.6E+01	$\frac{1.4E+05}{(8.5E+02)^3}$ $\frac{1.4E+03}{(8.5E+02)^3}$	Harsh (Mild) ³	Harsh Mild
	1 yr					1.8E+02	-	1.8E+02	$\frac{1.4E+05}{(9.4E+02)^3}$ $\frac{1.4E+03}{(9.4E+02)^3}$	Harsh (Mild) ³	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.
3. Normal operation cumulative dose for service life 35 years.