MITSUBISHI HEAVY INDUSTRIES, LTD.
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TOKYO, JAPAN

July 10, 2009

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-09370

Subject: MHI's Responses to US-APWR DCD RAI No.379-2756 Revision 0

Reference: 1) "REQUEST FOR ADDITIONAL INFORMATION 379-2756 REVISION 0, SRP Section: 06.01.01 –Engineered Safety Features Materials Application Section: 6.1.1, QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects)" dated May 29, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No.379-2756 Revision 0."

Enclosed are the responses to Questions 06.01.01-1 through 06.01.01-10 that are contained within Reference 1.

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

Sincerely,

Y. Ogata

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

Enclosure:

1. Responses to Request for Additional Information No.379 Revision 0

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

D081
NRO

Contact Information

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Enclosure 1

UAP-HF-09370
Docket No. 52-021

Responses to Request for Additional Information No.379-2756
Revision 0

July 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 379-2756 REVISION 0**
SRP SECTION:	**06.01.01 – ENGINEERED SAFETY FEATURES MATERIALS**
APPLICATION SECTION:	**6.1.1**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-1

FSAR Table 6.1-1 and 6.1-2 list materials specifications and grades for ESF components. In order for the staff to confirm the suitability of materials for their intended application, the staff requests that the applicant modify FSAR Tables 6.1-1 and 6.1-2 to identify ESF systems that will be fabricated using each of the materials specifications and grades listed. Each ESF system should be identified and broken down by components, such as valves, piping, fittings, accumulators, pumps, heat exchanges etc., so the staff can identify the application of each material. In addition, the staff requests that the applicant include weld filler material specifications and classifications that will be used in each ESF system.

ANSWER:

Tables 6.1-1 and 6.1-2 have been revised to indicate materials on an ESF system basis and further by general component type.

Impact on DCD

DCD Table 6.1-1 and 6.1-2 will be revised as follows:

Table 6.1-1 Principle Engineered Safety Feature Pressure Retaining Material Specifications

ESF Component	Material Specification
Safety Injection System	
Safety Injection Pump	SA-216 Gr. WCB and WCC
	SA-217 Gr.WC9
	SA-351 GrCF8M and CF3M
	SA-487 Gr.CA6NM
	SA-182 TP F304, F304L, F316, F316L Gr. F11, F22, FXM-19
	SA-350 Gr.LF1 and LF2
Accumulator	SA-516 Gr.70

	SA-182 F304
	SA-516 Gr.70
Piping	SA-106, Gr. B and C
	SA-155 Gr. KC70 and 70
	SA-213, TP 304, 304L, 316 and 316L
	SA-249, TP 304L and 316L
	SA-312, TP 304, 304L and 316L
	SA-333 Gr. 1 and 6
	SA-376, TP 304 and 316
	SB-111 Gr. CDA 706
	SB-466 Gr. CDA 706
	SB-167 UNS N06690
	SA-312 TP316
	SA-358 304
	SA-53 Gr.A
Fitting/flange	SA-105
	SA-181, Gr. I and II
	SA-182, TP F304, F304L, F316, and F316L
	SA-234 Gr. WPB, WPBW, WPCW, and WPC
	SA-403, WP 304, 304L, 304W, and 304LW
	SA-420 Gr. WPL6
	SA-479, TP 304, 304L, and 316
	SA-53 Gr.A
	SA-312 TP304
	SA-358 304
	SA-106 Gr.B
	SA-312 TP316
	SA-181 Gr.70
Plate	SA-240, TP 304, 304L, and 316L
	SA-285 Gr. A and C
	SA-36
	SA-515 Gr. 60, 70
	SA-516 Gr. 60, 70
	SA-615 Gr. 60
	SA-537 Class 1
	SB-171 Gr. CDA 706
	ASTM A 515 Gr. 70
Shapes	SA-36
	ASTM A-36
	ASTM A-500 Gr. B (Code Case N71-18 in accordance with the conditions of RG 1.84)
Bolt/nuts/studs/pins	SA-193 Gr. B5, B6, B7, B8, and B8M
	SA-194, Gr. 2H, 8H, 8M, 7, 4, 6, and B8
	SA-307 Gr. B
	SA-320 Gr. L7
	SA-325 Type 1
	SA-453 Gr. 660A and 660B
Casting	SA-216 Gr. WCB and WCC
	SA-217 Gr. WC9
	SA-351 Gr. CF8, CF8M and CF3M
	SA-487 Gr. CA6NM

	SB-61
	SB-62 GR. CDA 836
	SB-148 Gr. CA 952
	ASTM-A276 TP410
Forging	SA-105
	SA-182, TP F304, F304L, F316, and F316L; Gr. F11, F22 and FXM-19
	SA-240 TP 304, 316 and 316L
	SA-350 Gr. LF1 and LF2
	SA-479, TP 304, 304L, 316, XM-19
Bars	SA-479, TP 304, 316 and 410 Gr. 316L and F316
	SA-564 Gr. 630
Weld rod	SFA 5.1, E 6010 and E7018
	SFA 5.4, E-308-16, E 308L-16, E 309, E316L
	SFA 5.9, ER 308, ER 308L, ER 309, ER316L
	SFA 5.17, EM 12K
	SFA 5.18, E 70S-2, E 70S-3, E 70S-4, E70S-6, and E 70S-1B
	SFA 5.20, E 70T-1 and 70T-5
	SFA-5.11, ENiCrFe-7
	SFA-5.14, ERNiCrFe-7
Containment Spray System	
CS/RHR pump	SA-216 Gr. WCB and WCC
	SA-217 Gr.WC9
	SA-351 GrCF8M and CF3M
	SA-487 Gr.CA6NM
	SA-182 TP F304, F304L, F316, F316L Gr. F11, F22, FXM-19
	SA-350 Gr.LF1 and LF2
CS/RHR heat exchanger	SA-106, Gr. B and C
	SA-213, TP304, 304L, 316 and 316L
	SA-249, TP304L and TP316L
	SA-312, TP304, 304L and 316L
	SA-105
	SA-182, TP F304, F304L, F316, F316L;Gr. F11, F22 and FXM-19
	SA-240 TP304, 316 and 316L
	SA-350 Gr. LF1 and LF2
	SA-479, TP304, 304L, 316 and XM-19
	SA-516 Gr.60 and 70
	SA-181 Cl.60 and 70
Piping	SA-106, Gr. B and C
	SA-155 Gr. KC70 Class 1 and 70 Class 1
	SA-213, TP 304, 304L, and 316
	SA-249, TP 304L
	SA-312, TP 304 and 304L
	SA-333 Gr. 1 and 6
	SA-376, TP 304 and 316
	SB-111 Gr. CDA 706
	SB-466 Gr. CDA 706

	SB-167 UNS N06690
	SA-312 TP316
	SA-358 304
	SA-53 Gr.A
Fitting/flange	SA-53 Gr.A
	SA-312 TP304
	SA-358 304
	SA-106 Gr.B
	SA-312 TP316
	SA-479 TP316 or SA-182F316
	SA-105 or equal
	SA-479 TP304 or SA-182 F304
	SA-182 F304
	SA-105 or equal
	SA-182 F316
	SA-181 Gr.70
Plate	SA-240, TP 304, 304L, and 316L
	SA-285 Gr. A and C
	SA-36
	SA-515 Gr. 60, 70
	SA-516 Gr. 60, 70
	SA-615 Gr. 60
	SA-537 Class 1
	SB-171 Gr. CDA 706
	ASTM A 515 Gr. 70
Shapes	SA-36
	ASTM A-36
	ASTM A-500 Gr. B (Code Case N71-18 in accordance with the conditions of RG 1.84)
Bolt/nuts/studs/pins	SA-193 Gr. B5, B6, B7, B8, and B8M
	SA-194, Gr. 2H, 8H, 8M, 7, 4, 6, and B8
	SA-307 Gr. B
	SA-320 Gr. L7
	SA-325 Type 1
	SA-453 Gr. 660A and 660B
Casting	SA-216 Gr. WCB and WCC
	SA-217 Gr. WC9
	SA-351 Gr. CF8, CF8M and CF3M
	SA-487 Gr. CA6NM
	SB-61
	SB-62 GR. CDA 836
	SB-148 Gr. CA 952
	ASTM-A276 TP410
Forging	SA-105
	SA-182, TP F304, F304L, F316, and F316L; Gr. F11, F22 and FXM-19
	SA-240 TP 304, 316 and 316L
	SA-350 Gr. LF1 and LF2
	SA-479, TP 304, 304L, 316, XM-19
Bars	SA-479, TP 304, 316 and 410 Gr. 316L and

	F316
	SA-564 Gr. 630
Weld rod	SFA 5.1, E 6010 and E7018
	SFA 5.4, E-308-16, E 308L-16, E 309, E316L
	SFA 5.9, ER 308, ER 308L, ER 309, ER316L
	SFA 5.17, EM 12K
	SFA 5.18, E 70S-2, E 70S-3, E 70S-4, E70S-6, and E 70S-1B
	SFA 5.20, E 70T-1 and 70T-5

Table 6.1-2 Principle Engineered Safety Features Materials Exposed to Core Coolant and Containment Spray (Sheet 1 of 2)

ESF Component	Material Specification
Safety Injection System, Containment Spray System	
Piping/Tubing	SA-106, Gr. B and C
	SA-155 Gr. KC70 Class 1 and 70 Class 1
	SA-213, TP 304, 304L, and 316
	SA-249, TP 304L
	SA-312, TP 304 and 304L
	SA-333 Gr. 1 and 6
	SA-376, TP 304 and 316
	SB-111 Gr. CDA 706
	SB-466 Gr. CDA 706
	SB-167 UNS N06690
	SA 358 TP 304, 304L, 316L
Fittings/flanges	SA-105
	SA-181, Gr. I and II
	SA-182, TP F304, F304L, F316, and F316L
	SA-234 Gr. WPB, WPBW, WPCW, and WPC
	SA-403, WP 304, 304L, 304W, and 304LW
	SA-420 Gr. WPL6
	SA-479, TP 304, 304L, and 316
Plate	SA-240, TP 304, 304L, and 316L
	SA-285 Gr. A and C
	SA-36
	SA-515 Gr. 60, 70
	SA-516 Gr. 60, 70
	SA-615 Gr. 60
	SA-537 Class 1
	SB-171 Gr. CDA 706
	ASTM A 515 Gr. 70
Shapes	SA-36
	ASTM A-36
	ASTM A-500 Gr. B (Code Case N71-18 in accordance with the conditions of RG 1.84)

Table 6.1-2 Principle Engineered Safety Features Materials Exposed to Core Coolant Water and Containment Spray (Sheet 2 of 2)

ESF Component	Material Specification
Bolts/nuts/studs/pins	SA-193 Gr. B5, B6, B7, B8, and B8M
	SA-194, Gr. 2H, 8H, 8M, 7, 4, 6, and B8
	SA-307 Gr. B
	SA-320 Gr. L7
	SA-325 Type 1
	SA-453 Gr. 660A and 660B
	SA-564 Gr. 630
	ASTM A 193 Gr. B7
	ASTM 194 Gr. 7
	ASTM A 307
	ASTM A 354
	ASTM A 490
Bars	SA-479, TP 304, 316, 410, 316L, and F316
	SA-564 Gr. 630
	ASTM A 108 Gr. 1018 CW (Code Case N71-18 in accordance with the conditions of RG 1.84)
Forgings	SA-105
	SA-181 Gr 70
	SA-182, TP F304, F304L, F316 and F316L; Gr. F11 and F22
	SA-240, TP 304 and 316
	SA-350 Gr. LF1 and LF2
	SA-479, TP 304, 304L and 316
	ASTM A 668 Class C (Code Case N71-18 in accordance with the conditions of RG 1.84)
Castings	SA-216 Gr. WCB and WCC
	SA-217 Gr. WC9
	SA-351 GR. CF8, CF8M and CF3M
	SA-487 Gr. CA6NM
	SB-61
	SB-62 Gr. CDA 836
	SB-148 Gr. CA 952
	ASTM A 276 TP 410
	ASTM A-216 Gr. WCB

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

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 379-2756 REVISION 0**
SRP SECTION:	**06.01.01 – ENGINEERED SAFETY FEATURES MATERIALS**
APPLICATION SECTION:	**6.1.1**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-2

Tables 6.1-1 and 6.1-2 indicate that ASTM A-500 Gr. B material will be used in accordance with Code Case N-71-10. The staff notes that the most recent version of this Code Case is N-71-18 which is approved for use in RG 1.84 "Design, Fabrication, and Materials Code Case Acceptability, ASME Section III, Revision 34, August 2007." The staff requests that the applicant modify FSAR Tables 6.1-1 and 6.1-2 to use Code Case N-71-18 in lieu of N-71-10 and state that the conditions listed in RG 1.84 will be followed. A similar issue exists with the applicant's use of ASTM 668 Class C in Table 6.1-2. In addition, the staff requests that the applicant identify the components fabricated from these materials and list any other materials that will be used in accordance with this Code Case. Also identify any other Code Cases that will be used to fabricate ESF systems components and modify the FSAR accordingly.

ANSWER:

For ASTM 668 Class C material the reference to code Case N71-5 will be revised to N71-18. For ASTM A500 Gr B, the reference to code Case N71-10 will be revised to N71-18. Reference to compliance to RG 1.84 will also be added to both items.

Code Cases except this will not be used to fabricate ESF system components.

Impact on DCD

Revise table 6.1.1-1 and 6.1.1-2 as shown in response 6.1.1-1.

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

7/10/2009

US-APWR Design Certification

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Docket No. 52-021

RAI NO.:	**NO. 379-2756 REVISION 0**
SRP SECTION:	**06.01.01 – ENGINEERED SAFETY FEATURES MATERIALS**
APPLICATION SECTION:	**6.1.1**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-3

The Emergency Feedwater System (EFWS) components materials specifications and grades are not listed in FSAR Table 6.1-1 or FSAR Chapter 10. The staff notes that per SRP 10.4.9, the compatibility of EFWS materials is reviewed by the staff under SRP 6.1.1. In order for the staff to find that the EFWS materials meet the acceptance criteria listed in SRP Section 6.1.1, the staff requests that the applicant modify FSAR Section 10.4.9 or 6.1.1 to list material specifications and grades for EFWS components (pumps, piping, valves, fittings, etc.) including weld filler materials. In addition, verify compliance with the guidance provided in RGs 1.31, 1.37, 1.44, 1.50 and preheat guidelines in ASME Code Section III, Appendix D, Article D-1000 for carbon steel and low alloy steel. Where the applicant deviates from staff guidance in these RGs or ASME Code Section III, Appendix D, the staff requests that the applicant provide justification for the deviation and describe any alternatives and the basis for such alternative approach. The staff notes that some of the aforementioned documents may not be applicable depending on the materials selected by the applicant. Also provide, in the FSAR, a justification for the materials selected based on the operating environment and include a discussion regarding the corrosion allowance for EFWS components and the basis for the corrosion allowance.

ANSWER:

Weld filler materials for the EFW are provided in Table 10.3.2-5 (See response to 10.3.6-8). EFW materials are provided as shown below. The recommendations of RGs 1.31, 1.37, 1.44 and 1.50 are applied during fabrication of EFW system, and also preheat guidelines in ASME Code Section III, Appendix D, Article D-1000 for carbon steel and low alloy steel is applied.

The EFW system components are designed to have sufficient wall thickness against corrosion. Though the main materials of the EFW system are ferritic materials, the EFW system piping does not fail due to corrosion, because the duration of the EFW system is very limited and operating temperature is low (below 200 deg F)

Impact on DCD

The following sentence will be added in the DCD Subsection 10.4.9.1 after last bullet.

<u>The principle emergency feedwater system materials are shown in Table 10.4.9-7.</u>

The following table will be added in the DCD Subsection 10.4.9.

Table 10.4.9-7 Principle Emergency Feedwater System Materials

ESF Component	Material Specification
Emergency Feedwater Pump	SA-216 Gr. WCB and WCC
	SA-217 Gr. WC9
	SA-351 Gr. CF8M and CF3M
	SA-487 Gr. CA6NM
Piping/Tubing	SA-106, Gr. B and C
	SA-213, TP 304, 304L, 316 and 316L
	SA-249, TP 304L and 316L
	SA-312, TP 304, 304L and 316L
	SA-53 Gr.A
	SA-106 Gr.B
Fittings/flanges	SA-182, TP F304, F304L, F316, and F316L
	SA-403, WP 304, 304L, 304W, and 304LW
	SA-312 TP304
	SA-53 Gr.A
	SA-106 Gr.B
	SA-479 TP304
	SA-182 F304, Class 150
	SA-105
	SA-181 Gr.70, Class 900
Plate	SA-240, TP 304, 304L, and 316L
	SA-36
	SA-515 Gr. 60, 70
	SA-516 Gr. 60, 70
Shapes	SA-36
	ASTM A-36
Bolts/nuts/studs/pins	SA-193 Gr. B6, B7, B8, and B8M
	SA-194, Gr. 2H, 8H, 8M, 7, 4, 6, and B8
Castings	SA-216 Gr. WCB and WCC
	SA-217 Gr. WC9
	SA-351 Gr. CF8M and CF3M
	SA-487 Gr. CA6NM
Forgings	SA-182, TP F304, F304L, F316, and F316L; Gr. F11, F22 and FXM-19
	SA-350 Gr. LF1 and LF2
	SA-479, TP 304, 304L, 316 and XM-19
Bars	SA-479, TP 304, 316 and 410 Gr. 316L, F316 and XM-19
	SA-564 Gr. 630 [17-4 PH]

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

7/10/2009

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APPLICATION SECTION:	**6.1.1**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-4

FSAR Subsection 6.1.1.2.1 states "The materials used in the fabrication of the ESF components are corrosion resistant in normal operation and the post-LOCA environment. General corrosion is negligible with the exception of low-alloy and carbon steels." In order for the staff to evaluate the applicant's corrosion allowance for ferritic materials used in ESF systems, the staff requests that the applicant modify FSAR Section 6.1.1 to identify the corrosion allowance for ferritic materials and state the technical basis for the corrosion allowance for ferritic materials used in ESF systems to ensure that it is sufficient for the design life of the plant.

ANSWER:

In general, high possibility of failure due to corrosion is the portion with high flow velocity. In the ESF, the SIS and CSS are the system with high flow velocity, because there are pumps in the systems. The other components may be made of ferritic materials, but their failure due to corrosion does not occur because their environmental conditions are not severe. The materials of SIS and CSS are selected to austenitic stainless, so failures due to corrosion do not occur in these systems.

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.

7/10/2009

US-APWR Design Certification

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APPLICATION SECTION:	**6.1.1**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-5

FSAR Section 6.1.1.1 indicates that Alloy 690 is used in some ESF systems and is identified in Table 6.1-1. Although not listed in Table 6.1-1, the staff assumes that Alloys 52/52M/152 will be used to weld Alloy 690 to Alloy 690, Alloy 690 to stainless steel and possibly stainless steel to carbon steel or Alloy 690 to ferritic materials. In order for the staff to complete its review, the staff requests that the applicant provide the following:

a. Identify ESF components fabricated from Alloy 690 and include them in Table 6.1-1. Also include weld filler metal specifications and classifications for welding Alloy 690 components and filler metal specifications and classifications used in dissimilar metal welds.

b. For components containing dissimilar-metal welds in ESF systems, provide a detailed description of how these welds are performed. The applicant's detailed description should include the following:
   1. Provide base material combinations.
   2. Describe the welding processes used.
   3. Describe special fabrication process requirements employed in dissimilar metal welds to limit the effects of cold work and residual stress, caused by grinding/repair or other fabrication processes on surfaces that come into contact with ESF and RCS fluids in order to minimize the susceptibility of components to stress corrosion cracking for the design life of the plant.
   4. Discuss welding process controls employed to reduce weld metal dilution in order to retain the maximum percentage of Chromium possible in order to decrease the susceptibility of components to stress corrosion cracking for the life of the plant.
   5. Given the susceptibility of Alloys 52, 52M and 152 to ductility dip cracking and other types of welding flaws that have resulted in extensive repairs during repair and replacement activities for current operating PWRs, provide a description of special process controls used to minimize welding flaws.

ANSWER:

a. The following table shows the component using alloy 690 filler material in EFS components. The specifications and classification of 690 alloy filler material are also shown.

Table 6.1-1 Principle Engineered Safety Feature Pressure Retaining Material Specification

ESF Component	Material Specification
Weld Rod (for accumulator)	
Pressure boundary welds (Stainless Steel to Carbon Steel)	SFA-5.11, ENiCrFe-7 SFA-5.14, ERNiCrFe-7

b. Detail of dissimilar metal welds process show the following:
   1. Combination of base materials is Stainless steel and Carbon steel
   2. Welding process is Gas Tungsten Arc Welding (GTAW) or Shielded Metal Arc Welding (SMAW).
   3. Regarding dissimilar welds with nickel-based alloy welding material, alloy 690 filler materials are used to avoid stress corrosion cracking. In addition, stress corrosion cracking by cold work and residual stress is hardly occur because accumulator isn't high temperature (max. 300°F (150°C)). Therefore, it can be avoided stress corrosion cracking.
   4. For dissimilar material weld area, small amounts of chromium dilution may occur. However, heat input is controlled in accordance with welding qualification procedures. Therefore, amount of chromium dilution is controlled to a minimum.
   5. The heat input is controlled in order to prevent hot cracks. Interpass treatment is also performed to minimize the number of weld flaws.

Impact on DCD

DCD table 6.1-1 will be added the alloy 690 weld filler material. (See response to 6.1.1-1)

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

7/10/2009

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APPLICATION SECTION:	**6.1.1**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-6

The staff was unable to locate ITAAC for the containment liner system relative to verifying compliance with ASME Codes for fabrication, welding and nondestructive examination. The staff requests that the applicant identify where the aforementioned information is addressed in FSAR Tier 1. If this is not addressed in Tier 1 information, modify the FSAR accordingly.

ANSWER:

As stated in DCD Tier 1 Subsection 2.11.1.1, the pre-stressed concrete containment vessel (PCCV) is designed and constructed in accordance with ASME Code, Section III. The containment liner is part of the PCCV pressure boundary and is therefore subject to ITAAC Item 1 in DCD Tier 1 Table 2.11.1-2, which includes the following design commitment (DC):

"The PCCV pressure boundary is designed to meet ASME Code, Section III requirements."

The inspections, tests and analyses (ITA) and acceptance criteria (AC) for ITAAC Item 1 in Table 2.11.1-2 refer to the ITAAC in Tier 1 Section 2.2. DCD Tier 1 Table 2.2-4 includes ITAAC requiring an ASME design report for the as-built PCCV (ITAAC Item 5), and hydrostatic testing and pre-operational non-destructive examination (NDE) of ASME Code Section III components and piping.

Impact on DCD

There are no impacts 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

7/10/2009

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DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-7

FSAR Subsection 6.1.1.2.2 states that Chapter 5, Subsection 5.2.3 describes control of welding, heat treatment, welder qualification, and contamination protection during ferritic and austenitic stainless steels material fabrication which are also applicable to ESFs. FSAR Subsection 6.1 indicates that the ESF systems comply with the guidance provided in RGs 1.44 and 1.71. In order to provide clarity regarding the applicant's compliance with guidance provided in applicable RGs, the staff requests that the applicant modify FSAR Subsection 6.1.1, to state that it complies with the guidance provided in RGs 1.31 and 1.50. In addition, modify FSAR Table 1.9.1-1 to list RGs 1.31, 1.44, 1.50 and 1.71 as being applicable to FSAR Subsection 6.1.1.

ANSWER:

DCD Tier 2, Revision 1, Subsection 6.1.1.2.2 is revised as discussed below to add discussion of compliance with the guidance contained in Regulatory Guide (RG) 1.31, "Control of Ferrite Content in Stainless Steel Weld Metal", and RG 1.50, "Control of Preheat Temperature for Welding of Low-Alloy Steel". RG's 1.31 and 1.50 have been added as references in Subsection 6.1.4. DCD Tier 2, Table 1.9.1-1 is revised as shown below to add a reference to Subsection 6.1.1 for RG's 1.31, 1.44, 1.50, and 1.71.

Impact on DCD

Revise DCD Tier 2, Revision 1, Subsection 6.1.1.2.2, 2nd paragraph, as shown below:

> "Chapter 5, Subsection 5.2.3 describes control of welding, heat treatment, welder qualification, and contamination protection **for** ferritic and austenitic stainless steels material fabrication which are also applicable to ESFs. **The ferrite content in stainless steel weld metal will be controlled in accordance with the recommendations of RG 1.31 (Ref. 6.1-13). The recommendations of RG 1.50, Control of Preheat Temperature for Welding of Low Alloy Steel, (Ref. 6.1-14) are applied during weld fabrication.**"

The following additional references will be added to Subsection 6.1.4:

6.1-13 **U.S. Nuclear Regulatory Commission, Control of Ferrite Content in Stainless Steel Weld Metal, Regulatory Guide 1.31, Rev. 3, April 1978**

6.1-14 **U.S. Nuclear Regulatory Commission, Control of Preheat Temperature for Welding of Low-Alloy Steel, Regulatory Guide 1.50, Rev. 0, May 1973**

Revise DCD Tier 2, Revision 1, Table 1.9.1-1 as shown below:

Table 1.9.1-1 US-APWR Conformance with Division 1 Regulatory Guides

Reg Guide Number	Title	Status	Corresponding Chapter/Section /Subsection
1.31	Control of Ferrite Content in Stainless Steel Weld Metal (Rev. 3, April 1978)	Conformance with no exceptions identified.	4.5.2, 5.2.3.4.4, 5.3.1.4, **6.1.1**
1.44	Control of the Use of Sensitized Stainless Steel (Rev. 0, May 1973)	Conformance with no exceptions identified.	3.6.3.3.4, **6.1.1**
1.50	Control of Preheat Temperature for Welding of Low-Alloy Steel (Rev. 0, May 1973)	Conformance with no exceptions identified.	5.3.1.2, 5.3.1.4, **6.1.1**
1.71	Welder Qualification for Areas of Limited Accessibility (Rev. 1, March 2007)	Conformance with no exceptions identified.	5.2.3.3.2, 5.2.3.4.4, 5.3.1.4, **6.1.1**

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

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 379-2756 REVISION 0**
SRP SECTION:	**06.01.01 – ENGINEERED SAFETY FEATURES MATERIALS**
APPLICATION SECTION:	**6.1.1**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-8

FSAR Subsection 6.1.1.1 states "Cold-worked austenitic stainless steel is not used for pressure boundary applications. If such material is used for other applications when there is no proven alternative available, cold work is controlled, measured and documented during each fabrication process. The COL Applicant is responsible to develop an augmented ISI program to ensure the structural integrity of such components during service [COL Item 6.1(2)]. Cold-worked austenitic stainless steels have a maximum 0.2 percent offset yield strength of 620 MPa (90,000 psi) to reduce the probability of stress-corrosion cracking in ESF systems." Supplemental information supplied by the applicant on November 7, 2008 modifies FSAR Subsection 6.1.1.1 to delete COL Item 6.1(2) and add the following statement in its place: "An augmented inservice inspection (ISI) is conducted to ensure the structural integrity of such components during service, which is described in Section 6.6." However, FSAR Section 6.6 does not contain a description of any augmented inspection program for cold worked austenitic stainless steel. The staff requests that the applicant modify the FSAR to correct this inconsistency.

ANSWER:

Letter to the NRC dated November 7, 2008 (UAP-HF-08259) provided updated COL information items in the DCD that were supplemented to provide the additional information necessary to support NRC's licensing review. COL Item 6.1(2) was deleted from DCD Subsection 6.1.3, and Subsection 6.1.1.1 was revised to add reference to Section 6.6 for description of the augmented inservice inspection (ISI) program.

Supplemental information was provided for Subsection 6.6.8 that stated "The COL Applicant is responsible for identifying the implementation milestone for the augmented inservice inspection program." COL Item 6.6(2) was also revised, but contained minor wording variations from that provided in Section 6.6.8, which are corrected in COL Item 6.6(2) as shown below.

The proposed changes to the DCD that were submitted to the NRC in the letter dated 11/7/08 were intended to eliminate duplication through the deletion of COL Item 6.1(2), and present one COL Item (i.e., 6.6(2)) regarding the implementation of an augmented ISI program. For consistency between DCD Sections 6.1 and 6.6, Subsection 6.6.8 is revised as shown below to add a statement that an augmented ISI program is required to ensure structural integrity of cold-worked austenitic stainless steel components.

Impact on DCD

DCD Subsection 6.6.8 is revised to add the following sentence after the 1st paragraph:

An augmented ISI program is required to ensure structural integrity of cold-worked austenitic stainless steel components (Refer to Subsection 6.1.1.1).

DCD Subsection 6.6.9, COL Item 6.6(2) that was submitted to the NRC in the letter dated 11/7/08 is revised as follows:

The COL Applicant is responsible for identify**ing** the implementation milestone for **the augmented** inservice inspection program. ~~The COL Applicant is responsible for preparing an augmented inservice inspection program for high energy fluid system piping.~~

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

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO. 379-2756 REVISION 0**
SRP SECTION:	**06.01.01 – ENGINEERED SAFETY FEATURES MATERIALS**
APPLICATION SECTION:	**6.1.1**
DATE OF RAI ISSUE:	**5/29/2009**

QUESTION NO.: 06.01.01-9

Table 6.1-1 indicates that non-low carbon austenitic stainless steels will be used to fabricate some ESF components. Given that the use of stainless steels, in LWRs, with a maximum carbon content of 0.03% has been shown to be highly resistant to stress corrosion cracking, the staff requests that the applicant modify FSAR Section 6.1.1 and Table 6.1-1 to limit the carbon content of austenitic stainless steel to 0.03% maximum or provide a technical basis for why this is not necessary.

ANSWER:

As discussed in Subsection 6.1.1.1, the requirements from RG 1.44 are followed during the manufacture of the ESF components. The material used to fabricate the safety significant portions of the ESF systems is highly resistant to corrosion. RG 1.44 includes measures to limit susceptibility of austenitic stainless steels to stress corrosion cracking, including consideration of carbon content. Therefore, austenitic stainless base metal used for the pressure retaining material of the ESF components has a limited carbon content not exceeding 0.03%.

Impact on DCD

The following sentence will be added after the 2nd paragraph of DCD Subsection 6.1.1.1.

> **Austenitic stainless base metal used for the pressure retaining material of the ESF components has a limited carbon content not exceeding 0.03%.**

Table 6.1-1 will be revised as shown in response 6.1.1-1.

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

7/10/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 379-2756 REVISION 0

SRP SECTION: 06.01.01 – ENGINEERED SAFETY FEATURES MATERIALS

APPLICATION SECTION: 6.1.1

DATE OF RAI ISSUE: 5/29/2009

QUESTION NO.: 06.01.01-10

FSAR Subsection 6.1.1.2 indicates that the chemistry of the borated reactor coolant and the borated water in the RWSP is controlled such that the concentrations of chlorides and fluorides is below 0.15 ppm. Subsection 6.1.1.2 also states that during periods of high temperatures, dissolved oxygen concentrations remain below 0.10 ppm. Subsection 6.1.1.2 further states that the controls on water chemistry include the chemical and volume control system (CVCS) and the spent fuel pit cooling and purification system (SFPCS). Details on these control systems are provided in Chapter 9, Subsection 9.3.4, for the CVCS and in Subsection 9.1.3 for the SFPCS. The staff notes that for refueling water storage tanks, the EPRI PWR Primary Water Chemistry Guidelines (EPRI Guidelines) recommend sampling several other parameters in addition to chloride and fluoride, such as sulfate. Also, FSAR Subsection 6.1.1.2.1 states that the water quality requirements for the RCS and RWSP are described in Chapter 9, Subsection 9.3.4. However, Section 9.3.4 only describes the RCS water quality requirements. The staff therefore requests that the applicant provide the following:

1. Discuss consistency of the impurity limits for the RWSP with the recommendations of the EPRI PWR Primary Water Chemistry Guidelines and modify the FSAR accordingly.
2. Confirm that the limit on dissolved oxygen of 0.10 ppm is applicable to the RWSP.
3. Modify Subsection 9.3.4 to include water quality requirements for the RWSP.

ANSWER:

1. Water chemistry specifications of RWSP are as follows:

Analysis item	Unit	Standard value	Limited value	Recommended analysis item standard value
1 Boron	ppm	-	≥ 4000* ≤ 4200*	
2 Chloride ion	ppm	≤ 0.05	≤ 0.15	
3 Fluoride ion	ppm	≤ 0.05	≤ 0.15	
4 Sulfate ion	ppm	≤ 0.05	≤ 0.15	
5 Turbidity	ppm	≤ 1.0	-	

6 Silica	ppm	-	-	≤ 0.5

*: See US-APWR Technical Specification (DCD Chap. 16)

In US-APWR, NaTB is used at letdown line of spray system, therefore ingress of Na dose not occur. This specification is almost consistent with EPRI Guidelines except Na.

2. Oxygen is not controlled at RWSP, because this pit is air open type. Therefore, limited value of dissolved oxygen is not specified at RWSP.

3. Water chemistry specifications of the RWSP will be added in Subsection 6.1.

Impact on DCD

The 4th paragraph of the DCD Subsection 6.1.1.2 will be revised as follows:

> Borated water is used in the RCS and the RWSP. The water quality requirements for the RCS and RWSP are described in Chapter 9, Subsection 9.3.4 **and Table 6.1-3, respectively**. The pH of the RWSP during a LOCA is adjusted by the NaTB baskets. The concrete that forms the structure of the RWSP is clad in stainless steel which inhibits the leach-out of chlorides and other contaminants into the RWSP water. Therefore, the compatibility of the ESF components is preserved in the post-LOCA environment.

Table 6.1-3 will be added as follows:

Table 6.1-3 Water chemistry specifications of the RWSP

Analysis item	Unit	Standard value	Limited value	Recommended analysis item standard value
1 Boron	ppm	-	≥ 4000* ≤ 4200*	
2 Chloride ion	ppm	≤ 0.05	≤ 0.15	
3 Fluoride ion	ppm	≤ 0.05	≤ 0.15	
4 Sulfate ion	ppm	≤ 0.05	≤ 0.15	
5 Turbidity	ppm	≤ 1.0	-	
6 Silica	ppm	-	-	≤ 0.5

*: See US-APWR Technical Specification (DCD Chap. 16)

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.