AP1000DCDFileNPEm Resource

From: DeBlasio, John J. [deblasjj@westinghouse.com]
Sent: Thursday, June 03, 2010 1:55 PM
To: Buckberg, Perry
Cc: Loza, Paul G.; Brehm, Jason A.; Melton, Michael A
Subject: FW: Revised Responses to RAI SRP5.2.3-CIB1-01 Rev 2 Resulting from W/NRC Phone Call on May 26
Attachments: Entire Table 5_2-1 Markup for RAI-SRP5_2_3-CIB1-01 5-28-10.doc

Perry

Attached is the proposed revisions based on our telecom last week. Please review and provide confirmation relative acceptability of our interpretation for the addition information requested from the staff. Please advise after review.

J.J. DeBlasio

From: Wiseman, Dale A.
Sent: Friday, May 28, 2010 11:19 AM
To: DeBlasio, John J.
Cc: Roberts, Gregory; Wiseman, Dale A.
Subject: Revised Responses to RAI SRP5.2.3-CIB1-01 Rev 2 Resulting from W/NRC Phone Call on May 26

John,

Below are the revised responses to RAI SRP5.2.3-CIB1-01 Rev 2 resulting from the Westinghouse/NRC phone call of May 26. The format is to provide the original response provided in Rev 2 (Red), followed by the revised response which resulted from the telephone discussions (Blue). The attached Table 5.2-1 includes all the changes made in response to this RAI, with the ones added as a result of the phone call highlighted in yellow (Notes 5 and 7).

Dale

WEC Revision 2 Response #4:
There are several methods that can be used to achieve full penetration welds on Inconel or stainless steel material. One is open root welding with the back-side of the weld purged with shielding gas, eliminating the oxygen. The other is to back-gouge and re-weld the back side. Either method is more common than using consumable inserts in commercial nuclear these days since consumable inserts are generally only used for manual welding and automatic GTAW is the most common process used for these types of welds.

Revised WEC Revision 2 Response #4:
There are several methods that can be used to achieve full penetration welds on Inconel or stainless steel material. One is open root welding with the back-side of the weld purged with shielding gas, eliminating the oxygen. The other is to back-gouge and re-weld the back side. Either method is more common than using consumable inserts in commercial nuclear these days since consumable inserts are generally only used for manual welding and automatic GTAW is the most common process used for these types of welds.

For another example of the types of joints described here, see NG-3352.1 Type I joints. One joint type is "double welded butt joints". The method used for these types of joints is described above as "back-gouge and re-weld the back side". Another is "consumable inserts", which is the method the NRC was inquiring about. The consumable insert is basically just preplaced filler metal, which makes manual welding easier, but does not affect the quality of the joint. The method for "gas backup" type of joint welding is described above as "open root welding with the back-side of the weld purge with shielding gas, eliminating the oxygen." Note that oxygen needs to be eliminated so that detrimental oxidation (discoloration) of the back-side of the weld does not occur. This is also required when the weld is performed with consumable inserts.

WEC Revision 2 Response #2b

Westinghouse agrees that using sensitized stainless steel for wetted pressure boundary applications is not appropriate, nor permitted per NRC Regulatory Guide 1.44. Westinghouse will address this by adding a note to the Table 5.2-1. This note will clarify the maximum carbon limit for stainless steel welds which will be exposed to high temperature post weld heat treatment. The addition of the new Note 5 is shown in the markup of Sheet 5 of Table 5.2-1 shown below in the Revision 2 DCD Markup Section.

Table 5.2-1 Note 5:

Austenitic stainless welds that are exposed to temperatures within the 800°F to 1500°F temperature range after welding and are not subsequently solution annealed do not contain more than 0.04% carbon by weight, or have demonstrated non-sensitization per Regulatory Guide 1.44.

Revised WEC Revision 2 Response #2b

The RAI response will remain the same.

Revised Table 5.2-1 Note 5:

Austenitic stainless steel filler metals that are exposed to temperatures within the 800°F to 1500°F temperature range after welding and are not subsequently solution annealed do not contain more than 0.03% or 0.04% carbon by weight (depending on the maximum carbon content of the corresponding low-carbon classification in the SFA specification), or have demonstrated non-sensitization per Regulatory Guide 1.44.

WEC Revision 2 Explanation of Additional Changes to the DCD

In addition to responses to the five Revision 2 questions, additional DCD revisions to be included in this response to address the following:

- Revisions are included to DCD Subsection 5.2.3.1 and Table 5.2-1 (adding Note 7) to allow alternate welding material or processes. These alternates are generally minor variations of the ENiCrFe-7, ERNiCrFe-7A, or ERNiCrFe-7 filler metals intended to improve weldability by reducing hot cracking and ductility dip cracking (DDC), also called microfissuring, and thus increase the overall safety of the welds since not all microfissuring is readily detected.

Table 5.2-1 Note 7

These materials are UNS N06052, N06054, & W86152, where F43 grouping is allowed by codes cases 2143-1 & 2142-2. Note that UNS N06054 is only in ASME Section II part C 2004 with 2006 addenda and later. Similar welding alloys developed for improved weldability may be used as well.

Revised WEC Revision 2 Explanation of Additional Changes to the DCD

In addition to responses to the five Revision 2 questions, additional DCD revisions to be included in this response to address the following:

- Revisions are included to DCD Subsections 5.2.3.1, 6.1.1.2, and Table 5.2-1 (adding Note 7) to allow alternate welding material or processes. These alternates are generally minor variations of the ENiCrFe-7, ERNiCrFe-7A, or ERNiCrFe-7 filler metals intended to improve weldability by reducing hot cracking and ductility dip cracking (DDC), also called microfissuring. The use of these alternates will improve AP1000 weld integrity by allowing the use of filler metals that have improved ductility dip or hot cracking resistance compared to the currently allowed 152/52/52M filler metals.

Revised Table 5.2-1 Note 7

These materials are UNS N06052, N06054, & W86152, where F43 grouping is allowed by codes cases 2143-1 & 2142-2. Note that UNS N06054 is only in ASME Section II part C 2004 with 2006 addenda and later. Similar welding alloys developed for improved weldability may be used as allowed by ASME B&PV Code rules.

Revised DCD Section 5.2.3.1, first paragraph

Table 5.2-1 lists material specifications used for the principal pressure-retaining applications in Class 1 primary components and reactor coolant system piping. Material specifications with grades, classes or types are included for the reactor vessel components, steam generator components, reactor coolant pump, pressurizer, core makeup tank, and the passive residual heat removal heat exchanger. Table 5.2-1 lists the application of nickel-chromium-iron alloys in the reactor coolant pressure boundary. The use of nickel-chromium-iron alloy in the reactor coolant pressure boundary is limited to Alloy 690, or its associated weld metals Alloys 52, 52M, 152, and similar alloys developed for improved weldability and allowed by ASME B&PV Code rules. Steam generator tubes use Alloy 690 in the thermally treated form. Nickel-chromium-iron alloys are used where corrosion resistance of the alloy is an important consideration and where the use of nickel-chromium-iron alloy is the choice because of the coefficient of thermal expansion. Subsection 5.4.3 defines reactor coolant piping. See subsection 4.5.2 for material specifications used for the core support structures and reactor internals. See appropriate sections for internals of other components. Engineered safeguards features materials are included in subsection 6.1.1. The nonsafety-related portion of the chemical and volume control system inside containment in contact with reactor coolant is constructed of or clad with corrosion resistant material such as Type 304 or Type 316 stainless steel or material with equivalent corrosion resistance. The materials are compatible with the reactor coolant. The nonsafety-related portion of the chemical and volume control system is not required to conform to the process requirements outlined below.

Revised DCD Section 6.1.1.2 first paragraph

The welding materials used for joining the ferritic base materials of the pressure-retaining portions of the engineered safety features conform to, or are equivalent to, ASME Material Specifications SFA 5.1, 5.5, 5.17, 5.18, 5.20, 5.23, 5.28, 5.29, and 5.30. The welding materials used for joining nickel-chromium-iron alloy in similar base material combination, and in dissimilar ferritic or austenitic base material combination conform to ASME Material Specifications SFA 5.11 and 5.14, or are similar welding alloys to those in SFA-5.11 or SFA-5.14 developed for improved weldability as allowed by the ASME B&PV Code rules.

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Email Number: 402

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From: DeBlasio, John J.

Created By: deblasjj@westinghouse.com

Recipients:
"Loza, Paul G." <lozapg@westinghouse.com>
Tracking Status: None
"Brehm, Jason A." <brehmja@westinghouse.com>
Tracking Status: None
"Melton, Michael A" <melto1ma@westinghouse.com>
Tracking Status: None
"Buckberg, Perry" <Perry.Buckberg@nrc.gov>
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Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
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Table 5.2-1 (Sheet 1 of 5)

REACTOR COOLANT PRESSURE BOUNDARY MATERIALS SPECIFICATIONS

Component	Material	Class, Grade, or Type
Reactor Vessel Components		
Head plates (other than core region)	SA-533 or SA-508	Type B, CL 1 or GR 3 CL 1
Shell courses	SA-508	GR 3 CL 1
Shell, flange, and nozzle forgings	SA-508	GR 3 CL 1
Nozzle safe ends	SA-182	F316, F316L, F316LN
Appurtenances to the control rod drive mechanism (CRDM)	SB-167 SB-166 or SA-182	N06690 N06690 or F304, F304L, F304LN, F316, F316L, F316LN
Instrumentation nozzles, upper head	SB-167 SB-166 and SA-182, or SA-479	N06690 N06690 and F304, F304L, F304LN, F316, F316L, F316LN 304, 304L, 304LN 316, 316L, 316LN, S21800
Closure studs	SA-540	GR B23 CL 3 or GR B24 CL 3
Monitor tubes	SA-312[(1)] or SA-376 or SA-182	TP304, TP304L, TP304LN, TP316, TP316L, TP316LN TP304, TP304LN, TP316, TP316LN F304, F304L, F304LN, F316, F316L, F316LN

Table 5.2-1 (Sheet 2 of 5)

REACTOR COOLANT PRESSURE BOUNDARY MATERIALS SPECIFICATIONS

Component	Material	Class, Grade, or Type
Vent pipe	SB-166 SB-167 or SA-312[(1)] SA-376	N06690 N06690 TP304, TP304L, TP304LN, TP316, TP316L, TP316LN TP304, TP304LN, TP316, TP316LN
Steam Generator Components		
Pressure plates	SA-533	Type B, CL 1 or CL 2
Pressure forgings (including primary side nozzles and tube sheet)	SA-508	~~CL 1A or~~ GR 3, CL 2
Nozzle safe ends	SA-182 SA-336 or SB-564	F316, F316L, F316LN F316LN N06690
Channel heads	SA-508	GR 3, CL 2
Tubes	SB-163	N06690
Manway studs/ Nuts	SA-193 SA-194	GR B7 GR 7
Pressurizer Components		
Pressure plates	SA-533	Type B, CL 1
Pressure forgings	SA-508	GR 3, CL 2
Nozzle safe ends	SA-182 SA-338 or SB-163	F316, F316L, F316LN F316, F316L, F316LN N06690
Manway studs/ Nuts	SA-193 SA-194	GR B7 GR 7

Table 5.2-1 (Sheet 3 of 5)

REACTOR COOLANT PRESSURE BOUNDARY MATERIALS SPECIFICATIONS

Component	**Material**	**Class, Grade, or Type**
Reactor Coolant Pump		
Pressure forgings	SA-182 SA-508 or SA-336	F304, F304L, F304LN, F316, F316L, F316LN GR1[4] F304, F304L, F304LN, F316, F316L, F316LN
Pressure casting	SA-351	CF3A or CF8A
Tube and pipe	SA-213 SA-376 or SA-312[1]	TP304, TP304L, TP304LN, TP316, TP316L, TP316LN TP304, TP304LN, TP316, TP316LN TP304, TP304L, TP304LN, TP316, TP316L, TP316LN
Pressure plates	SA-240	304, 304L, 304LN, 316, 316L, 316LN
Closure bolting	SA-193 or SA-540	GR B7 or GR B24, CL 2 & CL 4, or GR B23, CL2, CL 3 & 4
Reactor Coolant Piping		
Reactor coolant pipe	SA-376 SA-182[2]	TP304, TP304LN, TP316, TP316LN F304, F304L, F304LN, F316, F316L, F316LN
Reactor coolant fittings, branch nozzles	SA-376 SA-182	TP304, TP304LN, TP316, TP316LN F304, F304L, 304LN, F316, F316L, F316LN
Surge line	SA-376 or SA-312[1]	TP304, TP304LN, TP316, TP316LN TP304, TP304L, TP304LN, TP316, TP316L, TP316LN

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Table 5.2-1 (Sheet 4 of 5)

REACTOR COOLANT PRESSURE BOUNDARY MATERIALS SPECIFICATIONS

Component	**Material**	**Class, Grade, or Type**
RCP piping other than loop and surge line	SA-312[(1)] and SA-376	TP304, TP304L, TP304LN, TP316, TP316L, TP316LN TP304, TP304L, TP304LN, TP316, TP316L, TP316LN
CRDM		
Latch housing	SA-336	F304, F304L, F304LN, F316, F316L, F316LN
Rod travel housing	SA-336	F304, F304L, F304LN, F316, F316L, F316LN
Valves		
Bodies	SA-182 or SA-351	F304, F304L, F304LN, F316, F316L, F316LN or CF3A, CF3M, CF8
Bonnets	SA-182 SA-240 or SA-351	F304, F304L, F304LN, F316, F316L, F316LN, 304, 304L, 304LN, 316, 316L, 316LN or CF3A, CF3M, CF8
Discs	SA-182 SA-564 or SA-351	F304, F304L, F304LN, F316, F316L, F316LN Type 630 (H1100 or H1150), or CF3A, CF3M, CF8
Stems	SA-479 SA-564 or SB-637	316, 316LN or XM-19 Type 630 (H1100 or H1150) Alloy N07718
Pressure retaining bolting	SA-453 SA-564 SA-193	GR 660 Type 630 (H1100) GR B8

Table 5.2-1 (Sheet 5 of 5)

REACTOR COOLANT PRESSURE BOUNDARY MATERIALS SPECIFICATIONS

Component	**Material**	**Class, Grade, or Type**
Pressure retaining nuts	SA-453 or SA-194	GR 660 or GR 6 or 8
Core Makeup Tank		
Pressure plates	SA-533 or SA-240	Type B, CL 1 or 304, 304L, 304LN, 316, 316L, 316LN
Pressure forgings	SA-508 or SA-182 SA-336	GR 3 CL 1 or F304, F304L, F316, F316L F304, F304L, F316, F316L
Passive Residual Heat Removal Heat Exchanger		
Pressure plates	SA-533 or SA-240	Type B CL1 or 304, 304L, 304LN
Pressure forgings	SA-508 or SA-336	GR 3 CL 2 or F304, F304L, F304LN
Tubing	SB-163	N06690
Welding Consumables		
FOR REVISION OF THIS SECTION SEE NEXT PAGE		

Table 5.2-1 (Sheet 5 of 5)

REACTOR COOLANT PRESSURE BOUNDARY MATERIALS SPECIFICATIONS

Component	Material	Class, Grade, or Type
Welding Consumables		
Austenitic stainless steel corrosion resistant cladding, buttering, and welds(5)	SFA 5.4 SFA 5.9 (6) SFA 5.22(3) SFA 5.30	E308, E308L, E309, E309L, E316, E316L ER308, ER308L, ER309, ER309L, ER316, ER316L, EQ308L, EQ309L E308LTX-Y, E308TX-Y, E309LTX-Y, E309TX-Y, E316LTX-Y, E316TX-Y IN308, IN308L, IN316, IN316L
Ni-Cr-Fe corrosion resistant cladding, buttering, and welds	SFA 5.11 SFA 5.14	ENiCrFe-7 ERNiCrFe-7, ENiCrFe-7A, EQNiCrFe-7, EQNiCrFe-7A(7)
Carbon steel pressure boundary welds(8)	SFA 5.1, 5.17, 5.18, 5.20, 5.30	To be compatible with base material
Low alloy pressure boundary welds(8)	SFA 5.5, 5.23, 5.28, 5.29	To be compatible with base material

Notes:

1. Limited to seamless form only
2. Subject to manufacturing sequence and final finish condition review
3. Only gas shielded electrodes for use with the FCAW process are permitted. These electrodes shall not be used for root passes except for joints welded from two sides where the root is back-gouged to sound metal as evidenced by magnetic particle or liquid penetrant testing.
   X=Position, acceptable values 0 (flat and horizontal) and 1 (all positions)
   Y=Shield Gas, acceptable values 1 (100% CO_2) and 4 (75-80% Argon, remainder CO_2)
4. GR1 material (carbon steel) is used only for reactor coolant pump components which are not exposed to the reactor coolant. These components are limited to the stator main flange, stator shell, and external heat exchanger supports.
5. Austenitic stainless ~~welds~~ steel filler metals that are exposed to temperatures within the 800°F to 1500°F temperature range after welding and are not subsequently solution annealed do not contain more than 0.03% or 0.04% carbon by weight (depending on the maximum carbon content of the corresponding low-carbon classification in the SFA specification), or have demonstrated non-sensitization per Regulatory Guide 1.44.
6. In addition to ER, EC (composite) rod/electrodes may also be used.
7. These materials are UNS N06052, N06054, & W86152, where F43 grouping is allowed by codes cases 2143-1 & 2142-2. Note that UNS N06054 is only in ASME Section II part C 2004 with 2006 addenda and later. Similar welding alloys developed for improved weldability may be used as allowed by ASME B&PV Code rules ~~well~~.
8. These weld metals are compatible with the base metal mechanical requirements and meet applicable ASME Section III, Section II part C, and Section IX requirements. Their use is limited to applications in which the welds are not exposed to reactor coolant. These weld metals used with a flux bearing welding process are

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also not used for root passes of single sided welds.