AP1000DCDFileNPEm Resource

From: Behnke, Donald H. [behnkedh@westinghouse.com]
Sent: Tuesday, June 29, 2010 2:57 PM
To: Donnelly, Patrick
Cc: Behnke, Donald H.
Subject: Revised Draft of the response to RAI-SRP6 1 1-CIB1-02 R0
Attachments: 10-06-29 RAI-SRP6 1 1-CIB1-02 R0-draft.pdf

Patrick

Let me know if we addressed Bob's comments and I'll submit.

Don

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AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP6.1.1-CIB1-02
Revision: 0

Question:

LDX 2101 stainless steel

The AP1000 DCD, Revision 17, modifies the materials used in the IRWST to LDX 2101 from XM-29. In the applicant's response to Supplemental RAI TR106-CIB-05, dated May 14, 2008, the applicant stated that it would conduct a confirmatory corrosion testing program to demonstrate the adequacy of LDX 2101. The applicant stated that its confirmatory corrosion testing program includes LDX 2101 base material and weld filler materials that bound those filler materials that will be used during fabrication. The applicant also stated that the tests would include uniform corrosion, stress corrosion cracking and crevice corrosion tests. In addition, the applicant stated that its test program is designed to establish test data on LDX 2101 material and its welds on their susceptibility for any potential for degradation under exposure to oxygenated boric acid with halogen (chloride) contamination and in crevice corrosion conditions under accelerated service conditions to demonstrate a service life of 60 years. In order for the staff to reach a final safety determination on the applicant's use of LDX 2101, the staff requests that the applicant provide the results (test data) from its LDX2101 corrosion testing program and describe the extent to which results confirm that LDX 2101 will not be subject to general corrosion, stress corrosion or other forms of degradation for the design life of the plant.

Westinghouse Response:

The ASTM S32101 (LDX 2101®) Duplex stainless steel has been selected for structural modules in the Westinghouse AP1000 design for its unique combination of superior mechanical properties at lower service temperatures <350ºF (<177ºC), and good corrosion resistance, as well as its availability in the required (120 in.) plate width size. ~~The~~ Duplex ~~grade~~ stainless ~~steel has~~steels of various grades have been extensively used in the petro chemical and paper pulp industries for over the past two decades with demonstrated performance and excellent corrosion resistance. LDX 2101® has been code approved and in the commercial market for the past 6 years

To demonstrate the adequacy of the performance of S32101 (LDX 2101®) base material and its welds under service conditions in the AP 1000 IRWST, Westinghouse conducted a confirmatory corrosion testing program. The test program included three different types of corrosion namely, uniform corrosion, crevice corrosion, and stress corrosion cracking (SCC) under accelerated service conditions. The testing included Type 304L stainless steel as reference samples for bench marking.

Hot rolled S32101(LDX 2101®) and 304L were welded and tested for crevice corrosion and uniform corrosion. Cold rolled S32101(LDX 2101®) and 304L were welded and tested for stress corrosion cracking (SCC). Industry accepted ASTM test specimen configurations and

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test procedures were employed. The test conditions included boric acid concentrations of up to 5000 ppm and chloride concentrations of up to 50 ppm with test temperature at 200°F (93°C). The following results of the test program were noted:

- The corrosion rates for all tested combinations of 304L and S32101(LDX 2101®) were very low or insignificant in 5000 ppm boric acid with 50 ppm chlorides at 200°F(93°C).

- No stress corrosion cracking was detected for 304L and S32101(LDX 2101®) regardless of stressing method and weld method, after being immersed in 2500 ppm boric acid with 50 ppm chlorides for 120 days.

- No crevice corrosion was found on the samples after being immersed in 2500 ppm boric acid with 0.05 ppm chlorides for 30, 60, 90 or 120 days.

- No crevice corrosion was found on Gas Tungsten Arc Welded (GTAW) S32101 (LDX 2101®) with ER2209 filler material, Shielded Metal Arc Welded (SMAW) S32101 (LDX 2101®) with E2209 electrodes, Flux Cored Arc Welded (FCW) S32101 (LDX 2101®) with E2209 electrodes or SMAW welded S32101 (LDX 2101®) with LDX 2101® electrodes after being immersed in 2500 ppm boric acid with 50 ppm chlorides for 30, 60, 90 or 120 days.

- All SMAW welded 304L specimens in the test series with 320 mesh edge preparation suffered crevice corrosion, but no crevice corrosion was seen on any of the SMAW welded S3210 (LDX 2101®) specimens. The deepest crevice attack observed (0.309mm) was on GTAW welded 304L.

The overall results of the Westinghouse confirmatory tests demonstrated that the S32101 (LDX 2101®) Duplex stainless steel and its welds exhibited superior performance under accelerated service conditions in comparison with 304L stainless steel for its use in AP 1000 structural modules.

The test program and the results are documented in ~~a Westinghouse~~ WCAP ~~report which will be available~~ 17280-P, Confirmatory Corrosion Testing of S32101/LDX 2101® Duplex Stainless Steel Base and Weld Materials for ~~NRC audit on~~ AP1000 Structural Module Applications, June ~~18th,~~ 2010.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

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Technical Report (TR) Revision:

None.

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