ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Friday, June 05, 2009 11:07 AM
To: Getachew Tesfaye
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 200, FSAR Ch. 9, Supplement 1
Attachments: RAI 200 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 5 of the 6 questions of RAI No. 200 on April 24, 2009. The attached file, "RAI 200 Supplement 1 Response US EPR DC.pdf" provides a technically correct and complete response to the remaining question, as committed.

The following table indicates the respective pages in the response document, "RAI 200 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 200 —9.01.01-18	2	4

This concludes the formal AREVA NP response to RAI 200, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, April 24, 2009 4:14 PM
To: 'Getachew Tesfaye'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); KOWALSKI David J (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 200, FSAR Ch. 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 200 Response US EPR DC.pdf" provides a technically correct and complete response to 5 of the 6 questions.

The following table indicates the respective pages in the response document, "RAI 200 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 200 — 09.01.01-18	2	2
RAI 200 — 09.03.04-19	3	6
RAI 200 — 09.03.04-20	7	8
RAI 200 — 09.05.04-17	9	10
RAI 200 — 09.05.04-18	11	13
RAI 200 — 09.05.04-19	14	15

A complete answer is not provided for 1 of the 6 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 200 — 09.01.01-18	June 5, 2009

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, March 25, 2009 7:55 AM
To: ZZ-DL-A-USEPR-DL
Cc: Jeffrey Poehler; David Terao; Gerard Purciarello; Steven Bloom; John Segala; Peter Hearn; Joseph Colaccino; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 200 (2280, 2282,2267), FSAR Ch. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 6, 2009, and discussed with your staff on March 23, 2009. No changes were made to the Draft RAI Questions as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 542

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Received Date: 6/5/2009 11:07:18 AM
From: Pederson Ronda M (AREVA NP INC)

Created By: Ronda.Pederson@areva.com

Recipients:
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>
Tracking Status: None
"WILLIFORD Dennis C (AREVA NP INC)" <Dennis.Williford@areva.com>
Tracking Status: None
"Getachew Tesfaye" <Getachew.Tesfaye@nrc.gov>
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MESSAGE	3713	6/5/2009 11:07:18 AM
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Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 200 (2280, 2282, 2267), Supplement 1

3/25/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling
SRP Section: 09.03.04 - Chemical and Volume Control System (PWR) (Including Boron Recovery System)
SRP Section: 09.05.04 - Emergency Diesel Engine Fuel Oil Storage and Transfer System
Application Section: 9.5.4

QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)
QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

Question 09.01.01-18:

Background

On page 100/127 of the technical report on Metamic that was completed for Holtec (Reference 1), the following statement was provided as justification for no additional testing:

"Radiation and an aqueous environment do not couple to produce a synergistic effect on the corrosion of metals. The use of aluminum and other metals in wet, high-radiation environments for many years (in reactors, fuel storage facilities, test cells, etc.) has shown the corrosion behaviors of the metals are not affected by radiation. Consequently, no corrosion tests were performed on the Metamic samples following their irradiation, and no tests are planned. Radiation has no effect on the corrosion rate of Metamic."

However, no testing has been performed on Metamic in the specific conditions cited in the original RAI (simultaneous exposure to radiation, peroxide and sulfates in a boric acid solution).

Requested Information

Provide data from the other metallic, neutron-absorber materials that have been in-service (cited in the Metamic report) that supports the assertion that Metamic will not be degraded under conditions of radiation fields (dose rates at the surface of the Metamic when faced with freshly-discharged spent fuel) and chemistry experienced at US PWRs (2800 ppm boric acid, 5 ppm peroxide, 150 ppm sulfates, up to 1 ppm of silica).

References

I. Holtec proprietary report, HI-2043215, Rev. 2, "Sourcebook for Metamic Performance Assessment," Attachment 7 to Letter from Tammy Morin to USNRC dated August 3, 2007, Subject: Response to Request for Additional Information (RAI) on License Amendment Request (LAR) 9261-5 to HI-STAR 100 Certificate of Compliance (CoC) No. ; ADAMS Accession No. ML072550049

Response to Question 09.01.01-18:

The background information provided in this question contains the statement “no testing has been performed on Metamic in the specific conditions cited in the original RAI (simultaneous exposure to radiation, peroxide and sulfates in a boric acid solution).” There are no existing facilities with the capability to perform such a test. Research reactor facilities capable of producing the necessary gamma radiation fluxes would never permit the intentional introduction of potentially damaging materials like peroxides and sulfates into their reactors. This has meant, unfortunately, that a sequential method of testing for the effects of multiple environmental factors must be employed. This is why in-situ testing of coupons in the spent fuel pool is used to monitor for any evidence of environmental damage to the Metamic.

The statement quoted in the background section of the question (i.e., that aluminum and other metals [not necessarily in the form of metallic neutron absorber materials] have been used in various wet, high-radiation environments without any evidence of corrosion) is based on anecdotal evidence. Holtec is aware that several reactor sites in the U.S. have spent fuel storage racks and other equipment (e.g., channel storage racks, tools) constructed from

aluminum as the rack structural material. To Holtec's knowledge, none of these racks or other equipment had to be removed due to corrosion of the aluminum.

With respect to the specific conditions listed in the question (i.e., radiation, 2800 ppm boric acid, 5ppm peroxide, 150 ppm sulfates and 1 ppm silica), the following additional information is provided:

Radiation Field

Section 5.0 of Holtec Report HI-2022871 (included in HI-2043215 as Appendix A) describes that sample coupons were exposed to gamma radiation up to 1.5×10^{11} rads and fast neutron radiation up to 5.8×10^{19} nvt. As stated in this section of the report, this is expected to be equivalent to the 40-year design life of the Metamic in the spent fuel racks. There appears to have been little adverse effect on the material. Although some reduction in physical strength was observed, Metamic is installed in fuel storage racks in a manner that results in minimal stress, limited essentially to the self-weight of the material.

2800 ppm Boric Acid

There are two Holtec reports that address corrosion tests on representative coupons in boric acid solutions:

Section 7.2 of Holtec Report HI-2043215 indicates that corrosion testing of coupons in a 2000 ppm boric acid solution has been performed. While these tests were performed for a lower concentration than that stipulated in this question, they were performed at a temperature higher than would normally occur in the spent fuel pool (which would accelerate corrosion reactions). As stated in the report, these tests "indicate that no corrosion was observed."

Section 4.0 of Holtec Report HI-2022871 (included in HI-2043215 as Appendix A) describes that corrosion testing of coupons in a 2500 ppm boric acid solution was performed. This boron concentration is 90% of the concentration stipulated in this question, and these tests were performed at a temperature higher than would normally occur in the spent fuel pool (which would accelerate corrosion reactions). As stated in Section 4.3, these tests "demonstrate the excellent corrosion resistance of properly-prepared Metamic …" The phrase "properly-prepared" is explained in the same section to require cleaning of the Metamic to remove eroded bits from the rolling dies, which is a standard step in the material manufacturing process according to Holtec.

Neither of these two reports describes testing of coupons at or above the 2800 ppm boric acid concentration that is stipulated in the question. Additional data on the corrosion resistance of aluminum and aluminum alloys in boric acid solutions was obtained from a compilation by ASM International[1]. This data lists aluminum as "resistant" to corrosion by boric acid solutions, and states "Aqueous solutions of 1 to 15% boric acid at 60°C (140°F) did not attack the aluminum alloys 1100, 3003, or 6061…" It is noted that a 15% aqueous solution is 150,000 ppm and that the alloy of aluminum used in the manufacture of Metamic is 6061.

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[1] "Handbook of Corrosion Data," ASM International, Second Edition, 1995.

5 ppm Peroxide

Data on the corrosion resistance of aluminum and aluminum alloys in hydrogen peroxide solutions was obtained from a compilation by ASM International. This data states that 3% hydrogen peroxide is (30,000 ppm) a low concentration and that "aluminum alloy 6063 has been used in the service of hydrogen peroxide." The data also states "aluminum alloys 1060, 5052, and 6063 were resistant to attack." While the alloy of aluminum used in the manufacture of Metamic is 6061, it is noted that both aluminum alloys 6061 and 6063 have the same chemical constituents, albeit with slightly different maximum allowable concentrations[2].

150 ppm Sulfates

The most likely sulfate in the spent fuel pool environment would be iron sulfate, also known as ferric sulfate, due to the predominance of stainless steel in the pool water (e.g., fuel racks, liner plates, cooling system piping and components). Data on the corrosion resistance of aluminum and aluminum alloys in ferric sulfate solutions was obtained from a compilation by ASM International. This data indicates aluminum is "resistant" to corrosion from ferric sulfate.

1 ppm Silica

Silica is generally known to be an extremely inert material. Silica is not soluble in water[3], and therefore, does not form any aqueous solution that might be corrosive. The reactivity potential of silica is given as 0 by the Hazardous Material Information System (HMIS)[4].

The presence of silica in spent fuel pools has been used as an indication of the breakdown of Boraflex, as it is released from the decomposing polymer base of that material. The silica is not the source of the decomposition, however, but a byproduct thereof.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

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[2] "Handbook of Aluminum," Alcan Aluminum Corporation, Third Edition, 1970.
[3] U.S. Silica Company MSDS, Section 9.
[4] U.S. Silica Company MSDS, Section 16.