AREVAEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Thursday, September 06, 2012 5:00 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); LEIGHLITER John (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); TOLLEY Tracey (AREVA); VANCE Brian (AREVA); WELLS Russell (AREVA); GUCWA Len (EXTERNAL AREVA); BALLARD Bob (AREVA)
Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 546 (6407), FSAR Ch. 6, Questions 06.02.02-129 thru -133
Attachments: RAI 546 Questions 06.02.02-129-133 Response US EPR DC -DRAFT.pdf

Getachew,

Attached are DRAFT responses for RAI 546, Questions 06.02.02-129, 06.02.02-130, 06.02.02-131, 06.02.02-132 and 06.02.02-133 in advance of the final response date of October 4, 2012 shown below.

To keep our commitment to send a final response to these questions by the commitment date, we need to receive all NRC staff feedback and comments no later than **September 27th**.

Please let me know if the staff has questions or if the response to these questions can be sent as final.

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

From: WILLIFORD Dennis (RS/NB)
Sent: Friday, May 18, 2012 3:21 PM
To: Getachew.Tesfaye@nrc.gov
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 546 (6407), FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 546 Response US EPR DC.pdf," provides a schedule since a technically correct and complete response to the five questions cannot be provided at this time.

The following table indicates the respective pages in the response document, "RAI 546 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page

RAI 546 — 06.02.02-129	2	2
RAI 546 — 06.02.02-130	3	3
RAI 546 — 06.02.02-131	4	4
RAI 546 — 06.02.02-132	5	5
RAI 546 — 06.02.02-133	6	6

The schedule for technically correct and complete responses to these questions is provided below.

Question #	Response Date
RAI 546 — 06.02.02-129	**October 4, 2012**
RAI 546 — 06.02.02-130	**October 4, 2012**
RAI 546 — 06.02.02-131	**October 4, 2012**
RAI 546 — 06.02.02-132	**October 4, 2012**
RAI 546 — 06.02.02-133	**October 4, 2012**

Sincerely,

Dennis Williford, P.E.
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, April 25, 2012 12:04 PM
To: ZZ-DL-A-USEPR-DL
Cc: Makar, Gregory; Terao, David; Gleaves, Bill; Segala, John; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 546 (6407), FSAR Ch. 6

Attached please find the subject request for additional information (RAI). A draft of the RAI was provided to you on April 18, 2012, and on April 25, 2012, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. 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/LB1
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 4022

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D4DF1959)

Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 546 (6407), FSAR Ch. 6, Questions 06.02.02-129 thru -133
Sent Date: 9/6/2012 5:00:07 PM
Received Date: 9/6/2012 5:01:15 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

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Files	**Size**	**Date & Time**
MESSAGE	3665	9/6/2012 5:01:15 PM
RAI 546 Questions 06.02.02-129-133 Response US EPR DC -DRAFT.pdf	952556	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 546(6407), Revision 0

4/25/2012

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.02 - Containment Heat Removal Systems
Application Section: 6.2

QUESTIONS for Component Integrity Branch (CIB)

Question 06.02.02-129:

Follow-up to RAI 483, Question 06.02.02-90

The November 9, 2011, response to RAI 483, Question 06.02.02-90 stated that the amount of aluminum inside containment will be limited to 3000 square feet in accordance with COL information item 6.1-4 in U.S. EPR FSAR Tier 2, Table 1.8-2 and Section 6.1.1.2. The staff found no limit on aluminum in Section 6.1.1.2 and no COL item 6.1-4 in Rev. 2 or 3 of the U.S. EPR FSAR. Therefore, the staff requests that the applicant provide a revised response to identify the inspections and controls that will be in place to ensure that no more than 3,000 square feet of aluminum will be submerged during a LOCA in the recirculating sump liquid.

Response to Question 06.02.02-129:

U.S. EPR FSAR Tier 2, Section 6.1.1.2, will be revised to provide for a design limit of 3000 ft^2 for aluminum inside containment that can potentially be submerged. There is no associated COL information item as originally contemplated in the Response to RAI 483, Question 06.02.02-90. Instead of deferring resolution to the COL stage, the aluminum limit is being addressed as part of design certification.

This response supersedes the Response to RAI 483, Question 06.02.02-90.

FSAR Impact:

The U.S. EPR FSAR Tier 2, Section 6.1.1.2, will be changed as described above and shown on the attached page.

Technical Report Impact:

Technical Report ANP-10293P, Revision 4, will not be changed as a result of this question.

Question 06.02.02-130:

Follow-up to RAI 490, Question 06.02.02-108

The November 18, 2011, response to RAI 490, Question 06.02.02-108 describes how the chemical effects analysis for U.S. EPR considers an assumed quantity of latent fibrous insulation outside the zone of influence (ZOI). The response did not address other insulation in containment outside the ZOI that could be wetted in the post-LOCA environment and add inorganic materials to the recirculating liquid. Therefore, the staff requests that the applicant describe,

a. the effect of non-RMI insulation outside the ZOI on the chemical debris quantity, and,
b. how the quantity and type of this insulation will be limited to ensure that the assumptions in the chemical effects testing and analysis remain valid.

Response to Question 06.02.02-130:

a. Mechanisms to affect non-RMI insulation outside the zone of influence (ZOI) are described in NUREG-6808, “Knowledge Base for the Effect of Debris on Pressurized Water Reactor Emergency Core Cooling Sump Performance.” U.S. EPR FSAR, Section 2.3, “Loss-of-Coolant-Accident Exposure-Generated Debris,” discusses materials inside the containment that would be subject to the high temperatures and humidity resulting from the depressurization. Calcium-silicate debris is specifically noted but this type of insulation is not used in the U.S. EPR containment. Wash down by containment spray is not a factor since containment spray is not activated for a LOCA inside the U.S. EPR containment.

   NEI 04-07, Pressurized Water Reactor Sump Performance Evaluation Methodology, Revision 0, December 2004 (ADAMS Accession No. ML050550138) also addresses this issue in Section 3.4.3.2, “Discussion for Material Outside the ZOI.” Therefore, based on the use of NUKON® Fiber and Microtherm, there is reasonable assurance that an insignificant chemical debris quantity exists to add to the recirculating liquid because there is no mechanism to affect the generation of this source of debris.

b. U.S. EPR FSAR Tier 2, Section 5.2.3.4.3, “Compatibility of Construction Materials with External Insulation and Reactor Coolant,” states:

   > “The thermal insulation used on the RCPB is the reflective stainless steel type, wherever clearances permit. Areas of little clearance are insulated with high performance compounded materials which yield low leachable chloride and/or fluoride concentrations in accordance with RG 1.36, “Nonmetallic Thermal Insulation for Austenitic Stainless Steel.” Calcium silicate is not used as an insulating material.”

   U.S. EPR FSAR Tier 2, Section 6.1.1.4, “Thermal Insulation,” states:

   > “The use of non-metallic insulation is controlled in accordance with RG 1.36. To prevent stress corrosion cracking, non-metallic insulation is designed with low leachable chloride and fluoride concentrations that do not exceed the limits identified in RG 1.36 relative to associated sodium and silicate concentrations.”

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P, Revision 4, will not be changed as a result of this question.

Question 06.02.02-131:

Follow-up to RAI 90 Question 06.02.02-04

The May 20, 2010, response to RAI 90 Question 06.02.02-04, parts 4 and 7, stated that the chemical effects of chlorides, nitrates, and organic materials are superseded by the details in Appendices C, D and E to ANP-10293. Since these three chemical effects are not addressed explicitly in ANP-10293P R4, the staff requests that the applicant discuss how these effects were addressed.

Response to Question 06.02.02-131:

Technical Report ANP-10293P, Revision 4, “U.S. EPR Design Features to Address GSI-191,” addresses chlorides, nitrates, and organic materials. Although this document does not explicitly address the chemical species in terms of chlorides, nitrates, and organic materials; chlorides, nitrates, and organic materials are considered in the broader post-LOCA environment context of debris, hydrogen generation, and pH control of the IRWST.

U.S. EPR FSAR Tier 2, Section 6.1.2, “Organic Materials,” and Section 6.1.2.2.1, “Coating Integrity and Other Safety Measures,” discuss organic materials in detail. ANP-10293P Revision 4, Table 3.1-1, “Total Debris Source,” lists debris source. Epoxy coating would be an example of organic materials acting as debris.

U.S. EPR FSAR Tier 2, Section 6.2.5.3.1, “Post-LOCA Hydrogen Concentration,” discusses radiolysis of organic materials such as Hypalon and PVC jacketed cable in the containment.

U.S. EPR FSAR Tier 2, Section 15.0.3.12, “Postaccident Reactor Building Water Chemistry Control,” discusses maintaining IRWST water at a pH of 7.0 or above for 30 days following a DBA-LOCA for offsite dose consequences. Trisodium phosphate dodecahydrate (TSP-C) is added to buffer the acid associated with boric acid, chlorides, nitrates, and organic materials.

ANP-10293P Revision 4, Appendix D.2, “Chemical Effects Testing,” describes the debris materials exposed to borated water at elevated temperature in a recirculating autoclave. Trisodium phosphate was added to the borated water to produce a final room-temperature pH of approximately 7.5 in order to simulate the IRWST fluid conditions.

Because the post-LOCA fluid is buffered, issues brought about by chlorides and nitrates are eliminated. Therefore, the chemical effects on debris of chlorides, nitrates, and organic materials related to changing pH were tested as described in ANP-10293P, Revision 4.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P, Revision 4, will not be changed as a result of this question.

Question 06.02.02-132:

The staff requests that the applicant clarify the basis for the chemical debris quantities listed in Table F.3-7 of ANP-10293-R4. The table itself indicates that the quantities are from Appendix D, Table D.3-10. The corresponding text, Section F.3.9.1.4, states that the quantity and composition of chemical precipitates listed in Table F.3-7 represent the 30-day debris load. However, these quantities are different than the 30-day debris loads in Table D.3-10 in ANP-10293P-R4. The staff notes that the values in Table F.3-7 of Revision 4 are the values in Table D.3-10 of Revision 3 of ANP-10293P.

Response to Question 06.02.02-132:

The chemical debris values listed in ANP-10293 Appendix F, Revision 4, are the same values presented in Appendix D of ANP-10293, Revision 3.

During the revision of ANP 10293, Revision 4, the chemical debris calculation supporting Appendix D was revised to consider the impacts on IRWST chemistry resulting from the removal of fibrous insulation from the zone of influence (ZOI) for analyzed breaks and the reduction of the latent debris load in containment. The removal of fibrous insulation from the ZOIs, and the reduction of latent debris from containment, caused the total chemical precipitate released following a LOCA to decrease.

While ANP 10293 Revision 4, Appendix D, Table D.3-10, presents the latest (lower) chemical debris quantities; the larger values presented in ANP 10293 Revision 4, Table F.3-7, were used for fuel assembly testing and subsequent downstream effects analyses.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P Revision 4 will not be changed as a result of this question.

Question 06.02.02-133:

The staff requests that the applicant clarify the source the two data points labeled “WCAP-16530-NP, pH 7” on Figure D.3-5 in ANP-10293P, R4. The corrosion rates for these points, as plotted in the figure, are approximately 0.005 g/m^2-h at 150°F and 0.078 g/m^2-h at 220°F. Using WCAP-16530-NP-A, Equation 6-2, the staff calculated release rates of 0.12 g/m^2-h at 150°F and 1.49 g/m^2-h at 220°F. The figure shows good agreement between the WCAP data points and the OLI calculations, but the staff was not able to confirm this from the information in the WCAP.

The table below summarizes the discrepancy between the WCAP data points (pink squares) in Figure D.3-5 and the staff’s calculations.

T, °F	Corrosion Rate Staff calculation		Corrosion Rate Figure D.3-5 of ANP-10293P-R4
	mg/m^2-min*	g/m^2-hour	g/m^2-hour (approx.)
150	2.042	0.12	0.005
220	24.87	1.49	0.078

* Eqn. 6.2 of WCAP-16530-NP-A produces release rate in mg/m^2-min

Response to Question 06.02.02-133:

Equation 6.2 of WCAP-16530-NP was not utilized in the calculation of the aluminum release rates because it greatly over-predicts aluminum releases in neutral solution. Rather, the data points from the literature represent experimental data collected for aluminum in neutral solutions.

The first data point (140°F, pH 7) was incorrectly identified as sourced from WCAP-16530-NP. The data point (0.0039 g/m^2-h or 0.065 mg/m^2-min) is given in NUREG CR-6912, Table A-4.

The second data point (210°F, pH 7) at 0.078 g/m^2-h (1.3 mg/m^2-min) comes from WCAP 16530-NP, Table 6.2-1.

FSAR Impact:

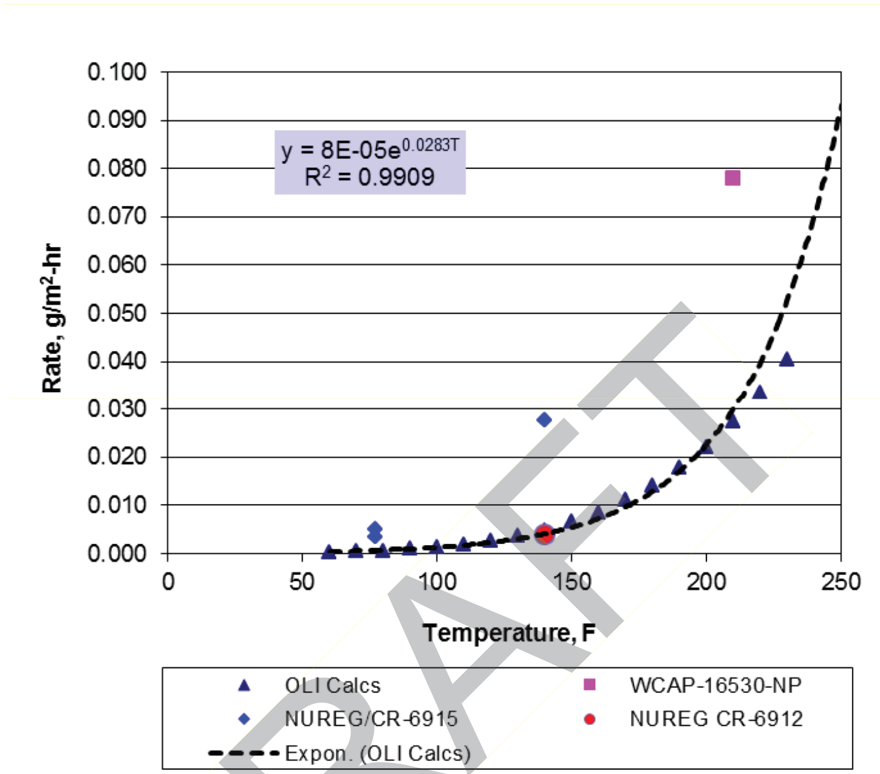
The U.S. EPR FSAR will not be changed as a result of this question.

Technical Report Impact:

Technical Report ANP-10293P, Revision 4, will be revised at a later date as shown below.

Figure D.3-5 of ANP-10293P should be as follows.

Figure D.3-5: Corrosion of Aluminum A1100



U.S. EPR Final Safety Analysis Report Markups

to Section 15.0.3.12 for an evaluation of postaccident Reactor Building water chemistry control.

Containment spray is not part of the U.S. EPR design basis accident mitigation approach, although the design does include a limited containment spray system for severe accident mitigation that draws suction from the pH-controlled water of the IRWST, as described in Section 19.2.

~~As discussed above,~~ ESF components are fabricated primarily from austenitic stainless steels, which are not susceptible to corrosion when exposed to these ESF fluids. For ferritic steel materials, protective coatings are applied inside containment, as addressed in Section 6.1.2.

The use of aluminum and zinc in components in containment that could be exposed to postaccident conditions is minimized to avoid hydrogen gas generation. Combustible gas control in containment through the use of passive autocatalytic recombiners is addressed in Section 6.2.5.

06.02.02-129

The amount of aluminum inside containment that can potentially be submerged will be limited by design to less than 3000 ft^2.

Materials used in the fabrication of ESF components are designed, qualified, and procured to withstand postulated accident environments.

6.1.1.3 Component and Systems Cleaning

To prevent stress corrosion cracking, austenitic stainless steel materials used in the fabrication, installation, and testing of ESF components and systems are handled, protected, stored, and cleaned according to recognized and accepted methods, as identified in the applicable procedures and specifications. As applicable, these procedures and specifications supplement the equipment specifications and purchase order requirements of the individual austenitic stainless steel components or systems that are procured for the ESF components and systems, regardless of the ASME Code classification. The procedures and specifications follow the guidance of RG 1.37 and RG 1.44.

Where minor leaks are anticipated (e.g., valve packing and pump seals), only materials compatible with the coolant are used. In these areas, the ferritic materials will show increased general corrosion rates. However, component integrity can be verified because this corrosion can be readily observed during the inservice visual or nondestructive inspection programs.