ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Wednesday, August 08, 2012 3:02 PM
To: Tesfaye, Getachew
Cc: Miernicki, Michael; Gleaves, Bill; GUCWA Len (EXTERNAL AREVA); BALLARD Bob (AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); LEIGHLITER John (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); TOLLEY Tracey (AREVA); VANCE Brian (AREVA); WELLS Russell (AREVA)
Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 552 (6512, 6526), FSAR Ch. 6, Questions 06.02.02-134 and -135
Attachments: RAI 552 Response US EPR DC - DRAFT.pdf

Getachew,

To support a final response date of September 27, 2012, a draft response for RAI No. 552, FSAR Ch. 6, Question 06.02.02-134 and Question 06.02.02-135 is provided in the attached file, "RAI 552 Response US EPR DC - Draft.pdf."

Let me know if the staff has questions or if this can be sent as a final response.

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, July 06, 2012 9:47 AM
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); bill.gleaves@nrc.gov
Subject: Response to U.S. EPR Design Certification Application RAI No. 552 (6512, 6526), FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 552 Response US EPR DC.pdf," provides a schedule since a technically correct and complete response to the two questions cannot be provided at this time.

The following table indicates the respective pages in the response document, "RAI 552 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 552 — 06.02.02-134	2	2

RAI 552 — 06.02.02-135	3	3

The schedule for a technically correct and complete response to these 2 questions is provided below.

Question #	Response Date
RAI 552 — 06.02.02-134	**September 27, 2012**
RAI 552 — 06.02.02-135	**September 27, 2012**

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: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, June 07, 2012 6:10 PM
To: ZZ-DL-A-USEPR-DL
Cc: Ashley, Clinton; McKirgan, John; Strnisha, James; Terao, David; Gleaves, Bill; Segala, John; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 552 (6512, 6526), FSAR Ch. 6

Attached please find the subject request for additional information (RAI). A draft of the RAI was provided to you on May 31, 2012, and on June 7, 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: 3996

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D4D7F137)

Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 552 (6512, 6526), FSAR Ch. 6, Questions 06.02.02-134 and -135
Sent Date: 8/8/2012 3:02:19 PM
Received Date: 8/8/2012 3:03:12 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

Recipients:
"Miernicki, Michael" <Michael.Miernicki@nrc.gov>
Tracking Status: None
"Gleaves, Bill" <Bill.Gleaves@nrc.gov>
Tracking Status: None
"GUCWA Len (EXTERNAL AREVA)" <Len.Gucwa.ext@areva.com>
Tracking Status: None
"BALLARD Bob (AREVA)" <Robert.Ballard@areva.com>
Tracking Status: None
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"LEIGHLITER John (AREVA)" <John.Leighliter@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
Tracking Status: None
"TOLLEY Tracey (AREVA)" <Tracey.Tolley@areva.com>
Tracking Status: None
"VANCE Brian (AREVA)" <Brian.Vance@areva.com>
Tracking Status: None
"WELLS Russell (AREVA)" <Russell.Wells@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: auscharmx02.adom.ad.corp

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MESSAGE	3399	8/8/2012 3:03:12 PM
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Response to

Request for Additional Information No. 552 (6512, 6526), Revision 0

6/07/2012

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 Containment & Ventilation Branch (SCVB)
QUESTIONS for Component Integrity Branch (CIB)

Question 06.02.02-134:

RG 1.206 (June 2007) Regulatory Position, Part IV: Miscellaneous Topics, describes the following:

> The creation of, and restrictions on, changing Tier 2* information resulted from the development of Tier 1 information for the advanced BWR design certification (Appendix A to 10 CFR Part 52) and the Asea Brown Boveri-Combustion Engineering System 80+ reactor design certification (Appendix B, "Design Certification Rule for the System 80+ Design," to 10 CFR Part 52). During this development process, these applicants requested that the agency minimize the amount of information in Tier 1 to allow additional flexibility for an applicant or licensee who references these appendices. Tier 2 also specified many codes, standards, and design processes that Tier 1 does not specify but that are acceptable for meeting ITAAC. As a result, certain significant information only exists in Tier 2, and the Commission does not want this significant information to be changed without prior NRC approval. The generic DCD identifies this Tier 2* information with italicized text and brackets.

NUREG-1792 "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design", describes the following:

The ACRS review for the AP1000 highlighted the significance of certain assumptions about debris in containment to the adequacy of long-term core cooling, and a concern that the values not be revised without substantial additional testing and analysis. As a means of emphasizing this, the applicant proposed to designate the key information as Tier 2*, to require prior NRC approval, in a letter dated February 23, 2011. This change is included in Revision 19. The NRC agrees that this is a prudent change and will modify the final rule language to reflect this addition, as a Tier 2* item without expiration at fuel load.

In the most recent amendment (December 2011) to Appendix D to Part 52 "Design Certification Rule for the AP1000 Design" this change was put into effect.

Given ANP-10293 Appendix F "Downstream Effects Evaluation for the U.S. EPR," containment debris limits discussed in response to RAI 511 Question 06.02.02-124 and RAI 488 Question 06.02.02-91 and associated DCD Section 6.3 markup, it appears that the US EPR is similar to the AP1000 regarding assumptions about debris in containment to the adequacy of long term core cooling, specifically the debris limits for core inlet blockage evaluations. Therefore, the NRC staff request that AREVA evaluate the appropriateness of applying Tier 2* designation to items associated with long term core cooling or the appropriateness of establishing a technical specification. If information related to long term core cooling is designated as Tier 2*, the staff request AREVA identify this information in the DCD to ensure that the appropriate change process and limits are followed.

Response to Question 06.02.02-134:

AREVA NP has reviewed NRC's Tier 2* designations of other Part 52 design certifications regarding GSI-191 long-term cooling. In particular, the ACRS review of the AP1000 design underscored the significance of certain assumptions regarding debris in containment and its potential effect on adequacy of long-term cooling under postulated scenarios.

The responses to RAI 488, Question 6.2.2-91 and RAI 511, Question 6.2.2-124 provide debris limits that are similar to debris parameters provided for the AP1000 design, although the values are greater for the U.S. EPR design. U.S. EPR FSAR Tier 2, Section 6.3.2.2.2 will be revised to apply Tier 2* designation to these debris limits. In addition, U.S. EPR FSAR Introduction, Table I-1 will be revised to provide a locator for this Tier 2* information. The debris limit will be specified as Tier 2* without expiration at fuel load. Although these limits are subject to change, any such change will require prior NRC approval in accordance with the change process specified in the U.S. EPR design certification rule and 10 CFR 52.63(a)(5).

AREVA NP has reviewed other GSI-191 design/debris inputs and assumptions for consideration as Tier 2* information; however, their relative importance does not rise to the high level for Tier 2* designation. This review included the results from a series of flow tests conducted by AREVA NP that demonstrate the effects and sensitivity of various debris loadings. In some cases, increasing the amount/ratio of certain debris resulted in less flow blockage. In addition, testing with surrogate chemical precipitates showed a “saturation plateau” where the addition of more chemicals did not appreciably increase flow blockage.

FSAR Impact:

U.S. EPR FSAR Introduction, Table I-1 and U.S. EPR FSAR Tier 2, Section 6.3.2.2.2 will be revised as described in the response and indicated on the enclosed markup.

Question 06.02.02-135:

Follow-up to RAI 498, Question 06.02.02-110

In response to RAI 498, Question 6.2.2-110 dated December 18, 2011, AREVA stated that no RMI will enter the ECCS during a LBLOCA. Section G.2.4 of ANP-10293 was revised to state:

> Results of the NRC debris generation test documented in NUREG/CR-6808 show that RMI debris size distribution ranges from 0.25 inches to 6 inches. Transport testing performed by AREVA demonstrated that RMI debris pieces will sink in the retaining basket (See Appendix E, Section E.7.1). In the unlikely event that RMI debris bypasses the retaining baskets, RMI debris will not bypass the sump screens and enter the ECCS because the size of the RMI debris is greater than the mesh size of the sump screen. As a result, this evaluation assumes no RMI bypasses through the sump screen.

NRC staff does not agree with AREVA's evaluation that the RMI debris size distribution ranges from 0.25 inches to 6 inches. Section 3.2.2.4 of NUREG-6808, "Knowledge Base for the Effect of Debris on Pressurized Water Reactor Emergency Core Cooling Sump Performance," provides results of jet impact testing on RMI performed by the NRC on May 31, 1995. These tests concluded that 4.3% of the RMI generated by a large pipe break was less than ¼". The jet impact test results do not specifically identify the amount of RMI generated that was less than the ECCS strainer and retaining basket screen size of 0.08" x 0.08". However, based on the fact that 4.3% of the RMI was less than ¼", it should be assumed that some pieces less than 0.08" were generated. Therefore, staff does not consider AREVA's evaluation that no RMI bypasses the sump screen to be acceptable. Based on the jet blast testing that produced RMI sizes less than ¼", staff requests the applicant to re-evaluate their position that no RMI will enter the ECCS during a LBLOCA.

Response to Question 06.02.02-135:

Section 3.2.2.4 of NUREG/CR-6808, "Knowledge Base for the Effect of Debris on Pressurized Water Reactor Emergency Core Cooling Sump Performance," provides results of jet impact testing on reflective metallic insulation (RMI). NUREG/CR-6808 Figure 3-7, "Typical RMI Debris Generated by Large Pipe Break," shows a size distribution at ¼ inch of 4.3 percent.

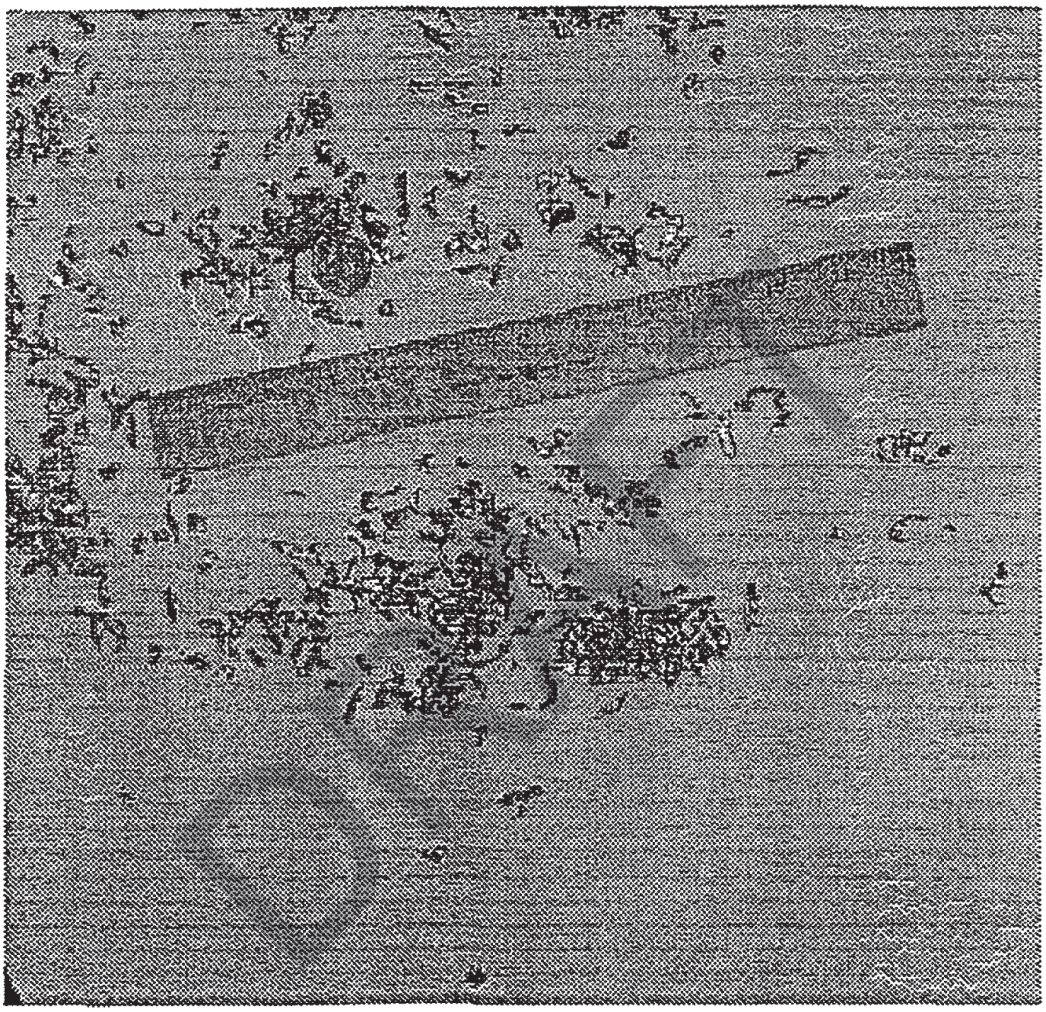
Reference 3-4 of NUREG/CR-6808, "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Bulletin 96-03 Boiling Water Reactor Owners Group Topical Report NEDO-32686, 'Utility Resolution Guidance for ECCS Suction Strainer Blockage,'" Docket No. PROJ0691, August 20, 1998 (ADAMS Accession No. ML092530505) provides more detailed information in Appendix D of NEDO-32686 (pdf file pages 366 to 399), "Structural Properties of Reflective Metal Insulation Installed in U.S. BWR's."

NUREG/CR-6808 Figure 3-7, Typical RMI Debris Generated by Large Pipe Break, can be found in NEDO-32686 Appendix D as Figure 6, Size vs. Percent by Weight. NEDO-32686 Appendix D test data analysis identifies Vattenfall/NRC test as a bounding case. Appendix D shows pictorially and states (ADAMS Accession No. ML092530505, pdf file page 387 of 399):

> "Photographs of a random sample of each size category are reproduced as Figure 7. Note that in the smallest sample size range, 0.25", debris smaller than 0.25" is not observed."

Figure 06.02.02-135-1 is from NEDO-32686-A, Appendix D, Figure 7a and shows the smallest sample size.

Figure 06.02.02-135-1—Foil Debris from the Vattenfall/NRC Test (1/4 inch)



1/4 inch

Therefore, the 4.3 percent of the RMI is 0.25 inches or larger.

Testing described in AREVA NP Technical Report ANP-10293P, “U.S. EPR Design Features to Address GSI-191,” Revision 4, Section E.4.1 used RMI debris pieces of 2 mil thickness and various sizes from 0.25 inch x 0.25 inch up to 4 inch x 4 inch which were shown to sink and settle on the bottom of the retaining basket. The size distribution was based on NUREG/CR-6808 that shows that the RMI debris size distribution ranges from 0.25 inches to 6 inches.

Furthermore, the U.S. EPR design takes advantage of the in-containment physical arrangement to develop a tiered “defense-in-depth” strategy. During a large break loss of coolant accident (LBLOCA), RMI would not only have to be transported to the retaining basket, but would also

have to transport to the strainer and enter the strainer before being entrained in the pump suction. Other sources of debris that could pass through retaining basket screen size of 0.08 inch x 0.08 inch are tested to demonstrate the complete range of debris. Therefore, based on the test programs identified above, there is reasonable assurance that RMI will not enter the emergency core cooling system (ECCS) during a LBLOCA.

FSAR Impact:

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

U.S. EPR Final Safety Analysis Report Markups

Table I-1—Summary of Tier 2* Information

Location	Description of Tier 2* Information	Expiration
6.3.2.2.2	Latent Debris Inside Containment ~~(LATER)~~	No

Question 6.2.2-134

- Controls for foreign material exclusion to limit the introduction of foreign material and debris sources into containment.

- Controls to assess and manage maintenance activities, including associated temporary changes, to confirm that ECCS function is not reduced by associated changes in analytical inputs or assumptions, or other activities that could introduce debris or potential debris sources into containment.

Question 6.2.2-134

- Controls on the introduction of coating materials into containment and to address deficiencies of coating materials used in containment.

- *[Latent debris will be limited to 150 pounds (10.2 lbs of fiber and 139.8 lbs of particulate) and 100 ft².]** These latent debris limits derive from U.S. EPR sump strainer and fuel assembly testing that demonstrates adequate long term core cooling under debris-laden coolant conditions.

Coolant pH adjustment baskets containing granulated trisodium phosphate dodecahydrate (TSP-C) are strategically placed in the inlet flow path to the IRWST within the boundary perimeter of the weirs at the four heavy floor openings of the RB. Flow through the baskets dissolves the TSP-C into the coolant that returns to the IRWST to passively neutralize entrained acids and maintain the alkalinity of the coolant. The pH of the recirculated coolant is maintained above 7.0. The control of pH in the recirculated coolant reduces the potential for stress-corrosion cracking of the austenitic stainless steel components, limits the generation of hydrogen attributable to corrosion of containment metals, and minimizes the re-evolution of iodine in post-LOCA containment solution, maintaining the radioiodine in solution to reduce radioactive releases to the environment. The minimum amount of granulated TSP-C for this pH control is 12,200 lb_m. Section 15.0.3.12 provides an evaluation of post-accident water chemistry control.

The IRWST is connected to the molten core spreading area by pipes that are closed during normal operation and accident conditions. If a severe accident occurs and molten material reaches the spreading area, an actuation device melts, flooding valves open, and IRWST water flows into the spreading area to support the operation of the SAHRS. The IRWST is located at a higher elevation than the core spreading area to provide gravity flooding of the spreading area with the IRWST water inventory. The core spreading area and the SAHRS are described in Section 19.2.3.3.

The debris interceptor components, including trash racks, retention baskets and ECCS strainers, are designed and analyzed per the provisions of ANSI/AISC N690-1994, "Specification for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities," including Supplement 2 (S2). The structural qualification of the debris interceptors includes an evaluation of the structural integrity of the supports and anchorages as it relates to the abilities of the trash rack, retention baskets and ECCS strainers to perform their intended function.