

ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Friday, November 18, 2011 9:22 AM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); GUCWA Len (EXTERNAL AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 490 (5788), FSAR Ch. 6, Supplement 3
Attachments: RAI 490 Supplement 3 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the 10 questions of RAI 490 on June 20, 2011. Supplement 1 and Supplement 2 responses to RAI 490 were submitted on July 13, 2011 and August 10, 2011, respectively, to revise the schedule for responding to these questions.

The attached file, "RAI 490 Supplement 3 Response US EPR DC.pdf" provides technically correct and complete responses to the remaining 10 questions.

The following table indicates the respective pages in the response document, "RAI 490 Supplement 3 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 490 — 06.02.02-100	2	3
RAI 490 — 06.02.02-101	4	6
RAI 490 — 06.02.02-102	7	7
RAI 490 — 06.02.02-103	8	8
RAI 490 — 06.02.02-104	9	9
RAI 490 — 06.02.02-105	10	10
RAI 490 — 06.02.02-106	11	11
RAI 490 — 06.02.02-107	12	12
RAI 490 — 06.02.02-108	13	13
RAI 490 — 06.02.02-109	14	14

This concludes the formal AREVA NP response to RAI 490, and there are no questions from this RAI for which AREVA NP has not provided responses.

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: Wednesday, August 10, 2011 5:09 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. 490 (5788), FSAR Ch. 6, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the ten questions of RAI No. 490 on June 20, 2011. AREVA NP provided Supplement 1 response on July 13, 2011 to revise the schedule for responding to these questions.

The schedule for providing technically correct and complete responses to the remaining 10 questions has been revised as shown below.

Question #	Response Date
RAI 490 — 06.02.02-100	November 18, 2011
RAI 490 — 06.02.02-101	November 18, 2011
RAI 490 — 06.02.02-102	November 18, 2011
RAI 490 — 06.02.02-103	November 18, 2011
RAI 490 — 06.02.02-104	November 18, 2011
RAI 490 — 06.02.02-105	November 18, 2011
RAI 490 — 06.02.02-106	November 18, 2011
RAI 490 — 06.02.02-107	November 18, 2011
RAI 490 — 06.02.02-108	November 18, 2011
RAI 490 — 06.02.02-109	November 18, 2011

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: Wednesday, July 13, 2011 1:58 PM
To: Tesfaye, Getachew
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. 490 (5788), FSAR Ch. 6, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responding to the ten questions of RAI No. 490 on June 20, 2011.

The schedule for providing technically correct and complete responses to these ten questions has been revised, as shown below.

Question #	Response Date
RAI 490 — 06.02.02-100	September 21, 2011
RAI 490 — 06.02.02-101	September 21, 2011
RAI 490 — 06.02.02-102	September 21, 2011
RAI 490 — 06.02.02-103	September 21, 2011
RAI 490 — 06.02.02-104	September 21, 2011
RAI 490 — 06.02.02-105	September 21, 2011
RAI 490 — 06.02.02-106	September 21, 2011
RAI 490 — 06.02.02-107	September 21, 2011
RAI 490 — 06.02.02-108	September 21, 2011
RAI 490 — 06.02.02-109	September 21, 2011

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: RYAN Tom (RS/NB)
Sent: Monday, June 20, 2011 10:28 AM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); WILLIFORD Dennis (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 490 (5788), FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 490 Response US EPR DC.pdf", provides a schedule since a technically correct and complete response to the 10 questions cannot be provided at this time.

The following table indicates the respective pages in the response document, "RAI 490 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 490 — 06.02.02-100	2	2
RAI 490 — 06.02.02-101	3	3

RAI 490 — 06.02.02-102	4	4
RAI 490 — 06.02.02-103	5	5
RAI 490 — 06.02.02-104	6	6
RAI 490 — 06.02.02-105	7	7
RAI 490 — 06.02.02-106	8	8
RAI 490 — 06.02.02-107	9	9
RAI 490 — 06.02.02-108	10	10
RAI 490 — 06.02.02-109	11	11

A complete answer is not provided for the 10 questions in RAI 490. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 490 — 06.02.02-100	August 17, 2011
RAI 490 — 06.02.02-101	August 17, 2011
RAI 490 — 06.02.02-102	August 17, 2011
RAI 490 — 06.02.02-103	August 17, 2011
RAI 490 — 06.02.02-104	August 17, 2011
RAI 490 — 06.02.02-105	August 17, 2011
RAI 490 — 06.02.02-106	August 17, 2011
RAI 490 — 06.02.02-107	August 17, 2011
RAI 490 — 06.02.02-108	August 17, 2011
RAI 490 — 06.02.02-109	August 17, 2011

Sincerely,

Tom Ryan for Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.

7207 IBM Drive, Mail Code CLT 2B
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From: Tesfaye, Getachew [<mailto:Getachew.Tesfaye@nrc.gov>]
Sent: Friday, May 20, 2011 3:00 AM
To: ZZ-DL-A-USEPR-DL
Cc: Makar, Gregory; Terao, David; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 490 (5788), FSAR Ch. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on May 16, 2011, and on May 19, 2011, 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/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 3574

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D49B585F)

Subject: Response to U.S. EPR Design Certification Application RAI No. 490 (5788),
FSAR Ch. 6, Supplement 3
Sent Date: 11/18/2011 9:22:13 AM
Received Date: 11/18/2011 9:22:25 AM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

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Files	Size	Date & Time
MESSAGE	7810	11/18/2011 9:22:25 AM
RAI 490 Supplement 3 Response US EPR DC.pdf		170609

Options

Priority: Standard

Return Notification: No

Reply Requested: No

Sensitivity: Normal

Expiration Date:

Recipients Received:

Response to

Request for Additional Information No. 490, Supplement 3

5/20/2011

U. S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 06.02.02 - Containment Heat Removal Systems

Application Section: 6.2.2

**QUESTIONS for Component Integrity, Performance, and Testing Branch 1
(AP1000/EPR Projects) (CIB1)**

Question 06.02.02-100:

The staff requests that AREVA modify Appendix D of ANP-10293P to address directly and completely the change in IRWST peak temperature from 230°F to 250°F. For example, there is a statement on page D-5 that, "The temperature during the test was controlled to simulate the IRWST response to a large-break LOCA as closely as practicable." The autoclave testing was conducted at a lower temperature than the IRWST peak, and this needs to be acknowledged and justified. Another example is on page D-11, which has a statement about Nukon binder stability relative to 230°F (rather than 250°F).

Response to Question 06.02.02-100:

The autoclave test was conducted using the temperature profile available at the time of the test, which had a peak temperature of 230°F. A very short exposure time at 250°F is not expected to affect binder stability as the NUKON material safety data sheet (MSDS) notes that the phenolic resin begins to decompose at a temperature of ≈400°F.

Thermodynamic modeling using OLI Analyzer™ shows that the solubility of CaCO₃ and SiO₂ do not change significantly or irregularly between 230°F and 250°F, as shown in Figures 06.02.02-100-1 and 06.02.02-100-2. Therefore, the material release equations developed from literature data and the autoclave testing may be extrapolated between 230°F and 250°F with reasonable certainty because:

- The solubility of the pertinent species, CaCO₃ and SiO₂, does not change significantly over the temperature range in question.
- In the absence of a significant solubility change, dissolution/corrosion kinetics are regular and predictable, allowing reasonable extrapolation.

Figure 06.02.02-100-1—Calcium Carbonate Solubility IRWST Chemistry Conditions

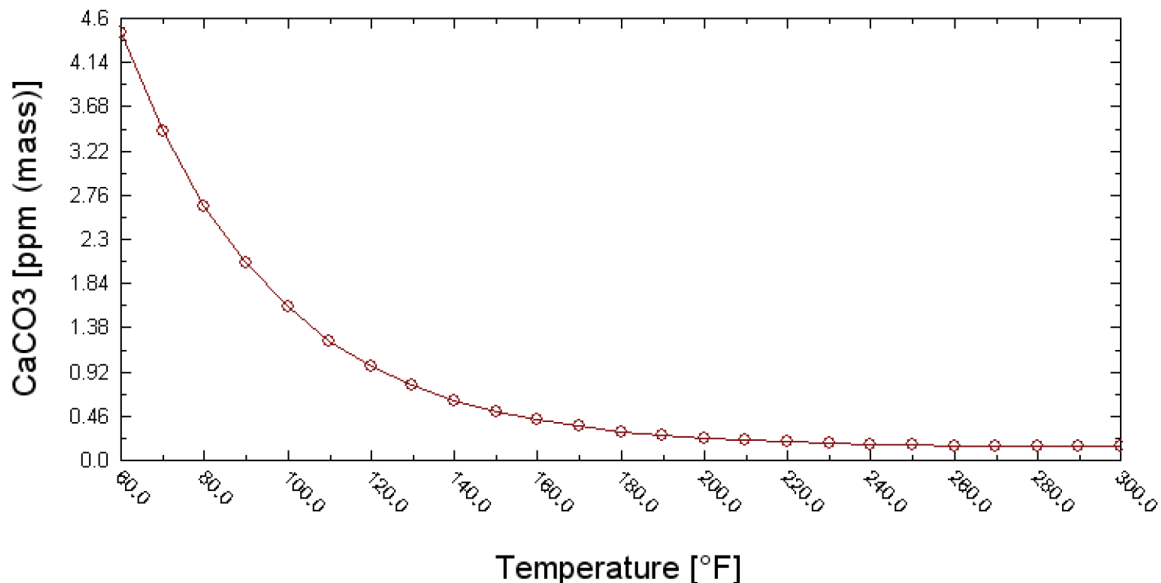
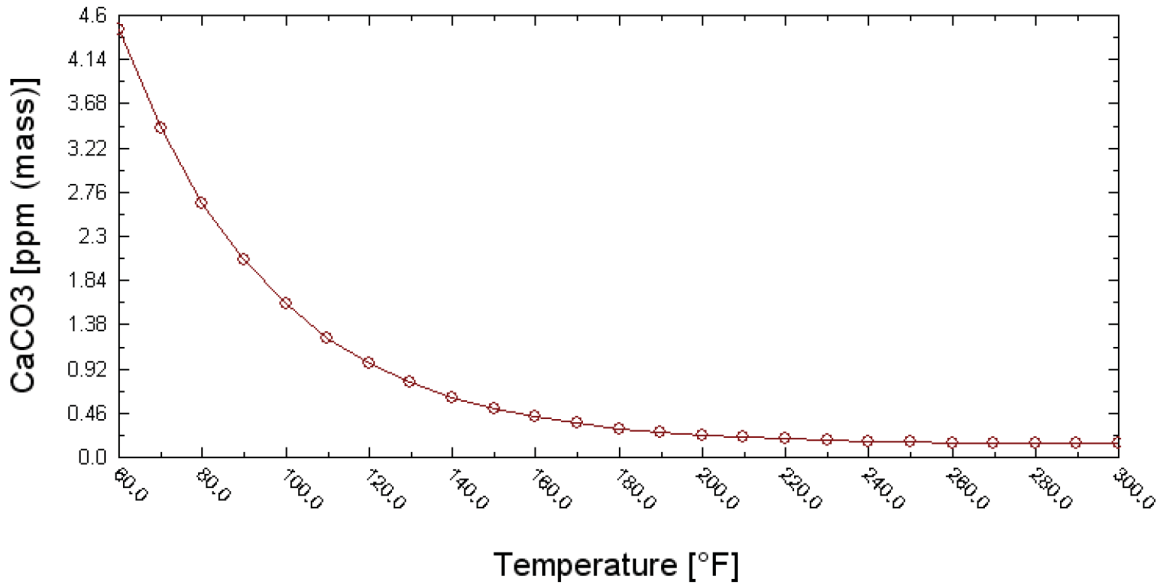


Figure 06.02.02-100-2—Silica Solubility IRWST Chemistry Conditions



Appendix D, Sections 2.2.2, 3.3.1, and 3.3.3 of Technical Report ANP-10293P will be revised to address the temperature change. These updates to ANP-10293P are provided by separate letter.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P will be revised as described in the response.

Question 06.02.02-101:

The staff requests that AREVA either justify the linear extrapolation of the calcium release rate shown in Figure D.3-1 or propose an alternative. It does not appear to the staff that the linear extrapolation from 230°F to 250°F is justified and conservative. Rather, it appears that an exponential form would fit the data better and at 250°F would predict a significantly higher release rate than the proposed linear extrapolation.

Response to Question 06.02.02-101:

In order to justify the linear fit of the calcium data shown in Figure D.3-1 of ANP-10293P, AREVA NP evaluated linear, polynomial, and exponential fits of the data points, as shown in Figure 06.02.02-101-1 through Figure 06.02.02-101-3. Each of the calcium release rate equations determined from the Excel data fits was applied to the newest IRWST temperature profile to calculate the total quantity of concrete released from the heavy floor as a function of time. As shown in Figure 06.02.02-101-4, the linear data fit produced the largest calcium release prediction, since it more encompasses the middle of the temperature range where the bulk of the transient time is spent. Note that since this is a graph of cumulative releases, the slope of the curves correspond to release rates, which change with time because of changes in the IRWST temperature.

Because the linear data fit produced the highest predicted calcium releases, it was deemed to be conservative and was used in the chemical debris generation calculation summarized in Appendix D of ANP-10293P.

Figure 06.02.02-101-1—Calcium Data Fit – Linear

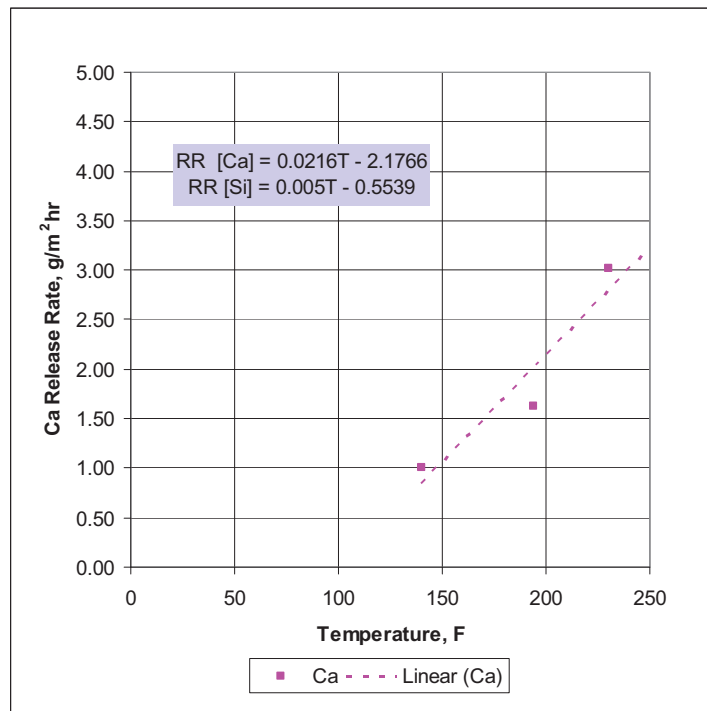


Figure 06.02.02-101-2—Calcium Data Fit – Exponential

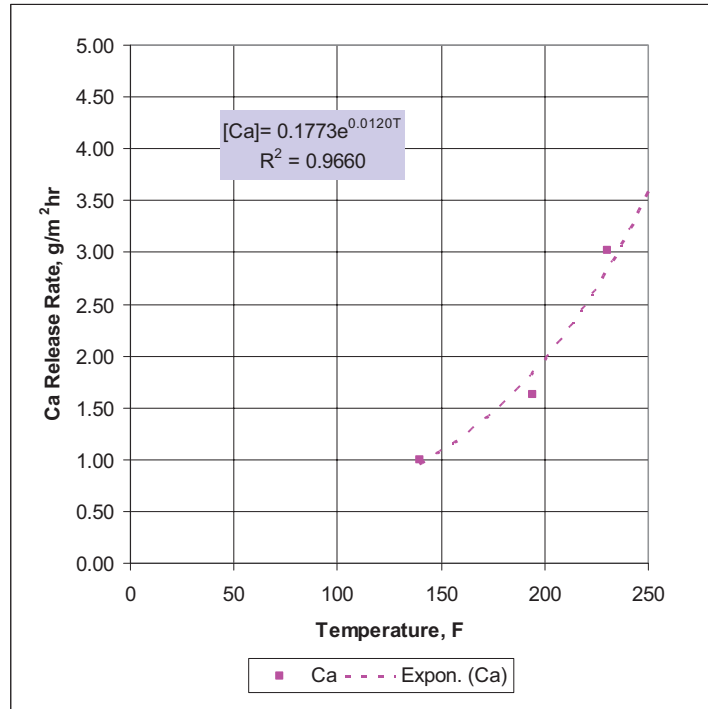


Figure 06.02.02-101-3—Calcium Data Fit – Polynomial

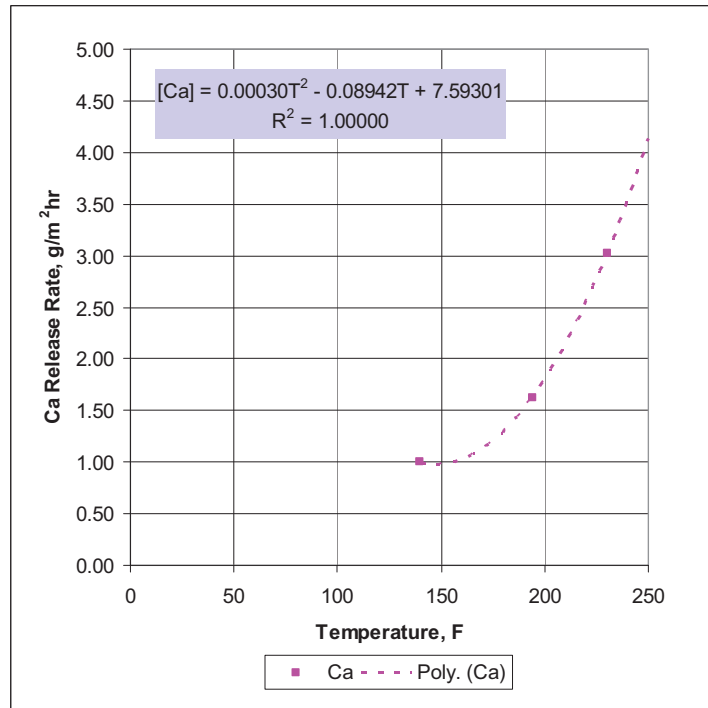
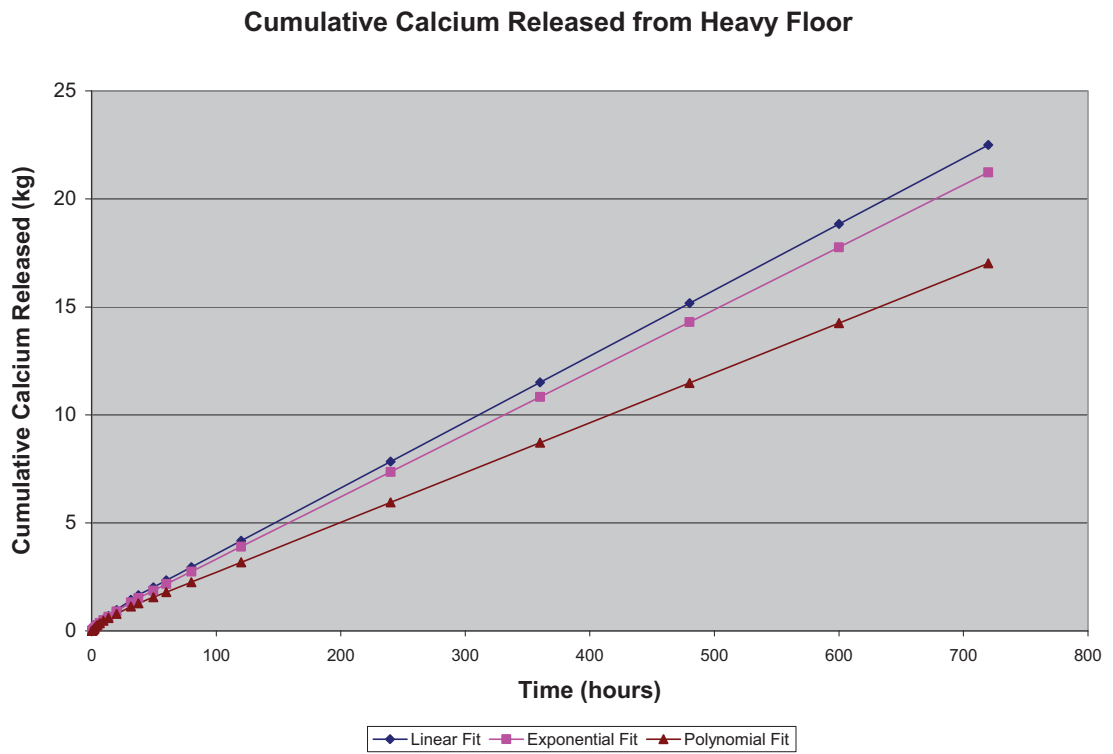


Figure 06.02.02-101-4—Calcium Released from Heavy Floor



FSAR Impact:

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

Technical Report Impact:

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

Question 06.02.02-102:

The staff requests that AREVA explain why Table D.2-3 does not identify carbon as a constituent of pulverized concrete, even though the sample presumably contained carbonate. If the analysis was normalized in some way based on the measurement technique, the staff requests that this be explained in the text or the table.

Response to Question 06.02.02-102:

The energy dispersive x-ray spectroscopy results were normalized to remove carbon from the reported results because the specimen was mounted on carbon tape for the analysis.

Appendix D, Section D.2.3.2 of Technical Report ANP-10293P will be revised to clarify the treatment of carbon in the pulverized concrete. These updates to ANP-10293P are provided by separate letter.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P will be revised as described in the response.

Question 06.02.02-103:

With respect to Figure D.2-10, the staff requests that AREVA discuss, or identify on the graph, the relationship between the measured concentrations and the amount of material added to the autoclave, since a measured value less than the theoretical added suggests precipitation was occurring.

Response to Question 06.02.02-103:

Appendix D, Section D.2.4.1.2 and Figure D.2-10 of Technical Report ANP-10293P will be revised to note the amount of sodium and phosphate added to the autoclave. These updates to ANP-10293P are provided by separate letter.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P will be revised as described in the response.

Question 06.02.02-104:

The staff requests that AREVA identify in Figure D.2-10 and D.2-11 whether the elemental concentrations are based on filtered or unfiltered samples, and the timing of the key steps in the analysis (e.g., filtration before or after cooling, filter pore size).

Response to Question 06.02.02-104:

The samples were filtered through 0.45 micron filters after sampling while the samples were cooling. Appendix D, Section D.2.4.1.2 and Figures D.2-10 and D.2-11 of Technical Report ANP-10293P will be revised accordingly. These updates to ANP-10293P are provided by separate letter.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P will be revised as described in the response.

Question 06.02.02-105:

Page D-60 discusses the corrosion rate of the fiberglass and states that the data suggest the corrosion rate becomes negligible after about 100 hours. The staff requests that AREVA clarify that the analysis assumed there was negligible fiberglass corrosion after 80 hours and, hence, the corrosion rate was set to zero in the release calculation after 80 hours. The staff also requests that AREVA discuss the possible role of silicon precipitation after 80 hours, since precipitation would seem to result in more corrosion to maintain equilibrium.

Response to Question 06.02.02-105:

Appendix D, Section D.3.3.3 of Technical Report ANP-10293P will be revised to state, "The chemical release calculation assumed that the releases from fiberglass were negligible after 80 hours of exposure, and the corrosion rate was, therefore, set to zero." The revision to ANP-10293P will be provided by separate letter.

The behavior of silica is discussed in ANP-10293P, Appendix D, Section D.3.3.5 and Section D.3.4.1, including precipitation. Furthermore, silicon precipitation will serve only to maintain the solution concentration at the saturation limit, which had previously been reached. As a result, the mass transfer rate away from the fiberglass surface, which will be governed by the local solution concentration, will not be affected by precipitation, and the corrosion could not increase. On the contrary, a more likely scenario would be that the fiberglass would be coated with precipitated material that would inhibit mass transfer and reduce the corrosion rate.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P will be revised as described in the response.

Question 06.02.02-106:

Figure D.3-5 compares calculated steady-state aluminum corrosion rates to measured values from NUREG/CR-6915 and WCAP-16530-NP. Since the measured values correspond to more than one pH, the staff requests that AREVA annotate the figure accordingly. (The staff also notes that the figure appears to have a typographical error: "WCAP-16539").

Response to Question 06.02.02-106:

Figure D.3-5 of Technical Report ANP-10293P, Appendix D will be revised to identify the pH of the corresponding data points and to correct the typographical error in Figure D.3-5. These updates to ANP-10293P are provided by separate letter.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P will be revised as described in the response.

Question 06.02.02-107:

Beginning on page D-66, there is a discussion of how, for “the U.S. EPR LOCA calculations,” the corrosion rate of aluminum was assumed to be made up of two parts (up to 20 hours and after 20 hours). It is the staff’s understanding that these two different corrosion rate relationships were used together to subsequently calculate the aluminum releases listed in Tables D.3-6, D.3-7, D.3-9, and D.3-10 (158 hours or 720 hours). The staff requests that AREVA clarify this in the discussion on page D-66 (i.e., define “the U.S. EPR LOCA calculations”). The staff also notes that the reference to Figure D.3-4 on page D-66 probably intends to reference Figure D.3-5.

Response to Question 06.02.02-107:

The linear relationship shown in ANP-10293P, Appendix D, Figure D.3-6 was used for the corrosion rate of aluminum for the first 20 hours. The long term, steady-state corrosion rate, identified by the corrosion rate relationship described in Section D.3.3.4 and shown in Figure D.3-5, was used for the corrosion rate of aluminum after 20 hours.

The parenthetical reference in Section D.3.3.4 will be changed to Figure D.3-5 in Appendix D of ANP-10293P. These updates to ANP-10293P are provided by separate letter.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P will be revised as described in the response.

Question 06.02.02-108:

The staff requests that AREVA confirm that the chemical effects analysis included insulation (other than RMI) or other materials that will not necessarily be destroyed (i.e., outside the zone of influence) but will be wetted and potentially add to the chemical debris and ionic content of the sump liquid. The mass of those other materials and the amount of ionic materials that may be leached should be included in the calculation.

Response to Question 06.02.02-108:

The zone of influence (ZOI) was used to determine the amount of exposed concrete (i.e., the coatings are assumed to fail within the ZOI) and the amount of insulation material exposed. Wetted materials considered outside the ZOI included latent debris in the reactor building, an assumed amount of NUKON[®] fiber for conservatism, and exposed aluminum.

Chemical debris that may form as a result of these interactions is included in the chemical effects analysis. Other wetted materials outside the ZOI are nonreactive and would contribute only an insignificant amount of chemical debris compared with what is identified in the chemical effects analysis.

FSAR Impact:

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

Technical Report Impact:

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

Question 06.02.02-109:

The chemical precipitate quantities ("Total Solids") identified in Table D.3-10 and in the text on page D-80 are different than the chemical precipitate quantities listed in Table E.5-2 (debris head-loss tests). The staff requests that AREVA modify ANP-10293P to include an explanation of how the quantities calculated in Appendix D relate to the quantities used in head-loss testing.

Response to Question 06.02.02-109:

A reconciliation between the chemical precipitate quantities identified in Technical Report ANP-10293P, Appendix D, Table D.3-10, including the text in Appendix D, and the quantities shown in Table E.5-2 will be revised in Section E.5.2 of ANP-10293P. These updates to ANP-10293P are provided by separate letter.

FSAR Impact:

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

Technical Report Impact:

Technical Report ANP-10293P will be revised as described in the response.