ArevaEPRDCPEm Resource

From: WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]
Sent: Friday, November 18, 2011 4:05 PM
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. 428 , FSAR Ch. 15, Supplement 4
Attachments: RAI 428 Supplement 4 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 17 questions of RAI 428 and a schedule for responding to the remaining 14 questions on November 18, 2010. Supplement 1 response was submitted on March 31, 2011 to provide responses to 9 questions and to revise the schedule for responding to the remaining 5 questions. Supplement 2 response was provided on April 28, 2011 to revise the schedule for the remaining questions. Supplement 3 response was sent on August 29, 2011 to revise the schedule for responding to the remaining 5 questions in accordance with the GSI-191 Closure Plan (AREVA NP letter NRC:11:092 dated August 25, 2011).

The attached file, "RAI 428 Supplement 4 Response US EPR DC.pdf" provides final responses to the remaining 5 questions and revises the responses to four questions. The revised responses to Questions 15.06.05-81, 15.06.05-82, 15.06.05-83 and 15.06.05-84 supersede those that were submitted in the Supplement 1 response on March 31, 2011.

The following table indicates the respective pages in the response document, "RAI 428 Supplement 4 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 428 — 15.06.05-81	2	2
RAI 428 — 15.06.05-82	3	3
RAI 428 — 15.06.05-83	4	4
RAI 428 — 15.06.05-84	5	6
RAI 428 — 15.06.05-85	7	7
RAI 428 — 15.06.05-86	8	8
RAI 428 — 15.06.05-87	9	9
RAI 428 — 15.06.05-88	10	10
RAI 428 — 15.06.05-95	11	11

This concludes the formal AREVA NP response to RAI 428, 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: Monday, August 29, 2011 4:52 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. 428 , FSAR Ch. 15, Supplement 3

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 17 questions of RAI 428 and a schedule for responding to the remaining 14 questions on November 18, 2010. Supplement 1 response to RAI 428 was submitted on March 31, 2011 to provide responses to 9 questions and to revise the schedule for responding to the remaining 5 questions. Supplement 2 response to RAI 428 was provided on April 28, 2011 to revise the schedule for responding to the remaining questions.

The schedule for responding to the remaining 5 questions in RAI 428 has been revised as described in the GSI-191 Closure Plan (AREVA NP Inc. letter NRC:11:092 dated August 25, 2011) and as provided below.

Question #	Response Date
RAI 428 — 15.06.05-85	**November 18, 2011**
RAI 428 — 15.06.05-86	**November 18, 2011**
RAI 428 — 15.06.05-87	**November 18, 2011**
RAI 428 — 15.06.05-88	**November 18, 2011**
RAI 428 — 15.06.05-95	**November 18, 2011**

Sincerely,

Dennis Williford, P.E.
U.S. EPR Design Certification Licensing Manager
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From: WELLS Russell (RS/NB)
Sent: Thursday, April 28, 2011 6:30 PM
To: 'Getachew Tesfaye'
Cc: GUCWA Len (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 428 , FSAR Ch. 15, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 3 of the 17 questions of RAI 428 and a schedule for responding to the remaining 14 questions on November 18, 2010. Supplement 1 response to RAI 428 was submitted on March 31, 2011 to provide responses to 9 questions and to revise the schedule for responding to the remaining 5 questions.

To provide an opportunity for additional technical evaluations and interaction with the NRC staff, AREVA NP is providing a revised schedule for responding to Questions 15.06.05-85 through 15.06.05-88 and Question 15.06.05-95 as provided below.

Question #	Response Date
RAI 428 — 15.06.05-85	August 31, 2011
RAI 428 — 15.06.05-86	August 31, 2011
RAI 428 — 15.06.05-87	August 31, 2011
RAI 428 — 15.06.05-88	August 31, 2011
RAI 428 — 15.06.05-95	August 31, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Thursday, March 31, 2011 3:11 PM
To: 'Tesfaye, Getachew'
Cc: GUCWA Len (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 428 , FSAR Ch. 15, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a response to 3 of the 17 questions of RAI 428 on November 18, 2010. The attached file, "RAI 428 Supplement 1 Response US EPR DC.pdf," provides technically correct and complete responses to 9 of the remaining 14 questions.

The following table indicates the respective pages in the response document, "RAI 428 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 428 — 15.06.05-81	2	2
RAI 428 — 15.06.05-82	3	3
RAI 428 — 15.06.05-83	4	4
RAI 428 — 15.06.05-84	5	6
RAI 428 — 15.06.05-92	7	7
RAI 428 — 15.06.05-93	8	9
RAI 428 — 15.06.05-94	10	11
RAI 428 — 15.06.05-96	12	13
RAI 428 — 15.06.05-97	14	14

To provide additional opportunity to interact with the NRC staff on Questions 15.06.05-85 through 15.06.05-88, the response schedule is revised as shown below. These questions include evaluations of the in-vessel, downstream effects of debris bypassing sump strainers. The schedule for responding to the 5 remaining RAI 428 questions has been revised and is provided below.

Question #	Response Date
RAI 428 — 15.06.05-85	April 30, 2011
RAI 428 — 15.06.05-86	April 30, 2011
RAI 428 — 15.06.05-87	April 30, 2011
RAI 428 — 15.06.05-88	April 30, 2011
RAI 428 — 15.06.05-95	April 30, 2011

Sincerely,

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Russell.Wells@Areva.com

From: BRYAN Martin (External RS/NB)
Sent: Thursday, November 18, 2010 11:41 AM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len (External RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 428 , FSAR Ch. 15

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 428 Response US EPR DC.pdf," provides technically correct and complete responses to 3 of the 17 questions.

The following table indicates the respective pages in the response document, "RAI 428 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 428 — 15.06.05-81	2	2
RAI 428 — 15.06.05-82	3	3
RAI 428 — 15.06.05-83	4	4
RAI 428 — 15.06.05-84	5	5
RAI 428 — 15.06.05-85	6	6
RAI 428 — 15.06.05-86	7	7
RAI 428 — 15.06.05-87	8	8
RAI 428 — 15.06.05-88	9	9
RAI 428 — 15.06.05-89	10	11
RAI 428 — 15.06.05-90	12	12

RAI 428 — 15.06.05-91	13	14
RAI 428 — 15.06.05-92	15	15
RAI 428 — 15.06.05-93	16	16
RAI 428 — 15.06.05-94	17	17
RAI 428 — 15.06.05-95	18	18
RAI 428 — 15.06.05-96	19	19
RAI 428 — 15.06.05-97	20	20

A complete answer is not provided for 14 of the17 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 428 — 15.06.05-81	March 31, 2011
RAI 428 — 15.06.05-82	March 31, 2011
RAI 428 — 15.06.05-83	March 31, 2011
RAI 428 — 15.06.05-84	March 31, 2011
RAI 428 — 15.06.05-85	March 31, 2011
RAI 428 — 15.06.05-86	March 31, 2011
RAI 428 — 15.06.05-87	March 31, 2011
RAI 428 — 15.06.05-88	March 31, 2011
RAI 428 — 15.06.05-92	March 31, 2011
RAI 428 — 15.06.05-93	March 31, 2011
RAI 428 — 15.06.05-94	March 31, 2011
RAI 428 — 15.06.05-95	March 31, 2011
RAI 428 — 15.06.05-96	March 31, 2011
RAI 428 — 15.06.05-97	March 31, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
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Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, October 20, 2010 10:00 AM
To: ZZ-DL-A-USEPR-DL
Cc: Forsaty, Fred; Lu, Shanlai; Thomas, George; Donoghue, Joseph; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 428 (4299), FSARCh. 15

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on July 21, 2010, and discussed with your staff on September 13, 2010. Draft RAI Questions 15.06.05-78, 15.06.05-79, 15.06.05-80 were deleted, and Draft RAI Questions 15.06.05-86, 15.06.05-87, 15.06.05-88, 15.06.05-94 were modified 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: 3578

Mail Envelope Properties (2FBE1051AEB2E748A0F98DF9EEE5A5D49B5925)

Subject: Response to U.S. EPR Design Certification Application RAI No. 428 , FSAR Ch. 15, Supplement 4
Sent Date: 11/18/2011 4:05:17 PM
Received Date: 11/18/2011 4:05:29 PM
From: WILLIFORD Dennis (AREVA)

Created By: Dennis.Williford@areva.com

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"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
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"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
Tracking Status: None
"GUCWA Len (EXTERNAL AREVA)" <Len.Gucwa.ext@areva.com>
Tracking Status: None
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Post Office: auscharmx02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	11120	11/18/2011 4:05:29 PM
RAI 428 Supplement 4 Response US EPR DC.pdf	93464	

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

Response to

Request for Additional Information No. 428, Supplement 4

10/20/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 15.06.05 - Loss of Coolant Accidents Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary
Application Section: Downstream

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

Question 15.06.05-81:

The ΔP acceptance criteria for fuel assembly flow blockage for the U.S. EPR design have been determined for several different classes of LOCA conditions based on break location and ECCS injection performance. For each ΔP acceptance criterion established, list the assumptions used to derive the available driving head. In particular, identify the assumptions related to the following aspects.

(1) Two-phase fluid conditions and properties including void fraction distribution in the core region and other participating regions that contain two-phase coolant mixture as participating and accounted for in the driving head balance analyses.

(2) Single phase liquid coolant conditions and properties including temperature profile in regions occupied by liquid coolant only as participating and accounted for in the driving head balance analyses.

(3) Availability, geometry, and flow resistance coefficients associated with each steam flow path available for steam venting from the upper plenum region and as considered for in the pressure balance across the reactor coolant system.

(4) Containment backpressure conditions and related assumptions taking into account post-LOCA containment pressurization.

(5) ECCS flow performance and availability as affected by containment post-LOCA conditions and other related factors and assumptions.

Identify any analytical tools and software codes applied to determine the applicable ΔP acceptance criteria.

Response to Question 15.06.05-81:

Reference 1, Section F.3 describes assumptions related to fluid conditions, containment pressure, downcomer voiding, steam flow paths for steam venting, the void fraction in the core, and describes core flow conditions used to determine the acceptance criterion.

References for Question 15.06.05-81:

1. ANP-10293P, “U.S. EPR Design Features to Address GSI-191 Technical Report,” AREVA NP Inc.

FSAR Impact:

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

Question 15.06.05-82:

Explain how the analyses, performed to determine ΔP acceptance criteria for U.S. EPR, take into account variation in time of thermal-hydraulic conditions in the primary reactor coolant system and in the reactor containment. With regard to the containment thermal-hydraulic response, address effects associated with limiting LOCA conditions associated with most restrictive ΔP acceptance criteria.

Response to Question 15.06.05-82:

Reference 1, Section F.3 describes assumptions related to fluid conditions and containment pressure and core flow conditions used to determine the acceptance criterion.

References for Question 15.06.05-82:

1. ANP-10293P, “U.S. EPR Design Features to Address GSI-191 Technical Report,” AREVA NP Inc.

FSAR Impact:

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

Question 15.06.05-83:

Explain how the analyses, performed to determine ΔP acceptance criteria for U.S. EPR, take into account effects associated with certain thermal-hydraulic phenomena that can take place in the primary reactor coolant system in the post-LOCA period. Such phenomena can have a major impact on the assumptions and pressure balance equations used in ΔP acceptance criteria derivation analyses. Specifically, address the following the thermal-hydraulic phenomena identified below.

(1) Reactor downcomer boiling.

(2) Loop seal reformation in individual primary coolant loops.

(3) Partial loop seal liquid blockage in individual primary coolant loops

(4) Non-uniform flow and void distribution in the core region.

(5) Boric acid accumulation in the reactor core region.

Response to Question 15.06.05-83:

Reference 1, Section F.3 describes assumptions related to fluid conditions, loop seals, containment pressure, the core void fraction, core flow conditions used to determine the acceptance criterion, and addresses boric acid accumulation.

References for Question 15.06.05-83:

1. ANP-10293P, “U.S. EPR Design Features to Address GSI-191 Technical Report,” AREVA NP Inc.

FSAR Impact:

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

Question 15.06.05-84:

U.S. EPR RAI 241 Question 15.06.05-51 addresses the reactor two-phase mixture level response during long term cooling. RAI 241 Question 15.06.05-52 considers the core region thermal-hydraulic conditions for the boric acid precipitation analysis. Explain how the core region thermal-hydraulic assumptions and conditions, as applied in the ΔP acceptance criteria analyses for core blockage evaluation, compare to assumptions and conditions considered in RAI 251 Question 15.06.05-51 and in RAI 251 Question 15.06.05-52. Explain and quantify any significant differences related to the same class of LOCA conditions.

Response to Question 15.06.05-84:

The responses to RAI 241 Question 15.06.05-51 and Question 15.06.05-52 were supplemented by responses to RAI 403 Question 15.06.05-64 and Questions 15.06.05-69 through 15.06.05-78.

The ΔP acceptance criteria analysis for core blockage was revised to use the static-balance model which is the basis of the responses identified above. The analysis for the core blockage evaluation was revised as reported in the responses to RAI 493, Questions 15.06.05 through 15.06.05-101 and Question 15.06.05-106.1(a,b,c) and as identified in Reference 1, Appendix F. The application of the static balance model is limited to the cold leg break with cold leg injection (CLB/CLI).

The revisions to the static balance model reported in the response to RAI 493, Question 15.06.05-101 includes the following:

1) The loop seal venting criterion is based on the depression of the water level on the steam generator side of a non-vented loop. The revised criterion is based on experimental observations from the Steam-Water Mixing Test Program (Reference 2). The change is necessary for high flow resistance at the core inlet.

2) The bypass flow from the upper plenum to the downcomer is now resolved by a non-linear solution.

These two changes have no significant impact on the conclusions presented in the responses to the RAI questions identified above.

Application of the static-balance model to the analysis of core inlet blockage imposes added requirements and conservatism beyond those considered in the previous RAI responses:

1) Debris is assumed to arrive at the core inlet at 15 minutes (900 seconds) following a LOCA.

2) Downcomer boiling is included. It is based on representative S-RELAP5 realistic large break LOCA cases. The downcomer average void fraction is 0.2 at 900 seconds and decreases to zero at 1500 seconds.

3) Reactor vessel water density is increased by boron concentration consistent with the response to RAI 403, Question 15.06.05-64, Figure 15.05.05-64-3. The boron concentration is 10,000 ppm at 15 minutes.

4) The analysis is performed at the highest credible containment pressure of 71 psia. High containment pressure suppresses the two-phase level swell in the core.

5) A conservative flow resistance is applied to the loop pressure drop at the safety injection point.

6) The analysis terminates at 3600 seconds, which is the time at the onset of hot leg injection.

Additional details and the results of a sensitivity analysis are presented in the response to RAI 493, Question 15.06.05-106.1(a,b,c).

References for Question 15.06.05-84:

1. ANP-10293P, “U.S. EPR Design Features to Address GSI-191, Technical Report,” AREVA NP Inc.
2. Steam-Water Mixing Test Program, Task D: Formal Report for Task B and Final Report for the Steam Relief Phases of the Test Program, Combustion Engineering, AEC-COO-2244-1, CENPD-101 (October 1973).

FSAR Impact:

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

Question 15.06.05-85:

Provide evidence that introducing the fiber load in larger batches rather than in a series of smaller batches during fuel assembly blockage testing produces results that are representative of the physical process of gradual debris accumulation. For this purpose, comparative results produced with incremental fibrous debris load introduction in smaller amounts, such as 2 gram fiber per batch or less, can be used.

Response to Question 15.06.05-85:

Small incremental two-gram fiber batching was used in the fuel assembly testing. Results will be provided in revised ANP-10293P, Appendix F, Section F.5.5. Table F.5-24 will provide a list of comparative results. The revision to ANP-10293P will be 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 15.06.05-86:

The approach currently applied in assessing downstream effects on U.S. EPR core cooling employs fuel assembly blockage testing for determining fuel head loss and separate sump screen bypass testing for assessing the downstream fiber load. Whereas similar fiber surrogate material is used in both types of testing, in reality length distribution of downstream fiber can differ significantly from that of source fibrous debris upstream of the retaining basket as a result of retention and bypass processes caused by the retaining basket and the sump strainer.

Explain how the fiber length distribution of fibrous source material used in strainer bypass testing for the U.S. EPR can impact the strainer bypass test results. Demonstrate the appropriateness and applicability of sump strainer bypass test results obtained with fibrous surrogate material of certain length distribution characteristics for the purpose of investigating downstream effects on core cooling resulting from fuel assembly blockage. In particular, consider any possible interdependency between fiber length distribution of source fiber material used in sump strainer bypass testing, fiber length distribution of fiber material used in downstream fuel assembly blockage testing, and sump strainer bypass ratio

Response to Question 15.06.05-86:

Target fiber length distribution is will be addressed in revised ANP-10293P, Appendix F, Section F.5.4. The revision ANP-10293P will be 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 15.06.05-87:

The applicant presented an experimentally derived curve based on existing data from fuel assembly blockage testing. The curve gives a relationship between the observed fuel assembly head loss and the particulates-to-fiber mass ratio in tests performed with a varying amount of particulates and a constant fiber mass load. The curve shows a maximum in the measured head loss at a certain particulates-to-fiber mass ratio. For mass ratios larger or smaller than this observed critical value, the curve predicts a smaller head loss for the specific fiber load considered.

If such a curve is used to determine particulates-to-fiber mass ratios for U.S. EPR fuel assembly blockage testing, present data that support the applicability of such a relationship to the U.S. EPR fuel assembly design. Describe the conditions and assumptions used in obtaining and qualifying the applied test data. Comment on data accuracy, repeatability, and applicability to U.S. EPR prototypical core conditions. Identify and explain key participating and competing mechanisms that cause such a maximum in the observed head loss. Discuss effects related to and appropriateness of values applied for the total fiber mass load, batch size of fiber addition, and coolant mass flow rate on the established head loss versus particulates-to-fiber mass ratio dependency as applicable to the U.S. EPR design.

Response to Question 15.06.05-87:

ANP-10293P, Appendix F, Section F.5.6 will be revised to address the sensitivity of the testing to particulate-to-fiber (p:f) ratio. The revision to ANP-10293P will be 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 15.06.05-88:

With regard to U.S. EPR fuel assembly blockage testing, address effects associated with length distribution of surrogate fiber material on test results obtained under limiting conditions for determining the maximum applicable ΔP. In addition, consider such effects on test data used in establishing the limiting ΔP versus particulates-to-fiber mass ratio. Demonstrate the conservatism associated with using fibrous surrogate material of certain length distribution characteristics in evaluating the U.S. EPR downstream effects on core cooling.

Response to Question 15.06.05-88:

ANP-10293P, Appendix F, Section F.5.4 will be revised to address the target fiber length distribution for testing and explain that the length of fibers used were consistent with the industry standard. The revision to ANP-10293P will be 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 15.06.05-95:

The EPRDM debris deposition model and analysis results for the U.S. EPR design used a limiting thickness criterion for the debris buildups based on the as-designed fuel geometry. Consider effects associated with ballooning and conditions related in post-LOCA long term cooling analyses.

Response to Question 15.06.05-95:

The U.S. EPR debris deposition model (EPRDM) does not specifically consider the effects of ballooning in the post-LOCA long term cooling analyses. Testing demonstrates that debris deposition on the spacer grid is the significant head loss term (see ANP-10293P, Appendix F, Section F.5.6). Testing was also performed to determine the sensitivity of the results to the number of spacer grids and found that more than four spacer grids did not make a significant difference in head loss. The test results indicate that the debris accumulates predominantly on the leading edge of the spacer grids (see revised ANP-10293P, Appendix F, Section F.5.6).

The first and second spacer grid along the direction of flow becomes a uniform 'filter' for debris deposition. However, other possible flow restrictions such as additional spacer grids or random ballooning would not be significant head loss terms.

For adequate long term cooling, it is assumed that core assemblies retain a coolable geometry. The core wide average blockage should be less than the 90 percent coolant channel blockage threshold. For the limiting fuel rod the maximum core assembly flow blockage is approximately 75 percent.

An evaluation was performed to equate the calculated values of K/A^2 to an equivalent flow area blockage in determining that debris deposition is more conservative than mechanical changes such as ballooning.

Test results provided in ANP-10293P, Appendix F, Section 5.6 show a large margin for K/A^2 acceptance criteria.

The revision to ANP-10293P will be 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.