ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Friday, May 29, 2009 9:45 AM
To: Getachew Tesfaye
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); GUCWA Len T (EXT); Michael Miernicki
Subject: Response to U.S. EPR Design Certification Application RAI No. 191, FSARCh. 15, Supplement 1
Attachments: RAI 191 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a response to 1 of the 7 questions of RAI No. 191 on April 9, 2009.

The response file, "RAI 191 Supplement 1 Response US EPR DC.pdf" provides partial responses to the 6 remaining questions.

The following table indicates the respective pages in the response document, "RAI 191 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 191—15.06.05-43	2	2
RAI 191—15.06.05-44	3	3
RAI 191—15.06.05-45	4	4
RAI 191—15.06.05-46	5	6
RAI 191—15.06.05-47	7	7
RAI 191—15.06.05-49	8	8

A complete answer is not provided for 6 of the 7 questions of RAI No. 191. The schedule for providing technically correct and complete responses to the remaining questions has been changed and is provided below.

Question #	Response Date
RAI 191—15.06.05-43	December 18, 2009
RAI 191—15.06.05-44	December 18, 2009
RAI 191—15.06.05-45	December 18, 2009
RAI 191—15.06.05-46	December 18, 2009
RAI 191—15.06.05-47	December 18, 2009
RAI 191—15.06.05-49	December 18, 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: DUNCAN Leslie E (AREVA NP INC)
Sent: Thursday, April 09, 2009 11:29 AM
To: Getachew Tesfaye
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 191 (2228), FSARCh. 15

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 191 Response US EPR DC.pdf" provides a technically correct and complete response to 1 of the 7 questions.

The following table indicates the respective pages in the response document, "RAI 191 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 191—15.06.05-43	2	2
RAI 191—15.06.05-44	3	3
RAI 191—15.06.05-45	4	4
RAI 191—15.06.05-46	5	5
RAI 191—15.06.05-47	6	6
RAI 191—15.06.05-48	7	10
RAI 191—15.06.05-49	11	11

A complete answer is not provided for 6 of the 7 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 191—15.06.05-43	May 29, 2009
RAI 191—15.06.05-44	May 29, 2009
RAI 191—15.06.05-45	May 29, 2009
RAI 191—15.06.05-46	May 29, 2009
RAI 191—15.06.05-47	May 29, 2009
RAI 191—15.06.05-49	May 29, 2009

Sincerely,

(on the behalf of Ronda Pederson)

Les Duncan
Licensing Engineer
AREVA NP Inc.
An AREVA and Siemens Company
Tel: (434) 832-2849
Leslie.Duncan@areva.com

From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, March 11, 2009 6:24 PM
To: ZZ-DL-A-USEPR-DL

Cc: Fred Forsaty; Shanlai Lu; Joseph Donoghue; Jason Carneal; Joseph Colaccino; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 191 (2228), FSARCh. 15

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on February 20, 2009, and discussed with your staff on March 3, 2009. The staff took action to review previous RAIs to determine if some of the draft questions were previously asked as suggested by AREVA during that discussion. The staff reviewed the references AREVA provided and concluded that the new RAIs were not covered by previous RAIs. Therefore, with minor modifications to draft RAI Questions 15.06.05-43, 15.06.05-44, 15.06.05-45, and 15.06.05-46, for clarification, the draft RAIs are issued as final. 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: 533

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Subject: Response to U.S. EPR Design Certification Application RAI No. 191, FSARCh. 15, Supplement 1
Sent Date: 5/29/2009 9:45:03 AM
Received Date: 5/29/2009 9:45:05 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
"GUCWA Len T (EXT)" <Len.Gucwa.ext@areva.com>
Tracking Status: None
"Michael Miernicki" <Michael.Miernicki@nrc.gov>
Tracking Status: None
"Getachew Tesfaye" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

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MESSAGE	4706	5/29/2009 9:45:05 AM
RAI 191 Supplement 1 Response US EPR DC.pdf	82871	

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

Response to

Request for Additional Information No. 191, Supplement 1

03/11/2009

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: Ch 15

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

Question 15.06.05-43:

Addressing Regulatory Position 1.1.1.12 in Regulatory Guide RG 1.82 Revision 3 on buildup of debris at downstream flow restriction locations including coolant channel openings in the core fuel assemblies and fuel assembly inlet debris screens, Appendix A of ANP-10293 Revision 0, in its conformance assessment states that "The impact of debris clogging downstream of the ECC sump screens on … fuel assemblies is expected to be negligible. An evaluation to support this conclusion is part of the U.S. EPR design process. This issue will be further assessed based on the results of industry consensus regarding confirmation of downstream effects."

Provide the results from such further assessments and the resolution for the U.S. EPR that considers such additional results of industry consensus regarding confirmation of downstream effects on fuel assemblies, including inlet nozzle, grid spacers, and fuel rods, in accordance with Regulatory Position 1.1.1.12 in Regulatory Guide RG 1.82 Revision 3. In this regard, provide the basis for the resolution and describe the impact of additional experimental and analytical work, including such that was carried out in addressing the resolution of GSI-191 and made available after the publication of Generic Letter GL-2004-02 on September 13, 2004, which is the most recently dated reference considered in ANP-10293 Revision 0, on the U.S. EPR FSAR and ANP-10293, if any.

Response to Question 15.06.05-43:

A complete response to this question will be provided by December 18, 2009.

Blockage at the core inlet and within the core due to debris ingestion into the reactor coolant system is part of the evaluation of downstream effects on fuel described in the response to RAI 15.06.05-46.

Question 15.06.05-44:

Addressing Regulatory Position 1.1.2.3 in Regulatory Guide RG 1.82 Revision 3 on chemical reaction effects, Appendix A of ANP-10293 Revision 0, in its conformance assessment states that "The need to address the potential impact of chemical reaction with the debris sources, filter differential pressure and other downstream effects is recognized by the U.S. EPR design program. This issue will be further assessed based on the results of industry consensus regarding confirmation of downstream effects."

Provide the results from such further assessments and the resolution for the U.S. EPR that considers additional results of industry consensus regarding confirmation of downstream effects on fuel assemblies, including inlet nozzle, grid spacers, and fuel rods in accordance with Regulatory Position 1.1.2.3 in Regulatory Guide RG 1.82 Revision 3. In this respect, provide the basis for the resolution and describe the impact of additional experimental and analytical work, including such that was carried out in addressing the resolution of GSI-191 and made available after the publication of Generic Letter GL-2004-02 on September 13, 2004, which is the most recently dated reference considered in ANP-10293 Revision 0, on the U.S. EPR FSAR and ANP-10293, if any.

Response to Question 15.06.05-44:

A complete response to this question will be provided by December 18, 2009.

Blockage at the core inlet and within the core due to debris ingestion into the reactor coolant system is part of the evaluation of downstream effects on fuel described in the response to RAI 15.06.05-46.

Question 15.06.05-45:

In response to requested information item 2.(d)(v) in Generic Letter GL-2004-02, Appendix B of ANP-10293 Revision 0 states that "The impact of debris clogging downstream of the ECCS sump screens on … fuel assemblies is expected to be negligible. An evaluation to support this conclusion is part of the U.S. EPR design process. This issue is to be addressed based on the results of industry consensus regarding confirmation of downstream effects."

Provide the results from additional assessments and the resolution for the U.S. EPR based on the results of such industry consensus regarding confirmation of downstream effects on fuel assemblies, including inlet nozzle, grid spacers, and fuel rods related to requested information item 2.(d)(v) in Generic Letter GL-2004-02. In this regard, provide the basis for the resolution and explain the impact on the U.S. EPR FSAR and ANP-10293, if any.

Response to Question 15.06.05-45:

A complete response to this question will be provided by December 18, 2009.

Blockage at the core inlet and within the core due to debris ingestion into the reactor coolant system is part of the evaluation of downstream effects on fuel described in the response to RAI 15.06.05-46.

Question 15.06.05-46:

Provide quantification of all types of debris generating/representing materials initially present in the U.S. EPR containment building along with sufficient evidence that the amounts assumed account in a conservative manner for any associated data uncertainties. Based on the amount and location of the identified debris generating/representing materials in the containment, determine and provide explanation of the critical LOCA conditions that will result in the maximum possible negative impact on the long-term coolability of the fuel assemblies. In particular, provide the amounts of generated debris of all possible types under the critical LOCA conditions determined, taking into account latent debris as well, and explain how the debris amounts, types, characteristics and flow conditions, along with limiting strainer response assumptions, lead to the most limiting downstream effects on the fuel. In assessing those effects, consider the impact of specific design characteristics and features of the U.S. EPR vessel and fuel assembly components, including inlet nozzle, grid spacers and fuel rods on the fluid flow and debris behavior in accounting for possible participating phenomena like chemical plate-out on fuel rod surfaces, blocking of core plates or fuel assembly inlet nozzles due to thin-bed or large fiber beds formation, localized hot spots formation due to fibers hanging up on fuel assembly grid spacer straps.

Response to Question 15.06.05-46:

A complete response to this question will be provided by December 18, 2009.

Generic Safety Issue 191 (GSI-191) addresses a variety of concerns associated with the operation of the emergency core cooling system (ECCS). These concerns include debris generation associated with a postulated high-energy line break inside containment, debris transport to the in-containment refueling water storage tank (IRWST), and the effects of ingesting debris through the sump screens on components downstream of the screens, including inside the reactor vessel. In addition to debris resulting from the action of the jet from the postulated pipe break, there is also the potential to generate chemical products (precipitates) from the reaction of containment materials with the reactor coolant fluid, coolant additives, and sump pH control additives that may also be transported to and through the sump screens.

AREVA NP is analyzing debris generation to determine the composition and maximum amount of debris that can reach the sump screens. This effort is being done in accordance with the methods defined in NEI 04-07 (Reference 1) as approved by the NRC for operating plants (Reference 2), taking into consideration design differences between currently operating pressurized water reactors (PWR) and the U.S. EPR. The results of this effort will define the total amount of debris generated for the worst-case break location.

Once the debris source term is defined, the effect of the debris that may pass through the sump screens on fuel coolability will be assessed. AREVA NP will perform the assessment in a similar manner as the current operating plants. The effect on post-loss of coolant accident long-term core cooling (LTCC) will be addressed for the following:

1. Debris accumulation at the core inlet.
2. Debris accumulation at the intermediate spacer grids.
3. Debris adherence to heated fuel rods.

4. Chemical effects in the reactor vessel and core region.
5. Debris introduced to the reactor coolant system (RCS) during hot leg injection.

The evaluation for the U.S. EPR will follow the approach documented in AREVA test report, "GSI-191 FA Test Report for PWROG," (Reference 3). The proposed acceptance criteria defined in Reference 3 apply to the U.S. EPR design and will be used to define acceptable LTCC for the U.S. EPR. The debris that reaches the RCS and fuel will be determined conservatively.

The U.S. EPR is expected to have a small fiber debris source term due to the extensive use of reflective metal insulation. If the total amount of fiber generated by the most limiting break is less than the acceptable amount of fiber in the reactor vessel and core as defined in Reference 3, then the fiber generated will be assumed to reach the core. If the total amount of fiber generated exceeds the acceptance limit in Reference 3, then some credit must be taken for debris filtration at the sump screens and testing will be performed to determine the amount of fiber that actually reaches the core. This testing will be designed to maximize the bypass debris. The amount of chemical precipitates will be determined using methods consistent with industry standards and prototypical of the U.S EPR design.

Reference 3 is currently under NRC review as part of industry efforts to resolve GSI-191 issues. Upon completion of NRC's review, any conditions and limitations imposed through NRC's generic safety evaluation will be addressed for the U.S. EPR. Therefore, the evaluation of the U.S. EPR fuel effects is expected to be complete in the first quarter of 2010.

The GSI-191 testing and evaluation documents for the U.S. EPR will be available for on-site inspection upon completion. Schedules for the testing and document completion will be communicated to the NRC staff during future meetings and audits.

References for Question 15.06.05-46:

1. NEI 04-07, Rev. 0, Volume 1, "Pressurized Water Reactor Sump Performance Evaluation Methodology," December 2004.
2. NEI 04-07, Rev. 0, Volume 2, "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02," December 2004.
3. "GSI-191 FA Test Report for PWROG," AREVA NP Inc. Proprietary, March 20, 2009 (ADAMS Accession No. ML090900245).

Question 15.06.05-47:

Provide a conservative estimate for the potential core inlet flow area blockage fraction in the U.S. EPR and assess the core cooling conditions versus the minimum core boil-off flow rate requirements. In assessing the core inlet flow area blockage, account for downstream effects associated with debris particulates, fibers and chemical reaction by-products entering into the reactor coolant system under the most limiting post-LOCA conditions in terms of debris ingress. Discus associated possible effects from potential flow blockages and formation of flow restriction patterns within the core region itself, if any.

Response to Question 15.06.05-47:

A complete response to this question will be provided by December 18, 2009.

Blockage at the core inlet and within the core due to debris ingestion into the reactor coolant system is part of the evaluation of downstream effects on fuel described in the response to RAI 15.06.05-46.

Question 15.06.05-49:

Demonstrate that the solids concentration in the downstream water of 10 ppm at 30 minutes into the test, as reported in ANP-10293 Revision 0, is representative for the worst U.S. EPR post-LOCA conditions in terms of downstream effects on the fuel in the core. Demonstrate how this experimental evidence can be scaled and applied to evaluate potential downstream effects considering the presence of debris particulates, fibers and chemical reaction by-products in the U.S. EPR reactor coolant system under post-LOCA conditions that lead to most limiting conditions in terms of downstream effects on the fuel. Explain why the independent review of the ANP-10293 Revision 0 did not address reported observations on downstream effects.

Response to Question 15.06.05-49:

A complete response to this question will be provided by December 18, 2009.

Blockage at the core inlet and within the core due to debris ingestion into the reactor coolant system is part of the evaluation of downstream effects on fuel described in the response to RAI 15.06.05-46.

Downstream effects were not within the scope of ANP-10293, Revision 0. The 10 ppm at 30 minutes was a measurement obtained during one test when determining strainer pressure drop. The U.S. EPR is expected to have a small fiber debris source term due to the extensive use of reflective metal insulation. If the total amount of fiber generated by the most limiting break is less than the acceptable amount of fiber in the reactor vessel and core as defined in Reference 1, then the fiber generated will be assumed to reach the core. If this conservative approach is not successful, then testing will be performed to determine the amount of fiber that actually reaches the core. This testing will be designed to maximize the bypass debris.

The independent review of ANP-10293 Revision 0 was based on test results of the Generic Safety Issue 191 (GSI-191) mitigation features available as of the date of the report (February 7, 2008).

References for Question 15.06.05-49:

1. "GSI-191 FA Test Report for PWROG," AREVA NP Inc. Proprietary, March 20, 2009 (ADAMS Accession No. ML090900245).