

ArevaEPRDCPEm Resource

From: WELLS Russell (AREVA) [Russell.Wells@areva.com]
Sent: Monday, April 11, 2011 2:43 PM
To: Tesfaye, Getachew
Cc: Miernicki, Michael; HOLM Jerald (EXTERNAL AREVA); PATTON Jeff (AREVA); TUCKER Jeff (AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); HALLINGER Pat (EXTERNAL AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); WILLIFORD Dennis (AREVA)
Subject: Draft Response to U.S. EPR Design Certification Application RAI No. 367, FSARCh. 4 OPEN ITEM, Supplement 6, Question 04.06-14
Attachments: RAI 367 Response US EPR DC - DRAFT.pdf

Getachew,

Attached is a draft response for RAI No. 367, Question 04.06-14 as shown below in advance of the May 20, 2011 final date.

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

Thanks,

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: Tuesday, March 29, 2011 10:20 AM
To: 'Tesfaye, Getachew'
Cc: HOLM Jerald (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. 367, FSARCh. 4 OPEN ITEM, Supplement 6

Getachew,

AREVA NP provided a revised schedule for responding to RAI 367 in emails on June 18, 2010, July 30, 2010, September 28, 2010, November 19, 2010, and January 17, 2011. The schedule for the response to RAI 367 is being revised to allow additional time for AREVA NP to interact with the NRC.

AREVA NP's schedule for providing a technically correct and complete response to the question in RAI 367 is provided below.

Question #	Response Date
RAI 367 — 04.06-14	May 20, 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*](mailto:Russell.Wells@Areva.com)

From: BRYAN Martin (External RS/NB)

Sent: Monday, January 17, 2011 5:58 PM

To: 'Tefsaye, Getachew'

Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); HOLM Jerald (External RS/NB)

Subject: Response to U.S. EPR Design Certification Application RAI No. 367, FSARCh. 4 OPEN ITEM, Supplement 5

Getachew,

AREVA NP provided a draft response to RAI 367 to the NRC on May 17, 2010. AREVA NP provided a revised schedule for responding to RAI 367 in emails on June 18, 2010, July 30, 2010, September 28, 2010, and November 19, 2010. Additional time is needed to address NRC comments, that have now been received, and to continue interacting with the NRC on the response.

AREVA NP's schedule for providing a technically correct and complete response to the question in RAI 367 is provided below.

Question #	Response Date
RAI 367 — 04.06-14	March 31, 2011

Sincerely,

Martin (Marty) C. Bryan

U.S. EPR Design Certification Licensing Manager

AREVA NP Inc.

Tel: (434) 832-3016

702 561-3528 cell

Martin.Bryan.ext@areva.com

From: BRYAN Martin (External RS/NB)

Sent: Friday, November 19, 2010 9:55 AM

To: 'Tesfaye, Getachew'

Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); HOLM Jerald (External RS/NB); 'Miernicki, Michael'

Subject: Response to U.S. EPR Design Certification Application RAI No. 367, FSARCh. 4 OPEN ITEM, Supplement 4

Getachew,

AREVA NP provided a draft response to RAI 367 to the NRC on May 17, 2010. AREVA NP provided a revised schedule for responding to RAI 367 in emails on June 18, 2010, July 30, 2010 and September 28, 2010. The schedule is being revised to reflect time needed to address additional anticipated feedback from the NRC.

AREVA NP's schedule for providing a technically correct and complete response to the question in RAI 367 is provided below.

Question #	Response Date
RAI 367 — 04.06-14	January 18, 2011

Sincerely,

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

From: BRYAN Martin (External RS/NB)

Sent: Tuesday, September 28, 2010 7:15 AM

To: 'Tesfaye, Getachew'

Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); HOLM Jerald (External RS/NB)

Subject: Response to U.S. EPR Design Certification Application RAI No. 367, FSARCh. 4 OPEN ITEM, Supplement 3

Getachew,

AREVA NP provided a schedule for a technically correct and complete response on April 30, 2010. The schedule was revised in Supplement 1 on June 18, 2010 and in Supplement 2 on July 30, 2010. To allow additional time to interact with the NRC, the schedule is being revised.

AREVA NP's schedule for providing a technically correct and complete response to the question in RAI 367 is provided below.

Question #	Response Date
RAI 367 — 04.06-14	November 19, 2010

Sincerely,

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

From: BRYAN Martin (EXT)
Sent: Friday, July 30, 2010 9:37 AM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); HOLM Jerald S (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 367, FSARCh. 4 OPEN ITEM, Supplement 2

Getachew,

AREVA NP provided a draft response to RAI 367 to the NRC on May 17, 2010. AREVA NP provided a revised schedule for responding to RAI 367 in an email on June 18, 2010. AREVA has not yet received feedback on the draft response and thus another revised schedule is being provided.

AREVA NP's schedule for providing a technically correct and complete response to the question in RAI 367 is provided below.

Question #	Response Date
RAI 367 — 04.06-14	September 30, 2010

Sincerely,

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

From: BRYAN Martin (EXT)
Sent: Friday, June 18, 2010 2:06 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); HOLM Jerald S (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 367, FSARCh. 4 OPEN ITEM, Supplement 1

Getachew,

AREVA NP provided a schedule for responding to RAI 367 in an email on April 30, 2010. This schedule was intended to allow for discussion between the NRC and AREVA NP of the response

prior to providing it to the NRC. Further discussion is necessary and a revised schedule is being provided.

AREVA NP's schedule for providing a technically correct and complete response to the question in RAI 367 is provided below.

Question #	Response Date
RAI 367 — 04.06-14	July 30, 2010

Sincerely,

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

From: BRYAN Martin (EXT)
Sent: Friday, April 30, 2010 3:21 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); HOLM Jerald S (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 367 (4369), FSARCh. 4 OPEN ITEM

Getachew,

AREVA NP's schedule for providing a technically correct and complete response to the question in RAI 367 is provided below.

Question #	Response Date
RAI 367 — 04.06-14	June 18, 2010

Sincerely,

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

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, March 11, 2010 4:25 PM

To: ZZ-DL-A-USEPR-DL

Cc: Budzynski, John; Lu, Shanlai; Donoghue, Joseph; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource

Subject: U.S. EPR Design Certification Application RAI No. 367 (4369), FSARCh. 4 OPEN ITEM

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on February 4, 2010, and discussed with your staff on February 24, 2010, and March 4, 2010. Draft RAI Questions 04.06-14 was modified as a result of those discussions. The question in this RAI is an OPEN ITEM in the safety evaluation report for Chapter 4 for Phases 2 and 3 reviews. As such, the schedule we have established for your application assumes technically correct and complete responses prior to the start of Phase 4 review. For any RAI that cannot be answered prior to the start of Phase 4 review, it is expected that a date for receipt of this information will be provided so that the staff can assess how this information will impact the published schedule.

Thanks,

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2827

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD4104365BE7)

Subject: Draft Response to U.S. EPR Design Certification Application RAI No. 367,
FSARCh. 4 OPEN ITEM, Supplement 6, Question 04.06-14
Sent Date: 4/11/2011 2:42:45 PM
Received Date: 4/11/2011 2:42:56 PM
From: WELLS Russell (AREVA)

Created By: Russell.Wells@areva.com

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MESSAGE	9599	4/11/2011 2:42:56 PM
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Options

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

Response to

Request for Additional Information No. 367, Question 04.06-14

3/28/2010

U.S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 04.06 - Functional Design of Control Rod Drive System

Application Section: 04.06

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

DRAFT

Question 04.06-14:

OPEN ITEM:

In general terms of the U.S. EPR Tier 2 FSAR Subsections 4.4.2.9.5, 4.4.4.3, 4.4.4.5.3, 4.4.4.5.4, 4.4.6.1, 4.4.6.4, and 4.4.6.5, the applicant provides a brief description of the fixed in-core SPND neutron flux measurements in relationship to the two types of in-core trips with regard to uncertainties in the calculations, influence of power distributions, high linear power density functions, low DNBR I&C functions, and analysis of steady and transient conditions. In these subsections, the applicant refers to the topical report ANP-10287P, "In-core Trip Setpoint and Transient Methodology for the U.S. EPR Topical Report" for a more detail discussion.

However, after review of these subsections and the topical report, the staff has determined that more information is necessary to determine how the methods described in ANP-10287P will be implemented and verified in regard to instrumentation and control systems.

Therefore, the staff requests that the applicant provide a description on how the methodologies contained in ANP-10287P will be implemented and verified for the U.S. EPR design relating to instrumentation and control systems. In particular, define what will be checked and verified by COL applicants prior to the first cycle core loading and as part of reload analysis to satisfy the following approval limitations stated in the SE for ANP-10287P:

1. LIMITATION NO. 1 – MIXED CORES

Section 4.8 contains an evaluation of the applicability of the U.S. EPR setpoint methodology to mixed core configurations. The following limitation applies to the application of ANP-10287P, Revision 0:

The setpoint methodology documented in ANP-10287P, Revision 0 [1] is only acceptable to cores that consist entirely of hydraulically compatible fuel assemblies, i.e, a single package of assembly specific CHF correlation.

2. LIMITATION NO. 2-CYCLE SPECIFIC UNCERTAINTY VALUES

Since the actual uncertainties and setpoint values are not part of this review and are not available to the staff, any transient analyses taking credit for the in-core setpoint system can only be approved when actual values of these uncertainties and setpoints are conservatively applied following this methodology, or it has been demonstrated that the uncertainties can be conservatively bounded. The following limitation applies to the application of ANP-10287P, Revision 0:

Applications of the setpoint methodology documented in ANP-10287P, Revision 0 [1] must include a review of the applicable uncertainty values used to generate the setpoint values used in the analyses.

3. APPLICATION SPECIFIC ITEM PRIOR TO THE FIRST CYCLE OPERATION

The methodology to confirm that the static setpoint values provide adequate protection during transient events described in Section 9 of Topical Report ANP-10287P depends on identifying and characterizing the limiting transient. The limiting transient is defined as the event that

results in the minimum difference between uncompensated DNBR and LPD results and the SAFDLs. The following limitation applies to the application of ANP-10287P, Revision 0:

Prior to the first cycle operation, confirmatory evaluation has to be performed for every AOO using the procedure described in Section 9 of Topical Report ANP-10287P to identify the limiting transient of the plant as built. Based on the confirmatory evaluation results, analyses have to be performed for AOOs that have significant differences between the assumed input conditions and the as-built conditions, if the differences can not be conservatively bounded by the assumed uncertainty values. For the most limiting transient that relies on in-core trip for protection, the applicant shall provide for staff review the analysis results demonstrating that the uncompensated DNBR and LPD satisfies SAFDL with a 95/95 assurance.

4. APPLICATION SPECIFIC ITEM FOR RELOAD ANALYSIS

The methodology described in Section 9 of Topical Report ANP-10287P is vague on which transient events are used to confirm that the static setpoint values provide adequate protection during transient events. Therefore, the following limitation applies to the application of ANP-10287P, Revision 0:

During reload analysis, it has to be confirmed and appropriately documented using the methodology described in Section 9 of ANP-10287P that the static setpoint value provides adequate protection for at least the three most limiting AOOs identified by Item 3 above.

Response to Question 04.06-14

It is anticipated that the NRC safety evaluation for the AREVA NP Topical Report ANP-10287P will include the limitations specified in this question. Because these limitations will apply to the approved methodology defined in the topical report, the plant and cycle specific implementation of the methodology, whether performed by AREVA NP Inc. (AREVA NP) or a COL applicant, must satisfy the approved methodology. AREVA NP considers that the approved methodology consists of details defined in the body of the topical report, RAI responses incorporated into the approved version of the report, and limitations defined in the NRC safety evaluation.

U.S. EPR FSAR Tier 2, Table 1.8-2 will be revised to include a COL item in Section 15.0.0.3.9 to verify that the methodology defined in ANP-10287P is implemented. Information on the existing ITAACs, which confirm the implementation of the methodology in the system hardware, is provided.

COL Item

A COL applicant that references the U.S. EPR design certification will provide for staff review, prior to the first cycle of operation, a report that demonstrates compliance with the following items:

1. Examine fuel assembly characteristics to verify that they are hydraulically compatible based on the criterion that a single package of assembly specific critical heat flux (CHF) correlations can be used to evaluate the assembly performance.

2. Verify that uncertainties used in the setpoint analyses are appropriate for the plant and cycle being analyzed.
3. Verify that the departure from nucleate boiling ratio (DNBR) and linear power density (LPD) satisfy the specified acceptable fuel design limits (SAFDL) with a 95/95 assurance.
4. Review the U.S. EPR FSAR Tier 2 analysis results for the first cycle to confirm that the static setpoint value provides adequate protection for at least the three limiting anticipated operational occurrences (AOO).

ITAAC Information

ITAAC is provided in U.S. EPR FSAR Tier 1, Section 2.4 to verify that safety-related functions, which include low DNBR and high linear power density (HLPD) functions, are properly implemented into the protection system hardware and software. U.S. EPR FSAR Tier 1, Table 2.4.1-7, ITAAC item 4.6 verifies that setpoints for the low DNBR and HLPD functions are determined in accordance with the established and documented setpoint methodology, ANP-10287P. U.S. EPR FSAR Tier 1, Table 2.4.1-7, ITAAC item 4.14 verifies that the low DNBR and HLPD algorithms are properly implemented into software code for the targeted TXS TELEPERM hardware used in the protection system. ANP-10272P, "Software Program Manual for TELEPERM XS Safety Systems Topical Report," is the supporting document for U.S. EPR FSAR Tier 2 that explains the protection system software development process. U.S. EPR FSAR Tier 1, Table 2.4.1-7, ITAAC item 4.1 verifies that the as-built protection system generates automatic reactor trip (RT) signals when the trip limits for the low DNBR and HLPD functions are reached.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 1.8-2 and U.S. EPR FSAR Tier 2, Section 15.0.0.3.9 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

DRAFT

**Table 1.8-2—U.S. EPR Combined License Information Items
Sheet 37 of 41**

Item No.	Description	Section
14.3-2	A COL applicant that references the U.S. EPR design certification will describe the selection methodology for site-specific SSC to be included in ITAAC, if the selection methodology is different from the methodology described within the FSAR, and will also provide the selection methodology associated with emergency planning and physical security hardware.	14.3
14.3-3	A COL applicant that references the U.S. EPR design certification will identify a plan for implementing DAC. The plan will identify 1) the evaluations that will be performed for DAC, 2) the schedule for performing these evaluations, and 3) the associated design processes and information that will be available to the NRC for audit.	14.3
15.0-1	<p>A COL applicant that references the U.S. EPR design certification will provide for staff review, prior to the first cycle of operation, the analysis results demonstrating that the uncompensated DNBR and LPD satisfies the SAFDL with a 95/95 assurance in accordance with ANP-10287P. A COL applicant that references the U.S. EPR design certification will provide for staff review, prior to the first cycle of operation, a report that demonstrates compliance with the following items:</p> <ul style="list-style-type: none"> • <u>Examine fuel assembly characteristics to verify that they are hydraulically compatible based on the criterion that a single package of assembly specific critical heat flux (CHF) correlations can be used to evaluate the assembly performance.</u> • <u>Verify that uncertainties used in the setpoint analyses are appropriate for the plant and cycle being analyzed.</u> • <u>Verify that the DNBR and LPD satisfy SAFDL with a 95/95 assurance.</u> • <u>Review the U.S. EPR FSAR Tier 2 analysis results for the first cycle to confirm that the static setpoint value provides adequate protection for at least three limiting AOO.</u> 	15.0.0.3.9
16.0-1	Reviewer's Notes and brackets are used to identify information or characteristics that are plant specific or are based on preliminary design information. A COL applicant that references the U.S. EPR design certification will provide the necessary information in response to the Reviewer's Notes and replace preliminary information provided in brackets of the Technical Specifications and Technical Specification Bases with plant specific values.	16.0
17.2-1	A COL applicant that references the U.S. EPR design certification will provide the Quality Assurance Programs associated with the construction and operations phases.	17.2

04.06-14

degradation for any LCO-basis event. The uncertainties considered in the LPD LCO setpoint are similar to those of the High LPD Channel LSSS.

Potentially limiting events that are protected in part by the LPD LCO are:

- Increase in Steam Flow.
- Steam System Piping Failures Inside and Outside of Containment.
- Uncontrolled Control Rod Assembly Withdrawal from a Subcritical or Low Power Startup Condition.
- Uncontrolled Control Rod Assembly Withdrawal at Power.
- Spectrum of Rod Ejection Accidents.
- Loss-of-Coolant Accidents Resulting from Spectrum of Postulated Piping Breaks within the Reactor Coolant Pressure Boundary.

Transient Analysis with Incore Trips

The transient analysis is performed with incore trip models decoupled from the system simulation code, S-RELAP5. The incore trip models are generically referred to as the “algorithm” or separately as the Low DNB Channel algorithm and High LPD Channel algorithm. The core boundary conditions for the algorithm are generated in S-RELAP5 and power distributions are generated in the nodal neutronics code, PRISM.

The Low DNB Channel and High LPD Channel algorithms are simulated to predict times at which the incore trip setpoints are reached, and to demonstrate the adequacy of the dynamic compensation on the trips. Table 15.0-7 lists the incore trip setpoints used in the accident analyses. The methodology for confirming the dynamic compensation is described in Section 9.4 of Reference 2.

The Low DNB Channel and High LPD Channel algorithms use the following measurements:

- The reactor power distributions derived from the SPNDs, which are part of the nuclear incore instrumentation.
- The primary system pressure derived from the primary pressure sensors.
- The core flow derived from the reactor coolant pump (RCP) speed sensors and the calibrated volumetric flow from a surveillance measurement.
- The reactor inlet temperature derived from the cold leg temperature sensors.

04.06-14

A GOL applicant that references the U.S. EPR design certification will provide for staff review, prior to the first cycle of operation, the analysis results demonstrating that the

04.06-14

~~uncompensated DNBR and LPD satisfies the SAFDL with a 95/95 assurance in accordance with ANP 10287P.~~ A COL applicant that references the U.S. EPR design certification will provide, prior to the first cycle of operation, a report that demonstrates compliance with the following items:

- Examine fuel assembly characteristics to verify that they are hydraulically compatible based on the criterion that a single package of assembly specific critical heat flux (CHF) correlations can be used to evaluate the assembly performance.
- Verify that uncertainties used in the setpoint analyses are appropriate for the plant and cycle being analyzed.
- Verify that the DNBR and LPDs satisfy SAFDL with a 95/95 assurance.
- Review the U.S. EPR FSAR Tier 2 analysis results for the first cycle to confirm that the static setpoint value provides adequate protection for at least three limiting AOO.

15.0.0.3.10 Plant Design Changes

The information presented in Section 15.0 represents the current U.S. EPR design. Some of the analyses presented in this section used slightly different values. In these cases the differences have been evaluated and found to have a negligible or conservative impact on the results and conclusions.

15.0.1 Radiological Consequence Analysis

This section is not applicable to new plants. The radiological consequences analyses are addressed in Section 15.0.3.

15.0.2 Computer Codes Used in Analysis

A summary of each principal computer code used in the accident analyses is presented in the following subsections. Additionally, Table 15.0-6 lists the code or codes used for each postulated event.

15.0.2.1 PRISM

The PRISM code is described in Section 4.3.3.

15.0.2.2 NEMO-K

The NEMO-K code is described in Section 4.3.3.

15.0.2.3 LYNXT

The LYNXT sub-channel thermal-hydraulic code is described in Section 4.4.