

## ArevaEPRDCPEm Resource

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**From:** BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]  
**Sent:** Thursday, May 20, 2010 3:37 PM  
**To:** Tesfaye, Getachew  
**Cc:** DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 233, FSAR Ch 6, Supplement 4  
**Attachments:** RAI 233 Sup4 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to portions of 2 of the 4 questions of RAI No. 233 on July 10, 2009. Responses to portions of the 2 remaining questions were provided by AREVA NP on September 1, 2009. AREVA NP submitted Supplement 2 to the response on December 18, 2009 to provide a revised response schedule. AREVA NP submitted Supplement 3 to the response on April 22, 2010 to provide a revised response schedule.

The attached file, "RAI 233 Supplement 4 Response US EPR DC.pdf," provides a technically correct and complete response to the 2 remaining questions.

The following table indicates the respective pages in the response document, "RAI 233 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 233 — 06.02.02-29	2	3
RAI 233 — 06.02.02-30	4	6

This concludes the formal AREVA NP response to RAI 233, and there are no questions from this RAI for which AREVA NP has not provided responses.

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](mailto:Martin.Bryan.ext@areva.com)

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**From:** BRYAN Martin (EXT)  
**Sent:** Thursday, April 22, 2010 6:18 PM  
**To:** 'Getachew.Tesfaye@nrc.gov'  
**Cc:** DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); GUCWA Len T (EXT)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 233, FSAR Ch 6, Supplement 3

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to portions of 2 of the 4 questions of RAI No. 233 on July 10, 2009. Responses to portions of the 2 remaining questions were provided by AREVA NP on September 1,

2009. AREVA NP submitted Supplement 2 to the response on December 18, 2009 to provide a revised response schedule.

Responses to the remaining RAI 233 questions are dependent upon the results of ongoing GSI-191 evaluations for demonstrating sump strainer performance. Because of these ongoing activities, AREVA NP is not providing a response at this time.

The schedule for providing technically correct and complete responses to the remaining 2 questions has been revised and is provided below:

Question #	Response Date
RAI 233 — 06.02.02-29	May 20, 2010
RAI 233 — 06.02.02-30	May 20, 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](mailto:Martin.Bryan.ext@areva.com)

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**From:** Pederson Ronda M (AREVA NP INC)  
**Sent:** Friday, December 18, 2009 3:27 PM  
**To:** 'Tefaye, Getachew'  
**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); GUCWA Len T (EXT)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 233, FSAR Ch 6, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to portions of 2 of the 4 questions of RAI No. 233 on July 10, 2009. Responses to portions of the 2 remaining questions were provided by AREVA NP on September 1, 2009.

Responses to the remaining RAI 233 questions are dependent upon the results of ongoing GSI-191 head loss testing, which will demonstrate sump strainer performance. Because additional testing is planned, AREVA NP is not providing a response at this time.

The schedule for providing technically correct and complete responses to the remaining 2 questions has been revised and is provided below:

Question #	Response Date
RAI 233 — 06.02.02-29	April 22, 2010
RAI 233 — 06.02.02-30	April 22, 2010

Sincerely,

*Ronda Pederson*  
[ronda.pederson@areva.com](mailto: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

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**From:** WELLS Russell D (AREVA NP INC)  
**Sent:** Tuesday, September 01, 2009 10:44 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. 233, FSAR Ch 6, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to portions of 2 of the 4 questions of RAI No. 233 on July 10, 2009. The attached file, "RAI 233 Supplement 1 Response US EPR DC.pdf" provides technically correct responses to portions of 2 of the remaining 4 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 233 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 233 — 06.05.01-1	2	4
RAI 233 — 06.05.03-1	5	5

The schedule for providing technically correct and complete responses to the remaining 2 questions is unchanged and is provided below:

Question #	Response Date
RAI 233 — 06.02.02-29	December 18, 2009
RAI 233 — 06.02.02-30	December 18, 2009

Sincerely,

(Russ Wells on behalf of)

*Ronda Pederson*

[ronda.pederson@areva.com](mailto:ronda.pederson@areva.com)

Licensing Manager, U.S. EPR Design Certification  
New Plants Deployment

**AREVA NP, Inc.**

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**From:** Pederson Ronda M (AREVA NP INC)  
**Sent:** Friday, July 10, 2009 9:54 AM  
**To:** 'Tesfaye, Getachew'

**Cc:** BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); GUCWA Len T (EXT)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 233, FSAR Ch. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 233 Response US EPR DC.pdf" provides responses to portions of 2 of the 4 questions.

The following table indicates the respective pages in the response document, "RAI 233 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 233 — 06.02.02-29	2	2
RAI 233 — 06.02.02-30	3	5
RAI 233 — 06.05.01-1	6	7
RAI 233 — 06.05.03-1	8	8

A complete answer is not provided for the 4 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 233 — 06.02.02-29	December 18, 2009
RAI 233 — 06.02.02-30	December 18, 2009
RAI 233 — 06.05.01-1 (Parts 2, 4, and 5)	September 3, 2009
RAI 233 — 06.05.03-1 (Part d)	September 3, 2009

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto:ronda.pederson@areva.com)

Licensing Manager, U.S. EPR Design Certification

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**From:** Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]

**Sent:** Friday, June 12, 2009 5:18 PM

**To:** ZZ-DL-A-USEPR-DL

**Cc:** Ashley, Clinton; ODriscoll, James; Jackson, Christopher; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource

**Subject:** U.S. EPR Design Certification Application RAI No. 233 (2857, 2872,2873), FSAR Ch. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on May 19, 2009, and on June 12, 2009, 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. Per your request, we support future interaction to give you an opportunity to clarify your design regarding Question 06.05.03-1 part d . The schedule we have

established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAls. For any RAls 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:** 1433

**Mail Envelope Properties** (BC417D9255991046A37DD56CF597DB7106342DA4)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 233, FSAR Ch  
6, Supplement 4  
**Sent Date:** 5/20/2010 3:37:13 PM  
**Received Date:** 5/20/2010 3:37:16 PM  
**From:** BRYAN Martin (EXT)

**Created By:** Martin.Bryan.ext@areva.com

**Recipients:**

"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>

Tracking Status: None

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Tracking Status: None

"GUCWA Len T (EXT)" <Len.Gucwa.ext@areva.com>

Tracking Status: None

"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>

Tracking Status: None

**Post Office:** AUSLYNCMX02.adom.ad.corp

Files	Size	Date & Time
MESSAGE	8596	5/20/2010 3:37:16 PM
RAI 233 Sup4 Response US EPR DC.pdf		80317

**Options**

**Priority:** Standard

**Return Notification:** No

**Reply Requested:** No

**Sensitivity:** Normal

**Expiration Date:**

**Recipients Received:**

**Response to**  
**Request for Additional Information No. 233, Supplement 4**

**6/12/2009**

**U. S. EPR Standard Design Certification**  
**AREVA NP Inc.**

**Docket No. 52-020**

**SRP Section: 06.02.02 - Containment Heat Removal Systems**

**SRP Section: 06.05.01 - ESF Atmosphere Cleanup Systems**

**SRP Section: 06.05.03 - Fission Product Control Systems and Structures**

**Application Section: FSAR Ch. 6**

**QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects)**  
**(SPCV)**

**Question 06.02.02-29:**

This question is a follow-up question to RAI 111, question 06.02.02-8. The design of the sumps and the protective strainer assemblies is a critical element in ensuring long-term recirculation cooling capability. Regulatory Guide 1.82, Revision 3, as modified and supplemented for PWRs by the Nuclear Energy Institute Guidance Report (NEI GR 04-07) and the NRC safety evaluation (SE) provide guidance for PWR debris evaluations. In addition, guidance exists for head loss testing, coatings and chemical effects. Responses to RAI 111, question 06.02.02-8 were discussed during an audit at the AREVA Twinbrook office on April 22 and 23, 2009, and in two subsequent conference calls. In several cases, the responses appear incomplete and/or did not appear to be in full accord with regulatory guidance (SE & NEI 04-07 and other guidance) and insufficient justification provided to address an alternative. Also, some RAI responses contained information that corrected typographical errors in documents that are incorporated by reference (IBR) into the FSAR or contained design basis information important to a safety evaluation but lacked a commitment to change these documents. Therefore provide additional information in the following areas previously identified in RAI 111 question 06.02.02-8 [also identified as eRAI 1446 Question 5154]:

- a. Break Selection - B1, B2
- b. Debris Generation/ZOI - C1, C2, C4, C6
- c. Debris Characteristics - D1, D2, D3, D4, D5
- d. Latent Debris - E1, E2, E3
- e. Head Loss - H1, H3
- f. Upstream Effects - J4, J6
- g. General Items - K1, K2, K3, K9, K14, K16

(Note, as stated previously, these items were discussed at length in the audit and conference calls and only the item number is listed here.)

**Response to Question 06.02.02-29:**

Question 06.02.02-29 requests additional information regarding information provided in the response to RAI-111, Question 06.02.02-8

The U.S. EPR GSI-191 sump strainer performance was originally based on testing and evaluations performed for another EPR project, with the exception of the debris source term. The U.S. EPR debris source term differs from that project in that the U.S. EPR design makes more extensive use of reflective metal insulation (RMI) for the large reactor coolant system piping and components.

The original basis of sump strainer performance for the U.S. EPR was documented in Technical Report ANP-10293, Rev. 0, "U.S. EPR Design Features to Address GSI-191." Subsequent to the issuance of ANP-10293, Rev. 0, AREVA NP Inc. revised the debris source term for the U.S. EPR and performed additional testing and evaluations that are now the basis for U.S. EPR sump strainer performance. A description of the revised source term, testing and results obtained are documented in ANP-10293, Rev. 1.



The GSI-191 program for the U.S. EPR is based on NRC Regulatory Guide 1.82, Revision 3, Nuclear Energy Institute Guidance Report (NEI 04-07) and the associated NRC safety evaluation.

To support the revised U.S. EPR GSI-191 program, AREVA NP Inc. has performed the following:

- developed a U.S. EPR debris evaluation
- developed a U.S. EPR chemical effects evaluation
- conducted strainer head loss performance testing

These evaluations and testing are specific to the U.S. EPR design. AREVA NP Inc. is also conducting evaluations of in-vessel downstream effects.

ANP-10293, Rev. 1 was revised to reflect changes in the development of the U.S. EPR GSI-191 program. Some previous responses to RAI-111 have been revised to reflect these changes and submitted to NRC as RAI-111, Supplement 10. In addition to RAI-111, certain revised responses have been provided in RAI-90, Supplement 2 and RAI-191, Supplement 5.

ANP-10293, Rev. 1 and the response to RAI-111, Supplement 10 provide the information requested in this question. However, many of the RAI-111 questions were based on information that has been superseded for the U.S. EPR. Because of this, some of the questions are not applicable to the current sump strainer design basis, and the responses have been revised to reference ANP-10293, Rev. 1.

**FSAR Impact:**

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

**Question 06.02.02-30:**

This is a follow-up RAI to eRAI 1446 question 5154 [also identified as RAI 111 Question 06.02.02-8].

Several responses to RAI 111 question 06.02.02-8 (multi part question) referred to head loss testing or strainer related design reports. These reports were the subject of an audit on April 22 and 23, 2009 at the AREVA Twinbrook office. One purpose of the audit was to examine and evaluate this supporting technical information and to identify information that will require docketing to support the basis of the U.S. EPR FSAR Chapter 6 review. Based upon audit materials reviewed, several RAI 111 responses are considered incomplete or not in full accord with regulatory guidance and are listed here:

Related portions of RAI 111 question 06.02.02-8 (multi part question):

Thin Bed - A1, A2

Debris Transport – F4, F8, F9

Head Loss – H1, H8, H10, H17, H23

Several of these items are incomplete due to a lack of assessment or commitment to regulatory guidance - such as NEI 04-07 & associated NRC GSI -191 SE, head loss testing, coatings and chemical effects – and/or absence of an argument demonstrating a conservative, alternative approach or methodology. Therefore, NRC staff requests that the applicant address the following:

- 1) It is unclear the extent to which the US-EPR design is assessed or committed to meet regulatory guidance from the following sources:
  - a. NEI 04-07 GR and the associated NRC SE
  - b. Chemical Effects guidance (WCAP 16530)
  - c. Other staff guidance related to head loss testing, coatings etc.

Therefore, clearly define those areas where the US-EPR conforms to the guidance or where an alternate methodology is used for each of the referenced areas listed above.

- 2) It is not clear what testing or data reports are credited to serve as the US-EPR strainer design basis. The following is a list of observations from the audit held at the AREVA Twinbrook office on April 22 and 23, 2009.
  - a. Head loss test reports provided during the audit (see Enclosure 1) were OL3 plant specific reports. (Note: Olkiluoto 3 (OL3), is a Framatome EPR being constructed for the Finnish utility TVO).
  - b. No reports were made available to affirm applicability of, or reconcile differences between, the OL3 reports and the US-EPR design.
  - c. No US-EPR design specific reports were provided for review.
  - d. US-EPR Technical Report ANP-10293 "U.S. EPR Design Features to Address GSI-191" does not provide any technical references when presenting head loss

test data, discussing head loss testing program or other technical inputs and assumptions.

Provide revisions to technical report ANP-10293 and list reports credited with establishing strainer performance, and submit all critical report(s) for staff review.

- 3) Non-prototypical debris sources and non-prototypical test conditions could result in non-conservative head losses during testing. A list of examples is given below.
- a. It appears OL3 test parameters/configuration and debris source term differ significantly from US-EPR:
    - i. Coating debris amount and sizing appears non-conservative (by order of magnitude)
    - ii. Particulate insulation (micro-porous) amount is non-conservative (33%)
    - iii. Fiber amount is very large and may be non-conservative for some tests
    - iv. Latent debris amount, types, and sizing is non-conservative
    - v. Chemical debris was not tested
    - vi. Scaled flow is non-conservative (too low)
    - vii. Weir wall height is non-conservative (too high)
  - b. The OL3 thin bed testing (V6, V7 tests in report 38-9061053-000) used a particulate to fiber ratio of 0.25/1 (max). In thin-bed testing, particulate to fiber ratios on the order of 10/1 are expected in order to effectively assess head losses due to thin beds.
  - c. The OL3 full load test (V3, V8 tests in report 38-9061053-000) identified that 50% of the debris that bypassed the basket (made it through the mesh) settled on the floor and did not make it to the strainer. Testing that takes credit for near-field settlement should either realistically or conservatively simulate the strainer upstream flow and turbulent conditions. Proper analytical evaluation of the similitude between the test tank and the actual plant condition was not provided.
  - d. OL3 report 38-9056567-000 states that all the debris is mixed in a homogeneous way. Staff guidance on sequencing the debris for thin bed testing adds 100 percent of the plant particulate load to the test flume and subsequently adds fibrous debris in incremental batches of an appropriate size. No justification for debris sequence was provided.
  - e. The testing should demonstrate that the scaling of the test - 1 to 1 for vertical and 1 to 20 for horizontal - provides conservative or prototypical results for head loss testing.
  - f. There was no sacrificial strainer area allotted to miscellaneous debris i.e. signs, labels and placards that will likely be installed in containment.

Evaluate how testing and/or documentation have addressed the above issues.

- 4) The retaining basket is a very important debris interceptor for the US-EPR defense-in-depth design strategy. Full load testing indicated a 96% filtration efficiency (4% of the debris made it through the basket mesh; also referred to as bypass). It is not clear if the baskets efficiency (or strainer efficiency) varies with debris loading. Discuss the primary

mechanisms that result in bypass and how the percentage of bypass changes with varying debris loads for both the basket and strainer.

- 5) During the audit it was determined that OL3 testing had a gradually increasing strainer head loss and lowering basket head loss (level) at test termination with steady flow. If similar data is used to justify US-EPR strainer performance, provide discussion and analysis to account for the head loss out to the mission time.

**Response to Question 06.02.02-30:**

Refer to the Response to Question 06.02.02-29 for information discussing the development of and changes to, the U.S. EPR GSI-191 program.

Question 06.02.02-30 states: "Based upon audit materials reviewed, several RAI 111 responses are considered incomplete or not in full accord with regulatory guidance and are listed here:

- Thin Bed - A1, A2
- Debris Transport – F4, F8, F9
- Head Loss – H1, H8, H10, H17, H23"

RAI-111 Supplement 10 addresses the preceding topics as addressed in the revised U.S. EPR GSI-191 program documented in ANP-10293, Rev. 1, "U.S. EPR Design Features to Address GSI-191."

AREVA NP Inc. has revised the U.S. EPR GSI-191 program with respect to applicable regulatory guidance and NEI 04-07 regarding, head loss testing, coatings and chemical effects, to derive a conservative methodology for evaluating the potential for ECCS sump strainer blockage.

During NRC audits a number of observations and comments were made, including those stated in this RAI question. Those comments and observations were based on the original U.S. EPR GSI-191 program. The revised U.S. EPR GSI-191 program conforms to the regulatory guidance and follows the methodology as defined in ANP-10293, Rev. 1.

**FSAR Impact:**

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