

## ArevaEPRDCPEm Resource

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**From:** BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]  
**Sent:** Friday, February 04, 2011 3:48 PM  
**To:** Tesfaye, Getachew  
**Cc:** DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); WELLS Russell (AREVA)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 435, FSAR Ch. 3, OPEN ITEM, Supplement 3  
**Attachments:** RAI 435 Supplement 3 Response US EPR DC.pdf

Getachew,

On October 18, 2010, AREVA NP Inc. (AREVA NP) submitted a schedule for a technically correct and complete response to the 4 questions in RAI 435. On November 29, 2010, AREVA NP submitted Supplement 1 to RAI 435 which provided a technically correct and complete response to 3 of the 4 questions. Supplement 2 to RAI 435 was submitted on January 21, 2011, which provided a revised schedule for the response to the remaining question (i.e., 03.11-37). As committed, the attached file, "RAI 435 Supplement 3 Response US EPR DC.pdf," provides a technically correct and complete response to the remaining question.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 435 Question 03.11-37.

The following table indicates the respective pages in the response document, "RAI 435 Response Supplement 3 US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 435 — 03.11-37	2	2

This concludes the formal AREVA NP response to RAI 435 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 (External RS/NB)  
**Sent:** Friday, January 21, 2011 9:14 AM  
**To:** 'Tesfaye, Getachew'  
**Cc:** DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); WELLS Russell (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 435, FSAR Ch. 3, OPEN ITEM, Supplement 2

Getachew,

On October 18, 2010, AREVA NP Inc. (AREVA NP) submitted a schedule for a technically correct and complete response to the 4 questions in RAI 435. On November 29, 2010, AREVA NP submitted Supplement 1 to RAI 435 which provided a technically correct and complete response to the 3 of the 4 questions. In order to allow time for interaction with the NRC, the schedule for a technically correct and complete FINAL response to the remaining question (03.11-37) has been revised and is provided below.

Question #	Response Date
RAI 435 — 03.11-37	February 24, 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](mailto:Martin.Bryan.ext@areva.com)

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**From:** BRYAN Martin (External RS/NB)  
**Sent:** Monday, November 29, 2010 6:01 PM  
**To:** 'Tefaye, Getachew'  
**Cc:** DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); WELLS Russell (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 435, FSAR Ch. 3, OPEN ITEM, Supplement 1

Getachew,

On October 18, 2010, AREVA NP Inc. (AREVA NP) submitted a schedule for a technically correct and complete response to the 4 questions in RAI 435. As committed, the attached file, "RAI 435 Supplement 1 Response US EPR DC.pdf," provides a technically correct and complete response to the 3 of the 4 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 435 Question 03.04.01-14.

The following table indicates the respective pages in the response document, "RAI 435 Response Supplement 1 US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 435 — 03.02.02-12	2	2
RAI 435 — 03.04.01-14	3	4
RAI 435 — 03.11-38	5	6

A complete answer is not provided for 1 of the 4 questions. In order to allow time for interaction with the NRC, the schedule for a technically correct and complete FINAL response to this question has been revised and is provided below.

Question #	Response Date
RAI 435 — 03.11-37	January 24, 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](mailto:Martin.Bryan.ext@areva.com)

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**From:** BRYAN Martin (External RS/NB)  
**Sent:** Monday, October 18, 2010 3:49 PM  
**To:** 'Tesfaye, Getachew'  
**Cc:** DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); WELLS Russell (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 435, FSAR Ch. 3, OPEN ITEM

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 435 Response US EPR DC.pdf," provides a schedule for a technically correct and complete response to the 4 questions.

The following table indicates the respective pages in the response document, "RAI 435 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 435 — 03.02.02-12	2	2
RAI 435 — 03.04.01-14	3	3
RAI 435 — 03.11-37	4	4
RAI 435 — 03.11-38	5	5

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

Question #	Response Date
RAI 435 — 03.02.02-12	November 30, 2010
RAI 435 — 03.04.01-14	November 30, 2010
RAI 435 — 03.11-37	November 30, 2010
RAI 435 — 03.11-38	November 30, 2010

Sincerely,

Martin (Marty) C. Bryan  
U.S. EPR Design Certification Licensing Manager  
AREVA NP Inc.  
Tel: (434) 832-3016  
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**From:** Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]  
**Sent:** Saturday, September 18, 2010 11:54 AM  
**To:** ZZ-DL-A-USEPR-DL

**Cc:** McNally, Richard; Dixon-Herrity, Jennifer; Li, Chang; Lee, Samuel; Strnisha, James; Terao, David; Miernicki, Michael; Patel, Jay; Colaccino, Joseph; ArevaEPRDCPEm Resource

**Subject:** U.S. EPR Design Certification Application RAI No. 435(4831,4981,4925), FSAR Ch. 3, OPEN ITEM

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 10, 2010, and discussed with your staff on September 15, 2010. No changes were made to the draft RAI 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:** 2511

**Mail Envelope Properties** (199EBB4D1CD9644D9472AA84D5D8EFA719385E)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 435, FSAR Ch. 3, OPEN ITEM, Supplement 3  
**Sent Date:** 2/4/2011 3:47:52 PM  
**Received Date:** 2/4/2011 3:49:47 PM  
**From:** BRYAN Martin (EXTERNAL AREVA)

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

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<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	7119	2/4/2011 3:49:47 PM
RAI 435 Supplement 3 Response US EPR DC.pdf		120477

**Options**

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

**Response to**

**Request for Additional Information No. 435(4831, 4981, 4925), Revision 1,  
Supplement 3**

**9/17/2010**

**U.S. EPR Standard Design Certification**

**AREVA NP Inc.**

**Docket No. 52-020**

**SRP Section: 03.02.02 - System Quality Group Classification**

**SRP Section: 03.04.01 - Internal Flood Protection for Onsite Equipment Failures**

**SRP Section: 03.11 - Environmental Qualification of Mechanical and Electrical  
Equipment**

**Application Section: 3.2.2**

**QUESTIONS for Engineering Mechanics Branch 2 (ESBWR/ABWR Projects)  
(EMB2)**

**QUESTIONS for Balance of Plant Branch 2 (ESBWR/ABWR) (SBPB)**

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

**Question 03.11-37:****Potential OPEN ITEM**

In response to RAI 326, Question 3.11-24, dated March 18, 2010, the applicant stated in Section 3.11.2.2 that environmental qualification of mechanical equipment located in harsh environments shall be demonstrated by appropriate testing and analyses. In response to RAI 96, Question 3.11-4, dated September 16, 2009, the applicant stated in Section 3.11.2.2.5 that during the procurement process, environmental effects of non-metallic components of safety-related mechanical equipment located in harsh environment areas are evaluated using one of the following methods: experience data, analysis, or testing. NRC staff does not consider these proposed FSAR sections to adequately describe the qualification methodology for nonmetallic parts in mechanical components in harsh environments. In Regulatory Guide 1.100, Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plant," NRC endorses ASME QME-1-2007 including Appendix QR-B, "Guide for Qualification of Nonmetallic Parts." Appendix QR-B describes a staff approved methodology for qualification of nonmetallic parts. NRC requests AREVA to discuss the extent to which it plans to meet ASME QME-1-2007, Appendix QR-B for the qualification of nonmetallic parts in mechanical equipment in the applicable 3.11 sections of the FSAR or explain how its methods provides an acceptable alternative to ASME QME-1-2007.

**Response to Question 03.11-37:**

AREVA NP's conformance with ASME QME-1-2007, including Appendix QR-B, was addressed in the Response to RAI 381, Supplement 3, Question 03.09.06-15. Specifically, guidance on ASME QME-1-2007, including Appendix QR-B, was included in U.S. EPR FSAR Tier 2, Section 3.10.2. U.S. EPR FSAR Tier 2, Section 3.11.2.2.5 will be revised to add a reference to ASME QME-1-2007, Appendix QR-B and to change the term "accident environments" to "postulated service conditions." U.S. EPR FSAR Tier 2, Section 3.10.2 will also be revised to clarify the utilization of ASME QME-1-2007, Appendix QR-B. Additionally, based on discussions with the NRC, the following changes will also be made to the U.S. EPR FSAR:

- U.S. EPR FSAR Tier 2, Section 3.11.2.2 will be revised to delete information pertaining to the qualification of mechanical equipment that is no longer needed due to the addition of ASME QME-1-2007, Appendix QR-B.
- The title of U.S. EPR FSAR Tier 2, Appendix 3D.6.2.3 will be revised to change "Analysis" to "Qualification," and the term "used in an item equivalency evaluation" will be deleted from this section.

**FSAR Impact:**

U.S. EPR FSAR Tier 2, Section 3.10.2, Section 3.11.2.2, and Appendix 3D will be revised as described in the response and indicated on the enclosed markup.

# U.S. EPR Final Safety Analysis Report Markups

As noted in Section 3.10.1.1, QME-1-2007 is used for the seismic qualification of active mechanical equipment with the following clarifications:

Non-mandatory Appendix QR-A, “Seismic Qualification of Active Mechanical Equipment.”

Non-mandatory Appendix QR-A is not utilized because seismic qualification is in accordance with IEEE 344-2004, which is consistent with QME-1-2007, Sections QV-7450(b), QR-A7100, QR-A7200, and QR-A7300. Additionally, Section 10.2, Earthquake Experience Data, QR-A7400 and QR-A7500, is not utilized by AREVA NP.

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Non-mandatory Appendix QR-B, “Guide for Qualification of Nonmetallic Parts.” ~~Qualification of non-metallic parts is consistent with non-mandatory Appendix QR-B as described in Section 3.11.2.2.5~~ is utilized for the qualification of non-metallic parts.

Non-mandatory Appendices to Section QDR, “Qualification of Dynamic Restraints.”

The provisions for the design and qualification of snubbers, regarding Section Appendix QDR and non-mandatory Appendices QDR-A, QDR-B, and QDR-C, are provided in Section 3.9.3, Section 3.9.6.4, and Reference 3, Section 6.6. As noted in Section 3.9.6.4, snubbers in safety-related systems include provisions to allow access for IST program activities.

Non-mandatory Appendices to Section QP, “Qualification of Active Pump Assemblies.”

AREVA NP is not utilizing non-mandatory Appendices QP-A through QP-E. Pump and motor assemblies are designed and qualified in accordance with applicable standards (e.g., ASME B&PV Code, QME-1, ASME B16, IEEE 323, IEEE 334, IEEE 344, RG 1.84, ASME NQA-1).

Appendices to Section QV, “Functional Qualification Requirements for Active Valve Assemblies for Nuclear Power Plants.”

- Mandatory Appendix QV-I, “Qualification Specification for Active Valves,” was used in the development of valve specifications.
- Non-mandatory Appendix QV-A, “Functional Specification for Active Valves for Nuclear Power Plants,” is used as guidance in the development of valve specifications to demonstrate that lessons learned from industry experience are included in the specifications.
- The definition of “valve assembly” in Section QV-4000, “Definitions,” refers to power operated valves. NRC considers the power actuators for valve assemblies to include all types of power actuators, such as motor, pneumatic, hydraulic, solenoid, and other drivers. The guidance in ASME QME-1-2007 may also be used, where applicable, in the qualification of manually operated valves.

- Measures are established for the selection and review of the suitability of application of materials, parts, and equipment that are essential to safety-related functions.
- Design control measures are established for verifying the adequacy of design.
- Equipment qualification records are maintained and include the results of tests and materials analyses.

Mechanical components are qualified to perform their required functions under the appropriate environmental effects of normal, abnormal, accident, and post-accident conditions as required by GDC 4 and discussed in Appendix 3D. For mild

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environments, the area conditions do not change as a result of an accident. ~~There are no degrading environmental effects that lead to common mode failure of equipment in mild environments.~~ Equipment qualification is verification of equipment design by demonstrating functional capability under significant operational and environmental stresses, including those resulting from design basis accidents (DBAs). ~~For mechanical equipment, important service conditions (temperature, pressure, and chemical exposure) do not significantly change as a result of an accident because mechanical components are routinely exposed to the RCS fluid. However, degradation of mechanical equipment due to thermal and radiation aging is typically more severe than the possible degradation due to other environments.~~ Since most mechanical equipment interfaces with process fluid, the effect of the fluid on the environmental conditions is considered for the design and qualification of mechanical equipment.

~~For mechanical equipment, temperature and pressure during abnormal events and DBA do not significantly increase stressors because mechanical components are routinely exposed to RCS fluid.~~ Normal operation and periodic testing, in conjunction with specified maintenance and surveillance activities, ~~demonstrate~~ provide assurance that each installed item is functional and can also operate during a DBA.

For mechanical equipment located in a mild environment, acceptable environmental design is demonstrated by the design and purchase specifications for the equipment. The specifications contain a description of the functional requirements for a specific environmental zone during normal environmental conditions and anticipated operational occurrences. The maintenance and surveillance programs ~~demonstrate~~ provide assurance that the qualified status of the equipment is maintained, by performing required activities upon which the qualification is based, including those activities necessary to extend the qualified life period to the plant life period, which could involve replacement.

The operational program that supports implementation of the Maintenance Rule (10 CFR 50.65) and RG 1.160 monitors the effectiveness of maintenance at the plant, and therefore provides assurance that the material degradation related to environmental considerations established during design are maintained on a continuing basis.

under hostile process conditions. GDC 4 states, in part, that components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with postulated accidents, including loss-of-coolant accidents. Mechanical equipment is designed to comply with GDC 4 by verifying the ability of the components to perform their required safety functions when exposed to internal and external, normal and abnormal operating conditions, and when exposed to external postulated ~~accident environments~~ service conditions. The engineering design process and program evaluates both metallic and non-metallic components to meet environmental conditions (e.g., radiation, temperature, pressure) for safety related and important to safety mechanical equipment. The combination of operating temperatures and pressures are compared to the design parameters of each component to confirm and demonstrate that design limits are not exceeded. The effects of radiation are considered in the evaluations. These evaluations constitute a normal and accident environmental analysis in accordance with GDC 4. The procurement process provides confirmation that the material capabilities of the components provided by the vendor satisfy the environmental conditions described in Section 3.11.2.2.3.

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**3.11.2.2.5 Evaluating Environmental Effects on the Nonmetallic Components of the Equipment.**

For mechanical equipment, the environmental design and qualification process focuses on the materials that are sensitive to environmental effects (e.g., seals, gaskets, lubricants, fluids for hydraulic systems, diaphragms). Equipment records are maintained, and these records include the results of tests and material analyses used as part of the environmental design and qualification process for each mechanical component. Engineering design specifications are generated and used in the procurement of equipment, components, and parts that are to be qualified. Under the procurement program, compliance with GDC 4 through the evaluation of nonmetallic parts in mechanical components will be based on material evaluations. Metallic components that form a pressure boundary are considered to be qualified by the nature of their pressure retention capability as demonstrated by the application of an ASME Boiler and Pressure Vessel stamp. Nonmetallic components, such as greases, gaskets, and lubricants, are shown to be capable of performing their intended functions under ~~accident environments~~ postulated service conditions.

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Non-metallic parts in a harsh environment are qualified in accordance with QME-1-2007, Appendix QR-B, as endorsed by RG 1.100 Revision 3. See Section 3.10.2 for further discussion on QME-1-2007.

Accordingly, during the procurement process, environmental effects of non-metallic components of safety-related mechanical equipment located in harsh environment areas are evaluated using one of the following methods:

- Experience data with identical or similar equipment of non-metallics under similar conditions with a supporting analysis to show that the equipment is acceptable.
- Analysis in combination with type test data that supports the analytical assumptions and conclusions.
- Testing an identical item of equipment under identical conditions or under similar conditions with a supporting analysis to show that the equipment is acceptable.
- Testing a similar item of equipment with a supporting analysis to show that the equipment is acceptable.

Mechanical equipment is designed to have the capability of performing its design safety functions under anticipated operational occurrences and normal, accident, and post accident environment, and for the length of time for which its function is required. The component design includes service conditions, including accident conditions. Since most mechanical equipment interfaces with process fluid, the effect of the fluid on the environmental conditions (temperature, radiation, and chemical) is considered in the design and qualification.

#### 3.11.2.2.6 Maintaining Mechanical Equipment Qualification

Compliance with GDC 4 is maintained through the engineering design, procurement, maintenance, and surveillance programs. These plant programs include inspections, testing, analyses, repairs, and replacements.

For mechanical equipment, qualification is maintained through implementation of the preventive maintenance program, surveillance program, and periodic testing of mechanical equipment.

Under the maintenance program, routine monitoring of mechanical equipment is performed to identify age-related degradation of non-metallic parts. The program also verifies that the safety function of the mechanical equipment is maintained in normal, abnormal, and accident environments postulated service conditions. Similarly, the procurement, maintenance, and surveillance programs maintain the equipment in sufficient operating condition and generate necessary corrective actions. This is based on documentation that includes vendor certification, design and purchase specifications for replacement parts, and material evaluations for replacement parts.

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To verify the effectiveness of these programs to maintain compliance with GDC 4, the program data and records are reviewed periodically in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI and other inspection, in situ test and monitoring programs. This process demonstrates that the equipment has not suffered degradation, which may include the effects of thermal, radiation, and/or cyclic aging.

- The safety function(s) of the tested equipment and the subject equipment are evaluated to be the same.

### 3D.6.2.2 Substitution

Substitution of parts or materials is acceptable if a comparison or analysis of their material evaluations as described in Section 3.11.2.2.5 supports the conclusion that the equipment performance is equal to or better than the originally qualified equipment.

### 3D.6.2.3 **Analysis Qualification** of Safety-Related Mechanical Equipment

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Section 3.11.2.2 describes the qualification of mechanical equipment. Engineering design specifications are generated and used to procure equipment, components, and parts. Under the procurement program, compliance with GDC 4 through the evaluation of non-metallic parts in mechanical components is based on material

evaluations as described in Section 3.11.2.2.5 used in an item equivalency evaluation.

Table 3D-10—Mechanical Equipment Components Requiring Environmental Qualification provides a summary of the types of non-metallic or consumable parts in mechanical components that will be screened for EQ. The list of specific non-metallic components by tag number screened in the EQ program is provided in Section 3.10, Table 3.10-1—List of Seismically and Dynamically Qualified Mechanical and Electrical Equipment.

## 3D.7 Equipment Qualification Maintenance Requirements

The equipment qualification maintenance requirements serve a dual function. They identify the specific maintenance requirements for EQ, and the condition monitoring and preventive maintenance activities required based on vendor requirements and engineering judgment.

These maintenance requirements documents typically consist of the following sections:

- 1.0 Equipment Description  
Tag numbers, equipment numbers, description of function, location, manufacturer, and model number—general information for completing maintenance orders.
- 2.0 Technical References  
Reference information useful for preparing for or conducting maintenance.
- 3.0 Installation and Maintenance Requirements
  - 3.1 Installation Requirements