ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Wednesday, August 12, 2009 5:04 PM
To: Tesfaye, Getachew
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. 249, FSAR Ch 3
Attachments: RAI 249 Response US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 249 Response US EPR DC.pdf" provides a technically correct and complete response to all 7 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 249 Questions 03.11-9 and 03.11-12.

The following table indicates the respective pages in the response document, "RAI 249 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 249 — 03.11-5	2	2
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RAI 249 — 03.11-14	9	9

This concludes the formal AREVA NP response to RAI 249 and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

(Russ Wells on behalf of)

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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, July 10, 2009 8:13 PM
To: ZZ-DL-A-USEPR-DL
Cc: Kang, Peter; Jenkins, Ronaldo; Patel, Jay; Miernicki, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 249 (2968), FSARCh. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on June 18, 2009, and discussed with your staff on July 2, 2009. Draft RAI Questions 03.11-7, 03.11-10, and 03.11-13 were deleted 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: 724

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Response to

Request for Additional Information No. 249

7/10/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.11 - Environmental Qualification of Mechanical and Electrical Equipment
Application Section: 3.11

QUESTIONS for Electrical Engineering Branch (EEB)

Question 03.11-5:

ITAAC commitment 6.1 and 6.2 wording in U.S. EPR Tier 1 ITAAC tables in Sections 2.2, 2.3, 2.4, 2.6, 2.7, 2.8 and 3.5, pertinent to EQ testing, states that equipment located in a harsh environment is required to be functional “before and during design basis accidents,” while 10 CFR 50.49 (b1)(1)(i) requires the equipment to remain functional “during and following design basis events.” Justify the difference in terminology used between the ITAAC (before and during), and 10 CFR 50.49 (during and after), or make the appropriate changes to the above ITAAC tables.

Response to Question 03.11-5:

The Response to RAI 182, Supplement 2, Question 14.03-10, Part H revised the environmental qualification (EQ) ITAAC from “before and during design basis accidents” to “during and following design basis events” to be consistent with 10 CFR 50.49(b)(1).

FSAR Impact:

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

Question 03.11-6:

In IEEE Std 323-1974, margin is included in the design basis event environmental qualification test profile twice (2 test transients). Discuss how margin was applied for the U.S. EPR (Table 3D-3) for the EQ test profiles and provide justification.

Response to Question 03.11-6:

As stated in U.S. EPR FSAR, Tier 2, Section 3D.4.8:

> "The purpose of using margin in the qualification program is to account for commercial production variability, errors in establishing satisfactory performance, and errors in experimental measurements, thereby providing greater assurance that the equipment can perform under the specified service conditions. Table 3D-3, EQ Program Margin Requirements, presents the margins for various environmental parameters. The margins shown in the table are those recommended in IEEE Standard 323-1974."

U.S. EPR FSAR, Tier 2, Section 3.11.1.2 notes:

> "The environmental conditions include anticipated operational occurrences and normal, accident and post accident environments due to design basis events (DBEs). The environmental parameters (e.g. radiation, temperature, chemical spray, humidity (steam), pressure, flooding) applicable to the various environmental conditions in specific plant building and room locations are specified in Appendix 3D, Section 3D.5, and in the tables and figures provided in Appendix 3D.
>
> Service conditions are the actual environmental, physical, mechanical, electrical, and process conditions experienced by equipment during service. Plant operation includes both normal and abnormal operations. Abnormal operation occurs during plant transients, system transients, or in conjunction with certain equipment or system failures."

The U.S. EPR FSAR provides the service conditions for the U.S. EPR, which, by definition, do not include margin. However, as described in U.S. EPR FSAR, Tier 2, Section 3D.4.8, these margins are required to be added by vendors to the service conditions when conducting the qualification activities for equipment being qualified. This methodology also applies to the service condition envelopes shown in U.S. EPR FSAR, Tier 2, Figures 3D-1 through 3D-6.

FSAR Impact:

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

Question 03.11-8:

The U.S. EPR FSAR states that certain NUREG-0588 Category guidance was used to enhance the guidance provided in RG 1.89. Identify the elements of NUREG-0588, Category 1 that were used to enhance the EQ Program.

Response to Question 03.11-8:

U.S. EPR FSAR, Tier 2, Section 3.11.2.1 states, “However, certain NUREG-0588 Category I guidance may be used to enhance the guidance provided in RG 1.89,” and does not state that, “NUREG-0588 Category I guidance was used.” The environmental qualification (EQ) program for the U.S. EPR is based on compliance with 10 CFR 50.49. Therefore, AREVA NP stated in the U.S. EPR FSAR that the guidance in NUREG-0588 and RG 1.89 “may be used” to meet the requirements of 10 CFR 50.49. The use of any guidance documents will be determined and documented later in the in the procurement phase after vendors respond to AREVA NP’s specification requirements for the specific component. This NUREG-0588 guidance is not specified in the U.S. EPR FSAR and the elements of such guidance, if used, will be documented in the EQ program implementation documents.

FSAR Impact:

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

Question 03.11-9:

The equipment qualification program must consider the elements of temperature, pressure, humidity, chemical effects, radiation, aging, submergence, synergistic effects, and margin. Justify why U.S. EPR FSAR Section 3.11 does not contain any discussion of synergistic effects for electrical, mechanical, and I&C equipment.

Response to Question 03.11-9:

U.S. EPR FSAR, Tier 2, Section 3.11.1.2 will be revised to address synergistic effects.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 3.11.1.2 will be revised as described in the response and indicated on the enclosed markup.

Question 03.11-11:

Table 3D-8 (Bounding Normal EQ Radiation Dose) indicates that these values were determined based on 60 years of continuous operation and steady state operating conditions, and take into account radiation exposure. Identify what the qualified life is of the electrical and I&C equipment discussed in section 3.11.

Response to Question 03.11-11:

The mechanical and electrical equipment qualified life is 60 years, based on the design life of the plant. The qualified life is verified using methods and procedures of qualification and documentation as stated in IEEE-323. Each vendor is required to determine the qualified life for each component of equipment within their scope of supply. Any components that do not meet the qualified life will be evaluated for extension of the qualified life or replaced to meet the 60 year design life of the plant.

FSAR Impact:

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

Question 03.11-12:

Page 3.11-19 of the U.S. EPR FSAR states that applicable chemical environments are defined in Tables 3D-1, 3D-4, and 3D-7 for normal and abnormal operating conditions. Since Table 3D-7 does not identify any chemical environments, explain how the table addresses chemical environments present during normal operating conditions. Provide a discussion why chemical spray is not required for the U.S. EPR design and, the equipment qualification impact of the SAHRS system that is used for chemical environments to prevent pressure and temperature within the containment from exceeding design limits. Based on the above, discuss how the U.S. EPR EQ program considers and addresses the chemical effects resulting from the most limiting mode of plant operation.

Response to Question 03.11-12:

As noted in 10 CFR 50.49, environmental qualification (EQ) applies to equipment relied upon to remain functional during and following a design basis event (DBE). U.S. EPR FSAR, Tier 2, Section 3.11.5.1 states that "chemical spray is not considered for the U.S. EPR because chemical spray is not used to mitigate a DBE." Therefore, in U.S. EPR FSAR, Tier 2, Table 3D-1, chemical spray is shown as "Not applicable" and in U.S. EPR FSAR, Tier 2, Table 3D-4, the chemistry parameter is identified as "None." For consistency, U.S. EPR FSAR, Tier 2, Table 3D-7 will be revised to indicate that the chemical environment also does not apply to the conditions identified in this table.

As described in U.S. EPR FSAR, Tier 2, Section 3.11.5.1, "Chemical spray is not considered for the U.S. EPR because chemical spray is not used to mitigate a DBE." U.S. EPR FSAR, Tier 2, Section 3.11.5.1 also states, "For beyond DBEs, a SAHRS system is used to prevent the pressure and temperature within the containment from exceeding design limits." As described in U.S. EPR FSAR, Tier 2, Section 19.2.3.3.3.2 (which is referenced in U.S. EPR FSAR, Tier 2, Section 3.11.5.1) and AREVA NP Topical Report ANP-10268PA, "U.S. EPR Severe Accident Evaluation," the severe accident heat removal system (SAHRS) is a system dedicated to support mitigation of beyond DBEs and is classified as a non-safety system. Therefore, the SAHRS (chemical spray system) is not required to be environmentally qualified per 10 CFR 50.49, and U.S. EPR FSAR, Tier 2, Section 3.11.5.1 will be revised accordingly.

U.S. EPR FSAR, Tier 2, Table 3.10-1 and Table 3.11-1 both have entries for the SAHRS. These entries consist of various equipment items (e.g., valves, actuators, sensors) that are associated with normal plant operation, and have safety-related functions applicable to DBEs, for which qualification is required (i.e., containment isolation and single failure protection of the in-containment refueling water storage tank (IRWST)). These SAHRS system entries in U.S. EPR FSAR, Tier 2, Table 3.10-1 and Table 3.11-1 are equipment that have a dual function of supporting both applicable DBEs and the beyond DBE of SAHRS. These dual function components within the SAHRS system are, therefore, qualified to the higher required DBE conditions. They are not qualified for the beyond DBE SAHRS conditions.

See the Responses to RAI 6, Question 19-113, and RAI 6, Supplement 1, Question 19-101 and U.S. EPR FSAR, Tier 2, Section 6.2.1 and Section 19.2.3.3.3.2 for additional information on the design of the SAHRS.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 3.11.5.1 and Table 3D-7 will be revised as described in the response and indicated on the enclosed markup.

Question 03.11-14:

Follow-up to RAI Question 06.02.01-14

Figures 3D-1 and 3D-2 of Appendix 3D of Section 3.11 of US EPR FSAR provides EQ curves for combined LOCA/SLB inside containment temperature and pressure envelopes. If the re-calculation, prescribed by the staff (RAI 06.02.01-14) that uses a multi-node containment model, shows significant changes, confirm whether those temperature and pressure curves on Figure 3D-1 and 2 will be revised. Discuss what the result of new calculation will have on the EQ program.

Response to Question 03.11-14:

The Response to RAI 209, Question 06.02.01-14 is scheduled to be provided to the NRC by December 18, 2009. The results of the recalculation to be performed in response to that question will be evaluated to determine what changes, if any, are required for the environmental qualification (EQ) program, including the temperature and pressure curves on U.S. EPR FSAR, Tier 2, Figure 3D-1 and Figure 3D-2.

FSAR Impact:

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

U.S. EPR Final Safety Analysis Report Markups

3.11-9

3D and in the tables and figures provided in Appendix 3D. Use of synergistic effects is considered when these effects are believed to have asignificant effect on equipment performance.

Service conditions are the actual environmental, physical, mechanical, electrical, and process conditions experienced by equipment during service. Plant operation includes both normal and abnormal operations. Abnormal operation occurs during plant transients, system transients, or in conjunction with certain equipment or system failures.

Service condition environments fall into two general categories of harsh and mild environments.

- Harsh environments (H) are plant areas where the environmental conditions significantly exceed the normal design conditions as a direct result of a DBE. This excludes the seismic-related DBEs that are discussed in Section 3.10. Harsh environments include environmentally harsh environments and radiation harsh environments as discussed below:
  - An environmentally harsh environment is a location that is subject to a break in the RCS, steam, or other HELB piping that significantly alters the environmental parameters of temperature, pressure, humidity, and/or flooding. This includes a LOCA, main steam line break (MSLB) within the containment building (see Figures 3D-1 and 3D-2) and outside the containment in the feedwater valve compartment (see Figures 3D-3 and 3D-4) and main steam valve compartment (see Figures 3D-5 and 3D-6). Other HELB breaks outside of containment in areas such as the SBs and fuel building, while creating adverse environments (e.g., temperature, pressure, humidity, and/or flooding) does not require consideration as a harsh environment because of the independent and redundant safety trains.
  - A radiation harsh environment is a location inside or outside containment where the radiation levels exceed the following thresholds:
    - >1.0E04 Rads gamma for mechanical equipment including non-metallics or consumables (e.g., O-rings, seals, packing, gaskets, lube oil, diaphragms).
    - >1.0E03 Rads gamma for electrical or digital equipment.
- Mild environments (M) are plant areas where the environment at no time would be significantly more severe than the environment that would occur during normal plant operation, including anticipated operational occurrences. A mild location is essentially an area not subject to DBEs (excluding seismic events) and whose radiation levels are less than or equal to the thresholds discussed above for mechanical and electrical equipment.

A new service condition for plant equipment, especially for digital I&C systems, is electromagnetic compatibility (EMC). Addressing EMC involves testing to show that

3.11.5 Estimated Chemical and Radiation Environment

3.11.5.1 Chemical Environments

Applicable chemical environments are defined in Tables 3D-1, 3D-4, and 3D-7 for normal and abnormal operating conditions. Chemical spray is not considered for the U.S. EPR because chemical spray is not used to mitigate a DBE. For beyond DBEs, a SAHRS system is used to prevent the pressure and temperature within the containment from exceeding design limits. However, given the deliberate steps required to initiate and actuate the SAHRS system, inadvertent actuation of this system is not considered a credible event (Refer to Section 19.2.3.3.3.2). Since the SAHRS is a system dedicated to support mitigation of beyond DBEs, it is not required to be environmentally qualified per 10 CFR 50.49.

03.11-12

The use of chemicals for pH control and their effects have been considered. Containment sump pH is adjusted to the range of 7.0 and higher if the containment is flooded. Information on pH adjustment is provide in Section 6.3, Containment pH Control, and is based on maintaining the cesium iodide (CsI) in the IRWST solution as discussed in Section 15.0.3.

3.11.5.2 Radiation Environments

Radiation environments are defined in Tables 3D-1, 3D-3, and 3D-8 for normal and accident conditions.

Normal operation radiation doses are calculated for initial plant start-up conditions. Radiation doses are continuously monitored during plant operation. If the actual measured radiation doses are higher than the original calculated doses, the U.S. EPR database will be revised and qualified life adjustments identified through the EQ program. The assumptions associated with the normal operations dose rates are discussed in Section 12.3.

The normal operations dose rates for equipment qualification are derived from direct gamma emitted by components that contain radioactive fluids. Because the structural walls of these components shield beta particles, beta radiation is omitted. Bremsstrahlung radiation is also neglected because it is a small contributor compared to the normal operations source term gamma contribution. The LOCA accident dose rates include a submersion dose and a direct dose contribution. The submersion dose is primarily from ESF leakage; the dose contribution is derived from both the gamma and beta radiation. The beta radiation may be attenuated by low-density equipment enclosures. Alpha radiation is neglected from both the normal and accident equipment qualification dose rates because the alpha particle is easily attenuated by air, and it is primarily a personnel committed dose concern.

Table 3D-6—Operating Temperature Ranges for Selected Components

Type of Equipment	Minimum Temperature	Maximum Temperature
Raw water system	>32°F	None Specified[1]
Borated water system 2200 ppm	45°F	113°F
Borated water system 7000 ppm	65°F	113°F
I&C equipment	41°F	104°F
Electrical Components (e.g., Transformers, Switchgear)	41°F	104°F
Computers and associated peripherals	50°F	95°F
Battery	66°F	88°F

Notes:

1. There is no EQ equipment within this system.

03.11-12

Table 3D-7—Abnormal Room Conditions

Rooms	Maximum Temperature	Humidity	Chemistry
Reactor Building			
Non-accessible area	131°F	Non-condensing	N/A
Localized hot spots	140°F	Non-condensing	N/A
Electrical Division of Safeguard Building Ventilation System			
All Locations	104°F	20%-80%	N/A