ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Friday, June 12, 2009 2:38 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); WELLS Russell D (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 218, FSARCh. 3
Attachments: RAI 218 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 218 Response US EPR DC.pdf" provides a technically correct and complete response to 2 of the 5 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 218 Questions 03.04.01-10 and 03.04.01-12.

The following table indicates the respective pages in the response document, "RAI 218 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 218 — 03.04.01-8	2	2
RAI 218 — 03.04.01-9	3	3
RAI 218 — 03.04.01-10	4	4
RAI 218 — 03.04.01-11	5	5
RAI 218 — 03.04.01-12	6	6

A complete answer is not provided for 3 of the 5 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 218 — 03.04.01-8	July 9, 2009
RAI 218 — 03.04.01-9	July 9, 2009
RAI 218 — 03.04.01-11	July 9, 2009

Sincerely,

Ronda Pederson
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, May 15, 2009 8:57 AM
To: ZZ-DL-A-USEPR-DL
Cc: Chang Li; John Segala; Michael Miernicki; Joseph Colaccino; ArevaEPRDCPEm Resource; Jay Patel
Subject: U.S. EPR Design Certification Application RAI No. 218 (2613), FSARCh. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on April 22, 2009, and discussed with your staff on May 12, 2009. No change was to the draft RAI questions 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: 567

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Response to

Request for Additional Information No. 218 (2613), Revision 0

05/15/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.04.01 - Internal Flood Protection for Onsite Equipment Failures
Application Section: 3.4.1

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

Question 03.04.01-8:

This is a follow-up of RAI 03.04.01-1, -4, and -7.

The staff in RAI 03.04.01-1 requested the applicant to:

> "…Clarify whether the U.S. EPR flood protection design intends to include the option of submerged SSCs operation in the design certification stage or in the COL application stage. If it is in the DC stage, provide the information about the submerged SSCs and the qualification program for those SSCs in the FSAR for the DC. However, if it is in the COL stage, identify a COL information item that requires the applicant to provide the above information, if the applicant will locate safety-related SSCs below the flood level. …"

The applicant responded as follows:

a. In Response to eRAI No. 109, Question 03.04.01-1, the applicant stated, "There are no safety-related structures, systems, and components (SSC) required to perform a safety-related function while being completely or partially flooded. The U.S. EPR flood protection design does not include an option of submerged SSC operation."

b. In Response to eRAI No. 118, Question 03.04.01-4, the applicant responded by stating that the safety-related SSCs for structures without physical separation between divisions (containment and annulus) have the safe shutdown systems and components located above the flood level.

c. In Response to eRAI No. 118, Supplement 1, Response to Question 03.04.01-7, the applicant responded with Tier 1 (ITAAC) and Tier 2 FSAR changes that state the U.S. EPR flood protection design includes the option of SSCs withstanding flooding. It states that a flood analysis will be performed prior to fuel load by the COL applicant, and COL Information Items (U.S. FSAR Tier 2, Table 1.8-2, Items 3.4-4 and 3.4-5) were created.

These RAI responses are inconsistent as related to the operation of submerged SSCs. The staff finds the response to RAI 03.04.01-7 with Tier 1 and Tier 2 FSAR changes acceptable in providing COL information items and ITAAC inspections. However, the details of the COL information items and the ITAAC inspection need to be revised; this is discussed in RAI 03.04.01-9.

To be consistent with this change in the response to RAI 03.04.01-7, the applicant needs to revise the FSAR Tier 2, Section 3.4.3.3, Page 3.4-6 changes associated with RAI 03.04.01-1. In addition, the applicant is requested to clarify this inconsistency among the responses to RAI 03.04.01-1, -4 and -07 with respect to the operation of submerged SSCs.

Response to Question 03.04.01-8:

A response to this question will be provided by July 9, 2009.

Question 03.04.01-9:

This is a follow-up of the responses to RAI 04.03.01-1, -4, and -7.

a. The staff noted that in the responses to the above RAIs and FSAR Tier 1 and Tier 2, the applicant identified the components to be protected from internal flooding being limited to safe shutdown equipment. SRP Section 3.4.1, Subsection I, "Areas of Review," and Subsection III, "Review Procedures," indicate that the review of the plant internal flood protection includes all safety-related SSCs. Based on SRP Section 3.4.1, the staff believes that the components to be protected from internal flooding should include all safety-related components, not just being limited to safe shutdown equipment. The applicant is requested to clarify and revise the FSAR accordingly.

b. In the response to RAI 03.04.01-7, the applicant proposed a COL Information Items 3.4-5. It states that "A COL applicant that references the U.S. EPR design certification will perform an internal flooding analysis prior to fuel load for the Reactor Building and Reactor Building Annulus to demonstrate that the essential equipment required for safe shutdown is located above the internal flood level or is designed to withstand flooding."

   In accordance with SRP Section 3.4.1, Review Procedure No. 5, the safety-related SSCs being located below the flood level should be identified in the FSAR, and the qualification program should be described in the FSAR for the staff review. Exceptions, if any, should be justified in the FSAR. Clarification is needed that if the operation of submerged SSCs is allowed, the COL applicant should identify the submerged components and describe the qualification program for the staff review in accordance with SRP Section 3.4.1.

Response to Question 03.04.01-9:

A response to this question will be provided by July 9, 2009.

Question 03.04.01-10:

This is a follow-up of the response to RAI 03.04.01-5. The applicant was requested to provide the information about door seals to ensure that water tight doors serve their intended flood protection function in RAI 03.04.01-5. The applicant responded to RAI 03.04.01-5 (eRAI No. 118) stating that water resistant door design details are to be specified later in the design process and that water resistant doors would be designed and engineered to meet leak-rate limits, door-seal aging-degradation characteristics, and maintainability. The applicant stated that maintenance requirements would be based on manufacturer recommendations and that maintenance procedures would be prepared by COL applicants in accordance with their respective regulatory approved maintenance programs. The staff found that the commitment for the seals design to meet leakage limits with maintenance based on manufacturer recommendations acceptable.

The applicant is requested to revise FSAR Tier 2 to reflect the above response and identify a COL information item in FSAR Tier 2, Table 1.8-2, "U.S. EPR Combined License Information Items," to reflect the above RAI response.

Response to Question 03.04.01-10:

U.S. FSAR Tier 2, Section 17.6 notes that implementation of the maintenance program is the responsibility of the COL applicant. Thus, no new COL Information Item is required regarding maintenance. U.S. EPR FSAR Tier 2, Section 3.4.1 will be revised to state that watertight doors are periodically inspected and tested to verify proper functionality.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.4.1 will be revised as described in the response and indicated on the enclosed markup.

Question 03.04.01-11:

This is a follow-up of the response to RAI 03.04.01-6. The staff found that the response to RAI 03.04.01-6 did not address the questions.

a) In RAI 118 Question 04.03.01-6 (a), the staff asked the applicant to provide a list of potential flood sources in the containment and reactor building annulus. In the response, the applicant stated that "all" of the water-carrying systems inside each building including high and moderate energy lines were considered for the potential flood sources. The staff found the response using "all of the water systems" without explicit system names to be nonresponsive to the question. In an audit of February 19, 2009, the staff found in the audit documentation that there was a list of systems being considered as potential flood sources. The applicant is requested to provide such list in the FSAR.

b) In Question 04.03.01-6 (b), the staff asked the applicant to explain how the bounding pipe breaks for the flood analysis in the containment and in reactor building annulus were determined. In the responses, the applicant restated what the bounding cases are, but did not respond the staff's question as how the bounding cases were determined. The staff found that the response did not address the question. In the audit review, the applicant explained verbally how the bounding cases were determined, but that was not documented in the FSAR or in the audit documentation. The applicant is requested to document how the bounding cases were determined in the RAI responses.

c) In Question 04.03.01-6 part (c), the applicant was requested to provide details of the analysis outlined in FSAR Tier 2 Section 3.4.3.1, "Internal Flooding Events," for the containment and reactor building annulus, including flood water volumes, flow rates, building floor elevation, free areas, free volumes, and assumptions used for obtaining these volumes and flood levels. The applicant referred the response to an audit. The staff reviewed the audit documentation regarding the details of the analysis and found the analysis acceptable. However, the staff believes that the key parameters that were used in the analysis determining the flood levels in the design should be documented in the RAI responses. Such parameters include flood water volumes and flow rates, building bottom floor elevation, free areas, free volumes, % of area occupied by equipments.

Response to Question 03.04.01-11:

A response to this question will be provided by July 9, 2009.

Question 03.04.01-12:

This is a follow-up to the response to RAI 03.04.01-2 (eRAI No. 109). In the response, the applicant states that "the internal flood is restricted to one emergency power generating building (EPGB) and it is assumed the associated safety-related SSCs in the flooded division are lost." This statement that the internal flood is restricted to one EPGB is inconclusive in explaining the adequacy of the flood protection for the safety-related SSCs in the EPGBs. It needs further to explain that the remaining EPGBs are sufficient to perform the intended safety function. The staff understood from the discussion in the audit that there are three redundant EPGB divisions remaining un-flooded, and that 50% load can be carried by the equipment in each EPGB. The remaining three divisions of SSCs in the un-flooded EPGBs have sufficient capability to carry out the intended safety function. The applicant is requested to confirm and document the above understanding in the FSAR.

Further, other buildings, such as safeguard building, fuel building, essential service water pump building, applied the same concept of physical separation by division for flood protection need a similar FSAR statement that with one division flooded, the systems and components in the remaining divisions are sufficient to perform the intended safety function. Assuming one division of the equipment is in maintenance and another division is flooded, are there any operational arrangement, or interaction among systems and components between divisions could prevent the remaining two divisions to perform the intended safety function?

Response to Question 03.04.01-12:

The Safeguard Buildings (SBs), Emergency Power Generating Buildings (EPGBs), and Essential Service Water Pump Buildings (ESWPBs) are designed with divisional separation of the four divisions of safety systems and are consistent with an N+2 safety concept. With four divisions, one division can be down for maintenance and one can fail to operate due to an event such as internal flooding, while the remaining two divisions are available and sufficient to perform the necessary safety functions. The Fuel Building (FB) is designed with complete separation into two divisions below elevation +0 feet 0 inches such that in the event of an internal flood, the flood is restricted to one division of the FB while the other division is available to perform the necessary safety functions. Each of the two divisions is designed to fulfill the safety function assuming the other division is not available.

U.S EPR FSAR Tier 2, Section 3.4.1, Section 3.4.3.8, and Section 3.4.3.9 will be revised to add statements clarifying these design features.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.4.1, Section 3.4.3.8, and Section 3.4.3.9 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

3.4 Water Level (Flood) Design

In accordance with GDC 2 and RG 1.29, the Seismic Category I structures, systems, and components (SSC) identified in Table 3.2.2-1 can withstand the effects of flooding due to natural phenomena or onsite equipment failures, without losing the capability to perform their safety-related functions. A description of these structures is provided in Section 3.8. The U.S. EPR design meets the requirements of GDC 4 because safety-related SSC accommodate the effects of discharged fluid resulting from the high- and moderate-energy line breaks postulated in Sections 3.6.1 and 3.6.2. The criteria in RG 1.59 and ANSI/ANS-2.8-1992 "Determining Design Basis Flooding at Power Reactor Sites" (Reference 1) are used to establish the probable maximum flood (PMF), probable maximum precipitation (PMP), seiche, and other hydrologic considerations. The flood protection measures for Seismic Category I SSC are designed in accordance with RG 1.102. Section 2.4 provides further information on hydrologic engineering. Section 2.5 provides information on safe shutdown earthquake ground motion. Section 3.8 provides information on the design of Seismic Category I structures. The risk assessment for external and internal flooding is provided in the U.S. EPR probabilistic risk assessment addressed in Chapter 19.

3.4.1 Internal Flood Protection

The U.S. EPR includes measures for protecting safety-related SSC against the effects of internal flooding from postulated flooding sources. These measures also protect safety-related SSC from flooding from non-safety-related SSC that are not required to be protected from either internal or external flooding. Because of these measures, a failure of components due to an internal flooding event will not prevent safe shutdown of the plant or mitigation of the flooding event. The nuclear island general arrangement drawings in Section 3.8 are a useful reference for the following description of protective measures for internal flooding.

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The principal protective measure for Seismic Category I buildings is physical separation of the redundant safe shutdown systems and components. The safeguard buildings (SB), emergency power generating buildings (EPGB), and essential service water pump buildings (ESWPB) are Seismic Category I buildings designed with complete divisional separation of the four divisions of safety systems and are therefore consistent with an N+2 safety concept. With four divisions, one division can be down for maintenance and one can fail to operate due to an event such as internal flooding, while the remaining two divisions are available and sufficient to perform the necessary safety functions. The fuel building (FB) is designed with complete separation into two divisions below elevation +0 feet 0 inches such that in the event of an internal flood, the flood is restricted to one division of the FB while the other division is available and sufficient to perform the necessary safety functions. Each of the two divisions is designed to fulfill the safety function assuming the other division is not available. These buildings are designed such that the consequences of an internal hazard are

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contained within the division of hazard origin and are not allowed to propagate to other divisions. Consequently, in a large internal flooding event in buildings with divisional separation safety-related SSC within the affected division are assumed to be flooded. ~~The principal protective measure for Seismic Category I buildings is physical separation of the redundant safe shutdown systems and components.~~ The plant arrangement provides divisional separation walls to physically separate the redundant trains of safe shutdown systems and components. A combination of fluid diversion flow paths and passive features contain the water within the affected division. A COL applicant that references the U.S. EPR design certification will perform internal flooding analyses prior to fuel load for the Safeguard Buildings and Fuel Building to demonstrate that the impact of internal flooding is contained within the Safeguard Building or Fuel Building division of origin. Features credited in the analysis will be verified by walk-down.

Division walls below elevation +0 feet, 0 inches (hereinafter +0 feet) provide separation and serve as flood barriers to prevent flood waters spreading to adjacent divisions. These division walls are watertight, have no doors, and a minimal number of penetrations. Water is directed within one division to the building elevations below +0 feet, where it is stored. Above elevation +0 feet, a combination of watertight doors and openings for water flow to the lower building levels prevent water ingress into adjacent divisions. Watertight doors have position indicators for control of the closed

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position and are periodically inspected and tested to verify proper functionality. Existing openings (e.g., stair cases, elevator shafts, and ~~building drains~~equipment openings) are credited as water flow paths ~~when available~~. Flooding pits with burst openings collect and direct water flow to lower building levels. Rooms within divisions have interconnections so that the maximum released water volume can be distributed and stored in the lower building levels of the affected division. Interconnections include doors with flaps, wall openings, and other wall penetrations that are not required to be sealed. Elevated thresholds, curbs, and pedestals are provided as necessary.

In Seismic Category I structures that are not designed with divisional separation, e.g., the Reactor Building (RB), the layout allows water released inside the building to flow to the lower level of the building. In the RB, water flows down to the in-containment refueling water storage tank (IRWST). In the annulus, water flows to the bottom level where it is stored. Safety-related systems and components in these structures are located above the maximum water level, protecting them from the effects of flooding. A COL applicant that references the U.S. EPR design certification will perform an internal flooding analysis prior to fuel load for the Reactor Building and Reactor Building Annulus to demonstrate that the essential equipment required for safe shutdown is located above the internal flood level or is designed to withstand flooding. Locations of essential SSC and features provided to withstand flooding will be verified by walk-down.

fire zone (i.e., FB-1 or FB-2); therefore manual fire fighting will be performed from one safety fire zone. Divisional separation for flooding exists for assumed manual fire fighting by hose streams.

3.4.3.6 Nuclear Auxiliary Building Flooding Analysis

There are no safety-related structures, systems or components that must be protected from flooding in the Nuclear Auxiliary Building (NAB). Physical separation exists below elevation +0 feet between the NAB and the FB and between the NAB and SB-4. The building arrangement directs released water from potential internal flood sources to the lowest level of the NAB. Water flows to the lower levels via the building drain system, stairways, and additional drain openings without passing to the FB or SB-4.

Water carrying systems with respect to internal flooding include the fuel pool purification system, steam generator blowdown system, fire water distribution system, CCWS, and the SCWS. Tanks with the highest flooding potential are located below elevation +0 feet.

3.4.3.7 Radioactive Waste Building Flooding Analysis

There are no safety-related structures, systems or components that must be protected from flooding in the Radioactive Waste Building (RWB). The RWB is connected to the NAB below elevation +0 feet. The arrangement of the RWB directs water released from potential sources of internal flooding to the lower levels of the RWB, where it is stored.

3.4.3.8 Emergency Power Generating Buildings Flooding Analysis

The Emergency Power Generating Buildings (EPGBs) house the emergency diesel generators. The station blackout diesels and associated generators are located in the switchgear buildings, which are adjacent to the EPGBs.

The flooding analysis considers postulated pipe breaks in water-carrying systems within the EPGB, which include the ESWS, fire water distribution system, demineralized water distribution system, and potable and sanitary water distribution system. The bounding internal flooding source is a pipe break in the fire water distribution system, which produces a maximum flood level of 17 feet. The divisional separation wall between the EPGB, is designed as a flood barrier and is higher than the bounding maximum flood level. Piping and cable penetrations between EPGB are watertight. Internal flooding is restricted to one EPGB and the associated safety-related SSC in the flooded division are assumed lost. See Section 3.4.1 for a description of the divisional separation of the EPGB.

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The level measurements in the building sumps provide leak detection. The water released during fire fighting within one EPGB is enveloped by the higher flow rates and released water volumes in the postulated pipe failures.

3.4.3.9 Essential Service Water Pump Buildings and Essential Service Water Cooling Tower Structures Flooding Analysis

03.04.01-12

The ESWPB ~~Pump Buildings~~ are physically separated by division and connected to their respective ESW cooling tower. The flooding analysis considers a postulated pipe failure in the ESWS piping to be the bounding internal flooding source. In the event of an ESWS piping failure in the building, the affected division of the ESWS is considered lost. See Section 3.4.1 for a description of the divisional separation of the ESWPB.~~unavailable, leaving the remaining divisions to perform the system safety function.~~

3.4.3.10 Ultimate Heat Sink Makeup Water Intake Structure Flooding Analysis

A COL applicant that references the U.S. EPR design certification will perform a flooding analysis for the ultimate heat sink makeup water intake structure based on the site-specific design of the structure and the flood protection concepts provided herein.

3.4.3.11 Permanent Dewatering System

The U.S. EPR design does not have a permanent dewatering system. A COL applicant that references the U.S. EPR design certification will define the need for a site-specific permanent dewatering system.

3.4.4 Analysis Procedures

The analytical methodology used to perform the flooding analyses for external and internal flooding events is described in Section 3.4.3. Section 3.8 provides additional information on the design of Seismic Category I structures against external flooding.

3.4.5 References

1. ANSI/ANS-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites," American Nuclear Society, 1992.

Next File