ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Tuesday, September 14, 2010 10:10 AM
To: Tesfaye, Getachew
Cc: Hearn, Peter; KOWALSKI David (AREVA); BALLARD Bob (AREVA)
Subject: FW: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Attachments: Blank Bkgrd.gif; DRAFT RESPONSE RAI 351 Q.09.02.05-31(c).pdf; DRAFT FSAR Changes RAI 351 Q.09.02.05-30(b).pdf; DRAFT RESPONSE RAI 351 Q.09.02.05-30(b), -34 & -35.pdf

Importance: High

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Subject: DRAFT RESPONSES FOR FSAR Chapter 9 Weekly NRC Telecon
Importance: High

Marty:

Please transmit to Getachew Tesfaye the attached partial set of DRAFT responses to RAI 351 questions. If the NRC reviewers have enough time to review these responses, they can be discussed at today's (9/14/10) FSAR Chapter 9 Weekly Telecon/GoToMeeting with the NRC, or can be scheduled for a future telecon.

Attached are the following DRAFT response(s):

- Response to RAI 351 - Question 09.02.05-30(b).
- Response to RAI 351 - Question 09.02.05-31(c).
- Response to RAI 351 - Question 09.02.05-34.
- Response to RAI 351 - Question 09.02.05-35.

Note that these DRAFT responses have not been through the final Licensing review/approval process; nor do they reflect technical editing.

Please call me if you have any questions. Thanks.

David J. Kowalski, P.E.
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MESSAGE	1694	9/14/2010 10:10:33 AM
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DRAFT RESPONSE RAI 351 Q.09.02.05-31(c).pdf	226569	
DRAFT FSAR Changes RAI 351 Q.09.02.05-30(b).pdf	307854	
DRAFT RESPONSE RAI 351 Q.09.02.05-30(b), -34 & -35.pdf	232634	

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Response to

Request for Additional Information No. 351(4112, 4163), Revision 1

01/15/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.05 - Ultimate Heat Sink
SRP Section: 09.05.01 - Fire Protection Program

Application Section: FSAR Chapter 9

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

Question 09.02.05-31:

Follow-up to RAI 175, Question 9.2.5-18:

Standard Review Plan (SRP) 9.2.5 Section III, paragraph 1 requires confirmation of the overall arrangement of the ultimate heat sink (UHS). The staff reviewed the information provided in Tier 1, Table 2.7.11-3, "Essential Service Water System Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)," to confirm that the proposed ITAAC are adequate for EPR design certification. However, the staff found that the proposed ITAAC are incomplete, inconsistent, inaccurate, or that clarification is needed as follows:

1. Item 2.1 only refers to functional arrangement, but it should refer to functional arrangement and design details since nominal pipe size is an important consideration that needs to be verified, as it pertains to the ultimate heat sink (UHS).
2. Item 2.3 is incomplete in that it does not address physical separation criteria for outdoor piping and components such as for the UHS fans.
3. Provide an ITAAC for the UHS/ESW fans are (proper accident response, operating capability in various speeds including reverse).
4. Need to include under several existing item, such as 7.1, the performance of the UHS fans since neither the UHS fans are listed under Tables 2.7.11-2 or 2.7.11-3. Quantitative acceptance criteria need to be established for all ITAAC as applicable (flow rates, heat transfer rates, completion times, etc.).

Based on the staff's review of the applicant's response to RAI 9.2.5-18 (ID1817/6816) AREVA #175, Supplement 2, the following were determined as unresolved and needed further clarification/resolution by the applicant.

With regard to Item 3, the staff does not agree with the assertion that fan performance is not safety significant. In fact, fan performance is critical for establishing the cooling tower heat removal capability that is necessary to satisfy accident analysis assumptions. Therefore, an ITAAC is necessary to confirm that fan performance in high speed (with one fan operating separately and with both fans operating simultaneously) satisfies the manufacturer's specifications for the cooling tower design. An ITAAC is also needed to confirm that both cooling tower fans operating simultaneously through all speed combinations (including reverse) will not result in unacceptable vibrations or other deleterious conditions. Additionally, Standard Review Plan Section 14.3, Appendix C, Paragraph II.B.vii, entitled, "Initiation Logic," states: "If a system/component has a direct safety function it typically receives automatic signals to perform some action. This includes start, isolation, etc. The system ITAAC capture these aspects related to the direct safety function…" Therefore, an ITAAC is also needed to confirm proper fan response to an accident.

Also, based on further review of the ITAAC that are proposed in FSAR Tier 1 Section 2.7.11, Table 2.7.11-3, "Essential Service Water System ITAAC," the staff identified the following additional items that need to be addressed:

a. An ITAAC is needed to confirm the seismic adequacy of the cooling towers and their component parts (fill material, nozzles, wind drift eliminators).
b. With regard to the ITAAC that are specified by Item 7.1, the commitment refers to the "ESW UHS as listed in Table 2.7.11-1." Table 2.7.11-1 includes all of the mechanical

equipment that is included in the essential service water system (ESWS), but does not include the cooling towers, components that are included in the cooling tower design, and the cooling tower basins. Therefore, the UHS part of the ESWS is not really listed in Table 2.7.11-1 and it is not clear what this commitment means and what is actually being accomplished by this ITAAC. Consequently, additional thought is required to establish ITAAC that are meaningful and appropriate for the ESWS and UHS designs. Along these lines, ITAAC need to be established to confirm that important design specifications and features have been properly implemented (to the extent that they have not been established elsewhere). For example, inspections should be conducted to confirm that the cooling towers have been constructed in accordance with manufacturer drawings and specifications (e.g., elevations, dimensions, materials, piping, fill, wind drift eliminators, spray nozzles). Likewise, ITAAC are needed to confirm that the cooling tower basins have been constructed in accordance with design specifications (e.g., elevations, dimensions, materials, screens, penetrations). Also, ITAAC should be established for the ESWS (e.g., elevations, materials, height of pump impeller above the bottom of the basin, valve and pipe sizes, pump specifications, heat exchanger specifications, filter size and specifications).

c. The ITAAC specified by Item 7.2 should be revised to also recognize vortex effects since this is more limiting than net positive suction head considerations.

d. The acceptance criteria for the ITAAC specified by Item 7.6 should be revised to indicate that the required flow rate is “greater than or equal to” the value specified.

e. An ITAAC needs to be established to confirm that the cooling towers, with the minimum specified water inventory available and for the most limiting conditions that are assumed for heat removal, are capable of removing the design-basis heat load without exceeding the maximum specified temperature limit for ESWS. A transient analysis should be completed by qualified individuals with the results documented in a report that includes performance curves for the cooling towers being used for the specific conditions of interest, such as limiting meteorology, initial water volume and quality, no filter backwash and blowdown, and no makeup or blowdown flow for the initial 72 hours. After 72 hours, makeup water of specified flow rate and water quality is provided for the remainder of the 30 day period, but no blowdown or filter backwash is provided consistent with design basis assumptions. The report should show how the water temperature in the cooling tower basin will trend over time; and the effect of concentrated impurities in the cooling tower basin on ESWS flow rate and cooling tower performance, and how the water quality at the end of the 30 day period compares with manufacturer’s specifications, should be assessed. The report should include a listing of the limiting assumptions and inputs that were used, as well as an uncertainty analysis that demonstrates conservative results. The qualifications of the individuals performing the analysis and independent verification, and their certification of the accuracy of the information in the report should also be included, as well as a discussion of the analytical methods and modeling that were used, and a listing of references that are pertinent to the analysis that was performed.

f. An ITAAC needs to be established to confirm that the cooling towers, with the minimum specified water inventory available and for the most limiting conditions that are assumed for water usage, are capable of removing the design basis heat load without the water inventory dropping below the minimum required level in the cooling tower basin. A report similar to the one referred to in (e) above should be prepared demonstrating

acceptable performance. Note that because water usage is higher in this case, impurities in the water will be more concentrated at the end of the 30 day period and may have a more severe impact on ESWS flow rate and cooling tower performance.

Response to Question 09.02.05-31:

Item (c)

Tier 1 Section 2.7.11 Table 2.7.11-3 ITAAC 7.1 acceptance criteria refers to the minimum allowable cooling tower basin water level, and as stated in response to RAI 345 question 9.2.1-41(b) the required minimum water level in the cooling tower basin considers NPSH and vortex suppression.

FSAR Impact:

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

A failure of the cleaning function of the debris filter in a safety-related division is monitored by the elevated differential pressure or function alarm. In this case, the operator initiates a division switchover.

9.2.1.5 Safety Evaluation

The ESWS pump buildings are designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other natural phenomena. Section 3.3, Section 3.4, Section 3.5, Section 3.7 and Section 3.8 provide the basis for the adequacy of the structural design of these structures.

The ESWS is designed to remain functional after a safe shutdown earthquake (SSE). Section 3.7 and Section 3.9 provide the design loading conditions that are considered. Section 3.5, Section 3.6 and Section 9.5.1 provide the hazards analyses to verify that a safe shutdown, as outlined in Section 7.4, can be achieved and maintained.

The four division design of the ESWS provides complete redundancy; therefore a single failure will not compromise the ESWS system safety-related functions. Each division of ESWS is independent of any other division and does not share components with other divisions or with other nuclear power plant units.

Considering a single failure and preventative maintenance, two ESW divisions may be lost, but the ability to achieve the safe shutdown state under DBA conditions can be reached by the remaining two ESWS divisions. In case of LOOP the four ESW pumps have power supplied by their respective division EDGs.

During SAs, containment heat is removed by the dedicated cooling chain consisting of the severe accident heat removal system (SAHRS), dedicated CCWS, and dedicated ESWS. This cooling chain is manually actuated. In case of loss of the dedicated ESWS division, the SAHRS cooling chain is lost. This condition is outside the DBA.

In the event of an LOCA during power operations, the engineered safety features system (ESFS) (refer to Section 7.3) initiates a safety injection and containment isolation phase 1 signal. The ESWS divisions previously not in operation are automatically started by the PS.

9.2.1.6 Inspection and Testing Requirements

The ESWS is initially tested with the program given in Section 14.2, Test # 48.

The installation and design of the ESWS provides accessibility for the performance of periodic inservice inspection and testing. Periodic inspection and testing of all safety-related equipment verifies its structural and leak tight integrity and its availability and ability to fulfill its functions. Inservice inspection and testing requirements are in accordance with Section XI of the ASME BPV Code and the ASME OM Code.

at least 72 hours of water inventory for the DBA, in combination with the worst ambient evaporation conditions, the UHS emergency makeup is not required to start until after 72 hours. At that point, the makeup requirements are diminished. The minimum makeup supply rate is based on the maximum evaporation rate over a 72 hour period post-DBA and considers such losses as drift, seepage and valve seat leakage.

COL applicants that reference the U.S. EPR will verify that the makeup water supply is sufficient for the ambient conditions corresponding to their plant location. Refer to Table 1.8-2, Item number 2.3-10.

9.2.5.6 Inspection and Testing Requirements

Prior to initial plant startup, a comprehensive preoperational test is performed to demonstrate the ability of the ESWS and UHS to supply cooling water as designed under normal and emergency conditions. The UHS is tested as described in Chapter 14.2, Test # 49.

The installation and design of the UHS provides accessibility for the performance of periodic inservice inspection and testing. Periodic inspection and testing of safety-related equipment verifies its structural and leaktight integrity and its availability and ability to fulfill its functions. Inservice inspection and testing requirements are in accordance with Section XI of the ASME BPV Code and the ASME OM Code.

Section 3.9 and Section 6.6 outline the inservice testing and inspection requirements. Refer to Section 16.0, Surveillance Requirements (SR) 3.7.19 for surveillance requirements that verify continued operability of the UHS.

9.2.5.7 Instrumentation Applications

Instrumentation is provided in order to control, monitor and maintain the safety-related functions of the UHS. Indications of the process variables measured by the instrumentation are provided to the operator in the main control room.

9.2.5.7.1 System Monitoring

- Cooling tower basin water level.
- Cooling tower water temperature.

9.2.5.7.2 System Alarms

- Cooling tower water temperature low.
- Cooling tower basin water level low.
- Cooling tower basin water level high.

Response to

Request for Additional Information No. 351(4112, 4163), Revision 1

01/15/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.05 - Ultimate Heat Sink
SRP Section: 09.05.01 - Fire Protection Program

Application Section: FSAR Chapter 9

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

Question 09.02.05-30:

Follow-up to RAI 175, Question 9.2.5-17:

Standard Review Plan (SRP) 9.2.5 Section III, paragraph 1 requires confirmation of the overall arrangement of the ultimate heat sink (UHS). The staff reviewed the descriptive information, arrangement, design features, environmental qualification, performance requirements, and interface information provided in Tier 1 Final Safety Analysis Report (FSAR) Section 2.7.11 to confirm completeness and consistency with the plant design basis as described in Tier 2 Section 9.2.5. The staff found that the Tier 1 information is incomplete, inconsistent, inaccurate, or that clarification is needed with respect to the following considerations:

a. Although the Introduction Section in Chapter 1 of the Tier 1 FSAR states that the information in the Tier 1 portion of the FSAR is extracted from the detailed information contained in Tier 2, the staff found that much of the information provided in FSAR Tier 1 is not described in Tier 2 FSAR Section 9.2.5 (e.g., equipment locations, valve functional requirements, indication and control information, priority actuation and control system description and functions, automatic actuation and interlock details, valve failure modes, and harsh environment considerations). This Tier 1 information needs to be added to Tier 2.

b. FSAR Tier 1 does not stipulate that the ultimate heat sink (UHS) is accessible for performing periodic inspections as required by General Design Criteria (GDC) 45.

c. FSAR Tier 1 does not stipulate that the UHS design provide for flow testing of makeup water for accident and emergency conditions.

d. FSAR Tier 1 does not stipulate that the essential service water system (ESWS) pumps are protected from debris from the cooling towers.

e. FSAR Tier 1 does not stipulate that the safety related UHS outdoor piping is adequately protected from the elements and postulated hazards.

f. Tier 1, Figure 2.7.11-1, "Essential Service Water System Functional Arrangement," does not show nominal pipe sizes for the UHS, which are necessary for design certification. This table does not show design information for the UHS fans.

g. Tier 1, Table 2.7.11-2, "Essential Service Water System Equipment I&C and Electrical Design," does not include information pertaining to the UHS fans and corresponding power supplies.

h. The point of Note 2 for Tier 1, Table 2.7.11-2 is not clear since it does not appear to pertain to anything on the table. However, this appears to be due to an oversight whereby dedicated ESWS components are not listed in the table.

i. The discussion under Item 6 Tier 1 of Table 2.7.11-2 related to environmental qualification is inconsistent with the information provided in Table 2.7.11-2 in that no equipment is listed in the table for harsh environment considerations.

Based on the staff's review of the applicant's response to RAI 9.2.5-17 (ID1817/6814) AREVA #175, Supplement 3, the following were determined as unresolved and needed further clarification/resolution by the applicant.

The applicant's response to Item (b) focuses on inservice inspection requirements, while the question that was asked focuses on the requirement specified by 10 CFR 50, Appendix A, General Design Criterion (GDC) 45. GDC 45 requires that "the cooling water system shall be designed to permit appropriate periodic inspections of important components, such as heat exchangers and piping, to assure the integrity and capability of the system." Therefore, the capability to perform periodic inspections of important components needs to be described in FSAR Tier 2 and ITAAC need to be established to confirm this aspect of the design.

With regard to the response to Item (d), the staff does not agree that screens and filters that are solely for equipment protection are not safety significant. Filters and screens are relied upon to ensure that debris, aquatic organisms, and other material that find their way into the cooling tower basins do not adversely impact the capability of the essential service water system and ultimate heat sink to perform their safety functions. Without the screens and filters, pumps and valves can be damaged and rendered inoperable, heat exchanger tubes and cooling tower spray nozzles can become clogged, and heat transfer surfaces can become fouled. Therefore, ITAAC are needed to confirm the installation and proper mesh size of the filters and screens that are relied upon. Additionally, FSAR Tier 2 Sections 9.2.1 and 9.2.5 need to be revised to describe important filter and screen design specifications such as maximum allowed differential pressure and mesh size, including the bases for these specifications.

The response to Item (e) indicates that the UHS does not have any safety-significant outdoor piping within the scope of design certification. Based on this, the staff agrees that ITAAC are not needed to confirm adequate protection of exposed equipment. However, ITAAC are needed to confirm that ESWS and UHS piping and components are not exposed to the elements and postulated hazards. Additionally, based upon further review, the staff found that additional information needs to be included in the FSAR to address freeze protection considerations, especially for divisions that are in standby and for those parts of the cooling tower that are exposed and vulnerable to cold weather conditions.

The response to Item (f) refers to a response that was provided to RAI 9.2.1-22 (AREVA RAI No. 119, Supplement 1). The response indicates that line sizing details will be identified later in the design process. Consequently, this item remains open pending submittal of the information that was requested and a schedule for providing this information needs to be established.

In response to second part of Item (f), the applicant stated that design information for the UHS fans will be added to FSAR Tier 1, Table 2.7.11-2, "Essential Service Water System Equipment I&C and Electrical Design," as part of the response to Item (g) of this RAI. The staff noted that the FSAR markup of Table 2.7.11-2 does not specify alternate power supplies for the two fans in Essential Service Water (ESW) Building 4. In this regard, additional information is needed to explain why an alternate power source is not specified for the ESW Building 4 cooling tower fans since they are necessary to support operation of the dedicated ESW train. The dedicated ESW train is provided to mitigate accidents that are beyond the design basis when normal backup power may not be available. Therefore, the applicant should specify an alternate power source for these fans similar to that shown for several other dedicated ESW train components in FSAR Tier 1 Table 2.7.11-2.

Response to Question 09.02.05-30:

Item (b)

The design of the UHS components includes design features as described in Tier 2 Section 6.6.2 that permit appropriate periodic inspections. Tier 2 Section 9.2.1.6 and 9.2.5.6 will be revised, including a cross reference to Tier 2 Section 6.6.2, as stated in the enclosed markup.

In addition, NUREG-0800 Section 14.3 Appendix C, Subsection I.A.xii, states that accessibility does not need to be addressed in Tier 1 but should be addressed in Tier 2. Therefore, accessibility is not addressed in Tier 1 Section 2.7.11. As stated in Tier 2 Section 9.2.1.6 and 9.2.5.6 with the revision described above, the ESWS and UHS is accessible for periodic inspection.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 9.2.1.6 and 9.2.5.6 will be revised as described in the response and indicated on the enclosed markup.

Insert 1

, as described in Tier 2 Section 6.6.2,

Insert 2

(including inservice inspection)

Question 09.02.05-34:

Follow-up to RAI 175, Question 9.2.5-12:

General Design Criteria (GDC) 45 requires the ultimate heat sink (UHS) to be designed so that periodic inspections of piping and components can be performed to assure that the integrity and capability of the system will be maintained over time. The staff finds the design to be acceptable if the Final Safety Analysis Report (FSAR) describes inspection program requirements that will be implemented and are considered to be adequate for this purpose. While Tier 2 FSAR Section 9.2.5.6 indicates that periodic inspections will be performed, the extent and nature of these inspections and procedural controls that will be implemented to assure that the UHS is adequately maintained over time were not described. Furthermore, the accessibility and periodic inspection safety related buried piping and the cooling tower spray header system and tower fill is of particular interest. Consequently, additional information needs to be provided in the FSAR to describe the extent and nature of inspections that will be performed and procedural controls that will be implemented commensurate with this requirement.

Based on the staff's review of the applicant's response to RAI 9.2.5-12 (ID1817/6807) AREVA #175, Supplement 1, the following were determined as unresolved and needed further clarification/resolution by the applicant.

The applicant's response indicated that the extent and nature of periodic inspections of piping and components that will be performed, and the procedural controls that will be implemented to assure that the UHS is adequately maintained over time, will be developed later in the design process. Consequently, this item will remain open pending submittal of the information that was requested and a schedule for providing this information needs to be established.

Response to Question 09.02.05-34:

The extent and nature of periodic inspections of piping and components that will be performed and the procedural controls that will be implemented is the responsibility of the COL applicant as stated in Tier 2 Section 13.5 and listed in Tier 2 Table 1.8-2 Item No. 13.5-1

FSAR Impact:

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

Question 09.02.05-35:

Follow-up to RAI 175, Question 9.2.5-13:

General Design Criteria (GDC) 46 requires the ultimate heat sink (UHS) to be designed so that periodic pressure and functional testing of components can be performed to assure the structural and leak tight integrity of system components, the operability and performance of active components, and the operability of the system as a whole and performance of the full operational sequences that are necessary for accomplishing the UHS safety functions. The staff finds the design to be acceptable if the Final Safety Analysis Report (FSAR) describes pressure and functional test program requirements that will be implemented and are considered to be adequate for this purpose. While Tier 2 FSAR Section 9.2.5.6 indicates that periodic testing will be performed, the extent and nature of these tests and procedural controls that will be implemented to assure continued UHS structural and leak tight integrity and system operability over time were not described. Consequently, additional information needs to be provided in the FSAR to describe the extent and nature of testing that will be performed and procedural controls that will be implemented commensurate with this requirement.

Based on the staff's review of the applicant's response to RAI 9.2.5-13 (ID1817/6808) AREVA #175, Supplement 2, the following were determined as unresolved and needed further clarification/resolution by the applicant.

The applicant's response is incomplete in that it did not address the extent and nature of testing that will be performed and procedural controls that will be implemented to periodically confirm that the cooling towers remain capable of removing the design-basis heat load over time, including confirmation that the limiting assumptions remain valid. Also, based upon further review, the staff determined that cooling tower design details, such as manufacturer specifications and recommendations, performance characteristics, drawings showing overall dimensions, and manufacturer recommendations regarding operation, maintenance and upkeep need to be evaluated. Consequently, additional information needs to be provided and reflected in the FSAR as appropriate to fully address this question.

Response to Question 09.02.05-35:

Part (1)

As stated in the response to RAI 351 9.2.5-34, "The extent and nature of periodic inspections of piping and components that will be performed and the procedural controls that will be implemented is the responsibility of the COL applicant as stated in Tier 2 Section 13.5 and listed in Tier 2 Table 1.8-2 Item No. 13.5-1".

FSAR Impact:

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