

ArevaEPRDCPEm Resource

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Subject: Draft - U.S. EPR Design Certification Application RAI No. 356 (4232), FSAR Ch. 9
Attachments: Draft RAI_356_SBPA_4232.doc

Attached please find draft RAI No. 356 regarding your application for standard design certification of the U.S. EPR. If you have any question or need clarifications regarding this RAI, please let me know as soon as possible, I will have our technical Staff available to discuss them with you.

Please also review the RAI to ensure that we have not inadvertently included proprietary information. If there are any proprietary information, please let me know within the next ten days. If I do not hear from you within the next ten days, I will assume there are none and will make the draft RAI publicly available.

Thanks,
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Request for Additional Information No. 356 (4232), Revision 0

1/10/2010

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

Docket No. 52-020

SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems

Application Section: 09.02.08

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

09.02.02-86

Follow-up to RAI 174, Question 9.2.2-39:

Standard Review Plan (SRP) 9.2.2 Section III, requires confirmation of the overall arrangement of the component cooling system (CCWS) which is being utilized as guidance for the review of the Safety Chilled Water System (SCWS). The SCWS description and piping and instrumentation diagrams (P&ID), Tier 2, FSAR Figure 9.2.8-1, were reviewed to assess the design adequacy of the SCWS for performing its heat removal functions. While the P&ID shows the SCWS components and identifies the boundaries between safety-related and non-safety-related parts of the system, some of the information is incomplete, inaccurate, or inconsistent. Consequently, the applicant needs to revise the Final Safety Analysis Report (FSAR) to address the following considerations in this regard:

- a. Pipe sizes are not shown on the Tier 2, FSAR Figure 9.2.8-1, and the system description does not explain the criteria that were used in establishing the appropriate bounding pipe sizes (such as limiting flow velocities from conceptual/preliminary design studies).
- b. The system description does not provide bounding details such as system operating temperatures, pressures, and flow rates for all operating modes and alignments.
- c. Tier 2, FSAR Figure 9.2.8-1 does not show the location of the indications display (e.g., local, remote panel, control room), and does not identify the instruments that provide input to a process computer and/or have alarm and automatic actuation functions.
- d. Tier 2, FSAR Figure 9.2.8-1 does not identify the normal valve positions, the valves that are locked in position, and the valves that have automatic functions. These design features should be described.
- e. Tier 2, FSAR Figure 9.2.8-1 does not show specific set point for system alarms (including head tank) and relief and the bases for these set points are not explained in the system description.
- f. Isolation valves for taking components out of service for maintenance are not shown on the Tier 2, FSAR Figure 9.2.8-1.
- g. Describe in Section 9.2.8 showing the filters in the return lines for some but not all HVAC units.

Based on the staff's review of the applicant's response to RAI 9.2.2-39 (ID1810/6769) AREVA #174 Supplements 1 and 4 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The information described above is required by the staff in order to complete their review. Consequently, these items will remain open pending submittal of the information that was requested and a schedule for providing this information needs to be established.

09.02.02-87

Follow-up to RAI 174, Question 9.2.2-40:

The safety chilled water system (SCWS) must be capable of removing heat from structures, system and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. In order for the staff to confirm that the SCWS has been adequately sized, the applicant needs to include additional information in Tier 2 of the Final Safety Analysis Report (FSAR), Section 9.2.8, to fully describe and explain the bounding requirements for the minimum system heat transfer and flow for normal operating, refueling, and accident conditions, the bases for these requirements including limiting assumptions that apply (such as temperature considerations), to provide the excess margin that is available and the method for determining this margin, and to provide the limiting system temperatures and pressures that are assumed with supporting basis.

Based on the staff's review of the applicant's response to RAI 9.2.2-40 (ID1810/6770) AREVA #174 Supplement 1 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The applicant stated the major SCWS users for each division but stated that the specific details of the SCWS minimum heat transfer and flow requirements for the various plant operating modes and accident conditions will be identified later in the design process. The applicant stated that the final determination of these design values depends on SCWS user heat loads and flow requirements and that the SCWS will be designed to satisfy these minimum heat transfers and flow requirements for each user under plant operating scenarios (after the plant is built). In order to complete its review the staff requires: (a.) Commitment by the applicant that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to generate the operating data to determine and to calculate the minimum heat transfer and flow requirements; or (b.) provide the bounding values for the minimum heat transfer and flow requirements that were used for the Conceptual/Preliminary design for the US EPR.

The information described above is required by the staff in order to complete their review. Consequently, these items will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

09.02.02-88

Follow-up to RAI 174, Question 9.2.2-41:

General design criteria (GDC) 44 requires the transfer of heat from systems, structures and components (SSC) important to safety to a heat sink during both normal and accident conditions assuming a single active component failure coincident with the loss of offsite power. The Final Safety Analysis Report (FSAR) indicates that the safety chilled water system (SCWS) chillers are rated at 275 tons (Divisions 1 and 4) and 250 tons (divisions 2 and 3) but does not provide a basis for these capacities.

- Provide the bounding heat loads in the various SCWS divisions for which the chillers have been sized during the Conceptual/Preliminary Design for the US EPR. Information should include both normal operations and postulated accident conditions.

Based on the staff's review of the applicant's response to RAI 9.2.2-41 (ID1810/6772) AREVA #174 Supplement 1 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The applicant stated that specific details of the SCWS chiller sizing will be identified later in the design process and that the final chiller sizing determination depends on a number of factors. SCWS user (after the plant is built) heat removal and flow requirements, developed after the US EPR is built, under all operating modes and alignments will form the basis for the SCWS chiller sizing.

In order to complete its review the staff requires: (a.) Commitment by the applicant that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to generate the operating data to determine and to calculate the heat removal and flow requirements; or (b.) provide the bounding values for the heat removal and flow requirements that were used for the Conceptual/Preliminary design for the US EPR.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

09.02.02-89

Follow-up to RAI 174, Question 9.2.2-43:

The safety chilled water system (SCWS) must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. In order to satisfy system flow requirements, the SCWS design must assure that the minimum net positive suction head (NPSH) for the SCWS pumps will be met for all postulated conditions, including consideration of vortex formation. The staff found that the NPSH requirement for the SCWS pumps was not specified and Tier 2 Final safety Analysis Report (FSAR) Section 9.2.8 did not provide information that the SCWS design will assure that the NPSH requirement for the

SCWS pumps is satisfied (including consideration of vortex formation) and identify the bounding margin provided by the SCWS design for the most limiting assumptions. Consequently, the applicant needs to provide additional information in Tier 2 FSAR Section 9.2.8 to specify the bounding value for the minimum net positive suction head (NPSH) requirement for the SCWS pumps and to demonstrate the compliance of this minimum NPSH requirement with the system design when taking vortex formation into consideration, and identify the bounding margin that is available for the most limiting case. Sufficient information is needed to enable the staff to independently confirm that the design is adequate in this regard, including bounding assumptions that were used along with supporting justification.

Based on the staff's review of the applicant's response to RAI 9.2.2-43 (ID1810/6776) AREVA #174 Supplement 3 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The applicant stated that pump sizing, including NPSH requirements, will be determined after the final pump pressures and flow rates are determined, later in the design process, after the plant is built. The applicant also stated NPSH-available, as well as excess margin, will be based on pump NPSH-required for the limiting line up at the minimum expansion tank level. The possibility of vortex formation will also be considered in the NPSH evaluation.

In order to complete its review the staff requires: (a.) Commitment by the applicant that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to generate the operating data to determine and to calculate the final pump pressures, flow rates and the NPSH information requested above or (b.) provide the bounding values for the the final pump pressure, flow rates and NPSH information requested above, that were used for the Conceptual/Preliminary design for the US EPR.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

09.02.02-90

Follow-up to RAI 174, Question 9.2.2-44:

The safety chilled water system (SCWS) must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. Based on Final safety Analysis Report (FSAR) Tier 2 Section 9.2.8.2, a diaphragm expansion tank is utilized with a nitrogen fill connection with relief valve protection for each division. Piping voids are precluded by the constant pressure from the divisionalized nitrogen-charged expansion tank; however, there is no FSAR detailed description of waterhammer consideration in the design.

Based on the staff's review of the applicant's response to RAI 9.2.2-44 (ID1810/6777) AREVA #174 Supplement 3 and audit conducted on October 27, 2009, the following

items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

The applicant stated piping voids associated with potential water-hammer are precluded by the constant pressure maintained in the nitrogen charged expansion tank in each division. In addition, the diaphragm expansion tank is also used for the equalization of pressure and volumetric expansion and maintains the requisite static system pressure. A relief valve on the connecting line prevents exceeding the line design pressure.

The applicant also stated that a hydraulic analysis of the SCWS will be performed later in the design process to identify the system requirements during normal startup, normal shutdown and abnormal conditions to confirm the minimum and maximum system pressures for various system mechanical and piping components. This analysis will consider pump details, as well as the pipe sizes and piping physical arrangement. Based on the analysis, an evaluation of water-hammer concerns will be performed to confirm that the system pressures are within the maximum allowed internal pressures. Sizing of the permanent surge control devices will also be confirmed. Provide the standards, guidelines and bounding requirements from the Conceptual/Preliminary Design that were used to address the the water-hammer concerns. Provide a committment that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to generate the system requirements for various system mechanical and piping components to evaluate the concerns involving the system pressures being within the allowed internal pressure.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending completion and submittal of the water-hammer analysis and a schedule for providing this information needs to be established.

09.02.02-91

Follow-up to RAI 174, Question 9.2.2-45:

The safety chilled water system (SCWS) must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. Under seismic or post-accident conditions where demineralized water may be unavailable for safety chilled water system (SCWS) makeup, the expansion tanks should contain sufficient water volume to assure reliable system operation without makeup for at least seven days. The Final Safety Analysis Report (FSAR) does not discuss expansion tank capabilities in the event of a makeup source interruption.

- a. Describe the bounding system leak rate that is assumed during normal operating and accident conditions, the bases for these assumptions, and the number of days of operation that the expansion tank is sized for should the makeup source be unavailable.

- b. Describe the treatment of these lines with regard to expansion tank capabilities, and the routing of the nitrogen relief valves to safe areas for discharge. Verify hose connections are safety related and seismic at the interface of the pump suction.

Based on the staff's review of the applicant's response to RAI 9.2.2-45 (ID1810/6782) AREVA #174 Supplement 4 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

With regards to part (a), the applicant responded that a seismically qualified makeup source will be used to feed the SCWS and satisfy NRC Standard Review Plan Section 9.2.2, Section 3C requirements for makeup water in closed loop cooling systems but did not modify Tier 1 drawings to show this connection stating that the connection does not perform a significant safety function. The staff requests the applicant provide amplifying information to support this conclusion.

In addition, the applicant stated that SCWS expansion tank sizing details will be developed later in the design process noting that expansion tank sizing and internal volume determination are dependent on several factors. Provide a commitment that the Initial Plant Test Programs in FSAR Chapter 14 contains requirements to confirm that the expansion tank sizing and internal volume determination are acceptable.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

09.02.02-92

Follow-up to RAI 174, Question 9.2.2-46:

The safety chilled water system (SCWS) must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. The Final Safety Analysis Report (FSAR) does not adequately describe the various operating modes and operator actions that are required and the initiation of the SCWS control system functions, such as the operation of protective measures (i.e., chilled water system "Protection OFF" alarms, refrigeration unit shuts down, chilled water circulating pump shuts down). These considerations need to be fully described in FSAR Tier 2 Section 9.2.8, including (for example):

- a. The process of selecting a particular system by the safety chilled water system (SCWS) system to initiate when the pressure falls below the second set limit,
- b. schematics showing all circuit process components with associated signal inputs and control signal outputs (the schematic provided should be of the type provided by Figure RAI 19-1, page 5, and Figure RAI 19-2, page 6, in "Response to Second Request for Additional information", Attachment A, ANP-10284Q2P),
- c. failure positions for the flow control valves,
- d. a discussion of normal power and alternate power (as shown in Tier 1 FSAR Table 2.7.2-2),

- e. a discussion of implementing the alternate supplies while maintaining divisional separation,
- f. the bases for the trip setpoint for low expansion tank pressure,
- g. SBO operation (FSAR Tier 2 Section 8.4 indicates that the Division 1 and 4 compressors are powered, but the SCWS pumps are not listed), and
- h. instrumentation and controls (I&C) related to SCWS operation such as starts signals, trip signals, and permissives (the schematic that is provided should be of the type provided by Figure RAI 19-1, page 5, and Figure RAI 19-2, page 6, in "Response to Second Request for Additional information", Attachment A, ANP-10284Q2P).

Based on the staff's review of the applicant's response to RAI 9.2.2-46 (ID1810/6785) AREVA #174 Supplement 4 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

With regards to part (a), the applicant stated that FSAR Tier 2, Section 9.2.8.6 describes the SCWS pressure control. If the pressure falls below a set limit, an alarm is annunciated. If the pressure falls below a second set limit, one of the following measures is automatically initiated:

- Chilled water system "Protection OFF" alarms.
- Refrigeration unit shuts down.
- Chilled water circulating pump shuts down.

The staff requests the applicant provide the two pressure setpoints and supporting bases for those setpoints. In addition, the staff requests that the applicant identify and describe which of the three automatic measures initiate (one, two, or all) upon reaching the second set pressure limit. Finally, describe which trip would encompass a loss of component cooling water to Division 2 and 3 chillers.

With regards to parts (b), (c), (f), and (h), the applicant stated that the information requested will be identified later in the design process.

The information described above is required by the staff in order to complete their review.

Consequently, this item will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.

09.02.02-93

Follow-up to RAI 174, Question 9.2.2-47:

The safety chilled water system (SCWS) must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with general design criteria (GDC) 44 requirements. The Final Safety Analysis Report (FSAR) states that each of the four SCWS trains circulates chilled water to the user heat exchangers with one of the two chilled water circulating pumps. The other pump remains in standby and starts automatically upon failure of the running pump. However, FSAR Tier 2 Section 9.2.8 does not explain the operation the automatic start of the standby pump and the

protection-off signal based on pump failure are coordinated (note that automatic start of the standby pump is mentioned in FSAR Tier 1 Table 2.7.2-3, Item 4.4 of the inspections, tests, analyses, and acceptance criteria, but this feature is not described in Tier 2 of the system description).. The following information needs to be included in FSAR Tier 2 Section 9.2.8:

- a. Explain the operation by which the SCWS system automatically starts a standby pump upon failure of the running pump. Provide schematic diagrams showing all inputs (i.e., PS, logic inputs, sensor inputs, all variables, actuation logic, binary limitation signals), with input types (i.e. PS, hardwired, fiber, type of isolation used), SCWS circuit components, and all SCWS control signal outputs of the SCWS control system. The schematic provided should be of the type provided by Figure RAI 19-1, page 5, and Figure RAI 19-2, page 6, in "Response to Second Request for Additional information", Attachment A, ANP-10284Q2P.
- b. Provide a discussion of these pump trips and coordination of signals in FSAR Tier 2 Section 9.2.8. Similarly, a discussion of the heating, ventilation and cooling (HVAC) system backup by the non-safety related 100% capacity maintenance train (cooled by operational chilled water) is discussed in the Technical Specification Bases (B 3.7.9) but is not described in FSAR Tier 2 Section 9.2.8.

Based on the staff's review of the applicant's response to RAI 9.2.2-47 (ID1810/6786) AREVA #174 Supplement 4 and audit conducted on October 27, 2009, the following items were determined as unresolved and therefore need to be further addressed and resolved by the applicant.

With regards to parts (a) and (b), the applicant responded the details of the pump interlocks, protection off trips, and SCWS I&C controls would be identified later in the design process.

The information described above is required by the staff in order to complete their review.

Consequently, these items will remain open pending submittal of the requested information and a schedule for providing this information needs to be established.