

## ArevaEPRDCPEm Resource

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**From:** Tesfaye, Getachew  
**Sent:** Wednesday, July 14, 2010 1:34 PM  
**To:** 'usepr@areva.com'  
**Cc:** Wheeler, Larry; Lee, Samuel; Segala, John; Hearn, Peter; Colaccino, Joseph;  
ArevaEPRDCPEm Resource  
**Subject:** U.S. EPR Design Certification Application RAI No. 417(4741), FSAR Ch. 9  
**Attachments:** RAI\_417\_SBPA\_4741.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on June 8, 2010, and discussed with your staff on June 29, 2010. No changes were made to the draft RAI as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,  
Getachew Tesfaye  
Sr. Project Manager  
NRO/DNRL/NARP  
(301) 415-3361

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**Created By:** Getachew.Tesfaye@nrc.gov

**Recipients:**

"Wheeler, Larry" <Larry.Wheeler@nrc.gov>  
Tracking Status: None  
"Lee, Samuel" <Samuel.Lee@nrc.gov>  
Tracking Status: None  
"Segala, John" <John.Segala@nrc.gov>  
Tracking Status: None  
"Hearn, Peter" <Peter.Hearn@nrc.gov>  
Tracking Status: None  
"Colaccino, Joseph" <Joseph.Colaccino@nrc.gov>  
Tracking Status: None  
"ArevaEPRDCPEm Resource" <ArevaEPRDCPEm.Resource@nrc.gov>  
Tracking Status: None  
"usepr@areva.com" <usepr@areva.com>  
Tracking Status: None

**Post Office:** HQCLSTR02.nrc.gov

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Request for Additional Information No. 417(4741), Revision 0

7/14/2010

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: 9.2.2

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

09.02.02-115

Follow-up to RAI 334, Question 9.2.2-57 and RAI 174, Question 9.2.2-8:

From RAI 9.2.2-8: The component cooling water system (CCWS) must be able to withstand natural phenomena without the loss of function in accordance with General Design Criteria (GDC) 2 requirements. As specified in Standard Review Plan (SRP) Tier 2 Section 9.2.2, staff acceptance is based upon compliance with GDC 2, "Design Basis for Protection Against Natural Phenomena." The staff considers the CCWS to be acceptable with respect to GDC 2 if it satisfies Position C1 and C.2 of Regulatory Guide 1.29, "Seismic Design Classification." Position C1 specifies that safety-related SSCs should satisfy Seismic Category I specifications and Position C2 indicates that the design on non-safety-related SSCs is acceptable if failures do not adversely affect the control room or safety-related SSCs, or result in excessive radiological releases to the environment. Consequently, the applicant needs to include additional information in Tier 2 Section 9.2.2 of the Final Safety Analysis Report (FSAR) to fully describe and address the impact of failures of the non-safety-related parts of the CCWS on the control room and radiological release considerations.

In response to follow-up RAI 9.2.2-57 the applicant provided a detailed markup of FSAR Tier 2 Section 9.2.2 that identified areas of the plant where non-safety, non-seismic CCWS piping was routed and a discussion of the isolation valves that the system design provided for isolation of these areas from the safety related portions of the CCWS system. Since several of the areas identified also contain other safety-related SSCs (e.g. Safeguards Buildings 1 to 4, Reactor Building Annulus etc.) the staff requests that the applicant revise the markup to include a description of the means used to assure that failure of the non-seismic CCWS piping will not adversely impact other safety-related SSCs located in these buildings. For example, the non-safety related headers are as large as 20" diameter. This part of the original RAI (RAI 9.2.2-8) has not been previously addressed; that is, the design of non-safety-related SSCs is acceptable if failures do not adversely affect the control room or safety-related SSCs, or result in excessive radiological releases to the environment". This guidance is found in RG1.29, C.2 which states:

Those portions of SSCs of which continued function is not required but of which failure could reduce the functioning of any plant feature included in items 1.a through 1.q above to an

unacceptable safety level or could result in incapacitating injury to occupants of the control room should be designed and constructed so that the SSE would not cause such failure.

In summary the applicant should address the following:

- a. The failure of non-seismic CCWS related to safety-related SSCs as addressed in RG 1.29, C.2 should be addressed in the FSAR. The applicant should consider for example, Seismic Category II, geographical separation, impact evaluation, etc. (see FSAR 3.7.3.8, "Interaction of Other Systems with Seismic Category I Systems"), for any portions of the non-safety CCWS that could possibly affect safety-related SSCs. This information should be added to the FSAR.
- b. The information that was added as part of RAI 9.2.2-57 FSAR mark-up related to the details of the non-seismic CCWS piping, locations and failure consequences should be removed and more of a high level summary added in its place.

09.02.02-116

Follow-up to RAI 334, Question 9.2.2-61 and RAI 174, Question 9.2.2-12:

During the staff's review of the FSAR markup provided for RAI 334 Supplement 1 and RAI 9.2.2-61, it was noted on page 9.2-44 of Tier 2 Section 9.2.2.6.1, "Control Features and Interlocks" that the CCWS pump trip interlock was omitted from the discussion of the response to MIN4 surge tank level. The staff also found that the corresponding FSAR Tier 1 ITAAC Commitment Item 4.6 had been deleted. While not specifically addressed in RAI 334, the staff was informed that this change was made by the applicant in response to RAI 182 Supplement 4 and guidance from SRP 14.3 was cited as the basis for deletion of the ITAAC for MIN4 CCWS pump trip interlock in FSAR Tier 1 Section 2.7.1. However, staff review of this change found that the MIN4 interlock provides other functions (described below) and therefore questions the applicability of the SRP 14.3 definition "provided solely for equipment protection." The applicant is therefore requested to determine if removal of the Tier 1 ITAAC for MIN4 was appropriate with consideration to the other functions identified below.

- a. Since the comment of RAI 182 and the SRP 14.3 guidance appear to apply only to Tier 1 ITAAC, describe the basis in this RAI response for the CCWS pump trip interlock being omitted from the discussion of the response to MIN4 surge tank level on page 9.2-44 of the Tier 2 Section 9.2.2 markup for RAI 334. Furthermore, based on the FSAR markup of the Emergency Backup Switchover Sequence from RAI 9.2.2-61), the tripping of the CCWS pump will automatically start the opposite CCWS train. Therefore, the tripping of a CCWS pump based on MIN4, is not solely for equipment protection but does automatically start the opposite CCWS pump.
- b. The description of the MIN4 interlock on page 9.2-44 of the markup indicates that the common header switchover function is unlocked to allow restoration of flow to the common users, which were isolated at MIN3. Since restoration of flow to users on the common header can be important (e.g. RCP thermal barrier coolers), describe the basis for deleting the Tier 1 MIN4 Interlock from the CCWS ITAAC.

09.02.02-117

Follow-up to RAI 334, Question 9.2.2-63 and RAI 174, Question 9.2.2-14:

The applicant should explain in the RAI response the application of the pump head and flow margins (calculated to be approximate 15-16%) to the pump parameters identified in FSAR Tier 2 Table 9.2.2-1. For example, Table 9.2.2-1 states that the design parameter for the pump is 17,768 gpm and the pump head is 199.7 ft.

The information that was added as part of RAI 9.2.2-63 FSAR mark-up related to the details of the pump head and pump flow margin, including new Table 9.2.2-5, should be removed and more of a high level summary added in its place.

09.02.02-118

Follow-up to RAI 334, Question 9.2.2-66 and RAI 174, Question 9.2.2-17:

The staff's review of the applicant's response and found that the FSAR markup was incomplete in that it did not fully address the basis and requirements for the special single failure requirements applied for RCP Thermal Barrier Cooling. AREVA is requested to expand the proposed FSAR markup to address at least the following key points:

- a. Since all four RCP thermal barriers are cooled by one of two common headers, describe the maintaining of this configuration by train separation. Failure-modes and effects analysis have not been provided in the FSAR for any CCWS active failures, in particular the common thermal barrier cooling headers. Single failure includes, but not limited to, operator errors, spurious activation of a valve operator and loss of a cooling water pump.
- b. To clarify, SRP 9.2.2, Section III, part 6 states that the SAR description information, P&IDs, CWS drawings, and failure-modes and effects analysis are reviewed by the primary review organization for whether essential portions of the system function following design-basis accidents, assuming a concurrent single active component failure. The applicant should incorporate this information into the FSAR.
- c. In addition, this intrusion of air from the surge tank or failures of CCWS users should also be considered into the failure-modes and effects analysis base on operating experience at St. Luice (LER3352010001R0), from October 16, 2008.

09.02.02-119

Follow-up to RAI 334, Question 9.2.2-70 and RAI 174, Question 9.2.2-22

Some of this RAI is editorial in nature.

Part (a)- In Part (a) of follow-up Question 9.2.2-70 the applicant was requested to clarify and state the basis for the Safety Injection (SI) sequences presented in U.S. EPR FSAR

Tier 2 Sections 9.2.2.3.1 and 9.2.2.6. The staff's review found the applicant's response unacceptable and noted the following corrections (technical and editorial) are required in the FSAR markups submitted in RAI 334, Supplement 1:

1. Section 9.2.2.3.1 on page 9.2-36 of the mark-up under the heading for "Previously Running Pumps..." At the end of the first bulleted sentence; delete the phrase "of the train not initially in operation," since it does not belong under this heading. Also, "The initiation of each sequence is provided as a group command" should be removed. (editorial)
2. Section 9.2.2.6 on page 9.2-44 of the markup under the heading "CCWS Actuation from a Safety Injection Signal; this sequence needs to recognize that a "Safety Injection Signal" will also initiate a concurrent containment Isolation "Stage 1" signal to isolate CCWS HVAC and NIDVS users in the Reactor Building. Refer to FSAR Tier 2, Section 7.3.1.2.9 "Containment Isolation," and Figure 7.3-20, "Containment Isolation" for justification that stage 1 is initiated by a safety injection signal. (editorial)
3. Section 9.2.2.3.1 was not consistent with Section 9.2.2.6.1 related to SI signal and the opening of the LHSI pump seal cooler. (technical)

09.02.02-120

Follow-up to RAI 334, Question 9.2.2-75 and RAI 174, Question 9.2.2-29:

Part (c)- In Part (c) of follow-up RAI 9.2.2-75 to RAI 9.2.2-29 the staff asked the applicant to add a discussion to FSAR Tier 2 Section 9.2.2 relative to the intended use of common header manual isolation valves (e.g. 20/30KAA30 AA013 and AA014 for 1b and 2b common header). The staff also requested the applicant to include a discussion in the RAI response of potential Technical Specifications that may apply if these valves must be closed during power operation. In response to RAI 334 Supplement 1, the applicant stated that these valves were provided only for maintenance isolation purpose to provide the capability for isolation of a common headers (1b or 2b) while still maintaining flow to the Safety Chilled Water System (SCWS).

However, the staff review noted that the applicant's response did not address the potential applicability of Technical Specifications (TS) when the valves **are** closed (e.g. note A-1 of TS 3.7.7) and no FSAR text markup of Section 9.2.2 was included. The staff noted that closure of these valves would prevent automatic train switchover of the 1b or 2b headers to the opposite pump and the plant would **then be forced to** shutdown since the 1b or 2b header would be isolated to the reactor coolant pumps for two pumps. Accordingly, the staff considers the capability provided by these valves of sufficient importance to warrant a description in the FSAR Tier 2 Section 9.2.2. The staff also requests that the applicant explain what is meant by the portion of the response that states "This configuration confirms the availability of the safety chillers during normal plant operation when only two CCWS trains are operating."

In summary, the applicant should address the following:

- a. The applicant should address the meaning of: "This configuration confirms the availability of the safety chillers during normal plant operation when only two CCWS trains are operating."

- b. Since credit is taken for these manual valves to isolate either the 1b or 2b header and provide CCWS flow to the SCWS to maintain operability, this should be discussed in the FSAR in Section 9.2.2.
- c. For manual valves 20/30KAA30 AA013 and AA014 for the 1b and 2b common headers, which are required to be manually closed (for example, during maintenance conditions) to maintain system operability, testing should be included that these valves are able to be closed and provide proper isolation.
- d. The applicant should include a discussion of potential Technical Specifications that may apply if these valves must be closed in the applicable TS modes.
- e. The applicant should explain (from RAI 9.2.2-29) the equalizing of runtimes of each CCWS pump by the closing of these maintenance valves.

09.02.02-121

Follow-up to RAI 334, Question 9.2.2-76 and RAI 174, Question 9.2.2-31:

Part (i)2 and Part (i)3- In Parts (i)2 and (i)3 of follow-up RAI 9.2.2-76 the staff asked the applicant to resolve discrepancies with the alternate power source for ESWS and CCWS Dedicated Train Components identified in U.S. EPR FSAR Tier 1 Tables 2.7.1-2 (CCWS) and 2.7.11-2 (ESWS). In Part (i)2 the staff noted that the FSAR markup provided by the applicant in the response to RAI 174, Supplement 3 of Table 2.7.1-2 identified normal power for the Dedicated Train was provided by Class 1E Division 4 with alternate power from Division 3 for some components but not for others. In Part (i)3 the staff asked the applicant to resolve differences in the power source identified in dedicated train components between CCWS Tier 1 Table 2.7.1-2 (markup for RAI 174, Supplement 3) and ESWS Tier 1 Table 2.7.11-2 (From FSAR Rev. 1). For some Dedicated Train components ESWS Table 2.7.11-2 identified Division 4 normal power with alternate power from the SBO EDG while the markup of CCWS Table 2.7.1-2 identified alternate power from division 3.

The response provided by the applicant in RAI 334, Supplement 1 included markups of Tier 1 Tables 2.7.1-2 and Table 2.7.11-2 as well as Tier 2 Sections 9.2.1 (ESWS) and 9.2.2 (CCWS). The staff's review of the applicant's response and markup of Tier 1 Tables 2.7.1-2 and 2.7.11-2 found them acceptable since only normal power was identified from Class 1E Division 4 and the conflicting alternate power sources were deleted. However, the staff review of the markups provided for FSAR Tier 2 Sections 9.2.1 and 9.2.2 noted a difference in the description of the power source for the Dedicated ESWS Train when compared to the markup for CCWS. The staff believes the FSAR description for the power source for the Dedicated ESWS and CCWS trains should be consistent. Accordingly, the applicant is requested to revise the markup provided for FSAR Tier 2, Section 9.2.1 and 9.2.2 to provide consistency. The subject descriptions from the markup are provided below followed by a list of items that require clarification.

From the markup of ESWS Tier 2 Section 9.2.1, Page 9.2-3

The dedicated ESWS pump is powered by Class 1E electrical buses and is capable of being supplied by an EDG or a station blackout diesel generators (SBODG).

From the markup of CCWS Tier 2 Section 9.2.2, Page 9.2-20

The dedicated CCWS train ... is normally fed from offsite power and is capable of being supplied by the onsite electrical power supplies that are backed by an EDG or SBO diesel generator.

The applicant should provide clarifications as shown below:

1. The FSAR description should state that the identified power sources are applicable to the entire dedicated train (pump, valves, components etc.) not just the pump as stated in the ESWS markup.
2. The FSAR description should be corrected since Tier 1 Table 2.7.1-2 and Table 2.7.11-2 which identified normal power for the dedicated train is from Class 1E Division 4, conflicts with the CCWS markup of Section 9.2.2 states that the normal source is off-site power.
3. The FSAR description should state the dedicated trains are also capable of being powered by the Division 4 EDG or the SBO DG.

Part (i)5- In Part (i)5 the applicant was asked to describe the basis for CCWS equipment that is provided with alternate power supplies in Tier 2, Section 9.2.2 In RAI 334 Supplement 1 the applicant responded by including new Table 9.2.2-4 "Power Supplies for CCWS Valves" in the markup of U.S. EPR FSAR Tier 2 Section 9.2.2 which is consistent with Tier 1. The Table identifies CCWS motor operated valves that are provided with normal and alternate Class 1E power supplies. The staff noted that Tier 2 Section 8.3.1.1.1, "Emergency Power Supply System," describes the alternate feed alignments which addressed the basis for alternate power in the EPR design for added power flexibility. However, the staff noted that the markup of Tier 1 Table 2.7.1-2 should identify a Class 1E power source for hydraulic fluid pumps that are associated with each hydraulic valve and associated pilot valves. This information should be added to the FSAR.

Part (m)- In Part (m) the staff requested that the applicant define the ESWS/CCWS design heat load in Tier 1 and cited examples of comparable FSAR Tier 1 Sections where this information was provided. In RAI 334 Supplement 1 the applicant responded by referring to the response to RAI 9.2.2-77 for revised CCWS ITAAC. However, the staff's review of the response to RAI 9.2.2-77 found no information was provided in regard to the addition of ITAAC for ESWS/ CCWS Hx heat load. The applicant should provide this information in Tier 1.

09.02.02-122

Follow-up to RAI 334, Question 9.2.2-77 and RAI 174, Question 9.2.2-32:

In RAI 9.2.2-77 the staff asked the applicant to resolve several follow-up issues in regard to U.S. EPR FSAR Tier 1 Section 2.7.1 ITAAC. The applicant's response to these issues was provided in RAI 334 Supplement 1. However, the staff's review of the response identified the following items that remain unresolved and should be addressed:

Part (2)(d)- In Part (2)(d) the staff asked the applicant to modify the description of Commitment Item 7.4 to assure that the required flow rate would be confirmed to be met



when the four Thermal Barriers were connected to either of the common headers. This item was requested by the staff since the four thermal barriers can be connected to either common header each of which is supplied by one of two CCWS pumps. However, the applicant's response only referred to the current ITAAC item and no Tier 1 change was proposed. This item should be resolved by the applicant to state that the design flow rate is for each thermal barrier cooler and tested for each header (1b and 2b).

Part (4)(a)-In Part (4)(a) the staff asked that water hammer be addressed in FSAR Section 14.2, Test #46. The response and FSAR markup did not specifically address 'all operational conditions' which should at the minimum include, but not be limited to;

- a. Automatic switchover between divisional trains
- b. Thermal barrier transfer between common headers
- c. System automatic starts, for example safety injection
- d. Valve automatic closures
- e. Pumps trips followed by pump automatic starts and emergency diesel generator loading

The applicant should add this information to the FSAR in Chapter 14.2. In addition, a water hammer analysis may be used to identify the bounding scenarios and limit plant testing to only those conditions.