ArevaEPRDCPEm Resource

From: Miernicki, Michael
Sent: Wednesday, October 23, 2013 3:10 PM
To: ArevaEPRDCPEm Resource
Subject: FW: Response to U.S. EPR Design Certification Application FINAL RAI 602, Section 09.02.05 - Ultimate Heat Sink
Attachments: RAI 602 Response US EPR DC.pdf

Michael J. Miernicki
Sr. Project Manager
NRC/NRO/DNRL/LB1
301-415-2304

From: HOTTLE Nathan (AREVA) [mailto:Nathan.Hottle@areva.com]
Sent: Monday, October 21, 2013 5:59 AM
To: Miernicki, Michael
Cc: Hearn, Peter; RANSOM Jim (AREVA); LEIGHLITER John (AREVA); GUCWA Len (EXTERNAL AREVA); UYEDA Graydon (AREVA); RYAN Tom (AREVA); ROMINE Judy (AREVA); DELANO Karen (AREVA)
Subject: Response to U.S. EPR Design Certification Application FINAL RAI 602, Section 09.02.05 - Ultimate Heat Sink

Mike,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 602 Response U.S. EPR DC.pdf" provides a technically correct and complete FINAL response to Question 09.02.05-39.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 602 Question 09.02.05-39.

The following table indicates the respective pages in the response document, "RAI 602 Response U.S. EPR DC," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 602 — 09.02.05-39	2	2

This completes the formal AREVA NP response to RAI 602. There are no additional questions associated with this RAI.

Sincerely,

Nathan Hottle
AREVA Inc.
3315 Old Forest Road
Lynchburg, VA 24501
Phone 434-832-3864
Mobile 434-485-4239
nathan.hottle@areva.com

From: Snyder, Amy [mailto:Amy.Snyder@nrc.gov]
Sent: Thursday, September 19, 2013 3:38 PM
To: ZZ-DL-A-USEPR-DL
Cc: Segala, John; Miernicki, Michael; Gleaves, Bill; Wheeler, Larry; Hearn, Peter; McKenna, Eileen
Subject: U.S. EPR Design Certification Application FINAL RAI 602, Section 09.02.05 - Ultimate Heat Sink

Attached please find the subject request for additional information (RAI). A draft RAI was provided to you on August 23, 2013. On August 27, 2013, AREVA informed us that, the RAI is clear and does not contain proprietary information and that no further clarification is needed.

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 or October 21, 2013**, 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.

Thank You,

Amy

Amy Snyder, U.S. EPR Design Certification Lead Project Manager
Licensing Branch 1 (LB1)
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
☎ Office: (301) 415-6822
Fax: (301) 415-6406
Mail Stop: T6-C20M
E-mail: Amy.Snyder@nrc.gov

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 4708

Mail Envelope Properties (9C2386A0C0BC584684916F7A0482B6CAEAF42FC733)

Subject: FW: Response to U.S. EPR Design Certification Application FINAL RAI 602, Section 09.02.05 - Ultimate Heat Sink
Sent Date: 10/23/2013 3:09:57 PM
Received Date: 10/23/2013 3:10:01 PM
From: Miernicki, Michael

Created By: Michael.Miernicki@nrc.gov

Recipients:
"ArevaEPRDCPEm Resource" <ArevaEPRDCPEm.Resource@nrc.gov>
Tracking Status: None

Post Office: HQCLSTR02.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	3008	10/23/2013 3:10:01 PM
RAI 602 Response US EPR DC.pdf	180248	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No.602

09/19/2013
U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.05 - Ultimate Heat Sink
Application Section: 9.2.5
SRSB Branch

Question 09.02.05-39:

In accordance with 10 CFR50 Appendix A and GDC 44, cooling water must have the capability to transfer heat from systems, structures, systems, and components (SSCs) important to safety to an ultimate heat sink during both normal and accident conditions, with suitable redundancy, assuming a single active component failure coincident with either the loss of offsite power or loss of onsite power. Based on the staff's review of US-EPR FSAR Revision 5, the following questions are needed related to the ultimate heat sink (UHS) and SSCs important to safety.

Page 9.2-129, note number 2 is incorrect; "241 x 106 BTU/hr". The 10 should be superscript with a 6.

Page 9.2.125-126, two paragraphs with 4 bullet items are repeated twice. "During the 27 days....will also be included."

Both on these items should be corrected in the FSAR.

Response to Question 09.02.05-39:

U.S. EPR FSAR Tier 2, Section 9.2.5.5 and Table 9.2.5-1 will be revised to incorporate the requested information.

For the purpose of consistency with the requested changes, a thorough examination of the U.S. EPR FSAR was performed, and as a result U.S. EPR FSAR Tier 2, Section 10.4.9.3, Chapter 16, Technical Specification Bases B 3.3.3, and Table 9.2.2-2 will also be revised to correct superscript formatting errors.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.2.5.5, 10.4.9.3, and Chapter 16, Technical Specifications Bases B 3.3.3, and Tables 9.2.2-2 and 9.2.5-1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

Table 9.2.2-2—CCWS User Requirements Summary
Sheet 1 of 2

Component	KKS	Heat Load (10^6 BTU/hr)	Required Flow (10^6 lb/hr)	Comments
CCWS Main Trains 1 and 4				
CCWS Pump Motor Cooler	KAA10/40 AC002	0.0955	0.0302	
LHSI Heat Exchanger	JNG10/40 AC001	152.8	2.984	Normal Cooldown when CCW train is only connected to the train SIS users (1)
		36.54	2.1906	Normal Cooldown when CCW train is only connected to the CCW common header (1)
		241	2.1906	DBA
MHSI Pump Motor Cooler	JND10/40 AP001	0.0239	0.0265	
CCWS Main Trains 2 and 3				
CCWS Pump Motor Cooler	KAA20/30 AC002	0.0955	0.0302	
LHSI Heat Exchanger	JNG20/30 AC001	152.8	2.984	Normal Cooldown when CCW train is only connected to the train SIS users (1)
		36.54	2.1906	Normal Cooldown when CCW train is also connected to the CCW common header (1)
		241	2.1906	DBA
MHSI Pump Motor Cooler	JND20/30 AP001	0.0239	0.0265	
LHSI Pump Motor Cooler	JNG20/30 AP001	0.1262	0.0141	
LHSI Sealing Fluid Cooler	JNG20/30 AP001	0.0341	0.0062	Flow isolated when LHSI pump is out of service for dilution prevention
Common Header 1				
Fuel Pool Cooling Hx	FAK10 AC001	29	0.8818	Normal Operations
		67.62	2.645	Refueling

Table 9.2.2-2—CCWS User Requirements Summary
Sheet 2 of 2

Component	KKS	Heat Load (10^6 BTU/hr)	Required Flow (10^6 lb/hr)	Comments
Safety Chiller	QKA20 AC002	5.705	0.514	
RCP Thermal Barrier	N/A	1.566	0.0792	Thermal Barriers 1-4 can be cooled by Common header 1 or 2
Additional Operational Users	QNA, QNB, JEB, KBA, KLA, KTA, QUC, KUA	69.86	4.11	
Common Header 2				
Fuel Pool Cooling Hx	FAK20 AC001	29	0.8818	Normal Operations
		67.62	2.645	Refueling
Safety Chiller	QKA30 AC002	5.705	0.514	
RCP Thermal Barrier	N/A	1.566	0.0792	Thermal Barriers 1-4 can be cooled by Common header 1 or 2
Additional Operational Users	QNA, QNB, JEB, KBA, QUC, KUA, LCQ, KBF, KBG, KPC, KPF	86.29	4.29	
Dedicated CCWS Train				
Severe Accident Heat Removal System Heat Exchanger	JMQ40 AC001/004	50.5	1.104	

Note:

1. A CCWS train aligned only to the train SIS users has a higher heat removal capacity than a CCWS train that is also aligned to the common header plus the CCWS train SIS users. Flow that would normally go to the common header is used for additional heat removal capacity from the SIS users.

3. A trend of water temperature in the cooling tower for the 30-day period.
4. The effect of concentrated impurities in the cooling tower basin on the ESWS flow rate and the cooling tower performance.

The report shall also include limiting assumptions and inputs, analytical methods, uncertainty analyses that demonstrate conservative results, and a list of references. Qualifications of the individuals performing the analysis and independent verification will also be included.

~~During the 27 days following the 72-hour post-accident period the UHS cooling towers are capable of removing the design basis heat load without water level dropping below the minimum required level in the cooling tower with minimum specified water inventory available and the most limiting site-specific ambient conditions that are assumed for water usage. Analyses will demonstrate that the cooling towers are capable of removing the design basis heat load without the water inventory dropping below the minimum required level in the cooling tower. Transient analyses shall be completed by qualified individuals and the results will be documented in the Cooling Tower Design Report. The report shall include:~~

1. ~~Performance curves for the cooling towers.~~
2. ~~The period of record for the temperature data and the specific worst case periods used in the analysis together with selection methods and validation techniques for the meteorological data,~~
3. ~~A trend of water temperature and water level in the cooling tower for the 30-day period.~~
4. ~~The effect of concentrated impurities in the cooling tower basin on the ESWS flow rate and the cooling tower performance.~~

~~The report shall also include limiting assumptions and inputs, analytical methods, uncertainty analyses that demonstrate conservative results, and a list of references. Qualifications of the individuals performing the analysis and independent verification will also be included.~~

As noted in Section 9.2.5.3, 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. In accordance with Section 3.4.3.9, ESWPBs 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. As indicated in Section 3.4.1, if there is a failure of one division of ESWS and one division is out for

Table 9.2.5-1—Ultimate Heat Sink System Interface

Component	Max Heat Load MBTU/hr	Total Required ESW Flow (10^6 lb_m/hr)	Required ESW Temperature °F	Comments
CCWS heat exchanger	128.1	7.540 min	≤92	Normal Operation
	120.1	7.540 min	≤90	Spring/Fall Outage Cooldown
	293.35[1]	7.540 min	≤95	DBA
Dedicated CCWS heat exchanger	51.2 nominal)	1.102 min	≤95	Severe Accident
EDG heat exchangers	22.0[2]	0.8985[3] min	≤95	EDG Operation
ESW pump room cooler for 31/32/ 33/34 UQB	0.619	0.0685	≤ 95	Normal Operations Shutdown/ Cooldown and DBA
ESW pump room cooler for 34 UQB	0.314	0.0347	≤ 95	Severe Accident - ESW flow supplied by dedicated ESW pump
ESW pump PEB 10/20/30/40 AP001	2.80	N/A	N/A	Normal Operations/ Cooldown/and DBA
UHS	297.2	N/A	N/A	Total from the CCWS and EDG heat exchangers, the ESWPBVS room cooler, and the ESW pump mechanical work.

Notes:

1. The CCWS heat exchanger load on the UHS in DBA is equal to the LHSI DBA heat load of 241 x 10^6 ~~Btu~~BTU/hr in Table 9.2.2-2 plus the additional loads from the CCWS common users.

2. Heat load includes all three associated heat exchangers (intercooler loop HX, lube oil cooler, and jacket water loop HX).

3. Heat exchangers are in series.

over the entire range of reactor operation and cool the plant to the decay heat removal system cut-in temperature coincident with a single active failure and loss of offsite power.

- The EFWS has the capability to remove the full range of decay heat from the RCS during design basis transient and accident conditions. The system has suitable redundancy, as demonstrated by a failure modes and effects analysis (FMEA) to withstand a high-energy pipe break, a single active failure, and LOOP and still perform its safety functions. Refer to Table 10.4.9-3—Emergency Feedwater System Failure Analysis.
- The EFWS automatically initiates upon a system actuation signal. The EFWS also satisfies the recommendations of RG 1.62 regarding the capability of manual initiation of protective actions.
- The EFWS meets the applicable recommendations of NUREG-0611 (Reference 2) and NUREG-0635 (Reference 3) with the exception to GS-5 and GL-3.

From a reliability perspective, the EFWS design satisfies the requirements of the TMI Action Plan item II.E.1.1 of NUREG 0737 (Reference 4) and 10 CFR 50.34(f)(1)(ii) for applicants subject to 10 CFR 50.34(f). An acceptable AFWS should have unreliability in the range of 10^{-4} to 10^{-5} per demand exclusive of station blackout scenarios. The EFWS achieves this reliability target, as described in Table 10.4.9-5—EFWS Unreliability Results, through a combination of redundancy and diversity.

- There are four complete trains, each normally aligned to a separate SG. The supply and discharge headers can be configured to allow the pumps to feed any combination of SGs.
- Each EFWS train receives power from a separate Class 1E emergency power system. In the event of loss of normal onsite and offsite power, power is supplied by the EDGs. The level control valves, SG isolation valves, fire water distribution system isolation valves, and discharge header cross-connect valves are also provided uninterruptible vital battery power.
- The system has suitable redundancy, as demonstrated by a single active failure analysis to withstand a single active failure and still perform its safety functions. Refer to Table 10.4.9-3 for a summary of the evaluation.
- The EFWS is not required to operate following a normal loss of the MFWS, as the SSS pump is actuated automatically. The SSS actuation reduces the frequency of EFWS actuation and increases the reliability of the plant overall decay heat removal capability.
- EFWS trains 1 and 4, including pump room cooling, are powered from the two non-Class 1E SBODGs.
- Critical EFWS valves and instrumentation are provided with uninterruptible emergency power.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The P3 permissive is utilized in Reactor Trip 11: RCS Flow Rate – Low-Low in One Loop.

Four divisions of the P3 Automatic Validation - Power Range Flux Measurement Higher than Second Setpoint Function are required to be OPERABLE in MODE 1.

This Function utilizes the Power Range Detectors sensors.

To generate the permissive, neutron flux measurements from the PRDs are compared to the setpoint (approximately 70% RTP). When at least two measurements are greater than the setpoint, the permissive is automatically validated.

3. P5 Automatic Validation

a. P5 Automatic Validation - Intermediate Range Flux Measurement Higher than Setpoint

The P5 permissive is representative of Intermediate Range Detector (IRD) neutron flux measurements above a low-power setpoint value. The P5 setpoint value corresponds to the boundary between the operating ranges of the Source Range Detectors and IRDs (greater than approximately 10^{-5} % RTP as indicated on the IRDs).

The P5 permissive is utilized in the following reactor trips:

– Reactor Trip 8: Core Power Level - High, and
– Reactor Trip 9: Saturation Margin - Low.

Four divisions of the P5 Automatic Validation - Intermediate Range Flux Measurement Higher than Setpoint Function are required to be OPERABLE in MODE 2.

This Function utilizes the IRD sensors.

To generate the permissive, neutron flux measurements from the IRDs are compared to the setpoint (greater than approximately 10^{-5} % RTP). When at least two measurements are greater than the setpoint, the permissive is automatically validated.