ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Thursday, September 23, 2010 7:48 PM
To: Tesfaye, Getachew
Cc: Hearn, Peter; GARDNER Darrell (AREVA)
Subject: FW: RAI 345, Questions 09.02.01-32 and 09.02.01-48 for Friday's NRC meeting.
Attachments: RAI 345, Q32 Draft Response for Review_092310.pdf; RAI 345, Q48 Draft Response for Review_092310.pdf

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Cc: HUDDLESTON Stephen (EP/PE); BALLARD Bob (EP/PE)
Subject: RAI 345, Questions 09.02.01-32 and 09.02.01-48 for Friday's NRC meeting.

Darrell, David, Marty

Attached are the DRAFT responses to RAI 345 Question 09.02.01-32 and Question 09.02.01-48. This is for second round review by NRC for Q32. Question 48 has been revised (prior to submittal) based on changes to UHS loads and T1 acceptance criteria.

Best Regards,
Jody

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Response to

Request for Additional Information No. 345

3/04/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.01 - Station Service Water System
Application Section: 9.2.1

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

Question 09.02.01-32:

Follow-up to RAI 119, Question 9.2.1-05

The ESWS must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements. In order for the staff to confirm that the ESWS has been adequately sized, the applicant needs to include additional information in Tier 2 of the FSAR, Section 9.2.1, to fully describe and explain what the minimum system heat transfer and flow requirements are for normal operating, refueling, and accident conditions, the bases for these requirements including limiting assumptions that apply (such as temperature considerations, recirculation flow, and blowdown flows), the degree of excess margin available and the method used to determine the margin, and the limiting system temperatures and pressures that are assumed with supporting basis.

Based on the staff's review of response to RAI 119, Question 9.2.1-05 and an audit by the staff conducted on October 27, 2009, this item remains open and requires further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the item remaining open.

The applicant stated that final margin and limiting system temperatures and pressures will be determined later in the design process incorporating vendor information. The staff review of this response found that the applicant's response did not address the bases for heat transfer, assumptions, degree of excess margin and the method used to determine the margin.

Response to Question 09.02.01-32:

The minimum requirements for the system user's exchangers which form the bases of heat transfer can be found in U.S. EPR Table 9.2.5-1. The maximum heat loads specified in Table 9.2.5-1 are considered bounding for the operating modes.

The ESW pumps are sized to provide the capacity to support system flow to transfer heat from the CCWS and EDG heat exchangers and the Essential Service Water Pump Building Ventilation System (SAQ) room coolers to the environment during normal operating and accident conditions. The pumps are sized to meet the largest flow requirement which would be the DBA mode.

Margin has been added to both the required flow and the required head of the ESW pumps as shown below.

	Pump Head	Design Flow	Basis
Pump Wear Margin	-4%	-8%	(1)
Plant Testing Instrument Uncertainty	±2%	±2%	(2)
Frequency Variations	±4%	±2%	(3)

	Pump Head	Design Flow	Basis
System flow balancing	4%	4%	(4)
Total Margin	10.0%	12.5%	See Below

Note 1 Pump Wear Margin is assumed.
Note 2 ASME OM Code – 2004 ISTB 3500, Table ISTB-3510-1 "Required Instrument Accuracy" and AREVA document 118-9018501-000, Guideline for System Design Margins.
Note 3 Per AREVA document 118-9018501-000, Guideline for System Design Margins.
Note 4 This additional margin is to ensure that adequate system flow will be available for system flow balancing.

Margin is combined using the sum of the squares method to prevent system over design. The total margin is calculated by adding the system flow balancing margin to the square root of the sum of the squares of the other margins. This way the collective margin will account for transients in the pump wear, plant testing instrument uncertainty, and the frequency variation margins. These margins are considered acceptable due to the nature of the fluid through the ESW pumps. With a maximum temperature of 95°F, a low TSS through the pump, and with regular maintenance of the safety related pumps, any additional margin is considered to be excessive. The calculated margins are shown below.

Pump Head Design Margin: $\sqrt{(4\%)^2 + (2\%)^2 + (4\%)^2} + 4\% = 10.0\%$

Pump Flow Design Margin: $\sqrt{(8\%)^2 + (2\%)^2 + (2\%)^2} + 4\% = 12.49\%$, approx. 12.5%

As a minimum, the above calculated margins will be applied to the pump design conditions.

ESW flowrates listed in U.S. EPR FSAR Table 9.2.5-1 as minimum flowrates do not reflect these applied design flow margins. Applying the margin to the total ESW minimum flow requirement envelopes the required flow for the ESWS pumps to transfer heat in any operating mode. The maximum heat loads specified in Table 9.2.5-1 are considered bounding for the operating modes.

Section 9.2.1.3.1 will be revised to include the above pump head and pump flow design margins of 10% and 12.5%, respectively.

U.S. EPR FSAR Table 9.2.5-1 will be revised to clarify that the stated heat load for the emergency diesel generators includes all 3 associated heat exchangers (Intercooler Loop HX, Lube Oil Cooler, and Jacket Water Loop HX). The flow rate applies to all 3 exchangers in series.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.2.1 and 9.2.5 will be revised as described in the response and indicated on the enclosed markup.

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	Comments
CCWS heat exchanger	128.1	7.540 min	≤92°F	Normal Operation
	120.1	7.540 min	≤90°F	Spring/Fall Outage Cooldown
	291.3	7.540 min	≤95°F	DBA
Dedicated CCWS heat exchanger	48.64	1.205 min	≤95°F	Severe Accident
EDG heat exchanger	22.0	1.06	≤95°F	
ESW pump room cooler for 31/32/ 33/34 UQB	0.619	0.0685	≤ 95°F	Normal Operations Shutdown/ Cooldown and DBA
ESW pump room cooler for 34 UQB	0.314	0.0347	≤ 95°F	Severe Accident - ESW flow supplied by dedicated ESW pump

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INSERT 3

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ESWS are powered by Class 1E electrical buses and are emergency powered by the EDGs.

The non-safety-related dedicated division contains a dedicated ESWS pump, debris filter, piping, valves, controls, and instrumentation. The non-safety related ESWS pumps cooling water from the division four UHS cooling tower basin to the dedicated CCWS HX and back to the division four UHS cooling tower during severe accidents (SA). The dedicated ESWS ~~pump~~train is powered by Class 1E electrical ~~buses~~Division 4 and is capable of being supplied by an EDG or a station blackout diesel generator (SBODG).

Refer to Section 12.3.6.5.7 for essential service water system design features which demonstrate compliance with the requirements of 10 CFR 20.1406.

9.2.1.3 Component Description

9.2.1.3.1 Safety-Related Essential Service Water Pumps

Each of the four safety-related cooling divisions contains one 100 percent capacity pump. During normal operating conditions, two of the four divisions are operating. The required flow rate of each ESWS pump is defined by the heat to be removed from the system loads. Design parameters are listed in Table 9.2.1-1. The pumps are designed to fulfill the corresponding minimal required design mass flow rate under the following conditions:

INSERT 1

- Minimal water level without cavitation.
- Head losses in the cooling water inlet piping according to full power plant operation.
- Fluctuations in the supplied electrical frequency.
- Increased pipe roughness due to aging and fouling.
- Fouled debris filters.
- Maximum pressure drop through the system HXs.
- Minimum water level in cooling tower basin considers minimum submergence requirements to prevent vortex effects, and net positive suction head to prevent cavitation of the ESWS pump.

Determination of the discharge head of the pumps is based on the dynamic pressure losses, the minimum/maximum water levels of the water source, and the head losses of the mechanical equipment of the associated ESWS at full load operation.

INSERT 2

INSERTS for RAI 345, Q 09.02.01-32

INSERT 1 for 9.2.1.3.1

plus an additional minimum flow margin of approximately 12.5%,

INSERT 2 for 9.2.1.3.1

with an additional margin of approximately 10% added to the total head

INSERT 3 for Table 9.2.5-1

Notes:

2. Heat load includes all 3 associated heat exchangers (Intercooler Loop HX, Lube Oil Cooler, and Jacket Water Loop HX).
3 Heat exchangers are in series.

Response to

Request for Additional Information No. 345

3/04/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.02.01 - Station Service Water System
Application Section: 9.2.1

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

Question 09.02.01-48:

Follow-up to RAI 119, Question 9.2.1-22

Applications for standard plant design approval must contain proposed ITAAC in accordance with 10 CFR 52.47(b)(1) requirements. Proposed ITAAC for the ESWS are provided in Tier 1 FSAR Section 2.7.11. The staff reviewed the information provided in Table 2.7.11-3, "Essential Service Water System Inspections, Tests, Analyses, and Acceptance Criteria," to confirm that the proposed ITAAC are adequate for EPR design certification. In addition to the items referred to in RAI 9.2.1-1 through -9 and RAI 9.2.1-21, some of which involve ITAAC considerations, the staff found that the proposed ITAAC are incomplete, inconsistent, inaccurate, or that clarification is needed and the applicant needs to revise the Tier 1 information to address the following considerations in this regard:

Part 4: Quantitative acceptance criteria needed to be established for all ITAAC as applicable (flow rates, heat transfer rates, completion times, etc.).

Based on the staff's review of response to RAI 119, Question 9.2.1-22 and an audit by the staff conducted on October 27, 2009, this item remains open and requires further resolution and/or clarification by the applicant. The following description provides the results of the staff's evaluation of the applicant's initial response and justification for the item remaining open.

1. The applicant's response to Question 4 of RAI 9.2.1-22 states that FSAR Tier 1, Section 2.7.11 and Table 2.7.11-3 would be revised to list quantitative acceptance criteria for applicable ESWS ultimate heat sink (UHS) ITAAC. This information was missing from the FSAR markup.
2. The acceptance column of ITAAC 7.6 Part b, which requires confirmation of "the following" ESWS response time, however, no response time requirement is identified.
3. The acceptance column of ITAAC 7.6 Part b states "a report exists and concludes that the ESWS starts within the following required time in reponsed to a simulated actuation signal". The applicant should consider adding the response time to Tier 1.

Response to Question 09.02.01-48:

1. Refer to the U.S. EPR FSAR Table 9.2.5-1 for the quantitative acceptance criteria applicable to the ESWS ultimate heat sink (UHS) ITAAC. The quantitative acceptance criteria previously provided in response to RAI 345, Q 09.02.01-45 has changed. Refer to RAI 351, Q 09.02.05-27 for the quantitative acceptance criteria applicable to the ESWS ultimate heat sink (UHS) ITAAC and changes to U.S. EPR FSAR Table 9.2.5-1.

2. The ESWS response time will be added to ITAAC 7.6 Part b as indicated on the enclosed markup.

   The flow rates to be used as the acceptance criteria, for which the ESWS delivers water to the CCWS and EDG heat exchangers within this response time, are provided in U.S. EPR FSAR Tier 2 Table 9.2.5-1 as minimum required flow rates. The flow rate to be used as the acceptance criteria for the ESWPBVS room cooler is the total required ESW flow rate as stated in U.S. EPR FSAR Table 9.2.5-1.

U.S. EPR FSAR Table 9.2.5-1 will be changed to revise the flow rate to the EDG heat exchangers to be the minimum required ESW flow to the EDG heat exchangers. The minimum required flow to the EDG heat exchangers is 0.8985E+6 lbm/hr.

3. Refer to Item 2 response above.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.7.11 and Tier 2, Section 9.2.5 will be revised as described in the response and indicated on the enclosed markup.

Table 2.7.11-3—Essential Service Water System ITAAC (6 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
7.3	Class 1E valves listed in Table 2.7.11-2 perform the function listed in Table 2.7.11-1 under system operating conditions.	Tests and analyses or a combination of tests and analyses will be performed to demonstrate the ability of the valves listed in Table 2.7.11-2 to change position as listed in Table 2.7.11-1 under system operating conditions.	The ~~as-installed~~ valve changes position as listed Table 2.7.11-1 under system operating conditions.
7.4	The ESWS has provisions to allow flow testing of the ESWS pumps during plant operation.	Testing for flow of the ESWS pumps back to the ESW cooling tower basin will be performed.	The ~~flow test line~~closed loop allows ESWS pump flow back to the ESW cooling tower basin.
7.5	Deleted.~~The non-safety related dedicated ESWS as listed in Table 2.7.11-1 has the capacity to remove the design heat load from the non-safety related dedicated CCWS heat exchanger and ESWPBVS division 4 room cooler.~~	Deleted.~~Tests and analyses will be performed to demonstrate the capability of the non-safety-related dedicated ESWS as listed in Table 2.7.11-1 to remove the design heat load from the non-safety related dedicated CCWS heat exchanger and ESWPBVS division 4 room cooler.~~	Deleted.~~The non-safety related dedicated ESWS has the capacity to remove the design heat load from the non-safety-related dedicated CCWS heat exchanger and ESWPBVS division 4 room cooler.~~
7.6	The ESWS delivers water at the required flow~~ and within the required time due to design basis events~~.	a. Tests and analyses will be performed to ~~determine~~ verify the ESWS delivery rate under design conditions. ~~b. An integrated system test will be performed using a simulated actuation signal to verify the startup time of the ESWS.~~	a. A report exists and concludes that the ESWS system delivers the following combined total design flowrate of at least~~:~~ 19,340 gpm. ~~b. A report exists and concludes that the ESWS starts within the following required time in response to a simulated actuation signal.~~

INSERT — RAI 345 09.02.01-48

Next File

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	Comments
CCWS heat exchanger	128.1	7.540 min	≤92°F	Normal Operation
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	291.3	7.540 min	≤95°F	DBA
Dedicated CCWS heat exchanger	48.64	1.205 min	≤95°F	Severe Accident
EDG heat exchanger	22.0	~~1.06~~ 0.8985 min	≤95°F	
ESW pump room cooler for 31/32/ 33/34 UQB	0.619	0.0685	≤ 95°F	Normal Operations Shutdown/ Cooldown and DBA
ESW pump room cooler for 34 UQB	0.314	0.0347	≤ 95°F	Severe Accident - ESW flow supplied by dedicated ESW pump

RAI 345
09.02.01-48

INSERT for RAI 345, Question 09.02.01-48 Response

INSERT for Item 7.6 in Table 2.7.11.-3:

7.6		b. An integrated system test will be performed to verify the startup time of the ESWS.	b. The ESWS starts and delivers water to the CCWS and EDG heat exchangers at the minimum required design flow rate for the heat exchangers within 120 seconds. A report exists and concludes that the ESWS delivers water to the ESWPBVS room cooler at ≥ the total required flow rate for the room cooler within 120 seconds.

Editorial

Make the first part of ITA and AC a part "a."