ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Tuesday, May 19, 2009 11:53 AM
To: Getachew Tesfaye
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 185, FSAR Ch 9, Supplement 1
Attachments: RAI 185 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 9 of the 10 questions of RAI No. 185 on April 22, 2009. The attached file, "RAI 185 Supplement 1 Response U.S. EPR DC" provides a technically correct and complete response to the remaining question, as committed.

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 185 Question 09.03.02-9.

The following table indicates the respective pages in the response document, "RAI 185 Supplement 1 Response U.S. EPR DC," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 185 - 09.03.02-9	2	4

This concludes the formal AREVA NP response to RAI 185, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

(Russ Wells on behalf of)
Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
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3315 Old Forest Road
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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, April 22, 2009 4:42 PM
To: Getachew Tesfaye
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); HEDRICK Gary E (AFS)
Subject: Response to U.S. EPR Design Certification Application RAI No. 185, FSAR Ch. 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 185 Response US EPR DC.pdf" provides technically correct and complete responses to 9 of the 10 questions.

The following table indicates the respective pages in the response document, "RAI 185 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 185 - 09.01.02-22	2	2
RAI 185 - 09.01.02-23	3	3
RAI 185 - 09.01.02-24	4	4
RAI 185 - 09.01.02-25	5	5
RAI 185 - 09.01.02-26	6	6
RAI 185 - 09.01.03-11	7	7
RAI 185 - 09.03.02-9	8	9
RAI 185 - 09.03.02-10	10	10
RAI 185 - 09.03.02-11	11	11
RAI 185 - 09.03.02-12	12	12

An answer is not provided for 1 of the 10 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 185 - 09.03.02-9	May 29, 2009

Sincerely,

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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, March 24, 2009 1:37 PM
To: ZZ-DL-A-USEPR-DL
Cc: Jeffrey Poehler; David Terao; Peter Hearn; Joseph Colaccino; Meena Khanna; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 185 (2097, 2101,2085), FSAR Ch. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on February 5, 2009, and discussed with your staff on March 6, 2009. RAI Question 09.03.02-9 was significantly modified 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

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 488

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD41017DC35B)

Subject: Response to U.S. EPR Design Certification Application RAI No. 185, FSAR Ch 9, Supplement 1
Sent Date: 5/19/2009 11:53:10 AM
Received Date: 5/19/2009 11:53:14 AM
From: WELLS Russell D (AREVA NP INC)

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Files	**Size**	**Date & Time**
MESSAGE	4051	5/19/2009 11:53:14 AM
RAI 185 Supplement 1 Response US EPR DC.pdf	134801	

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

Response to

Request for Additional Information No. 185 (2097, 2101, 2085), Supplement 1
Revision 0

03/24/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.02 - New and Spent Fuel Storage
SRP Section: 09.01.03 - Spent Fuel Pool Cooling and Cleanup System
SRP Section: 09.03.02 - Process and Post-Accident Sampling Systems
Application Section: FSAR Ch. 9

QUESTIONS for Component Integrity, Performance, and Testing Branch 1
(AP1000/EPR Projects) (CIB1)

Question 09.03.02-9:

Background

Figures 9.3.2-1 to 9.3.2-3 of Section 9.3.2.1 identify the sample point for the reactor coolant drain tank (RCDT) as the mechanism of sampling the pressurizer. The applicant's response to RAI 113 Question 09.03.02-3 identified other gaseous inputs to the RCDT besides the vented pressurizer gas phase fluids.

The noble gas, hydrogen, oxygen, and nitrogen content of the gas phase of the pressurizer are important chemistry operational, start-up and shutdown parameters that need to be monitored on a routine basis. The capability to accurately determine the concentrations of various species in the pressurizer gas phase is required based on the following:

- Technical Specification B 3.4.9, identifies the bases for pressurizer controls during operation and states, “Relatively small amounts of non-condensable gases can inhibit the condensation heat transfer between the pressurizer spray and the steam, and diminish the spray effectiveness for pressure control.” Hydrogen and nitrogen are non-condensable gases.
- Technical specification B 3.4.15 identifies the bases for radioactivity control in the RCS based on dose equivalent iodine (DEI) and dose equivalent xenon (DEX). Both of these constituent radionuclides in the RCS have significant fractions that are volatile.
- The EPRI Primary Water Chemistry Guidelines in Appendix B Section 4 identify the need for control of oxygen and hydrogen in the pressurizer during operation, start-up and shutdown to prevent stress corrosion cracking (SCC) of components both in the pressurizer and the RCS. During reactor start-up EPRI guidelines require RCS dissolved oxygen to be less than 100 ppb prior to proceeding above 250°F. However, oxygen and hydrogen in the pressurizer gas phase may not be in equilibrium with the liquid phase during start-up.

Additionally, the response to Question 09.02.03-3 noted that FSAR Section 5.4.10.2.1 identifies the pressurizer as continuously vented. In reviewing this section of the FSAR, the staff notes that the actual wording is:

> "A vent nozzle on the upper head connects to the pressurizer degasification system, the vacuum vent system, and the nitrogen injection system."

It is not clear to the staff that the pressurizer is continuously vented from either section 5.4.10.2.1 or Section 5.4.10.2.3, which covers operation of the pressurizer. (Figure 9.3.3-1 Sheet 4 does show the connection of the pressurizer vent to the RCDT.)

While the continuous venting of the pressurizer is potentially an adequate method of controlling the equilibrium concentrations of noble gases, hydrogen, oxygen and nitrogen in the RCS, it is not clear how the concentrations of these species for the pressurizer are calculated independently of the other inputs to the RCDT.

During a teleconference with the staff on March 6, 2009, the applicant provided the following rationale for not requiring a separate pressurizer gas phase sample:

- The pressurizer liquid phase is sampled for oxygen and checked against the RCS loop sample to make sure they are in equilibrium.
- Iodine and xenon would normally be sampled from the liquid phase even if the capability existed to sample the pressurizer gas phase
- The RCDT sample is expected to be representative of the pressurizer for hydrogen and oxygen because all other input to the RCDT is from other parts of the RCS, and is expected to be minimal compared to the input from the pressurizer vent.

Requested Information

Can the statement that the pressurizer is continuously vented (during normal operation start-up and shutdown) be added to both sections 5.4.10.2.3 and section 9.3.2 of the FSAR making it clear that this is the method of control of all of the noble gases, hydrogen, oxygen and nitrogen in the pressurizer gas phase?

Provide a calculation that demonstrates that inputs to the RCDT from all other parts of the RCS are minimal compared to the input from the pressurizer. The calculation should include the following inputs:

a) Flow rates from all sources (including the pressurizer) during normal operation, start-up and shutdown

b) Expected concentrations of noble gases, hydrogen, oxygen and nitrogen from each source (including the pressurizer) during the three phases of operations where these species need to be controlled.

Describe the method of assurance of equilibrium in the concentrations of species listed above:

a) between the RCS loop and pressurizer, and

1) between the pressurizer gas phase and liquid phase (particularly during start-up and shutdown)

Response to Question 09.03.02-9:

The pressurizer is continuously vented from the high point vent described in U.S. EPR FSAR, Tier 2, Section 5.4.2.10.1. However, the pressurizer continuous vent is not the exclusive means of control of the subject gases for all modes of operation.

The Reactor Coolant System (RCS) will be vacuum-filled during Mode 5 operations following refueling or mid-cycle shutdowns. This startup practice minimizes the amount of air remaining in the RCS, reduces the necessity to jog the Reactor Coolant Pumps (RCP) to aid gas venting during startup, and reduces the amount of hydrazine needed to scavenge residual oxygen.

During the remaining plant start-up (and shutdown) operations, the RCS is continuously vented via a pressurizer vent of greater capacity than the continuous vent used during normal power operation. Pressurizer spray is used in combination with continuous venting of the pressurizer gas phase to establish and maintain equilibrium between the reactor coolant and pressurizer and between the pressurizer gas and liquid phases. Following U.S. PWR industry practice, pressurized coolant liquid samples will be used to obtain the information required for controlling all RCS gas concentrations during start-up, shutdown and normal operations.

The following statement from the telecon on March 6, 2009 was mis-communicated and was not the intended position of the applicant:

> "The RCDT sample is expected to be representative of the pressurizer for hydrogen and oxygen because all other input to the RCDT is from other parts of the RCS, and is expected to be minimal compared to the input from the pressurizer vent."

It is not an expectation for the RCDT gas sample to be representative of the pressurizer gases. If needed, the gas sample from the RCDT can be used as a DIAGNOSTIC indication for the gases in the RCS as a whole, which also includes the gases in the pressurizer. The RCDT gas sample is not the indication used for CONTROL of the gases in pressurizer. The control of the pressurizer gases is as explained above.

In summary, the method that assures equilibration of gas concentrations between the RCS and pressurizer and between the pressurizer gas phase and liquid phase is periodic pressurizer spray in combination with continuous venting of the pressurizer gas phase. During plant start-up and shutdown operations, the RCS will be vented via a continuous pressurizer vent of greater capacity than the continuous pressurizer vent used during normal operations.

U.S. EPR FSAR Tier 2, Section 5.4.10.2.3, Operation, will be revised to include the following statement.

> "During normal operations, the pressurizer is vented by a continuous vent. During plant start-up and shutdown operations, the pressurizer is vented by a vent of greater capacity than the continuous vent used during normal operations."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 5.4.10.2.3, will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

During transient events, pressure can increase with an in-surge to the pressurizer from the RCS. These events are mitigated by the pressurizer spray, which automatically sprays the steam bubble to lower pressure. This prevents a high pressurizer pressure reactor trip (RT) from occurring. Conversely, during pressure decreases caused by out-surge to the RCS, water flashes to steam and heaters are automatically energized to maintain RCS pressure above the low pressurizer pressure RT setpoint.

09.03.02-9

During normal operations, the pressurizer is vented by a continuous vent. During plant start-up and shutdown operations, the pressurizer is vented by a vent of greater capacity than the continuous vent used during normal operations.

5.4.10.3 Design Evaluation

The pressurizer is designed to withstand loading combinations as described in Section 3.9.1. Pressurizer nozzles and the areas of the pressurizer adjacent to the nozzles are analyzed for nozzle loads.

Three PSRVs provide overpressure protection of the RCS. The surge line is sized to minimize the pressure drop in the line. The PSRVs are addressed in Section 5.4.13. Overpressure protection is addressed further in Section 5.2.2.

The pressurizer volume is sized to minimize pressure changes and reduce challenges to the PSRVs. The pressurizer spray valves, heaters, PSRVs and the reactor protection system pressure setpoints are presented in Table 5.4-6.

The total electrical power provided to the pressurizer heaters is sufficient to heat the pressurizer faster than the RCPs heat the reactor coolant in the rest of the RCS so as not to limit the RCS heat up rate. The proportional heater control power is above the required capacity to compensate for pressurizer heat losses during normal operation.

The pressurizer heaters supplied from emergency electrical power have sufficient capacity to compensate for pressurizer losses during a loss of offsite power. The pressurizer heater groups and their capacities are listed in Table 5.4-7—Pressurizer Heater Capacities. The pressurizer heater power supplies are addressed in Section 8.3.1.2.10.

5.4.10.4 Inspection and Testing Requirements

Pressure testing is performed on all pressure retaining components in accordance with the requirements of the ASME Section III. Non-destructive examination (NDE) is performed prior to and during fabrication of the pressurizer in accordance with the requirements of the ASME Section III.

The pressurizer design permits preservice examinations in accordance with ASME Section III and an inspection program in accordance with ASME Section XI. The