ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
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
Attachments: RAI 185 Response US EPR DC.pdf

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.

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RAI 185 - 09.01.02-22	2	2
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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,

Ronda Pederson

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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, March 24, 2009 1:37 PM
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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
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Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 419

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Response to

Request for Additional Information No. 185 (2097, 2101, 2085), 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 09.01.02-22:

Background

Your response to RAI 86, Question 09.01.02-19, Item 2, indicated that chloride, fluoride, and sulfate levels would be checked quarterly for the EPR spent fuel pool. The EPRI guidelines recommend monthly monitoring of these parameters. Industry experience has shown that, especially for sulfates, the concentration can rapidly increase (above the 150 ppb limit) due to resin radiolytic degradation. This can be significant particularly following a refueling outage.

Requested Information

Provide evidence showing that quarterly sampling will provide sufficient time to take remedial actions to stem contaminant transients in the SFP.

Response to Question 09.01.02-22:

The monitoring frequency for chloride, fluoride and sulfate in the spent fuel pool (SFP) liquid is once per month (monthly). This monitoring frequency is the same as the monitoring frequency suggested in the EPRI PWR Primary Water Chemistry Guidelines.

This question is also addressed in the Response to RAI 185 (2097, 2101, 2085), Revision 0, Question 09.01.03-11.

NOTE: This information supersedes the information in the earlier RAI response (e.g., RAI 86, Question 09.01.02-19, Item 2).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.01.02-23:

Background

Your response to RAI 86, Question 09.01.02-19, Item 3, indicated that contaminant limits for chloride, fluoride and sulfate for the spent fuel pool were the same as those imposed on the RCS during refueling (100 mg/kg or 0.100 ppm). It was not clear to the staff from this response whether these limits applied only during refueling or at all times for the spent fuel pool.

Requested Information

1. Provide the limits on contaminants imposed during the operating fuel cycle when the SFP and RCS are not connected.
2. If the contaminant limits for the spent fuel pool during normal operation are different than the limits during the refueling outage, provide a technical justification for these different limits.

Response to Question 09.01.02-23:

1. The contaminant limits for chloride, fluoride and sulfate in the spent fuel pool (SFP) liquid are the same as those imposed on the reactor coolant system (RCS) during refueling (e.g., 0.150 mg/kg or 0.150 ppm). These limits are the same as the limits suggested for chloride, fluoride and sulfate in the EPRI PWR Primary Water Chemistry Guidelines.

   This question is also addressed in the Response to RAI 185, Revision 0, Question 09.01.03-11.

   NOTE: This information supersedes the information in the earlier RAI response (e.g., RAI 86, Question 09.01.02-19, Item 3).
2. These limits apply at all times for the spent fuel pool (SFP) liquid.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.01.02-24:

Background

Your response to RAI 86 Question 09.01.02-20 (RAI ID 1143, Question 3916), Items 1 and 2, described the maintenance and monitoring of the spent fuel pool leak channel system. Your responses to these two items are technically acceptable, but they should be included in the EPR FSAR.

Requested Information

Include the information provided in responses to RAI 86 Question 09.01.02-20 Items 1 and 2 in the EPR FSAR.

Response to Question 09.01.02-24:

There is no guidance in RG 1.206 or SRP 9.1.2 to identify in the U.S. EPR FSAR the information provided in response to RAI 86 Question 09.01.02-20, Items 1 and 2. That level of detail would be inconsistent with the existing information in U.S. EPR FSAR Tier 2, Section 9.1.2. The level of detail provided in this section of the U.S. EPR FSAR is consistent with that provided by other design certification submittals.

The earlier response to RAI 86 Question 09.01.02-20, Items 1 and 2 described routine Leakage Chase Systems (LCS) inspections and maintenance activities and noted that routine inspections will be performed as part of the plant's regular maintenance program. Similarly, it was noted that the actual monitoring frequencies for LCS leakage rates will be part of the plant's regular maintenance program.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.01.02-25

Background

Your response to RAI 86, Question 09.01.02-20, Items 3 and 4, did not include a design figure.

Requested Information

1. Confirm it is your intent to use the same design that has been used in the past and use monitoring to maintain integrity. Include this information in the FSAR.

2. If an alternate design is to be used, provide a description with a detailed justification including a figure that identifies the alternate design for these leak-off channels.

Response to Question 09.01.02-25:

Pools provided with Leakage Chase Systems (LCS) will be of an alternate design, allowing for improved liner leak-off channel monitoring, inspection, and cleaning. The alternate design will provide reasonable assurance that all liner weld seams (leak-channels) both horizontal and vertical are accessible for inspections, cleaning for debris (boron crystallization, foreign material entry through inspection ports, corrosion build-up, etc.) removal, and monitoring; reducing the potential of any off-site contamination.

The details on the pool liner leakage monitoring LCS are integral to the pool liner supplier manufacturer’s final design.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.01.02-26:

Background

In your response to RAI 86 Question 09.01.02-20 Item 6, you stated, "The Seismic Category I back-up water sources have larger volumes of available water."

Requested Information

1. Provide the system names, and volumes of these back-up sources.
2. Identify the operational methods for making up to the SFP through this source.

Response to Question 09.01.02-26:

1. The Seismic Category I In-Containment Refueling Water Storage Tank (IRWST) has over 500,000 gallons of water that can be provided as make-up to the spent fuel pool (SFP). In addition, the Fire Water Distribution System (FWDS), which is designed to remain functional following a safe shutdown earthquake (SSE), can provide approximately 280,000 gallons of water.

2. The normal means of transferring water from the IRWST to the SFP is via the non-Seismic Category I Fuel Pool Purification System (FPPS) pumps and piping. If required, a Low Head Safety Injection (LHSI) pump can be aligned for IRWST recirculation with water directed to the SFP using hose connected to existing hose connections on the discharge of the pump. The FWDS water is transferred to the SFP using a hose from a standpipe in the Fuel Building.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.01.03-11:

Background

The technical specification cited in your response to RAI 86, Question 09.01.03-2 Item 2 (RAI ID 1227, Question 4194) deals only with boron. It does not address impurity monitoring or limits in the SFP. You stated that the SFP liquid is part of the RCS. SRP 9.3.4 contains the NRC staff guidance on primary-water chemistry control which cites the EPRI PWR Primary-Water Chemistry Guidelines as an acceptable evaluation standard for primary-water chemistry.

Requested Information

1. Provide the approach you plan to use for monitoring frequency. Provide a technical justification for the monitoring frequency chosen if it differs from the recommendations for the spent fuel pool cooling and cleanup system in the EPRI PWR Primary Water Chemistry Guidelines.
2. Provide the approach you plan to use for impurity monitoring (i.e., which impurities and chemical paramters are tested) and the acceptance limits. Provide a detailed technical justification for the approach if it differs from the recommendations for the spent fuel pool cooling and cleanup system in the EPRI PWR Primary Water Chemistry Guidelines.

Response to Question 09.01.03-11:

1. The monitoring frequency for impurities in the spent fuel pool (SFP) liquid is once per month (monthly). This monitoring frequency is the same as the monitoring frequency suggested in the EPRI PWR Primary Water Chemistry Guidelines.

   This question is also addressed in the Response to RAI 185, Revision 0, Question 09.01.02-22.
2. The impurities that should be analyzed in the SFP liquid on a routine basis are chloride, fluoride, and sulfate. The contaminant limits for chloride, fluoride and sulfate are the same as those imposed on the reactor coolant system (RCS) during refueling (e.g., 0.150 mg/kg or 0.150 ppm). These limits are the same as the limits suggested for chloride, fluoride and sulfate in the EPRI PWR Primary Water Chemistry Guidelines.

   This question is also addressed in the Response to RAI 185, Revision 0, Question 09.01.02-23.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

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^{o}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:

A response to this question will be provided by May 29, 2009.

Question 09.03.02-10:

Background

FSAR Tier 2, Figure 9.3.2-1—Nuclear Sampling System, Sheet 1, shows the nuclear sampling system (NSS) sample line from the LHSI system. The IRWST must be sampled once every 7 days for chemical parameters, ensuring it is within specifications. In response to RAI 113 for question 09.03.02-4 item 1 the applicant stated that the LHSI pumps will be run to perform this function. Representative sampling of a tank like the IRWST requires that the tank be recirculated for at least two tank volumes, or for a period of time that experience has shown is sufficient to create a representative sample. A one volume recirculation of the IRWST with a 2200 gpm (maximum) flow rate from the LHSI pumps will take approximately 3.8 to 4 hours based on the technical specification requirements for minimum and maximum volumes. Thus, a minimum time frame for operating these safety-related pumps (~8 hours) is much more than is necessary to ensure operability of the pumps and verifying they are operable.

Requested Information

State in the FSAR that operating of the LHSI pumps for at least the 8-hour time period will be the routine method of sampling of the IRWST. If not, provide an alternate method of ensuring a representative sample of the IRWST in the FSAR.

Response to Question 09.03.02-10:

As stated in the response to RAI 113 for Question 09.03.02-4, the Low Head Safety Injection (LHSI) pumps will be run to perform the In-Containment Refueling Water Storage Tank (IRWST) sampling function.

The function of mixing the IRWST contents to obtain a representative sample may be performed by operating the Safety Injection System/Residual Heat Removal System (SIS/RHRS) pumps and the Fuel Pool Purification System (FPPS) pump. The specific pump combination and pump operating time for the IRWST mixing will be documented in U.S. EPR operating procedures.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.03.02-11:

Background

The containment atmosphere is required to be sampled per TS 3.4.14. Normally this ‘sampling’ is performed by a continuous radiation monitor. In order to ensure compliance with GDC 64, as it relates to monitoring the containment atmosphere and plant environs for radioactivity, and GDC 60 as it relates to the capability of the PSS to control the release of radioactive materials to the environment, a back-up system for sampling containment for hydrogen and radioactive gases is required in the event that the continuous radiation monitor is out of service. The response to RAI 113, Question 09.03.02-4 indicated that the sampling activity monitoring and hydrogen monitoring system were also used to sample the containment atmosphere during normal operation. The SASS cannot serve as the backup system because it only operates during a severe accident.

Requested Information

Identify the system used to obtain containment gas samples in the event that the containment radiation monitor is out of service.

Response to Question 09.03.02-11:

The Sampling Activity Monitoring System (SAMS) as described in U.S. EPR FSAR Tier 2, Section 12.3.4 and the Hydrogen Monitoring System (HMS) as described in U.S. EPR FSAR Tier 2, Section 6.2.5.2.2 sample airborne radioactivity and hydrogen, respectively, within containment.

The SAMS system in the Reactor Building upstream of KLA05 filters (see U.S. EPR FSAR Tier 2, Table 12.3-4) continuously monitors airborne radioactivity. This system is composed of monitors and piping that obtain a grab sample of the containment atmosphere (via the KLA05 HVAC system), process the sample for airborne radioactivity, and then return the sample to the containment atmosphere (via the KLA05 HVAC system). In the event that the monitor itself is out-of-service, the system has the capability for obtaining a grab sample that can be analyzed in the laboratory (for containment airborne radioactivity and hydrogen).

The HMS low range, safety-related subsystem is composed of hydrogen sensors that are continuously monitoring hydrogen concentration during normal operation. The high range subsystem is composed of gas samplers and piping that obtain a grab sample of the containment atmosphere, process the sample for the hydrogen concentration, then return the sample to the containment atmosphere. Although the high range subsystem is for use in severe accidents, it can be started manually to provide the Main Control Room (MCR) with indication of hydrogen concentration within containment should the low range subsystem become unavailable.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.03.02-12:

Background

FSAR Tier 2 Section 9.3.2.3 identifies that one function of the SASS is to sample the containment atmosphere for gases, both hydrogen and radioactive gases. The applicant's response to RAI 113 Question 09.03.02-6 indicates that the Figure 9.3.2-2 description of "in-situ pool samplers" are the water scrubbing systems that will remove the non-condensable gases, iodines and aerosols from the containment atmosphere and allow determination. Scrubbing would be an acceptable method for iodines and particulates; however, the determination of noble gases by enhancing solubility in a liquid phase is the reverse process of normally performed at US PWRs.

Requested Information

Describe the techniques for removing noble gases from the gas phase in the pool samplers and explain the technique for determining the noble gases in the containment air sample.

Response to Question 09.03.02-12:

The in-situ pool samplers do not separate noble gases from the gas phase. The in-situ pool samplers are stainless steel vessels with both inner and outer flow chambers. During operation, the sampler contains a preheated alkaline scrubbing solution. A slight pressure difference relative to containment causes containment atmosphere to enter through a venturi nozzle. Aerosols and iodine passing through the venturi nozzle are retained in the scrubbing liquid. The gases not retained by the scrubbing solution, including noble gases, are transported to the gas sampling module. A gaseous sample may be diluted in the gas sampling module before being transferred to the sample box. A gaseous sample containing the noble gases can be obtained from the sample box with a syringe. Laboratory analysis then determines airborne radioactivity. The SASS system is described in U.S. EPR FSAR Tier 2, Figure 9.3.2-2—Severe Accident Sampling System.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.