ArevaEPRDCPEm Resource

From: Getachew Tesfaye
Sent: Wednesday, February 25, 2009 8:19 PM
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Cc: John Budzynski; Shanlai Lu; Joseph Donoghue; Jason Carneal; Joseph Colaccino; ArevaEPRDCPEm Resource
Subject: Draft - U.S. EPR Design Certification Application RAI No. 194 (598), FSAR Ch. 4
Attachments: Draft RAI_194_SRSB_598.doc

Attached please find draft RAI No. 194 regarding your application for standard design certification of the U.S. EPR. If you have any question or need clarifications regarding this RAI, please let me know as soon as possible, I will have our technical Staff available to discuss them with you.

Please also review the RAI to ensure that we have not inadvertently included proprietary information. If there are any proprietary information, please let me know within the next ten days. If I do not hear from you within the next ten days, I will assume there are none and will make the draft RAI publicly available.

Thanks,
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Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 252

Mail Envelope Properties (C56E360E9D804F4B95BC673F886381E71D99A5BFD0)

Subject: Draft - U.S. EPR Design Certification Application RAI No. 194 (598), FSAR Ch. 4
Sent Date: 2/25/2009 8:19:08 PM
Received Date: 2/25/2009 8:19:10 PM
From: Getachew Tesfaye

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Files	**Size**	**Date & Time**
MESSAGE	722	2/25/2009 8:19:10 PM
Draft RAI_194_SRSB_598.doc	38394	

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

Draft

Request for Additional Information No. 194 (598), Revision 0

02/25/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 04.04 - Thermal and Hydraulic Design
Application Section: 4.4

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

04.04-1

Containment isolation valve of the N2 supply to the AMS is a manually operated valve, located outside of the containment, which is open whenever there is a need to replenish the accumulators to the AMS. Describe the containment isolation capability for this system. Confirm that there are isolation valves inside the containment which will automatically close upon receiving an isolation signal.

04.04-2

Please provide information/data in regard to the AMS guide tube deformation and the impact it would have operationally and neutronically. How would the signal measurement be affected and what compensation is performed in POWERTRAX program?

04.04-4

1) Please provide P&IDs, related schematics and detail design information of the aeroball monitoring system (AMS) and power density detector system (PDDS) to supplement and enhance the information contained in the DC FSAR. Provide a more detailed description of the AMS operation including a discussion of a complete calibration cycle with opening and closing times of the system valves. Also please provide information/data in regards to the AMS transport time correction and the effect it may have on the flux measurements. Explain how compensation is performed in POWERTRAX/E program to account for the transport time of the aeroballs.

2) What are the design criteria for the aeroball finger tubing? Can the tubing system withstand the RCS nominal system pressure of 2250 psi if the carrying gas supply is cut off? Describe the isolation systems that will actuate in case an AMS tube ruptures inside the vessel.

3) Please identify any reports of excessive residual moisture in the aeroball tubing at operating plants employing the aeroball monitoring system (AMS). Please provide a detail description of the event(s) and the root cause of excessive residual moisture. If excessive residual moisture had been detected, can one assume a single failure resulting in the leakage of the primary loop coolant through the tubing to the counting room or N2 supply room?

Please identify any reports of excessive residual moisture in the aeroball tubing at operating plants employing the aeroball monitoring system (AMS). Please provide a detail description of the event(s) and the root cause of excessive residual moisture. If excessive residual moisture had been detected, can one assume a single failure resulting in the leakage of the primary loop coolant through the tubing to the counting room or N2 supply room?

4) Where are the aeroball monitoring system (AMS) counting room and the N2 supply line source located? What are the dose limits in these areas? Can the leakage of a tube cause significant dose in the upper containment?

5) Please identify the primary nitrogen source for the aeroball monitoring system (AMS) during normal plant operation. In the event of a nitrogen gas pressure drop in the main supply nitrogen source, describe the process sequence of events to isolate the primary nitrogen source from the AMS. If the primary nitrogen source is isolated, identify the backup nitrogen source to the AMS that ensures continue aeroball transport operation. In detail, describe the backup source functions and interface with the primary source and AMS. If applicable, show the relevant containment isolation valves on the P&IDs. What is the pressure setpoint at which the solenoid valve isolates the supply line to the main supply system? What is the nominal nitrogen pressure during normal operation? If there is a tube failure within the containment, what is the impact of the leakage on the containment pressure?

6) What is the allowable moisture content in the N2 line? Is the allowable limit controlled by the Technical Specifications? Please provide detail information to clarify how the moisture content is measured and controlled below the limit. There are 40 aeroball tubes which are grouped into four subsystems representing the symmetrical core quadrants. If the moisture level in any of the subsystems is too high, is there a moisture sensor and controlling mechanism that will shut down and isolate the affected subsystem. If so, describe the operation in detail. Also, provide a detail description of the mechanism which controls the routing of the 10 aeroballs strings per quadrant onto the counting table. If there is a moisture buildup within a tube, explain in detail how does this affect the following: (1) the flux readings of the aeroball stack, (2) thermal limits calculations, and (3) the neutronics of the fuel assembly in the vicinity of the tube?

7) Twelve Siemens nuclear plants have used the PDDS and aeroball monitoring system (AMS) systems for core monitoring. What are the major differences between the EPR core monitoring system and those used in Siemens plants? What are the advantages and disadvantages?

8) Please discuss in detail the self powered neutron detector (SPND) failure events reported at operating plants including additional details on the performance and maintenance history of this type of detector?

9) What is the lifetime of the aeroballs? Is there an age-based correction factor in the calibration calculations?

10)If Self Powered Neutron Detectors (SPND) are safety related, where are the test procedures about SPND documented to support ITTAC? Please provide the test and calibration procedures.

11) The cables and tubes are routed out of the reactor through a penetration into the aeroball monitoring system (AMS) room housing the instrumentation measuring cabinet and table. Is this penetration pressure tight? If so, please explain the reason for this pressure tight penetration since the AMS is located within the containment.

12) Does the POWERTRAX/E receive signals from only non-safety systems? If so, it appears that POWERTRAX/E system receives signals from SPND. Therefore, does it mean that SPND is a non-safety system?

13) Describe in detail the Power Density Detector System (PDDS) and provide a list of references.

14) Considering any sensitivity deviations to core instrumentation calibration to potential shuffling of the aeroballs allowed by the mechanical design of the system and manufacturing tolerances, please provide detail information of manufacturing tolerances to the measurement uncertainty.

How does the aeroball monitoring system (AMS) system compensate for the difference in the time of the flux measurements between each quadrant while the ball stacks are in the waiting position?

15) There are 40 ball stacks with 36 flux measuring detectors per ball stack. Please discuss in detail how the detectors are inter-calibrated to compensate for individual detector signal sensitivity loss? Is this performed in the aeroball monitoring system (AMS) or POWERTRAX/E?

16) Please discuss in detail the following questions. How does the aeroball monitoring system (AMS) compensate for a bad measuring detector? How many bad measuring detectors are permitted per ball stack before the ball stack is declared inoperable? If a ball stack is declared inoperable, how would the flux profile for that location be determine and what effect would there be on the thermal limit calibrations? What is the maximum number of inoperable ball stacks permitted per quadrant and full core? Are these limits regulated by the technical specifications? Is there a limit for the combination of failed in-core detectors and measuring detectors (ball stacks)?

17) The aeroball has a diameter of 0.067inch (1.7mm). What is the inner diameter of the aeroball tubing? What are the temperature coefficients of expansion for the aeroball and tubing? Due to expansion, how is the gap between the tube and ball affected at normal operational temperature conditions? Does this affect the ball travelling through the tube? Also, how is the ball travelling through the tubing affected by growth and deformation of the aeroball tube at operating temperature and high flux fields?

18) Describe in detail the quality control process for fabrication of aeroballs. How are individual balls tested? What is the tolerance on the ball composition?