

June 18, 2009

U.S. NUCLEAR REGULATORY COMMISSION (NRC)
OFFICE OF NEW REACTORS
DIVISION OF ENGINEERING
REGULATORY AUDIT REPORT

Docket No.: 052-000020

Applicant: AREVA NP, INC.
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Application and Section: U.S. EPR AREVA FSAR SECTION 3.9.4

Audit Dates: APRIL 09, 2009

NRC Audit Reviewers: Terri Spicher, Lead Technical Reviewer (NRO/DE/EMB2)
Patrick Sekerak, Technical Reviewer (NRO/DE/EMB1)
Michael Miernicki, Project Manager (NRO/DNRL/NARP)
Jay Patel, NRC Project Manager (NRO/DNRL/NARP)

Approved by: Jennifer Dixon-Herrity, Branch Chief
Engineering Mechanics Branch 2, NRO/DE

EXECUTIVE SUMMARY

AREVA NP, INC.
Docket No. 052-000020

Upon review of Section 3.9.4.4 of the AREVA FSAR, The NRC staff requested confirmation that for mechanical adequacy of Control Rod Drive Mechanism's (CRDMs), a prototype testing program comprised of performance, stability, and endurance tests is created. The purpose of this audit was to discuss the basis for the response to RAI 95 Question 03.09.04-1b: and to gain an understanding of the testing that had been performed for the US EPR CRDMs in Germany at the KOPRA test facility for the US EPR design.

The results of the audit are summarized below:

The NRC staff successfully reviewed the results of the prototype testing program for CRDMs and the range of environmental conditions that support it. AREVA provided the prototype testing results for the U.S. EPR design which consists of performance, stability, and endurance testing. The performance test results verified the adequacy of the performance of the equipment in a range of temperature, pressure and flow conditions. The stability test results ensured proper functioning is achieved over time. The endurance test results quantified the number of steps during which no appreciable damage possibly altering the mechanical behavior is expected.

REPORT DETAILS

Audit Scope/Summary:

The overall scope of the audit was to accomplish the following:

- Discuss the basis for the response to RAI 95 Question 03.09.04-1b
- Discuss CRDM endurance testing performed at the KOPRA facility in Germany
- Advise AREVA of the NRC expectations regarding the technical content of the responses
- Provide feedback on the RAI response
- Determine if, as a result of the audit, additional RAIs are required

Individuals involved in the audit are listed in Attachment 1 of this audit report. At the time of the audit, the RAI 95 response had been received for FSAR Section 03.09.04. The purpose of the audit was to discuss the basis for the response to RAI 95 Question 03.09.04-1b. AREVA provided an overview of the testing that had been performed for the US EPR CRDM's in Germany at the KOPRA test facility for the US EPR design. In support of the audit, AREVA made available copies of the calculations which documented the results of the testing performed. The test results for the US EPR CRDM's were discussed and as a result of the audit additional information was requested.

Observations and Findings

AREVA made a presentation describing the testing performed for the US EPR CRDM's in Germany at the KOPRA test facility for the US EPR design. The following provides an overview of AREVA's presentation and the items discussed:

- Introduction (R. Wells)
- Meeting Objectives (R. Wells)
- RAI 95 Question 03.09.04-1b Overview (R. Wells)
- US ERP CRDM Test Program Description (F. Champomier)
- US ERP CRDM Performance Test Results (F. Champomier)
- US ERP CRDM Stability and Endurance Test Results (F. Champomier)
- Conclusions (F. Champomier)
- Inspection Findings (F. Champomier)

During the presentation, the NRC staff asked specific questions regarding the test results presented. AREVA answered all questions with one outstanding that will be addressed in a RAI. To summarize:

- NRC requested the total number of steps in the testing process. AREVA responded that testing encompassed over nine million steps.

- AREVA discussed an observance of latch arm wear at three million steps. They determined the latch mechanism hard facing was related to the manufacturing practice used with the hardfacing of latches. The latches were remanufactured with a different hardfacing technique. The new latch arms were successfully tested for over nine million steps.
- The performance tests were conducted under various conditions, both normal and abnormal, in step by step operating mode with period drops. All test results were acceptable.
- The stability tests results ensured that proper functioning is reliably achieved over an appreciable amount of time. All test results were acceptable.
- The endurance test results quantified the number of steps that can be performed with no notably wear. All test results were acceptable.

As a result of the presentation, additional information was requested by the NRC staff. The NRC viewed a hardcopy of the presentation, U.S. EPR Control Rod Drive Mechanism (CRDM) Test Results (this document is proprietary) and the documents listed in Attachment 1.

The NRC staff asked a few questions regarding these documents. To summarize:

- The CRDM design specification and design calculations were completed by AREVA staff.
- JSPM will be N stamping and fabricating the CRDMs.
- For non-pressure boundary components, AREVA will use ASME Code, Section III, NB Criteria for allowable stress and will maintain ASME code material.

Exit Meeting

On April 09, 2009, the NRC staff presented the audit scope and findings during an exit meeting with Russ Wells and AREVA personnel.

ATTACHMENT 1

1. PERSONS CONTACTED

NAME	ORGANIZATION	TELEPHONE	E-MAIL
Jay Patel	NRC	301-415-6174	Jay.Patel@nrc.gov
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2. DOCUMENTS REVIEWED

Document Number	Title	Rev. No.	Date
32-9058232-000	Control Rod Drive Mechanism (CRDM) Dynamic Analysis – U.S. EPR	0	10/2/2007
32-9062444-000	Control Rod Drive Mechanism (CRDM) Sizing Analysis of the Pressure Housing by Design Loadings	0	10/3/2007
32-9062445-000	Mechanical and Physical Material Properties for Design Calculation of the Pressure Retaining Boundary Parts of the CRDM	0	10/3/2007
32-9062529-000	Control Rod Drive Mechanism (CRDM) Stress Analysis for Flange Connection	0	10/5/2007
32-9062530-000	Control Rod Drive Mechanism (CRDM) Strength Proof for Faulted Condition	0	10/5/2007
32-9062814-001	EPR KOPRA Tests – EPR Short Drive Rod Configuration Synthesis Report for CRDM Validation September 2006 – June 2007 Tests	1	1/29/2009
38-9102922-000	EPR KOPRA Tests – Rod Drop Times During Stability Test	0	1/29/2009
38-9102923-000	EPR KOPRA Tests Short Drive Rod Configuration Synthesis Report for CRDM Validation – Stability Test	0	1/29/2009
38-9102925-000	EPR KOPRA Tests Short Drive Rod Configuration – Performance Tests – Synthesis Report for Validation Purposes	0	1/29/2009
38-9102926-000	EPR KOPRA Tests Specification	0	1/29/2009
08-9071381-000	Design Specification Control Rod Drive Mechanism for US EPR	0	TBD

3. STANDARD REVIEW PLAN AND GUIDANCE USED

Section 3.9.4, "Control Rod Drive Systems"

4. LIST OF RAIs

In RAI 03.09.04-1a, the staff requested the applicant to provide reference that documents CRDM qualification to operate in RPV environment for 60 years. The applicant in their response indicated Primary Stress Analysis will provide justification for 60 year design life. Additionally, the applicant based endurance testing on nine million steps for 60 year design life. The NRC staff finds this response acceptable; however, the NRC staff is requesting the applicant to provide the basis for enveloping the number of cycles or steps for 60 year design life.