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Date: May 25, 2017

To: John Lehning

From: L.-Y. Cheng and U.S. Rohatgi

*Subject: Trip Report for Regulatory Audit of AREVA Topical Report ANP-10332P
Rev. 0 (TO0013)*

Memo

Project Title:

Technical Assistance in Support of Review of AREVA Topical Report ANP-10332P,
"AURORA-B: An Evaluation Model for Boiling Water Reactors; Application to Loss of
Coolant Accident Scenarios"

NRC Agreement Number: NRC-HQ-25-14-D-0002

NRC Task Order Number: NRC-HQ-20-16-T-0013

TAC Number: MF3829

Date of audit meeting: May 16-18, 2017.

Place of audit meeting: AREVA office in Richland, WA.

Meeting participants:

NRC: John Lehning (TM), Jonathan Rowley (PM)

BNL: Lap-Yan Cheng (PI), Upendra (Kumar) Rohatgi

AREVA: Alan Meginnis, Kevin Quick, Tim Guidotti, Joo Seok Baek, Robert Schnepf, plus
others.

A regulatory audit meeting was held at the vendor site in Richland, WA for the discussion of outstanding questions generated by the NRC [U.S. Nuclear Regulatory Commission] staff and the BNL [Brookhaven National Laboratory] review of the subject topical report to date. The focus of the meeting was to seek clarification on the technical contents of the topical report and to identify additional information to facilitate the continuing review. Technical staff from the thermal-hydraulics group of AREVA, Richland was present at the audit meeting.

The audit meeting began with a presentation by the AREVA staff, highlighting recent modifications to the AURORA-B LOCA [loss of coolant accident] evaluation model (EM). These modifications resulted in a new version of S-RELAP5 while the validation cases shown in the licensing topical report (LTR) for BWR [boiling water reactor] LOCA were from a previous released version of the code, namely, []. AREVA has indicated a desire

to seek approval of the BWR LOCA EM that is based on the newer version of S-RELAP5, namely, [].

During the acceptance review of the LTR the NRC staff prepared a list of questions for discussion with AREVA at a future audit of the AURORA-B LOCA methodology. AREVA prepared a written response (not formally reviewed by AREVA) to each question and the responses were discussed in two sessions during the audit meeting. Based on the discussions a number of the questions remain to be addressed in future RAIs.

On April 28, 2017, BNL transmitted to the PM [project manager], via email, a list of 22 questions (some with multiple parts) to support discussion with AREVA during the audit. AREVA discussed all BNL questions during the meeting and will follow up with written responses. In the afternoon of May 17 and the morning of May 18, BNL reviewed several supporting documents furnished by AREVA. They include reports on the development of models implemented in the AURORA-B LOCA EM and the documentation for validation of the LOCA EM against different tests and experiments.

In general AREVA was found to have clarified most of the BNL pre-meeting questions. The four outstanding questions (Questions 3 and 6 and Questions 4 and 20) that will require additional information are consolidated into the first two comments listed below. The list continues with comments from the review of supporting documents onsite.

1. EMDAP [evaluation model development and assessment process] requires a validation matrix to accompany a PIRT [phenomena identification and ranking table], listing separate effects and integral effect tests for each high and medium ranked phenomenon. BNL review identified [].

The validation description, [

]. AREVA will need to provide additional documentation to complete the validation description and conclusions.

2. Validation of a code is generally in reference to an application. The LTR is for BWR LOCA and all the validations based on SETs and IETs should provide evidence of applicability of the code to BWR LOCA. The results of validation will depend on code version, nodalization, code options and convergence criteria along with adequacy of the tests to represent the plant such as scaling. The validation section of the LTR [

]. The validation should be consistent with the intended application to the plant modeling. AREVA will have to provide information about [] with the intended application.

3. The LTR is based on the [] version of the codes ([]). AREVA is transitioning to the [] version of code ([]). If the SE is to reflect [] version of the code, AREVA will have to provide documentation to delineate the effect of code changes on validation. A complete and comprehensive [] document will be needed to conclude about the applicability of [] to intended application.

4. In reviewing the [] document for [] it became apparent that some of the []. For example, the [

-]
5. A limited review of additional documents provided by AREVA showed that [
-]. Any rearrangement of [
-]. This should be explained. In addition, a
-] for plant calculation and its impact on peak clad temperature (Figure of Merit) need to be performed to eliminate a possibility of [
-].
6. Review of THTF [thermal hydraulic test facility] steady state test [
-]. It is not clear what change caused it.
7. FIST [full integral simulation test] test 6SB2C prediction by the EM showed [
-]. The experimental data showed [
-]. However the EM predicted a [
-]. AREVA needs to provide additional detail on the EM's [
-].
8. The BWR LOCA EM relies on the RODEX4 kernel incorporated in the EM to comply with a number of Appendix K required models (related to fuel performance). The [
-] is not discussed in the LTR. For example, additional information is needed to [
-].
9. It was noted by AREVA during the audit meeting that [
-]. For example, [
-]. Also, some [
-]
- exhibited by the tests. This was done to better represent the [
-] that was driving the phenomena of interest. An example was the use of the [
-]. AREVA needs to identify in the discussion of the validation cases: 1) [
-], and 2) [
-] employed.