August 10, 2005

ORGANIZATION: General Electric Nuclear Energy (GE)

PROJECT: Economic Simplified Boiling Water Reactor (ESBWR) Pre-application Review

SUBJECT: SUMMARY OF MEETING HELD ON JULY 12, 2005, TO DISCUSS PRE-APPLICATION REVIEW SUBMITTAL REGARDING THE APPLICATION OF THE TRACG CODE TO ESBWR STABILITY (NEDC-33083P)

The Nuclear Regulatory Commission (NRC) held a meeting with General Electric Nuclear Energy (GE) on July 12, 2005, at GE's offices in San Jose, CA., to discuss topical report NEDC-33083P, Supplement 1, "TRACG Application for ESBWR Stability Analysis," submitted on December 9, 2004. A list of attendees is provided as Enclosure 1.

This meeting was closed to the public. During the meeting, the NRC and GE discussed GE's proprietary code, TRACG, as it is being applied to thermal-hydraulic stability analysis for the ESBWR. A non-proprietary summary of these discussions is provided as Enclosure 2. No handouts were provided during the meeting.

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Office of Nuclear Reactor Regulation

Project No. 717

Enclosures: As stated

cc w/encls: See next page

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ADAMS ACCESSION NUMBER: ML052160250

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MEETING WITH GENERAL ELECTRIC
ESBWR PRE-APPLICATION REVIEW
JULY 12, 2005

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Lev Klebanov	GENE
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Enclosure 1

Non-Proprietary Summary of July 12, 2005, Meeting

The purpose of the meeting was to discuss the application of General Electric's (GE) proprietary TRACG code to the analysis of thermal-hydraulic stability of the ESBWR design. Prior to the meeting, in response to a staff request for additional information (RAI #2), GE provided additional stability calculations for comparison using the ODYSY code. The staff also performed independent confirmatory calculations using the LAPUR code. The staff found that there was disagreement between the decay ratios (DR) as calculated by LAPUR and the DR calculated by GE using TRACG and ODYSY.

The staff discussed the LAPUR modeling and approximations with GE. The staff and GE reviewed the LAPUR output file for the channel decay ratio calculation. LAPUR was calculating a channel DR about 2 times greater than that of TRACG and a frequency that was about 20 percent greater. The staff and GE checked various parameters including the void fractions, pressure drops, flow rates and temperatures in the hot channel. LAPUR was calculating a pressure drop due to the channel inlet restriction lower than GE's by a factor of 3. The staff and GE then checked the loss coefficients, and suspected some differences between TRACG, LAPUR, and ODYSY in the way loss coefficients are expressed. The staff increased the loss coefficients in LAPUR to see how the DR responded. The DR decreased, but the frequency was still higher than TRACG. The staff and GE suspected that the area differences due to the part length rods could be the difference, since LAPUR cannot model part length rods.

GE originally supplied the TRACG loss coefficients to the staff by letter dated August 9, 2004 (MFN-04-077). GE stated that TRACG simulates leakage and bypass so the loss coefficients from TRACG look artificially low due to the higher flow. Also, the numbers reported to the NRC did not include the lower tie plate—they were only for the inlet to the core. LAPUR does not model the inlet of the core separately from the lower tie plate, so the numbers provided to the NRC were much lower than that which should have been used as input to LAPUR. LAPUR needs what is known as the PANCEA-model input loss coefficients as opposed to the TRACG coefficients that were provided in GE's August 9, 2004, letter.

When the correct loss coefficients are input into LAPUR, the DR results are very similar to GE's ODYSY calculation, which are much lower than the TRACG calculation showing that TRACG calculates a more conservative DR than either LAPUR or ODYSY. Based on the discussion during the meeting and the revised LAPUR results, this issue was resolved. To clarify the loss coefficients that should be used, GE committed to revise the information provided in their August 9, 2004, letter, accordingly.

GE's response to RAI #3 submitted on June 2, 2005 (MFN-05-052), shows the core wide decay ratio jumping significantly when the power was increased from the 5000 and 5200 MWt cases to the 5400 MWt case. During the meeting, GE informed the staff that there was a mistake in their calculation of the steady state condition which carried over to the transient case they ran to determine the decay ratio reported in the RAI response. GE has since re-run the higher power cases with the correction in the steady state case, and has committed to submit the corrected results as a revised response to RAI #3.

Enclosure 2

RAI #3 requested GE to increase the power until they saw a DR > 1. In the revised calculation, at 5400 MWt, GE still calculated a DR < 1. GE explained that they were not able to perform the calculation at a power level greater than 5400 MWt. This is because the steam flow from the higher power causes a lower pressure drop across the steam dryer. To compensate for the pressure drop and balance the hydrostatic head in the downcomer, GE would have to artificially raise the water level in the core and the results would not be meaningful. Therefore, GE was not able to raise the power level higher than the 5400 MWt case. The staff was satisfied with this response since the 5400 MWt case was already 20 percent higher than rated power which demonstrates that there is margin to instability at 4500 MWt.

The staff and GE discussed the detailed results of the revised TRACG calculations at 5400 MWt. At the higher power level there are more oscillations before steadying. This makes it easier to calculate the DR because there are more peaks which can be discerned. GE is using the ratio of the second and third peaks to determine DR. The staff showed examples where this may come out artificially high. Unlike the frequency domain codes, the time domain codes (TRACG) have an infinite number of higher order terms which make it difficult to conclusively determine the DR. At the beginning of the transient there is an exponential term that must decay away, so it would be more appropriate to determine the frequency based on the third and fourth peaks rather than the second and the third, however GE expressed the difficulty in using the later peaks because the results from ESBWR at 4500 MWt are so stable that it is difficult to even discern these later peaks. The staff suggested that using a three peak correlation may be more realistic. GE did not express interest in changing their strategy for determining the DR since their approach is more conservative.

Lastly, during the meeting, the staff proposed that GE perform a regional stability calculation using TRACG, rather than applying the "dog bite" correlation. GE staff were not available during the meeting to address this issue, so the issue was deferred to a future teleconference.

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