VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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U. S. Nuclear Regulatory Commission
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Washington, D.C. 20555

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VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2
EVALUATION OF NRC SER RESTRICTION FOR
REALISTIC LARGE BREAK LOSS OF COOLANT ACCIDENT (RLBLOCA)
ANALYSES

In a May 24, 2007 telephone conference call, Dominion informed the NRC that an error had been discovered in the RLBLOCA analyses for North Anna Units 1 and 2. Specifically, two analytical cases exhibited blowdown quench and AREVA's internal evaluation of these results did not include additional justification for the blowdown heat transfer model and uncertainty, as required by restrictions identified in the NRC's SER for AREVA's RLBLOCA methodology (EMF-2103-P-A, Revision 0). During the call, the staff requested information regarding the impact of the error for North Anna Units 1 and 2. The requested information is provided in the attachment to this letter.

Although some of the non-limiting cases show a blowdown quench, the blowdown heat transfer model and uncertainty reasonably predict the expected behavior for boundary conditions. Therefore, there is no change to the limiting case (i.e., no impact to the reported PCT and oxidation results) and thus no impact to meeting the criteria of 10 CFR 50.46.

If you have any questions or require additional information, please contact us.

Very truly yours,

G. T. Bischof
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Commitments made in this letter: None

Attachment

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Attachment

EVALUATION OF NRC SER RESTRICTION FOR REALISTIC LARGE BREAK LOSS OF COOLANT ACCIDENT (RLBLOCA) ANALYSES

Virginia Electric and Power Company
(Dominion)
North Anna Power Station Units 1 and 2

Evaluation of NRC SER Restriction for Realistic Large Break Loss of Coolant Accident (RLBLOCA) Analyses

AREVA has determined that an error was made in the RLBLOCA analyses for North Anna Units 1 and 2. One of the restrictions in the Nuclear Regulatory Commission's (NRC) Safety Evaluation Report (SER) for AREVA's Realistic LBLOCA (RLBLOCA) methodology as described in Reference 1, states the following:

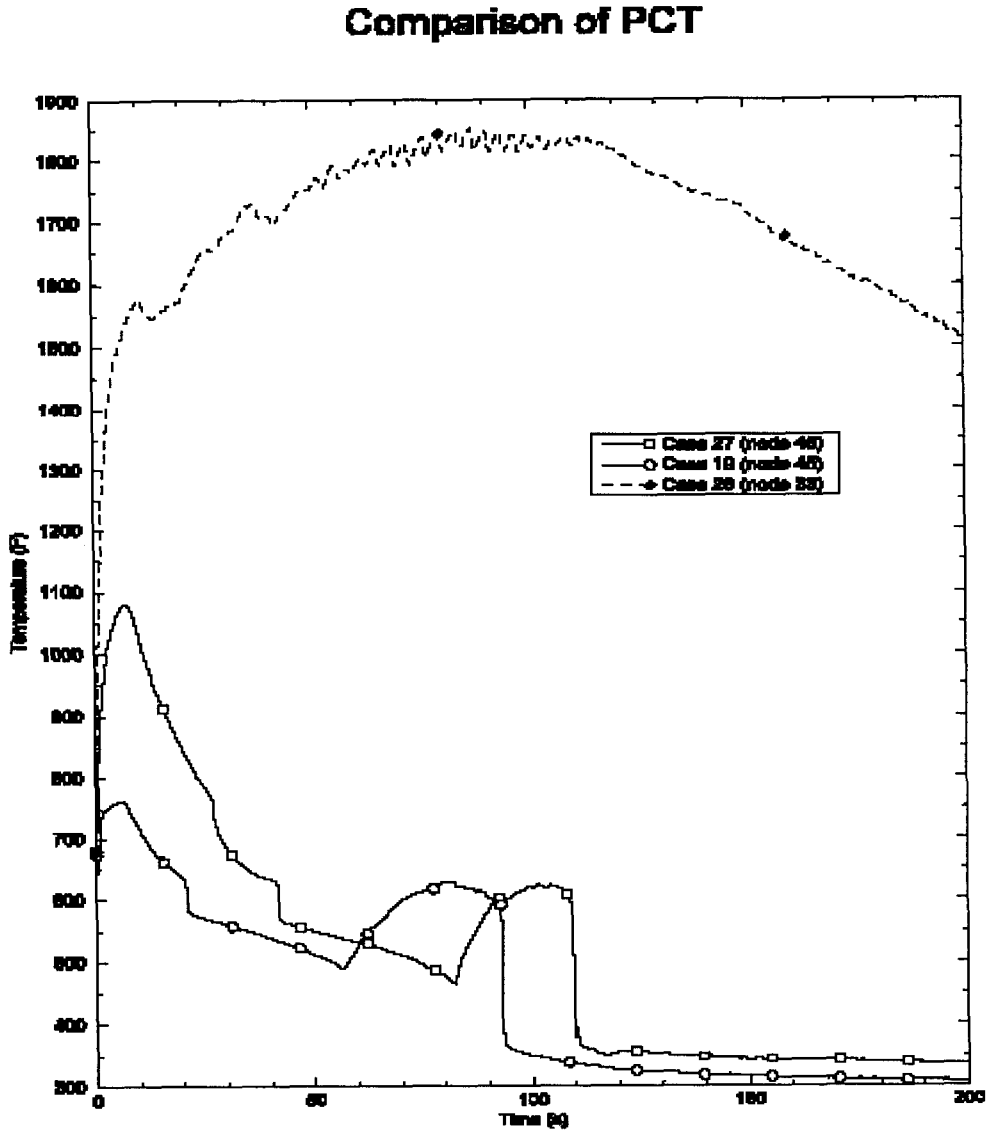
> "The model is valid as long as blowdown quench does not occur. If blowdown quench occurs, additional justification for the blowdown heat transfer model and uncertainty are needed or the run corrected. A blowdown quench is characterized by a temperature reduction of the PCT node to saturation temperature during the blowdown period."

A recent RLBLOCA analysis for another licensee contained some cases that exhibited a blowdown quench. This discovery led to the evaluation of other RLBLOCA analyses to assess if previous analyses were being adequately checked with regard to meeting this SER restriction. Further investigation showed that two cases for the North Anna Unit 1 analysis exhibited a blowdown quench and additional justification for the blowdown heat transfer model and uncertainty were not provided as required by the NRC SER restriction. There were no cases that exhibited a blowdown quench for the North Anna Unit 2 analysis.

The boundary conditions for the limiting peak clad temperature (PCT) case (Case 28) and the two cases with blowdown quench (Cases 19 and 27) are compared in the table below.

Case	PCT (°F)	PCT Elevation	PCT time (sec)	T_{min} Sampled (K)	Break Type	Break Size (ft^2/side)	Peak LHGR Sampled (kW/ft)	Offsite power
Case 28	1853	Node 33 of 48 (in top half)	87.4	684.4	Guillotine (double sided)	3.66	12.96	Not available
Case 19	762	Node 45 of 48 (near top)	5.3	602.8	Split (single side)	0.54	12.55	available
Case 27	1081	Node 45 of 48 (near top)	7.0	603.7	Split	0.48	13.34	available

The PCT as a function of time for the limiting case and the two cases with blowdown quench are compared in the figure below:



The difference in PCT between the limiting case and any case that showed a blowdown quench was over 750°F. Consistent with the smaller breaks, the liquid inventory in the core remained at higher values than that of the limiting case. Investigation of the blowdown quench cases showed that the liquid content at the PCT node at the time of interest was sufficiently high to warrant a quench behavior. In order to be considered a quench, the PCT node was required to heat up by more than 200°F above the saturation temperature of the fluid prior to the quench. For all cases that experienced a blowdown quench, the highest heatup above saturation was on the order of 500°F. The highest heatup above saturation for the limiting PCT case during blowdown was on the order of 1000°F. This reduced heatup for the blowdown quench cases provides supporting evidence that these rods were susceptible to being quenched.

The most important features for the cases that exhibited a quench of the PCT node before the end of blowdown are a relatively small break area and offsite power continuing to be available to power Reactor Coolant Pumps (RCPs). The small break area reduces the rates at which pressure and flow decrease at the PCT location compared with the limiting case. The void fraction at the PCT locations that exhibit quench indicates significant liquid is available for cooling. The continued operation of the RCPs provides increased forced convection cooling. The resulting combination of higher core flow and pressure cools the cladding sufficiently to enable a return to nucleate boiling.

In summary, blowdown quench is appropriate for these non-limiting cases (19 and 27) and this behavior is not applicable in any way to the limiting case (28). It is concluded that even though some non-limiting cases show a blowdown quench, the blowdown heat transfer model and uncertainty reasonably predict the expected behavior for the selected boundary conditions. Therefore, there is no change to the limiting case (i.e., no impact to the reported PCT and oxidation results), and, thus no impact to meeting the criteria of 10 CFR 50.46.

Reference

1. EMF-2103(P)(A) Revision 0, Realistic Large Break LOCA Methodology, Framatome ANP, September 2003.