VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261
September 26, 2003

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

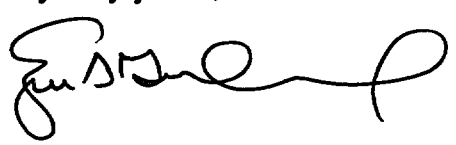
Serial No. 03-313E
NLOS/ETS
Docket Nos. 50-338/339
License Nos. NPF-4/7

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2
PROPOSED TECHNICAL SPECIFICATIONS CHANGES AND EXEMPTION REQUEST FOR USE OF FRAMATOME ANP ADVANCED MARK-BW FUEL
REQUEST FOR ADDITIONAL INFORMATION PERTAINING TO THE ICECON MODULES IN THE REALISTIC LARGE BREAK LOCA (RLBLOCA)

In letters dated May 6, 2003 (Serial No. 03-313), and July 18, 2003 (Serial No. 03-407), Dominion submitted results of the Realistic Large Break LOCA (RLBLOCA) analyses for Advanced Mark-BW fuel in North Anna Units 2 and 1, respectively. The RLBLOCA information was presented in the form of supplements to the evaluation report provided in our March 28, 2002 letter (specifically, report Section 7.2) and included a discussion of the containment pressure analysis. In a September 11, 2003 facsimile and subsequent discussion in a September 15, 2003 telephone call, the NRC staff requested additional information regarding the use of the ICECON computer code to determine the containment pressure response(s) for the RLBLOCA analysis. The attachment to this letter provides the requested information to complete your review of the containment analysis.

To support the use of Framatome Advanced Mark-BW fuel in North Anna Unit 2, Cycle 17, we respectfully request the NRC to complete their review and approval of the license amendment by October 31, 2003. We appreciate your consideration of our technical and schedular requests. If you have any questions or require additional information, please contact us.

Very truly yours,



Eugene S. Grecheck
Vice President - Nuclear Support Services

Attachment

Commitments made in this letter: None

A001

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SN: 03-313E
Docket Nos.: 50-338/339
Subject: Proposed TS Change RAI
Framatome Fuel Transition – RLBLOCA ICECON

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Eugene S. Grecheck, who is Vice President - Nuclear Support Services, of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 26th day of September, 2003.

My Commission Expires: March 31, 2004.

Maggie McCune
Notary Public

(SEAL)

Attachment

Request for Additional Information
ICECON Module for Containment Pressure Analysis

Framatome Fuel Transition Program
Technical Specification Change

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

Request for Additional Information
ICECON Module for Containment Pressure Analysis

NRC Question 1

Reference 15 of Topical Report EMF-2103 Revision 0 is Supplement 1 to Revision 2 of ICECON. This has not been supplied to the NRC staff. What is its relevance to the review of the calculation of minimum containment pressure?

Response

The NRC review and approval history for the ICECON modules used in the RLBLOCA methodology is as follows:

- *The SER for Exxon Nuclear Corp. (ENC) ECCS Evaluation Model (XN-75-41), dated September 11, 1975, documents NRC review and acceptance for use of CONTEMPT22-ENC in dry containments.*

- *The SER for ICECON dated June 30, 1978 documents NRC's review and acceptance of ICECON, modified from CONTEMPT22-ENC by adding routines to analyze ice condenser containments. The approved features for analysis of dry containments were retained in ICECON, so that ICECON can be used for analysis of either dry or ice condenser containments.*

- *The SER for RLBLOCA topical EMF-2103 documents NRC's review and acceptance of ICECON (as adapted to run as a module of S-RELAP5) for the analysis of realistic LBLOCA transients. Usage of ICECON for RLBLOCA analysis is as specified in EMF-2103.*

The report EMF-CC-039(P) Revision 2 Supplement 1 (Reference 15 in EMF-2103(P)) provides a description of the input for the ICECON routines used in S-RELAP5 for RLBLOCA analyses. This report was provided to the NRC in the Framatome ANP letter NRC:01:037 dated August 21, 2001. The report is Reference 20 in the NRC SER for the topical report EMF-2103(P).

The ICECON routines are used in S-RELAP5 for the realistic large break LOCA methodology to provide a realistic containment backpressure. A minimum containment pressure is not part of the calculation. Even though the methodology does not involve producing a minimum containment pressure, a number of features of the methodology do produce containment pressure calculation results that are biased toward low values. The most significant of these features is that the statistical treatment of the containment volume ranges from nominal to maximum. Containment volumes below nominal are not considered.

NRC Question 2

Please confirm that the version of ICECON documented in XN-CC-39 dated August 1975 and approved by the NRC in a June 30,1978 safety evaluation report (SER) is identical with the version documented in EMF-CC-39(P), dated November 1999. If this is not the case, please describe any differences and explain their effect on calculated minimum containment pressure.

Response

The ICECON modules incorporated into S-RELAP5 are identical to those in the code ICECON except for the replacement of the Tagami correlation with the Uchida correlation and the changes to interface the modules with S-RELAP5. The implementation of the ICECON code into S-RELAP5 is described in Section 3.4.2 of EMF-2103 on pages 3-15 and 3-16. The description is repeated below.

> *"FRA-ANP performed sensitivity calculations to evaluate the effects of containment back pressure. The results showed that the RLBLOCA model significantly reduces the sensitivity of calculated PCT to containment back pressure, relative to the current Appendix K based ECCS evaluation models, but does not eliminate these effects. A conservatively low (atmospheric) containment backpressure yields an increased PCT. However, varying time dependent containment pressures within a band of a few psi gave little difference in calculated PCTs. Thus, based on these results, FRA-ANP concluded that a containment backpressure calculation which provides a reasonable approximation for the time dependent backpressure is desirable for a RLBLOCA evaluation model.*
>
> *The conversion from RELAP5/MOD2 includes the capability to interface external calculations with S-RELAP5. With this interface, a containment pressure calculation using a different code can be run concurrently with S-RELAP5. Break flows and enthalpies are transferred to the containment code, which continuously feeds back calculated pressure and temperature through S-RELAP5 time dependent volumes. The choice for the containment code to use with the RLBLOCA evaluation model is ICECON (References 14 and 15), which is based on CONTEMPT LT-022 (Reference 20). ICECON was originally approved for calculating a conservative containment back pressure under Appendix K rules, but it can be used with realistic input and, with only minor modifications, to give an approximate realistic back pressure calculation."*

NRC Question 3

The NRC staff's SER approving ICECON (June 30, 1978) requires, as a condition for approval, that a user of ICECON will provide justification for the values of the area and heat capacities of the structural heat sinks used in the analysis of minimum containment pressure. Please describe how these values were obtained and provide justification for the values used. It is not necessary to provide the values themselves.

Response

The RLBLOCA methodology does not use a minimum containment backpressure and, thus, the SER requirement in the SER approving ICECON as a separate code/method does not apply.

The passive heat sink surface areas and material heat capacities used in the North Anna RLBLOCA containment backpressure calculations are based on Dominion-supplied inputs. These inputs are the same as those used in the current NAPS licensing base Appendix K LOCA analysis, performed by Dominion for Westinghouse fuel. The surface area of the heat sinks are increased by 3 percent above the areas used in the containment integrity calculations. The values can be found in the North Anna UFSAR, Chapter 15, Table 15.4-2. The heat sink thermophysical properties are consistent with those in Branch Technical Position CSB 6-1. Hence, Appendix K-type inputs, designed to conservatively minimize the containment backpressure, were used in the North Anna LOCA analyses, even though this conservatism is not required by the methodology.

NRC Question 4

An important consideration in calculating containment pressure is the distribution of the break flow (liquid, vapor and drops) as it enters the containment atmosphere. Please describe the assumption used. CONTEMPT, the starting point for ICECON, contains a temperature flash model. If temperature flash was used for minimum containment pressure calculations please explain why this is acceptable since temperature flash tends to overestimate pressure.

Response

The response to Question 1 discusses the history of the code ICECON. The code ICECON derives from the CONTEMPT code series through the addition of routines for wet containment (ice condensers) computations. The ICECON subroutines incorporated into S-RELAP5 for RLBLOCA calculation purposes preserve CONTEMPT dry containment calculation methods. The original CONTEMPT models inherently assume the air/steam/liquid water mixture is instantaneously brought to equilibrium. This so-called "Temperature Flash" model is used in all these computer codes, including S-RELAP5 and ICECON. Its use has been found acceptable in numerous LOCA

evaluation models. Any potential pressure over-prediction is compensated by conservatisms expressed in CSB 6-1 for deterministic LOCA analyses and by the statistical treatment of containment volume in the realistic LOCA analyses.

NRC Question 5

The calculation of peak cladding temperature conservatively assumes a worst single failure. VEPCO's submittal dated May 6, 2003, states that the loss of one HHSI and one LHSI pump is assumed. It is not clear that this single failure is the worst single failure. Actually, the worst case could be no failure since this would provide more ECCS flow and hence more break flow, which would result in cooler sump water. The cooler sump water may have a significant effect on containment pressure. Please provide the results of a realistic large break LOCA (RLBLOCA) calculation with no single failure.

Response

The response to RAI Question 111, provided during the review of EMF-2103, presents results of a sensitivity study investigating various single failures that would influence containment pressure response. This study was performed using a North Anna plant model, making it directly applicable for use in determining the worst single failure for North Anna Units 1 and 2. The cases investigated in the response to Question 111 are listed below, in order of most limiting to least limiting PCT results. The case denoted 'Base Case' is the configuration assumed in the North Anna 1 and 2 RLBLOCA analyses. The specific numerical results can be found in the actual RAI response.

Case	*HPSI Flow*	*LPSI Flow*	*Containment Spray*	*Relative PCT Results*
Base Case	*1 pump*	*1 pump*	*Full spray*	PCT_{base}
Loss of 1 Diesel	*1 pump*	*1 pump*	*0.5 spray*	$PCT_{base} - 35$ °F
Loss of 1 LPSI	*2 pumps*	*1 pump*	*Full spray*	$PCT_{base} - 174$ °F
No Failure	*2 pumps*	*2 pumps*	*Full spray*	$PCT_{base} - 221$ °F

The potential for a case with no failure to produce limiting PCT results has typically been observed on only certain Westinghouse-designed 4-loop plants. No previous North Anna results have indicated this is a limiting configuration. The possibility of a no failure configuration being limiting is even less likely for a best-estimate LBLOCA analysis, for which the influence of containment pressure upon overall results is less exaggerated than with Appendix K models. The results for RAI Question 111 support this conclusion and provide the basis for single failure selection in the North Anna analyses.

NRC Question 6

What is the basis for assuming the distribution of volumes from minimum to maximum is uniform? (Table 7.2-3 of the May 6, 2003 letter)

Response

The selection of a uniform distribution for containment volume is a feature of the approved methodology, as documented in Section 4.3.3.2.12 of EMF-2103. Justification for this treatment of containment volume is based upon its effect on the ultimate parameter of interest -- peak cladding temperature. Assuming a uniform distribution for a parameter with demonstrated importance for PCT exaggerates the scatter (i.e. produces a wider variation) of the PCT results as compared with assuming a normal distribution. The treatment of this parameter for North Anna Units 1 and 2 is conservative and is consistent with the assumptions accepted by NRC in issuing the SER for EMF-2103.

Supplemental Request: In a September 15, 2003 teleconference, NRC staff requested that results be provided to aid in demonstrating that the containment response obtained from the North Anna RLBLOCA analysis encompassed results obtained from an Appendix K-type minimum containment pressure analysis. It was determined that this could be accomplished by providing results from the North Anna Units 1 and 2 analyses that are analogous to that presented in response to RAI Question 26 on the RLBLOCA topical EMF-2103. Responding to this supplemental request eliminates the need to respond to Question 7 through 10 and Question 12.

Supplemental Response: *Figure 1 presents the containment pressure range (case-independent) from the North Anna Unit 2 RLBLOCA case set, the UFSAR (Appendix K-type) minimum containment backpressure prediction, and the containment backpressure from the limiting Unit 2 RLBLOCA case. This comparison indicates that the containment conditions, modeled in accordance with the EMF-2103 methodology, encompass a wide range of pressures, with the limiting Unit 2 case appearing near, but not at the most extreme (i.e., low pressure) value. This comparison provides insight into the relationship between ranged parameter values and PCT results from the RLBLOCA methodology. It indicates that the most limiting of the RLBLOCA PCT cases does not, in general, exhibit a value for any single ranged parameter that coincides with the most extreme value in the parameter sampled range. This is an inherent feature of the RLBLOCA methodology, and in relation to containment pressure, is distinctly different from the 10CFR50 Appendix K approach of using inputs obtained from performing a minimum backpressure analysis Figure 1 also indicates that the containment pressure predicted from the RLBLOCA calculations encompasses a significant portion of the predicted Appendix K behavior, although this is not a requirement of the methodology.*

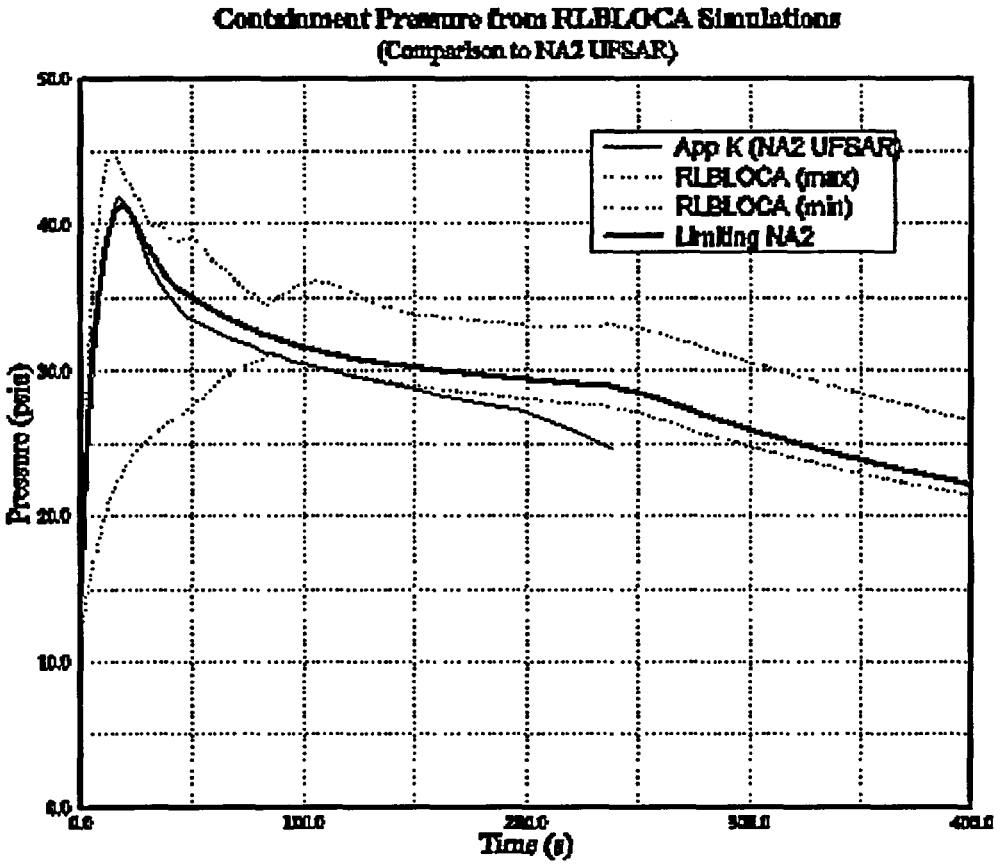

Figure 1 North Anna Unit 2 Case-Independent Containment Pressure Comparison

NRC Question 11

Will the sump water temperatures calculated with this model be used for ECCS NPSH calculations? If so, please justify why this is acceptable.

Response

Dominion has no plans to use the sump conditions determined from the North Anna 1 and 2 RLBLOCA analysis cases for any other purpose than part of the RLBLOCA analysis. Other analytical methodologies are available for use in determining NPSH conditions for ECCS and spray system pumps.

In the September 15, 2003 telephone conference call, the NRC Staff stated that responses are not required for Questions 7 through 10 and 12 from the September 11, 2003 facsimile. These questions are listed below for information.

NRC Question 7

Other factors besides the containment volume can have a significant influence on the containment pressure. For Instance, the containment pressure is affected by the containment atmosphere initial conditions, heat transfer coefficient between the sump surface and the containment atmosphere (see RAIs 5 and 8), heat transfer coefficient to the containment structural heat sinks (see RAIs 3 and 9), spray flow, distribution of break flow vapor, liquid and droplets in the containment atmosphere (see RAI 4), service water temperature, etc. Explain why it is not necessary to account for variations in other parameters, which have a significant effect on the containment minimum pressure.

NRC Question 8

Describe the modeling of the heat transfer from the containment atmosphere to the water in the sump.

NRC Question 9

Section 3.4.2 of Topical Report EMF-2103 states that in order to make ICECON results realistic, conservatism is removed from the conservative evaluation model multipliers on the Tagami and Uchida correlations. (a) What were the original multipliers on the Tagami and Uchida correlations in ICECON? (b) The guidance in Standard Review Plan Section 6.2.1.5, Branch Technical Position CSB 6-1, states that for minimum pressure calculations a peak heat transfer coefficient value of four times the peak Tagami correlation should be used and 1.2 times the value of the Uchida correlation should be used. However, changes were made to the use of these correlations in order to produce realistic results. This appears to be much less conservative. Please justify this deviation from Branch Technical Position CSB 6-1 to use realistic results when the heat transfer coefficients to structures are not included in the uncertainty analysis.

NRC Question 10

Provide the results of calculations which demonstrate that the RLBLOCA model significantly reduces the sensitivity of the calculated peak cladding temperature to containment backpressure, relative to the current Appendix K-based ECCS evaluation models as claimed in Section 3.4.2 of Topical Report EMF-2103. This statement is significant in determining the required accuracy and conservatism in the RLBLOCA containment calculations

NRC Question 12

Provide or reference comparisons of ICECON with experimental data.