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LIC-13-0056

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

References:   1.     Docket 50-285  
                  2.     EMF-2328(P)(A), Revision 0, "PWR Small Break LOCA Evaluation Model, S-RELAP5 Based," Framatome ANP, INC., March 2001  
                  3.     EMF-2103(P)(A), Revision 0, "Realistic Large Break LOCA Methodology for Pressurized Water Reactors," Framatome ANP, Inc., April 2003

**Subject: Annual Report for 2012 Loss-of-Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46**

The Omaha Public Power District (OPPD) has received the 2012 AREVA (formerly Framatome ANP) 10 CFR 50.46 Annual Notification Report for the Small Break (SB) and Large Break (LB) Loss-of-Coolant Accident (LOCA) Analyses that are subject to the reporting requirements of 10 CFR 50.46. Therefore, in accordance with 10 CFR 50.46(a)(3)(ii), OPPD submits the Annual 10 CFR 50.46 Summary Report. This report updates all identified changes or errors in the LOCA/ECCS codes, methods, and applications used by AREVA to model Fort Calhoun Station (FCS), Unit No. 1. References 2 and 3 respectively describe the SB and LB LOCA analysis methodology used by AREVA for the FCS Analyses of Record (AOR).

Two evaluations were performed against the LB LOCA methodology in 2012, neither of which affected the final peak clad temperature (PCT) value for the LB LOCA analysis of record. The first evaluation resulted from AREVA Condition Report (CR) 2012-2301, concerning Liquid Fallback into the six (6) assemblies surrounding the hot channel. The second evaluation resulted from AREVA CR 2012-8277, concerning Cathcart-Pawel Uncertainty Implementation in Realistic LB LOCA Applications. Both CRs and the evaluations performed are described in Attachment 1.

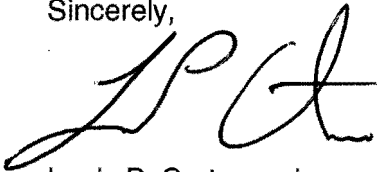
No evaluations were performed against the SB LOCA methodology in 2012; therefore, the final PCT value for the SB LOCA remains unchanged.

In summary, the FCS PCT values for the SB and Realistic LB LOCA remain unchanged as a result of the 2012 evaluations and remain significantly less than the 10 CFR 50.46(b)(1) acceptance criteria of 2200°F.

No commitments to the NRC are made in this letter.

If you should have any questions, please contact Mr. Bill Hansher at (402) 533-6894.

Sincerely,

A handwritten signature in black ink, appearing to read 'LPC', is written over the word 'Sincerely,'.

Louis P. Cortopassi,  
Site Vice President and CNO

LPC/DRW/mle

Attachments:

1. 10 CFR 50.46 Large Break LOCA Model Assessments
2. Large Break LOCA Margin Summary Sheet – Annual Report
3. Small Break LOCA Margin Summary Sheet – Annual Report

c:     A. T. Howell, NRC Regional Administrator, Region IV  
       J. M. Sebrosky, NRC Project Manager  
       L. E. Wilkins, NRC Project Manager  
       J. C. Kirkland, NRC Senior Resident Inspector

## **10 CFR 50.46 Large Break LOCA Assessments**

### **Flow Path Reverse Loss Coefficient from the Upper Plenum to the Central Core Region**

The issue was discovered when reviewing the results for a W 3-loop plant sensitivity study. The limiting case revealed a non-conservatism in the core exit modeling relative to the form loss coefficient (FLC) between the upper plenum and the central core region. Liquid communication from the central core region, which represents six assemblies surrounding the hot channel, to the hot channel resulted in steam cooling and a reduction in the hot rod PCT at elevations associated with the peaked axial power.

This Condition Report (CR) is related to AREVA CR 2011-1688, where in all plant cases, a high reverse FLC is applied to the hot channel (HC) and central core to upper plenum (UP) junctions at the beginning of the core re-flooding phase. In AREVA CR 2011-1688, cases were re-run that had liquid down flow into the hot channel and which potentially affected the AOR PCT limit. Whereas AREVA CR 2011-1688 involved re-running cases that had liquid downflow into the hot channel, AREVA CR 2012-2301 involves re-running cases that had liquid downflow into the central core. That is, AREVA CR 2012-2301 only changes the criteria for re-running cases with the high reverse form loss coefficients.

The Fort Calhoun Station, Unit No. 1 AOR does not include the high reverse FLCs above the hot assembly and the surrounding six assemblies and thus, the Peak Cladding Temperature (PCT) impact of these issues on the Fort Calhoun RLBLOCA (current AOR) is 0 °F.

### **Cathcart-Pawel Correlation for Oxide Growth**

In realistic large break loss-of-coolant accident (RLBLOCA) analyses, energy released through the oxidation of cladding is calculated from the Cathcart-Pawel correlation for oxide growth. The correlation has the form:

$$\delta^2/2 = A * \exp(-Q/R*1/T)$$

Where A and Q are experimentally determined constants and R and T are the gas constant and temperature, respectively. The uncertainty parameter for the A value is given in terms of the natural logarithm:  $\ln(A)$ . The value of  $\ln(A)$  follows a normal distribution and the value of A follows a log-normal distribution. RLBLOCA applications implement the Cathcart-Pawel uncertainty using a log-normal function for the uncertainty multiplier, B, applied to a constant, A. The equation to determine the uncertainty multiplier, B, was determined to be incorrect.

However, the incorrect equation still has a log-normal distribution like the corrected equation for the uncertainty multiplier, B. In addition, the range of sampled values for B falls within the range expected for the corrected equation for the uncertainty multiplier, B.

The PCT impact of this error on the Fort Calhoun Station, Unit No. 1, Cycle 24, RLBLOCA is 0°F.

## Large Break LOCA Margin Summary Sheet – Annual Report

**Plant Name:** Fort Calhoun Station, Unit No. 1  
**Utility Name:** Omaha Public Power District

Evaluation Model: Large Break LOCA			
		Net PCT Effect ( $\Delta$ PCT)	Absolute PCT Effect
A.	Prior 10 CFR 50.46 Changes of Error Corrections-Previous Year	-62°F	84°F
B.	Prior 10 CFR 50.46 Changes of Error Corrections-This Year	+0°F	0°F
C.	Absolute Sum of 10 CFR 50.46 Changes		84°F

The sum of the PCT from the most recent analysis using an acceptable evaluation model and the estimates of the PCT impact for changes and errors identified since this analysis is less than 2200°F.

### Small Break LOCA Margin Summary Sheet – Annual Report

**Plant Name:** Fort Calhoun Station, Unit No. 1  
**Utility Name:** Omaha Public Power District

Evaluation Model: Small Break LOCA			
		Net PCT Effect ( $\Delta$ PCT)	Absolute PCT Effect
A.	Prior 10 CFR 50.46 Changes or Error Corrections – Previous Years	-32°F	108°F
B.	Prior 10 CFR 50.46 Changes or Error Corrections – This Year	0°F	0°F
C.	Absolute Sum of 10 CFR 50.46 Changes		108°F

The sum of the PCT from the most recent analysis using an acceptable evaluation model and the estimates of the PCT impact for changes and errors identified since this analysis is less than 2200°F.