

LIC-15-0059

10 CFR 50.46

April 24, 2015

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

Fort Calhoun Station (FCS), Unit 1  
Renewed Facility Operating License No. DPR-40  
NRC Docket No. 50-285

Subject: Small Break Loss-of-Coolant Accident (SBLOCA) / Emergency Core Cooling System (ECCS) Evaluation Model Change/Error - 30-Day Report

- References:
1. Letter from OPPD (M. J. Prospero) to NRC (Document Control Desk), "Annual Report for 2013 Loss-of-Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 25, 2014 (ML14118A208) (LIC-14-0062)
  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.

In accordance with 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," paragraph (a)(3)(ii), the Omaha Public Power District (OPPD) is submitting the attached information to fulfill the 30-day reporting requirement for Fort Calhoun Station (FCS), Unit No. 1.

FCS is currently in Refueling Outage 27, which began on April 11, 2015. Per the current schedule, FCS will re-load the core in early May 2015 for Operating Cycle 28 and at that time, will implement a design change for the initial fill gas pressurization of new fuel rods. This change is intended to provide more margin in the reload analysis for internal rod pressure. This design change decreases the initial fill gas pressure of the new UO<sub>2</sub> fuel rods from 390 psia to 330 psia, which is estimated to increase the peak clad temperature (PCT) for the small break loss-of-coolant accident (SBLOCA) analysis by +31°F. The cumulative effect of the design change and a prior +23°F error found to impact the 2014 annual 10 CFR 50.46 report necessitates the submittal of this report. For the SBLOCA AOR, this results in a total PCT of 1800°F.

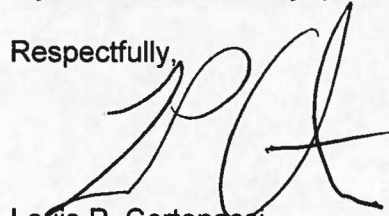
The attached report describes the impact of the design change and the error on the SBLOCA analysis of record (AOR), which uses the Reference 2 methodology. These issues had no material impact on the realistic large break loss-of-coolant accident (RLBLOCA) AOR, which uses the Reference 3 methodology. For the RLBLOCA AOR, the estimated impact of the Cycle 28 UO<sub>2</sub> initial fuel fill gas pressurization design change on calculated PCT is 0°F resulting in a

total PCT of 1587°F. Additional discussion regarding the impact on the RLBLOCA AOR will be provided in the annual 10 CFR 50.46 report.

There are no regulatory commitments contained in this submittal.

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

Respectfully,

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

Louis P. Cortopassi  
Site Vice President and CNO

LPC/SEC/mle

Attachments:    1. 30-Day Report of Significant Change in LOCA/ECCS Models  
                      2. Fort Calhoun Station Small Break LOCA Margin Summary Sheet

c: M. L. Dapas, NRC Regional Administrator, Region IV  
C. F. Lyon, NRC Project Manager  
S. M. Schneider, NRC Senior Resident Inspector

### **30-Day Report for Significant Change in LOCA/ECCS Models**

#### **Evaluation of Design Change to Initial Fuel Rod Pressurization for Cycle 28**

For Operating Cycle 28, Fort Calhoun Station (FCS), Unit No. 1 is implementing a change in fuel rod fill gas initial pressurization. The initial fill gas pressure of the UO<sub>2</sub> fuel rods has been reduced from 390 psia to 330 psia in order to optimize rod internal pressure margin by up to 170 psia while maintaining up to 0.750 mils of margin on creep collapse. The UO<sub>2</sub> fuel rods with M5 cladding being provided to FCS at an initial fill gas pressure of 330 psia continue to have sufficient design margin.

AREVA (formerly Framatome ANP) performed an operability assessment on the impact of thermal conductivity degradation (TCD) on fuel temperatures and hot free volumes in the RODEX2 fuel performance code used for small break loss-of-coolant accident (SBLOCA) analysis. The current Operating Cycle (27) was assessed and it was concluded that all fuel rods met the criteria for rod internal pressure and fuel-clad liftoff (approximately 2835 psia versus a criterion of 2900 psia). The assessment also noted a reduction of margin on end-of-cycle (EOC) rod internal pressure.

For the SBLOCA analysis, the reduction in fuel rod fill gas internal pressure affects the swell and rupture model. The SBLOCA transient is a slow progressing transient with peak clad temperature (PCT) occurring later in the event as compared to the realistic large break loss-of-coolant accident (RLBLOCA) transient. A change in fuel rod internal pressure affects the timing of cladding rupture, which could result in a change to PCT time leading to a change in the PCT calculated oxidation. Therefore, AREVA performed a sensitivity study to evaluate the impact on the SBLOCA analysis-of-record (AOR) PCT. The limiting case and multiple break sizes around the limiting case were rerun with the reduced fuel rod internal pressure.

For the RLBLOCA analysis, the swell and rupture model is not incorporated on plant specific applications as it is considered a benefit in the PCT calculation. The relocation phenomenon is not evaluated for FCS as the AOR PCT results are below 1850°F and the phenomenon is not significant below this threshold. In the AOR, the PCT is not driven by the rupture node or rupture time and changes in the initial rod pressure do not have an effect on the estimation of PCT.

For the FCS SBLOCA analysis, the calculated PCT impact was estimated to be +31°F with a PCT of 1800°F. For the FCS RLBLOCA analysis, the calculated PCT impact was estimated to be +0°F with a PCT of 1587°F.

#### **AREVA Condition Report (CR) 2012-8371**

In addition to the +31°F impact on PCT resulting from reduced UO<sub>2</sub> fuel rod initial fill gas pressure, a non-conservatism in AREVA's correlation for vapor absorptivity used in S-RELAP5 was discovered. In AREVA CR 2012-8371, it was determined that the correlation for vapor absorptivity used in S-RELAP5 was being applied outside of its intended range of applicability. The PCT impact of the error on the FCS SBLOCA AOR is +23°F, which raises the evaluated PCT during a limiting SBLOCA to 1769°F compared to the limit allowed in 10 CFR 50.46 of 2200°F. There was no impact to PCT for the RLBLOCA transient. The cumulative effect of the design change discussed above and this error applicable to the Cycle 28 core is +54°F.



**Small Break LOCA Margin Summary Sheet – 30-day Report**

<b>Plant Name:</b>	<b>Fort Calhoun Station, Unit No. 1 – Cycle 28</b>
<b>Utility Name:</b>	<b>Omaha Public Power District</b>
<b>ECCS Evaluation Model:</b>	<b>EMF-2482P</b>
<b>Report Revision Date:</b>	<b>April 24, 2015</b>
<b>Current Cycle:</b>	<b>27</b>

**ANALYSIS OF RECORD**

<b>Evaluation Method:</b>	EMF-2328(P)(A), Revision 0, "PWR Small Break LOCA Evaluation Model, S-RELAP5 Based," Framatome ANP, Inc., March 2001.
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<b>Calculations:</b>	AREVA Calculation 32-9016476-000, Revision 0, "Fort Calhoun Cycle 24 SBLOCA Analysis."
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AREVA Calculation 32-9130020-001, Revision 1, "Fort Calhoun SBLOCA Analysis with Reduced HPSI Flow."

<b>Fuel Type:</b>	AREVA HTP 14x14 M5
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<b>Limiting Fuel Type:</b>	AREVA HTP 14x14 M5
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<b>Limiting Single Failure:</b>	Loss of one ECCS pumped injection train
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<b>Limiting Break Size/Location:</b>	3.5 inch break size
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<b>Reference PCT:</b>	1537°F
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**MARGIN ALLOCATION**

<b>Evaluation Model: Small Break LOCA</b>				
		Net PCT Effect ( $\Delta$ PCT)	Absolute PCT Effect	Total PCT
A.	Prior 10 CFR 50.46 Changes or Error Corrections – 2013, HPSI Pump Runout Prevention Modification (FAB13-00350)	+309°F	417°F	1746°F
B.	10 CFR 50.46 Changes or Error Corrections – 2014, S-RELAP5 Vapor Absorptivity Correlation (FAB14-00196)	+23°F	23°F	1769°F
C.	10 CFR 50.46 Changes or Error Corrections – 2014, Change to Initial Fuel Rod Pressurization (FAB-14-00609-001)	+31°F	31°F	1800°F
Absolute Sum of 10 CFR 50.46 Changes			471°F	

The absolute sum of the PCT from the most recent 10 CFR 50.46 report using an acceptable evaluation model and the estimates of the PCT impact for changes and errors identified since that report is +54°F. The sum of the PCT from the SBLOCA AOR and these errors is 1800°F, which is still within the 2200°F criterion described in 10 CFR 50.46(b)(1).