Omaha Public Power District

10 CFR 50.46

LIC-16-0031
April 28, 2016

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

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

Subject: Annual Report for 2015 Loss-of-Coolant Accident (LOCA)/ Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46

References:
1. EMF-2328(P)(A), Revision 0, "PWR Small Break LOCA Evaluation Model, S-RELAP5 Based," Framatome ANP, Inc., March 2001
2. 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(a)(3)(ii), the Omaha Public Power District (OPPD) hereby submits the annual 10 CFR 50.46 summary report for Fort Calhoun Station (FCS), Unit No. 1. The report provides an update of all identified changes or errors in the LOCA/ECCS codes, methods, and applications. References 1 and 2 respectively are the small break (SB) and realistic large break LOCA (RLBLOCA) analysis methodology used by AREVA (formerly Framatome ANP) for the FCS Analyses of Record (AOR).

No SBLOCA Analysis Peak Cladding Temperature (PCT) 10 CFR 50.46 Model Assessment errors were discovered in 2015. Therefore, the final PCT value for the SBLOCA remains unchanged. Due to total errors reported in previous years, the SBLOCA PCT has changed from the baseline value of 1537°F (Updated Safety Analysis Report (USAR) Section 14.15) to 1800°F. The sum of the absolute values of the changes/errors in the SBLOCA AOR is 471°F. Enclosure 1 provides the 2015 Small Break LOCA Margin Summary Sheet for FCS.

No RLBLOCA Analysis PCT 10 CFR 50.46 Model Assessment errors were discovered in 2015. Therefore, the final PCT value for the RLBLOCA remains unchanged. Due to total errors reported in previous years, the RLBLOCA PCT has changed from the baseline value of 1636°F (USAR Section 14.15) to 1587°F. The sum of the absolute value of the changes/errors in the RLBLOCA AOR is 91°F. Enclosure 2 provides the 2015 Realistic Large Break LOCA Margin Summary Sheet for FCS.

In summary, the FCS PCT values for the SBLOCA AOR and the RLBLOCA AOR continue to remain significantly less than the 10 CFR 50.46(b)(1) acceptance criterion of 2200°F. OPPD is currently reanalyzing the SBLOCA to incorporate AREVA's methodology revision. Upon approval of AREVA's methodology revision for RLBLOCA, OPPD plans to reanalyze the RLBLOCA to incorporate the revision.

If you should have any questions, please contact Mr. Bradley H. Blome at 402-533-7270.

No commitments to the NRC are made in this letter.

Respectfully,

Bradley H. Blome
Manager, Site Regulatory Assurance

BHB/SEC/epm

Enclosures:

1. Fort Calhoun Station Unit 1, Small Break LOCA Margin Summary Sheet - Annual 10 CFR 50.46 Report
2. Fort Calhoun Station Unit 1, Realistic Large Break LOCA Margin Summary Sheet - Annual 10 CFR 50.46 Report
3. Fort Calhoun Station Unit 1, 10 CFR 50.46 Report Assessment Notes

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

Enclosure 1
Fort Calhoun Station Unit 1
Small Break LOCA Margin Summary Sheet – Annual 10 CFR 50.46 Report

Plant Name:	Fort Calhoun Station, Unit 1
Utility Name:	Omaha Public Power District
ECCS Evaluation Model:	EMF-2482P
Report Date:	April 29, 2016
Current Operating Cycle:	28

ANALYSIS OF RECORD

Evaluation Method:	EMF-2328(P)(A), Revision 0, "PWR Small Break LOCA Evaluation Model, S-RELAP5 Based," Framatome ANP, Inc., March 2001.
Calculations:	FC07397, Revision 0, "Fort Calhoun Cycle 24 SBLOCA Analysis." EA13-023, Revision 0, "Fort Calhoun SBLOCA Analysis with Reduced HPSI Flow (AREVA Calc. 32-9130020-001)."
Fuel Type:	AREVA HTP 14x14 M5
Limiting Fuel Type:	AREVA HTP 14x14 M5
Limiting Single Failure:	Loss of one emergency diesel generator
Limiting Break Size/Location:	3.5 inch break size (FC07397); 3.0 inch break size (EA13-023)
Reference PCT:	1537°F

MARGIN ALLOCATION

A. Prior LOCA Model Assessments

Annual 10 CFR 50.46 Report (LIC-07-0034) dated April 25, 2007 (See Note 1)	ΔPCT = +0°F
Annual 10 CFR 50.46 Report (LIC-08-0048) dated April 21, 2008 (See Note 2)	ΔPCT = +0°F
Annual 10 CFR 50.46 Report (LIC-09-0026) dated April 3, 2009 (See Note 3)	ΔPCT = -8°F
Annual 10 CFR 50.46 Report (LIC-10-0027) dated April 26, 2010 (See Note 4)	ΔPCT = -60°F
Annual 10 CFR 50.46 Report (LIC-11-0029) dated April 6, 2011 (See Note 5)	ΔPCT = +0°F

Enclosure 1
Fort Calhoun Station Unit 1
Small Break LOCA Margin Summary Sheet – Annual 10 CFR 50.46 Report

Annual 10 CFR 50.46 Report (LIC-12-0053) dated April 27, 2012 (See Note 6)	ΔPCT = -32°F
Annual 10 CFR 50.46 Report (LIC-13-0056) dated April 30, 2013 (See Note 7)	ΔPCT = +0°F
Annual 10 CFR 50.46 Report (LIC-14-0062) dated April 25, 2014 (See Note 8)	ΔPCT = +309°F
Annual 10 CFR 50.46 Report (LIC-15-0060) dated April 30, 2015 (See Note 9)	ΔPCT = +54°F
Net PCT	**1800°F**

B. Current LOCA Model Assessments

None (See Note 10)	ΔPCT = +0°F
Total PCT change from current assessments	ΣΔPCT = +0°F
Cumulative PCT change from current assessments	Σ|ΔPCT| = +0°F
Net PCT	**1800°F**

Enclosure 2
Fort Calhoun Station Unit 1
Realistic Large Break LOCA Margin Summary Sheet – Annual 10 CFR 50.46 Report

Plant Name:	Fort Calhoun Station, Unit 1
Utility Name:	Omaha Public Power District
ECCS Evaluation Model:	BAW-2502P Rev. 1
Report Date:	April 29, 2016
Current Operating Cycle:	28

ANALYSIS OF RECORD

Evaluation Method:	EMF-2103(P)(A), Revision 0, "Realistic Large Break LOCA Methodology for Pressurized Water Reactors," Framatome ANP, Inc., April 2003.
Calculations:	FC07260, Revision 1, "Fort Calhoun Station Realistic Large Break LOCA Summary Report."
Fuel Type:	AREVA HTP 14x14 M5
Limiting Fuel Type:	AREVA HTP 14x14 M5
Limiting Single Failure:	Loss of one ECCS pumped injection train
Limiting Break Size/Location:	Double ended guillotine or split/between 0.5 and 1.0 on the cold leg pump discharge piping
Reference PCT:	1636°F

MARGIN ALLOCATION

A. Prior LOCA Model Assessments

Annual 10 CFR 50.46 Report (LIC-07-0034) dated April 25, 2007 (See Note 1)	ΔPCT = +0°F
Annual 10 CFR 50.46 Report (LIC-08-0048) dated April 21, 2008 (See Note 2)	ΔPCT = +0°F
Annual 10 CFR 50.46 Report (LIC-09-0026) dated April 3, 2009 (See Note 3)	ΔPCT = -13°F
Annual 10 CFR 50.46 Report (LIC-10-0027) dated April 26, 2010 (See Note 4)	ΔPCT = -49°F
Annual 10 CFR 50.46 Report (LIC-11-0029) dated April 6, 2011 (See Note 5)	ΔPCT = +0°F
Annual 10 CFR 50.46 Report (LIC-12-0053) dated April 27, 2012 (See Note 6)	ΔPCT = +8°F*
Annual 10 CFR 50.46 Report (LIC-13-0056) dated April 30, 2013 (See Note 7)	ΔPCT = +0°F

Enclosure 2
Fort Calhoun Station Unit 1
Realistic Large Break LOCA Margin Summary Sheet – Annual 10 CFR 50.46 Report

Annual 10 CFR 50.46 Report (LIC-14-0062) dated April 25, 2014 (See Note 8)	ΔPCT = +6°F
Annual 10 CFR 50.46 Report (LIC-15-0060) dated April 30, 2015 (See Note 9)	ΔPCT = +0°F
Net PCT	**1587°F**

*Note: LIC-12-0053 reported a +8°F increase in PCT. That report did not account for the -1°F for Cycle 25 thimble modification for core bypass flow (10 CFR 50.59). This is reflected in the Net PCT of 1587°F.

B. Current LOCA Model Assessments

None (See Note 10)	ΔPCT = +0°F
Total PCT change from current assessments	ΣΔPCT = +0°F
Cumulative PCT change from current assessments	Σ|ΔPCT| = +0°F
Net PCT	**1587°F**

Enclosure 3
Fort Calhoun Station Unit 1
10 CFR 50.46 Report Assessment Notes

1. Prior Loss-of-Coolant Accident (LOCA) Assessment

   The referenced letter reported a new analysis of record for both AREVA LOCA analyses. The RLBLOCA Revision 0 AOR reported the PCT at 1675°F and a change due to a Cycle 24 neutronics parameter, resulting in a -39°F change in PCT, resulted in Revision 1 to the RLBLOCA AOR with a PCT of 1636°F. The new baseline PCT for SBLOCA was 1537°F and the new baseline PCT for RLBLOCA was 1636°F. Reference 1

2. Prior LOCA Assessment

   The referenced letter reported no new PCT assessment for AREVA LOCA analyses. Also, no ECCS-related changes or modifications occurred at Fort Calhoun that affected the assumptions of the ECCS analyses. Reference 2

3. Prior LOCA Assessment

   The referenced letter reported two errors in the current AREVA SBLOCA analysis and three errors in the current AREVA RLBLOCA analysis. The two errors associated with the SBLOCA analysis were inconsistencies in application of the S-RELAP5 mixture level model and legacy FORTRAN programming issues with point kinetics in RELAP5 based computer codes. The impact on PCT due to these errors was determined to be +0°F and -8°F, respectively. The three errors associated with the RLBLOCA analysis were inconsistencies in application of the S-RELAP5 mixture level model, legacy FORTRAN programming issue with point kinetics in RELAP5 based computer codes, and cold leg condensation in RLBLOCA methodology. The impact on PCT due to these errors was determined to be +7°F, -20°F, and +0°F, respectively. Reference 3

4. Prior LOCA Assessment

   The referenced letter reported three errors in the current AREVA SBLOCA and RLBLOCA analysis associated with S-RELAP5 radiation to fluid correlation under predicting the radiative heat transfer, legacy error in RELAP5 series heat conduction model, and pellet thermal conductivity degradation in RODEX codes. The impact on the SBLOCA PCT due to these errors was determined to be -64°F, +4°F, and +0°F, respectively. The impact on the RLBLOCA PCT due to these errors was determined to be -27°F, -22°F, and +0°F, respectively. Reference 4

5. Prior LOCA Assessment

   The referenced letter reported one error in the current AREVA Fort Calhoun RLBLOCA analysis associated with FIJ Multiplier and under predicting liquid entrained to steam generator tubes. The impact due to this error was determined to be +0°F for RLBLOCA in PCT. Reference 5

Enclosure 3
Fort Calhoun Station Unit 1
10 CFR 50.46 Report Assessment Notes

6. Prior LOCA Assessment

   The referenced letter reported two errors in the current AREVA Fort Calhoun LOCA analyses associated with the use of the Sleicher-Rouse Correlation. The impact due to this error was determined to be -32°F for SBLOCA and +8°F for RLBLOCA in PCT. Reference 6

7. Prior LOCA Assessment

   The referenced letter reported two errors in the current AREVA Fort Calhoun RLBLOCA analysis associated with flow path reverse loss coefficient from the upper plenum to the central core region and the Cathcart-Pawel correlation for oxide growth. The impact due to this error was determined to be +0°F for RLBLOCA in PCT. Reference 7

8. Prior LOCA Assessment

   The referenced letter reported a re-analysis of the AREVA SBLOCA analysis of record, which incorporated a reduction in the credited high pressure safety injection flow rate. The impact due to this change was determined to be +309°F in PCT increase. Also, the referenced letter reported an error in RLBLOCA with the S-RELAP routine associated with the RODEX3a fuel rod model. The impact due to this error was determined to be +6°F for RLBLOCA in PCT. Reference 8

9. Prior LOCA Assessment

   The referenced letter reported two changes in the current AREVA SBLOCA analysis and two changes/errors in the current AREVA RLBLOCA analysis. The two changes associated with the SBLOCA analysis were a change in vapor absorptivity correlation and a change to the initial fill gas pressurization. The impact on PCT due to these changes was determined to be +23°F and +31°F, respectively. The three changes/errors associated with the RLBLOCA analysis were a change in vapor absorptivity correlation, an error of non-physical axial shapes being generated by the Modal Decomposition, and a change to the initial fill gas pressurization. The impact on PCT due to these changes/errors was determined to be +0°F, +0°F, and +0°F, respectively. Reference 9

10. Current Assessment

    In the referenced letter, AREVA reported no new changes, error corrections, or enhancements in the current Fort Calhoun LOCA analyses. Additionally, no new changes, error corrections, or enhancements were reported since the referenced letter was issued. No ECCS related changes or modifications have occurred at Fort Calhoun that affected the assumptions in the Fort Calhoun Station LOCA analyses of record. Reference 10

Enclosure 3
Fort Calhoun Station Unit 1
10 CFR 50.46 Report Assessment Notes

References:

1. Letter from OPPD (H. J. Faulhaber) to NRC (Document Control Desk), "Annual Report for 2006 Loss of Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 25, 2007. (ML071170467) (LIC-07-0034)
2. Letter from OPPD (R. P. Clemens) to NRC (Document Control Desk), "Annual Report for 2007 Loss of Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 21, 2008. (ML081200799) (LIC-08-0048)
3. Letter from OPPD (R. P. Clemens) to NRC (Document Control Desk), "Annual Report for 2008 Loss of Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 3, 2009. (ML091040197) (LIC-09-0026)
4. Letter from OPPD (H. J. Faulhaber) to NRC (Document Control Desk), "Annual Report for 2009 Loss of Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 26, 2010. (ML101170014) (LIC-10-0027)
5. Letter from OPPD (J. B. Herman) to NRC(Document Control Desk), "Annual Report for 2010 Loss of Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 6, 2011. (ML110960457) (LIC-11-0029)
6. Letter from OPPD (J. B. Herman) to NRC (Document Control Desk), "Annual Report for 2011 Loss-of-Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 27, 2012. (ML12121A006) (LIC-12-0053)
7. Letter from OPPD (L. P. Cortopassi) to NRC (Document Control Desk), "Annual Report for 2012 Loss-of-Coolant Accident (LOCA)/Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 30, 2013. (ML13121A088) (LIC-13-0056)
8. 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)
9. Letter from OPPD (L. P. Cortopassi) to NRC (Document Control Desk), "Annual Report for 2014 Loss-of-Coolant Accident (LOCA)/ Emergency Core Cooling System (ECCS) Models Pursuant to 10 CFR 50.46," dated April 30, 2015. (ML15120A392) (LIC-15-0060)
10. Letter from AREVA (E. H. Marshall) to OPPD (C. Waszak), "Fort Calhoun 2015 Annual 10 CFR 50.46 Report," dated March 11, 2016. (FAB16-00138)