

10 CFR 50.46

August 13, 2015

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

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: 10 CFR 50.46 Annual Report

Reference: 1. Letter from J. Barstow (Exelon Generation Company, LLC) to the U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 15, 2014

The purpose of this letter is to transmit the 10 CFR 50.46 reporting information for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. The previous 50.46 Report for PBAPS, Units 2 and 3, (Reference 1) provided the cumulative Peak Cladding Temperature (PCT) errors for the most recent fuel designs through August 15, 2014.

Since the last PBAPS 10 CFR 50.46 Report (Reference 1), no new vendor notifications regarding Emergency Core Cooling System (ECCS) modeling changes/errors applicable to PBAPS, Units 2 and 3, have been issued. No ECCS-related changes or modifications have occurred at PBAPS, Units 2 and 3, that affect the assumptions of the ECCS analyses.

Since the referenced report, PBAPS, Unit 2, has undergone the transition to Extended Power Uprate (EPU) operation. A new LOCA analysis was performed for EPU conditions and the results are presented in Attachment 1.

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There are no regulatory commitments in this letter.

If you have any questions concerning this letter, please contact Stephanie J. Hanson at 610-765-5143.

Respectfully,



David P. Helker
Manager, Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachments: 1. Peach Bottom Unit 2 | SAFER/GESTR-LOCA | GNF2 Fuel
 10 CFR 50.46 Report
 2. Peach Bottom Unit 3 | SAFER/GESTR-LOCA | GE14/GNF2 Fuel
 10 CFR 50.46 Report
 3. Assessment Notes

cc: USNRC Region I, Regional Administrator
 USNRC Senior Resident Inspector, PBAPS
 USNRC Project Manager, PBAPS
 R. R. Janati, Bureau of Radiation Protection
 S. T. Gray, State of Maryland

ATTACHMENT 1

**Peach Bottom Unit 2 | SAFER/GESTR-LOCA | GNF2 Fuel
10 CFR 50.46 Report**

PLANT NAME: Peach Bottom Unit 2
ECCS EVALUATION MODEL: SAFER/GESTR-LOCA
EVALUATION MODEL VENDOR: GNF/GEH
REPORT REVISION DATE: August 13, 2015
CURRENT OPERATING CYCLE: 21

ANALYSIS OF RECORD CALCULATIONS

1. 0000-0123-2474-R2, Rev 2, "Peach Bottom Atomic Power Station Units 2 and 3, Extended Power Uprate Task T0407: ECCS-LOCA SAFER/GESTR," January 2012.
2. GEH-PBAPS-EPU-408, "GEH Response to NRC Reactor System Branch RAI-1," April 26, 2013.
3. NEDO-33173 Supplement 4-A, Rev 1, "Implementation of PRIME Models and Data in Downstream Methods," November 2012.

Fuels Analyzed in Calculations and in Operation: GNF2

Limiting Fuel Type: GNF2

Limiting Single Failure: Battery Failure

Limiting Break Size/Location: 0.05 ft² Small Break in a Recirculation Discharge Pipe

Reference PCT: 1925 °F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS:

Annual 10 CFR 50.46 Report dated August 16, 2013 (See Note 12)	$\Delta PCT=0$ °F
Annual 10 CFR 50.46 Report dated August 15, 2014 (See Note 13)	$\Delta PCT=5$ °F
Net PCT	1930 °F

B. CURRENT LOCA MODEL ASSESSMENTS:

New EPU LOCA Analysis (See Note 14)	$\Delta PCT=0$ °F
Total PCT change from current assessments	$\Sigma \Delta PCT=0$ °F
Cumulative PCT change from current assessments	$\Sigma \Delta PCT =0$ °F
Net PCT	1930 °F

ATTACHMENT 2

**Peach Bottom Unit 3 | SAFER/GESTR-LOCA | GE14/GNF2 Fuel
10 CFR 50.46 Report**

PLANT NAME: Peach Bottom Unit 3
ECCS EVALUATION MODEL: SAFER/GESTR-LOCA
EVALUATION MODEL VENDOR: GNF/GEH
REPORT REVISION DATE: August 13, 2015
CURRENT OPERATING CYCLE: 20

ANALYSIS OF RECORD CALCULATIONS*

1. NEDC-32163P, "Peach Bottom Atomic Power Station Units 2 and 3 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," January 1993.
2. GENE-J11-03716-09-02P, "Peach Bottom Atomic Power Station ECCS-LOCA Evaluation for GE14," July 2000.
3. GENE-J11-03716-09-02P, "Errata and Addenda Sheet for Peach Bottom Atomic Power Station ECCS-LOCA Evaluation for GE14," October 2007.
4. 0000-0100-8531-R1, "Peach Bottom Atomic Power Station Units 2 & 3 GNF2 ECCS-LOCA Evaluation," March 2011.

Fuels Analyzed in Calculations and in Operation: GE14 and GNF2

Limiting Fuel Type: GNF2

Limiting Single Failure – GE14/GNF2: Battery Failure

Limiting Break Size/Location – GE14: 0.08 ft² Small Break in a Recirculation Discharge Pipe

Limiting Break Size/Location – GNF2: 0.06 ft² Small Break in a Recirculation Discharge Pipe

Reference PCT – GE14: 1450 °F

Reference PCT – GNF2: 1870 °F

*The Unit 3 PCT results presented are based on LOCA analysis performed prior to Extended Power Uprate (EPU). Peach Bottom Unit 3 will transition to EPU during the next cycle of operation (Cycle 21 – expected October 2015). After Unit 3's EPU implementation the LOCA analysis and associated PCT will be the same as the Unit 2 analysis reported on Attachment 1.

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS:

30-Day 10 CFR 50.46 Report dated June 4, 2001 (See Note 1)	GE14 Δ PCT=55 °F
Annual 10 CFR 50.46 Report dated December 18, 2002 (See Note 2)	GE14 Δ PCT=45 °F
Annual 10 CFR 50.46 Report dated December 3, 2004 (See Note 3)	GE14 Δ PCT=0 °F
Annual 10 CFR 50.46 Report dated December 1, 2005 (See Note 4)	GE14 Δ PCT=0 °F
30-Day 10 CFR 50.46 Report dated August 22, 2006 (See Note 5)	GE14 Δ PCT=150 °F
Annual 10 CFR 50.46 Report dated August 22, 2007 (See Note 6)	GE14 Δ PCT=0 °F
Annual 10 CFR 50.46 Report dated August 22, 2008 (See Note 7)	GE14 Δ PCT=0 °F
Annual 10 CFR 50.46 Report dated August 21, 2009 (See Note 8)	GE14 Δ PCT=15 °F
Annual 10 CFR 50.46 Report dated August 20, 2010 (See Note 9)	GE14 Δ PCT=0 °F
Annual 10 CFR 50.46 Report dated August 19, 2011 (See Note 10)	GE14 Δ PCT=50 °F
Annual 10 CFR 50.46 Report dated August 17, 2012 (See Note 11)	GE14 Δ PCT=0 °F GNF2 Δ PCT=50 °F
Annual 10 CFR 50.46 Report dated August 16, 2013 (See Note 12)	GE14 Δ PCT=30 °F GNF2 Δ PCT=0 °F
Annual 10 CFR 50.46 Report dated August 15, 2014 (See Note 13)	GE14 Δ PCT=5 °F GNF2 Δ PCT=5 °F
Net PCT (GE14)	1800 °F
Net PCT (GNF2)	1925 °F

B. CURRENT LOCA MODEL ASSESSMENTS:

None (See Note 14)	GE14 Δ PCT=0 °F GNF2 Δ PCT=0 °F
Total PCT change from current assessments (GE14)	$\Sigma \Delta$ PCT=0 °F
Total PCT change from current assessments (GNF2)	$\Sigma \Delta$ PCT=0 °F
Cumulative PCT change from current assessments (GE14)	$\Sigma \Delta$ PCT =0 °F
Cumulative PCT change from current assessments (GNF2)	$\Sigma \Delta$ PCT =0 °F
Net PCT (GE14)	1800 °F
Net PCT (GNF2)	1925 °F

ATTACHMENT 3

Assessment Notes
10 CFR 50.46 Report

1. Prior LOCA Assessment

The referenced letter reported two GE LOCA errors related to a SAFER condensation error and a SAFER pressure rate error. The PCT impact for the new errors was determined to be 45°F and 10°F, respectively. These PCT errors were applicable to the GE14 fuel type. This letter constituted a 30-Day Report. The total PCT impact of these errors on GE14 fuel was determined to be 55°F. This report is no longer applicable to Unit 2.

[Reference: Letter from James A. Hutton (Exelon Generation Company, LLC) to U.S. NRC, "Peach Bottom Atomic Power Station, Units 2 and 3 10 CFR 50.46 Reporting Requirements," dated June 4, 2001.]

2. Prior LOCA Assessment

The referenced letter provided the Annual 50.46 Report for Units 2 and 3 (though it is no longer applicable to Unit 2). This letter reported GE LOCA errors related to a SAFER core spray sparger elevation error and a SAFER bulk water level error. The PCT impact for the new errors was determined to be 40°F and 5°F, respectively. These PCT errors were applicable to the GE14 fuel type. The total PCT impact of these errors on GE14 fuel was determined to be 45°F.

[Reference: Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. NRC, "10 CFR 50.46 Reporting Requirements," dated December 18, 2002.]

3. Prior LOCA Assessment

The referenced letter provided the Annual 50.46 Report for Units 2 and 3 (though it is no longer applicable to Unit 2). This letter reported GE LOCA errors related to a GESTR file interpolation error (not applicable to GE14 fuel), a SAFER computer platform change, a WEVOL S1 volume error, a SAFER level/volume table error, a SAFER separator pressure drop error, and a new heat source. The PCT impact each of these errors was determined to be 0°F. Therefore, the total PCT impact of these errors on GE14 fuel was determined to be 0°F.

[Reference: Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated December 3, 2004.]

4. Prior LOCA Assessment

The referenced letter provided the Annual 50.46 Report for Units 2 and 3 (though it is no longer applicable to Unit 2). This letter reported that no vendor 50.46 change/error notifications had been received since the last annual report. Therefore, the annual PCT change for GE14 fuel was reported as 0°F.

[Reference: Letter from Pamela B. Cowan (Exelon Generation Company, LLC) to U.S. NRC, "10 CFR 50.46 Annual Report," dated December 1, 2005.]

5. Prior LOCA Assessment

The referenced letter provided a 30-Day 50.46 Report for Units 2 and 3 (though it is no longer applicable to Unit 2). This letter reported a newly discovered sensitivity to the assumed axial power shape for small break LOCA cases. This sensitivity may result in higher calculated PCT values for top-peaked axial power shapes. Due to this sensitivity, the calculated PCT for Peach Bottom was higher than the previously calculated value. The PCT impact was determined to be 150°F for GE14 fuel. The 0.08 ft² Small Break in a Recirculation Discharge Pipe is the Licensing Basis PCT event for Peach Bottom for GE14 fuel.

[Reference: Letter from Pamela B. Cowan (Exelon Generation Company, LLC) to U.S. NRC, "10 CFR 50.46 30-Day Report," dated August 22, 2006.]

6. Prior LOCA Assessment

The referenced letter provided the Annual 50.46 Report for Units 2 and 3 (though it is no longer applicable to Unit 2). This letter reported that no vendor 50.46 change/error notifications had been received since the last annual report. Therefore, the annual PCT change for GE14 fuel was reported as 0°F.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. NRC, "10 CFR 50.46 Annual Report," dated August 22, 2007.]

7. Prior LOCA Assessment

The referenced letter provided the Annual 50.46 Report for Units 2 and 3 (though it is no longer applicable to Unit 2). This letter reported that no vendor 50.46 change/error notifications had been received since the last annual report. Therefore, the annual PCT change for GE14 fuel was reported as 0°F.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 22, 2008.]

8. Prior LOCA Assessment

The referenced letter provided the Annual 50.46 Report for Units 2 and 3 (though it is no longer applicable to Unit 2). This letter reported that GE/GNF identified a Steam Flow Induced Error (SFIE, or Bernoulli Error) where water level could reach the bottom of the dryer and allow steam to bypass to the annulus. This bypass affects the L3 water level measurement, which relies on pressure taps in the annulus. Scram from the L3 level indication is conservatively modeled in the Small Break ECCS-LOCA analyses assuming Appendix K requirements. The DBA (large break) analyses are confirmed to be unaffected by the SFIE because the modeling relies on signals other than L3 for scram and ECCS response. The PCT impact for PBAPS GE14 fuel (small break limited) due to the SFIE was reported as 15°F.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 21, 2009.]

9. Prior LOCA Assessment

The referenced letter provided the Annual 50.46 Report for Units 2 and 3 (though it is no longer applicable to Unit 2). This letter reported that no vendor 50.46 change/error notifications had been received since the last annual report. Therefore, the annual PCT change for GE14 fuel was reported as 0°F.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 20, 2010.]

10. Prior LOCA Assessment

The assessment notes above are not applicable to GNF2 fuel. The referenced letter also reported that two vendor notifications of Emergency Core Cooling System (ECCS) model error/changes that were applicable to Peach Bottom were issued. No ECCS-related changes or modifications had occurred at Peach Bottom that affected the assumptions of the ECCS analyses. This assessment is no longer applicable to Unit 2. The errors/changes are summarized below:

The error identified in Reference 2 of the referenced letter involved the way input coefficients were used to direct the deposition of gamma radiation energy produced by the fuel. Correction of this error resulted in a PCT increase of 45°F for GE14 fuel.

The error identified in Reference 3 of the referenced letter involved the contribution of heat from gamma ray absorption by the channel. The gamma ray absorption by the channel was found to have been minimized. Correction of this error resulted in a PCT increase of 5°F for GE14 fuel.

[Reference: Letter from Michael D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 19, 2011.]

11. Prior LOCA Assessment

The referenced letter reported that the GNF2 fuel design had been introduced into the Peach Bottom Unit 3 core since the last annual report. The ECCS model error/changes discussed in Note 10 were applied to the GNF2 fuel in the Peach Bottom Unit 3 core which resulted in a PCT increase of 50°F. This assessment is no longer applicable to Unit 2.

[Reference: Letter from Michael D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 17, 2012.]

12. Prior LOCA Assessment

To address inaccuracies in thermal conductivity degradation (TCD), GEH replaced the GESTR-LOCA model with a newer model, PRIME. The most dominant effect impacting PCT is from the way the PRIME fuel properties treat thermal conductivity, which results in a higher fuel stored energy. The PCT impact identified in the referenced letter reflects the difference between the existing GESTR analysis PCT and a conservatively postulated PCT if the analysis were performed with the PRIME model. The ECCS-LOCA analysis methodology remains GESTR based and will not be PRIME based until the ECCS-LOCA analysis is re-performed using PRIME. The notification resulted in a 0°F PCT impact to GNF2 fuel and a 30°F PCT impact to GE14 fuel. Note that the 10 CFR 50.46 Notification discussed in the referenced report was applicable to the GNF2 fuel in the Unit 2 EPU LOCA analysis.

[Reference: Letter from James Barstow (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 16, 2013.]

13. Prior LOCA Assessment

The referenced letter reported four vendor notifications that were received. The first notification addressed several accumulated updates to the SAFER04A model. The code maintenance changes had an individually and collectively insignificant effect on calculated peak cladding temperature. The second notification was for a correction to a logic error that was isolated, occurring with an indication that the expected systems mass diverged from the calculated actual system mass. This error affected the ECCS flow credited as reaching the core. Correction of this error resulted in a 10°F PCT change to both GE14 and GNF2 fuel. The third notification addressed an error with the imposed minimum pressure differential (Δp) for droplet flow above a two-phase level in the core. This error could have offered an inappropriate steam cooling benefit above the core two phase level. To correct this error an explicit core Δp calculation was applied without regard to droplet condition resulting in a PCT of -10°F to both GE14 and GNF2 fuel. The forth notification addressed an incorrect pressure head representation when defining the counter current flow limitation (CCFL). Correction of this error resulted in a 5°F PCT change to both GE14 and GNF2 fuel. Note that the 10 CFR 50.46 Notifications discussed in the referenced report are applicable to the Unit 2 EPU LOCA analysis.

[Reference: Letter from James Barstow (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 15, 2014.]

14. Current LOCA Assessment

Since the last annual report, Peach Bottom Unit 2 implemented Extended Power Uprate (EPU) for which a new LOCA analysis was performed. Assessment Notes 12 and 13 are applicable to the Peach Bottom Unit 2 EPU LOCA analysis, but prior assessment notes (1-11) are no longer applicable. No vendor 50.46 change/error notifications had been received since the last annual report.