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10 CFR 50.46

August 12, 2022

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

Peach Bottom Atomic Power Station, Units 2 and 3  
Subsequent 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: Letter from David P. Helker (Exelon Generation Company, LLC) to the U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 12, 2021

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 10 CFR 50.46 report for PBAPS, Units 2 and 3, (Reference) provided the cumulative Peak Cladding Temperature (PCT) errors for the most recent fuel designs through August 12, 2021.

There has been one change since the last report (Reference) which is further discussed in Attachment 4, Item 2. Beginning in PBAPS, Unit 3, Cycle 24, GNF3 fuel was introduced into the core, in addition to GNF2 fuel. PBAPS, Unit 2, continues to operate with a full core of GNF2 fuel. The PCT value of 1962°F for GNF2 fuel remains unchanged for this 2022 report and a PCT value of 2040°F for GNF3 fuel is being reported.

There are no regulatory commitments in this letter.

If you have any questions concerning this letter, please contact Richard Gropp at 610-765-5557.

Respectfully,

A handwritten signature in blue ink that reads "D. P. Helker".

David P. Helker  
Sr. Manager, Licensing  
Constellation Energy Generation, LLC

U.S. Nuclear Regulatory Commission  
Peach Bottom Atomic Power Station, Units 2 and 3  
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cc:    w/Attachments  
        USNRC Region I, Regional Administrator  
        USNRC Senior Resident Inspector, PBAPS  
        USNRC Project Manager, PBAPS  
        W. DeHaas, Pennsylvania Bureau of Radiation Protection  
        S. Seaman, State of Maryland

**ATTACHMENT 1**

**Peach Bottom Unit 2 | SAFER/PRIME | GNF2 Fuel  
10 CFR 50.46 Report**

PLANT NAME: Peach Bottom, Unit 2  
ECCS EVALUATION MODEL: SAFER/PRIME  
EVALUATION MODEL VENDOR: GNF/GEH  
REPORT REVISION DATE: August 1, 2022  
CURRENT OPERATING CYCLE: 24

### **ANALYSIS OF RECORD CALCULATIONS**

1. Project Task Report, Exelon Generation Company LLC, Peach Bottom Atomic Power Station, Units 2 & 3 MELLLA+ Task T0407: ECCS-LOCA Performance, 0000-0162-2354-R0, Revision 0, (PLM 000N0296 Revision 0), December 2013.

Fuels Analyzed in Calculations and in Operation: GNF2  
Limiting Fuel Type: GNF2  
Limiting Single Failure: Battery Failure  
Limiting Break Location: Recirculation Discharge Line  
Limiting Break Size: 0.05 ft<sup>2</sup> (Small Break)

Reference Peak Cladding Temperature (PCT) for GNF2 Fuel: 1920°F

### **MARGIN ALLOCATION**

#### A. PRIOR LOCA ASSESSMENTS (Note 1):

10 CFR 50.46 Report dated August 15, 2014 (Note 1.1)	GNF2: $\Delta PCT = 5^{\circ}F$
10 CFR 50.46 Report dated August 10, 2016 (Note 1.2)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated August 10, 2017 (Note 1.3)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated August 10, 2018 (Note 1.4)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated August 12, 2019 (Note 1.5)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated August 12, 2020 (Note 1.6)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report (30-Day Report) dated November 5, 2020 (Note 1.7)	GNF2: $\Delta PCT = 37^{\circ}F$
10 CFR 50.46 Report dated August 12, 2021 (Note 1.8)	GNF2: $\Delta PCT = 0^{\circ}F$
<b>Net PCT</b>	<b>GNF2: 1962°F</b>

#### B. CURRENT LOCA ASSESSMENTS (Note 2):

Total PCT Change from Current Assessments (Note 2)	GNF2: $\sum \Delta PCT = 0^{\circ}F$
Cumulative PCT Change from Current Assessments	GNF2: $\sum  \Delta PCT  = 0^{\circ}F$
<b>Net PCT</b>	<b>GNF2: 1962°F</b>

**ATTACHMENT 2**

**Peach Bottom Unit 3 | SAFER/PRIME | GNF2 Fuel  
10 CFR 50.46 Report**

PLANT NAME: Peach Bottom, Unit 3  
ECCS EVALUATION MODEL: SAFER/PRIME  
EVALUATION MODEL VENDOR: GNF/GEH  
REPORT REVISION DATE: August 1, 2022  
CURRENT OPERATING CYCLE: 24

### **ANALYSIS OF RECORD CALCULATIONS**

1. Project Task Report, Exelon Generation Company LLC, Peach Bottom Atomic Power Station, Units 2 & 3 MELLLA+ Task T0407: ECCS-LOCA Performance, 0000-0162-2354-R0, Revision 0, (PLM 000N0296 Revision 0), December 2013.

Fuels Analyzed in Calculations and in Operation: GNF2  
Limiting Fuel Type: GNF2  
Limiting Single Failure: Battery Failure  
Limiting Break Location: Recirculation Discharge Line  
Limiting Break Size: 0.05 ft<sup>2</sup> (Small Break)

Reference Peak Cladding Temperature (PCT) for GNF2 Fuel: 1920°F

### **MARGIN ALLOCATION**

#### **A. PRIOR LOCA ASSESSMENTS (Note 1):**

10 CFR 50.46 Report dated August 15, 2014 (Note 1.1)	GNF2: $\Delta PCT = 5^{\circ}F$
10 CFR 50.46 Report dated August 10, 2016 (Note 1.2)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated August 10, 2017 (Note 1.3)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated August 10, 2018 (Note 1.4)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated August 12, 2019 (Note 1.5)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated August 12, 2020 (Note 1.6)	GNF2: $\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report (30-Day Report) dated November 5, 2020 (Note 1.7)	GNF2: $\Delta PCT = 37^{\circ}F$
10 CFR 50.46 Report dated August 12, 2021 (Note 1.8)	GNF2: $\Delta PCT = 0^{\circ}F$
<b>Net PCT</b>	<b>GNF2: 1962°F</b>

#### **B. CURRENT LOCA ASSESSMENTS (Note 2):**

Total PCT Change from Current Assessments (Note 2)	GNF2: $\Sigma \Delta PCT = 0^{\circ}F$
Cumulative PCT Change from Current Assessments	GNF2: $\Sigma  \Delta PCT  = 0^{\circ}F$
<b>Net PCT</b>	<b>GNF2: 1962°F</b>

**ATTACHMENT 3**

**Peach Bottom Unit 3 | SAFER/PRIME | GNF3 Fuel  
10 CFR 50.46 Report**

PLANT NAME: Peach Bottom, Unit 3  
ECCS EVALUATION MODEL: SAFER/PRIME  
REPORT REVISION DATE: August 1, 2022  
EVALUATION MODEL VENDOR: GNF/GEH  
CURRENT OPERATING CYCLE: 24

## ANALYSIS OF RECORD CALCULATIONS

1. Peach Bottom Atomic Power Station Units 2 & 3 GNF3 ECCS-LOCA Evaluation,  
005N9630-R0, Revision 0, April 2021.

Fuels Analyzed in Calculations and in Operation:	GNF3
Limiting Fuel Type:	GNF3
Limiting Single Failure:	Battery Failure
Limiting Break Location:	Recirculation Discharge Line
Limiting Break Size	0.05 ft <sup>2</sup> (Small Break)

Reference Peak Cladding Temperature (PCT) for GNF3 Fuel: 2040°F

## MARGIN ALLOCATION

### A. PRIOR LOCA ASSESSMENTS (Note 1)

No prior LOCA Model Assessments have been provided as this is the first time the reference Analysis of Record is being reported. (See Note 1)	N/A
<b>Net PCT</b>	<b>GNF3: 2040°F</b>

### B. CURRENT LOCA ASSESSMENTS (Note 2)

Total PCT Change from Current Assessments (Note 2)	GNF2: $\sum \Delta PCT = 0^\circ F$
Cumulative PCT Change from Current Assessments	GNF2: $\sum  \Delta PCT  = 0^\circ F$
<b>Net PCT</b>	<b>GNF3: 2040°F</b>



**ATTACHMENT 4**

**Assessment Notes  
10 CFR 50.46 Report**

Assessment Notes 10 CFR 50.46 Report

1. Prior LOCA Assessment

The last 10 CFR 50.46 annual report submitted to the NRC was on August 12, 2021 (Reference 1). This report documents a Net PCT of 1962°F; a Licensing Basis PCT of 1920°F from the analysis of record report, and a total PCT adder of +42°F for GNF2 fuel at Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. No Net PCT, Licensing Basis PCT, or PCT adder for GNF3 fuel was provided in this report, since neither PBAPS unit had GNF3 fuel in operation at the time. Beginning with PBAPS, Unit 3, Cycle 24, GNF3 fuel was introduced into the core, in addition to GNF2 fuel. PBAPS, Unit 2, continues to operate with a full core of GNF2 fuel. All the listed prior LOCA assessments below are documented in the referenced letter.

[Reference 1: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 12, 2021.]

1.1. Prior LOCA Assessment - 2014

The referenced letter reported four vendor notifications that were received.

1. 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.
2. 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 Emergency Core Cooling System (ECCS) flow credited as reaching the core. Correction of this error resulted in a +10°F Peak Cladding Temperature (PCT) change for GNF2 fuel.
3. The third notification addressed an error with the imposed minimum Pressure Differential ( $\Delta p$ ) 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 pressure drop calculation was applied without regard to droplet condition resulting in a PCT of -10°F for GNF2 fuel.
4. 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 for GNF2 fuel.

Note that the 10 CFR 50.46 notifications discussed in the referenced report are applicable to the Unit 2 and Unit 3 MELLLA+ LOCA analysis and the net effect of these notifications is +5°F.

[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.]

1.2. Prior LOCA Assessment - 2016

The referenced letter reported that PBAPS, Units 2 and 3, implemented Maximum Extended Load Line Limit Analysis Plus (MELLLA+) for which a new LOCA analysis was performed. PBAPS, Units 2 and 3, transitioned to MELLLA+ operation mid-cycle in April 2016 and May 2016, respectively. The error notifications reported in Assessment Note 1.1 are applicable to the PBAPS, Units 2 and 3, MELLLA+ LOCA analysis. The notifications were issued subsequent to the performance of the MELLLA+ LOCA analysis, but prior to its implementation.

[Reference: Letter from James Barstow (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 10, 2016.]

1.3. Prior LOCA Assessment - 2017

The referenced letter reported two (2) vendor notifications regarding Emergency Core Cooling System (ECCS) modeling changes/errors applicable to PBAPS (Notifications 2017-01 and 2017-02). These notifications described issues related to the improper modelling of lower tie plate leakage for the GNF2 fuel design and changes to modeling of the fuel rod plenum for 10x10 fuel. Correction of these errors each resulted in a 0°F PCT change for GNF2 fuel.

The referenced letter reported a change in the Level 3 setpoint. The impact of this change on the Loss of Coolant Accident (LOCA) analysis was assessed in GNF Report 003N4534-R0, "Peach Bottom Level 3 Analytical Limit Reduction," dated May 25, 2016, which concluded that there is no impact on the licensing basis PCT for PBAPS.

[Reference: Letter from David T. Gudger (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 10, 2017.]

1.4. Prior LOCA Assessment - 2018

The referenced letter reported no changes/errors against the PBAPS LOCA Analysis of Record during this reporting period.

[Reference: Letter from David T. Gudger (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 10, 2018.]

1.5. Prior LOCA Assessment - 2019

The referenced letter reported no changes/errors against the PBAPS LOCA Analysis of Record during this reporting period.

[Reference: Letter from David T. Gudger (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 12, 2019.]

1.6. Prior LOCA Assessment - 2020

The referenced letter reported two vendor notifications:

- Notification 2019-05 identified that the upper and lower limits for the SAFER code forward and backward bypass leakage were coded incorrectly for the control rod guide tube to control rod drive housing interface backward leakage path. The error was estimated to have zero-degree upon the GNF2 PCT.
- Notification 2020-01 identified that the PRIME code contained errors in irradiation growth after a breakaway neutron fluence, thermal conductivity applied to the zirconium barrier for cladding temperature drop, and gap conductance during pellet-cladding gap closure. The errors were estimated to have zero-degree impact upon the GNF2 PCT.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 12, 2020.]

1.7. Prior LOCA Assessment - 2020 (30-Day Report)

The referenced letter reported two vendor notifications:

- Notification Letter (NL) 2020-02 documented that the vendor impact evaluation performed in NL 2014-01 was incorrect, and NL 2020-02 provides an updated impact evaluation for one of the issues reported in NL 2014-01. NL 2014-01 (Assessment Note 1.1) reports several changes, one of which is regarding the SAFER code error regarding the subcooled water level in the downcomer. Per NL 2020-02, the impact evaluation performed for 2014-01 was inaccurate, especially for postulated LOCA scenarios where a two-phase level establishes in the downcomer, an expected response for small recirculation line break scenarios. The PBAPS LOCA analysis is small break limited as documented in Attachments 1 and 2, and hence, NL 2020-02 impacted the PBAPS LOCA analysis.

NL 2020-02 was issued by the vendor as a new notification with a PCT impact of 35°F. This was the first NL for PBAPS since the 2020 annual report (Assessment Note 1.6), and the absolute value of the reported impact was less than 50°F; therefore, typically this NL would not have required a 30-day reporting per 10CFR50.46(a)(3)(ii). However, as documented in NL 2020-02,

while this notification did not alter the SAFER code used in the PBAPS LOCA evaluation (Attachments 1 and 2), it did alter the PCT impact from the SAFER code change as reported in NL 2014-01. Therefore, NL 2020-02 effectively amended NL 2014-01 for PBAPS.

Since NL 2020-02 notification effectively amended 2014-01, the 30-day reporting requirement was evaluated based upon the conditions applicable when notification 2014-01 was initially issued. Assessment Note 1.1 documents four notifications reported on August 15, 2014. Those four notifications were:

- 2014-01 = 0°F
- 2014-02 = 10°F
- 2014-03 = -10°F
- 2014-04 = 5°F

with a total impact of 25°F ( $= 0 + 10 + |-10| + 5$ ). When the reported 2014-01 value (0°F) is corrected with the updated value from NL 2020-02 (35°F), the total impact becomes 60°F ( $= 35 + 10 + |-10| + 5$ ), which is larger than the 50°F significance threshold defined in 10 CFR 50.46(a)(3)(i) for 30-day reporting. Therefore, this 30-day report was prepared for PBAPS for NL 2020-02.

- Notification 2020-03 identified that the dome pressure input used for Appendix K calculations in the current LOCA analysis of record (Attachments 1 and 2) did not cover operation allowed by Technical Specifications 3.4.10. A PCT impact of +2°F was reported in NL 2020-03 for correcting the dome pressure input used in the analysis.

As described in the description of NL 2020-02, this 30-day report was prepared for NL 2020-02 received on October 7, 2020. However, since NL 2020-03 was issued within the 30-day reporting timeframe for NL 2020-02, this 30-day report also addressed NL 2020-03 for complete and accurate reporting.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Emergency Core Cooling System (ECCS) Loss of Coolant Accident (LOCA) 10 CFR 50.46 30-Day Report," dated November 5, 2020.]

#### 1.8. Prior LOCA Assessment - 2021

The referenced letter reported three vendor notifications:

- Notification 2021-01 identifies an error in the fuel rod stress and perforation model due to an incorrect value used for the fuel pellet to plenum spring conductance input. The error was a result of an incorrect conversion from SI units in preparing the input for SAFER analyses. The error was estimated to have a zero-degree impact upon the GNF2 PCT.

- Notification 2021-02 identifies an error in the inner cladding surface roughness value in the gap conductance model. An inconsistency was identified between the roughness value used in the fuel performance model PRIME and the input to the SAFER and TRACG calculations. The error was estimated to have a zero-degree impact upon the GNF2 PCT.
- Notification 2021-03 identifies that an incorrect Low-Pressure Coolant Injection (LPCI) flow rate value at a high pressure point was used in the input to the SAFER calculations. The error was estimated to have a zero-degree impact upon the GNF2 PCT.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated August 12, 2021.]

## 2. Current LOCA Assessment

Since the previous 10 CFR 50.46 report (Reference in Note 1.8) there has been one change. It was recently discovered that a change in 2011 was made to the decay heat (DH) input used in nominal calculations for the SAFER evaluation model. The updated DH model is a best estimate decay heat curve based on the 1979 ANS 5.1 standard and considers SIL 636. This change was discovered during review of the GNF3 New Fuel Introduction and additional vendor assessments estimated an impact of 0°F upon the GNF2 PCT. This change was already incorporated into the initial GNF3 LOCA evaluation and, therefore, has no impact on the GNF3 LOCA analysis of record.

No additional ECCS related changes or modifications occurred at PBAPS that affected the assumptions in the GNF2 or GNF3 LOCA analysis of record.