



Exelon Generation®

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RS-19-099

10 CFR 50.46

October 10, 2019

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

Clinton Power Station, Unit 1  
Facility Operating License No. NPF-62  
NRC Docket No. 50-461

Subject: Annual Report of Emergency Core Cooling System Evaluation Model Changes  
and Errors for Clinton Power Station

Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC,  
"Annual Report of Emergency Core Cooling System Evaluation Model Changes  
and Errors for Clinton Power Station," dated October 18, 2018

This letter provides the annual report required by 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," for Clinton Power Station, Unit 1. The attachments describe the changes in accumulated peak cladding temperature since the previous annual report submitted in the referenced letter.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

Respectfully,

Patrick R. Simpson  
Sr. Manager Licensing  
Exelon Generation Company, LLC

Attachments:

1. 10 CFR 50.46 Report
2. 10 CFR 50.46 Report Assessment Notes

cc: NRC Regional Administrator, Region III  
NRC Senior Resident Inspector, Clinton Power Station

**ATTACHMENT 1**  
**Clinton Power Station, Unit 1 | SAFER/GESTR-LOCA | GNF2 Fuel**  
**10 CFR 50.46 Report**

PLANT NAME: Clinton Power Station, Unit 1  
ECCS EVALUATION MODEL: SAFER/GESTR-LOCA  
EVALUATION MODEL VENDOR: GNF/GEH  
REPORT REVISION DATE: October 10, 2019  
CURRENT OPERATING CYCLE: 19

**ANALYSIS OF RECORD CALCULATIONS**

1. GEH Report 0000-0121-9100-R0, Clinton Power Station, GNF2 ECCS-LOCA Evaluation, October 2011
2. NEDO-33173, Supplement 4-A, Revision 1, "Implementation of PRIME Models and Data in Downstream Methods," November 2012

Fuel Analyzed in Calculation and in Operation: GNF2

Limiting Fuel Type: GNF2

Limiting Single Failure: High Pressure Core Spray Diesel Generator

Limiting Break Size/Location: Double-Ended Guillotine of Recirculation-Pump Suction Piping

Reference Peak Cladding Temperature (PCT): 1880 °F

**MARGIN ALLOCATION**

**A. PRIOR LOCA MODEL ASSESSMENTS:**

10 CFR 50.46 report dated October 26, 2012 (Note 1)	$\Delta PCT = 0\text{ }^{\circ}\text{F}$
10 CFR 50.46 report dated October 25, 2013 (Note 2)	$\Delta PCT = 40\text{ }^{\circ}\text{F}$
10 CFR 50.46 report dated October 24, 2014 (Note 3)	$\Delta PCT = -15\text{ }^{\circ}\text{F}$
10 CFR 50.46 report dated October 23, 2015 (Note 4)	$\Delta PCT = 0\text{ }^{\circ}\text{F}$
10 CFR 50.46 report dated October 21, 2016 (Note 5)	$\Delta PCT = 0\text{ }^{\circ}\text{F}$
10 CFR 50.46 report dated October 18, 2017 (Note 6)	$\Delta PCT = 30\text{ }^{\circ}\text{F}$
10 CFR 50.46 report dated October 18, 2018 (Note 7)	$\Delta PCT = 0\text{ }^{\circ}\text{F}$
<b>Net PCT</b>	<b>1935 °F</b>

**B. CURRENT LOCA MODEL ASSESSMENTS:**

Total PCT change from current assessments (Note 8)	$\Delta PCT = 0\text{ }^{\circ}\text{F}$
Total PCT change from current assessments	$\Sigma \Delta PCT = 0\text{ }^{\circ}\text{F}$
Cumulative PCT change from current assessments	$\Sigma  \Delta PCT  = 0\text{ }^{\circ}\text{F}$
<b>Net PCT</b>	<b>1935 °F</b>

**ATTACHMENT 2**  
**Clinton Power Station, Unit 1**  
**10 CFR 50.46 Report Assessment Notes**

**1. Prior LOCA Model Assessment (2012)**

The referenced letter reported that the GNF2 fuel design was introduced into the Clinton Power Station (CPS) core during the Reload 13 (Cycle 14) outage. There were no Emergency Core Cooling System (ECCS) related changes or modifications that affected the assumptions in the CPS Loss-of-Coolant Accident (LOCA) analysis of record.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Clinton Power Station," dated October 26, 2012]

**2. Prior LOCA Model Assessment (2013)**

To address inaccuracies in thermal conductivity degradation, GEH replaced the GESTR-LOCA model with a newer model, PRIME. The dominant Peak Cladding Temperature (PCT) effect is from the PRIME thermal conductivity which produces 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 CPS ECCS-LOCA analysis methodology remains GESTR based, and it will not be PRIME based until the ECCS-LOCA analysis is re-performed using PRIME. The notification resulted in a +40 °F PCT impact to GNF2 fuel.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Clinton Power Station," dated October 25, 2013]

**3. Prior LOCA Model Assessment (2014)**

The referenced letter identified four vendor notifications.

- The first notification addressed several accumulated updates to the SAFER04A model. These code maintenance changes had an individually and collectively insignificant effect on calculated PCT.
- The second notification corrected a logic error that was isolated, occurring with an indication that the expected system mass diverges from the calculated actual system mass. This error affects the ECCS flow credited as reaching the core. Correction of this error did not impact the PCT for GNF2 fuel.
- 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 can create an inappropriate steam cooling benefit above the core two phase level. To correct this error, an explicit core  $\Delta P$  calculation was applied without regard to droplet condition resulting in a PCT of -15 °F to GNF2.

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**Clinton Power Station, Unit 1**  
**10 CFR 50.46 Report Assessment Notes**

- The fourth notification addressed an incorrect pressure head representation when defining the counter current flow limitation. Correction of this error did not impact the PCT for GNF2 fuel.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Clinton Power Station," dated October 24, 2014]

**4. Prior LOCA Model Assessment (2015)**

Per the referenced letter, no vendor notifications of ECCS model errors/changes applicable to CPS were issued. There were no ECCS related changes or modifications at CPS that affect the LOCA analysis of record.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Clinton Power Station," dated October 23, 2015]

**5. Prior LOCA Model Assessment (2016)**

Per the referenced letter, no vendor notifications of ECCS model errors/changes applicable to CPS were issued. There were no ECCS related changes or modifications at CPS that affect the LOCA analysis of record.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Clinton Power Station," dated October 21, 2016]

**6. Prior LOCA Model Assessment (2017)**

Per the referenced letter, there were two vendor notifications of ECCS model errors/changes applicable to CPS.

- The first notification identifies that GNF2 leakage flow paths between the bundle and the bypass were incorrectly modeled. The correction to the model had an impact of +30 °F.
- The second notification identifies that fuel rod plenum region was not modeled consistent with GNF2's 10 x 10 design. Plenum inputs were updated to reflect the current design with a 0 °F impact to PCT.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Clinton Power Station," dated October 18, 2017]

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**10 CFR 50.46 Report Assessment Notes**

**7. Prior LOCA Model Assessment (2018)**

Per the referenced letter, no vendor notifications of ECCS model errors/changes applicable to CPS were issued. There were no ECCS related changes or modifications at CPS that affect the LOCA analysis of record.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Clinton Power Station," dated October 18, 2018]

**8. Current LOCA Model Assessment (2019)**

Since the last 10 CFR 50.46 annual report, there have been no notifications of ECCS model errors/changes applicable to the GNF2 fuel at CPS. No ECCS related changes or modifications occurred at CPS that affect the conclusions of the LOCA analysis of record.