

RS-21-110

10 CFR 50.46

October 19, 2021

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

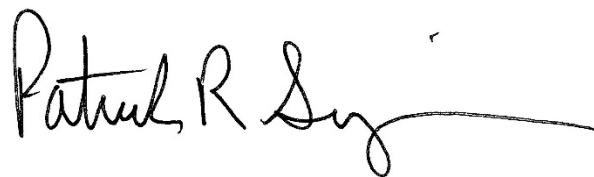
Dresden Nuclear Power Station, Units 2 and 3  
Renewed Facility Operating License Nos. DPR-19 and DPR-25  
NRC Docket Nos. 50-237 and 50-249

Subject: Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Dresden Nuclear Power Station, Units 2 and 3

In accordance with 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," paragraph (a)(3)(ii), Exelon Generation Company, LLC (EGC) is submitting this letter and its attachments to meet the annual reporting requirements of the Emergency Core Cooling System (ECCS) Evaluation Model changes and errors for Dresden Nuclear Power Station, Units 2 and 3. This report covers the period from October 19, 2020, through October 19, 2021.

There are no regulatory commitments contained in this letter. If there are any questions concerning this letter, please contact Mr. Mitchel A. Mathews at (630) 657-2819.

Respectfully,



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

Attachments:

1. Dresden Nuclear Power Station, Unit 2 10 CFR 50.46 Report (Westinghouse Fuel)
2. Dresden Nuclear Power Station, Unit 2 10 CFR 50.46 Report (Framatome Fuel)
3. Dresden Nuclear Power Station, Unit 3 10 CFR 50.46 Report (Framatome Fuel)
4. Dresden Nuclear Power Station, Units 2 and 3 10 CFR 50.46 Report Assessment Notes

**Attachment 1  
Dresden Nuclear Power Station, Unit 2  
10 CFR 50.46 Report (Westinghouse Fuel)**

PLANT NAME: Dresden Nuclear Power Station, Unit 2  
ECCS EVALUATION MODEL: USA6  
REPORT REVISION DATE: October 19, 2021  
CURRENT OPERATING CYCLE: 27

**ANALYSIS OF RECORD**

Evaluation Model: WCAP-16865-P-A, "Westinghouse BWR ECCS Evaluation Model Updates: Supplement 4 to Code Description, Qualification and Application," Revision 1, dated October 2011

Calculations:

1. NF-BEX-13-68P, "Dresden 2 and 3 LOCA Analysis for SVEA-96 Optima2 Fuel," Revision 0, dated June 2015
2. NF-BEX-15-101-NP, "Dresden Nuclear Power Station Unit 2, Cycle 25 MAPLHGR Report," Revision 0, dated September 2015

Fuel Analyzed in Calculation: SVEA-96 Optima2

Limiting Fuel Type: SVEA-96 Optima2

Limiting Single Failure: Low Pressure Coolant Injection system injection valve

Limiting Break Size and Location: 1.0 Double-Ended Guillotine Break in the Recirculation Pump Suction Line

**Reference Peak Cladding Temperature (PCT) 2150°F**

**Attachment 1  
Dresden Nuclear Power Station, Unit 2  
10 CFR 50.46 Report (Westinghouse Fuel)**

**MARGIN ALLOCATION**

**A. PRIOR LOCA MODEL ASSESSMENTS**

10 CFR 50.46 report dated October 21, 2016 (See Note 1)	$\Delta\text{PCT} = 0^\circ\text{F}$
10 CFR 50.46 report dated October 20, 2017 (See Note 2)	$\Delta\text{PCT} = 0^\circ\text{F}$
10 CFR 50.46 report dated October 19, 2018 (See Note 3)	$\Delta\text{PCT} = 0^\circ\text{F}$
10 CFR 50.46 report dated October 18, 2019 (See Note 4)	$\Delta\text{PCT} = 0^\circ\text{F}$
10 CFR 50.46 report dated October 19, 2020 (See Note 5)	$\Delta\text{PCT} = 0^\circ\text{F}$
<b>Net PCT</b>	<b>2150°F</b>

**B. CURRENT LOCA MODEL ASSESSMENTS**

None (See Note 6)	$\Delta\text{PCT} = 0^\circ\text{F}$
Total PCT change from current assessments	$\Sigma\Delta\text{PCT} = 0^\circ\text{F}$
Cumulative PCT change from current assessments	$\Sigma \Delta\text{PCT}  = 0^\circ\text{F}$
<b>Net PCT</b>	<b>2150°F</b>

**Attachment 2**  
**Dresden Nuclear Power Station, Unit 2**  
**10 CFR 50.46 Report (Framatome Fuel)**

PLANT NAME: Dresden Nuclear Power Station, Unit 2  
ECCS EVALUATION MODEL: EXEM BWR-2000  
REPORT REVISION DATE: October 19, 2021  
CURRENT OPERATING CYCLE: 27

**ANALYSIS OF RECORD**

Evaluation Model: EMF-2361(P)(A), "EXEM BWR-2000 ECCS Evaluation Model," Revision 0, dated May 2001

Calculations:

1. ANP-3749P, Revision 0, "Dresden Units 2 and 3 ATRIUM 10XM LOCA Break Spectrum Analysis with Increased ADS Flow," dated September 2019
2. ANP-3751P, Revision 0, "Dresden Units 2 and 3 ATRIUM 10XM LOCA-ECCS Analysis MAPLHGR Limits with Increased ADS Flow," dated October 2019

Fuel Analyzed in Calculation: ATRIUM 10XM

Limiting Fuel Type: ATRIUM 10XM

Limiting Single Failure: High Pressure Coolant Injection system

Limiting Break Size and Location: 0.13 ft<sup>2</sup> Split Break Recirculation Discharge Line

**Reference Peak Cladding Temperature (PCT) 2101°F**

**Attachment 2**  
**Dresden Nuclear Power Station, Unit 2**  
**10 CFR 50.46 Report (Framatome Fuel)**

**MARGIN ALLOCATION**

**A. PRIOR LOCA MODEL ASSESSMENTS**

10 CFR 50.46 report dated October 19, 2020 (See Note 5)	$\Delta\text{PCT} = -8^{\circ}\text{F}$
<b>Net PCT</b>	<b>2093°F</b>

**B. CURRENT LOCA MODEL ASSESSMENTS**

None (See Note 6)	$\Delta\text{PCT} = 0^{\circ}\text{F}$
Total PCT change from current assessments	$\sum\Delta\text{PCT} = 0^{\circ}\text{F}$
Cumulative PCT change from current assessments	$\sum \Delta\text{PCT}  = 0^{\circ}\text{F}$
<b>Net PCT</b>	<b>2093°F</b>

**Attachment 3  
Dresden Nuclear Power Station, Unit 3  
10 CFR 50.46 Report (Framatome Fuel)**

PLANT NAME: Dresden Nuclear Power Station, Unit 3  
ECCS EVALUATION MODEL: EXEM BWR-2000  
REPORT REVISION DATE: October 19, 2021  
CURRENT OPERATING CYCLE: 27

**ANALYSIS OF RECORD**

Evaluation Model: EMF-2361(P)(A), "EXEM BWR-2000 ECCS Evaluation Model," Revision 0, dated May 2001

Calculations:

1. ANP-3749P, Revision 0, "Dresden Units 2 and 3 ATRIUM 10XM LOCA Break Spectrum Analysis with Increased ADS Flow," dated September 2019
2. ANP-3751P, Revision 0, "Dresden Units 2 and 3 ATRIUM 10XM LOCA-ECCS Analysis MAPLHGR Limits with Increased ADS Flow," dated October 2019

Fuel Analyzed in Calculation: ATRIUM 10XM  
Limiting Fuel Type: ATRIUM 10XM  
Limiting Single Failure: High Pressure Coolant Injection system  
Limiting Break Size and Location: 0.13 ft<sup>2</sup> Split Break Recirculation Discharge Line

**Reference Peak Cladding Temperature (PCT) 2101°F**

**Attachment 3  
Dresden Nuclear Power Station, Unit 3  
10 CFR 50.46 Report (Framatome Fuel)**

**MARGIN ALLOCATION**

**A. PRIOR LOCA MODEL ASSESSMENTS**

None (New Analysis - See Note 6)	$\Delta\text{PCT} = 0^\circ\text{F}$
<b>Net PCT</b>	<b>2101°F</b>

**B. CURRENT LOCA MODEL ASSESSMENTS**

RODEX4 Updates (See Note 6)	$\Delta\text{PCT} = 1^\circ\text{F}$
AUTOHUP Updates (See Note 6)	$\Delta\text{PCT} = -9^\circ\text{F}$
Total PCT change from current assessments	$\Sigma\Delta\text{PCT} = -8^\circ\text{F}$
Cumulative PCT change from current assessments	$\Sigma \Delta\text{PCT}  = 10^\circ\text{F}$
<b>Net PCT</b>	<b>2093°F</b>

**Attachment 4**  
**Dresden Nuclear Power Station, Units 2 and 3**  
**10 CFR 50.46 Report Assessment Notes**

**Assessment Notes**

**1. Prior Loss of Coolant Accident (LOCA) Model Assessment (2016)**

The new USA6 LOCA Evaluation Model and calculation has been implemented for Dresden Nuclear Power Station (DNPS), Unit 2 for all fresh fuel starting with Cycle 25. This evaluation model and calculation supplement the existing Evaluation Model and calculation. This model reports a limiting PCT of 2150°F.

No changes, error corrections, or enhancements have been reported for the current DNPS, Units 2 and 3 LOCA analysis. No ECCS-related changes or modifications have occurred at DNPS, Unit 2 and 3 that affect the assumptions in the DNPS LOCA analysis of record.

[Reference: Letter from Patrick R. Simpson (RS-16-206, EGC) to NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Dresden Nuclear Power Station, Units 2 and 3," dated October 21, 2016]

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

No changes, error corrections, or enhancements have been reported for the current DNPS, Units 2 and 3 LOCA analysis. No ECCS-related changes or modifications have occurred at DNPS, Unit 2 and 3 that affect the assumptions in the DNPS LOCA analysis of record.

[Reference: Letter from Patrick R. Simpson (RS-17-136, EGC) to NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Dresden Nuclear Power Station, Units 2 and 3," dated October 20, 2017]

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

No changes, error corrections, or enhancements have been reported for the current Westinghouse DNPS, Units 2 and 3 LOCA analysis. No ECCS-related changes or modifications have occurred at DNPS, Unit 2 and 3 that affect the assumptions in the DNPS LOCA analyses by Westinghouse and Framatome.

[Reference: Letter from Patrick R. Simpson (RS-18-132, EGC) to NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Dresden Nuclear Power Station, Units 2 and 3," dated October 19, 2018.]



**Attachment 4**  
**Dresden Nuclear Power Station, Units 2 and 3**  
**10 CFR 50.46 Report Assessment Notes**

**4. Prior LOCA Model Assessment (2019)**

No changes, error corrections, or enhancements have been reported for the current Westinghouse DNPS, Units 2 and 3 LOCA analyses. No ECCS-related changes or modifications have occurred at DNPS, Unit 2 and 3 that affect the assumptions in the DNPS LOCA analyses by Westinghouse.

No ECCS-related changes or modifications occurred at DNPS, Units 2 and 3 that affected the assumptions to any of the LOCA Analyses of Record (AORs).

[Reference: Letter from Patrick R. Simpson (RS-19-103, EGC) to NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Dresden Nuclear Power Station, Units 2 and 3," dated October 18, 2019.]

**5. Prior LOCA Model Assessment (2020)**

No changes, error corrections, or enhancements have been reported for the current Westinghouse DNPS, Units 2 and 3 LOCA analysis. No ECCS-related changes or modifications have occurred at DNPS, Unit 2 and 3 that affect the assumptions in the DNPS LOCA analyses by Westinghouse and Framatome.

A new Framatome LOCA calculation using the approved EXEM BWR-2000 Evaluation model has been implemented for DNPS Unit 2 for all ATRIUM 10XM fuel loaded into the core. This model reports a limiting PCT of 2101°F. All previous changes, error correction, or enhancements to the Framatome EXEM BWR-2000 Evaluation model that were identified prior to issuance of ANP-3749P and ANP-3751P, both Revision 0, for Unit 2 were addressed in the calculation and no longer applicable.

There are two new changes, error corrections or enhancements in the Framatome EXEM BWR-2000 Evaluation Model for DNPS Units 2. A coding issue was identified in the interpolation process in the RODEX4 Pellet-Cladding Mechanical Interaction routines, which resulted in a +1°F PCT impact. Additionally, some of the RODEX2-2a inputs associated with the fuel geometry were not being appropriately prepared, resulting in a PCT impact of -9°F.

[Reference: Letter from Patrick R. Simpson (RS-20-128, EGC) to NRC, "Annual Report of Emergency Core Cooling System Evaluation Model Changes and Errors for Dresden Nuclear Power Station, Units 2 and 3," dated October 19, 2020.]

**Attachment 4**  
**Dresden Nuclear Power Station, Units 2 and 3**  
**10 CFR 50.46 Report Assessment Notes**

**6. Current LOCA Model Assessment**

All fuel evaluated under the Westinghouse USA5 methodology has been removed from operation at Dresden Station and reference to this evaluation model has been removed from the report.

DNPS Unit 2 maintains operation with fuel evaluated under the Westinghouse USA6 evaluation model (fuel loaded fresh in Cycle 25). No changes, error corrections, or enhancements have been reported for the current Westinghouse DNPS, Units 2, LOCA analyses. No ECCS-related changes or modifications have occurred at DNPS, Unit 2, that affect the assumptions in the DNPS LOCA analyses by Westinghouse.

The new Framatome LOCA calculation using the approved EXEM BWR-2000 Evaluation Model has been implemented for DNPS Unit 3 for all ATRIUM 10XM fuel loaded in the core (Cycles 25, 26, and 27). This model was previously implemented for DNPS Unit 2 in November 2019 and included in the previous 2020 LOCA Model Assessment. This model reports a limiting PCT of 2101°F. Prior to implementation of the new calculations on Unit 3, the limiting PCT of 2101°F was adjusted, as was implemented for Unit 2 in the previous 2020 LOCA model assessment, to account for two code issues. The first was a coding issue in the interpolation process in the RODEX4 Pellet-Cladding Mechanical Interaction routines, which resulted in a +1°F PCT impact. The second was that some of the RODEX2-2a inputs (part of AUTOHUP preparation) associated with the fuel geometry were not being appropriately prepared, resulting in a PCT impact of -9°F. (These adjustments were previously applied to Unit 2; See Note 5)

No changes, error corrections, or enhancements have been reported for the current Framatome DNPS, Units 2, LOCA analyses. No ECCS-related changes or modifications have occurred at DNPS, Unit 2 and Unit 3, that affect the assumptions in the DNPS LOCA analyses by Framatome.