

RS-21-112

10 CFR 50.46

October 22, 2021

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

Braidwood Station, Unit 2
Renewed Facility Operating License No. NPF-77
NRC Docket No. STN 50-457

Byron Station, Unit 1
Renewed Facility Operating License No. NPF-37
NRC Docket Nos. STN 50-454

Subject: Updated 10 CFR 50.46 Report of Emergency Core Cooling System Evaluation Model Changes and Errors

- Reference:
- 1) Letter from D. Murray (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission (NRC), "Annual 10 CFR 50.46 Report of Emergency Core Cooling System Evaluation Model Changes and Errors," dated April 9, 2021(ML21099A106)
 - 2) Letter from D. Murray (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission (NRC), "Application to Revise Technical Specifications 5.6.5, "Core Operating Limits Report", dated February 28, 2020 (ML20063L400)
 - 3) NRC Safety Evaluation Report, Braidwood Station Units 1 and 2 and Byron Station Units 1 and 2 – Issuance of Amendment Nos. 219, 219, 223, and 223 RE: Revision of Technical Specifications 5.6.5, "Core Operating Limits Report (COLR)", dated December 28, 2020 (ML20315A516)

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 the attached information to fulfill the reporting requirements for a change to the evaluation model for Byron Station Unit 1 and Braidwood Station Unit 2. The new analyses of record (Full Spectrum LOCA (FSLOCA) small break region and FSLOCA large break region) implementation is considered a change of greater than 50°F (Reference 1) as the limiting Peak Clad Temperature (PCT) for both regions dropped significantly.

The FSLOCA analysis was implemented for Byron Station Unit 1 in place of both the Small Break and Large Break LOCA analyses at the start of Cycle 25 and implemented at Braidwood

Station Unit 2 at the start of Cycle 23. This analysis creates new analyses of record PCT for the small break region (Region I) and for the large break region (Region II). With these new analyses there was one assessment to the small break region and two changes to the small and large break regions along with their impacts.

The assessment to the small break region was an ECCS Line Void Evaluation that was included in the licensing amendment request for FSLOCA approval (References 2 and 3) at Byron Station Unit 1 and Braidwood Station Unit 2. That evaluation had a limit PCT impact of +20°F.

The first of two changes that impact both the small and large break regions involved general code maintenance. Various changes have been made to enhance the usability of codes and to streamline future analyses which represent Discretionary Changes and had an estimated peak cladding temperature impact of 0°F.

The second change that impacted both the small and large break regions involved an impact to the LUCIFER KINECTICS and DECAY HEAT MODEL. The WCOBRA/TRAC-TF2 code is the thermal-hydraulic system code licensed as part of the FULL SPECTRUM LOCA evaluation model. The kinetics and decay heat models in the code are described in Section 9 of WCAP-16996-P-A, Revision 1. The nuclear physics data supporting the code models was generated using the ARK depletion program, which evolved from the LEOPARD and CINDER codes as described in the response to Request for Additional Information (RAI) #25 on the FSLOCA EM. Since the approval of the FSLOCA EM, the kinetics and decay heat model in the WCOBRA/TRAC-TF2 code was updated to support the analysis of higher burnup fuel as described in Section 4.6 of WCAP-18446-P. The updated nuclear physics data is based on the NRC-approved PARAGON code (WCAP-16045-P-A). While the primary purpose of this update is for the analysis of higher burnup fuel, the change will impact licensing basis analysis calculations with the FSLOCA EM even under the existing burnup limits imposed via Limitation and Condition (L&C) #5 on the FSLOCA EM. This change to the WCOBRA/TRAC-TF2 code represents a Discretionary Change and will be implemented on a forward-fit basis. Therefore, this effort has no impact on the current FSLOCA evaluation model.

The attachments describe the changes in the evaluations associated with the accumulated PCT since the previous annual report submitted in the referenced letter. No additional assessments occurred to the previous method referenced prior to implementation of FSLOCA.

There are no regulatory commitments contained in this submittal.

Should you have any questions concerning this letter, please contact Mr. Phillip Henderson at (630) 657-4727.

Respectfully,



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

October 22, 2021
U.S. Nuclear Regulatory Commission
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Attachments: 1) Braidwood Station, Unit 2 – 10 CFR 50.46 Report
2) Byron Station, Unit 1 – 10 CFR 50.46 Report

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, Braidwood Station
NRC Senior Resident Inspector, Byron Station
NRR Project Manager, Braidwood and Byron Stations
Illinois Emergency Management Agency – Division of Nuclear Safety

**Attachment 1
Braidwood Station Unit 2
10 CFR 50.46 Update**

PLANT NAME: Braidwood Station Unit 2
 ECCS EVALUATION MODEL: Full Spectrum LOCA EM Small Break Region I
 REPORT REVISION DATE: 10/22/2021
 CURRENT OPERATING CYCLE: 23

ANALYSIS OF RECORD (AOR)

Evaluation Model: FSLOCA
 Calculation: Westinghouse WCAP-18449-P, September 2019
 Fuel: VANTAGE+ 17 x 17
 Limiting Fuel Type: VANTAGE+ 17 x 17
 Limiting Single Failure: Loss of one train of ECCS flow
 Limiting Break Size and Location: 3.7-inch Break in the Cold Leg
 Reference Peak Cladding Temperature (PCT) PCT = 1169.0°F

MARGIN ALLOCATION

A. PRIOR LOSS OF COOLANT ACCIDENT (LOCA) MODEL ASSESSMENTS

| | |
|------|--|
| None | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
|------|--|

NET PCT

PCT = 1169.0°F

B. CURRENT LOCA MODEL ASSESSMENTS

| | |
|--|--|
| New LOCA Model | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| ECCS Line Void Evaluation | $\Delta PCT = +20\text{ }^{\circ}\text{F}$ |
| General Code Maintenance | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| LUCIFER KINETICS and DECAY HEAT MODEL | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| | |
| Total PCT change from current assessments | $\sum \Delta PCT = +20\text{ }^{\circ}\text{F}$ |
| Cumulative PCT change from current assessments | $\sum \Delta PCT = 20\text{ }^{\circ}\text{F}$ |

NET PCT

PCT = 1189.0°F

**Attachment 1
Braidwood Station Unit 2
10 CFR 50.46 Update**

PLANT NAME: Braidwood Station Unit 2
 ECCS EVALUATION MODEL: Full Spectrum LOCA EM Large Break Region II
 REPORT REVISION DATE: 10/22/2021
 CURRENT OPERATING CYCLE: 23

AOR

Evaluation Model: FSLOCA
 Calculation: Westinghouse WCAP-18449-P, September 2019
 Fuel: VANTAGE+ 17 x 17
 Limiting Fuel Type: VANTAGE+ 17 x 17
 Limiting Single Failure: Loss of one train of ECCS flow
 Limiting Break Size and Location: Guillotine break in the Cold Leg
 Reference PCT PCT = 1752.0°F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

| | |
|------|--|
| None | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
|------|--|

NET PCT

PCT = 1752.0°F

B. CURRENT LOCA MODEL ASSESSMENTS

| | |
|--|---|
| New LOCA Model | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| General Code Maintenance | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| LUCIFER KINETICS and DECAY HEAT MODEL | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| Total PCT change from current assessments | $\sum \Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| Cumulative PCT change from current assessments | $\sum \Delta PCT = 0\text{ }^{\circ}\text{F}$ |

NET PCT

PCT = 1752.0°F

**Attachment 2
Byron Station Unit 1
10 CFR 50.46 Update**

PLANT NAME: Byron Station Unit 1
 ECCS EVALUATION MODEL: Full Spectrum LOCA EM Small Break Region I
 REPORT REVISION DATE: 10/22/21
 CURRENT OPERATING CYCLE: 25

ANALYSIS OF RECORD (AOR)

Evaluation Model: FSLOCA
 Calculation: Westinghouse WCAP-18448-P, August 2019
 Fuel: VANTAGE+ 17 x 17
 Limiting Fuel Type: VANTAGE+ 17 x 17
 Limiting Single Failure: Loss of one train of ECCS flow
 Limiting Break Size and Location: 3.8-inch Break in the Cold Leg
 Reference Peak Cladding Temperature (PCT) PCT = 1181.0°F

MARGIN ALLOCATION

A. PRIOR LOSS OF COOLANT ACCIDENT (LOCA) MODEL ASSESSMENTS

| | |
|------|--|
| None | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
|------|--|

NET PCT

PCT = 1181.0°F

B. CURRENT LOCA MODEL ASSESSMENTS

| | |
|--|--|
| New LOCA Model | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| ECCS Line Void Evaluation | $\Delta PCT = +20\text{ }^{\circ}\text{F}$ |
| General Code Maintenance | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| LUCIFER KINETICS and DECAY HEAT MODEL | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| Total PCT change from current assessments | $\sum \Delta PCT = +20\text{ }^{\circ}\text{F}$ |
| Cumulative PCT change from current assessments | $\sum \Delta PCT = 20\text{ }^{\circ}\text{F}$ |

NET PCT

PCT = 1201.0°F

**Attachment 2
Byron Station Unit 1
10 CFR 50.46 Update**

PLANT NAME: Byron Station Unit 1
 ECCS EVALUATION MODEL: Full Spectrum LOCA EM Large Break Region II
 REPORT REVISION DATE: 10/22/21
 CURRENT OPERATING CYCLE: 25

AOR

Evaluation Model: FSLOCA
 Calculation: Westinghouse WCAP-18448-P, August 2019
 Fuel: VANTAGE+ 17 x 17
 Limiting Fuel Type: VANTAGE+ 17 x 17
 Limiting Single Failure: Loss of one train of ECCS flow
 Limiting Break Size and Location: Guillotine break in the Cold Leg
 Reference PCT PCT = 1643.0°F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

| | |
|------|--|
| None | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
|------|--|

NET PCT

PCT = 1643.0°F

B. CURRENT LOCA MODEL ASSESSMENTS

| | |
|--|---|
| New LOCA Model | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| General Code Maintenance | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| LUCIFER KINETICS and DECAY HEAT MODEL | $\Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| Total PCT change from current assessments | $\sum \Delta PCT = 0\text{ }^{\circ}\text{F}$ |
| Cumulative PCT change from current assessments | $\sum \Delta PCT = 0\text{ }^{\circ}\text{F}$ |

NET PCT

PCT = 1643.0°F