

RS-19-002

10 CFR 50.46

January 9, 2019

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

Quad Cities Nuclear Power Station, Units 1 and 2  
Renewed Facility Operating License Nos. DPR-29 and DPR-30  
NRC Docket Nos. 50-254 and 50-265

Subject: ECCS Evaluation Model Error – 10 CFR 50.46 30-Day Report

Reference: Letter from P.R. Simpson (Exelon Generation Company, LLC) to U.S. NRC,  
"10 CFR 50.46 Annual Report," dated May 2, 2018

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 30-day reporting requirement for Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2.

In the referenced letter, EGC submitted the most recent 10 CFR 50.46 report for Quad Cities Nuclear Power Station, Units 1 and 2, describing the cumulative changes in the peak cladding temperature (PCT) for the current emergency core cooling systems evaluation model. Framatome Inc. subsequently notified EGC of four errors and an input change impacting the ATRIUM 10XM Large Break Loss of Coolant Accident (LBLOCA) analysis. A 30-day report is required since the cumulative sum of the absolute magnitudes of the respective PCT changes resulting from these errors and input change is greater than 50°F.

The revised PCT value remains well below the 10 CFR 50.46 acceptance criteria of 2200°F; therefore, a reanalysis is not required due to these errors and input change.

Attachments 1 and 2 provide updated information regarding the cumulative changes to the PCT values for the limiting ATRIUM 10 XM LBLOCA analysis for Quad Cities Nuclear Power Station, Units 1 and 2. Attachment 3 contains the associated Assessment Notes. There are no impacts to the Westinghouse LBLOCA analysis results reported in the referenced letter.

There are no regulatory commitments contained in this submittal. Should you have any questions regarding this letter, please contact Ms. Rebecca L. Steinman at (630) 657-2831.

Respectfully,

A handwritten signature in black ink, appearing to read "Patrick R. Simpson", followed by a long horizontal flourish.

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

Attachments:

1. Quad Cities Nuclear Power Station Unit 1, 10 CFR 50.46 Report (Framatome Fuel)
2. Quad Cities Nuclear Power Station Unit 2, 10 CFR 50.46 Report (Framatome Fuel)
3. Quad Cities Nuclear Power Station Units 1 and 2, 10 CFR 50.46 30-Day Report Assessment Notes

cc: NRC Regional Administrator – Region III  
NRC Senior Resident Inspector, Quad Cities Nuclear Power Station

**Attachment 1**  
**Quad Cities Nuclear Power Station Unit 1**  
**10 CFR 50.46 Report (Framatome Fuel)**

PLANT NAME: Quad Cities Unit 1  
 ECCS EVALUATION MODEL: EXEM BWR-2000  
 REPORT REVISION DATE: 12/21/2018  
 CURRENT OPERATING CYCLE: 25

**ANALYSIS OF RECORD**

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

- Calculations:
1. "Quad Cities Units 1 and 2 LOCA Break Spectrum Analysis for ATRIUM 10XM Fuel," ANP-3328P, Revision 2, December 2016
  2. "Quad Cities Units 1 and 2 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10XM Fuel," ANP-3356P, Revision 2, dated February 2017

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 pipe

Reference Peak Cladding Temperature (PCT) PCT = 2138°F

**MARGIN ALLOCATION**

**A. PRIOR LOCA MODEL ASSESSMENTS**

10 CFR 50.46 Report dated May 2, 2017 (See Note 1)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 Report dated May 2, 2018 (See Note 2)	$\Delta PCT = 0^{\circ}F$
<b>Net PCT</b>	<b>2138°F</b>

**B. CURRENT LOCA MODEL ASSESSMENTS**

Incorrect Cladding Axial Growth Factor (See Note 3)	$\Delta PCT = 0^{\circ}F$
Updated steam dryer information (See Note 3)	$\Delta PCT = +5^{\circ}F$
Incorrect power in break spectrum HUXY calculations (See Note 3)	$\Delta PCT = 0^{\circ}F$
Incorrect planar power used in the heatup analysis (See Note 3)	$\Delta PCT = +5^{\circ}F$
Increased ADS flow capacity (See Note 3)	$\Delta PCT = -50^{\circ}F$
Total PCT change from current assessments	$\Sigma \Delta PCT = -40^{\circ}F$
Cumulative PCT change from current assessments	$\Sigma  \Delta PCT  = 60^{\circ}F$
<b>Net PCT</b>	<b>2098°F</b>

**Attachment 2**  
**Quad Cities Nuclear Power Station Unit 2**  
**10 CFR 50.46 Report (Framatome Fuel)**

PLANT NAME: Quad Cities Unit 2  
ECCS EVALUATION MODEL: EXEM BWR-2000  
REPORT REVISION DATE: 12/21/2018  
CURRENT OPERATING CYCLE: 25

**ANALYSIS OF RECORD**

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

- Calculations:
1. "Quad Cities Units 1 and 2 LOCA Break Spectrum Analysis for ATRIUM 10XM Fuel," ANP-3328P, Revision 2, December 2016
  2. "Quad Cities Units 1 and 2 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10XM Fuel," ANP-3356P, Revision 3, dated January 2018

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 pipe

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

**MARGIN ALLOCATION**

**A. PRIOR LOCA MODEL ASSESSMENTS**

10 CFR 50.46 Report dated May 2, 2018 (See Note 2)	$\Delta PCT = 0^{\circ}F$
<b>Net PCT</b>	<b>2150°F</b>

**B. CURRENT LOCA MODEL ASSESSMENTS**

Updated steam dryer information (See Note 3)	$\Delta PCT = +5^{\circ}F$
Incorrect power in break spectrum HUXY calculations (See Note 3)	$\Delta PCT = 0^{\circ}F$
Incorrect planar power used in the heatup analysis (See Note 3)	$\Delta PCT = +45^{\circ}F$
Increased ADS flow capacity (See Note 3)	$\Delta PCT = -63^{\circ}F$
Total PCT change from current assessments	$\Sigma \Delta PCT = -13^{\circ}F$
Cumulative PCT change from current assessments	$\Sigma  \Delta PCT  = 113^{\circ}F$
<b>Net PCT</b>	<b>2137°F</b>

**Attachment 3**  
**Quad Cities Nuclear Power Station, Units 1 and 2**  
**10 CFR 50.46 30-Day Report Assessment Notes**

1. Prior Loss of Coolant Accident (LOCA) Assessment

The new Framatome (formerly AREVA) EXEM BWR-2000 Evaluation Model and calculation has been implemented for Quad Cities Nuclear Power Station (QCNPS) Unit 1 for the fresh fuel of ATRIUM 10XM loaded into the Cycle 25 core. This model reports a limiting PCT of 2138°F and has no additional PCT impacts or estimates for Unit 1.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "10 CFR 50.46 Annual Report," dated May 2, 2017]

2. Prior LOCA Assessment

The new Framatome EXEM BWR-2000 Evaluation Model and calculation has been implemented for QCNPS Unit 2 for the fresh fuel of ATRIUM 10XM loaded into the Cycle 25 core. This model reports a limiting PCT of 2150°F and has no additional PCT impacts or estimates for Unit 2. There is no additional PCT impact reported for the Unit 1 LOCA analysis.

[Reference: Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "10 CFR 50.46 Annual Report," dated May 2, 2018]

3. Current LOCA Assessment

Since the previous 10 CFR 50.46 report to the NRC dated May 2, 2018, there are several error corrections and one input change to the current QCNPS LOCA analysis based on the Framatome EXEM BWR-2000 Evaluation Model.

The first LOCA error determined that the QCNPS Unit 1 ATRIUM 10XM licensing basis used an incorrect cladding axial growth factor. The value used in the input, 0.0006, is for PWR fuel, whereas the appropriate value for BWR fuel is 0.0007. This issue had a +0°F impact on the licensing PCT for QCNPS Unit 1. QCNPS Unit 2 was not impacted by this error.

The second LOCA error determined that the QCNPS free volume input for the steam dryer region within the LOCA model needed to be updated. The impact of this steam dryer parameter change on PCT was evaluated. Based on the assessment, the impact on the licensing PCT is estimated to be +5°F for both QCNPS Unit 1 and Unit 2.

The third LOCA error determined an incorrect value for reactor power was used in the HUXY runs of the QCNPS break spectrum analysis. This update resulted in no impact to the limiting break. As such, the bounding condition input used in the analysis to confirm the maximum average planar linear heat generation rate (MAPLHGR) limits were unaffected and thus had a 0°F impact on the licensing basis PCT for both QCNPS Unit 1 and Unit 2.

The fourth LOCA error determined that the AUTOHUP LOCA automation code calculated an incorrect power level approximately 1% lower when building the HUXY input decks. The impact of this error on the QCNPS Unit 1 licensing basis PCT is estimated to be +5°F and on the QCNPS Unit 2 licensing basis PCT is estimated to be +45°F.

**Attachment 3**  
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The one LOCA analysis input change updated the automatic depressurization system (ADS) flow capacity. The effect of this change on the QCNPS Unit 1 licensing basis PCT is estimated to be  $-50^{\circ}\text{F}$ . The corresponding change to the QCNPS Unit 2 licensing basis PCT is estimated to be  $-63^{\circ}\text{F}$ .

The overall net change due to the above errors and input change was a decrease in the QCNPS Unit 1 licensing basis PCT of  $-40^{\circ}\text{F}$  and an absolute value impact of  $60^{\circ}\text{F}$ . The corresponding overall net change in the QCNPS Unit 2 PCT due to the above errors and input change was a decrease of  $-13^{\circ}\text{F}$  and an absolute value impact of  $113^{\circ}\text{F}$ . The current licensing basis PCT for Unit 1 is  $2098^{\circ}\text{F}$  and for Unit 2 is  $2137^{\circ}\text{F}$ .