

RS-17-136

10 CFR 50.46

October 20, 2017

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 21, 2016, through October 20, 2017.

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
Manager – Licensing

Attachments:

1. Dresden Nuclear Power Station, Unit 2 10 CFR 50.46 Report (Westinghouse Fuel – Evaluation Model – USA5)
2. Dresden Nuclear Power Station, Unit 2 10 CFR 50.46 Report (Westinghouse Fuel – Evaluation Model – USA6)
3. Dresden Nuclear Power Station, Unit 3 10 CFR 50.46 Report (Westinghouse Fuel – Evaluation Model – USA5)
4. Dresden Nuclear Power Station, Unit 3 10 CFR 50.46 Report (AREVA Fuel – Evaluation Model – EXEM BWR-2000)
5. 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 – Evaluation Model – USA5)

PLANT NAME: Dresden Nuclear Power Station, Unit 2
ECCS EVALUATION MODEL: USA5
REPORT REVISION DATE: 10/20/2017
CURRENT OPERATING CYCLE: 25

ANALYSIS OF RECORD

Evaluation Model: WCAP-16078-P-A "Westinghouse BWR ECCS Evaluation Model: Supplement 3 to Code Description, Qualification and Application to SVEA-96 Optima2 Fuel," Revision 0, dated November 2004

Calculations:

1. OPTIMA2-TR021DR-LOCA, "Dresden 2 & 3 LOCA Analysis for SVEA-96 Optima2 Fuel," Revision 6, dated September 2010
2. NF-BEX-13-111-NP, "Dresden Nuclear Power Station Unit 2 Cycle 24 MAPLHGR Report," Revision 0, dated September 2013

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: 1.0/0.8 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 – Evaluation Model – USA5)

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 report dated October 30, 2009 (See Note 1)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 29, 2010 (See Note 2)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 28, 2011 (See Note 3)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 26, 2012 (See Note 4)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 25, 2013 (See Note 5)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 24, 2014 (See Note 6)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 23, 2015 (See Note 7)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 21, 2016 (See Note 8)	$\Delta PCT = 0^{\circ}F$
Net PCT	2150°F

B. CURRENT LOCA MODEL ASSESSMENTS

None (See Note 9)	$\Delta PCT = 0^{\circ}F$
Total PCT change from current assessments	$\Sigma \Delta PCT = 0^{\circ}F$
Cumulative PCT change from current assessments	$\Sigma \Delta PCT = 0^{\circ}F$
Net PCT	2150°F

**Attachment 2
Dresden Nuclear Power Station, Unit 2
10 CFR 50.46 Report (Westinghouse Fuel – Evaluation Model – USA6)**

PLANT NAME: Dresden Nuclear Power Station, Unit 2
ECCS EVALUATION MODEL: USA6
REPORT REVISION DATE: 10/20/2017
CURRENT OPERATING CYCLE: 25

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-13-68, "Dresden 2 & 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
3. NF-BEX-11-101-NP, "Dresden Nuclear Power Station Unit 2 Cycle 23 MAPLHGR Report," Revision 1, 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: 1.0/0.8 Double-Ended Guillotine Break in the Recirculation Pump Suction Line

Reference Peak Cladding Temperature (PCT) 2150°F

Attachment 2
Dresden Nuclear Power Station, Unit 2
10 CFR 50.46 Report (Westinghouse Fuel – Evaluation Model – USA6)

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 report dated October 21, 2016 (See Note 8)	$\Delta\text{PCT} = 0^\circ\text{F}$
Net PCT	2150°F

B. CURRENT LOCA MODEL ASSESSMENTS

None (See Note 9)	$\Delta\text{PCT} = 0^\circ\text{F}$
Total PCT change from current assessments	$\sum\Delta\text{PCT} = 0^\circ\text{F}$
Cumulative PCT change from current assessments	$\sum \Delta\text{PCT} = 0^\circ\text{F}$
Net PCT	2150°F

Attachment 3
Dresden Nuclear Power Station, Unit 3
10 CFR 50.46 Report (Westinghouse Fuel – Evaluation Model – USA5)

PLANT NAME: Dresden Nuclear Power Station, Unit 3
ECCS EVALUATION MODEL: USA5
REPORT REVISION DATE: 10/20/2017
CURRENT OPERATING CYCLE: 25

ANALYSIS OF RECORD

Evaluation Model: WCAP-16078-P-A, "Westinghouse BWR ECCS Evaluation Model: Supplement 3 to Code Description, Qualification and Application to SVEA-96 Optima2 Fuel," Revision 0, dated November 2004

Calculations:

1. OPTIMA2-TR021DR-LOCA, "Dresden 2 & 3 LOCA Analysis for SVEA-96 Optima2 Fuel," Revision 6, dated September 2010
2. NF-BEX-14-77-NP, "Dresden Nuclear Power Station Unit 3 Cycle 24 MAPLHGR Report," Revision 0, dated September 2014
3. NF-BEX-12-100-NP, "Dresden Nuclear Power Station Unit 3 Cycle 23 MAPLHGR Report," Revision 1, dated May 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: 1.0/0.8 Double-Ended Guillotine Break in the Recirculation Pump Suction Line

Reference Peak Cladding Temperature (PCT) 2150°F

Attachment 3
Dresden Nuclear Power Station, Unit 3
10 CFR 50.46 Report (Westinghouse Fuel – Evaluation Model – USA5)

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 report dated October 30, 2009 (See Note 1)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 29, 2010 (See Note 2)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 28, 2011 (See Note 3)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 26, 2012 (See Note 4)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 25, 2013 (See Note 5)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 24, 2014 (See Note 6)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 23, 2015 (See Note 7)	$\Delta PCT = 0^{\circ}F$
10 CFR 50.46 report dated October 21, 2016 (See Note 8)	$\Delta PCT = 0^{\circ}F$
Net PCT	2150°F

B. CURRENT LOCA MODEL ASSESSMENTS

None; Discharge of fuel related to Note 3 (See Note 9)	$\Delta PCT = 0^{\circ}F$
Total PCT change from current assessments	$\Sigma \Delta PCT = 0^{\circ}F$
Cumulative PCT change from current assessments	$\Sigma \Delta PCT = 0^{\circ}F$
Net PCT	2150°F

Attachment 4
Dresden Nuclear Power Station, Unit 3
10 CFR 50.46 Report (AREVA Fuel – Evaluation Model – EXEM BWR-2000)

PLANT NAME: Dresden Nuclear Power Station, Unit 3
ECCS EVALUATION MODEL: EXEM BWR-2000
REPORT REVISION DATE: 10/20/2017
CURRENT OPERATING CYCLE: 25

ANALYSIS OF RECORD

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

Calculations:

1. ANP-3483P, "Dresden Units 2 and 3 LOCA Break Spectrum Analysis for ATRIUM 10XM Fuel," Revision 0, dated July 2016
2. ANP-3493P, "Dresden Units 2 and 3 LOCA-ECCS Analysis MAPLHGR Limits for ATRIUM 10XM Fuel," Revision 0, dated August 2016

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 ft² Split Break Recirculation Discharge Line

Reference Peak Cladding Temperature (PCT) 2125°F

Attachment 4
Dresden Nuclear Power Station, Unit 3
10 CFR 50.46 Report (AREVA Fuel – Evaluation Model – EXEM BWR-2000)

MARGIN ALLOCATION

C. PRIOR LOCA MODEL ASSESSMENTS

None (New Analysis)	$\Delta PCT = 0^{\circ}F$
Net PCT	2125^oF

D. CURRENT LOCA MODEL ASSESSMENTS

New LOCA Model (See Note 9)	$\Delta PCT = 0^{\circ}F$
Total PCT change from current assessments	$\sum \Delta PCT = 0^{\circ}F$
Cumulative PCT change from current assessments	$\sum \Delta PCT = 0^{\circ}F$
Net PCT	2125^oF

Attachment 5
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

The referenced letter provided the annual 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems (ECCS) for light-water nuclear power reactors," report for Dresden Nuclear Power Station (DNPS), Units 2 and 3. The letter updated the vessel leakage between the lower shroud and the downcomer. Westinghouse evaluated this change and demonstrated that all 10 CFR 50.46 criteria were satisfied. This evaluation resulted in maximum peak cladding temperature (PCT) impact due to the change in vessel leakage of 2°F for Optima2 fuel with the licensing basis PCT of 2152°F. This PCT impact will remain in effect until the maximum average planar linear heat generation rate (MAPLHGR) limits for all bundles in future DNPS, Unit 2 and Unit 3 cores are evaluated for this change. The MAPLHGR limits for all bundles in the DNPS, Unit 2 were evaluated for this change for Cycle 24 and this penalty no longer applies for DNPS, Unit 2. Additionally, the MAPLHGR limits for all bundles in the DNPS, Unit 3 were evaluated for this change for Cycle 24 and this penalty no longer applies for DNPS, Unit 3.

[Reference: Letter from Timothy Hanley (SVPLTR: No. 09-0052, Exelon Generation Company, LLC (EGC)) to NRC, "Plant Specific ECCS Evaluation Changes – 10 CFR 50.46 Report," dated October 30, 2009]

2. Prior LOCA Model Assessment

The referenced letter provided the annual 10 CFR 50.46 report for DNPS, Units 2 and 3. The letter reported the replacement of core spray lower sectional piping in DNPS, Unit 2 during DNPS, Unit 2 Refueling Outage No. 21. Westinghouse evaluated the core spray leakage due to this modification and concluded that the PCT impact was 0°F. The letter also identified a change in input for modeling bypass hole flow coefficient in the Westinghouse LOCA analysis. The impact on PCT due to this change was determined by Westinghouse to be 12°F. Westinghouse established a MAPLHGR limit for the fresh bundles to accommodate the change. For 10 CFR 50.46 reporting purposes, the PCT impact is conservatively applied to all bundle types in the core including the fresh bundles. This PCT update will remain in effect until the MAPLHGR limits for all bundles in future Dresden, Unit 2 and Unit 3 cores are evaluated for the change in bypass hole flow coefficient. The MAPLHGR limits for all bundles in the DNPS, Unit 2 were evaluated for this change for Cycle 24 and this penalty no longer applies for DNPS, Unit 2. Additionally, the MAPLHGR limits for all bundles in the DNPS, Unit 3 core were evaluated for this change for Cycle 24 and this penalty no longer applies for DNPS, Unit 3.

[Reference: Letter from Jeffrey Hansen (RS-10-191, EGC) to NRC, "Plant Specific ECCS Evaluation Changes – 10 CFR 50.46 Report," dated October 29, 2010]

Attachment 5
Dresden Nuclear Power Station, Units 2 and 3
10 CFR 50.46 Report Assessment Notes

3. Prior LOCA Model Assessment

The referenced letter provided the annual 10 CFR 50.46 report for DNPS, Units 2 and 3. The letter reported errors in the current Westinghouse Dresden LOCA analysis associated with the use of incorrect R-factors. The impact due to this change was determined to be 18°F in PCT update. For 10 CFR 50.46 reporting purposes, the PCT update is conservatively applied to all bundle types including the fresh bundles. This PCT update will remain in effect only until the MAPLHGR limits for all bundles in future DNPS, Unit 2 and Unit 3 cores are evaluated with the correct R-factors.

[Reference: Letter from David M. Gullott (RS-11-171, EGC) to NRC, "Plant Specific ECCS Evaluation Changes - 10 CFR 50.46 Report," dated October 28, 2011]

4. Prior LOCA Model Assessment

The referenced letter provided the annual 10 CFR 50.46 report for DNPS, Units 2 and 3. The letter reported no changes, error corrections, or enhancements in the current Westinghouse Dresden LOCA analysis; therefore the delta is 0°F in PCT update.

[Reference: Letter from Patrick R. Simpson (RS-12-192, 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 26, 2012]

5. Prior LOCA Model Assessment

The referenced letter provided the annual 10 CFR 50.46 report for DNPS, Units 2 and 3. The letter reported no changes, error corrections, or enhancements in the current Westinghouse Dresden LOCA analysis; therefore the delta is 0°F in PCT update.

[Reference: Letter from Patrick R. Simpson (RS-13-250, 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 25, 2013]

Attachment 5
Dresden Nuclear Power Station, Units 2 and 3
10 CFR 50.46 Report Assessment Notes

6. Prior LOCA Model Assessment

Updated LOCA/MAPLHGR analyses were performed for DNPS, Unit 2 in support of operating Cycle 24. These analyses maintained the calculated PCT at 2150°F and accounted for the changes to the vessel leakage and bypass hole coefficient. Therefore, the penalties in Notes 1 and 2 no longer apply for DNPS, Unit 2. The penalty for incorrect R-factors in Note 3 remains applicable resulting in a net PCT of 2168°F for DNPS, Unit 2.

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

[Reference: Letter from Patrick R. Simpson (RS-14-296, 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 24, 2014]

7. Prior LOCA Model Assessment

Updated LOCA/MAPLHGR analyses were performed for DNPS, Unit 3 in support of Operating Cycle 24. These analyses for DNPS, Unit 3 maintained the calculated PCT at 2150°F and accounted for the changes to the vessel leakage and bypass hole coefficient. Therefore, the previous penalties of 2°F in Note 1 and 12°F in Note 2 above no longer apply for DNPS, Unit 3. The penalties in Attachment 2 listed for Notes 1 & 2 for DNPS, Unit 3 were changed to 0°F. The penalty for incorrect R-factors in Note 3 remains applicable resulting in a net PCT of 2168°F for DNPS, Unit 3.

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

[Reference: Letter from Patrick R. Simpson (RS-15-265, 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 23, 2015]

Attachment 5
Dresden Nuclear Power Station, Units 2 and 3
10 CFR 50.46 Report Assessment Notes

8. Prior LOCA Model Assessment

The new USA6 LOCA Evaluation Model and calculation has been implemented for 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 and has no additional PCT impacts or estimates as seen in Attachment 2.

Additionally, updated LOCA/MAPLHGR analyses were performed for DNPS, Unit 2 in support of operating Cycle 25. These analyses for DNPS, Unit 2 maintained the calculated PCT at 2150°F and accounted for the incorrect R-factors. Therefore, the previous penalty of 18°F in Note 3 no longer applies for DNPS, Unit 2. The penalty in Attachment 1 listed for Note 3 for DNPS, Unit 2 was changed to 0°F. The penalty for DNPS, Unit 3 in Attachment 3 related to Note 3 remains.

No changes, error corrections, or enhancements have been reported for the current DNPS, Units 2 & 3 LOCA analysis. No ECCS-related changes or modifications have occurred at DNPS, Unit 2 & 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]

9. Current LOCA Model Assessment

The new AREVA EXEM BWR-2000 Evaluation Model and calculation has been implemented for DNPS Unit 3 for the fresh fuel of ATRIUM 10XM loaded into the Cycle 25 core. This model reports a limiting PCT of 2125°F and has no additional PCT impacts or estimates.

Additionally, updated LOCA/MAPLHGR analyses were performed for DNPS, Unit 3 for the Westinghouse fuel first introduced in Cycles 23 & 24. These analyses for DNPS, Unit 3 maintained the calculated PCT at 2150°F and accounted for the incorrect R-factors. All other Westinghouse fuel from before Cycle 23 that was impacted by the R-factor error within Unit 3 has been discharged. Therefore, the previous penalty of 18°F in Note 3 no longer applies for DNPS, Unit 3. The penalty in Attachment 3 listed for Note 3 for DNPS, Unit 3 was changed to 0°F.

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