Exelon Generation

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RS-16-073

10 CFR 50.46

April 7, 2016

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

Braidwood Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and 50-457

Byron Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and 50-455

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

Reference: Letter from D. M. Gullott (Exelon Generation Company, LLC) to U.S. NRC, "Annual 10 CFR 50.46 Report of Emergency Core Cooling System Evaluation Model Changes and Errors," dated April 7, 2015

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 annual reporting requirements for Braidwood and Byron Stations, Units 1 and 2. The attachments describe the changes in accumulated peak cladding temperature (PCT) since the previous annual report submitted in the referenced letter.

There are no regulatory commitments contained in this submittal.

Should you have any questions concerning this letter, please contact Jessica Krejcie at (630) 657-2816.

Respectfully,

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

Attachments:
1) Braidwood and Byron Stations, Units 1 and 2 – 10 CFR 50.46 Report
2) Braidwood and Byron Stations, Units 1 and 2 – 10 CFR 50.46 Report Assessment Notes

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 and Byron Stations, Units 1 and 2
10 CFR 50.46 Report

PLANT NAME: Braidwood Station Unit 1
ECCS EVALUATION MODEL: Small Break Loss of Coolant Accident (SBLOCA)
REPORT REVISION DATE: 04/7/16
CURRENT OPERATING CYCLE: 19

ANALYSIS OF RECORD (AOR)

Evaluation Model: NOTRUMP
Calculation: Westinghouse CN-LIS-00-208, December 2000
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: 2-inch Break in the Bottom of the Cold Leg
Reference Peak Cladding Temperature (PCT) PCT = 1624.0°F

MARGIN ALLOCATION

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

10 CFR 50.46 report dated June 11, 2001 (Note 1)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 18, 2002 (Note 2)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2003 (Note 3)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2004 (Note 4)	ΔPCT = +35 °F
10 CFR 50.46 report dated April 14, 2005 (Note 5)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2006 (Note 6)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 13, 2007 (Note 7)	ΔPCT = 0 °F
10 CFR 50.46 report dated June 22, 2007 (Note 9)	ΔPCT = 0 °F
10 CFR 50.46 report dated November 19, 2007 (Note 10)	ΔPCT = +90 °F
10 CFR 50.46 report dated April 11, 2008 (Note 11)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 9, 2009 (Note 12)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 8, 2010 (Note 13)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2011 (Note 15)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2012 (Note 17)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 5, 2013 (Note 19)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2014 (Note 21)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2015 (Note 22)	ΔPCT = 0 °F

NET PCT **PCT = 1749.0°F**

B. CURRENT LOCA MODEL ASSESSMENTS

General Code Maintenance (Note 23)	ΔPCT = 0 °F
Total PCT change from current assessments	$\sum$ ΔPCT = 0 °F
Cumulative PCT change from current assessments	$\sum \lvert$ ΔPCT $\rvert$ = 0 °F

NET PCT **PCT = 1749.0°F**

Attachment 1
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report

PLANT NAME: Braidwood Station Unit 1
ECCS EVALUATION MODEL: Large Break Loss of Coolant Accident (LBLOCA)
REPORT REVISION DATE: 04/7/16
CURRENT OPERATING CYCLE: 19

AOR

Evaluation Model: ASTRUM (2004)
Calculation: Westinghouse WCAP-16841-P, November 2007
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 = 1913.0°F

MARGIN ALLOCATION

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

10 CFR 50.46 report dated March 15, 2011 (Note 14)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2011 (Note 15)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2012 (Note 17)	ΔPCT = 0 °F
10 CFR 50.46 report dated May 21, 2012 (Note 18)	ΔPCT = +44 °F
10 CFR 50.46 report dated April 5, 2013 (Note 19)	ΔPCT = 0 °F
10 CFR 50.46 report dated February 27, 2014 (Note 20)	ΔPCT = +66 °F
10 CFR 50.46 report dated April 7, 2014 (Note 21)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2015 (Note 22)	ΔPCT = +2 °F

NET PCT **PCT = 2025.0°F**

B. CURRENT LOCA MODEL ASSESSMENTS

None (Note 23)	ΔPCT = 0 °F
Total PCT change from current assessments	$\sum$ ΔPCT = 0 °F
Cumulative PCT change from current assessments	$\sum \lvert$ ΔPCT $\rvert$ = 0 °F

NET PCT **PCT = 2025.0°F**

Attachment 1
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report

PLANT NAME: Braidwood Station Unit 2
ECCS EVALUATION MODEL: Small Break Loss of Coolant Accident (SBLOCA)
REPORT REVISION DATE: 04/7/16
CURRENT OPERATING CYCLE: 19

AOR

Evaluation Model: NOTRUMP
Calculation: Westinghouse CN-LIS-00-208, December 2000
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: 2-inch Break in the Bottom of the Cold Leg
Reference PCT PCT = 1627.0°F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 report dated June 11, 2001 (Note 1)	ΔPCT = +3 °F
10 CFR 50.46 report dated April 18, 2002 (Note 2)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2003 (Note 3)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2004 (Note 4)	ΔPCT = +35 °F
10 CFR 50.46 report dated April 14, 2005 (Note 5)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2006 (Note 6)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 13, 2007 (Note 7)	ΔPCT = 0 °F
10 CFR 50.46 report dated June 22, 2007 (Note 9)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 11, 2008 (Note 11)	ΔPCT = +90 °F
10 CFR 50.46 report dated April 9, 2009 (Note 12)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 8, 2010 (Note 13)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2011 (Note 15)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2012 (Note 17)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 5, 2013 (Note 19)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2014 (Note 21)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2015 (Note 22)	ΔPCT = 0 °F

NET PCT **PCT = 1755.0°F**

B. CURRENT LOCA MODEL ASSESSMENTS

General Code Maintenance (Note 23)	ΔPCT = 0 °F
Total PCT change from current assessments	$\sum$ ΔPCT = 0 °F
Cumulative PCT change from current assessments	$\sum \lvert$ ΔPCT $\rvert$ = 0 °F

NET PCT **PCT = 1755.0°F**

Attachment 1
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report

PLANT NAME: Braidwood Station Unit 2
ECCS EVALUATION MODEL: Large Break Loss of Coolant Accident (LBLOCA)
REPORT REVISION DATE: 04/7/16
CURRENT OPERATING CYCLE: 19

AOR

Evaluation Model: ASTRUM (2004)
Calculation: Westinghouse WCAP-16841-P, November 2007
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 = 2041.0°F

MARGIN ALLOCATION

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

10 CFR 50.46 report dated March 15, 2011 (Note 14)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2011 (Note 15)	ΔPCT = 0 °F
10 CFR 50.46 report dated March 19, 2012 (Note 16)	ΔPCT = -42 °F
10 CFR 50.46 report dated April 6, 2012 (Note 17)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 5, 2013 (Note 19)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2014 (Note 21)	ΔPCT = +46 °F
10 CFR 50.46 report dated April 7, 2015 (Note 22)	ΔPCT = +2 °F

NET PCT **PCT = 2047.0°F**

B. CURRENT LOCA MODEL ASSESSMENTS

None (Note 23)	ΔPCT = 0 °F
Total PCT change from current assessments	$\sum$ ΔPCT = 0 °F
Cumulative PCT change from current assessments	$\sum \lvert \Delta PCT \rvert$ = 0 °F

NET PCT **PCT = 2047.0°F**

Attachment 1
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report

PLANT NAME: Byron Station Unit 1
ECCS EVALUATION MODEL: Small Break Loss of Coolant Accident (SBLOCA)
REPORT REVISION DATE: 04/7/16
CURRENT OPERATING CYCLE: 21

AOR

Evaluation Model: NOTRUMP
Calculation: Westinghouse CN-LIS-00-208, December 2000
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: 2-inch Break in the Bottom of the Cold Leg
Reference PCT PCT = 1624.0°F

MARGIN ALLOCATION

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

10 CFR 50.46 report dated June 11, 2001 (Note 1)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 18, 2002 (Note 2)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2003 (Note 3)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2004 (Note 4)	ΔPCT = +35 °F
10 CFR 50.46 report dated April 14, 2005 (Note 5)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2006 (Note 6)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 13, 2007 (Note 7)	ΔPCT = 0 °F
10 CFR 50.46 report dated June 22, 2007 (Note 9)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 11, 2008 (Note 11)	ΔPCT = +90 °F
10 CFR 50.46 report dated April 9, 2009 (Note 12)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 8, 2010 (Note 13)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2011 (Note 15)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2012 (Note 17)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 5, 2013 (Note 19)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2014 (Note 21)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2015 (Note 22)	ΔPCT = 0 °F

NET PCT **PCT = 1749.0°F**

B. CURRENT LOCA MODEL ASSESSMENTS

General Code Maintenance (Note 23)	ΔPCT = 0 °F
Total PCT change from current assessments	$\sum$ ΔPCT = 0 °F
Cumulative PCT change from current assessments	$\sum \lvert$ ΔPCT $\rvert$ = 0 °F

NET PCT **PCT = 1749.0°F**

Attachment 1
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report

PLANT NAME: Byron Station Unit 1
ECCS EVALUATION MODEL: Large Break Loss of Coolant Accident (LBLOCA)
REPORT REVISION DATE: 04/7/16
CURRENT OPERATING CYCLE: 21

AOR

Evaluation Model: ASTRUM (2004)
Calculation: Westinghouse WCAP-16841-P, November 2007
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 = 1913.0°F

MARGIN ALLOCATION

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

10 CFR 50.46 report dated March 15, 2011 (Note 14)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2011 (Note 15)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2012 (Note 17)	ΔPCT = 0 °F
10 CFR 50.46 report dated May 21, 2012 (Note 18)	ΔPCT = +44 °F
10 CFR 50.46 report dated April 5, 2013 (Note 19)	ΔPCT = 0 °F
10 CFR 50.46 report dated February 27, 2014 (Note 20)	ΔPCT = +66 °F
10 CFR 50.46 report dated April 7, 2014 (Note 21)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2015 (Note 22)	ΔPCT = +2 °F

NET PCT **PCT = 2025.0°F**

B. CURRENT LOCA MODEL ASSESSMENTS

None (Note 23)	ΔPCT = 0 °F
Total PCT change from current assessments	$\sum$ ΔPCT = 0 °F
Cumulative PCT change from current assessments	$\sum \lvert$ ΔPCT $\rvert$ = 0 °F

NET PCT **PCT = 2025.0°F**

Attachment 1
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report

PLANT NAME: Byron Station Unit 2
ECCS EVALUATION MODEL: Small Break Loss of Coolant Accident (SBLOCA)
REPORT REVISION DATE: 04/7/16
CURRENT OPERATING CYCLE: 19

AOR

Evaluation Model: NOTRUMP
Calculation: Westinghouse CN-LIS-00-208, December 2000
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: 2-inch Break in the Bottom of the Cold Leg
Reference PCT PCT = 1627.0°F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 report dated June 11, 2001 (Note 1)	ΔPCT = +3 °F
10 CFR 50.46 report dated April 18, 2002 (Note 2)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2003 (Note 3)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2004 (Note 4)	ΔPCT = +35 °F
10 CFR 50.46 report dated April 14, 2005 (Note 5)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 14, 2006 (Note 6)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 13, 2007 (Note 7)	ΔPCT = 0 °F
10 CFR 50.46 report dated May 10, 2007 (Note 8)	ΔPCT = +90 °F
10 CFR 50.46 report dated June 22, 2007 (Note 9)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 11, 2008 (Note 11)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 9, 2009 (Note 12)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 8, 2010 (Note 13)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2011 (Note 15)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2012 (Note 17)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 5, 2013 (Note 19)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2014 (Note 21)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2015 (Note 22)	ΔPCT = 0 °F

NET PCT **PCT = 1755.0°F**

B. CURRENT LOCA MODEL ASSESSMENTS

General Code Maintenance (Note 23)	ΔPCT = 0 °F
Total PCT change from current assessments	$\sum$ ΔPCT = 0 °F
Cumulative PCT change from current assessments	$\sum \lvert$ ΔPCT $\rvert$ = 0 °F

NET PCT **PCT = 1755.0°F**

Attachment 1
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report

PLANT NAME: Byron Station Unit 2
ECCS EVALUATION MODEL: Large Break Loss of Coolant Accident (LBLOCA)
REPORT REVISION DATE: 04/7/16
CURRENT OPERATING CYCLE: 19

AOR

Evaluation Model: ASTRUM (2004)
Calculation: Westinghouse WCAP-16841-P, November 2007
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 = 2041.0°F

MARGIN ALLOCATION

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

10 CFR 50.46 report dated March 15, 2011 (Note 14)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 6, 2011 (Note 15)	ΔPCT = 0 °F
10 CFR 50.46 report dated March 19, 2012 (Note 16)	ΔPCT = -42 °F
10 CFR 50.46 report dated April 6, 2012 (Note 17)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 5, 2013 (Note 19)	ΔPCT = 0 °F
10 CFR 50.46 report dated April 7, 2014 (Note 21)	ΔPCT = +46 °F
10 CFR 50.46 report dated April 7, 2015 (Note 22)	ΔPCT = +2 °F

NET PCT **PCT = 2047.0°F**

B. CURRENT LOCA MODEL ASSESSMENTS

None (Note 23)	ΔPCT = 0 °F
Total PCT change from current assessments	$\sum$ ΔPCT = 0 °F
Cumulative PCT change from current assessments	$\sum \lvert$ ΔPCT $\rvert$ = 0 °F

NET PCT **PCT = 2047.0°F**

Attachment 2
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report
Assessment Notes

1. Prior LOCA Model Assessment

   The 10 CFR 50.46 report dated June 11, 2001 reported new small break loss of coolant accident (SBLOCA) analyses to support operations at uprated power conditions. The same report assessed the impact from annular axial blankets on SBLOCA analysis, which determined a 0°F peak cladding temperature (PCT) penalty for Units 1 and a 3°F PCT penalty for Units 2. Evaluations for plant conditions and SBLOCA model changes which resulted in 0°F PCT change were reported.

2. Prior LOCA Model Assessment

   The 10 CFR 50.46 report dated April 18, 2002 reported evaluations for SBLOCA model changes which resulted in 0°F PCT change.

3. Prior LOCA Model Assessment

   The 10 CFR 50.46 report dated April 14, 2003 reported evaluations for SBLOCA model changes which resulted in 0°F PCT change.

4. Prior LOCA Model Assessment

   The 10 CFR 50.46 report dated April 14, 2004 reported evaluations for a SBLOCA assessment related to NOTRUMP bubble rise/drift flux model inconsistency corrections, which resulted in 35°F PCT assessment.

5. Prior LOCA Model Assessment

   The 10 CFR 50.46 report dated April 14, 2005 reported evaluations for SBLOCA model changes which resulted in 0°F PCT change for Byron and Braidwood Stations, Unit 1 and Unit 2. The Braidwood Station, Unit 1 assembly N10S was reconstituted with two stainless steel filler rods during Braidwood Unit 1 Refueling Outage 11. This assembly is reloaded into the core and is in use during Braidwood Unit 1 Cycle 12 operation. The introduction of up to five stainless steel filler rods has been evaluated and shown to have no impact on SBLOCA analysis. The estimated PCT effect is 0°F for Braidwood Unit 1. This assembly was discharged during Reload 12.

6. Prior LOCA Model Assessment

   The 10 CFR 50.46 report dated April 14, 2006 reported evaluations for SBLOCA NOTRUMP General Code Maintenance which resulted in 0°F change.

7. Prior LOCA Model Assessment

   The 10 CFR 50.46 report dated April 13, 2007 reported evaluations for SBLOCA model changes and errors. The report documented general code maintenance for NOTRUMP, AXIOM lead test assembly evaluation and NOTRUMP refined break spectrum, which resulted in 0°F PCT impact.

Attachment 2
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report
Assessment Notes

8. Prior LOCA Model Assessment

   The 30-day 10 CFR 50.46 report dated May 10, 2007 applicable to Byron Station, Unit 2 reported an assessment of the Emergency Core Cooling System (ECCS), which evaluated changes in ECCS flow during the recirculation phase due to Generic Safety Issue (GSI) -191 related safety injection (SI) throttle valve replacements. The evaluation of recirculation phase ECCS flow changes relative to impact on the current Analysis of Record (AOR) was performed for the SBLOCA. Based on the NOTRUMP and SBLOCTA calculations performed for Byron Unit 2, a conservative, bounding PCT assessment of +90°F was applied to the current Byron Unit 2 SBLOCA PCT.

9. Prior LOCA Model Assessment

   A 30-day report was submitted to the NRC dated June 22, 2007 to report an error in the HOT SPOT Code which did not impact the SBLOCA analysis. The 30-day report also reported minor errors with the reactor vessel data collections that potentially affected the vessel inlet and outlet fluid volume, metal mass and surface area. The corrected values were evaluated for impact, and a 0°F penalty was assessed for Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2, SBLOCA analysis.

10. Prior LOCA Model Assessment

    The 30-day 10 CFR 50.46 report dated November 19, 2007 applicable to Braidwood Station, Unit 1 reported an assessment of the ECCS, which evaluated changes in ECCS flow during the recirculation phase due to GSI-191 related SI throttle valve replacements. The evaluation of recirculation phase ECCS flow changes relative to impact on the current Analysis of Record (AOR) was performed for the SBLOCA. Based on the NOTRUMP and SBLOCTA calculations performed for Braidwood Station, Unit 1, a conservative, bounding PCT assessment of +90°F was applied to the Braidwood Station, Unit 1 SBLOCA PCT.

11. Prior LOCA Model Assessment

    The combined 30-day and annual 10 CFR 50.46 report dated April 11, 2008 reported evaluations for LOCA model changes and errors. Applicable to Braidwood Station, Unit 2 and Byron Station, Unit 1, the ECCS assessment evaluated changes in ECCS flow during the recirculation phase due to GSI-191 related safety injection SI throttle valve replacements. A conservative, bounding PCT assessment of +90°F was applied to the Braidwood Station, Unit 2 and Byron Station, Unit 1 SBLOCA PCTs. The report also documented general code maintenance for SBLOCA and evaluation for pump weir resistance modeling for SBLOCA analyses, which resulted in 0°F PCT impact.

12. Prior LOCA Model Assessment

    The 10 CFR 50.46 report dated April 9, 2009 reported evaluations for LOCA model changes and errors. The report documents general code maintenance for SBLOCA, errors in reactor vessel lower plenum surface area calculations, discrepancies in metal mass from drawings, and an evaluation of Areva Lead Use Assemblies (LUAs). All of which have a 0°F PCT penalty associated with them.

Attachment 2
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report
Assessment Notes

13. Prior LOCA Model Assessment

    The 10 CFR 50.46 report dated April 8, 2010 reported no evaluations for SBLOCA model changes which resulted in 0°F PCT change.

14. Prior LOCA Model Assessment

    The 30-day 10 CFR 50.46 report dated March 15, 2011 reported a new large break BELOCA (ASTRUM) analysis to support operations for Byron and Braidwood Stations, Units 1 and 2. The same report assessed the impact from several errors, issues, and code enhancements. Each of these errors/issues/code enhancements had a 0°F PCT impact with a net 0°F PCT impact.

15. Prior LOCA Model Assessment

    The 10 CFR 50.46 report dated April 6, 2011 reported no evaluations for the large break loss of coolant accident (LBLOCA) model. For the SBLOCA model, the following errors, changes, corrections or enhancements were reported. Two errors relating to urania-gadolinia pellet thermal conductivity calculation, two errors relating to pellet crack and dish volume calculation, a discrepancy involving the treatment of vessel average temperature uncertainty, and general code maintenance were reported for the SBLOCA model. All of these issues were determined to have an estimated impact of 0°F.

16. Prior LOCA Model Assessment

    The 30-day 10 CFR 50.46 report dated March 19, 2012 applicable to Braidwood Station, Unit 2 and Byron Station, Unit 2 reported an assessment of Thermal Conductivity Degradation (TCD) with an associated peaking factor burndown and a design input change consisting of a reduction in upper bound steam generator tube plugging, a reduction in nominal upper bound nominal vessel average temperature, and an increase in the assumed containment pressure boundary condition. As a result, the estimated effect of the TCD with burndown was determined to be +148°F and the estimated effect of the design input changes was determined to be -190°F. These two assessments are coupled together via their evaluations of burnup effects which include thermal conductivity degradation, peaking factor burndown and design input changes. Therefore, the combined affect of these two changes results in a net change in the reported LBLOCA PCT for Braidwood Station, Unit 2 and Byron Station, Unit 2 of -42°F.

17. Prior LOCA Model Assessment

    The 10 CFR 50.46 report dated April 6, 2012 reported evaluations for LOCA model changes and errors. The report documents general code maintenance for both SBLOCA and LBLOCA, errors in Radiation Heat Transfer Logic for SBLOCA, and an error in the Maximum Fuel Rod Time Step Logic for SBLOCA. All of which have a 0°F PCT penalty associated with them.

Attachment 2
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report
Assessment Notes

18. Prior LOCA Model Assessment

The 30-day 10 CFR 50.46 report dated May 21, 2012 applicable to Braidwood Station, Unit 1 and Byron Station, Unit 1 reported an assessment of TCD with an associated peaking factor burndown an analysis input change consisting of a reduction in conservatism in analyzed F_Q values and an increase in the assumed containment pressure boundary condition. As a result, the estimated effect of the TCD with burndown was determined to be +110°F and the estimated effect of the analysis input changes was determined to be -66°F. These two assessments are coupled together via their evaluations of burnup effects which include thermal conductivity degradation, peaking factor burndown and analysis input changes. Therefore, the combined affect of these two changes results in a net change in the reported LBLOCA PCT for Braidwood Station, Unit 1 and Byron Station, Unit 1 of +44°F.

19. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated April 5, 2013 reported evaluations for LBLOCA model changes, and HOTSPOT and WCOBRA/TRAC code corrections. For SBLOCA, TCD was evaluated with NOTRUMP to estimate the effect on the limiting cladding temperature model. All evaluations led to PCT impact of 0°F.

20. Prior LOCA Model Assessment

The 30-day 10 CFR 50.46 report dated February 27, 2014 applicable to Braidwood Station, Unit 1 and Byron Station; Unit 1 reported evaluations for LBLOCA model changes and code corrections. For Braidwood Station, Unit 2 and Byron Station, Unit 2, a net change of 46°F PCT impact did not require inclusion in the 30-day report and was reported in the Annual 10 CFR 50.46 Report dated April 7, 2014. Revised heat transfer multiplier distributions, changes to grid blockage ratio and porosity and HOTSPOT burst strain error corrections was determined to be 5°F, 24°F, and 37°F PCT impact, respectively for Braidwood Station, Unit 1 and Byron Station, Unit 1. Other model changes and code corrections sum to 0°F PCT impact. Therefore, the combined effect of the changes resulted in a net change of 66°F PCT impact for Braidwood Station, Unit 1 and Byron Station, Unit 1.

21. Prior LOCA Model Assessment

The annual 10 CFR 50.46 report dated April 7, 2014 applicable to Byron and Braidwood Stations, Units 2 reported evaluations for LBLOCA model changes and code corrections. For the Braidwood Station, Unit 1 and Byron Station, Unit 1 LBLOCA, a net change of 66°F PCT impact required a 30-day report sent on February 27, 2014 (Note 20). Revised heat transfer multiplier distributions, changes to grid blockage ratio and porosity and HOTSPOT burst strain error corrections was determined to be 7°F, 24°F, and 15°F PCT impact, respectively for Braidwood Station, Unit 2 and Byron Station, Unit 2. Other model changes and code corrections sum to 0°F PCT impact. Therefore, the combined effect of the changes resulted in a net change of 46°F PCT impact for Braidwood Station, Unit 2 and Byron Station, Unit 2 LBLOCA. Additionally, SBLOCTA cladding strain requirements for fuel rod burst resulted in a 0°F PCT impact to Byron and Braidwood Stations, Unit 1 and 2 SBLOCA.

Attachment 2
Braidwood and Byron Stations, Units 1 and 2
10 CFR 50.46 Report
Assessment Notes

22. Prior LOCA Model Assessment

The annual 10 CFR 50.46 report dated April 7, 2015 reported General Code Maintenance and a change to Safety Injection and Containment Spray flow rates for LBLOCA and SBLOCA. The report also reported an error in the decay group uncertainty factor for LBLOCA, errors in the fuel rod gap conductance, radiation heat transfer model and pre-DNB cladding surface heat transfer coefficient and an evaluation to increased Auxiliary Feedwater System switchover delay for SBLOCA. With the exception of 2°F PCT impact to LBLOCA due to the change to Safety Injection and Containment Spray flows, all other changes reported an impact of 0°F PCT.

23. Current LOCA Model Assessment – General Code Maintenance (SBLOCA)

Various changes have been made to enhance the usability of codes and to streamline future analyses. Examples of these changes include: modifying input variable definitions, units and defaults; improving the input diagnostic checks; enhancing the code output; optimizing active coding; and eliminating inactive coding. These changes resulted in an estimated PCT impact of 0°F. There were no impacts to LBLOCA.