Exelon Nuclear
200 Exelon Way
Kennett Square, PA 19348

www.exeloncorp.com

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10 CFR 50.46

TMI-12-042
March 21, 2012

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

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: 10 CFR 50.46 30-Day Report

References:

1) Letter from M. D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated May 13, 2011

2) Letter from G. A. Thomas (AREVA) to R. Jaffa (Exelon Generation Company, LLC), "10 CFR 50.46 LOCA Report of Two EM Error Corrections (AREVA CR 2012-165: ECCS Bypass Mathematical Error and AREVA CR 2012-757: Upper Plenum Column Weldment EM Change)," dated February 20, 2012

The purpose of this letter is to submit a 30-day 10 CFR 50.46 report for Three Mile Island Nuclear Station (TMI), Unit 1. The most recent annual 50.46 Report for TMI, Unit 1 (Reference 1) provided the cumulative Peak Cladding Temperature (PCT) errors.

Subsequent to the issuance of Reference 1, AREVA notified Exelon Generation Company, LLC (Exelon) of two Evaluation Model (EM) error corrections in the Reference 2 letter. The first EM error is an Emergency Core Cooling System (ECCS) Bypass Mathematical Error and the second EM error concerns an Upper Plenum Column Weldment. These errors were identified during performance of sensitivity studies for another Babcock & Wilcox (B&W) reactor.

For the first error, a mathematical error was discovered in the RELAP5/MOD2-B&W blowdown model control variables that calculate the time for total end of bypass. AREVA identified in the BWNT LOCA Evaluation Model (AREVA NP Topical Report BAW-10192P-A, Rev. 0, "BWNT LOCA - BWNT Loss-of-Coolant Accident Evaluation Model for Once-Through Steam Generator Plants," June 1998) that the end of bypass calculations determine when an 80 percent condensation efficiency on the core flood tank (CFT) injected liquid could condense all the steam reaching the upper downcomer region. The control variables incorrectly calculated the steam energy flowing into the upper downcomer region. When the control variables were corrected, the end of bypass time was predicted approximately 2 seconds earlier, resulting in a shorter lower plenum refill period with a quicker onset of lower core quench and lower Peak Cladding Temperature (PCT). ECCS bypass is not used for SBLOCA so these analyses are not affected by this error.

For the second error, a revised explicit modeling of the upper plenum and upper head reflects a more detailed noding arrangement in the reactor vessel upper plenum than was used and approved for application in the BWNT LOCA Evaluation Model (AREVA NP Topical Report BAW-10192P-A, Rev. 0, "BWNT LOCA - BWNT Loss-of-Coolant Accident Evaluation Model for Once-Through Steam Generator Plants," June 1998). A representative simplified column weldment model was developed for the 177 FA (Fuel Assembly) model to address a deficiency. From that model, a scoping case with the column weldment modeled over the top of the hot channel resulted in reduced cooling during portions of the blowdown phase. As a result, the end of blowdown fuel temperatures increased and these changes translate into an increase in overall PCT for the LBLOCA. This error was considered for SBLOCA and it was concluded that it will not affect the limiting results because the SBLOCA is a slower evolving transient with up flows in the core hot bundles such that there is no net change from the presence of a column weldment in the upper plenum.

For the first error, the PCT is estimated to decrease by 80°F from that reported in Reference 1 for ruptured segments and decrease by 40°F for unruptured segments for LBLOCA. This error is not applicable for SBLOCA. For the second error, the PCT is estimated to increase by 80°F from that reported in Reference 1 for ruptured segments and increase by 40°F for unruptured segments for LBLOCA. This error is estimated to have no effect (i.e., 0°F) on SBLOCA. As a result, these two errors result in an estimated net PCT change of 0°F for both the LBLOCA and SBLOCA. The updated PCT values did not change so they remain within the NRC 10 CFR 50.46 acceptance criteria of 2200°F.

As discussed in 10 CFR 50.46(a)(3)(i), this 30-day report is required because the absolute magnitudes of the respective temperature changes is greater than 50°F.

Two attachments are included with this letter that provide the current TMI, Unit 1, 10 CFR 50.46 status. Attachment 1 ("Peak Cladding Temperature Rack-Up Sheets") provides updated information regarding the PCT for the limiting SBLOCA and LBLOCA analyses. Attachment 2, "Assessment Notes," contains a detailed description for each change or error reported.

No new regulatory commitments are established in this submittal. If any additional information is needed, please contact Tom Loomis at (610) 765-5510.

Respectfully,

Michael D. Jesse
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Attachments: 1) Peak Cladding Temperature Rack-Up Sheets
2) Assessment Notes

cc: USNRC Administrator, Region I
USNRC Project Manager, TMI, Unit 1
USNRC Senior Resident Inspector, TMI, Unit 1

ATTACHMENT 1

10 CFR 50.46
"Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors"

Report of the Emergency Core Cooling System Evaluation Model Changes and Errors Assessments

Assessments as of March 21, 2012

Peak Cladding Temperature Rack-Up Sheets

TMI, Unit 1

PLANT NAME: Three Mile Island Nuclear Station, Unit 1
ECCS EVALUATION MODEL: Small Break Loss of Coolant Accident (SBLOCA)
REPORT REVISION DATE: 3/21/12
CURRENT OPERATING CYCLE: 19

ANALYSIS OF RECORD (AOR)

Evaluation Model: BWNT[1]

Calculation: AREVA NP, 86-9111507-000, August 2009 (Mark-B-HTP with Enhanced Once-Through Steam Generators (EOTSGs))
Fuel: Mark-B12, Mark-B-HTP
Limiting Fuel Type: Mark-B-HTP
Limiting Single Failure: Loss of One Train of ECCS

Limiting Break Size and Location: 0.07 ft^2 Break in Cold Leg Pump Discharge Piping

Reference Peak Cladding Temperature (PCT) PCT =1444°F

MARGIN ALLOCATION

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

10 CFR 50.46 report dated May 9, 2006 (see Note 7)	ΔPCT = 0°F
10 CFR 50.46 report dated May 16, 2007 (see Note 8)	ΔPCT = 0°F
10 CFR 50.46 report dated May 14, 2010 (see Note 11)	ΔPCT = 0°F
10 CFR 50.46 report dated September 7, 2010 (see Note 12)	ΔPCT = 225°F
10 CFR 50.46 report dated May 13, 2011 (see Note 13)	ΔPCT = 0°F
NET PCT	**PCT = 1669°F**

B. CURRENT LOCA MODEL ASSESSMENTS

Upper Plenum Column Weldment EM Error (see Note 14)	ΔPCT = 0°F
NET PCT	**PCT = 1669°F**

[1] The BWNT EM is based on RELAP5/MOD2-B&W.

PLANT NAME: Three Mile Island Nuclear Station, Unit 1
ECCS EVALUATION MODEL: Large Break Loss of Coolant Accident (LBLOCA)
REPORT REVISION DATE: 3/21/12
CURRENT OPERATING CYCLE: 19

ANALYSIS OF RECORD (AOR)

Evaluation Model: BWNT[2]
Calculation: Framatome ANP 86-5011294-00, March 2001 (Mark-B12)
AREVA NP, 86-9111507-000, August 2009 (Mark-B-HTP with EOTSGs)
Fuel: Mark-B12, Mark-B-HTP
Limiting Fuel Type: Mark-B12
Limiting Single Failure: Loss of One Train of ECCS

Limiting Break Size and Location: Guillotine Break in Cold Leg Pump Discharge Piping

Reference Peak Cladding Temperature (PCT) PCT = 1989°F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 report dated June 5, 2000 (see Note 1)	ΔPCT = 0°F
10 CFR 50.46 report dated June 11, 2001 (see Note 2)	ΔPCT = 0°F
10 CFR 50.46 report dated June 6, 2002 (see Note 3)	ΔPCT = 0°F
10 CFR 50.46 report dated June 19, 2003 (see Note 4)	ΔPCT = 0°F
10 CFR 50.46 report dated June 1, 2004 (see Notes 5 and 11)	ΔPCT = -35°F
10 CFR 50.46 report dated May 16, 2005 (see Note 6)	ΔPCT = 0°F
10 CFR 50.46 report dated May 9, 2006 (see Note 7)	ΔPCT = 0°F
10 CFR 50.46 report dated May 16, 2007 (see Note 8)	ΔPCT = 0°F
10 CFR 50.46 report dated May 15, 2008 (see Note 9)	ΔPCT = 0°F
10 CFR 50.46 report dated May 15, 2009 (see Note 10)	ΔPCT = 0°F
10 CFR 50.46 report dated May 14, 2010 (see Note 11)	ΔPCT = 0°F
10 CFR 50.46 report dated May 13, 2011 (see Note 13)	ΔPCT = 0°F
NET PCT	**PCT = 1954°F**

B. CURRENT LOCA MODEL ASSESSMENTS

ECCS Bypass Mathematical Error and Upper Plenum Column Weldment EM Error (see Note 14)	ΔPCT = 0°F
NET PCT	**PCT = 1954°F**

[2] The BWNT EM is based on RELAP5/MOD2-B&W.

ATTACHMENT 2

10 CFR 50.46
"Acceptance criteria for emergency core
cooling systems for light-water nuclear power reactors"

Report of the Emergency Core Cooling System
Evaluation Model Changes and Errors Assessments

Assessments as of March 21, 2012

Peak Cladding Temperature Rack-Up Sheets

TMI, Unit 1

Assessment Notes

1. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated June 5, 2000 reported a new LBLOCA analysis to support operations at 20% steam generator tube plugging conditions for Mark-B9 fuel.

2. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated June 11, 2001 reported evaluations for LBLOCA model changes which resulted in 0°F PCT change.

3. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated June 6, 2002 reported a new LBLOCA analyses to support operations with Mark-B12 fuel.

4. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated June 19, 2003 reported evaluation for LBLOCA model change which resulted in 0°F PCT change.

5. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated June 1, 2004 reported evaluation for LBLOCA model changes which resulted in 0°F PCT change. An error correction in containment pressure input resulted in a reduction in PCT for the LBLOCA analysis.

6. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated May 16, 2005 reported evaluations for LBLOCA model changes which resulted in a 0°F PCT change. LOCA oxygen/hydrogen recombination was considered and the PCT effect was determined to be 0°F.

7. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated May 9, 2006 reported evaluations for LOCA model changes which resulted in a 0°F PCT change. Reported changes included operation with no APSR pull and batch 18 fuel design changes. These were applicable for SBLOCA and LBLOCA.

8. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated May 16, 2007 reported an evaluation for a LOCA model change which resulted in a 0°F PCT change. The reported evaluation considered the effect on the containment pressure response for LOCA due to GSI-191 related reactor building sump screen replacement. The evaluation resulted in 0°F impact for LBLOCA and SBLOCA PCTs.

9. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated May 15, 2008 reported evaluations for LOCA model changes which resulted in a 0°F PCT change. Reported changes included the impact of an energy deposition factor error which resulted in a LBLOCA PCT impact of 0°F.

10. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated May 15, 2009 reported no evaluations or PCT penalties for LBLOCA.

11. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated May 14, 2010 reported a change to the reference PCT value for LBLOCA due to the final discharge of all Mark-B9 fuel. Additionally, with the change in limiting fuel type from Mark-B9 to Mark-B12, the PCT reduction for the LBLOCA analysis reported in 2004 was updated to be a -35°F.

Also identified in this report was a new SBLOCA analysis, implemented beginning with the Cycle 18 operation. This SBLOCA analysis was evaluated with the mixed core of Mark-B12 and Mark-B-HTP and a new PCT of 1444°F was calculated for the limiting Mark-B-HTP fuel type, which bounds the Mark-B12 fuel type. This analysis also includes consideration of the effect of reduced EFW wetting associated with the Enhanced Once-Through Steam Generators (EOTSGs).

12. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated September 7, 2010 reported an evaluation for the SBLOCA analysis due to a non-bounding axial power shape from middle-of-cycle to end-of-cycle conditions. This resulted in a PCT increase of 225°F. The large break LOCA is not affected in this report.

13. Prior LOCA Model Assessment

The 10 CFR 50.46 report dated May 13, 2011 reported no evaluations or PCT penalties for either SBLOCA or LBLOCA.

14. Current LOCA Model Assessment

Two errors were identified by AREVA which impact the TMI LOCA analysis. The first error is an error in ECCS bypass calculation and the second error is in the upper plenum column weldment modeling.

For LBLOCA, correcting the error in ECCS bypass calculation results in the end of bypass time being predicted approximately 2 seconds earlier, resulting in a shorter lower plenum refill period with a quicker onset of lower core quench and lower PCT. The PCT decreased by 80°F for the rupture node and decreased by 40°F for the unruptured node. For LBLOCA, correcting the upper plenum column weldment modeling results in an increase of 80°F in

PCT for the rupture node and an increase of 40°F in PCT for the unruptured node. The net change in PCT for both of these errors in the LBLOCA is 0°F.

For SBLOCA, ECCS bypass is not used so the analysis is not impacted by this error. The upper plenum and upper head modeling change was considered for the SBLOCA analysis and it was concluded that it will not affect the limiting results because the SBLOCA is a slower evolving transient. The net change in PCT for the SBLOCA for this error is 0°F.

Note that these errors are being applied to our most recent annual report, which has an analysis of record PCT based on a full core of B-12 fuel. TMI has recently off-loaded the remaining B-12 fuel; however, no update to the analysis of record is being made for this 30-day report because the older B-12 analysis is conservative for the remaining fuel.