

November 7, 2014

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

Limerick Generating Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

Subject 10 CFR 50.46 Annual Report

- References:
- 1) Letter from J. Barstow (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated November 8, 2013
 - 2) GE Hitachi Nuclear Energy (GEH) to Exelon Generation Company, LLC, Notification Letter 2014-01, "SAFER04A E4-Maintenance Update Changes," dated May 21, 2014
 - 3) GE Hitachi Nuclear Energy (GEH) to Exelon Generation Company, LLC, Notification Letter 2014-02, "SAFER04A E4-Mass Non-Conservatism," dated May 21, 2014
 - 4) GE Hitachi Nuclear Energy (GEH) to Exelon Generation Company, LLC, Notification Letter 2014-03, "SAFER04A E4-Minimum Core DP Model," dated May 21, 2014
 - 5) GE Hitachi Nuclear Energy (GEH) to Exelon Generation Company, LLC, Notification Letter 2014-04, "SAFER04A E4-Bundle/Lower Plenum CCFL Head," dated May 21, 2014
 - 6) GE Letter 0000-0129-8688-R1, "Summary of GEH Transient Anticipated Operational Occurrences (AOO) and Loss of Coolant Accident (LOCA) Analyses with Respect to ASD Modification in Limerick Generating Station Units 1 and 2," Revision 1, dated May 2011

The purpose of this letter is to submit the 10 CFR 50.46 reporting information for Limerick Generating Station (LGS), Units 1 and 2. The most recent annual 10 CFR 50.46 Report for LGS, Units 1 and 2, (Reference 1) provided the cumulative Peak Cladding Temperature (PCT) errors for the most recent fuel designs through November 8, 2013.

Since the Reference 1 report was issued, four vendor notifications of an Emergency Core Cooling System (ECCS) model error/change applicable to LGS, Units 1 and 2 have been

issued (see References 2, 3, 4, and 5). Also, no ECCS-related changes or modifications have occurred at LGS, Units 1 and 2, that affect the assumptions of the ECCS analyses. The vendor notifications are summarized below:

1) Notification Letter 2014-01, "SAFER04A E4-Maintenance Update Changes"

Reference 2 is a notification of a change to General Electric Hitachi Nuclear Energy (GEH) ECCS-LOCA evaluation model. This change involves the incorporation of a new code version of SAFER04A and can be regarded as general code maintenance. Very minimal influence is seen on the hot node heat-up calculation. Sensitivity calculations have demonstrated that all changes as a result of this code maintenance, both individually and collectively, have insignificant effect on calculated peak cladding temperature. The absolute value of the change in PCT (PCT correct - PCT w/ error) has been determined to be 0°F for both GE14 and GNF2 fuel.

2) Notification Letter 2014-02, "SAFER04A E4-Mass Non-Conservatism"

Reference 3 is a notification of an error to GEH ECCS-LOCA evaluation model. This error involves a divergence between the expected system mass and the calculated actual system mass. This occurs when upper plenum liquid mass and core spray flow rate is low; system mass is gradually lost due to core spray being discarded, resulting in marginally less ECCS flow credited as reaching the core. Representative sensitivity calculations have been performed to arrive at the estimated effects. The total change in PCT (PCT correct - PCT w/ error) has been determined to be +10°F for both GE14 and GNF2 fuel.

3) Notification Letter 2014-03, "SAFER04A E4-Minimum Core DP Model"

Reference 4 is a notification of an error to GEH ECCS-LOCA evaluation model. This error involves a potential non-conservatism when a minimum code Δp was assumed for droplet flow above a two-phase level in the core. It has been observed that for cores with greater voiding (more steam flow), this minimum Δp could be non-conservative, actually driving the steam flow slightly, and offering inappropriate steam cooling benefit above the core two-phase level. Representative sensitivity calculations have been performed with this correction made to arrive at the estimated effects. The total change in PCT (PCT correct - PCT w/ error) has been determined to be +20°F for both GE14 and GNF2 fuel.

4) Notification Letter 2014-04, "SAFER04A E4-Bundle/Lower Plenum CCFL Head"

Reference 5 is a notification of an error to GEH ECCS-LOCA evaluation model. A counter current flow limitation (CCFL) is applied on the interface between the hot bundle and the lower plenum. The pressure head applied at that location is based on the liquid water level in the bundle. It was found that, upon exercising the routine to define CCFL, the output would replace the pressure head with a value revised by that calculation, resulting in a representation of pressure head slightly different from that of the calculated water level in the bundle. The iteration scheme for CCFL has been fixed in the SAFER04A E4 model so that, consistently, the level head is applied whenever CCFL is calculated in that location. A more consistent pressure head from the hot bundle water level as input to the CCFL routine results in slightly better indicated performance in overcoming CCFL at the interface

between the hot bundle and the lower plenum. The effect demonstrated by representative sensitivity studies has shown this correction to be a small penalty for small break limited plants, and a general benefit (no change to some reduction of PCT) for plants with large break limited analyses. The total change in PCT (PCT correct - PCT w/ error) has been determined to be -20°F for both GE14 and GNF2 fuel.

Lastly, a supplement to GE14 and GNF2 Analysis of Records (AORs) involving the implementation of ASD modification at Units 1 and 2 (Reference 6) is included in the Limerick rackup sheets (Calculation #4). This calculation does not change or affect the reporting PCT in any way and should be included as part of the GE14 and GNF2 AORs.

Three attachments are included with this letter that provide the current LGS, Units 1 and 2, 10 CFR 50.46 status. Attachments 1 and 2 ("Peak Cladding Temperature Rack-Up Sheet") provide updated information regarding the PCT for the limiting Loss of Coolant Accident (LOCA) analysis evaluations for LGS, Units 1 and 2, respectively. Attachment 3, "Assessment Notes," contains a detailed description for each change or error reported.

If you have any questions, please contact Tom Loomis at 610-765-5510.

Respectfully,



James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Attachments:

- 1) Peak Cladding Temperature Rack-Up Sheet (Limerick Generating Station, Unit 1)
- 2) Peak Cladding Temperature Rack-Up Sheet (Limerick Generating Station, Unit 2)
- 3) Assessment Notes (Limerick Generating Station, Units 1 and 2)

cc: USNRC Region I, Regional Administrator
USNRC Senior Resident Inspector, LGS
USNRC Project Manager, LGS
R. R. Janati, Bureau of Radiation Protection

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 as of November 7, 2014

Peak Cladding Temperature Rack-Up Sheet

Limerick Generating Station, Unit 1

**Report of the Emergency Core Cooling System
Evaluation Model Changes and Errors
Assessments as of November 7, 2014
Peak Cladding Temperature Rack-Up Sheet, LGS U1**

**Attachment 1
Page 1 of 2**

PLANT NAME: Limerick Unit 1
ECCS EVALUATION MODEL: SAFER/GESTR-LOCA
REPORT REVISION DATE: 11/7/14
CURRENT OPERATING CYCLE: 16

ANALYSIS OF RECORD

Evaluation Model:

1. NEDC-23785-1-PA Rev. 1, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-Of-Coolant Accident Volume II, SAFER – Long Term Inventory Model for BWR Loss-Of-Coolant Analysis," October 1984.
2. NEDC-30996P-A, "SAFER Model for Evaluation of Loss-of-Coolant Accidents for Jet Pump and Non-jet Pump Plants, Volume I, SAFER – Long Term Inventory Model for BWR Loss-of-Coolant Analysis," October 1987.
3. NEDC-32950P, "Compilation of Improvements to GENE's SAFER ECCS-LOCA Evaluation Model," January 2000.
4. NEDC-23785-1-PA Rev. 1, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-Of-Coolant Accident Volume III, SAFER/GESTR Application Methodology," October 1984. (Jet Pump Plant – SAFER)

Calculations:

1. "Limerick Generating Station, Units 1 and 2 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," NEDC-32170P, Rev. 2, May 1995.
2. "Limerick Generating Station Units 1 and 2 ECCS-LOCA Evaluation for GE14," GE-NE-J1103793-09-01P, March 2001.
3. "Limerick Generating Station Units 1 and 2 GNF2 ECCS-LOCA Evaluation," 0000-0111-9078-R0, February 2011.
4. "Summary of GEH Transient Anticipated Operational Occurrences (AOO) and Loss of Coolant Accident (LOCA) Analyses with Respect to ASD Modification in Limerick Generating Station Units 1 and 2," 0000-0129-8688-R1, Revision 1, May 2011.

Fuels Analyzed in Calculations and in Operation: GE14 and GNF2

Limiting Fuel Type: GNF2

Limiting Single Failure (GE14/GNF2): Battery Failure

Limiting Break Size and Location (GE14/GNF2): Double-Ended Guillotine in a Recirculation Suction Pipe

Reference Peak Cladding Temperature (PCT) – GE14: 1670°F

Reference Peak Cladding Temperature (PCT) – GNF2: 1880°F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 Report dated December 18, 2002 (See Note 1)	GE14 Δ PCT = 10°F
10 CFR 50.46 Report dated December 16, 2003 (See Note 2)	GE14 Δ PCT = -5°F
10 CFR 50.46 Report dated December 3, 2004 (See Note 3)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated December 1, 2005 (See Note 4)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated December 1, 2006 (See Note 5)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 30, 2007 (See Note 6)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 24, 2008 (See Note 7)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 24, 2009 (See Note 8)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 24, 2010 (See Note 9)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 23, 2011 (See Note 10)	GE14 Δ PCT = 50°F GNF2 Δ PCT = 50°F
10 CFR 50.46 Report dated November 9, 2012 (See Note 11)	GE14 Δ PCT = 0°F GNF2 Δ PCT = 0°F
10 CFR 50.46 Report dated December 12, 2012 (See Note 12)	GE14 Δ PCT = 65°F GNF2 Δ PCT = 45°F
10 CFR 50.46 Report dated November 8, 2013 (See Note 13)	GE14 Δ PCT = 0°F GNF2 Δ PCT = 0°F
Net PCT (GE14)	1790°F
Net PCT (GNF2)	1975°F

B. CURRENT LOCA MODEL ASSESSMENTS

SAFER04A E4-Maintenance Update Changes (See Note 14)	GE14 Δ PCT = 0°F GNF2 Δ PCT = 0°F
SAFER04A E4-Mass Non-Conservatism (See Note 14)	GE14 Δ PCT = +10°F GNF2 Δ PCT = +10°F
SAFER04A E4-Minimum Core DP Model (See Note 14)	GE14 Δ PCT = +20°F GNF2 Δ PCT = +20°F
SAFER04A E4-Bundle/Lower Plenum CCFL Head (See Note 14)	GE14 Δ PCT = -20°F GNF2 Δ PCT = -20°F
Total PCT change from current assessments (GE14)	$\Sigma \Delta$ PCT = +10°F
Total PCT change from current assessments (GNF2)	$\Sigma \Delta$ PCT = +10°F
Cumulative PCT change from current assessments (GE14)	$\Sigma \Delta$ PCT = 50°F
Cumulative PCT change from current assessments (GNF2)	$\Sigma \Delta$ PCT = 50°F
Net PCT (GE14)	1800°F
Net PCT (GNF2)	1985°F

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 as of November 7, 2014

Peak Cladding Temperature Rack-Up Sheet

Limerick Generating Station, Unit 2

**Report of the Emergency Core Cooling System
Evaluation Model Changes and Errors
Assessments as of November 7, 2014
Peak Cladding Temperature Rack-Up Sheet, LGS U2**

**Attachment 2
Page 1 of 2**

PLANT NAME: Limerick Unit 2
ECCS EVALUATION MODEL: SAFER/GESTR-LOCA
REPORT REVISION DATE: 11/7/14
CURRENT OPERATING CYCLE: 13

ANALYSIS OF RECORD

Evaluation Model:

1. NEDC-23785-1-PA Rev. 1, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-Of-Coolant Accident Volume II, SAFER – Long Term Inventory Model for BWR Loss-Of-Coolant Analysis," October 1984.
2. NEDC-30996P-A, "SAFER Model for Evaluation of Loss-of-Coolant Accidents for Jet Pump and Non-jet Pump Plants, Volume I, SAFER – Long Term Inventory Model for BWR Loss-of-Coolant Analysis," October 1987.
3. NEDC-32950P, "Compilation of Improvements to GENE's SAFER ECCS-LOCA Evaluation Model," January 2000.
4. NEDC-23785-1-PA Rev. 1, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-Of-Coolant Accident Volume III, SAFER/GESTR Application Methodology," October 1984. (Jet Pump Plant – SAFER)

Calculations:

1. "Limerick Generating Station, Units 1 and 2 SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," NEDC-32170P, Rev. 2, May 1995.
2. "Limerick Generating Station Units 1 and 2 ECCS-LOCA Evaluation for GE14," GE-NE-J1103793-09-01P, March 2001.
3. "Limerick Generating Station Units 1 and 2 GNF2 ECCS-LOCA Evaluation," 0000-0111-9078-R0, February 2011.
4. "Summary of GEH Transient Anticipated Operational Occurrences (AOO) and Loss of Coolant Accident (LOCA) Analyses with Respect to ASD Modification in Limerick Generating Station Units 1 and 2," 0000-0129-8688-R1, Revision 1, May 2011.

Fuels Analyzed in Calculations and in Operation: GE14 and GNF2

Limiting Fuel Type: GNF2

Limiting Single Failure (GE14/GNF2): Battery Failure

Limiting Break Size and Location (GE14/GNF2): Double-Ended Guillotine in a Recirculation Suction Pipe

Reference Peak Cladding Temperature (PCT) – GE14: 1670°F

Reference Peak Cladding Temperature (PCT) – GNF2: 1880°F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 Report dated December 18, 2002 (See Note 1)	GE14 Δ PCT = 10°F
10 CFR 50.46 Report dated December 16, 2003 (See Note 2)	GE14 Δ PCT = -5°F
10 CFR 50.46 Report dated December 3, 2004 (See Note 3)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated December 1, 2005 (See Note 4)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated December 1, 2006 (See Note 5)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 30, 2007 (See Note 6)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 24, 2008 (See Note 7)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 24, 2009 (See Note 8)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 24, 2010 (See Note 9)	GE14 Δ PCT = 0°F
10 CFR 50.46 Report dated November 23, 2011 (See Note 10)	GE14 Δ PCT = 50°F GNF2 Δ PCT = 50°F
10 CFR 50.46 Report dated November 9, 2012 (See Note 11)	GE14 Δ PCT = 0°F GNF2 Δ PCT = 0°F
10 CFR 50.46 Report dated December 12, 2012 (See Note 12)	GE14 Δ PCT = 65°F GNF2 Δ PCT = 45°F
10 CFR 50.46 Report dated November 8, 2014 (See Note 13)	GE14 Δ PCT = 0°F GNF2 Δ PCT = 0°F
Net PCT (GE14)	1790°F
Net PCT (GNF2)	1975°F

B. CURRENT LOCA MODEL ASSESSMENTS

SAFER04A E4-Maintenance Update Changes (See Note 14)	GE14 Δ PCT = 0°F GNF2 Δ PCT = 0°F
SAFER04A E4-Mass Non-Conservatism (See Note 14)	GE14 Δ PCT = +10°F GNF2 Δ PCT = +10°F
SAFER04A E4-Minimum Core DP Model (See Note 14)	GE14 Δ PCT = +20°F GNF2 Δ PCT = +20°F
SAFER04A E4-Bundle/Lower Plenum CCFL Head (See Note 14)	GE14 Δ PCT = -20°F GNF2 Δ PCT = -20°F
Total PCT change from current assessments (GE14)	$\Sigma \Delta$ PCT = +10°F
Total PCT change from current assessments (GNF2)	$\Sigma \Delta$ PCT = +10°F
Cumulative PCT change from current assessments (GE14)	$\Sigma \Delta$ PCT = 50°F
Cumulative PCT change from current assessments (GNF2)	$\Sigma \Delta$ PCT = 50°F
Net PCT (GE14)	1800°F
Net PCT (GNF2)	1985°F

Attachment 3

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**

Assessment Notes

Limerick Generating Station, Units 1 and 2

1. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. This letter reported GE LOCA errors related to a SAFER core spray sparger elevation error and a SAFER bulk water level error. The PCT impact for the new errors was determined to be 15°F and -5°F, respectively, for GE14 fuel. The total PCT impact of these errors was determined to be 10°F for GE14 fuel.

[Reference: Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Reporting Requirements," dated December 18, 2002.]

2. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. This letter reported a GE LOCA error related to a SAFER Level/Volume Table error. The PCT impact for the new error was determined to be -5°F for GE14 fuel.

[Reference: Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Reporting Requirements," dated December 16, 2003.]

3. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. This letter reported GE LOCA errors related to a GESTR file interpolation error, a SAFER computer platform change, a WEVOL S1 volume error, a SAFER separator pressure drop error and a new heat source. The PCT impact for the new errors was determined to be 0°F for each error. The total PCT impact of these errors on GE14 fuel was determined to be 0°F.

[Reference: Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated December 3, 2004.]

4. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. There were no errors reported for the 2005 reporting period.

[Reference: Letter from Pamela B. Cowan (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated December 1, 2005.]

5. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. This letter reported a newly discovered sensitivity to the assumed axial power shape for small break LOCA cases. This sensitivity may result in higher calculated PCT values for top-peaked

axial power shapes. Due to this sensitivity, the calculated small break PCT for Limerick was higher than the previously calculated value. However, the Licensing Basis PCT (based on large break) remained the same. Therefore the PCT impact of the new power shape sensitivity was determined to be 0°F for GE14 fuel.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated December 1, 2006.]

6. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. There were no errors reported for the 2007 reporting period.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated November 30, 2007.]

7. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. There were no errors reported for the 2008 reporting period.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated November 24, 2008.]

8. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. There were no errors reported for the 2009 reporting period.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated November 24, 2009.]

9. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. There were no errors reported for the 2010 reporting period.

[Reference: Letter from David P. Helker (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated November 24, 2010.]

10. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. The referenced letter discussed the introduction of the GNF2 fuel design to the Limerick Unit 2 core. The assessment notes above (Notes 1-9) are not applicable to GNF2 fuel. Subsequent to the referenced letter, the GNF2 fuel design was introduced to the Unit 1 core and the errors discussed in this note also apply to Unit 1 (See Note 11).

Also discussed in the referenced letter are two vendor notifications of Emergency Core Cooling System (ECCS) model error/changes for GE14 and GNF2 fuel applicable to Limerick. The errors/changes are summarized below.

The first error involved the way input coefficients were used to direct the deposition of gamma radiation energy produced by the fuel. Correction of this error resulted in a PCT increase of 45°F for both the GE14 fuel and GNF2 fuel.

The second error involved the contribution of heat from gamma ray absorption by the channel. The gamma ray absorption by the channel was found to have been minimized. Correction of this error resulted in a PCT increase of 5°F for both the GE14 fuel and GNF2 fuel.

[Reference: Letter from Michael D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated November 23, 2011.]

11. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. There were no errors reported for the 2012 reporting period.

GNF2 fuel was introduced into the Unit 1 core during Reload 14 (Cycle 15) outage. The ECCS model error/changes discussed in Note 10 were applied to Unit 1 as Prior LOCA Model Assessments.

[Reference: Letter from Michael D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 Annual Report," dated November 9, 2012.]

12. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. To address inaccuracies in fuel pellet thermal conductivity as a function of exposure, commonly referred to as thermal conductivity degradation (TCD), GEH replaced the GESTR-LOCA model with a newer model, PRIME. The most dominant effect impacting PCT is from the way the PRIME fuel properties treat thermal conductivity, which results in a higher fuel stored energy. The PCT impact identified in the referenced letter reflects the difference between the existing GESTR analysis PCT and a conservatively postulated PCT if the analysis was performed with the PRIME model. The ECCS-LOCA analysis methodology

remains GESTR based and will not be PRIME based until the ECCS-LOCA analysis is re-performed using PRIME.

[Reference: Letter from Michael D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "10 CFR 50.46 30-Day Report," dated December 12, 2012.]

13. Prior LOCA Assessment

The referenced letter provided an annual 50.46 report for Units 1 and 2. There were no errors reported for the 2013 reporting period.

[Reference: Letter from James Barstow (Exelon Generation Company, LLC (EGC)) to U.S. NRC, "10 CFR 50.46 Annual Report," dated November 8, 2013]

14. Current LOCA Assessment

Four vendor notifications of Emergency Core Cooling System (ECCS) model errors/changes applicable to Limerick have been issued since the last 10 CFR 50.46 report (see Note 13).

The first change involves the incorporation of a new code version of SAFER04A and can be regarded as general code maintenance. Very minimal influence is seen on the hot node heat-up calculation. Sensitivity calculations have demonstrated that all changes as a result of this code maintenance, both individually and collectively, have insignificant effect on calculated peak cladding temperature. Incorporation of this change resulted in no PCT change (0°F) for both the GE14 fuel and GNF2 fuel.

The second issue is an error found during the incorporation of the new code version of SAFER04A which involves a divergence between the expected system mass and the calculated actual system mass. This occurs when upper plenum liquid mass and core spray flow rate is low; system mass is gradually lost due to core spray being discarded, resulting in marginally less ECCS flow credited as reaching the core. Representative sensitivity calculations have been performed to arrive at the estimated effects. Correction of this error resulted in a PCT increase of 10°F for both the GE14 fuel and GNF2 fuel.

The third issue is an error found during the incorporation of the new code version of SAFER04A which involves a potential non-conservatism when a minimum code Δp was assumed for droplet flow above a two-phase level in the core. It has been observed that for cores with greater voiding (more steam flow), this minimum Δp could be non-conservative, actually driving the steam flow slightly, and offering inappropriate steam cooling benefit above the core two-phase level. Representative sensitivity calculations have been performed with this correction made to arrive at the estimated effects. The correction of this error resulted in a PCT increase of 20°F for both the GE14 fuel and GNF2 fuel.

The fourth issue is an error found during the incorporation of the new code version of SAFER04A. A counter current flow limitation (CCFL) is applied on the interface between the hot bundle and the lower plenum. The pressure head applied at that location is based on the liquid water level in the bundle. It was found that, upon exercising the routine to define CCFL, the output would replace the pressure head with a value revised by that calculation, resulting in a representation of pressure head slightly different from that of the calculated water level in the bundle. The iteration scheme for CCFL has been fixed in the SAFER04A E4 model so that, consistently, the level head is applied whenever CCFL is calculated in that location. A more consistent pressure head from the hot bundle water level as input to the CCFL routine results in slightly better indicated performance in overcoming CCFL at the interface between the hot bundle and the lower plenum. The effect demonstrated by representative sensitivity studies has shown this correction to be a small penalty for small break limited plants, and a general benefit (no change to some reduction of PCT) for plants with large break limited analyses. Correction of this error resulted in a PCT decrease of 20°F for both the GE14 fuel and GNF2 fuel.

Additionally, a supplement to GE14 and GNF2 Analysis of Records (AORs) involving the implementation of ASD modifications (listed as Calculation #4) has been included. This calculation has no impact to the reported PCT and should be included as part of the GE14 and GNF2 AORs.

No other ECCS related changes or modifications have occurred at Limerick that affect the assumptions in the Limerick Generating Station LOCA analysis of record.