

RS-10-087

May 7, 2010

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

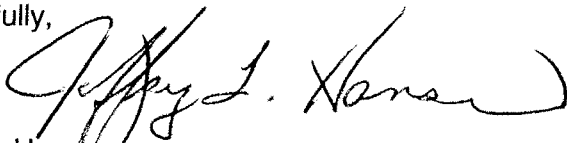
Subject: 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," Annual Report

Reference: Letter from Jeffery L. Hansen (Exelon Generation Company, LLC) to U. S. NRC, "10 CFR 50.46, 'Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors,' Annual Report," dated May 7, 2008

This letter provides the annual report required by 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," for Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. The attachments describe the changes in accumulated Peak Cladding Temperature (PCT) since the previous annual submittal (Reference).

Should you have any questions concerning this letter, please contact Mr. John Schrage at (630) 657-2821.

Respectfully,



Jeffrey L. Hansen
Manager – Licensing

Attachments:

- Attachment 1: Quad Cities Nuclear Power Station Unit 1, 10 CFR 50.46 Report (GE Fuel)
- Attachment 2: Quad Cities Nuclear Power Station Unit 1, 10 CFR 50.46 Report (Westinghouse Fuel)
- Attachment 3: Quad Cities Nuclear Power Station Unit 2, 10 CFR 50.46 Report (Westinghouse Fuel)
- Attachment 4: Quad Cities Nuclear Power Station Units 1 and 2, 10 CFR 50.46 Report Assessment Notes

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

PLANT NAME: Quad Cities Unit 1
 ECCS EVALUATION MODEL: SAFER/GESTR-LOCA
 REPORT REVISION DATE: 04/15/10
 CURRENT OPERATING CYCLE: 21

ANALYSIS OF RECORD

Evaluation Model:

The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Volume III, SAFER/GESTR Application Methodology, NEDE-23785-1-PA, General Electric Company, Revision 1, October 1984.

Calculations:

"SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis for Dresden Nuclear Station 2 and 3 and Quad Cities Nuclear Station Units 1 and 2," NEDC-32990P, Revision 2, GE Nuclear Energy, September 2003.

Fuel Analyzed in Calculation: GE9/10, ATRIUM-9B and GE14
 Limiting Fuel Type: GE14
 Limiting Single Failure: Diesel Generator
 Limiting Break Size and Location: 1.0 Double-Ended Guillotine in a Recirculation Suction Pipe

Reference Peak Cladding Temperature (PCT) PCT = 2110°F

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

10 CFR 50.46 Report dated December 6, 2002 (See Note 2)	$\Delta PCT = 0^\circ F$
10 CFR 50.46 Report dated May 8, 2003 (See Note 4)	$\Delta PCT = 0^\circ F$
10 CFR 50.46 Report dated May 5, 2004 (See Note 5)	$\Delta PCT = 0^\circ F$
10 CFR 50.46 Report dated May 5, 2005 (See Note 6)	$\Delta PCT = 0^\circ F$
10 CFR 50.46 Report dated May 5, 2006 (See Note 7)	$\Delta PCT = 0^\circ F$
10 CFR 50.46 Report dated May 7, 2007 (See Note 8)	$\Delta PCT = 0^\circ F$
10 CFR 50.46 Report dated May 7, 2008 (See Note 9)	$\Delta PCT = 0^\circ F$
10 CFR 50.46 Report dated May 7, 2009 (See Note 10)	$\Delta PCT = 0^\circ F$
Net PCT	2110 °F

B. CURRENT LOCA MODEL ASSESSMENTS

Implementation of ASD Modification - See Note 11	$\Delta PCT = 0^\circ F$
Increased Vessel Leakage - See Note 12	$\Delta PCT = 0^\circ F$
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	2110 °F

Attachment 2
Quad Cities Nuclear Power Station Unit 1
10 CFR 50.46 Report (Westinghouse Fuel)

PLANT NAME: Quad Cities Unit 1
 ECCS EVALUATION MODEL: USA5
 REPORT REVISION DATE: 04/15/10
 CURRENT OPERATING CYCLE: 21

ANALYSIS OF RECORD

Evaluation Model:

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

Calculations:

"Quad Cities 1 & 2 LOCA Analysis for SVEA-96 Optima2 Fuel," OPTIMA2-TR021QC-LOCA, Revision 5, Westinghouse Electric Company, LLC., September 2009.

Fuel Analyzed in Calculation: SVEA-96 Optima2
 Limiting Fuel Type: SVEA-96 Optima2
 Limiting Single Failure: LPCI injection valve
 Limiting Break Size and Location: 1.0 double-ended guillotine break in the recirculation pump suction line

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

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

New Analysis – See Note 12	Δ PCT = 0°F
Net PCT	2150°F

B. CURRENT LOCA MODEL ASSESSMENTS

Implementation of ASD Modification - See Note 11	Δ PCT = 0°F
Increased Vessel Leakage - See Note 12	Δ PCT = 2°F
Bypass hole flow coefficient update - See note 13	Δ PCT = 9°F
Total PCT change from current assessments	$\Sigma \Delta$ PCT = 11°F
Cumulative PCT change from current assessments	$\Sigma \Delta$ PCT = 11°F
Net PCT	2161°F

**Attachment 3
Quad Cities Nuclear Power Station Unit 2
10 CFR 50.46 Report (Westinghouse Fuel)**

PLANT NAME: Quad Cities Unit 2
 ECCS EVALUATION MODEL: USA5
 REPORT REVISION DATE: 04/15/10
 CURRENT OPERATING CYCLE: 21

ANALYSIS OF RECORD

Evaluation Model:

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

Calculations:

"Quad Cities 1 & 2 LOCA Analysis for SVEA-96 Optima2 Fuel," OPTIMA2-TR021QC-LOCA, Revision 5, Westinghouse Electric Company, LLC., September 2009.

Fuel Analyzed in Calculation: SVEA-96 Optima2
 Limiting Fuel Type: SVEA-96 Optima2
 Limiting Single Failure: LPCI injection valve
 Limiting Break Size and Location: 1.0 double-ended guillotine break in the recirculation pump suction line

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

MARGIN ALLOCATION

A. PRIOR LOCA MODEL ASSESSMENTS

New Analysis - See Note 12	Δ PCT = 0°F
Net PCT	2150°F

B. CURRENT LOCA MODEL ASSESSMENTS

Implementation of ASD Modification - See Note 11	Δ PCT = 0°F
Increased Vessel Leakage - See Note 12	Δ PCT = 2°F
Bypass hole flow coefficient update - See note 13	Δ PCT = 9°F
Total PCT change from current assessments	$\Sigma \Delta$ PCT = 11°F
Cumulative PCT change from current assessments	$\Sigma \Delta$ PCT = 11°F
Net PCT	2161°F

Attachment 4
Quad Cities Nuclear Power Station Units 1 and 2
10 CFR 50.46 Report Assessment Notes

1. Prior LOCA Model Assessment

The 50.46 letter dated March 28, 2002 reported a new LOCA analysis to support extended power uprate (EPU) and transition to GE14 fuel for Quad Cities Unit 2.

[Reference: Letter from Timothy J. Tulon (Exelon) to U.S. NRC, "10 CFR 50.46, 30-Day Report for Quad Cities Unit 2," SVP-02-025, dated March 28, 2002.]

2. Prior LOCA Assessment

A new LOCA analysis was performed to support EPU and transition to GE14 fuel for Quad Cities Unit 1. In the referenced letter, the impact of CS and LPCI leakage, GE LOCA error in the WEVOL code and change in DG start time requirement were reported. There is no assessment penalty.

[Reference: Letter from Timothy J. Tulon (Exelon) to U.S. NRC, "10 CFR 50.46, 30-Day Report for Quad Cities Nuclear Power Station, Unit 1," SVP-02-104, dated December 6, 2002.]

3. Prior LOCA Assessment

In the referenced letter, no LOCA model assessment was reported for Unit 2 PCT.

[Reference: Letter from Timothy J. Tulon (Exelon) to U.S. NRC, "Transmittal of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light water nuclear power reactors," Annual Report for Quad Cities Units 1 and 2," SVP-02-039, dated May 9, 2002.]

4. Prior LOCA Assessment

The referenced letter provided the annual 50.46 report for Quad Cities Units 1 and 2. This letter reported no LOCA model assessment for Unit 1 whereas it reported the impact of GE LOCA error in the WEVOL code and change in DG start time requirement for Unit 2. The PCT impact for these errors was determined to be 0°F.

[Reference: Letter from Timothy J. Tulon (Exelon) to U.S. NRC, "Transmittal of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light water nuclear power reactors," Annual Report for Quad Cities Nuclear Power Station, Units 1 and 2," SVP-03-063, dated May 8, 2003.]

5. Prior LOCA Assessment

The referenced letter provided the annual 50.46 report for Quad Cities Units 1 and 2. This letter reported GE LOCA errors related to SAFER level/volume table and Steam Separator pressure drop and mid-cycle reload of GE14 fuel for Unit 1 (Cycle 18A). For Unit 2, this letter reported the same GE LOCA errors and second reload of GE14 fuel in Cycle 18 core. The PCT impact for these errors and reloads of GE14 fuel was determined to be 0°F.

[Reference: Letter from Patrick R. Simpson (Exelon) to U.S. NRC, Transmittal of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light water nuclear power reactors," Annual Report for Quad Cities Nuclear Power Station, Units 1 and 2, RS-04-066, dated May 5, 2004.]

Attachment 4
Quad Cities Nuclear Power Station Units 1 and 2
10 CFR 50.46 Report Assessment Notes

6. Prior LOCA Assessment

The referenced letter provided the annual 50.46 report for Quad Cities Units 1 and 2. This letter reported GE LOCA error due to new heat source for Units 1 & 2 and Quad Cities Unit 1 Cycle 19 with a new reload of GE14 fuel.

[Reference: Letter from Patrick R. Simpson (Exelon) to U.S. NRC, Transmittal of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light water nuclear power reactors," Annual Report for Quad Cities Nuclear Power Station, Units 1 and 2, RS-05-056, dated May 5, 2005.]

7. Prior LOCA Assessment

The referenced letter provided the annual 50.46 report for Quad Cities Units 1 and 2. This letter reported LOCA evaluations for installation of new steam dryers during mid-cycle outages for Q1C19 and Q2C18, respectively. Also, the letter reported Q2C19 startup in April 2006 with the first reload of Westinghouse Optima2 fuel and implementation of the Westinghouse LOCA analysis. Additionally, LOCA evaluations by both GE and Westinghouse were reported for Unit 2 modification to the inlet configuration of the 6" inlet standpipe of eight main steam safety valves and four Electromatic relief valves, which replaced the previously installed inlet pipe and flange with a 6" Tee, flange and an Acoustic Side Branch (ASB). The PCT impact due to the plant modifications was determined to be 0°F.

[Reference: Letter from Patrick R. Simpson (Exelon) to U.S. NRC, Transmittal of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light water nuclear power reactors," Annual Report for Quad Cities Nuclear Power Station, Units 1 and 2, RS-06-064, dated May 5, 2006.]

8. Prior LOCA Assessment

The referenced letter provided the annual 50.46 report for Quad Cities Units 1 and 2. This letter reported GE LOCA evaluation for installation of a modification to the inlet configuration of the 6" inlet standpipe of eight main steam safety valves and four Electromatic relief valves for Quad Cities Unit 1. Also, this letter reported evaluation of a change in the GE small break analysis assumption for axial power shape and Westinghouse LOCA analysis of Hgap correlation input error. The PCT impact due to these changes was determined to be 0°F.

[Reference: Letter from Patrick R. Simpson (Exelon) to U.S. NRC, Transmittal of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light water nuclear power reactors," Annual Report for Quad Cities Nuclear Power Station, Units 1 and 2, RS-07-070, dated May 7, 2007.]

9. Prior LOCA Assessment

For the GE LOCA analysis, the referenced letter reported no PCT assessment whereas for the Westinghouse analysis, it reported a revision to Quad Cities LOCA analysis report thus a new plant-specific LOCA Analysis. This new analysis applies to operation of the Westinghouse Optima2 fuel in the Quad Cities Unit 1 and 2 reactors. This analysis applies specific inputs and assumptions in the LOCA calculation approved in the licensed Westinghouse methodology. Also, a second reload of SVEA-96 Optima2 fuel was implemented with the Quad Cities Unit 2 Cycle 20 core. The limiting PCT for Optima2 as

Attachment 4
Quad Cities Nuclear Power Station Units 1 and 2
10 CFR 50.46 Report Assessment Notes

analyzed under the Westinghouse LOCA method is 2150 °F whereas the limiting PCT for GE14 as analyzed under GE LOCA method is 2110 °F.

[Reference: Letter from Jeff Hansen (Exelon) to U.S. NRC, Transmittal of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," Annual Report for Quad Cities Nuclear Power Station, Units 1 and 2, RS-08-064, dated May 7, 2008.]

10. Prior LOCA Assessment

For the GE LOCA analysis, the referenced letter reported no PCT assessment whereas for the Westinghouse analysis, it reported a revision to Quad Cities LOCA analysis report. The revision was required to clarify the low-pressure core spray flow and leakage model because of an error in the assumed Dresden Unit 2 core spray flow in the Dresden LOCA analysis. The Westinghouse Quad Cities LOCA analysis was not affected by the change due to this revision and the PCT impact due to these changes was determined to be 0°F.

[Reference: Letter from Jeff Hansen (Exelon) to U.S. NRC, Transmittal of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," Annual Report for Quad Cities Nuclear Power Station, Units 1 and 2, RS-09-059, dated May 7, 2009.]

11. Current LOCA Assessment

Quad Cities Units 1 and 2 have implemented a modification to replace the recirculation MG sets with adjustable speed drive (ASD) beginning with Cycle 21 operation. The ASD modification will affect the recirculation pump coastdown response. Westinghouse showed that the LOCA analysis of record for Optima2 fuel remains applicable with the change due to ASD modification and the licensing basis PCT remains unaffected. GE evaluated impact on LOCA analysis for GE14 while assuming that the shorter coastdown due to ASD could potentially lead to early boiling transition of the high power node in the hot channel. To ensure that the current licensing basis PCT for GE14 fuel remains below 2110 °F, GE conservatively determined that a 7% reduction in MAPLHGR and PLHGR is required for GE fuel. The reduction in MAPLHGR and PLHGR only applies to operation of Quad Cities Unit 1 Cycle 21. Because, with startup of Quad Cities Unit 2 Cycle 21 operation, all GE14 fuel types are discharged from the Unit 2 core and the reactor core consists of Westinghouse Optima2 fuel types only.

[References: 1) "Quad Cities 1 & 2 LOCA Analysis for SVEA-96 Optima2 Fuel," OPTIMA2-TR021QC-LOCA, Revision 5, Westinghouse Electric Company, LLC, September 2009.]

2) "Evaluation of LOCA Analysis Effects from Installation of Adjustable Speed Drive for Dresden and Quad Cities," GE report 0000-0085-9120-R0, August 2008.]

12. Current LOCA Assessment

Westinghouse evaluated the effect of the updated vessel leakage between the lower shroud and the downcomer in the latest LOCA analysis for Quad Cities and demonstrated all 10 CFR 50.46 criteria satisfied. The latest LOCA analysis identified impact of this change as + 2 °F PCT update. Beginning with Quad Cities Units 1 and 2 Cycle 21 MAPLHGR calculation, the increased vessel leakage has been accounted for in calculation of the MAPLHGR limit for the fresh bundles loaded into the Cycle 21 cores. For 10 CFR 50.46 reporting purposes, the PCT update is conservatively applied to all

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Quad Cities Nuclear Power Station Units 1 and 2
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bundle types including the fresh bundles. This PCT update will remain in effect only until the MAPLHGR limits for all bundles in future Quad Cities Unit 1 and Unit 2 cores are evaluated for the increased vessel leakage. The vessel leakage has been identified by GE for Quad Cities reactor internals evaluation to have an insignificant impact on the PCT transient portion of the LOCA event. Therefore, a PCT impact of 0°F is reported for GE14 fuel.

- [References: 1) "Quad Cities 1 & 2 LOCA Analysis for SVEA-96 Optima2 Fuel," OPTIMA2-TR021QC-LOCA, Revision 5, Westinghouse Electric Company, LLC, September 2009.
- 2) "Reactor internals Leakage Evaluation Dresden Units 2 & 3 and Quad Cities 1 & 2," GE report GE-NE-0000-0021-3568-01, Revision 1, March 2009.
- 3) "Dresden Units 2 & 3 and Quad Cities Units 1 & 2 10 CFR 50.46 Annual Notification and Reporting for 2009," Westinghouse letter LTR-LAM-09-168, Rev. 0, March 9, 2010.]

13. Current LOCA Assessment

Westinghouse identified a change in input for modeling bypass hole flow coefficient, which was evaluated for impact on the LOCA analysis. The impact due to this change for Q1C21 reloads was determined to be + 9 °F in PCT update. For Q2C21, Westinghouse established the MAPLHGR limit for the fresh bundles to accommodate the change. 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 Quad Cities Unit 1 and Unit 2 cores are evaluated for the change in bypass hole flow coefficient.

- [References: 1) "Dresden Units 2 & 3 and Quad Cities Units 1 & 2 10 CFR 50.46 Annual Notification and Reporting for 2009," Westinghouse letter LTR-LAM-09-168, Rev. 0, March 9, 2010.
- 2) "Quad Cities Nuclear Power Station Unit 2 Cycle 21 MAPLHGR Report," NF-BEX-09-200-NP, Revision 2, January 2010.]