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March 9, 2020
L-21-089

10 CFR 50.46

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

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Report of ECCS Model Changes and Errors Pursuant to 10 CFR 50.46

On February 18, 2021, GE-Hitachi Nuclear Energy Americas (GEH) provided two notifications to Energy Harbor Nuclear Corp. that identified errors in an acceptable evaluation model regarding the emergency core cooling system (ECCS) – loss of coolant accident (LOCA) analyses for the Perry Nuclear Power Plant (PNPP). Pursuant to 10 CFR 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors,” Energy Harbor Nuclear Corp. is notifying the Nuclear Regulatory Commission (NRC) of the errors.

The first identified error was in the fuel pellet to plenum spring conductance, which is an input to the fuel rod stress and perforation model in ECCS LOCA calculations. The identified error in the value of this parameter stemmed from an incorrect conversion from SI units in preparing the input for SAFER analyses. The error only affects the temperature and plenum gas pressure calculation in the plenum region, outside of the active fuel region. The error has an insignificant effect on the rod internal pressure calculation because the heat capacity of the spring is much smaller when compared to the fuel stored energy and decay heat.

An assessment was performed for a span of representative plants with the SAFER evaluation model. Using the correct fuel pellet to plenum spring conductance input value to SAFER, the results confirmed an insignificant PCT impact for affected fuel types. Therefore, a 0°F PCT change is reported as the estimated impact.

The second error identified was a discrepancy in inner cladding surface roughness, which is an input to the gap conductance model. An inconsistency was identified between the roughness value used in fuel performance model PRIME and the input to the SAFER and TRACG calculations. The difference stems from a recent change in the

way the PRIME model evaluates the nominal value from the distribution uncertainty. The inner cladding surface roughness affects the pellet-cladding contact heat transfer and therefore, the gap conductance. The input inconsistency is small and should have an insignificant effect on the ECCS LOCA calculations.

An assessment was performed for a span of representative plants with the SAFER and TRACG evaluation models. Using consistent values for the inner cladding surface roughness input to SAFER and TRACG, the results confirmed an insignificant PCT impact for affected fuel types. Therefore, a 0°F PCT change is reported as the estimated impact.

In the previous cycle (within the last 36 months), PNPP's reactor core included both the GE14 and GNF2 fuel types. During the refueling outage that ended on April 19, 2019, Energy Harbor Nuclear Corp. transitioned to a complete core of GNF2 fuel at PNPP. The assessment addresses the impact on both the GE14 LOCA analysis and the GNF2 LOCA analysis.

The GNF2 SAFER/PRIME LOCA assessment for PNPP identified the current PCT for GNF2 is 1610°F. The addition of the 0°F results in an unchanged GNF2 PCT of 1610°F. The revised GNF2 PCT is less than the 2200 °F Licensing Basis Peak Cladding Temperature Limit. As such, a compensatory power de-rate or a change to Thermal Limits is not required.

The absolute sum of all GNF2 SAFER/PRIME LOCA Analysis errors is 20°F and remains below the 50 °F Limit. Since the revised GNF2 PCT did not exceed 2200°F and the revised absolute sum of all errors did not exceed 50°F, an NRC 30 Day Report is not required.


The current PCT for GE14 is 1555°F. The addition of the 0°F results in an unchanged GE14 PCT of 1555 °F. The revised GE14 PCT is less than the 2200°F licensing basis peak cladding temperature limit.

The absolute sum of all GE14 SAFER/PRIME LOCA Analysis errors is 125°F and is above the 50°F limit. Since the GE14 absolute sum of all errors exceeded 50°F, an NRC 30-day report is required. A summary of the PNPP 10 CFR 50.46 changes and errors is attached.

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There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Phil H. Lashley, Manager – Fleet Licensing, at (330) 696-7208.

Sincerely,

Penfield, Rod 55166
site vp
I am approving this document
Mar 9 2021 10:53 AM


Rod L. Penfield

Attachment:
Perry Nuclear Power Plant 10 CFR 50.46 Changes and Errors

cc: NRC Region III Administrator
NRC Resident Inspector
NRR Project Manager

Attachment
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Vendor Notification Number	Summary of Change/Error	Licensing Basis Peak Cladding Temperature (PCT) Impact	Licensee Report of Notification (Accession No)
2001-02	Impact of SAFER ¹ pressure rate inconsistency error.	PCT impact for GE14 fuel is +5°F.	ML020710641
2002-01	Impact of SAFER core spray injection elevation error.	PCT impact for GE14 fuel is +15°F.	ML030710170
2002-02	Impact of SAFER bulk water level error.	PCT impact for GE14 fuel is 0°F.	ML030710170
2002-04	Impact of SAFER ⁰⁴ computer platform change.	PCT impact for GE14 fuel is 0°F.	ML030710170
2002-05	Impact of error in WEVOL ² calculation of downcomer free volume.	PCT impact for GE14 fuel is 0°F.	ML030710170
2003-01	Impact of SAFER level/volume table error.	PCT impact for GE14 fuel is +5°F.	ML040710502
2003-03	Impact of SAFER initial steam separator pressure drop.	PCT impact for GE14 fuel is 0°F.	ML040710502
2003-05	Impact of postulated post-LOCA ³ hydrogen-oxygen recombination.	PCT impact for GE14 fuel is 0°F.	ML040710502
2006-01	Impact of top peaked power shape for small break LOCA analysis.	PCT impact for GE14 fuel is 0°F.	ML062490520 ML070390113
2011-02	Impact of database error for heat deposition for 10X10 fuel bundles.	PCT impact for GE14 fuel is +25°F.	ML112290919
2011-03	Impact of updated formulation gamma heat deposition to channel wall for 10X10 fuel bundles.	PCT impact for GE14 fuel is -40°F.	ML112290919
2012-01	Impact of change in fuel properties from GESTR ⁴ to PRIME ⁵ .	PCT impact for GE14 fuel is +20°F.	ML12353A320

Perry Nuclear Power Plant 10 CFR 50.46 Changes and Errors (Continued)

Vendor Notification Number	Summary of Change/Error	Licensing Basis Peak Cladding Temperature (PCT) Impact	Licensee Report of Notification (Accession No)
2014-01	Impact of use of a new version of SAFER04A.	PCT impact for GE14 fuel is 0°F	ML14170A178
2014-02	Impact of system mass divergence error.	PCT impact for GE14 fuel is 0°F	ML14170A178
2014-03	Impact of minimum delta pressure error.	PCT impact for GE14 fuel is -15°F	ML14170A178
2014-04	Impact of counter current flow limitation (CCFL) error.	PCT impact for GE14 fuel is 0°F	ML14170A178
2017-02	Impact of fuel rod plenum temperature update.	PCT impact for GE14 fuel is 0°F	ML17233A279
2019-05	Impact of lower control rod drive housing interface backward leakage path.	PCT impact for GE14 fuel is 0°F	ML19323F143
2020-01	PRIME Coding Errors for Zircaloy Irradiation Growth and Zr Barrier Thermal Conductivity as input to ECCS LOCA Analyses.	PCT impact for GE14 fuel is 0°F	ML20129H958
2021-01	Error in Fuel Pellet to Plenum Spring Conductance	PCT impact for GE14 fuel is 0°F	This submittal
2021-02	Discrepancy in Inner Cladding Surface Roughness	PCT impact for GE14 fuel is 0°F	This submittal
TOTAL	Summation of the absolute values of the changes/errors	125°F	

Notes:

1. SAFER – Name of the code developed by General Electric Company that calculates long term reactor vessel inventory and peak cladding temperature for LOCA and loss of inventory events.
2. WEVOL – Name of a code that is used to calculate the weight and volume inputs for jet pump plant SAFER analyses.
3. LOCA – Loss of coolant accident.
4. GESTR – General Electric stress and thermal analysis of fuel rods
5. PRIME – Name of the model for analysis of fuel rod thermal-mechanical performance.