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10 CFR 50.46

August 19, 2011  
NRC-11-0042

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington D C 20555-0001

- References:
- 1) Fermi 2  
NRC Docket No. 50-341  
NRC License No. NPF-43
  - 2) USNRC Letter to Detroit Edison, "Fermi 2 – Approval of Plant Specific ECCS Evaluation Model Reanalysis (TAC No. MD9169)," dated June 30, 2009 [ML091740255]
  - 3) Detroit Edison Letter to USNRC, "Submittal of 2008 Safety Relief Valve Challenge Report, Main Steam Bypass Line Report, and ECCS Cooling Performance Evaluation Model Changes or Errors Report," NRC-09-0025, dated April 17, 2009 [ML091140127]
  - 4) General Electric- Hitachi "10 CFR 50.46 Notification Letter 2011-02," dated July 20, 2011
  - 5) General Electric- Hitachi "10 CFR 50.46 Notification Letter 2011-03," dated July 20, 2011

Subject: 30-Day 10 CFR 50.46 Report - Plant Specific ECCS Evaluation Change

In accordance with 10 CFR 50.46(a)(3)(ii), this letter reports model changes or errors in the General Electric-Hitachi (GEH) Plant Specific Emergency Core Cooling System (ECCS) evaluation for Fermi 2.

In Reference 2, NRC provided a safety evaluation of the Fermi 2 plant-specific ECCS model evaluation reanalysis. The reanalysis identified the small recirculation suction line break as the design basis limiting Loss of Coolant Accident (LOCA) that

results in a maximum Peak Clad Temperature (PCT) of the GE14 type fuel. Starting with reactor operation in fuel cycle 15 which commenced on December 5, 2010, the GE14 type fuel is the only type used in the Fermi 2 reactor.

In Reference 3, Detroit Edison reported a non-significant error in the analysis approved by NRC in Reference 2. The impact of the error reported in Reference 3 resulted in a 5 degree Fahrenheit (5°F) increase in the maximum PCT for GE14 fuel.

On July 20, 2011, GEH and Global Nuclear Fuel (GNF) issued GE Notification Letters 2011-02 and 2011-03 (References 4 and 5) which indicate that a change has been made in the ECCS- LOCA analyses inputs that affect Fermi 2.

The change discussed in Reference 4 is related to input coefficients used to direct the deposition of gamma radiation energy produced by fuel, determining whether it would heat the fuel rod, cladding, channel, or control rod structure materials. The input caused the heat deposited in the fuel channel (post scram) to be over-predicted and the corresponding heat to the fuel to be under-predicted. This effect was considered to be non-conservative. The error applies to the GE14 fuel used at Fermi 2. Reference 4 reports a 40°F increase in licensing basis peak cladding temperature.

The change discussed in Reference 5 is related to the input formulation for SAFER (one of the codes used in the Fermi 2 LOCA analysis) input coefficients used to direct the deposition of gamma and neutron radiation energy produced by fuel fissions and decay heat. The error is in determining whether the gamma and neutron radiation would heat the fuel rod, cladding, channel, or control rod structural materials. While investigating an input anomaly regarding energy deposition, the formulation of these terms was examined. The contribution of heat from gamma ray absorption by the channel was found to have been minimized. The method had been simplified such that initially all the energy was assumed to be deposited in the fuel rods prior to the LOCA and then adjusted such that the correct heat deposition was applied after the scram. It was concluded that this modeling is potentially conservative, as not accounting for this small fraction of total power generation outside the fuel rod would tend to suppress the hot bundle power required to meet the initial operating planar linear heat generation rate. Furthermore, there is a small effect on the initial conditions for the balance of the core as these are set in relation to the hot bundle condition. The energy distribution during the pre-scram phase was updated with the appropriate energy distribution. Since the integral heat deposition is dominated by post-scram energy, the change has only a small impact on the results. Reference 5 reports a 15°F decrease in licensing basis PCT.

As stated previously, the current licensing basis peak cladding temperature (LBPCT) for the GE14 fuel is based on a limiting small break LOCA. The result of the analysis of errors reported in References 4 and 5 shows a net addition to LBPCT that

needs to be applied to account for the changes in energy deposition. The reported change in calculated Peak Cladding Temperature is the net change in LBPCT.

References 4 and 5 indicate that the Fermi 2 limiting transient for the licensing basis peak cladding temperature has increased by 25°F for GE14 fuel. Incorporating the 5°F reported in Reference 3 yields a PCT value of 2020°F for the GE14 fuel in the core.

In addition to the errors reported above, as a result of a recent evaluation of the hydraulic design calculation for the Low Pressure Cooling Injection (LPCI) system, Detroit Edison determined that the LPCI pump performance curve that provides maximum flow against different discharge pressures does not account for any pump degradation in the pump shutoff region. A design calculation revision was issued by Detroit Edison incorporating an allowance for pump degradation at shutoff pressure.

Since the Fermi 2 limiting LOCA analysis predicts that fuel PCT increase would terminate when LPCI pumps are able to inject water into the vessel, a lower design LPCI pump shutoff pressure results in a delay of the injection and an increase in the maximum PCT.

Detroit Edison contracted GEH to evaluate the limiting small break LOCA scenario for the lower LPCI pump shutoff pressure. The reevaluation resulted in an increase of 57°F. Therefore, this increase is applied to the maximum PCT of 2020°F discussed above yielding a new maximum PCT of 2077°F. This value provides a 123°F margin to the 2200°F PCT limit in 10 CFR 50.46.

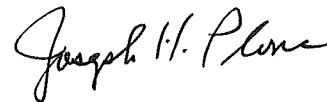
Enclosure 1 provides updated information regarding the PCT for the limiting LOCA analysis evaluations and detailed assessment for each model change or error reported for Fermi 2.

Detroit Edison has already completed a reevaluation of the LPCI pump degradation at shutoff pressure as it affects SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis for Fermi 2. The results of this reevaluation are reported in this letter. This reevaluation was completed prior to issuance of References 4 and 5. The reported net PCT assessment in the Enclosure is a conservative bounding value for the maximum PCT. Therefore, no other reanalysis of the SAFER/GESTR-LOCA Loss of Coolant Accident is planned at this time.

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Should you have any questions or require additional information, please contact Mr. Rodney W. Johnson of my staff at (734) 586-5076.

Sincerely,

A handwritten signature in cursive script, reading "Joseph H. Plone".

Enclosure:  
Peak Cladding Temperature Analysis Update and Assessment of Model Changes

cc: NRC Project Manager  
NRC Resident Office  
Reactor Projects Chief, Branch 4, Region III  
Regional Administrator, Region III  
Supervisor, Electric Operators,  
Michigan Public Service Commission

**ENCLOSURE TO  
NRC-11-0042**

**PEAK CLADDING TEMPERATURE  
ANALYSIS UPDATE**

**AND**

**ASSESSMENT OF MODEL CHANGES**

Plant Name: Fermi 2 Power Plant  
ECCS Evaluation Model: SAFER/GESTR-LOCA  
Report Revision Date: August 19, 2011  
Current Operating Cycle: 15

### **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)
5. NEDC-23785-1-PA Rev. 1, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-Of-Coolant Accident Volume III, Supplement 1 Additional information for Upper Bound PCT," March 2002.

#### **Calculations:**

1. DTE Energy Enrico Fermi 2 SAFER/GESTR Loss of Coolant Accident Analysis for GE14 Fuel," GE-NE-0000-0030-6565-R1 dated June 2008

**Fuel Analyzed in Calculations:** GE14

**Limiting Fuel Type for Original Analyses:** GE14

**Limiting Single Failure for Original Analyses:** Division I Battery Power

**Limiting Break Size and Location for Original Analyses:** 0.21 square foot recirculation line break

**Reference LBPCT for Original Analyses:** 1990°F \*

*\*Note: This value is conservative since the analysis is performed for a power of 3952 MWth. The current Fermi 2 licensed power is 3430 MWth.*

### Margin Allocation

#### Prior LOCA Model Assessments for GE14 Fuel

	GE14
NRC-09-0025 dated April 17, 2009 (See Note 1)	$\Delta PCT = 5^{\circ}F$
NRC-10-0031 dated April 27, 2010 (See Note 1)	$\Delta PCT = 0^{\circ}F$
NRC-11-0010 dated April 29, 2011 (See Note 1)	$\Delta PCT = 0^{\circ}F$
Net PCT	1995°F

#### Current LOCA Model Assessment for GE14 Fuel

	GE14
10 CFR 50.46 Notification Letter 2011-02 dated July 20, 2011, Impact of database error for heat deposition on the Peak Cladding Temperature (PCT) for 10x10 fuel bundles (See Note 2)	$\Delta PCT = 40^{\circ}F$
10 CFR 50.46 Notification Letter 2011-03 dated July 20, 2011, Impact of updated formulation for gamma heat deposition to channel wall for 9x9 and 10x10 fuel bundles (See Note 3)	$\Delta PCT = -15^{\circ}F$
Self-identified non-conservative assumption regarding LPCI pump degradation at shutoff pressure (See Note 4)	$\Delta PCT = 57^{\circ}F$
Net PCT	2077°F

### Notes

1. The referenced letters provide the annual 50.46 report for Fermi 2. There was one 5°F error reported for the 2008 reporting period.
2. The Notification Letter affects all GNF 10x10 fuel. Fermi 2 utilizes GE14 so the LBPCT is impacted with a 40°F error.
3. The Notification Letter affects all GNF 10x10 fuel. Fermi 2 utilizes GE14 so the LBPCT is impacted with a -15°F error.
4. Evaluation is documented in GEH Report No. 0000-0121-0144-R1, "DTE Energy Enrico Fermi 2 – Reduced LPCI Flow GE11 and GE14 ECCS-LOCA Evaluation," dated July 2010 (GEH Proprietary).