



FirstEnergy Nuclear Operating Company

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10 CFR 50.46

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

**SUBJECT:**

Davis-Besse Nuclear Power Station, Unit 1  
Docket No. 50-346, License No. NPF-3  
Report of Changes to the Emergency Core Cooling System  
Evaluation Model in Accordance with 10 CFR 50.46(a)(3)

In accordance with 10 CFR 50.46(a)(3), the FirstEnergy Nuclear Operating Company (FENOC) hereby submits the annual report for changes and errors in the Emergency Core Cooling System (ECCS) Evaluation Model (EM) and in the application of the model used at the Davis-Besse Nuclear Power Station, Unit 1 (DBNPS). The attached report covers the period of January 1, 2007 to December 31, 2007.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at (330) 761-6071.

Sincerely,

Attachment: Annual Report of Changes to the 10 CFR 50.46 Emergency  
Core Cooling System Evaluation Model for the Davis-Besse  
Nuclear Power Station, Unit 1

cc: NRC Region III Administrator  
NRR Project Manager - Davis-Besse Nuclear Power Station  
NRC Resident Inspector - Davis-Besse Nuclear Power Station  
Executive Director, Ohio Emergency Management Agency,  
State of Ohio (NRC Liaison)  
Utility Radiological Safety Board

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## **Annual Report of Changes to the 10 CFR 50.46 Emergency Core Cooling System Evaluation Model for the Davis-Besse Nuclear Power Station, Unit 1**

10 CFR 50.46 (a)(3) states that each holder of an operating license shall report to the Nuclear Regulatory Commission (NRC) at least annually each change or error in an acceptable Emergency Core Cooling System (ECCS) evaluation model (EM) or in the application of such a model that affects the calculation of peak cladding temperature (PCT).

### **BWNT LOCA EM Changes and Errors**

The BWNT EM is applicable to all Babcock & Wilcox (B&W) designed pressurized water reactors for large and small-break loss-of-coolant accident (LBLOCA, SBLOCA) analyses for Zircaloy or M5 cladding.

#### **Energy Deposition Factor (EDF) Error**

An error affecting the EDF utilized in LOCA analyses was identified during investigations of control rod heating rates. The source of the error was an incorrect interpretation of gamma energy fractions reported from the ORIGEN2 code. These gamma energy fractions are used to determine the energy deposition during a LOCA transient for high burnup fuel and low power fuel. The corrections to the gamma energy fractions result in an increase in the energy deposited within the fuel during the LBLOCA transient for high burnup and low power conditions (e.g., end-of-life analyses). The effect of the EDF error on PCT has been evaluated for the Davis-Besse Nuclear Power Station, Unit 1 (DBNPS) and is discussed in the next section.

### **EM Application Changes and Errors**

#### **EDF Error**

The effect of the correction to the gamma energy fractions on the current LOCA analyses of record was evaluated for the DBNPS. The evaluation considered all of the appropriate fuel assembly designs (Mark-B8A, Mark-B10K, Mark-B10M, Mark-B12 and Mark-B-HTP). Based on the evaluation, the PCTs for the reduced power (gadolinia pins) and/or higher burnup fuel (middle-of-life and/or end-of-life) have increased as a result of the corrections to the gamma energy fractions. The effect on the reported licensing PCT for the Mark-B-HTP in a mixed-core configuration is +2.7° F. The effect on the reported licensing PCT for the Mark-B8A, Mark-B10K, Mark-B10M and Mark-B12 is 0° F. The SBLOCA reported licensing PCTs were determined to be unaffected.

With the incorporation of the gamma energy correction, a new equation for calculation of the energy deposition factor was implemented for  $\text{UO}_2$  at end-of-life. For the DBNPS, this affects the end-of-life analyses for  $\text{UO}_2$  which remains a non-limiting case. Consequently, the change to the limiting PCT is  $0^\circ\text{F}$ .

#### RELAP5 Limitation Regarding Bypass of Pin Pressure Calculation Under Certain Conditions

An issue was identified relating to coding logic in RELAP5 that results in bypassing of the pin pressure calculation under certain conditions. The pin pressure calculation is bypassed after the upper-most pin segment in an unruptured pin channel becomes plastic. The power in the upper-most segment is zero since this represents an unheated region at the end of the pin. Therefore, the upper-most segment typically does not heat-up sufficiently to become plastic. However, for a SBLOCA with an extended period of core uncovering and a high peak clad temperature, the steam flow can heat the cladding to the point where the upper-most cladding segment may become plastic. This condition was observed for only a small subset of cases.

This issue was addressed by AREVA NP and the code logic was updated in Version 27.0 of the RELAP5 code to ensure that the pin pressure calculation is no longer bypassed. Due to the nature of the selection of composite initial pin conditions that represent a bounding time-in-life for the SBLOCA analyses, the consequences of the bypass in the pin pressure calculation is small. A PCT change of  $0^\circ\text{F}$  has been assigned to the limiting SBLOCA case. Also, the local and whole-core hydrogen generation values previously reported have not been affected. The LBLOCA reported licensing PCTs were determined to be unaffected.

#### Summary

A summary of the errors identified during the reporting period and the corresponding PCT changes is provided in Table 1.

**Table 1 - 10 CFR 50.46 Summary for 2007**

<b>Plant Name:</b>		Davis-Besse Nuclear Power Station, Unit 1	<b>LOCA Spectrum</b>				
<b>Utility Name:</b>		FirstEnergy Corp.	<i>Mk-B10M LBLOCA</i>	<i>Mk-B10K LBLOCA</i>	<i>Mk-B12 LBLOCA</i>	<i>Mk-B-HTP LBLOCA Mixed- Core</i>	<i>SBLOCA</i>
<b>Item #</b>	<b>Reporting Category</b>	<b>Description</b>	<b>PCT or (Delta PCT)</b>				
<b>Licensing Basis at Beginning of 2007</b>			<b>&lt;2,102° F Estimate EM R0.6</b>	<b>2,102° F Analyzed EM R0.6</b>	<b>2,099° F Analyzed EM R0.6</b>	<b>2,095° F Analyzed EM R0.9</b>	<b>1,555° F Analyzed EM R0.9</b>
<b>2007 Licensing Activity</b>							
1	Application Error Correction	Energy Deposition Factor Error	0° F	0° F	0° F	2.7° F	0° F
2	Other	Change to Transient Energy Deposition Factor Equation for UO <sub>2</sub> Fuel	0° F	0° F	0° F	0° F	N/A
3	Other	RELAP5 Limitation Regarding Bypass of Pin Pressure Calculation Under Certain Conditions	N/A	N/A	N/A	N/A	0° F
<b>Licensing Basis at End of 2007</b>			<b>&lt;2,102° F Estimate EM R0.6</b>	<b>2,102° F Analyzed EM R0.6</b>	<b>2,099° F Analyzed EM R0.6</b>	<b>2,098° F Analyzed EM R0.9</b>	<b>1,555° F Analyzed EM R0.9</b>