



Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802
Tel 479-858-4704

Stephenie L. Pyle
Manager, Regulatory Assurance
Arkansas Nuclear One

1CAN121405

December 22, 2014

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

Subject: Special Report
Licensee Event Report 50-313/2014-002-00
Arkansas Nuclear One, Unit 1
Docket No. 50-313
License No. DPR-51

Dear Sir or Madam:

Pursuant to the reporting requirements of 10 CFR 50.73 and 10 CFR 50.46, attached is the subject Special Report (Licensee Event Report) concerning a significant change in peak cladding temperature.

There are no new commitments contained in this submittal.

Should you have any questions concerning this issue, please contact me.

Sincerely,

ORIGINAL SIGNED BY STEPHENIE L. PYLE

SLP/rwc

Attachment: Licensee Event Report 50-313/2014-002-00

cc: Mr. Marc L. Dapas
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
1600 East Lamar Boulevard
Arlington, TX 76011-4511

NRC Senior Resident Inspector
Arkansas Nuclear One
P.O. Box 310
London, AR 72847

Institute of Nuclear Power Operations
700 Galleria Parkway
Atlanta, GA 30339-5957
LEREvents@inpo.org

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Arkansas Nuclear One – Unit 1	05000313	YEAR	SEQUENTIAL NUMBER	REV. NO.	2 OF 4
		2014 -- 002 -- 00			

The current Loss-of-Coolant Accident (LOCA) Evaluation Model (EM) for Babcock & Wilcox (B&W) plants uses the fuel performance code TACO3. The identified deficiency is in the thermal conductivity model in this computer code. The deficiency is that the code does not adequately represent the reduction in fuel thermal conductivity with burnup. This issue was discussed in the NRC Information Notice (IN) 2009-23 "Nuclear Fuel Thermal Conductivity Degradation". Recent comparisons of the fuel temperatures from this code with fuel temperatures from the code GALILEO (a code that has an adequate fuel thermal conductivity model) indicate that the TACO3 code thermal conductivity model may lead to an under prediction of the Peak Clad Temperature (PCT) during a LOCA.

TACO3 does not model the thermal conductivity degradation (TCD) with burnup explicitly but has adjustments to the methodology and increases in the LOCA fuel temperature inputs. These adjustments were intended to compensate for the non-conservative thermal conductivity model in TACO3.

The continued use of this code was previously evaluated by AREVA in 2009 following the NRC issuance of Information Notice 2009-23. In 2009, it was concluded that sufficient conservatism in both code predictions and LOCA methodology compensated for a lack of TCD models based, in part, on comparisons to an early version of the code GALILEO. However this conclusion has been invalidated based on recent GALILEO LOCA initialization studies.

Based on these new Large Break LOCA (LBLOCA) initializations, it is concluded that the LOCA EM that uses TACO3 must be modified by application of additional fuel temperature uncertainty to account for the effects of TCD based on COPENIC2, a code that models TCD adequately.

An evaluation was performed by applying the EM change to a Lower-Loop LBLOCA model with an axial power shaped peaked at core elevation 2.506-feet (ft) with a middle-of-life (MOL) burnup condition. For the representative plant, the 95/95 volume-average fuel temperature from the limiting PCT case was increased by 230°F. The results of the evaluation show that the original limiting MOL case cladding temperatures at the core elevation of 2.506 ft were increased by 481°F for the ruptured node and 288°F for the unruptured node. The results of this evaluation can be generically applied to all B&W plants. These ruptured and unruptured node cladding temperature deltas were applied to the Arkansas Nuclear One, Unit 1 (ANO-1) full spectrum of MOL cases and led to an increase in limiting PCT of 388°F. An evaluation of the cladding temperatures at end-of-life (EOL) has confirmed that the MOL results were limiting. Also it is noted that the cladding temperatures at beginning-of-life (BOL) remain unaffected by TCD. This LBLOCA EM model change results in a significant increase to the calculated PCT. When applying the estimated PCT increases with the revised EM approach, the limiting PCT was estimated to be 2396°F, which is in excess of 2200°F.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Arkansas Nuclear One – Unit 1	05000313	YEAR	SEQUENTIAL NUMBER	REV. NO.	3 OF 4
		2014 -- 002 -- 00			

In order to reduce the PCT to less than 2200°F, AREVA recommended linear heat rate (LHR) limit reductions on October 21, 2014, and suggested that it was prudent to administratively implement any changes as a compensatory measure. The compensatory measures recommended a 2 kilowatt / foot reduction in the MOL LHRs. Imposition of the compensatory measures reduces the evaluated PCT to be equal to the PCT prior to the EM correction and thus less than 2200°F. As a precautionary measure pending the completed analysis, ANO-1 implemented the compensatory measures on October 20, 2014.

The local oxidation and whole core hydrogen also remain well within the 10 CFR 50.46 acceptance criteria for the LBLOCA scenarios. With the MOL LHR limit reduction, the core geometry remains amenable to cooling and acceptable long-term cooling is unaffected by these changes.

The impact of the EM correction and compensatory measure is summarized in Table 1 for LBLOCA and in Table 2 for Small Break LOCA (SBLOCA). The SBLOCA analyses are not sensitive to the initial fuel temperatures and thus the estimated impact on the SBLOCA peak cladding temperature is zero.

This deficiency will be corrected in a future LOCA analyses on an NRC agreed upon schedule.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
Arkansas Nuclear One – Unit 1	05000313	YEAR	SEQUENTIAL NUMBER	REV. NO.	4 OF 4
		2014 -- 002 -- 00			

Table 1**Summary of Peak Clad Temperature (PCT) Impact of
Large Break Loss-of-Coolant-Accident (LOCA) Changes and Errors**

Analysis	PCT (°F)	Delta PCT (°F)	Absolute Delta PCT (°F)*	Notes
Initial LBLOCA PCT [1]	2008.1			9.536-feet (ft) Beginning-Of-Life (BOL) Case
Thermal Conductivity Degradation (TCD) issue	2396	+388	388	Evaluation Model (EM) Change with updated uncertainty to account for TCD in TACO3 2.506-ft Middle-Of-Life (MOL) Case
MOL Linear Heat Rate (LHR) Reduction	2008.1	-388		Compensatory actions of updated imbalance limits based on 2 kilowatt/foot plant LHR reduction at MOL
Final Results	2008.1	0	388	

Table 2**Summary of PCT Impact of Small Break LOCA Changes and Errors**

Analysis	PCT (°F)	Delta PCT (°F)	Absolute Delta PCT (°F)*	Notes
Initial SBLOCA PCT [1]	1459			
TCD issue	1459	0	0	EM Change with updated uncertainty to account for TCD in TACO3
Final Results	1459	0	0	

[1] Entergy letter to NRC, "Annual 10 CFR 50.46 Report for Calendar Year 2013 Emergency Core Cooling System Evaluation Changes," dated June 24, 2014 (0CAN061402) (ML14175B275)