

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

														-
(02.2014)					APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017									
(02-2014) LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)							Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.							
1. FACILITY NAME 2. DOCKET NUMBER 3. PAGE														
Arkans	sas N	uclear (One – L	Jnit 1						05000	0313		1 OF	4
4. TITLE														
Specia	ıl Rep	ort – S	gnifica	nt Cha	ange in	Peak	Cladding	Tem	peratu	re				
5. EV	ENT D	ATE	6	. LER N	IUMBER		7. REF	PORT	DATE		8. OTHER	FACILITIES	NVOLVI	ĒD
MONTH	DAY	YEAR	YEAR		ENTIAL /IBER	REV NO.	MONTH	DAY	YEAR	N/A	FACILITY NAME		DOCKET NUMBER N/A	
11	25	2014	20	014 – 0	002 – 00)	12	22	2014	FACILIT N/A	Y NAME		DOCKET NUMBER N/A	
9. OPER	ATING	MODE	11. THIS	REPOR	RT IS SUI	BMITTE	D PURSUAN	т то т	HE REQ		TS OF 10 CFR	§: (Check all		y)
	1		20.22	☐ 20.2201(b) ☐ 20.2201(d) ☐ 20.2203(a)(1) ☐			20.2203(a)(3)(i) 20.2203(a)(3)(ii) 20.2203(a)(4) 50.36(c)(1)(i)(A)			□ 50.73(a)(2)(i)(C) □ 50.73(a) □ 50.73(a)(2)(ii)(A) □ 50.73(a) □ 50.73(a)(2)(ii)(B) □ 50.73(a)			3(a)(2)(vi 3(a)(2)(vi 3(a)(2)(vi 3(a)(2)(ix	iii)(A) iii)(B)
10. POW	ER LE	VEL		203(a)(2			50.36(c)(1			50.73	(a)(2)(iv)(A)	<u> </u>	3(a)(2)(x))
	1000/		_	203(a)(2				50.36(c)(2)						
	100%						☐ 50.73(a)(2)(v)(B) ☐ 73.71(a)(5) ☐ 50.73(a)(2)(v)(C) ☐ OTHER							
			20.2203(a)(2)(v)							(a)(2)(v)(C) (a)(2)(v)(D)	_	y in Abstra	act below	
				(- /(, ,						(-/(/(// /	or in N	RC Form	366A
LICENSEE	CONTAC	Т				12. LI	CENSEE CO	NIACI	FOR IH	IS LER	TELEPHON	E NUMBER (Inclu	de Area Co	de)
Stephe	nie L.	Pyle, M									479-85			,
			13. COM	PLETE					T FAILU	RE DESCR	RIBED IN THIS I	t		
CAUSE	s	YSTEM	COMPONENT MANU-FACTURER		REPORTABL TO EPIX		AUSE	SYSTEM		FACTU	RER	REPORTABLE TO EPIX		
N/A		N/A	N/	A	N/A	١.	N/A		N/A	N/A	N/A	N/A	١	N/A
		14. 9	SUPPLEM	IENTAL	REPORT	ГЕХРЕ	CTED				XPECTED	MONTH	DAY	YEAR
YES	(If yes,	complete	15. EXPE	CTED S	SUBMISS	ION DA	TE) 🛛 NO				MISSION DATE	N/A	N/A	N/A
ABSTRAC	T (Limit	to 1400 spa	aces, i.e., a	pproxima	tely 15 sing	gle-space	ed typewritten lir	nes)						
guidanto be o On No Nuclea accour 2200°F Excee	This report is submitted pursuant to the 30 day Special Report requirement of 10 CFR 50.46(a)(3)(ii). The guidance provided in NURGEG 1022, Revision 3, allows the reporting under 10 CFR 50.73 and 10 CFR 50.46 to be combined. On November 25, 2014, AREVA NP Inc. notified Entergy Operations, Inc. of a deficiency in the Arkansas Nuclear One, Unit 1 (ANO-1) Emergency Core Cooling System evaluation model. When the deficiency is accounted for, the Large Break Loss-of-Coolant Accident Peak Clad Temperature was estimated to exceed 2200°F and the absolute value of the deficiency is greater than the requirement of 10 CFR 50.46(a)(3)(ii). Exceeding 2200°F resulted in ANO-1 making an 8-hour NRC notification on November 25, 2014. See Event Notification EN 50641. The purpose of this report is to provide the information required by 10 CFR 50.46(a)(3)(ii).													

NRC FORM 366A (02-2014) LICENSEE EVENT REPORT (LER) U.S. NUCLEAR REGULATORY COMMISSION CONTINUATION SHEET						
1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE	
A	4 05000343	YEAR	SEQUENTIAL NUMBER	REV. NO.	2 05 4	
Arkansas Nuclear One – Unit	1 05000313	2014 002 00			2 OF 4	

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 conservatisms 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 COPERNIC2, 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.

(02-2014)	SEE EVENT			U.S. NUCLEAR REGULATORY COMMISSION		
1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE	
Arkanaga Nuglaar Ona - Unit 1	05000313	YEAR	SEQUENTIAL NUMBER	REV. NO.	3 OF 4	
Arkansas Nuclear One – Unit 1	03000313	2014 002 00			3014	

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.

NRC FORM 366A (02-2014)	ENSEE EVENT CONTINUATI		KI (LEK)	U.S. NUCLEAR REGULATORY COMMISSION		
1. FACILITY NAME	2. DOCKET		6. LER NUMBER		3. PAGE	
Arkonaga Nuglaar Ona	nit 1 05000313	YEAR	SEQUENTIAL NUMBER	REV. NO. 4 OF 4		
Arkansas Nuclear One – L	1111 1 03000313	2014 002 00			7014	

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)