

A Centerior Energy Company

EDISON PLAZA 300 MADISON AVENUE TOLEDO, OHIO 43652-0001

16231

AB-95-0006 NP-33-95-001

Docket No. 50-346

License No. NPF-3

February 24, 1995

United States Nuclear Regulatory Commission Document Control Desk Washington, D. C. 20555

Gentlemen:

## LER 95-001 Davis-Besse Nuclear Power Station, Unit No. 1 Date of Occurrence - January 26,1995

Enclosed please find Licensee Event Report 95-001, which is being submitted to provide 30 days written notification of the subject occurrence. This LER is being submitted in accordance with 10 CFR 50.73(a)(2)(1.1) and 10 CFR 50.46(a)(3)(ii).

Very truly yours,

John K. Wood Plant Manager Davis-Besse Nuclear Power Station

JKW/eld

Enclosure

cc: Mr. John B. Martin Regional Administrator USNRC Region III

> Mr. Stan Stasek DB-1 NRC Sr. Resident Inspector

Utility Radiological Safety Board

9503060055 950224 PDR ADDCK 05000346 S PDR

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSI					ISSION	APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95									
	(Se	LIC e reverse	ENSE	E EVENT RE	SPORT	(L	.ER) or each bid	ock)		ESTIMA INFORM COMME AND RE REGUU THE PI MANAG	TED BURD MATION CO ENTS REGAI ECORDS MA ATORY COM APERWORK EMENT AND	NEN PER DULECTION RDING BU NAGEME IMISSION REDUCT BUDGET	RESPONSE N REQUEST: JADEN ESTIMJ NT BRANCH (A WASHINGTON NON PROJECT WASHINGTON	TO CO 50.0 H ATE TO MNBB 77 N, DC 20 N, DC 20 N, DC 20	MPLY WITH HRS. FORM THE INFORM (14), U.S. NUC 0555-0001, AN 0104), OFFICI 0503.
ACILIT	Y NAME (1)		ale and			-	1			DOCKE	TNUMBER	(2)		No. of other	I DAGE (
avi	s-Bes	se Uni	t Num	per 1							C	5000-	346		1 OF
TLE (4	)					-				H.					l
ote	ntial	Ly Non	-Conse	ervative LOC	A Analy	ys	is Due	to Mo	odeli	ng Er	rors				
EV	ENT DAT	Έ (5)		LER NUMBER	(6)		REPORT NUMBER (7)			T	OTHER FACILITIES INVOLVED				D (8)
ONTH	DAY	YEAR	YEAR	SEQUENTIAL	REVISIO	NC	MONTH	DAY	VEAD	FACILITY	NAME	Theory Contractor		DOC	KET NUMBER
				NUMBER	NUMBE	ER.		DA.	1.000					0	5000
										FACILITY NAME				DOCKET NUMBER	
1	26	95	95	001	00		02	24	95	1				0	5000
OPER	RATING		THIS R	EPORT IS SUBMIT	TED PUR	SU/	ANT TO TH	E REQ	UIREM	ENTS O	F 10 CFR	1 1: (Ch	eck one or	more)	(11)
MU	UE (9)	1 1	20.4	02(0)	(D)		20.405(c)				50.73(	a) (2) (iv)			73.71(b)
PO	EL (10)	100	20.4	05(a)(1)(i)			50.36(c)(1	1			50.73(	a)(2)(v)	1)		73.71(c)
LEVE	L (10)	1100	20 405(a)(1)(ii)				50.36(c)(2	()		50.73(a)(2)(vii)		)	X	OTHER	
			20.405(a)(1)(III)				50.73(a)(2)(i)			50.73(a) (2) (viii) (A)		) (A)	below and in Text, N		
			20 405(a)(1)(iv)			X	50.73(a)(2)(ii)			50.73(a)(2)(viii)(B)		)(8)	Form 366A)		
			20.4	03(a)(1)(v)		-	00.73(a)(2	(m)		50.73(a		a)(2)(x)		150.46	
ME					LICENSEE	: 0	ONTACTE	OR THI	SLEA	(12)	TELEDW		000 4 1 1 1		
											I CLEPTK	DINE NUM	ach photode A	rea Gool	e}
01.11	an K.	Peter	son, S	Sr. Engineer	- L1C	en	sing				(419	9) 32	1-8450		
			COMPL	ETE ONE LINE FO	REACHC	ON	PONENT	FAILUR	E DESC	CRIBED	IN THIS	REPOR	T (13)		
CAUSE SYSTEM COM		COMP	PONENT MANUFACTURER REPO			E	CAUSE		SYSTEM COMPONENT MANUE		MANUFACT	ACTURER REPORTABLE			
					TO NERGO			-							TO NPROS
		1.11.11									1.0				
						-		-			+				
						- 1					100.00				
			01	IDDI CHICUTAL DC	CODT EV					-	1	-	1		and the second second
T vee			51	JPPLEMENTAL RE	PORTEXI	PEC	TED (14)					EX	PECTED	MON	TH DAY Y
(IT ye	a, complete	EXPECTED	SUBMISSIC	N DATE)		~	NO	DATE (15)							
CTO.	ACT					A		UATE (15)			AIC (15)	1			
STR	ACT (Lir	nit to 140	0 spaces.	i.e., approximately	15 single	spa	aced typew	ritten lin	ies) (16	6)					
	TT L			Adda a days		ac		i. Li z	6	D					
	100	e Loss	01 00	bolant Accid	lent (L	00	A) ana.	Lysis	for	Davis	s-bess	e 1s	perior	med	by
	B&	V Nucl	ear Te	echnologies	(BWNT)	•	This a	analy	sis c	ieteri	nines	the i	allowab	le	
	111	near h	eat ra	ate limits a	s pres	en	ted in	the	Core	Opera	ating	Limi	ts Repo	rt	
	(C(	)LR),	which	is referenc	ed by	th	e Techr	nical	Spec	cifica	ations	(TS	). The	COL	R
	pro	ovides	accep	otance crite	eria fo	r	some T	5 sur	veill	lance	requi	reme	nts. B	WNT	has
	de	termin	ed th	hat the LOCA	analy	si	s resul	lts f	or th	ie 2-1	ft cor	e el	evation	are	
	po	tentia	lly no	on-conservat	ive.	BW	NT ini	tiate	dal	reli	ninary	Safe	ety Con	cern	
	(P	SC 5-9	4) on	November 28	, 1994	a	nd nct:	lfied	the	Nucle	ear Re	gula	tory		
	Cor	nmissi	on (NE	RC) of this	concer	n	by let	ter d	ated	Janua	ary 27	, 19	95. Th	e NR	С
	Vas	s not!	fied b	y Toledo Ed	lison v	ia	Emerge	ency	Notif	ficat	ion Sv	stem	(ENS)	at 1	522
	ho	irs on	Janua	rv 26, 1995	under	1	OCFR 50	).72	(b)(1	)(11	(B) b	ecau	se the		
	DO	1-cons	ervati	ism could re	sult i	n	the pre	dict	ed ne	ak c	lad to	mper	ature		
	evi	eedin	a 1001	2850.46 limi	te at	th	e 2_ft	core	ele	ation	. Fy	icti	ng plan	+	
	CAL	aratin	g reel	trictions or	o cuff	in	iont to	Dre	clude	lim	ite fr	om b	aing ou	cood	bo
	Th	in oue	s lesi	hoing report	tod up	de	r 10 C	pre so	726	1/2)	(11)(1)	) 20	erng ex	itte	eu.
	1.11.	o eve	111 12	being repor	rea au	and.	1 10 01	NU				1 11.25	0 0000	1110	11
	275.2.5	E 2 3 1 1 1 1 1 1 1	the m	antia danta	n haai	-	This	rone		100 F.	16411	n +1			
			a boot the second		1 1		2001 J		.1310	1101	121/10	1			
	ou	tside	the pl	lant's desig	n basi	5.	This	repo	rt al	lso fu	ulfill	s the	e repor	ting	

NRC FORM 366A

# U.S. NUCLEAR REGULATORY COMMISSION

#### APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95

# LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (0150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)		PAGE (3)				
	05000 - 346	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER		
Davis-Besse Unit Number 1	05000 340	95	- 001 -	00	02 OF 06	

TEXT (II more space is required, use additional copies of NRC Form 306A) (17)

#### Description of Occurrence:

Recently, the Loss of Coolant Accident (LOCA) analysis applicable to Davis-Besse, performed by B&W Nuclear Technologies (BWNT), has concluded that the analytical results for the 2-ft core elevation are potentially non-conservative. The non-conservatism is the result of the discovery of a more adverse combination of Core Flood Tank (CFT) level and pressure than was previously believed to be bounding. Specifically, operation with CFT at the maximum permissible level and the minimum permissible pressure results in the most rapid CFT pressure decrease and lowest rate of core flood injection. It was determined that only the 2-ft core elevation is sensitive to this reduction in flow rate.

Additionally, during the investigation of this condition, a computer code interface concern between the CRAFT2 and THETA1-B computer codes used in the LOCA analysis was discovered. Coarse noding in the core model and internal CRAFT2 treatment of refilling nodes combined with a low data sampling rate produced a non-conservative enthalpy input into the THETA1-B code. This caused significant changes in the analytical results to occur only at the 2-ft core elevation. These computer codes and methodology are part of the Nuclear Regulatory Commission (NRC) approved 10 CFR 50, Appendix K LOCA Evaluation Model.

BWNT initiated an internal Preliminary Safety Concern (PSC 5-94) on November 28, 1994. The preliminary evaluation in response to PSC 5-94 concluded that a reduction in the 2-ft allowable linear heat rate of 1.3 KW/ft is sufficient to maintain Peak Cladding Temperature (PCT) within the established limits for all B&W plants. The B&W Fuel Company has reviewed the Davis-Besse core operating limits for the present cycle and has concluded that power tilt, power imbalance, and control rod insertion limits, as provided in the Technical Specifications (TS), are not adversely impacted, however, the Core Operating Limits Report (COLR) allowable linear heat rates (LHRs) are adversely affected and will be revised.

### Apparent Cause of Occurrence:

The apparent cause for this condition was that the assumption made in the original analysis was not conservative at the 2-ft elevation. During original licensing of the LOCA evaluation model, nominal CFT initial conditions (level and pressure) were used. Sensitivity studies done by BWNT at the core midplane (6-ft.elevation) indicated that initial conditions

NRC FORM 366A U.S. NUCLEAR REGULATORY COMMISSION APPROVED BY OMB NO. 3150-0104 (5-92) **EXPIRES 5/31/95** ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION LICENSEE EVENT REPORT (LER) TEXT CONTINUATION AND RECORDS MANAGEMENT BRANCH (MN88 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20055-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503 FACILITY NAME (1) DOCKET NUMBER (2) LER NUMBER (6) PAGE (3) SEQUENDA YEAR NUMBER NUMBER 05000-346 03 OF 06 Davis-Besse Unit Number 1 95 001 00

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

### Apparent Cause of Occurrence (Continued):

using minimum CFT level and pressure were the most conservative for evaluating PCT. In an attempt to bound all permissible operating conditions, these CFT parameters were adopted for use in subsequent analyses. However, it was recently discovered that the most limiting initial conditions for the 2-ft elevation PCT analysis are the maximum CFT liquid inventory and minimum pressure.

The apparent cause for the second issue concerning computer code behavior was less than ideal familiarity with the internal operation of the CRAFT2 code used in the currently approved Emergency Core Cooling System (ECCS) evaluation model. Earlier extensive reviews by all involved parties failed to detect the noted deficiencies. A contributing factor is that the existing evaluation model is cumbersome to use, placing practical limits on extent and frequency of use. Thus, experience and expertise in its application is limited.

## Analysis of Occurrence:

When the CFT input parameter changes were analyzed with the current evaluation model and existing allowable LHRs, the calculated PCT change at the 2-ft elevation was found to be greater than 50° F and exceeded 2200°F. However, if the LOCA LHR limits at the 2-ft elevation are reduced by 1.3 KW/ft, all PCTs will meet the acceptance criteria contained in 10 CFR 50.46.

In November 1994, a sensitivity study performed by BWNT for another utility using the RELAP5/MOD2-based evaluation model for the Mark-B11 fuel design revealed that the maximum CFT liquid inventory would produce the highest PCT at the 2-ft elevation. It was found that the combination of minimum gas volume and minimum pressure would result in the lowest CFT flow during the adiabatic heatup period. This low flow decreased the liquid remaining in the reactor vessel lower plenum and extends the time period to refill the lower plenum. The net result was an increase in the adiabatic heatup period by approximately 20 percent. The PCT was found to be higher than would be produced with the minimum CFT initial liquid volume.

On this basis, Preliminary Safety Concern (PSC) 5-94 was initiated. This PSC related to the anticipated PCT variation associated with the input of the minimum versus the maximum CFT liquid inventory in the approved Large Break LOCA ECCS analyses.

NRC FORM 366A

## U.S. NUCLEAR REGULATORY COMMISSION

#### APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) PAGE (					
	05000-3/6		SEQUENTIAL NUMBER	REVISION NUMBER			
Davis-Besse Unit Number 1	05000-346	95	- 001 -	00	04 OF 06		

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Analysis of Occur ence (Continued):

The adverse effects from the CFT parameter changes were compounded by an observed variation in the CRAFT2 core path inlet enthalpy supplied by the CRAFT2 code to THETA1-B for the hot fuel pin thermal analysis. The enthalpy was supplied to THETA1-B on a coarse data frequency (one point every 0.5 seconds). However, the CRAFT2 output was subject to high frequency oscillations that corresponded to the changes in instantaneous flow direction. The calculated PCT was found to be sensitive to the enthalpy sampling because a large enthalpy difference existed between the two nodes surrounding the 2-ft elevation. In addition to the oscillations, it was observed that the enthalpy could also be skewed in the non-conservative direction by a nonhomogeneous treatment of the core nodes following total dryout with subsequent return to two-phase conditions. The Large Break LOCA blowdown model is constrained to homogeneous flows calculated by homogenous node conditions. So long as the nodes remain continuously in two-phase Large Break LOCA conditions the homogeneous conditions are correctly calculated. After dryout and return to two-phase conditions, however, the homogeneous condition is not met. Under these conditions, CRAFT2 allows the node to separate the steam and liquid phases. Because of the flow path connections, this configuration can artificially cause the inlet flow path enthalpy to be lower than the model homogeneous enthalpy. Since this enthalpy is transferred to THETA1-B, it can cause nonconservative conditions to be used for the hot fuel pin analysis. While this mechanism could potentially affect results at all elevations, significant affects are limited to the 2-ft elevation.

## Corrective Actions:

After the initial 2-ft LHR limit reduction estimates were available, BWNT evaluated the current fuel cycle to determine if the operating limits remained valid. Technical Specification operating limits are not affected and remain valid. Therefore, this condition has minimal safety significance. Administrative reductions of 1.5 kW/ft have been temporarily applied to the affected LHR limits as provided in the COLR. These COLR limits are applicable only under certain core flux imbalance or tilt conditions (e.g., dropped rod). This assures that PCTs would remain acceptable even if a LOCA should occur during unusual operations outside the TS limits. Based on the most recent preliminary results, required reductions in allowable linear heat rates for Davis-Besse are considerably less than the worst case generic B&W plant predicted required reduction (1.3 kW/ft). The 1.5 kW/ft administrative reduction in LHR limits applied at Davis-Besse is conservative.

NRC FORM 366A U.S. NUCLEAR REGULATORY COMMISSION APPROVED BY OMB NO. 3150-0104 (5-92) EXPIRES 5/31/95 ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 MRS. FORMARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION LICENSEE EVENT REPORT (LER) TEXT CONTINUATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 2055-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503 FACILITY NAME (1) DOCKET NUMBER (2) LER NUMBER (8) PAGE (3) SEQUENTIA REVISION YEAR NUMBER NUMBER 05000 - 346 05 OF 06 Davis-Besse Unit Number 1 95 001 00 TEXT (II more space is required, use additional copies of NRC Form 3664) (17)

Corrective Actions (Continued):

The adjustment of the traditional CFT liquid inventory input assumption and non-conservative enthalpy specified to the hot fuel pin thermal analysis will produce changes in the Large Break LOCA peak cladding temperature in excess of 50° F. Reductions in the LOCA LHR limits are required to continue to meet the 10 CFR 50.46 acceptance criteria. The most conservative CFT liquid inventory input will be used in analyses that conservatively adjust the enthalpy transferred from the CRAFT2 results to THETA1-B for the hot fuel pin analysis. The work performed to date supports the validity of a simple change in the enthalpy data transfer to the THETA1-B analysis, without input model changes or use of a new CRAFT2 code version. The current analyses will continue to calculate the CRAFT2 blowdown transient without any changes. The inlet enthalpy for the CRAFT2 analysis will be adjusted before the input is supplied to THETA1-B. The inlet enthalpy will be conservatively set to envelope on the upstream homogeneous nodal enthalpy based on the filtered flow direction. THETA1-B will be run with this conservative enthalpy to determine a PCT. The new 2-ft LOCA LHR limits will be used in maneuvering analyses to determine if any changes are needed to the core operating limits. The required analyses are in progress. The results of the LOCA analyses, including changes the COLR, are scheduled to be completed by August of this vear.

A report will be sent to the NRC by BWNT within 30 days of the completion of the aforementioned reanalyses. Toledo Edison will also provide the COLR revisions to the NRC in accordance with T.S. 6.9.1.7 within 30 days of the completion of the BWNT analyses.

The existing CRAFT2/THETA1-B based evaluation model is in the process of being replaced by a RELAP5 based evaluation model. A topical report (BAW-10192) describing the new evaluation model was submitted for NRC review in February, 1994. The new model does not suffer from the same technical shortcomings as the CRAFT2 based model and is more economical to use. It utilizes modern thermal-hydraulic techniques and requires fewer manual interfaces. The core noding in the new model is much finer, leading to more reliable results. NRC FORM 366A U.S. NUCLEAR REGULATORY COMMISSION APPROVED BY OME NO. 3150-0104 (5-92) EXPIRES 5/31/95 ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST 50.0 HRS. FORMARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR LICENSEE EVENT REPORT (LER) TEXT CONTINUATION REGULATORY COMMISSION, WASHINGTON, DC 2055-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), DFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503. FACILITY NAME (1) DOCKET NUMBER (2) LER NUMBER (6) PAGE (3) SEQUENTIA. REVISION YEAR NUMBER NUMBER 05000-346 06 OF 06 Davis-Besse Unit Number 1 95 001 00

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

#### Failure Data:

1.8

In the past five years, there has been one Licensee Event Report (LER) submitted describing an error in the Davis-Besse LOCA analysis. LER 91-006 describes an event where the analysis of boron concentration in the core after a LOCA in the Reactor Coolant System cold leg was non-conservative.

NP-33-95-001

PCAQR: 94-1327