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ACCESSION NBR:8905110124 DOC.DATE: 89/05/01 NOTARIZED: NO DOCKET #
 FACIL:50-316 Donald C. Cook Nuclear Power Plant, Unit 2, Indiana & 05000316
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SUBJECT: LER 89-009-00:on 890331, rated thermal power exceeded due to
 computer program error.

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) D. C. Cook Nuclear Plant - Unit Two										DOCKET NUMBER (2) 0 5 0 0 0 3 1 6				PAGE (3) 1 OF 0 5		
TITLE (4) Rated Thermal Power Exceeded on Unit Two Due to Computer Program Error																
EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)						
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES				DOCKET NUMBER(S)			
0	3	3	1	8	9	8	9	0	0	9	Cook Plant				0 5 0 0 0 3 1 6	
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)																
OPERATING MODE (9)		1														
POWER LEVEL (10)		1 0 0														
		20.402(b)				20.405(c)				50.73(a)(2)(iv)				73.71(b)		
		20.405(a)(1)(i)				50.38(c)(1)				50.73(a)(2)(v)				73.71(c)		
		20.405(a)(1)(ii)				50.38(c)(2)				50.73(a)(2)(vi)				OTHER (Specify in Abstract below and in Text, NRC Form 366A)		
		20.405(a)(1)(iii)				50.73(a)(2)(i)				50.73(a)(2)(viii)(A)						
		20.405(a)(1)(iv)				50.73(a)(2)(ii)				50.73(a)(2)(viii)(B)						
		20.405(a)(1)(v)				50.73(a)(2)(iii)				50.73(a)(2)(ix)						
LICENSEE CONTACT FOR THIS LER (12)																
NAME T. K. Postlewait Technical Engineering Superintendent										TELEPHONE NUMBER AREA CODE 6 1 6 4 6 5 - 1 5 9 0 1						
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC						
SUPPLEMENTAL REPORT EXPECTED (14)												EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)												X NO				
ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)																

On March 31, 1989, with Unit Two operating at 100 percent reactor thermal power (Unit One in refueling), it was suspected that a discrepancy existed in the Westinghouse P-250 computer calculated thermal power value, which, if true, would lead to exceeding Rated Thermal Power. Investigation revealed the blowdown-mass enthalpy term ($m_{bd} h_{bd}$) was not included in the Thermal Output Program. Assumed worst case analysis indicated a potential 1.8 percent difference between the P-250 calculated and actual thermal power. This took into account plant conditions in which maximum computer program code error existed and assumed actual blowdown flow was 50 percent of the blowdown compensation (constants). Actual detailed evaluation has confirmed a 0.81 percent error for Unit Two. It is expected that detailed evaluation on Unit One, following startup, will similarly reduce the actual power deviation. It should be noted that, although the errors in the P-250 program have existed since initial startup, the Cook units have been administratively restricted to 90 and 80 percent power, respectively, for essentially the entire cycle of the existing fuel. Unit Two is now operating conservatively using no compensation for blowdown flow (actual reactor thermal power is less than P-250 calculated thermal power). Prior to Unit One startup, changes will be made to ensure it will operate conservatively. Enhancement to the P-250 computer program is being pursued.

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/88

FACILITY NAME (1) D. C. Cook Nuclear Plant Unit Two	DOCKET NUMBER (2) 0 5 0 0 0 3 1 6	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		8 9	— 0 0 9	— 0 0	0 2	OF	0 5

TEXT (If more space is required, use additional NRC Form 365A's) (17)

Conditions Prior To Occurrence

Unit One in Mode 6 (Refueling)

Unit Two in Mode 1 (Power Operation) at 100% power

Description of Event

On March 31, 1989, with Unit Two operating at 100 percent reactor thermal power (Unit One shut down for refueling), it was suspected that a discrepancy existed in the Westinghouse P-250 computer (EIIS/ID) calculated thermal power value, which, if true, would lead to exceeding Rated Thermal Power, when operating at calculated 100 percent Rated Thermal Power. The unit had been operating at an administrative limit of 80 percent reactor thermal power, as a steam generator conservation measure, for approximately four years and was recently returned to 100 percent reactor thermal power. The steam generator startup flashtank (EIIS/WI-TK) had been in operation for an extended amount of time since unit startup on March 17, 1989. At 0400 hours, steam generator blowdown was removed from startup flashtank operation. Following isolation of blowdown flow and the removal of the P-250 computer compensation (constants) (m_{bd}) for blowdown, the licensed Control Room Reactor Operators noticed an increase in the P-250 calculated thermal power of approximately 1 percent with no indicated change to NI power. Operations immediately reduced reactor power until the cause of the P-250 calculated reactor thermal power increase could be found.

To operate conservatively, the Unit Two procedure for placing/removing steam generator blowdown in/out of service was modified (at approximately 2000 hours on March 31, 1989) such that no feedwater flow compensation would be made for blowdown (i.e., actual reactor thermal power will always be less than P-250 calculated reactor thermal power while blowdown is in service).

On April 14, 1989, investigation revealed a possible deficiency with the P-250 Thermal Output Program. On April 21, 1989, following review of the situation by Westinghouse, it was verified that the blowdown-mass enthalpy term ($m_{bd} h_{bd}$) was not included in the Thermal Output Program Code. This program error has existed since initial criticality in both Unit One and Unit Two. It affects P-250 calculated reactor thermal power nonconservatively whenever blowdown (either the startup or normal flashtank operation) is in service. The errors caused by this missing term are 35.1 MWt or 1.08 percent of rated thermal power (Unit One startup flashtank), 6.0 MWt or 0.18 percent of rated thermal power (Unit One normal flashtank), 27.5 MWt or 0.81 percent of rated thermal power (Unit Two startup flashtank) and 7.3 MWt or 0.21 percent of rated thermal power (Unit Two normal flashtank).

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/88

FACILITY NAME (1) D. C. Cook Nuclear Plant Unit Two	DOCKET NUMBER (2) 0 5 0 0 0 3 1 6 8 9 - 0 0 9 - 0 0 0 3 OF 0 5	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			

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

Description of Event, Continued

$$\text{Real SGTO} = (m_{fw} - m_{bd})h_{stm} - m_{fw}h_{fw} + m_{bd}h_{bd}$$

$$\text{P-250 SGTO} = (m_{fw} - m_{bd})h_{stm} - m_{fw}h_{fw}$$

$$\text{Error} = m_{bd}h_{bd}$$

SGTO = Steam Generator Thermal Output

 m_{fw} = mass of feedwater m_{bd} = mass of blowdown h_{stm} = enthalpy of steam h_{fw} = enthalpy of feedwater h_{bd} = enthalpy of blowdown

The MWt power increase the operators noted on the March 31, 1989 incident was approximately one percent. This corresponds to the 0.81 percent power error for Unit Two startup flashtank operation caused by the missing blowdown-mass enthalpy term.

Cause of Event

Investigation revealed the blowdown-mass enthalpy term was not included in the Thermal Output Program. This Thermal Output Program was supplied by Westinghouse prior to initial criticality. The program code was reviewed by Westinghouse and verified deficient on April 21, 1989.

Analysis of Event

The Unit Two accident analyses were performed with consideration of the fact that actual core power may deviate from Rated Thermal Power. This means the reactor was assumed to be at 102 percent of Rated Thermal Power, unless the limiting case was a lower power level or a spectrum of powers was analyzed. Similar 2 percent allowances are made for the Unit One analyses. For the Unit One analyses performed with the Westinghouse Improved Thermal Design Procedure, however, the 2 percent allowance is built into the DNBR limit for DNBR transients. The 2 percent allowance is intended to cover calorimetric error or short-term drifts in power.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES: 8/31/88

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
D. C. Cook Nuclear Plant Unit Two	0 5 0 0 0 3 1 6	8 9	— 0 0 9	— 0 0	0 4	OF	0 5

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

Analysis of Event, Continued

The largest P-250 calculated reactor thermal power deviation caused by the missing blowdown-mass enthalpy term would have occurred on Unit One during startup flashtank operation. An analysis of the assumed worst case, which took into account actual blowdown flow being 50 percent of the P-250 blowdown compensation (constants), shows a 58.6 MWt or 1.8 percent (Unit One) and 46.0 MWt or 1.3 percent (Unit Two) difference between actual and P-250 calculated thermal power. Actual deviations of calculated thermal power on Unit Two confirm the 0.81 percent error due to the missing $m_{bd} h_{bd}$ term. Therefore, no significant error in m_{bd} is believed to exist on Unit Two. There is no reason to believe that the 1.8 percent worst case error for Unit One would not similarly be reduced (to 1.08 percent) following verification of the blowdown flow computer constants upon return to service of the unit.

This maximum power deviation, due to blowdown error, of 1.8 percent of Rated Thermal Power is bounded by the 2 percent allowance in the accident analysis and therefore no significant threat to public health and safety existed. The condition is determined to be reportable per 10 CFR 50.73 (a)(2)(i)(B), as operation prohibited by the plant's Technical Specifications (T/S). (T/S 3.2.6 requires power to be less than or equal to 100 percent power. License conditions C(1) clarifies this to be a steady state power of 100 percent). The report is considered necessary only because of literal interpretation of the T/S and license requirements. The blowdown error appears to be an unanticipated systematic error which takes us out of literal compliance. The safety analysis assumed a 2 percent error in steady state reactor power to account for calorimetric errors. We believe the intent of the T/S was to ensure steady state reactor power did not exceed 100 percent power as indicated to the operators, with the 2 percent allowance accounting for deviations between the indicated and actual power.

Fuel cycle burnup tolerances were also affected. For Unit Two, the effect of the burnup was within the cycle burnup tolerance provided by the fuel vendor. For Unit One, the effect on burnup is being reviewed by the fuel vendor prior to unit startup.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1) D. C. Cook Nuclear Plant Unit Two	DOCKET NUMBER (2) 0 5 0 0 0 3 1 6	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		8 9	0 0 9	0 0	0 5	OF	0 5

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

Corrective Action

Immediate compensating action for Unit Two was completed on March 31, 1989, via a procedure modification. The procedure for placing/removing steam generator blowdown in/out of service was modified such that no compensation would be made for blowdown whenever it is in service. Corresponding modifications will be made to the Unit One procedure prior to unit startup. This modification conservatively bounds both of the potential sources of error (i.e., the missing blowdown-mass enthalpy term and the possible non-conservative blowdown compensation (constants)). However, the procedure modification causes the units to operate at less than 100 percent actual Rated Thermal Power when blowdown is in service. We are investigating possible enhancements to the P-250 computer code. These enhancements would allow the units to operate at actual full Rated Thermal Power with blowdown in service.

Failed Component Identification

None.

Previous Similar Events

None.

Indiana Michigan
Power Company
Cook Nuclear Plant
P.O. Box 458
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616 465 5901



May 1, 1989

United States Nuclear Regulatory Commission
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Docket No. 50-316

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In accordance with the criteria established by 10 CFR 50.73
entitled Licensee Event Reporting System, the following
report is being submitted:

89-009-00

Sincerely,

A handwritten signature in cursive script, appearing to read 'W. G. Smith, Jr.'.

W. G. Smith, Jr.
Plant Manager

WGS:clw

Attachment

cc: D. H. Williams, Jr.
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