NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Catawba Nuclear Station, Unit 1	0 5 0 0 0 4 1 3	1 OF 0 5

TITLE (4)
Shorted Lamp Socket Causes Reactor Trip Due To Design Deficiency

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 7	1 7	8 6	8 6	0 4 0	0 1	1 0	2 3	8 6	N/A	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 8 5	20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X 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)	50.72(b)(2)(ii)
		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)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
Roger W. Ouellette, Associate Engineer - Licensing	7 0 4 3 7 3 - 7 5 3 0

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
B	T B	I I L	C 7 7 0	NO							

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 July 17, 1986, at 1504 hours, the Unit 1 Reactor tripped due to a shorted lamp socket. A relay coil continuity indicating lamp socket in the Zone B Lockout relaying shorted. When the lamp socket shorted the associated relay energized causing a Zone B lockout and a Main Generator trip. The resulting loss of hydraulic pressure to the Main Turbine Control Valves caused a Reactor trip which then caused a Turbine trip. The unit was at 85% power at the time of this incident.

This incident is assigned Cause Code B, Design, Manufacturing, Construction/ Installation Deficiency. The design documents incorrectly specified terminal connections for the lamp socket. With the connections used, the lamp socket resistor operated at a high power causing the resistor to short, energizing the lockout relay.

This incident is reportable pursuant to 10 CFR 50.73, Section (a)(2)(iv) and 10 CFR 50.72, Section (b)(2)(ii).

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

BACKGROUND

The purpose of the Unit Main Power System Protective Relaying System is to promptly, precisely, and reliably remove from service any element of the power system when that element is subjected to an abnormal condition that may prove detrimental to the effective operation and integrity of the system. The Protective Relaying System must perform its functions while minimizing both the amount and degree of cycling the Unit is subjected to. The 22KV Main Power System is divided into three distinct zones of protection: the generator zone (Zone G), the train A normal offsite station feeder and associated transformers (Transformer Zone A), and the train B normal offsite station feeder and associated transformers (Transformer Zone B).

The lamp socket that failed is associated with a Transformer Zone B Lockout Relay 86BB1. The function of this relay is to trip the associated generator breaker, Motor Operated Disconnects, associated switchyard power circuit breakers, and the associated switchgear breakers. The lamp serves a function of indicating relay coil continuity and is in a series circuit with the relay coil.

DESCRIPTION OF INCIDENT

On July 17, 1986, at 1504:42:051 hours, a Generator Power Circuit Breaker B Fail To Trip Lockout alarm was received due to a short in a lamp socket. The Zone B Lockout caused the Main Generator (EIIS:TB) breakers to open at 1504:42 hours. The resulting loss of load caused the Turbine Control valves to close. The Electro Hydraulic Control System (EIIS:TG) interpreted the valves closing as a Turbine trip and subsequently tripped the Reactor at 1504:42:207 hours. The Turbine then received a trip singal at 1504:42:227 hours. Immediately, Motor Driven Auxiliary Feedwater (CA) (EIIS:BA) pump B started automatically. Between 1504:43:036 hours, and 1504:43:097 hours, Steam Generator (S/G) lo-lo level alarms were received on all four S/Gs. S/G lo-lo level alarms returned to normal between 1504:43:528 hours, and 1504:43:595 hours. Main Feedwater (CF) (EIIS:SJ) Pump Turbine (CFPT) A tripped at 1504:43:640 due to low oil pressure. At 1504:44 hours, Blowdown Isolation occurred and the Main Steam Bypass to Condenser Control Valves opened. The Turbine Driven CA Pump (CAPT) started at 1504:47 hours, due to lo-lo levels in 2 out of 4 S/Gs. At 1505:00:301 hours, CFPT B Solid State Protection System (SSPS) (EIIS:JC) trip occurred and at 1505:00:305 hours, CFPT B SSPS trip occurred. At 1505:02 hours, CF Isolation occurred, and the Main Steam Bypass to Condenser Control Valves closed. The CF isolation was reset at 1505:50 hours. The CAPT was secured at 1506:20 hours, CFPT A was started at 1625:11 hours, Motor Driven CA Pump B was secured at 1822:46 hours, and Motor Driven CA Pump A was secured at 2319:46 hours.

CONCLUSION

This incident is assigned Cause Code B, Design, Manufacturing, Construction/ Installation Deficiency. The connection diagram for the lamp specified the wiring incorrectly. The lamp was wired from terminal 1 to L2 and should have been wired from terminal 1 to L1. When the lamp is wired from terminal 1 to L2, an 1800 ohm

resistor is in series with the light bulb. With the lower resistance and the light being continually energized, the heat generated was large enough to cause the resistor to short due to being encased in the lamp socket. Normally, a resistor would open circuit if operated outside of its specified power range. If the higher resistance had been used the power dissipation would have been reduced and the lamps resistor may not have shorted. When the resistor shorted enough current was present to cause the relay to energize causing the zone B lockout. The Zone B Lockout relay 86BB1 was mislabeled as 86BA1. The labeling deficiency was corrected.

Three Nuclear Station Modifications (NSMs) have been written to correct this problem. The NSMs are written for the switchyard, Unit 1, and Unit 2. The modification will remove the relay coil continuity indicating light from the relay coil circuit. The light will be used to indicate relay status through the use of an auxiliary contact on the relay.

The Reactor trip was caused by a loss of hydraulic pressure to the Main Turbine Control valves. The SSPS senses the closing of the Main Turbine Control valves through a loss of hydraulic pressure to these valves. This signal also trips the Reactor. It is recognized that this setup is deficient and a Nuclear Station Modification has been issued to correct this problem during the second refueling outage. The modification will revise the control system to trip the Reactor on a closing of the Main Turbine Stop valves.

A Turbine Overspeed turbine trip was received but the transient monitor graph did not reveal an overspeed condition. This problem will be investigated to verify the validity of the trip.

Condenser Dump valve 1SB027 experienced spurious cycling during the trip and a Work Request was issued to investigate and repair the valve.

Main Feedwater Pump Turbine A tripped on low oil pressure as a result of a loss of power to both Main Oil Pumps associated with the Turbine. Power was lost when the Zone B Lockout occurred.

The transient monitor plot of main turbine speed and turbine generator megawatts showed sporadic indications caused by instrument problems. These problems occurred approximately nine minutes after the trip and lasted about four minutes. A Work Request was issued to investigate and repair this problem.

The failed lamp and socket are a Cutler-Hammer model E29NY1. There were no NPRDS reported failures found that resulted in a Reactor trip due to a shorted lamp socket. This failure is reportable to NPRDS.

There are three other incidents considered similar to this one. In the other incidents inadequate grounding/shielding specifications for signal wires caused radiation monitor actuations resulting in termination of containment air releases. The incidents are LERs 414/86-02, 414/86-08 and 414/86-27.

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CORRECTIVE ACTION

(1) The lamp and socket associated with relay 86BB1 was replaced.

(2) The labeling for relay 86BB1 was corrected.

(3) NSMs were issued to modify the relay continuity indicating circuit to indicate relay status using an auxiliary contact on the relay.

SAFETY ANALYSIS

This incident is classified as a "Loss of External Electrical Load and/or Turbine Trip:. Off-site power remained available for continued operation. Although the unit is designed to accommodate a full-load rejection, the Reactor tripped on a signal resulting from closing the Turbine Control Valves (to satisfy the P-9 interlock above 69% power), which in turn caused the actual turbine trip. The present design of SSPS sensing of a Turbine trip by low hydraulic oil pressure associated with the Turbine Control valves is conservative with respect to Reactor Control following a transient. However, the present design can non-conservatively effect generating reliability. The loss of external electrical load (trip of the generator) in itself is covered by the Turbine Generator Trip Abnormal Procedure, AP/1/A/5500/002, and the Reactor Trip which resulted is covered by the Reactor Trip or Safety Injection Emergency Procedure, EP/1/A/5000/001.

Reactor Trip Breakers RTB and RTA responded to the trip signal within 62 and 70 milliseconds, respectively, within the required limits.

Immediately following the Reactor trip, CA Pump 1B and the CAPT auto-started, the former on a lo-lo level signal from one S/G and the latter from two S/Gs (CA Pump 1A was already in service at the time of the trip). However, lo-lo level did not actually occur in any of the S/Gs, but rather, the signal was generated due to the level transmitter "ringing" phenomena revealed in the Unit 1 Reactor Trip of April 19, 1986 (see LER 413/86-22). The motor-driven CA Pumps would have been required to start regardless of the instrument problem, due to the protective trip of both CF Pumps following CF isolation on a Low Tave/Reactor Trip signal. The CAPT was secured approximately 1.5 minutes after the auto-start.

Emergency core cooling and emergency power were not required and were not actuated.

Following the Reactor trip, reactivity was controlled by rod insertion. The excess steam load was accommodated by steam dump to the condenser with the atmospheric dumps available as a backup. The S/G power-operated relief valves (PORV) were also available in the event that the condenser dumps failed to open. However, the PORVs were not required, nor were they actuated. Residual heat was removed by the CA pumps to the condenser.

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Pressurizer pressure responded as expected and attained the no-load target of 2235 psig, approximately 17 minutes after the trip. Pressurizer level was stabilized shortly after the trip at approximately 5% above the no-load target of 25%. All other parameters responded as expected. No radioactivity was released as a result of this event.

The event analysis for which this event is classified shows that the unit design is such that a total loss of full external electrical load, with or without a direct or immediate Reactor trip, presents no hazard to the integrity of the Reactor Coolant System (EIIS:AB) or the Main Steam System (EIIS:SB). The analysis takes no credit for operation of the steam dump system or S/G PORVs and assumes manual Reactor control.

The health and safety of the public were not affected by this incident.

DUKE POWER COMPANY
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HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

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October 23, 1986

Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Catawba Nuclear Station, Unit 1
Docket No. 50-413

Gentlemen:

Pursuant to 10 CFR 50.73 Section (a) (1) and (d), attached is Revision 1 to Licensee Event Report 413/86-40 concerning a shorted lamp socket causing a Reactor trip due to a design deficiency. This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Hal B. Tucker

RWO/58/slb

Attachment

xc: Dr. J. Nelson Grace, Regional Administrator
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