CCELERATED DISTRIBUTION DEMONSTRATION SYSTEM REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS) ACCESSION NBR:9111070147 DOC.DATE: 91/11/01 NOTARIZED: NO DOCKET # FACIL: 50-269 Oconee Nuclear Station, Unit 1, Duke Power Co. 05000269 AUTH .NAME AUTHOR AFFILIATION LOWERY, H.R. Duke Power Co. BARRON, H.B. Duke Power Co. RECIP.NAME RECIPIENT AFFILIATION R I SUBJECT: LER 91-011-00:on 911002, reactor tripped due to electrical generator lockout after equipment failure in generator protective relay circuit. Terminal connections tightened & . D coupling rebalanced.W/911101 ltr. S DISTRIBUTION CODE: IE22T COPIES RECEIVED:LTR ENCL SIZE: TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc. NOTES: А RECIPIENT COPIES RECIPIENT COPIES D ID CODE/NAME LTTR ENCL ID CODE/NAME LTTR ENCL PD2-3 LA 1 1 PD2-3 PD 1 1 D WIENS, L 1 1 **S** . INTERNAL: ACNW 2 2 ACRS 2 2 AEOD/DOA 1 1 AEOD/DSP/TPAB 1 1 AEOD/ROAB/DSP 2 2 NRR/DET/ECMB 9H 1 1 NRR/DET/EMEB 7E 1 1 NRR/DLPQ/LHFB10 1

NOTE TO ALL "RIDS" RECIPIENTS:

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RES/DSIR/EIB

NSIC POORE, W.

EXTERNAL: EG&G BRYCE, J.H

NRC PDR

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Duke Power Company Oconee Nuclear Station P.O. Box 1439 Seneca, SC 29679



DUKE POWER

November 1, 1991

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

Subject: Oconee Nuclear Station Docket Nos. 50-269, -270, -287 LER 269/91-11

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/91-11 concerning a reactor trip.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

1St Rouin

H. B. Barron Station Manager

RSM/ftr

Attachment

9111070147 911101

ADOCK 05000269

FDR

xc: Mr. S. D. Ebneter Regional Administrator, Region II U.S. Nuclear Regulatory Commission 101 Marietta St., NW, Suite 2900 Atlanta, Georgia 30323

Mr. L. A. Wiens Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission Washington, DC 20555

NRC Resident Inspector Oconee Nuclear Station

FDR

INPO Records Center Suite 1500 1100 Circle 75 Parkway Atlanta, Georgia 30339

M&M Nuclear Consultants 1221 Avenue of the Americas New York, NY 10020

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(803)885-3000

November 1, 1991 Page 2

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Form 35372 (R6-89)

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On October 2, 1991, Unit 1 reactor tripped from 73 percent full power on a Reactor Protective System turbine anticipatory trip signal due to a generator lockout. The lockout occurred when a protective relay circuit spuriously actuated. Investigation found that the relay circuitry was interrupted when either a terminal wire or a connector became loose. The root cause was assigned equipment failure in the 41MXa circuitry. Posttrip operator response stabilized the plant. After the trip, the Emergency Feedwater System was actuated due to low feedwater pump discharge pressure during a condensate-feedwater pressure oscillation. One main feedwater pump was manually secured. The second main feedwater pump tripped due to high pressure at the pump discharge. Corrective actions include tightening connections, evaluating the need for a preventive maintenance program on electrical connectors near vibrating equipment, and investigation into low demand feedwater oscillations.

NRC FORM 366A	U.S	NUCLEAR REGULATORY COMMISSION		
	· · · · · · · · · · · · · · · · · · ·		EXPIRES: 4/30/92	0-0104
	LICENSEE EVENT REPORT TEXT CONTINUATION	(LER)	ESTIMATED BURDEN PER RESPONSE T INFORMATION COLLECTION REQUEST COMMENTS REGARDING BURDEN ESTIM AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION, WASHINGT THE PAPERWORK REDUCTION PROJEC OF MANAGEMENT AND BUDGET, WASHI	O COMPLY WTH THIS 50.0 HRS. FORWARD IATE TO THE RECORDS (P-530), U.S. NUCLEAR ON, DC 20555, AND TO T (3150-0104), OFFICE NGTON, DC 20503.
FACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
			YEAR SEQUENTIAL REVISION NUMBER NUMBER	
Oconee M	Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	911 - 011 1 - 010	OLO OFINIO
TECT (If more space is re	quired, use additional NRC Form 395A's) (17)			

BACKGROUND

The electrical generator [EIIS:GEN] uses protective relaying to sense abnormal conditions which may adversely affect the generator. When such a condition is sensed, it produces a lockout which will open the main generator breakers [EIIS:BRK], Power Circuit Breakers (PCB)-20 and -21, and trip the turbine. One of the protective circuits used to produce these actions is the relay circuit associated with the 41MXa relay [EIIS:RLY]. This relay senses the position of the main generator field breaker. If it is actuated while PCBs -20 and -21 are closed, a lockout relay (86GA) will actuate and the generator lockout will occur. Some of the wire terminals for this circuitry are mounted to the generator exciter housing. This housing is physically removed during some refueling outages. To facilitate its removal, the incoming and outgoing wires are fitted with connectors.

A turbine trip will produce a reactor trip when power is greater than 30 percent power by actuating Reactor Protective System [EIIS:JC] turbine anticipatory trip channels. The purpose of this trip is to limit Reactor Coolant System [EIIS:AB] pressure and prevent challenging the Power Operated Relief Valve.

The Emergency Feedwater [EIIS:BA] system will actuate on loss of both main feedwater pumps. The actual initiating conditions are a low discharge pressure (800 psig) on both main feedwater pumps or loss of hydraulic oil pressure on both main feedwater pumps. Main feedwater pumps will trip on high discharge pressure.

The control of feedwater while the two main feedwater pumps are operating is through the integrated control system [EIIS:JA]. The demand signal which determines pump speed is derived from the feedwater master demands and a signal proportional to the pressure difference across the feedwater startup valves, which control steam generator [EIIS:HX] level. Pump speed is determined by the position of control valves to the feedwater pump turbine. At normal speeds, low pressure steam is admitted and at high c demand, high pressure steam is also admitted.

EVENT DESCRIPTION

On October-2, 1991, Unit 1 was operating at 73 percent full power. Startup from a refueling outage had occurred on September 29, 1991. The unit was being held at 73 percent full power for intermediate power escalation testing. The Turbine Driven Emergency Feedwater Pump (TDEFDWP) was inoperable while testing in the recirculation mode was being performed.

At 1555:27 hours an electrical generator lockout occurred. Immediately following this lockout the main turbine tripped. Since reactor power was greater than 30 percent, a Reactor Protective System (RPS) anticipatory signal tripped the reactor.

All full length control rods [EIIS:ROD] fully inserted into the core and the reactor was shutdown. One of two intermediate range neutron detectors [EIIS:IG], NI-3, did not return to its normal post-trip value. It decreased to approximately 5E-10 Amps and stabilized. All five power range

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NRC FORM 366A	U.S. I	NUCLEAR REGULATORY COMMISSION		
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•	LICENSEE EVENT REPORT (LER)	ESTIMATED BURDEN PER RESPONSE	O COMPLY WTH THIS
	TEXT CONTINUATION		COMMENTS REGARDING BURDEN ESTIM	ATE TO THE RECORDS
			REGULATORY COMMISSION, WASHINGT	ON DC 20555 AND TO
			OF MANAGEMENT AND BUDGET, WASHI	NGTON, DC 20503.
FACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
			YEAR SEQUENTIAL REVISION	
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Oconee Nucl	lear Station, Unit 1	0 5 0 0 2 6 9	9 1 - 0 1 1 - 0 0	013 0F 019
TEXT (If more space is required,	use additional NRC Form 368A's/ (17)			
detector	rs decreased normally follo	owing the trip. The	two source range	
second	which are also normal post	approximately 200 to t-trip values	300 counts per	
,	are are normal pob	e erip varues,		
Followir	ng the reactor trip, the Re	eactor Coolant System	m (RCS) average	•
temperat	ture decreased from 580 de	grees F to approxima	tely 555 degrees F.	
seconds	after the trip Pressure	then slowly increas	o 1886 psig forty	· · · · ·
setpoint	t. Pressurizer [EIIS:VSL]	level reached a min	imum of 86 inches one	
minute a	after the trip. Normal RC	5 letdown flow was f	irst isolated and then	1
reestabl	lished to control pressuri:	zer level above 100	inches. Level	
increase	ed and stabilized at 114 in	nches. Steam genera	tor pressures	、 .
Increase	the R steam concrator and	ig and then decrease	d to a minimum of 972	
leveling	off at approximately 101	8 nsia. Steam gener	ator levels decreased	
to a min	nimum of 21 inches on stear	m generator A and 20	inches on steam	· .
generato	or B before the 25 inch pos	st-trip setpoint was	maintained.	
·				
A reedwa	ater oscillation occurred	for twelve minutes a	fter the trip. The	-
oscillat	ing with approximately 50	(MrDwr) discharge p	ressures were	
value of	E = 1084 psig (1A MFDWP) and	963 psig (18 MFDWP)	The frequency of	
these os	cillations was approximate	ely 5.6 cycles per m	inute. The	• · · · ·
oscillat	ions in the two pumps were	e in phase, with bot	h pump discharge	
pressure	s and speeds reaching max	ima at the same time	. After Reactor	:
oscillat	(RO) A placed the B MFDW	P in manual at 1605:	34 hours, the	
MFDWP di	ischarge pressure was at a	minimum, 18 MFDWP d	ischarge pressure was	
at a max	kimum. Feedwater pump spee	eds and startup valv	e pressure	
differen	ntials also followed simila	ar oscillations. Th	is cycling was	
divergen	it with the amplitude of each and the second s	ach cycle increasing	with time. While	
MFDWP was	bich assures nump flow up	eedwater recirculation	on valve on the 1B	
between	a closed and throttled pos	sition.	ns, was cycling	
The 1B M	IFDWP was placed in manual	by RO A and its spe	ed decreased, with the	1
intent o	of securing the 1B MFDWP.	The operator is dire	ected to do this by	
the cond	lensate supply to the stat	. At 1608:19 hours,	the bypass valve for	
pressure	e difference across the co	plers. At 1608.25 h	ours the 1A and 1B	•
Motor Dr	riven Emergency Feedwater 1	Pumps started, as die	d the 1B Condensate	
Booster	Pump [EIIS:SD]. At 1608:	33 hours the Condens	ate Demineralizer	
Bypass v	valve [EIIS:KD], 1C-14, ope	ened. The 1B MFDW p	ump was tripped by RO	
Circuit	$(\Delta MSAC)$ a backup emergen	ours, the ATWS Mitig	ation Safety Actuation	1
assure e	emergency feedwater under A	ATWS conditions ini	tisted One second	
later, t	the 1A main feedwater pump	tripped. Transient	monitor [EIIS:10]	
data was	s not available to determin	ne the steam generat	or levels following	
these ac	tuations. RO A has stated	d that steam generate	or levels controlled	
correcti	ly at approximately 30 incl	hes on the startup l	evel following the	
emergeno	ly reedwater actuation.		· .	and the second second
Power De	livery Group personnel inv	vestigated the relay	circuitry associated	. '
with the	e generator lockout. They	found that relay 41	MXa, which senses the	
🦾 🧠 main gen	nerator field breaker closu	ure, had actuated bu	t that the main field	
			,	

NRC Form 356A 15-861

NRC FORM 366A (6-89)	U.S.	NUCLEAR REGULATORY COMMISSIO	APPROVED OMB NO. 31	50-0104
LIC	ENSEE EVENT REPORT	(LER)	EXPIRES: 4/30/92 ESTIMATED BURDEN PER RESPONSE INFORMATION COLLECTION REQUEST COMMENTS REGARDING BURDEN ESTIN AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION, WASHINGT THE PAPERWORK REDUCTION PROJEC OF MANAGEMENT AND BUDGET, WASHI	TO COMPLY WTH THIS : 50.0 HRS. FORWARD HATE TO THE RECORDS (P-530), U.S. NUCLEAR ON, DC 20555. AND TO TI (3150-0104), OFFICE NGTON, DC 20503.
FACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
			YEAR SEQUENTIAL REVISION	
	74-44-			
TEXT (If more space is required, use addition		0 5 0 0 0 2 6 9		0 4 0 0
generator loc found that the where wires we EHJ10). Thes housing cabin bottom of the EHF, and EHJ, EHC connector 41MXa relay. generator fiel Approximately was coasting [EIIS:EL] shat was found that was installed asked to eval personnel, it	ckout relay, 86GA, had be circuitry to the 41 yere connected to a te se terminal blocks are net. There are also de terminal cabinet. The were found. Circuit or the loose termina The relay fails in a eld breaker when it is down, eccentricity are ft was noticed as wel at the coupling between with one shipping be used that the construction.	d also actuated. Fur MXa relay had three erminal block (termin e mounted inside the connectors from a win three loose and unloc try drawings show the al at EHC6 would have a position which ind deenergized. The reactor trip, which the reactor trip, which the reactor trip, which the sector trip, which the the sector trip, which the sector the sector trip, which the sector trip, which the sector trip, which the sector trip, the sector trip, which the sector trip, the sector trip, which the sector trip, which the sector trip, the sector trip, the sector trip, the sector trip, the sector trip, the sector trip, the sector trip,	rther investigation loose connections hals EHC4, EHC6, and generator exciter ring harness to the cked connectors, EHC, at either the loose e deenergized the icates an open main hile the main turbine generator exciter exciter housing. It he main turbine shaft enance Engineering was ith General Electric al and could be	
A Maintenance the shipping determined th changed durin to a flexible The modificat installation instructions left out of t installed the left one bolt bearing data time that the from the coup	e Investigation Report bolt being left on the at the coupling betwee of the previous refuel to package used to is procedure from Genera to remove the shippin the Unit 1 exempt char coupling did remove remaining on the coupling indicated that vibrat shipping bolt was in pling following coasto	was initiated to de the exciter coupling. Seen the generator and ting outage from a re- fications had been mainstall the coupler of the coupler of the polts. The proceed al Electric. This pro- ng bolts. The proceed seven of the eight of seven of the eight of the seven of the sight of the seven of the sight of the seven of the sight of the seven of the shipp: the seven of the turbine.	etermine the cause of This investigation d the exciter had been igid type connection ade to Units 2 and 3. included a written cocedure gave dure was inadvertently chnicians who coupling bolts, but the exciter coupling yely high during the ing bolt was removed	
An investigat valve on the out of adjust have admitted speed. A Maj determine the pump turbine	ion of the 1A main fe low pressure steam [E ment. The valve was r high pressure steam ntenance Investigation cause and corrective controls.	eedwater pump indicat EIIS:JK] control to to eadjusted correctly if the pump turbine on Report has also be actions for the mis	ted that the last the pump turbine was This valve would was operating at high een initiated to sadjustment of the	
An investigat	ion into the root cau	use of the generator	lockout revealed that	- · · · ·

there were three loose terminal wires and three loose connectors on the terminal board containing the circuitry for relay 41MXa. Either the loose EHC connector or the loose connection at terminal EHC-6 could have resulted in the inadvertent loss of power to the 41MXa relay. The exciter housing was removed during the previous refueling outage for maintenance. This required that the connectors be disconnected and then reconnected during

		EXPIRES: 4/30/92		
•	TEXT CONTINUATION	ESTIMATED BURDEN PER RESPONSE 1 INFORMATION COLLECTION REQUEST COMMENTS REGARDING BURDEN ESTIM AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION. WASHINGT THE PAPERWORK REDUCTION PROJEC OC MANAGEMENT AND BUDGET WASHI	TO COMPLY WTH 50.0 HRS. FOR 14TE TO THE REC (P-530), U.S. NUC TON, DC 20555, AI TT (3150-0104), TO NGTON, DC 20501	+ THIS WARD CORDS CLEAR ND TO OFFICE
ACILITY NAM		OF MANAGEMENT AND BODGET, WASH		
		LER NUMBER (6)	PAGE (3)	1
		NUMBER NUMBER		
0cor	ee Nuclear Station, Unit 1 0 5 0 0 2 6 9	91-011-00	0 5 05	0 9
TEXT (If more a	ece la required, use additional NRC Form 305A's) (17)		•	
	assembly. The connectors are a twist-to-lock type ar fact that they were manipulated during the past outage the connectors that were at fault. On the other hand Group personnel who investigated the terminal board of connection was at fault based on the degree to which	nd not screw-type. Th ge suggests that it wa d, the Power Delivery felt that the terminal it was loose.	ie IS	
	A review of past events showed that a similar trip of December 2, 1984. The wire at EHC-6 was found to be connector, not at the terminal. The Exciter cabinet during the previous refueling outage. The unit had h November 29, 1984 and had experienced high vibration generator coupling. This indicates a recurring prob- records of similar trips on Unit 2 and 3 could be for action for the 1984 event was to tighten the wire to inspect similar connections on Units 2 and 3. These prevent the latest trip. Exciter removal is schedule refueling outage at Oconee. This is considered a recur	ccurred on Unit 1 on loose at the had been removed been placed on line on at the exciter- lem with Unit 1. No und. The corrective the connector and to actions did not ed for every third curring event.		
	The root cause of this event is considered equipment terminal connection, EHC-6, or the EHC wiring harness the 41MXa circuit. Since six loose connections (thre terminals) were discovered, it is likely that vibrat: the failure. This is also supported by the fact that existed when the relay was initially energized during Maintenance Engineer in charge of the main turbine has though the exciter coupling had a shipping bolt incom coupling, the vibration at the exciter-generator com measured as excessively high during the startup and a power. Furthermore, the location of the terminal blow would tend to respond to general turbine floor vibration vibration from the exciter itself. Since both this event occurred following maintenance which required the housing, it is also likely that this activity makes connectors more susceptible to failure.	failure. Either the s connector interrupte ee connectors and thre ion played a part in t circuit continuity g startup. The as stated that even rrectly left on the nection was not subsequent operation a ock is such that it tion rather than the event and the previous moving of the exciter the terminals and	d e	
	The exact component that failed is unknown, but measing prevent the recurrence of both possible failures. In Electrical (I&E) personnel will inspect terminals and vibrating equipment. The results of these inspection determine the need to establish a preventive maintena equipment. The suitability of the connectors used will determine if they are appropriate for the present app for reconnecting the connectors using lockwire and to connections will be written. This procedure will be replacement of the exciter housing. In addition to decrease the possibility of the event recurring, and performed by Design Engineering to determine the fea- the logic of the 41MXa circuitry so that the relay w	ures will be taken to nstrument and d connectors near othe ns will be used to ance program on that ill also be reviewed t plication. A procedur ightening all terminal performed after these actions to analysis will be sibility of changing ill not fail in the	er Co Te	

After the reactor trip, power range neutron detectors and one of two intermediate range detectors fell to their normal post-trip values. One intermediate range detector, NI-3, remained at approximately 5E-10 Amps, which is higher than expected. Since all other indications of reactivity indicated the successful shutdown of the reactor, the NI-3 response was

•		S. NUCLEAR REGULATORY COMMISSION	APPROVED OMB NO. 31	50-0104
	LICENSEE EVENT REPORT TEXT CONTINUATION	(LER)	EXPIRES: 4/30/92 ESTIMATED BURDEN PER RESPONSE INFORMATION COLLECTION REQUEST COMMENTS REGARDING BURDEN ESTIN AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION, WASHING THE BAREBWORK REPUBLICAN PROF	TO COMPLY WTH THIS 50.0 HRS. FORWARD AATE TO THE RECORDS (IP-530), U.S. NUCLEAR TON, DC 20555, AND TO TO ADD TO ADD. 51.0250 ADD.
			OF MANAGEMENT AND BUDGET, WASHI	INGTON, DC 20503.
LITT NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
, *			YEAR NUMBER NUMBER	4
Oconee Nucle	ar Station, Unit 1	0 5 0 0 0 2 6 9	91 -0111 -00	060F0
considered response instrument in this ma decided to duration. Response System (Re maintained the second	d invalid. Instrument a to be indicative of a de t would respond properly anner during the subsequ o replace the NI-3 detec of the primary system to CS) inventory, RCS press d within the normal post	and Electrical person etector failure, but above the 10E-10 ra- lent restart of the u- ctor at the next outa to the trip was normal sure, and RCS tempera c-trip range. The im mal Poth steam gen	nel considered the they felt that the nge. NI-3 did respond nit. It has been ge of sufficient . Reactor Coolant ture were all mediate response of	1
An upset Feedwater main feedw pump was w Feedwater were reach system ope a spare co feedwater pressures Feedwater generators being tes was secure was consis	in condensate-feedwater pressure began oscillat water pump speed was mar unable to quickly comper pressure began to decre hed: 1) the stator coola ened, 2) the condensate ondensate booster pump s system was actuated due reaching their 800 psic Pumps (MDEFDWP) started s. The Turbine Driven E ted. It started but was ed rather than realigned stent with the abnormal	control occurred sub ting with a divergent hually lowered, the r sate for the drop in ease so that several ant cooler bypass val demineralizer bypass started. In addition to both main feedwa g setpoint. Both Mot and began deliverin Emergency Feedwater P s not aligned to the d because it was not procedure for loss o	sequent to the trip. trend. When the 1B emaining feedwater feedwater pressure. actuation setpoints ve in the condensate valves opened, and 3) , the emergency ter pump discharge or Driven Emergency g water to the steam ump (TDEFDWP) was steam generators. It needed. This action f main feedwater.	
The effect drop and setpoint a steam gene they were bypass va system. the main increased setpoint.	ts of these actions was increase feedwater pump after emergency feedwate erator level. This shut controlling at 25 inche lve openings resulted i The condensate booster p feedwater pumps. The 14 until the pump tripped	to compensate for th discharge pressure. Fractuation was rais to the normal startup es. The stator coola in less pressure drop oump start further in A main feedwater pump at its high discharg	e original pressure Steam generator level ed to 30 inches on the control valves since nt and demineralizer across the condensate creased pressure to discharge pressure e pressure trip	
The cause still und	of the feedwater swing er investigation. Sever	and resultant loss o al factors may have	f main feedwater is been contributing:	
1.	The feedwater pumps a valves. These valves pump flow. The B MFI observed to be cyclir The control circuitry	are equipped with min s operate based on in DWP minimum recircula ng open and closed du v for these valves is	imum recirculation dividual feedwater tion valve was ring the transient. being evaluated.	
2.	Because the unit had after an extended ref reached 73 percent fu This led to a low dem Normal Integrated Cor low demands may be ur	only had one effecti- fueling outage and si all power, decay heat and for feedwater fo atrol System (ICS) co astable.	ve full power day nce the unit had only load was very low. llowing the trip. ntrol of feedwater at	

NRC Sum 2844 (6.80)

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NRC FORM 386A (6-89)	- U.S.	NUCLEAR REGULATORY COMMISSION	APPROVED OMB NO. 315	0-0104
	LICENSEE EVENT REPORT TEXT CONTINUATION	(LER)	EXPIRES: 4/30/92 ESTIMATED BURDEN PER RESPONSE T INFORMATION COLLECTION REQUEST COMMENTS REGARDING BURDEN ESTIM AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION, WASHINGT THE PAPERWORK REDUCTION PROJEC OF MANAGEMENT AND BUDGET, WASHI	O COMPLY WTH THIS 50.0 HRS. FORWARD IATE TO THE RECORDS (P-530), U.S. NUCLEAR ON, DC 20555, AND TO C (3150-0104), OFFICE NGTON, DC 20503.
FACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
			YEAR SEQUENTIAL REVISION	
	ar Station Ibit 1			
TEXT (If more space is required, us	e editionel NRC Form 3864/a/ (17)	0 5 0 0 0 2 0 9	91-011-00	
Plant pers determine Maintenanc of the mis The feedwater attempting stabilized determine operator t This equip	The control rack for the amount of steam to pressure steam control feedwater pump turbing pressure or high press are more stable, with the poor adjustment is been admitted prematur control on the pumps. these turbines states feedwater oscillations the cause and potential the cause and potential is Investigation Report is sadjustment of the 1A MFF state swing could have bee pumps in manual mode. If to follow startup feedwater of failure is NPRDS re	the 1A MFDW pump turk o the turbine, was for l valve out of adjust es can be supplied fr sure steam. They nor low pressure steam. s that the high press rely, thus reducing t The Maintenance Enc that this could have s but probably did nor luating the various f corrective actions f is being prepared to DWP controls. en terminated by plac This would have preve water valve pressure mulator training will oscillations can be i	pine, which adjusts bund with the high ment. The main om either low mally operate, and The significance of sure steam could have the degree of speed gineer in charge of increased the of cause them. actors involved to or this problem. A determine the cause ing both main nted the pumps from differences and be evaluated to ntroduced to enhance	
model ATI. radiation,	The event did not invo or personnel injuries.	olve radioactive rele	ases, overexposure to	
CORRECTIVE	ACTIONS	· · · · · · · · · · · · · · · · · · ·	. •	
Immediate				
1.	Operations personnel s trip.	safely controlled the	reactor after the	
2.	An immediate investiga of the reactor trip.	ation was initiated t	o determine the cause	
Subsequent	e de la companya de l La companya de la comp			
1.	All loose terminal con connectors found loose	nnections and electri in the investigation	cal harness n were tightened.	
2.	The shipping bolt foun rebalancing of the cou	nd on the exciter coup pling performed.	oling was removed and	
3.	After review, the Oper Unit 1 was changed to due to the failed neut	ations Emergency Ope incorporate special ron detector, NI-3.	rating Procedure on directions required	
4.	Maintenance personnel	readjusted the contro	ols on the 1A MFDW	

NRC Form 386A (6-89)

NRC FORM 386A (6-89)	U.S. P	NUCLEAR REGULATORY COMMISSION	APPROVED OMB N	0, 3150-0104
L	ICENSEE EVENT REPORT (TEXT CONTINUATION	LER)	EXPIRES: 4/ ESTIMATED BURDEN PER RESPOI INFORMATION COLLECTION REQ COMMENTS REGARDING BURDEN I AND REPORTS MANAGEMENT BRA REGULATORY COMMISSION, WASH THE PAPERWORK REDUCTION PE DE MANAGEMENT AND BURGET M	30/92 NSE TO COMPLY WTH THIS UEST: 50.0 HRS. FORWARD ESTIMATE TO THE RECORDS ANCH (P-530), U.S. NUCLEAR HINGTON, DC 20555, AND TO ROJECT (3150-0104), OFFICE VASHINGTON, DC 29503
FACILITY NAME (1)		DOCKET NUMBER (2)		
			LER NUMBER (6)	PAGE (3)
Oconee Nuclear	Station, Unit 1	0 5 0 0 0 2 6 9	911 - 0111 - 0	10 0 18 OF 0 19
TEXT (If more space is required, use ad	ditional NRC Form 385A's) (17)	**************************************		
Planned				· · · ·
1.	Instrument and Electri correct as necessary t equipment subject to h these inspections, an whether a preventive m terminals on a periodi	cal (I&E) personnel cerminals and connect high vibration. Base evaluation will be r maintenance program c basis is required	will inspect and tors located on ed on the findings on made to determine to inspect these	of
2.	Engineering personnel 41MXa to determine if	will evaluate the fa alternative logic so	ailure logic of rela chemes are needed.	ay
3.	Maintenance Engineerin couplings for shipping necessary, on Units 2 sufficient duration.	ng will inspect the e g bolts and remove and and 3 during the neg	exciter-generator ny bolts, if xt outage of	-
4.	During the next outage detector for NI-3 will	of sufficient duration of sufficient duration of sufficient duration of the second sec	tion on Unit 1, the	
5.	I&E engineers will eva feedwater swings which appropriate recommenda	luate the cause and occurred at low pou tions.	effects of the wer and make	
-	Operations Training pe introducing post-trip simulator training.	rsonnel will evaluat feedwater oscillatio	te the feasibility o ons into operator	of
7.	A procedure will be wr connectors and to tigh the exciter housing fo	itten to tighten and iten all terminal com illowing replacement	d lock-wire all nnections mounted o of the housing.	n
SAFETY ANAL	YSIS			
C A generator operation, the primary This results an eventual Reactor Pro- and heatup H turbine trip pressure. The operator	lockout and the result leads to an imbalance b system and the amount s in Reactor Coolant Sy challenge to the Power tective System (RPS) pr by use of the turbine a b will cause a reactor This safety feature suc	ing turbine trip, where the amount of of power removed by stem (RCS) heatup ar Operated Relief Vale of the second	hile at power f power produced in the secondary syste and pressurization an lve (PORV). The S overpressurization trip. That is, the n of increased RCS during this event.	em. nd e
main feedwa the Emergence	ter subsequent to the trip ter subsequent to the t cy Feedwater (EFDW) sys	rip presented an unities. He state in the second se	necessary challenge	to

the Emergency Feedwater (EFDW) system. The EFDW system actuated and controlled steam generator levels appropriately. Although the Turbine Driven EFDW pump was being tested, it could have been aligned, had it been necessary, by the manipulation of one manual valve and two electric valves. If either Motor Driven Emergency Feedwater Pump had failed, one emergency feedwater pump would have been sufficient to remove decay heat.

(6-89)	U.S. NUCLEAR REGULATORY COMMISSION LICENSEE EVENT REPORT (LER) TEXT CONTINUATION									APPROVED OMB NO. 3150-0104 EXPIRES: 4/30/92 ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH TH INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWAF COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORD AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLE/ REGULATORY COMMISSION, WASHINGTON, DC 20555, AND 1 THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFI OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.													
FACILITY	IAME (1)			<u></u>	· .	•	· .	,	00	CKET	NUMBE	R (2)				LE		ER (5) ·		1	PAGE (31
							, 1				,				YEAR		SEQUE	NTIA		REVISION			
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(803)885-3000

Duke Power Company Oconee Nuclear Station P.O. Box 1439 Seneca, SC 29679



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DUKE POWER

November 1, 1991

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

Subject: Oconee Nuclear Station Docket Nos. 50-269, -270, -287 LER 269/91-11

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 269/91-11 concerning a reactor trip.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

1AR Roun

H. B. Barron Station Manager

RSM/ftr

Attachment

xc: Mr. S. D. Ebneter Regional Administrator, Region II U.S. Nuclear Regulatory Commission 101 Marietta St., NW, Suite 2900 Atlanta, Georgia 30323

Mr. L. A. Wiens Office of Nuclear Reactor Regulation U.S. Nuclear Regulatory Commission Washington, DC 20555

NRC Resident Inspector Oconee Nuclear Station INPO Records Center Suite 1500 1100 Circle 75 Parkway Atlanta, Georgia 30339

N&M Nuclear Consultants 1221 Avenue of the Americas New York, NY 10020

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NRC FO (6-89)	RM 366					U.S. NU	CLEAR R	EGULATOR	Y COMMIS	SSION		AP	PROVED	OMB NO	0. 3150-010	4	
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					THE PAPE	RWORK	REDUCT	ION PR	OJECT (31	C 20555, 50-0104),	OFFICE						
FACILIT	Y NAME (1)									UF MANAG			31	ASHINGTO		GE (3)
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	Generator Protective Relay Circuit														urra (
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	React	or Pr	2, otec	1991, Unit tive Svste	c i reac em turhi	ne ar	tici	ed fro natory	m 73	perc	cent fu mal du	iii p	ower	on	a		
	gener	ator	lock	out. The	lockout	occi	urred	when	a pro	tect	cive re	elay	, a circu	uit	•		
	spuri	ously	act	uated. In	nvestiga	tion	foun	d that	the	rela	ay ciro	cuitr	y was	5			
	root	cause	was	assigned	a termi	.na⊥ v ent fa	vire (ailur	orac eint	onnec he 41	MXa	became	€ loc itrv	se.	The			
	trip	opera	tor	response :	stabiliz	ed th	ne pl	ant.	After	the	e trip	, the	Emei	aen	cv		
	Feedw	vater	Syst	em was act	tuated d	lue to	o low	feedw	ater	pump	o disci	harge	pres	ssur	e		
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NRC FORM 386A (6-89)	U.S. NUCLEAR REGULATORY COMMISSIC	APPROVED OMB NO. 315	0-0104
LICENSEE EVENT TEXT CONTIN	REPORT (LER) UATION	EXPIRES: 4/30/92 ESTIMATED BURDEN PER RESPONSE T INFORMATION COLLECTION REQUEST: COMMENTS REGARDING BURDEN ESTIM AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION, WASHINGT THE PAPERWORK REDUCTION PROJEC OF MANAGEMENT AND BUDGET, WASHI	O COMPLY WTH THIS 50.0 HRS. FORWARD ATE TO THE RECORDS (P-530), U.S. NUCLEAR ON, DC 20555. AND TO T (3150-0104), OFFICE VGTON, DC 20503.
ACILITY NAME (1) ACILITY NAME (1) DOCKET NUMBER (2) DOCKET NUMBER (2) DOCKET NUMBER (2) LER NUMBER (0) YEAR SEQUENTIAL REVISION NUMBER (1) VEAR SEQUENTIAL REVISION NUMBER (1) VEAR SEQUENTIAL REVISION NUMBER (1) VEAR SEQUENTIAL REVISION NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL REVISION NUMBER (1) VEAR SEQUENTIAL REVISION NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL REVISION NUMBER (1) VEAR SEQUENTIAL REVISION NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL REVISION NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL REVISION NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL REVISION NUMBER (1) PAGE VEAR SEQUENTIAL REVISION NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL REVISION NUMBER (1) PAGE VEAR SEQUENTIAL REVISION NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL REVISION NUMBER (1) PAGE VEAR SEQUENTIAL REVISION NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL NUMBER (0) DOCKET NUMBER (2) VEAR SEQUENTIAL NUMBER (0) DOCKET NUMBER (2) VEAR SEQUENTIAL NUMBER (0) DOCKET NUMBER (2) VEAR SEQUENTIAL NUMBER (0) DOCKET NUMBER (2) VEAR SEQUENTIAL NUMBER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL NUMBER (2) NUMER (1) DOCKET NUMBER (2) VEAR SEQUENTIAL NUMBER (2	PAGE (3)		
· · · · · · ·		YEAR SEQUENTIAL REVISION	
Oconee Nuclear Station, Unit	1 0 15 10 10 12 16 1	9 911 -01111 - 010	
EXT (If more space is required, use additional NRC Form 366A's) (17)			
The electrical generator abnormal conditions which condition is sensed, it pr generator breakers [EIIS:H trip the turbine. One of actions is the relay circu This relay senses the post is actuated while PCBs -20 actuate and the generator for this circuitry are mon housing is physically remo its removal, the incoming A turbine trip will produc	EIIS:GEN] uses protective may adversely affect the g oduces a lockout which wil BRK], Power Circuit Breaker the protective circuits us it associated with the 41M tion of the main generator and -21 are closed, a loc lockout will occur. Some unted to the generator exci- oved during some refueling and outgoing wires are fit are a reactor trip when powe	relaying to sense enerator. When such a l open the main s (PCB)-20 and -21, and ed to produce these Xa relay [EIIS:RLY]. field breaker. If it kout relay (86GA) will of the wire terminals ter housing. This outages. To facilitate ted with connectors. r is greater than 30	
percent power by actuating anticipatory trip channels Coolant System [EIIS:AB] p Operated Relief Valve. The Emergency Feedwater []	g Reactor Protective System 5. The purpose of this trip pressure and prevent challe CIIS:BA] system will actuat	[EIIS:JC] turbine p is to limit Reactor nging the Power e on loss of both main	

high discharge pressure. The control of feedwater while the two main feedwater pumps are operating is through the integrated control system [EIIS:JA]. The demand signal which determines pump speed is derived from the feedwater master demands and a signal proportional to the pressure difference across the feedwater startup valves, which control steam generator [EIIS:HX] level. Pump speed is determined by the position of control valves to the feedwater pump turbine. At normal speeds, low pressure steam is admitted and at high demand, high pressure steam is also admitted.

pressure on both main feedwater pumps. Main feedwater pumps will trip on

EVENT DESCRIPTION

On October 2, 1991, Unit 1 was operating at 73 percent full power. Startup from a refueling outage had occurred on September 29, 1991. The unit was being held at 73 percent full power for intermediate power escalation testing. The Turbine Driven Emergency Feedwater Pump (TDEFDWP) was inoperable while testing in the recirculation mode was being performed.

At 1555:27 hours an electrical generator lockout occurred. Immediately following this lockout the main turbine tripped. Since reactor power was greater than 30 percent, a Reactor Protective System (RPS) anticipatory signal tripped the reactor.

All full length control rods [EIIS:ROD] fully inserted into the core and the reactor was shutdown. One of two intermediate range neutron detectors [EIIS:IG], NI-3, did not return to its normal post-trip value. It decreased to approximately 5E-10 Amps and stabilized. All five power range

NRC FORM 386A U.S.	NUCLEAR REGULATORY COMMISSION	APPROVED OMB NO. 315 EXPIRES: 4/30/97	<i>i</i> 0-0104
LICENSEE EVENT REPORT (TEXT CONTINUATION	(LER)	ESTIMATED BURDEN PER RESPONSE T INFORMATION COLLECTION REQUEST: COMMENTS REGARDING BURDEN ESTIM AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION, WASHINGT THE PAPERWORK REDUCTION PROJEC OF MANAGEMENT AND BUDGET, WASHI	O COMPLY WTH THIS 50.0 HRS. FORWARD ATE TO THE RECORDS (P530). U.S. NUCLEAR ON. DC 20555. AND TO T (3150-0104). OFFICE NGTON, DC 20503.
FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
		YEAR SEQUENTIAL REVISION	
Oconee Nuclear Station, Unit 1	0 5 0 0 2 6 9	91 -011 -00	030509
TEXT (If more space is required, use additional NRC Form 366A's) (17)			
detectors decreased normally folly detectors came on scale and read second, which are also normal pos Following the reactor trip, the R temperature decreased from 580 de	owing the trip. The approximately 200 to t-trip values. eactor Coolant Syste grees F to approxima	two source range 300 counts per m (RCS) average telv 555 degrees F.	· · ·
RCS pressure decreased from approx seconds after the trip. Pressure setpoint. Pressurizer [EIIS:VSL] minute after the trip. Normal RC reestablished to control pressuri increased and stabilized at 114 i increased to a maximum of 1108 ps psig on the B steam generator and leveling off at approximately 101 to a minimum of 21 inches on stea generator B before the 25 inch po	ximately 2134 psig to then slowly increase level reached a min S letdown flow was f zer level above 100 nches. Steam genera ig and then decrease 995 psig on the A s 8 psig. Steam gener m generator A and 20 pst-trip setpoint was	o 1886 psig forty ed to its 2155 psig imum of 86 inches one irst isolated and then inches. Level tor pressures d to a minimum of 972 team generator before ator levels decreased inches on steam a maintained.	·
A feedwater oscillation occurred two operating main feedwater pump oscillating with approximately 50 value of 1084 psig (1A MFDWP) and these oscillations was approximate oscillations in the two pumps were pressures and speeds reaching max Operator (RO) A placed the B MFDW oscillations continued but were t MFDWP discharge pressure was at a at a maximum. Feedwater pump spe differentials also followed simil divergent with the amplitude of e this was occurring, the minimum f MFDWP, which assures pump flow un between a closed and throttled po	for twelve minutes a (MFDWP) discharge p to 125 psig differen 963 psig (1B MFDWP) ely 5.6 cycles per m e in phase, with both ima at the same time P in manual at 1605: hen out of phase by minimum, 1B MFDWP d eds and startup valv ar oscillations. Th ach cycle increasing eedwater recirculati der shutoff conditio sition.	fter the trip. The ressures were nces about their mean . The frequency of inute. The h pump discharge . After Reactor 34 hours, the 180 degrees. When 1A ischarge pressure was e pressure is cycling was with time. While on valve on the 1B ms, was cycling	
The 1B MFDWP was placed in manual intent of securing the 1B MFDWP. the Emergency Operating Procedure the condensate supply to the state pressure difference across the coor Motor Driven Emergency Feedwater 1 Booster Pump [EIIS:SD]. At 1608: Bypass valve [EIIS:KD], 1C-14, op A at 1608:35 hours. At 1608:50 h Circuit (AMSAC), a backup emergen assure emergency feedwater under later, the 1A main feedwater pump data was not available to determi these actuations. RO A has state correctly at approximately 30 inc emergency feedwater actuation.	by RO A and its spee The operator is dire . At 1608:19 hours, or coolant coolers of olers. At 1608:25 he Pumps started, as die 33 hours the Condens ened. The 1B MFDW p ours, the ATWS Mitig cy feedwater actuati ATWS conditions, ini tripped. Transient ne the steam generat d that steam generat hes on the startup 1	ed decreased, with the ected to do this by the bypass valve for pened on a high ours the 1A and 1B d the 1B Condensate ate Demineralizer ump was tripped by RO ation Safety Actuation on system used to tiated. One second monitor [EIIS:IQ] or levels following or levels controlled evel following the	
Power Delivery Group personnel inv with the generator lockout. They main generator field breaker clos	vestigated the relay found that relay 411 ure, had actuated bu	circuitry associated MXa, which senses the t that the main field	, ·

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NRC FORM 386A	U.S. NUCLEAR REGULATORY COMMISSION	APPROVED OMB NO. 315	50-0104	
LICENSEE EVENT REPOR	T (I FR)	EXPIRES: 4/30/92 ESTIMATED BURDEN PER RESPONSE	TO COMPLY Y	VTH THIS -
TEXT CONTINUATION		INFORMATION COLLECTION REQUEST COMMENTS REGARDING BURDEN ESTIN	50.0 HRS. F	ORWARD
		REGULATORY COMMISSION WASHINGT	(P-530), U.S. 1 FON, DC 20555 CT (3150-0104)	AND TO
FACILITY NAME (1)	DOCKET NUMBER (2)	I FR NUMBER (6)	INGTON, DC 20	
		YEAR SEQUENTIAL REVISION	PAGE	
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Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	91 -011 -00	0 4 0	F 0 9
(2) (17) The second second with form (2054's)				
breaker had not opened at the sa	me time. They also fo	ound the main		
generator lockout relay, 86GA, h found that the circuitry to the	ad also actuated. Fundation Fundatio	rther investigation		-
where wires were connected to a	terminal block (termin	nals EHC4, EHC6, and		
EHJ10). These terminal blocks a housing cabinet. There are also	re mounted inside the	generator exciter		
bottom of the terminal cabinet.	Three loose and unlo	cked connectors, EHC,		
EHF, and EHJ, were found. Circu	itry drawings show the	at either the loose		
41MXa relay. The relay fails in	a position which ind:	icates an open main		
generator field breaker when it	is deenergized.	• .		
Approximately one half hour afte	r the reactor trip, wh	hile the main turbine		
was coasting down, eccentricity	and thrusting of the o	generator exciter		
was found that the coupling betw	ell as noise from the een the exciter and th	exciter housing. It he main turbine shaft		
was installed with one shipping	bolt in place. Mainte	enance Engineering was	•	
personnel, it was decided that t	 After conferring was normalized as a normalized was normalized as a normalized was normalized as a normalinatinative as a normalized as a normali	ith General Electric		
expected. The noise was attribu	ted to the exciter bru	ushes and stopped when		
the brushes were pulled.	· • •	·		
A Maintenance Investigation Repo	rt was initiated to de	etermine the cause of	·	
determined that the coupling bet	the exciter coupling. ween the generator and	This investigation		
changed during the previous refu	eling outage from a r	igid type connection		,
to a flexible type. Similar mod The modification package used to	lifications had been may install the coupler	ade to Units 2 and 3.	۰ <i>۳</i>	
installation procedure from Gene	ral Electric. This p	rocedure gave		
instructions to remove the shipp left out of the Unit 1 evempt ch	ing bolts. The procee	dure was inadvertently		
installed the coupling did remov	e seven of the eight of	coupling bolts, but		
left one bolt remaining on the c	oupling. A review of	the exciter coupling		
time that the shipping bolt was	installed. The shipp:	ing bolt was removed		
from the coupling following coas	tdown of the turbine.	-		
An investigation of the 1A main	feedwater pump indicat	ted that the last		

valve on the low pressure steam [EIIS:JK] control to the pump turbine was out of adjustment. The valve was readjusted correctly. This valve would have admitted high pressure steam if the pump turbine was operating at high speed. A Maintenance Investigation Report has also been initiated to determine the cause and corrective actions for the misadjustment of the pump turbine controls.

CONCLUSIONS

An investigation into the root cause of the generator lockout revealed that there were three loose terminal wires and three loose connectors on the terminal board containing the circuitry for relay 41MXa. Either the loose EHC connector or the loose connection at terminal EHC-6 could have resulted in the inadvertent loss of power to the 41MXa relay. The exciter housing was removed during the previous refueling outage for maintenance. This required that the connectors be disconnected and then reconnected during

NRC FORM 366A U.S. (16-89)	NUCLEAR REGULATORY COMMISSION	APPROVED OMB NO. 315	0-0104
LICENSEE EVENT REPORT (TEXT CONTINUATION	LER)	ESTIMATED BURDEN PER RESPONSE T INFORMATION COLLECTION REQUEST: COMMENTS REGARDING BURDEN ESTIM AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION, WASHINGTI THE PAPERWORK REDUCTION PROJEC OF MANAGEMENT AND BUDGET, WASHIN	O COMPLY WTH THIS 50.0 HRS. FORWARD ATE TO THE RECORDS (P-530). U.S. NUCLEAR ON, DC 20555. AND TO T (3150-0104). OFFICE NGTON, DC 20503.
FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
		YEAR NUMBER NUMBER	
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	91 -0111-00	0 5 05 0 9
TEXT (If more space is required, use additional NRC Form 388A's) (17)	•		
assembly. The connectors are a the fact that they were manipulated of the connectors that were at fault Group personnel who investigated connection was at fault based on A review of past events showed the December 2, 1984. The wire at EF connector, not at the terminal, during the previous refueling out November 29, 1984 and had experied generator coupling. This indicate records of similar trips on Unit action for the 1984 event was to inspect similar connections on Ur prevent the latest trip.	wist-to-lock type and luring the past outage . On the other hand the terminal board is the degree to which hat a similar trip of IC-6 was found to be The Exciter cabinet tage. The unit had henced high vibration tes a recurring prob 2 and 3 could be for tighten the wire to hits 2 and 3. These	nd not screw-type. The ge suggests that it was d, the Power Delivery felt that the terminal it was loose. ccurred on Unit 1 on loose at the had been removed been placed on line on at the exciter- lem with Unit 1. No und. The corrective the connector and to actions did not	e 5
refueling outage at Oconee. This	<pre>removal is schedule s is considered a req</pre>	ed for every third	t
The root cause of this event is of terminal connection, EHC-6, or the the 41MXa circuit. Since six loc terminals) were discovered, it is the failure. This is also support existed when the relay was initian Maintenance Engineer in charge of though the exciter coupling had a coupling, the vibration at the ex- measured as excessively high during power. Furthermore, the location would tend to respond to general vibration from the exciter itself event occurred following maintena housing, it is also likely that the connectors more susceptible to far	considered equipment the EHC wiring harness ose connections (three s likely that vibration the day the fact that ally energized during the main turbine has a shipping bolt inconst citer-generator const ing the startup and s turbine floor vibration turbine floor vibration since which required m this activity makes t allure.	failure. Either the s connector interrupted ee connectors and three ion played a part in t circuit continuity g startup. The as stated that even crectly left on the nection was not subsequent operation at ock is such that it tion rather than the event and the previous noving of the exciter the terminals and	1 > t
The exact component that failed is prevent the recurrence of both po- Electrical (I&E) personnel will is vibrating equipment. The results determine the need to establish a equipment. The suitability of the determine if they are appropriate for reconnecting the connectors us connections will be written. This replacement of the exciter housing decrease the possibility of the e performed by Design Engineering to the logic of the 41MXa circuitry actuated position on loss of power	s unknown, but measu ssible failures. In inspect terminals and of these inspection preventive maintena- te connectors used wi for the present app using lockwire and ti s procedure will be ig. In addition to t event recurring, an a co determine the feas so that the relay wi er.	ires will be taken to istrument and i connectors near other is will be used to ance program on that ill also be reviewed to ilication. A procedure ightening all terminal performed after these actions to analysis will be sibility of changing ill not fail in the	r 2
After the reactor trip, power ran intermediate range detectors fell intermediate range detector, NI-3 which is higher than expected. S indicated the successful shutdown	ge neutron detectors to their normal pos , remained at approx ince all other indic of the reactor, the	s and one of two st-trip values. One simately 5E-10 Amps, sations of reactivity NI-3 response was	
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(6-89) U.S. M	NUCLEAR REGULATORY COMMISSION	APPROVED OMB NO. 3150	-0104
LICENSEE EVENT REPORT (TEXT CONTINUATION	LER)	EXTINCT 4/30/92 ESTIMATED BURDEN PER RESPONSE TO INFORMATION COLLECTION REQUEST: COMMENTS REGARDING BURDEN ESTIMA AND REPORTS MANAGEMENT BRANCH (REGULATORY COMMISSION, WASHINGTO THE PAPERWORK REDUCTION PROJECT OF MANAGEMENT AND BUDGET, WASHIN	0 COMPLY WTH THIS 50.0 HRS, FORWARD ATE TO THE RECORDS P530), U.S. NUCLEAR NJ, OC 20555, AND TO (3150-0104), OFFICE GTON, DC 20503.
FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
		YEAR SEQUENTIAL REVISION NUMBER NUMBER	
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	91 -011 - 00	0 6 0 9
<pre>TEXT (# more spece is required, use additional NAC form 300A's) (17) Considered invalid. Instrument an response to be indicative of a det instrument would respond properly in this manner during the subseque decided to replace the NI-3 detect duration. Response of the primary system to System (RCS) inventory, RCS pressu maintained within the normal post- the secondary system was also norm level were maintained at or near t An upset in condensate-feedwater c Feedwater pressure began oscillati main feedwater pump speed was manu pump was unable to quickly compens Feedwater pressure began to decrea were reached: 1) the stator coolan system opened, 2) the condensate du a Spare condensate booster pump st feedwater system was actuated due pressures reaching their 800 psig Feedwater Pumps (MDEFDWP) started generators. The Turbine Driven Em being tested. It started but was was secured rather than realigned was consistent with the abnormal p </pre>	d Electrical person ector failure, but a above the 10E-10 ran int restart of the un or at the next outage the trip was normal ire, and RCS temperat trip range. The imm al. Both steam gene heir proper setpoint control occurred sub- ing with a divergent ally lowered, the re- tate for the drop in ise so that several a it cooler bypass value lemineralizer bypass carted. In addition to both main feedwar setpoint. Both Mote and began delivering hergency Feedwater Pu not aligned to the because it was not in procedure for loss o	hel considered the they felt that the nge. NI-3 did respond nit. It has been ge of sufficient . Reactor Coolant ture were all mediate response of erator pressure and t. sequent to the trip. trend. When the 1B emaining feedwater feedwater pressure. actuation setpoints ve in the condensate valves opened, and 3) , the emergency ter pump discharge or Driven Emergency g water to the steam ump (TDEFDWP) was steam generators. It needed. This action f main feedwater.	
The effects of these actions was to drop and increase feedwater pump do setpoint after emergency feedwater steam generator level. This shuts they were controlling at 25 inches bypass valve openings resulted in system. The condensate booster pu the main feedwater pumps. The 1A increased until the pump tripped a setpoint.	o compensate for the lischarge pressure. actuation was raise the normal startup . The stator coolar less pressure drop imp start further ine main feedwater pump it its high discharge	e original pressure Steam generator level ed to 30 inches on the control valves since nt and demineralizer across the condensate creased pressure to discharge pressure e pressure trip	
The cause of the feedwater swing a still under investigation. Severa 1. The feedwater pumps ar valves. These valves pump flow. The B MFDW observed to be cycling The control circuitry 2. Because the unit had o after an extended refu reached 73 percent ful This led to a low dema Normal Integrated Cont low demands may be uns	nd resultant loss of 1 factors may have by 2 equipped with mini- 3 operate based on ind 3 open and closed due 4 for these valves is 5 only had one effectiv- 5 neling outage and sin 1 power, decay heat 5 and for feedwater for 5 rol System (ICS) con- 5 table.	f main feedwater is been contributing: imum recirculation dividual feedwater tion valve was ring the transient. being evaluated. we full power day nce the unit had only load was very low. llowing the trip. ntrol of feedwater at	

6-89)	U.S. M	NUCLEAR REGULATORY COMMISSIO	APPROVED OMB NO. 315	50-0104	
	LICENSEE EVENT REPORT (TEXT CONTINUATION	LER)	EXPIRES: 4/30/92 ESTIMATED BURDEN PER RESPONSE T INFORMATION COLLECTION REQUEST COMMENTS REGARDING BURDEN ESTIM AND REPORTS MANAGEMENT BRANCH REGULATORY COMMISSION, WASHINGT THE PAPERWORK REDUCTION PROJEC OF MANAGEMENT AND BUDGET, WASHI	COMPLY WTH THIS 50.0 HRS, FORWARD IATE TO THE RECORD (P-530), U.S. NUCLEAF ON, DC 20555, AND TO (3150-0104), OFFICE NGTON, DC 20503.	505405
ACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)	
			YEAR SEQUENTIAL REVISION		
Oconee Nuclea	ar Station, Unit 1	0 15 10 10 10 12 16 19	911 - 01111 - 010	0 17 OF 0 1	9
T (If more space is required, use	additional NRC Form 398A's) (17)				_
3.	The control rack for t the amount of steam to pressure steam control feedwater pump turbine pressure or high press are more stable, with the poor adjustment is been admitted prematur control on the pumps. these turbines states feedwater oscillations	he 1A MFDW pump turk the turbine, was for valve out of adjust s can be supplied fr ure steam. They nor low pressure steam. that the high press ely, thus reducing to The Maintenance Eno- that this could have but probably did no	bine, which adjusts bund with the high tment. The main com either low cmally operate, and The significance of sure steam could have the degree of speed gineer in charge of e increased the bt cause them.	· · · · · · · · · · ·	
Plant pers determine Maintenanc of the mis	onnel are currently eval the cause and potential e Investigation Report i adjustment of the 1A MFD	uating the various f corrective actions f s being prepared to WP controls.	Eactors involved to For this problem. A determine the cause		
The feedwa feedwater attempting stabilized determine operator t	ter swing could have bee pumps in manual mode. T to follow startup feedw pump speed demand. Sim if post trip feedwater o raining.	n terminated by plac his would have preve ater valve pressure ulator training will scillations can be i	ing both main ented the pumps from differences and be evaluated to introduced to enhance		
This equip model ATI. radiation,	ment failure is NPRDS re The event did not invo or personnel injuries.	portable as the Gene lve radioactive rele	eral Electric Alterex, ases, overexposure to		
CORRECTIVE	ACTIONS				
Immediate			· .		
1.	Operations personnel s trip.	afely controlled the	reactor after the		
2.	An immediate investiga of the reactor trip.	tion was initiated t	o determine the cause	· · ·	
Subsequent	•		•	,	
1.	All loose terminal con connectors found loose	nections and electri in the investigatio	cal harness n were tightened.		
2.	The shipping bolt foun rebalancing of the cou	d on the exciter cou pling performed.	pling was removed and		
3.	After review, the Opera Unit 1 was changed to due to the failed neut	ations Emergency Ope incorporate special ron detector, NI-3.	rating Procedure on directions required		
4.	Maintenance personnel pump.	readjusted the contr	ols on the 1A MFDW		

NRC FORM 366A (6-89)		U.S. NUCLEAR REGULATORY COMMISSIO	APPROVED OMB NO. 31	50-0104
	LICENSEE EVENT REPOR TEXT CONTINUATION	T (LER) N	EXPIRES: 4/30/9 ESTIMATED BURDEN PER RESPONSE INFORMATION COLLECTION REQUEST COMMENTS REGARDING BURDEN ESTII AND REPORTS MANAGEMENT BRANCI REGULATORY COMMISSION, WASHING THE PAPERWORK REDUCTION PROJE OF MANAGEMENT AND BUDGET, WASH	2 TO COMPLY WTH THIS 15 50.0 HRS, FORWARD MATE TO THE RECORDS 1 (P530), U.S. NUCLEAR TON, DC 20555, AND TO CT (3150-0104), OFFICE INGTON, DC 20503.
FACILITY NAME (1)		DOCKET NUMBER (2)	LER NUMBER (6)	PAGE (3)
			YEAR SEQUENTIAL REVISION	
	loom Station II. it]			
TEXT (If more space is required,	Lear Station, Unit 1			
Planned				
			. ,	
1.	Instrument and Elect Correct as necessary equipment subject to these inspections, a whether a preventive terminals on a perio	trical (I&E) personnel y terminals and connec o high vibration. Base an evaluation will be n e maintenance program odic basis is required	will inspect and tors located on ed on the findings of made to determine to inspect these •	•
2.	Engineering personne 41MXa to determine	el will evaluate the fait alternative logic so	ailure logic of relay chemes are needed.	- [*]
3.	Maintenance Engineer couplings for shippi necessary, on Units sufficient duration	ring will inspect the d ing bolts and remove an 2 and 3 during the ne:	exciter-generator ny bolts, if xt outage of	
4.	During the next outa detector for NI-3 wi	age of sufficient dura ill be replaced.	tion on Unit 1, the	
5.	I&E engineers will e feedwater swings whi appropriate recommer	evaluate the cause and ich occurred at low poundations.	effects of the wer and make	
б.	Operations Training introducing post-tri simulator training.	personnel will evaluat ip feedwater oscillatio	te the feasibility of ons into operator	
7.	A procedure will be connectors and to ti the exciter housing	written to tighten and ighten all terminal con following replacement	d lock-wire all nnections mounted on of the housing.	
SAFETY A	NALYSIS		· · · · · · · · · · · · · · · · · · ·	
A genera operatio the prim This res an event Reactor and heat turbine pressure The oper	tor lockout and the resu n, leads to an imbalance ary system and the amour ults in Reactor Coolant ual challenge to the Pow Protective System (RPS) up by use of the turbine trip will cause a reacto . This safety feature s ator response to the tri	alting turbine trip, when the amount of the between the amount of the trip of power removed by System (RCS) heatup are ver Operated Relief Value of the trip trip trip trip trip trip trip trip	hile at power f power produced in the secondary system. nd pressurization and lve (PORV). The 5 overpressurization trip. That is, the n of increased RCS during this event.	
main fee the Emer controll Driven E necessar If eithe feedwate	dwater subsequent to the gency Feedwater (EFDW) s ed steam generator level FDW pump was being teste y, by the manipulation o r Motor Driven Emergency r pump would have been s	system. The EFDW system system. The EFDW system of a ppropriately. Althed, it could have been of one manual valve and reedwater Pump had facult	necessary challenge to mecessary challenge to em actuated and hough the Turbine aligned, had it been d two electric valves. ailed, one emergency ecay heat.	· · ·

(6-89)	LICENSEE EVENT REPORT (TEXT CONTINUATION				(LER)	NUCLEAR REGULATORY COMMISSIO					APPROVED OMB NO. 3150-0104 EXPIRES: 4/30/92 ESTIMATED BURDEN PER RESPONSE TO COMPLY W INFORMATION COLLECTION REQUEST: 50.0 HRS. FO COMMENTS REGARDING BURDEN ESTIMATE TO THE R AND REPORTS MANAGEMENT BRANCH (P-530), U.S. N REGULATORY COMMISSION, WASHINGTON, DC 20555, THE PAPERWORK REDUCTION PROJECT (3150-0104), OF MANAGEMENT AND BUDGET, WASHINGTON, DC 2055								
FAČIL	ITY NAME (1)				1		DOCKE	TNUM	BER (2)		·		LE		t (6)		P	AGE ((;
												YEAP		SEQUENT		REVISION			Í
	Oconee	Nuclea	r Statio	n. Un	it :	1	0 5	101	0 0	121	619	911	_	0111	1 -	010	019	OF	
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	The Amps exis dete suff	failure result tence c ctors, icient	e of inte ted in or of anothe and two alterna	ermed ne le er va sour te co	liate ss : lid ce : ore :	e range indicat detect range c reactiv	dete ion o or wi letect vity i	ctor f co th t ors ndio	NI- ore r che s gave catio	3 t eac ame th ns.	o de tivi ran e co	crea ty. ge, ntro	se h Hov five l re	oelow wever, e powe bom op	5E-1 the r ran erat) nge ors			
	No p	ersonne	el injur:	ies o	or ra	adioact	ive r	elea	ases	occ	urre	d.	The	event	did	not			
	comp	LOUITSE	the nea.	ICH a	inu i	sarecy	or ch	e pi	10110	•									
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