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Ref: 10CFR50.73(a)(2)(iv)

W3B5-91-0214
A4.05
QA

July 24, 1991

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

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Submittal of Licensee Event Report

Gentlemen:

Attached is Licensee Event Report Number LER-91-013-00 for Waterford Steam Electric Station Unit 3. This Licensee Event Report is submitted pursuant to 10CFR50.73 (a)(2)(iv).

Very truly yours,

D.F. Packer
General Manager - Plant Operations

DFP/LDC/jrr
Attachment

cc: Messrs. R.D. Martin
G.L. Florreich
J.T. Wheelock - INPO Records Center
E.L. Blake
D.L. Wigginton
N.S. Reynolds
NRC Resident Inspectors Office

IE22

NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555; AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Waterford Steam Electric Station Unit 3	0 5 0 0 0 3 8 2	1 OF 0 6

TITLE (4): Manual Reactor Trip in Response to High Steam Generator Water Level Due to a Failed Startup Feedwater Regulating Valve

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)
									N/A	0 5 0 0 0
0 6	2 4	9 1	9 1	0 1 3	0 0	0 7	2 4	9 1	N/A	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 2 6	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)	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)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
W.R. Brian, Plant Engineering Superintendent	AREA CODE 5 0 4 , 6 4 - 3 1 2 7

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	J B	L C	W 1 2 0	Y		B	S J	T G	W 1 2 0	Y	
B	J I	V C	6 0 0	Y							

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)

At 1315 hours on June 24, 1991, the reactor at Waterford Steam Electric Station Unit 3 was manually tripped due to high water levels in Steam Generator (SG) #2. Four SG #2 high level reactor pre-trip alarms were received prior to manually initiating a reactor trip. A main steam isolation signal was manually actuated subsequent to the reactor trip as a result of excessive cool down rate. This event is reportable as an unplanned reactor protection system actuation.

The root cause of this event is SG #2 startup feedwater regulating valve failing open while at 25 percent reactor power. A process analog control (PAC) card in the valve control circuitry failed, resulting in a constant open signal to SG #2 startup feedwater regulating valve. The PAC card was replaced. Plant protective features functioned as designed; therefore, this event did not threaten the health or safety of the general public or plant personnel.

At 1119 hours on June 24, 1991, Waterford Steam Electric Station Unit 3 was operating at 100% power, when a grid voltage transient caused by lightning actuated the sudden pressure relay trips on main transformers A and B (EIIS Identifier EA-XFMR). The sudden pressure trips on both main transformers initiated a main turbine generator (EIIS Identifier TA) trip signal. The subsequent load rejection was automatically accommodated by the Steam Bypass Control System (SBCS) (EIIS Identifier JI) and the Reactor Power Cutback System (RPCS) (EIIS Identifier JD). Reactor power was stabilized at approximately 35% power with control element assembly (CEA) regulating groups 5 and 6 (EIIS Identifier AA) inserted as a result of the RPC.

Control room indications of the transient were main transformer A and B sudden pressure trip flags, the main turbine tripped, all 6 steam bypass control valves (SBCV) (EIIS Identifier JI-V) initially open and then sequentially shutting to modulate steam demand, and CEA regulating groups 5 and 6 rod bottom lights lit with corresponding plant parameters changing as expected in response to a RPC.

Off-normal Operating Procedure, OP-901-003, Reactor Power Cutback, was entered. At 1127 hours, reactor power had stabilized at approximately 35% power. At 1138 hours, withdrawal of CEAs was commenced in accordance with OP-901-003. At 1242 hours, CEA regulating group 6 was greater than 75 inches and OP-901-003 was exited. At 1251 hours, CEA regulating group 6 was greater than 120 inches and Feedwater Pump Turbine (FWPT) 'A' (EIIS Identifier SJ) was secured.

The Shift Supervisor, upon concurrence from the Operations Superintendent, directed that reactor power be lowered to approximately 25% while personnel inspected the main transformers and the switchyard electrical distribution for damage. The inspection was estimated to take several hours.

At 1303 hours, FWPT 'A' recirculation valve, FW-111A, was isolated due to the spurious cycling of this valve. At 1308 hours, the instrument air line for the actuator assembly to SBCV MS-320A was discovered to be broken with the valve failed in the open position. The control room staff ordered SBCV MS-320A to be isolated locally.

At 1315 hours, reactor power was 26% and slowly lowering, when the water level for steam generator (SG) #2 (EIIS Identifier SB) began to rise at a rapid rate. SG water level control (EIIS Identifier JB) was in automatic. Operations personnel in the control room recognized that SG #2 startup feedwater regulating valve (SUFWRV) (EIIS Identifier SJ-V) had failed open. SG #2 SUFWRV controller was placed in manual and the valve failed to respond. SG #2 high level pre-trips were received on all four channels of the Plant Protection System (PPS) (EIIS Identifier JC). Operations personnel manually tripped the reactor (EIIS Identifier AB) prior to the SG #2 high water level reactor trip setpoint (87.7% narrow range indication). SBCV MS-320A was partially isolated at this time.

A Main Steam Isolation Signal (MSIS) (EIIS Identifier JE) was manually actuated due to excessive reactor coolant system (RCS) cool down at 1317 hours. Operations personnel noted during the post trip review that at 1316 hours, a high SG #2 level wide range instrumentation (96% wide range indication) initiated a main feedwater isolation valve signal to shut FW-184B, main feed water isolation valve (EIIS Identifier SJ-V) to SG #2.

The reactor trip override circuitry provides signals to shut both main feedwater regulating valves and throttles SUFWRVs to approximately 20% open upon initiation of a reactor trip. The throttling in the shut direction of SG #1 SUFWRV increased the feedwater flow rate and the rise in water level for SG #2, since SG #2 SUFWRV was stuck in the open position. Ultimately, SG #2 level rose above the high SG #2 level main feedwater isolation valve signal and increased the RCS cool down rate.

At 1320 hours, Emergency Operating Procedure OP-902-004, Excess Steam Demand Recovery Procedure, was entered due to MS-320A failing open. At 1324 hours, an Unusual Event was declared as a result of the excessive cool down resulting from the stuck open SBCV MS-320A and SG #2 SUFWRV. The lowest reactor coolant cold leg temperature reached during the excess steam demand transient was approximately 528 degrees Fahrenheit.

At 1332 hours, operations personnel manually initiated an emergency feedwater actuation signal (EFAS) (EIIS Identifier JE) to SG #1. At 1424 hours, operations personnel manually initiated an emergency feed actuation signal (EFAS) to SG #2. The EFASs were initiated to restore SG water levels in accordance with OP-902-004.

At 1712 hours, OP-902-004 was exited and Emergency Operating Procedure OP-902-008, Safety Function Recovery Procedure, was entered. At 1718 hours, OP-902-008 was exited. At 1723 hours, the Unusual Event was terminated with plant conditions stable.

The root cause of this event is failure of the SUFWRV control circuitry to maintain proper water level (60-70% narrow range indication) in SG #2. The startup feedwater regulating valve failed open due to a malfunctioning Westinghouse Tracking Driver NTD card (EIIS Identifier JB), FW IHT1106 serial # c66056, in the Process Analog Control (PAC) System. Specifically, a quad two input nand chip failed on the NTD card. The PAC card failure resulted in a constant open signal to SG #2 startup feedwater regulating valve. The PAC card that failed was a new card with only one month of service time, installed as part of an effort to improve PAC card reliability. The PAC card was replaced. Similar failures of this card will be trended and efforts to enhance PAC card reliability will continue to be pursued.

The failure of the SBCV MS-320A was probably a result of the mechanical vibration caused by the inadvertent cycling of the FW-111A, FWPT 'A' recirculation valve. The close physical proximity of SBCV MS-320A to FW-111A may have resulted in mechanical vibration of SBCV MS-320A and caused the mechanical feedback position arm to become disconnected, resulting in a constant open signal to SBCV MS-320A. Methods to prevent vibration from adversely affecting operation of the mechanical feedback position arm are being investigated.

Mechanical vibration may have also resulted in the material failure of the instrument air line to the actuator assembly for SBCV MS-320A. The mechanical feedback position arm and instrument air line have been replaced. Improvements to instrument air lines are currently being evaluated to prevent material failure of the lines due to mechanical vibration. Further investigation will continue in order to confirm the cause of SBCV MS-320A failure.

FW-111A spuriously cycled open from the closed position due to a faulty Westinghouse function generator NCH card, CDIFCH2210A serial # 30352. The NCH card provided a spurious open signal to the recirculation valve FW-111A. The specific component that failed on the NCH card will be identified during post maintenance analysis of the card. The card was replaced and subsequently calibrated.

Contributing to this event is the design of the main transformer sudden pressure trip. An engineering evaluation has been performed and the main transformers sudden pressure trip signal to the main turbine has been removed.

SIMILAR EVENTS

LER 90-012 reported a reactor trip following a severe voltage transient on the 230 KV transmission grid (EIIS Identifier FK) caused by a lightning strike. The SBCS was inoperable during the event due to grid voltage fluctuations and as a result, the reactor tripped due to the load reduction from the main turbine.

LER 90-003 reported a reactor trip due to a severe voltage transient on the 230 KV power transmission grid. The transient was initiated when an Occidental Chemical Company employee inadvertently opened a wrong switch and caused the fault on the grid.

Since these two events, a design change has been implemented which re-aligned the SBCS control power supply to an uninterruptable power supply.

PLANT CONTACT

W. R. Brian, Plant Engineering Superintendent, 504/464-3127