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W3F1-93-0115
A4.05
QA

February 15, 1993

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

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

Gentlemen:

Attached is Licensee Event Report Number LER-92-018-00 for Waterford Steam Electric Station Unit 3. This Licensee Event Report is submitted voluntarily for the information of the NRC staff.

Very truly yours,

D.F. Packer
General Manager - Plant Operations

DFP/TWG/ssf
Attachment
cc: J.L. Milhoan, NRC Region IV
G.L. Florreich
J.T. Wheelock - INPO Records Center
R.B. McGehee
N.S. Reynolds
NRC Resident Inspectors Office
Administrator - LRPD

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

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

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

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Waterford Steam Electric Station Unit 3	05000 382	1 OF 13

TITLE (4)
Design Change Error Results in Undervoltage Relay Actuation and Loss of Safety-Related Bus

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	05000
09	30	92	92	-- 018 --	00	02	15	93	FACILITY NAME: N/A	DOCKET NUMBER: 05000

OPERATING MODE (9)	6	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)	000	20.402(b)	20.405(c)	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
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
		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)	Voluntary

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
R.S. Starkey, Operations and Maintenance Manager	(504) 464-3134

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

SUPPLEMENTAL REPORT EXPECTED (14)

	YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

September 30, 1992, while shutdown in Mode 6 for the fifth refueling outage, Waterford 3 SES experienced a loss of the 3A3-S safety bus when the bus feeder breaker tripped open on an apparent degraded voltage condition. The 3A3-S bus was deenergized for 59 minutes before power was restored. The operating shutdown cooling train was not affected.

The feeder breaker trip occurred during the installation of new undervoltage relays on the 3A3-S bus. Three factors contributed to this event: First, the approved design change included a significant error. Second, the installation instructions were inadequate because they were not set up to identify problems before they could affect the plant. Finally, the work was not scheduled such that the safety significance of problems that might reasonably have been anticipated would be minimized.

Programmatic reviews and procedure changes are planned to prevent recurrence. Since shutdown cooling was not affected, this event posed no risk to the health and safety of the public. LER 91-005 reported a similar occurrence.

REQUIRED NUMBER OF DIGITS/CHARACTERS
FOR EACH BLOCK

BLOCK NUMBER	NUMBER OF DIGITS/CHARACTERS	TITLE
1	UP TO 46	FACILITY NAME
2	8 TOTAL 3 IN ADDITION TO 05000	DOCKET NUMBER
3	VARIES	PAGE NUMBER
4	UP TO 76	TITLE
5	6 TOTAL 2 PER BLOCK	EVENT DATE
6	7 TOTAL 2 FOR YEAR 3 FOR SEQUENTIAL NUMBER 2 FOR REVISION NUMBER	LER NUMBER
7	6 TOTAL 2 PER BLOCK	REPORT DATE
8	UP TO 18 -- FACILITY NAME 8 TOTAL -- DOCKET NUMBER 3 IN ADDITION TO 05000	OTHER FACILITIES INVOLVED
9	1	OPERATING MODE
10	3	POWER LEVEL
11	1 CHECK BOX THAT APPLIES	REQUIREMENTS OF 10 CFR
12	UP TO 50 FOR NAME 14 FOR TELEPHONE	LICENSEE CONTACT
13	CAUSE VARIES 2 FOR SYSTEM 4 FOR COMPONENT 4 FOR MANUFACTURER NPRDS VARIES	EACH COMPONENT FAILURE
14	1 CHECK BOX THAT APPLIES	SUPPLEMENTAL REPORT EXPECTED
15	6 TOTAL 2 PER BLOCK	EXPECTED SUBMISSION DATE

REPORTABLE OCCURRENCE

On September 30, 1992, while shutdown in Mode 6 for the fifth refueling outage, Waterford 3 SES experienced a loss of the 3A3-S safety bus (EIIS Identifier EA) when the bus feeder breaker from the offsite power supply tripped open on an apparent degraded voltage condition. The 'A' side Emergency Diesel Generator (EDG; EIIS Identifier EK), which would normally start to energize the 3A3-S bus on a degraded voltage condition, was tagged out to perform routine outage-related engine maintenance. As a result, the 3A3-S bus was deenergized for 59 minutes before offsite power could be restored by locally closing the feeder breaker. Reactor Coolant System (RCS; EIIS Identifier AB) temperature was not affected by this event because shutdown cooling was being provided by train 'B' equipment which was energized from an unaffected power supply.

The "4.16 kV Emergency Bus Undervoltage (Loss of Voltage)" and "4.16 kV Emergency Bus Undervoltage (Degraded Voltage)" are both referenced as "initiating signals" in Technical Specification 3/4.3.2, "Engineered Safety Features Actuation System [EIIS Identifier JE] Instrumentation." Based on this reference to the undervoltage/degraded voltage devices in the Technical Specifications, the event was initially classified as an automatic Engineered Safety Features (ESF) actuation. Accordingly, a voice notification was made to the NRC as required by 10CFR50.72(b)(2)(ii).

However, a review of the Waterford 3 FSAR indicates that the "Standby (Emergency) Power and Distribution Systems" are described as "ESF Support Systems" rather than Engineered Safety Features. Given the guidance provided in NUREG-1022, Supplement 1, "Licensee Event Report System," which indicates

that no standard list of ESF's exists but rather that each plant has defined systems as ESF's in the plant's FSAR, the actuation of the undervoltage/degraded voltage devices in this event did not constitute actuation of an ESF because the devices are not classified as ESF's in the Waterford 3 FSAR. Therefore, the actuation of the undervoltage/degraded voltage relays in this event did not warrant notification of the NRC in accordance with 10CFR50.72(b)(2)(ii).

When power was locally restored to the 3A3-S bus after 59 minutes, an invalid actuation of control room emergency ventilation (EIIS Identifier VI) train 'A' occurred. The actuation was invalid because it did not occur in response to actual plant conditions satisfying the requirements for ESF actuation.

Effective October 13, 1992, invalid control room emergency ventilation system actuations are no longer reportable events. Guidance provided by the NRC to at least one other utility indicates that events which occur within 30 days prior to October 13 that satisfy the exclusion requirements of the new rule are not reportable as LERs even if a 10CFR50.72 notification was made. Therefore, this event (which occurred September 30) is not reportable on the basis of the invalid actuation of the control room emergency ventilation system.

In summary, this event does not satisfy any of the specific reporting criteria of 10CFR50.73. Given the sensitivity of these types of events, however, this report is provided as a voluntary LER for the information of the NRC staff.

INITIAL CONDITIONS

Plant Power	0 %
Plant Operating Mode	Refueling (Mode 6) with RCS level at the reactor vessel flange
Procedures Being Performed Specific to this Event	None
Technical Specification LCO's in Effect Specific to this Event	None
Major Equipment Out of Service Specific to this Event	EDG 'A'

EVENT SEQUENCE

On September 30, 1992, while shutdown in Mode 6 for the fifth refueling outage, Waterford 3 SES experienced a loss of the 3A3-S safety bus when the bus feeder breaker from the offsite power supply tripped open on an apparent degraded voltage condition.

The trip was caused by the actuation of three new undervoltage relays that were being installed as part of a design change. Because of an error in the design change, no provision was made for the relays to sense bus voltage. Accordingly, as all three of the relays were eventually energized during the installation, none of them sensed bus voltage. This condition satisfied the necessary coincidence logic for the undervoltage/degraded voltage trip of the offsite power feeder breaker. The relays functioned as designed in this condition and tripped the feeder breaker.

The 'A' side Emergency Diesel Generator, which would normally start to energize the 3A3-S bus on a degraded voltage condition, was tagged out to perform outage-related maintenance and inspections. As a result, the 3A3-S bus was deenergized for 59 minutes before offsite power could be restored by locally closing the offsite power feeder breaker.

Reactor Coolant System pressure and temperature were not affected by this event because shutdown cooling was being provided by train 'B' equipment energized from a source that was unaffected by the event.

The Control Room Emergency Ventilation System started as expected when power was restored to the 3A3-S bus.

CAUSAL FACTORS

A review of this event identified two problems which contributed equally to this event: a personnel error during preparation of the design change package and weaknesses in the Design Change Package implementation process.

First, DC-3358, "Degraded Voltage Detection Scheme For A and B Safety Busses," as originally issued, contained a significant error. Among other things, the modification specified the replacement of six undervoltage relays (three relays each for the 'A' and 'B' busses). However, the drawings issued to direct the installation of DC-3358 did not specify all of the necessary wiring for the new undervoltage relays to sense bus voltage. Although the impact of this omission could have been minimized by careful sequencing of the work in the outage schedule or installation instructions that were more fault-tolerant, the new relays could not have functioned properly without the

missing wiring. This deficiency was not noted during the design verification performed for DC-3358.

In any event, the three 'A' side undervoltage relays were installed in accordance with the drawings provided with DC-3358. Accordingly, the wiring by which the relays sense bus voltage was not installed. As the installation progressed, all three of the new relays were eventually installed and control power energized. Absent the missing wiring, none of the three relays sensed bus voltage. This condition satisfied the necessary coincidence logic for the undervoltage/degraded voltage trip of the offsite power feeder breaker. The relays functioned as intended in this condition and tripped the breaker that supplies offsite power to the 3A3-S bus.

This sequence of events highlights a second causal factor in this event: the failure of the Design Change Package implementation process to function as a barrier that should serve to prevent improperly installed equipment from affecting the plant. In this event, the installation instructions for the new relays were not fault-tolerant. That is, the installation was not set up such that the new relays could be installed and then evaluated under controlled conditions that would not impact the plant to ensure that they were installed properly. Instead, all three of the new relays were installed and control power energized before any testing had been performed to verify that the installation was correct. As originally written, the installation instructions implicitly assumed that the new relays were properly installed and would perform as expected. In retrospect, a more conservative installation and testing plan would have been appropriate given the potential that improperly wired relays could cause the bus to trip.

NON-CAUSAL FACTORS

A second barrier was also not fully effective in ensuring that the relay installation did not adversely affect the plant. Although this event did not affect the operating shutdown cooling train or reactor coolant system temperature, it did result in the temporary loss of a Technical Specification required train of shutdown cooling. Nevertheless, there was no provision in the outage schedule to ensure that- absent special precautions- the 'A' side relay replacement work did not occur at a time when the 'A' train of shutdown cooling was required to be operable (barriers were in place and were effective in controlling work on the 'B' train of shutdown cooling, which was operating).

Waterford 3 has established a multi-disciplinary "Outage Risk Assessment Team" which, among other things, was tasked with reviewing the schedule for the fifth refueling outage and ensuring that safety significant work was properly scheduled. However the original outage schedule which was submitted on July 28, 1992 for the Outage Risk Assessment Team (ORAT) review, did not include the full scope of DC-3358 because the modification had not yet been approved. Although general reference was made to DC-3358, the detailed activities necessary to implement the modification were not included in the schedule that was reviewed by the ORAT.

The absence of sufficient information about DC-3358 from the outage schedule essentially meant that an independent review of the implementation schedule was not performed by the ORAT. The net effect of this was to eliminate an independent check of the schedule which might well have identified that implementation schedule for DC-3358 was inadequate. At a minimum, the work

might well have been identified as a reliability risk for the redundent train of shutdown cooling which would have caused special administrative controls to be put into effect. As it was ultimately included in the outage schedule, the only restriction for replacing the relays was that the EDG 'A' not be in service. This single restriction was clearly inadequate for the work that was to be performed, given the potential impact on shutdown cooling train 'A.' Since DC-3358 was a safety significant modification, it should have been prepared and placed in the outage schedule in sufficient time before the outage for the ORAT review.

TIME LINE

July 15	Refuel 5 schedule frozen.
July 30	DC-3358 approved by Plant Operations Review Committee (PORC). ORAT begins review of outage schedule dated July 28th. The schedule which the team has for review includes DC-3358 as part of the outage scope; however, the detailed activities associated with the design change are not included in this edition of the outage schedule.
August 3	Preliminary schedule developed for DC-3358. The schedule breaks the modification down into individual activities each of which is specifically tied to "preceding" and "succeeding" activities. This "first cut" at adding DC-3358 to the outage schedule recommends beginning the work after Shutdown Cooling Train 'A' is tagged out.
September 4	Undervoltage relay replacement activity approved as a change to the outage schedule. As approved, the work may begin after EDG 'A' is taken out of service. The scheduled start date for this work is September 20, one day after the start of the outage.
September 20	EDG 'A' removed from service.
September 21	Existing undervoltage relays removed.
September 29	Installation of new relays begins.

September 30 1039 Shutdown Cooling train 'A' secured. SDC Train 'B' (protected train) remained in service carrying shutdown cooling loads. Reactor Coolant System level was at the reactor vessel flange.

1100 3A3-S Bus inadvertently deenergized as a result of relay replacement work.

1159 Power restored to 3A3-S bus.

ACTIONS TO PREVENT RECURRENCE

The corrective action described for this event represents synthesis of several independent reviews of this event. In addition to the research conducted for this report, the Waterford 3 Operational Experience Engineering Group conducted a review of this event. An independent review was also performed by a team of personnel made up of a representative from Entergy Operation's corporate headquarters as well as personnel from Entergy's other nuclear units, Arkansas Nuclear One and Grand Gulf Nuclear Station. For the most part, the corrective actions included here envelope the recommendations made in the other reviews of this event.

First, Administrative Procedure PLG-009-005, "Outage Planning and Controls," will be revised to require that the Outage Risk Assessment Team review all safety-significant schedule additions and changes. This will ensure that proposed changes to the outage schedule receive an independent review that is focused on preserving the availability of key shutdown safety systems and the key safety functions, including but not limited to the ability to remove decay heat. This will also ensure that late additions or changes to the outage schedule receive an appropriate review by the team. It is recognized

that this review would not have prevented this event. Nevertheless, the review could reasonably have been expected to identify this work as a reliability risk for shutdown cooling and caused it to be scheduled such that the safety significance of the event was minimized. It should be noted here that mid-way through the outage, the General Manager - Plant Operations requested that the ORAT retroactively review changes that had been made to the refueling outage schedule. The review had yet to evaluate DC-3358 activities when the 3A3-S bus was inadvertently deenergized.

This event also indicated that additional technical review of work instructions by Design Engineering might be warranted when implementing safety significant or complex modifications.

The design change package implementation process will be revised to provide for increased interaction, as appropriate, between the Lead Design Engineer and the responsible member of the design change implementing organization. It is anticipated that this increased interaction, particularly during the planning phase of the implementation process, will provide for the timely identification and resolution of potential problems. Unlike the more general pre-implementation meetings that have been required by the design change process, the revised process is expected to be strongly oriented towards a detailed review of the installation.

This event will be reviewed with various plant personnel for lessons learned. Specifically, it will be discussed by Design Engineering, Modification Control, Planning and Scheduling, System Engineering, and Construction supervision with appropriate members of their respective work groups. It

will also be included in a regularly scheduled industry events seminar. Finally, it will be reviewed with Maintenance personnel during regular shop meetings. The Design Engineering discussion will stress management expectations regarding the design verification process and the importance of accurately evaluating proposed changes to establish the full scope of the work involved.

Finally, the design engineer responsible for the development of DC-3358 has been counselled regarding the error in the Design Change Package and management expectations in this area.

Corrective action associated with this event will be complete one month prior to the start of the next refueling outage, which is currently scheduled to begin on April 21, 1994.

SAFETY SIGNIFICANCE

Although a Technical Specification required train of the shutdown cooling system was rendered inoperable, the train that was actually providing shutdown cooling was energized from a 'B' side bus and was not affected by this event. Since the operating shutdown cooling train was not affected, this event posed no risk to the health and safety of the public or plant personnel.

SIMILAR OCCURRENCES

LER 91-005 reported an event in which work control issues during Waterford 3's fourth refueling outage resulted in a loss of shutdown cooling. The most significant difference between the event described in LER 91-005 and

the event discussed here is this: despite the problems experienced with the implementation of DC-3358, the operating shutdown cooling train was not at risk during this event.