

## LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)  
St. Lucie, Unit 2

DOCKET NUMBER (2)

0 5 0 0 0 3 8 9 1 OF 0 5

PAGE (3)

TITLE (4)  
Reactor trip initiated by spurious Engineered Safeguards Features Actuation SignalEVENT DATE (5)  
MONTH DAY YEAR  
0 8 0 8 8 5 8 5  
LER NUMBER (6)  
YEAR SEQUENTIAL NUMBER REVISION NUMBER  
0 0 8 0 0  
REPORT DATE (7)  
MONTH DAY YEAR  
0 9 0 9 8 5  
OTHER FACILITIES INVOLVED (8)  
FACILITY NAMES  
N/A  
DOCKET NUMBER(S)  
0 5 0 0 0OPERATING MODE (9)  
POWER LEVEL (10) 0 1 9 1 9  
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)  
20.402(b) X 50.73(a)(2)(iv) 73.71(b)  
20.405(a)(1)(i) 50.36(a)(1) 50.73(a)(2)(v) 73.71(c)  
20.405(a)(1)(ii) 50.36(a)(2) 50.73(a)(2)(vi) OTHER (Specify in Abstract below and in Text, NRC Form 366A)  
20.405(a)(1)(iii) 50.73(a)(2)(ii) 50.73(a)(2)(viii)(A)  
20.405(a)(1)(iv) 50.73(a)(2)(iii) 50.73(a)(2)(viii)(B)  
20.405(a)(1)(v) 50.73(a)(2)(ix) 50.73(a)(2)(x)LICENSEE CONTACT FOR THIS LER (12)  
NAME  
R. L. Kulavich, Shift Technical Advisor  
TELEPHONE NUMBER  
AREA CODE 3 0 5 4 6 5 - 3 5 5 0COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)  
CAUSE SYSTEM COMPONENT MANUFAC TURE REPORTABLE TO NPROS  
Z E D F U B W 1 2 0 Yes  
PBD J E F U C 5 6 0 YesSUPPLEMENTAL 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 fifteen single-space typewritten lines) (16)

## EVENT:

A reactor trip occurred when both Main Steam Isolation Valves (MSIV's) (ISV) were closed by a spurious "A" side Engineered Safety Features Actuation Signal (ESFAS) (JE).

Operator error during the post-trip response caused a "B" Safety Injection Actuation Signal (SIAS) due to low Reactor Coolant System (RCS) (AB) pressure. All ESFAS actuated components functioned as designed but no water was injected to the RCS because RCS pressure remained above the shut-off head for the High Pressure Safety Injection pumps (BQ). The unit was stabilized using natural circulation of the RCS, manual control of RCS pressure by use of pressurizer heaters and auxiliary spray, and manual control of RCS temperature by manually controlling Auxiliary Feedwater (AFW) (BA) flow and Atmospheric Steam Dump Valves (ADV's) (PCV).

Reactor coolant pump (RCP) (P) seal damage resulted from the SIAS actuations due to the power supply arrangement for the RCP Seal Cooler Heat Exchanger Isolation Valves.

## CORRECTIVE ACTIONS AND ROOT CAUSES FOR EVENT:

The immediate corrective actions were to stabilize the plant and then commence RCS cooldown for RCP seal replacement. During the outage a multi-discipline effort found and resolved the root causes for the event, a loose fuseholder (FUB) connection and an under-sized fuse (FU), and other problems which occurred during the event (operator error in the response to the event and RCP seal damage caused by the electrical system arrangement).

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## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104  
EXPIRES 8-31-85

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TEXT (if more space is required, use additional NRC Form 366A 3/1/77)

EVENT:

The event occurred at 0202 on August 8, 1985. The reactor (AC) was at 99% power with all systems operating in their normal mode. No maintenance or surveillances were in progress. The event was initiated by loss of power to the "A" Engineered Safety Features Actuation Signal (ESFAS) (JE) system relays (44). These relays are deenergized to actuate, so an "A" Safety Injection (SIAS), Containment Isolation (CIAS), and Main Steam Isolation (MSIAS) were actuated. The reactor tripped on low steam generator water level immediately after the Main Steam Isolation Valves (MSIV's) (ISV) closed. The Main Steam Safety Valves (MSSV's) (RV) opened. The reactor coolant system (RCS) (AB) pressure increase actuated the pressurizer Power Operated Relief Valve (PORV) (PSV) for nine-tenths of one second; PORV reseating was confirmed by observation of the acoustic monitor. The Auxiliary Feedwater Actuation Signal (AFAS) started all three auxiliary feedwater (AFW) (BA) pumps and initiated full AFW flow to both steam generators. The immediate actions for a reactor trip were carried out, then one licensed operator (RCO) assumed control of the Atmospheric Steam Dump Valves (ADV's) (PCV) while the other licensed control room personnel (operators) began investigating the spurious "A" ESFAS actuation.

Several minutes later the Assistant Nuclear Plant Supervisor (ANPS) noted that RCS pressure and temperature were below normal and reviewed the actions of the RCO controlling the ADV's. The ANPS observed that AFW flow was maximum and the ADV's were excessively open. The ANPS ordered the ADV's closed and the AFW throttled to the required value. These actions terminated the RCS pressure drop with RCS pressure just above the SIAS setpoint. At 0209, the 2A1 and 2B2 Reactor Coolant Pump (RCP's) (P) were secured due to approaching 10 minutes since the "A" SIAS had secured Component Cooling Water (CCW) (CC) flow to the RCP Seal Cooler Heat Exchangers (HX's). It should be noted that isolation of CCW to the RCP Seal Cooler HX's was the result of the electrical supply arrangement to the HX Isolation Valves and not the CCW Containment Isolation Valves (IV), which can be overridden. At 0209, just seconds after the RCP's were secured, a "B" SIAS was actuated on low RCS pressure. The operators evaluated the "B" SIAS and determined it was due to the excessive RCS cooldown.

The operators directed their attention to (1) restoring RCS pressure to normal, and (2) investigating the cause of the spurious "A" ESFAS. At 0218, nine minutes after the "B" SIAS actuated, RCP's 2B1 and 2A2 were secured because of approaching the 10 minute limit since their RCP Seal Cooler HX's were isolated. Natural circulation of the RCS was initiated with one RCO assigned to manually control RCS pressure and temperature using manual control of pressurizer heaters and auxiliary spray, and manual control of AFW flow and ADV position. At 0223 the RCS pressure recovery reset the "B" SIAS, and by 0230 natural circulation of the RCS was confirmed.

At 0241 the "B" High Pressure and Low Pressure Safety Injection (HPSI and LPSI) (BQ, BP) pumps and Diesel Generator (EK) were secured and returned to their automatic actuation lineup. At 0242 two PORV actuations were recorded due to the RCO manually controlling RCS pressure near the setpoint. For the next two hours the RCS was held stable in natural circulation while troubleshooting the spurious "A" ESFAS. At 0328 the "A" HPSI and LPSI pumps were secured by placing their control switches in "off".

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TEXT: If more space is required, use additional NRC Form 366A (1/17)

At 0550 a blown fuse (FU) in the "A" ESFAS actuation cabinet was discovered and replaced. The "A" ESFAS signals were reset. The "A" Diesel Generator was secured. The "A" HPSI and LPSI pumps and the "A" Diesel Generator were returned to their automatic actuation lineup. At 0631 RCP 2B1 was started. At 0641 RCP 2A2 was started and RCS cooldown was commenced.

CAUSES OF EVENTS:

1. The cause of the reactor trip was closure of both MSIV's due to the spurious ESFAS actuation. The actuation occurred because both the "A" and "C" power supplies for the "A" ESFAS actuation relays were deenergized. The "A" power supply was deenergized by a loose connection in a fuse holder (FUB) (part of a fused switch, Westinghouse model FPPC2211) in the 125 Vac (EF) input power circuit.
2. The "C" power supply for the "A" actuation relays was lost when an erroneously installed undersized fuse blew as the "C" power supply picked up the load. A previous identical event in which the same "C" Power Supply Fuse (FU) blew was reported in LER 389-84-014. After that event the root cause of the fuse failure was not revealed because the post-trip investigation was concluded after several manual cycles of the "A" side power supply breaker did not reproduce the fuse failure. The conclusion at that time was that the fuse failure was a random event. After this second event an underlying problem was suspected, so the "A" power supply breaker was opened and left open for several minutes. The fuse blew after two minutes; the under-sized fuse was discovered after the technical manual was consulted. The fuse installed was a Littelfuse Model 313-003-3AG rather than the required Model 313-015-3AG. It is assumed the wrong fuse was installed due to a cognitive personnel error by a utility Instrument and Control Technician who did not understand the fuse size coding.
3. The cause of the valid "B" SIAS was a cognitive personnel error by a utility licensed operator, i.e. the operator failed to closely monitor the RCS parameters. The operator distractions caused by the ESFAS actuations were exacerbated by the electrical scheme in that the SIAS actuation deenergized the nonsafety grade control instrumentation, including strip chart trending recorders. This loss of power also caused the RCP seal failures and is discussed below. The two PORV actuations during manual RCS pressure control were also cognitive errors in that the operator was controlling RCS pressure too high. This resulted from the long-term containment isolation which secured RCS letdown. The secured RCS letdown caused the operator some concern for rising pressurizer level and resulted in his limiting the use of charging pumps to provide auxiliary pressurizer spray.

## LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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APPROVED OMB NO. 3150-0104

EXPIRES 6/31/85

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

4. The cause of the RCP seal damage was the electrical supply arrangement. At the time of this event the RCP Seal Cooler HX's Isolation Valves (IV) and the control room non-safety grade control instruments were powered from the "non-essential" section of the safety-related load centers. SIAS actuation deenergizes the non-essential sections of safety related load centers. The result was that although power was available, the "non-essential" section supply breaker could not be re-closed because of the SIAS lock-out. The "A" side RCP seal coolers and non-safety instruments were deenergized for four hours as a result of the spurious "A" ESFAS actuation. The "B" RCP seal coolers and non-safety instruments were deenergized for 14 minutes as a result of the "B" SIAS actuation.

#### SAFETY ASSESSMENT:

The plant response to this event was compared to the previous similar event (Spurious ESFAS Reactor Trip: LER 389-84-014) and the Final Safety Analysis Report (FSAR) chapter 15 response analysis for complete isolation of the turbine. The plant response was as expected except for the operator-induced SIAS actuation on low RCS pressure. The SIAS actuation and RCS parameter deviations from the reference events were accounted for by a review of those parameters. Calculations verified that the RCS pressure decrease to the SIAS setpoint was in accord with the observed RCS temperature decrease. The FSAR analysis indicated that pressurizer code safety valves would lift because in that analysis the PORV's were assumed to be in manual. For this event, the PORV actuation prevented the pressurizer code safeties from lifting. The FSAR analysis also indicated the MSSV's would lift as they did.

It should be noted that even with the spurious "A" ESFAS actuation, this could have been a routine reactor trip except for the effect of the electric power supply arrangement which existed at the time of the event. This arrangement allowed a SIAS actuation to cause RCP seal damage and caused control room instrumentation conditions inimical to operator response.

The RCO's overcooling error was mitigated by his supervisor, the ANPS, as he acted to stop the RCS cooldown.

Other systems affected by deenergizing the ESFAS (JE) relays (44) were the "A" Containment Spray Actuation Signal (BE) and the "A" Recirculation Actuation Signal (Part of BQ, BP). The availability of these systems were not affected, only their automatic actuation feature, i.e. these "A" train systems could have been actuated manually. The redundant "B" train systems were not affected and were available to provide the affected functions throughout the event.

In summary, this event is of interest because of the RCP seal damage but it is not a safety concern because:

1. All safety equipment actuated as required and functioned as designed, and
2. All plant parameters remained within the design basis of the plant.



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

CORRECTIVE ACTIONS:

1. The loose fuse holder connection was tightened and all fuse holders of this type were examined for possible loose connections. Manufacturer's representatives were brought in to examine the installed fuse holders for proper application and correct installation. The Electrical Department is preparing a special procedure to ensure that replacing a fuse does not result in a loose connection.
2. The I&C Department has provided training for maintenance personnel on fuse identification and the importance of ensuring that replacement fuses are only those specified in the equipment technical manual.
3. All equipment fuses in the ESFAS (JE) cabinets, the Reactor Protection System (JC) cabinet, and the AFAS (BA) cabinets were verified to be the proper fuses as required by the equipment technical manuals.
4. The licensed operator was counselled not to allow himself to be distracted by events and to properly monitor RCS parameters.
5. All RCP seals were replaced and a plant change was implemented to power the RCP Seal Cooler Heat Exchanger Isolation Valves and the control room non-safety related instrumentation from a source which is not deenergized by an ESFAS actuation.

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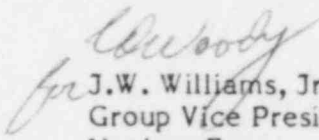
U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Gentlemen:

Re: Reportable Event 85-8  
St. Lucie Unit 2  
Date of Event: August 8, 1985  
Reactor Trip initiated by spurious Engineered  
Safeguards Actuation Signal

The attached Licensee Event Report is being submitted pursuant to the requirements of 10 CFR to provide notification of the subject event.

Very truly yours,

  
J.W. Williams, Jr.  
Group Vice President  
Nuclear Energy

JWW/SAV:mls

Attachment

cc: Dr. J. Nelson Grace, Region II, USNRC  
Harold F. Reis, Esquire  
File 933.1  
PNS 310/1

IE22  
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