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RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 87-009-00: on 871207, analysis of engineered safeguards sys analog Channel B identified faulty rotary switch that rendered portion of sys operable since 871203. Caused by inadequate procedure. Switch replaced. W/880106 ltr.

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NRC Form 366
(9-83)

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APPROVED OMB NO. 3150-0104
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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	1 OF 0 8

TITLE (4) Technical Specification Violation Due To Inadequate Procedure For Functional Test Of Engineered Safeguards System

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
										0 5 0 0 0
1 2	0 7	8 7	8 7	— 0 0 9	— 0 0	0 1	0 6	8 8		0 5 0 0 0

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	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)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	X 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
Philip J. North, Licensing	AREA CODE 7 0 4 3 7 3 - 7 4 5 6

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	
X	J E	H S	B 0 4 5	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)

ABSTRACT

On December 3, 1987 with Unit 3 at 100% full power performance of an Engineered Safeguards (ES) System Analog Channel B On Line Calibration procedure identified a potential problem with the ES System. An analysis performed on December 7 identified a faulty rotary switch that had rendered a portion of ES System Digital Channel 2 inoperable since December 3, 1987. Thus, Technical Specification table 3.5.1-1 was violated.

The root cause of this incident was the failure of the ES System Calibration procedure to insure the proper operation of the rotary switch. A contributing cause was the lack of follow up action taken by involved personnel.

On December 7, 1987, immediate corrective action was taken by replacing and functionally checking the ES System module containing the faulty rotary switch. In addition, Analog Channels on all three units were tested to insure the proper Digital Channel indications were received. Supplemental corrective actions involved counseling involved personnel and revising procedures. Planned corrective actions include an audit of ES Maintenance procedures and issuance of a training letter.

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

Background

The Engineered Safeguards (ES) (EIIS:JE) System is designed with three Analog Channels (A,B,C) feeding two groups of four Digital Channels. The two Digital Groups are divided into even (2,4,6,8) and odd (1,3,5,7) Channels. In order for a Digital Channel actuation to occur, at least 2 Analog Channels must trip. Three Analog Channels and associated instrumentation are provided to prevent a single component failure from rendering the ES System inoperable. The Analog Channels monitor Reactor Coolant System (RCS) (EIIS:AB) pressure and Reactor Building (EIIS:NH) pressure. The Digital Channels actuate ES components when any two of the three Analog Channels indicate that initiation of ES is required. One channel in each group of Digital Channels controls the actuation of certain ES components such that redundancy for actuation of any ES component exists.

In the event the ES System detects a failure of the Reactor Coolant System, it can cause the actuation of the High (EIIS:BQ) and Low (EIIS:BP) Pressure Injection Systems, Reactor Building Cooling Units (EIIS:BK), Reactor Building Isolation (EIIS:JM), Reactor Building Spray (EIIS:BE), Load Shed, and Keowee Hydro Station Emergency Start (EIIS:EK).

Sequence of Events

December 1, 1987
* The Engineered Safeguards (ES) System Digital Channel 2 on line calibration procedure was performed.

December 3

0800
* The ES System Analog Channel B on line calibration procedure was started.

1030
* An Instrument and Electrical (I&E) Technician noticed a possible problem with the indicating lights on ES System Digital Channel 2.

1100
* The I&E Technician notified a Job Supervisor of the potential problem with the ES System Digital Channel 2 indicating lights.
* The Job Supervisor instructed the I&E Technician to consult a Maintenance Engineer.

1300
* The I&E Technician informed the Maintenance Engineer of the potential problem with the ES System Digital Channel 2 indicating lights.

December 3, 1987

1300
* The I&E Technician told the Maintenance Engineer that he would review the applicable drawings and initiate a work request if any action was required.

1330
* The I&E Technician proceeded to finish the ES System Analog Channel on line calibration procedures and did not analyze the possible ES System problem.

December 4
* The I&E Technician was assigned other work and did not analyze the ES System problem.

December 7

1200
* The I&E Technician initiated a Work Request to investigate the possible ES System problem.

1300 * The I&E Technician and Maintenance Engineer began analyzing the ES Digital Channel 2 circuitry.
* Analysis showed that the ES Digital Channel 2 indicating light should have gone bright during the ES Analog Channel B on line test.

1500 * Operations was notified that a problem might exist with the ES System.

1600 * The I&E Technician and Maintenance Engineer performed a test on the ES System and found a faulty rotary switch.

1615 * A limited condition of operation with the ES System was declared.
* Reported on ENS to the NRC per 10 CFR 50.72(b)(2)(iii).

2000 * The ES System module containing the faulty rotary switch was replaced and tested.

December 7, 1987 * The analog channel tests on all three units were performed to verify the Digital Channels were functioning properly.

December 8 * Technical Specification Table 3.5.1-1 was determined to have been violated. Incident was determined to be not reportable per 10 CFR 50.72(b)(2)(iii).

DESCRIPTION OF OCCURRENCE

On December 1, 1987, with Unit 3 operating at 100% full power, an I&E Technician performed the Engineered Safeguards (ES) System Digital Channel 2 on line testing procedure without encountering any functional problems. On December 3, 1987 at 0800, Unit 3 continued to operate at 100% full power and the I&E Technician began performing the ES System Analog Channel B on line calibration procedure.

At 1030 hours, while in the process of performing ES System Analog Channel B trip logic testing, the I&E Technician placed the Pressure Test Circuit in the TEST/OPERATE position. Whenever the Pressure Test Circuit is placed in the TEST/OPERATE position, an Analog Channel trip signal is transmitted to all Digital Channels. During this part of the test, the I&E Technician happened to notice that when the Pressure Test Circuit was placed in the TEST/OPERATE position, Digital Channels 1,3, and 4 High Pressure Injection Analog Channel trip indicating lights (EIIS:IL) went from dim to bright, but the Digital Channel 2 High Pressure Injection Analog Channel trip indicating light did not go bright. These lights are located at the top of the ES System Digital Channel Cabinets. The Digital Channel Cabinets are located immediately adjacent to ES System Analog Channel B cabinet with Digital Channel 1 and 2 Cabinet located approximately eight feet from Analog Channel B Cabinet. The operation of these lights was not covered by the Analog Channel B on line calibration procedure. However, the I&E Technician thought it was strange that Digital Channel 2 High Pressure Injection analog trip indicating lights did not go bright when channels 1,3 and 4 lights did. Being curious about the digital channel 2 indicating light, he opened ES Digital Channel 2 and 4 cabinet to examine the Trip Module lights. He noticed that with Analog Channel B tripped, the trip indicating light was not on. He made a mental note of his observations and proceeded with Analog Channel B testing.

At approximately 1100 hours, the I&E Technician notified a Job Supervisor that he had encountered a potential problem with the ES System. The Job Supervisor was filling in for the I&E Technician's normal Job Supervisor and was not familiar with the operation of the ES System. Therefore, he instructed the I&E Technician to consult Maintenance Engineering concerning the problem. At approximately 1300 hours, the I&E Technician notified a Maintenance Engineer of the potential problem with the ES System. The I&E Technician told the Maintenance Engineer that he would research the applicable drawings and write a work request if any repairs were needed. The Maintenance Engineer agreed with the technician that this was the appropriate action. Both the I&E Technician and the Maintenance Engineer felt if the problem was significant, it would have been identified during the ES System Digital Channel on line calibration or the Analog Channel on line calibration. After discussing the problem with the Maintenance Engineer, the I&E Technician left to complete the ES System Analog Channel on line calibration procedures at 1330.

With the sense of security offered by the successful completion of the ES System Digital Channel On Line calibration procedures, the I&E Technician felt no urgency to immediately analyze the ES System drawings to determine the significance of the abnormal operation of the indicating lights. Therefore, he did not perform an analysis of the problem before the shift ended on December 3, 1987. In addition, he was assigned other work on December 4, 1987 and did not perform an analysis of the problem on that shift either.

At the time of the conversation between the Maintenance Engineer and the I&E Technician, the Maintenance Engineer was involved in other work and he did not ponder the significance of the problem explained to him by the I&E Technician. He felt that the I&E Technician would get back with him if a significant problem was identified. Therefore, he did not follow up on the reported problem. In addition, the Job Supervisor did not follow up with the I&E Technician to ensure a resolution to the problem was reached. The Job Supervisor was busy supervising his regular crew and felt that the I&E Technician and Maintenance Engineer would resolve the problem. Upon reflection, the Maintenance Engineer, I&E Technician, and Job Supervisor all agree that they should have communicated better with each other.

On December 7, 1987, the I&E Technician initiated a Work Request and reviewed ES System drawings to determine the significance of the problem discovered on December 3, 1987. After reviewing the prints, he determined that the indicating lights on ES Digital Channel 2 should have come on when Analog Channel B was placed in the TEST/OPERATE position. At approximately 1300 hours, the Maintenance Engineer and I&E Technician reviewed the relative electrical drawings together and reached the conclusion, that the problem with the lights did indicate an operability problem. At 1500, Operations was notified of the possible problem with the ES System. In order to further verify the existence of the problem, the Maintenance Engineer and I&E Technician proceeded to obtain permission from Operations to simulate the conditions that existed when the problem was first identified. At 1600, during the simulation, it was observed that the indicating lights in question did not come on or go bright as they should according to the ES System logic diagrams. The I&E Technician then

wiggled the rotary switch (EIIS:HS) on the Digital Channel Trip Module and the lights achieved their proper state. With the evidence provided by the simulated test and the ES System logic diagrams, it was determined that an operability problem did exist with ES System Digital Channel 2.

At 1615 hours on December 7, 1987, a limited condition for operation was declared because of the functional problem identified with ES System Digital Channel 2. At this time, the incident was mistakenly determined to be reportable per the requirements of 10 CFR 50.72(b)(2)(iii). The NRC was notified at 1615 via the ENS. To correct the problem, I&E Maintenance proceeded to replace the Digital Channel Trip Module (EIIS:IMOD) which contained the faulty rotary switch. The new module was functionally tested and subsequently, ES System Digital Channel 2 was returned to an operable state at approximately 2000 hours.

In order to verify the problem with the rotary switch did not exit in other ES Digital Channels, the analog channels on all three units were tested on December 7, 1987 to insure the proper digital channel indications were received. No additional ES System failures or operability concerns were identified during this additional testing.

Subsequently, on December 8, 1987, with Unit 3 operating at 100% full power, it was determined that a violation of Technical Specification Table 3.5.1-1 had occurred. This Technical Specification requires the reactor to be brought to Hot Shutdown within 24 hours if ES Digital Channels 1 or 2 are discovered to be inoperable. Since the actual problem with ES System Digital Channel 2 had been discovered on December 3, and no analysis or corrective action was taken until December 7, the 24 hour limited condition of operation allowed by Technical Specification Table 3.5.1-1 had been exceeded. In addition it was also determined that this incident was not reportable per 10 CFR 50.72.

Further investigation of the effect of the faulty rotary switch on the ES System yielded important information concerning the ability of ES System Digital Channel 2 to provide its safety function. After testing the rotary switch and analyzing the ES System logic diagrams, it was determined that only a portion of ES System Digital Channel 2 was inoperable. The rotary switch is composed of four contact wafers with each wafer having ten contacts. Whenever the rotary switch position is changed, a different contact on the wafers is selected and thus the electrical path through the rotary switch is changed. The manipulation of this switch is required during the ES System Digital Channel on line calibration procedure. When testing is completed, the rotary switch is returned to the OPERATE position which was its position when the rotary switch failure was identified. However, not all electrical paths through the rotary switch were inoperable while the switch was in the OPERATE position. Only the electrical path which provides an ES System Analog Channel B Trip indication to Digital Channel 2 was inoperable. ES System Analog Channels A and C trip signal paths were operable and would have tripped ES System Digital Channel 2 if both of these analog channels had tripped due to a true ES signal. Therefore, instead of operating with a 2 out of 3 coincidence trip logic, ES System Digital Channel 2 was operating with a 2 out of 2 coincidence trip logic. Hence, Digital Channel 2 was not rendered inoperable by the failure of the contact on the rotary switch

contact wafer, but the degree of the redundant ability of the analog portion of the ES System to cause a Digital Channel 2 trip was degraded.

CAUSE OF OCCURRENCE

The root cause of this incident was determined to be a Defective Procedure due to the failure of the ES Analog Channel B on line calibration procedure to adequately verify the correct ES System Digital Channel 2 response to an analog trip signal. If the ES System Analog Channel B on line calibration procedure had included the verification of the Digital Channel 2 response to the Analog Channel B trip signal, then the problem with the rotary switch would have been identified and corrected without violating Technical Specification Table 3.5.1-1.

A contributing cause to this incident was the failure of the I&E Technician, Maintenance Engineer, and Job Supervisor to expeditiously pursue an analysis of the apparent problem with the Digital Channel indicating lights. If an immediate analysis had been performed, the Trip Module containing the faulty rotary switch would have been identified and could have been replaced before the 24 hour limited condition for operation time limit was exceeded.

Several factors contributed to the failure of the involved personnel to follow up on the problem identified during the Analog Channel B test. Since neither the Digital Channel calibration procedure or the Analog Channel calibration procedure identified a problem with the ES System, the I&E Technician and Maintenance Engineer did not suspect the unusual behavior of the indicating lights to be significant. In addition, the lack of adequate communication between the Maintenance Engineer and I&E Technician also contributed to the failure to perform an immediate analysis of the problem. The Maintenance Engineer was under the impression that the I&E Technician was going to research the problem and initiate corrective action if needed. He felt if a significant problem was identified by the I&E Technician, he would be notified. Therefore, he did not investigate the problem or initiate any follow up action to verify that the I&E Technician performed an analysis of the problem.

The component that failed was a rotary switch model number 1945360A1 which was part of Bailey Trip Logic Module model number 6624010A1. A review of the Nuclear Plant Reliability Data System (NPRDS) provided no conclusive evidence that would indicate a generic problem exists with the rotary switch or the Bailey Trip Logic Module discussed in this report. However, the component failure discussed in this report will be reported to the Nuclear Plant Reliability Data System to be included for future reference concerning failures with the subject components.

This incident has no record of occurrence over the past three years. Therefore, this incident is considered non-recurring. In addition, there was no release of radioactive materials, radiation exposures, or personnel injuries involved with this incident.

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

CORRECTIVE ACTIONS

The immediate corrective actions were to replace and functionally test the ES Trip Logic Module containing the faulty rotary switch, and to test all ES Analog Channels on all three units to insure the proper Digital Channel indications were received.

Supplemental corrective actions were to:

- Counsel the Maintenance Engineer, Instrumentation and Electrical Technician, and Job Supervisor concerning the follow up action they should have taken upon the discovery of the problem with the Engineered Safeguards System. In addition, plant personnel were made aware of the incident through crew meetings, staff meetings, and the Station Manager's staff notes;

- Initiate a change to the Engineered Safeguards System Analog Channel A, B, and C On Line Calibration procedures to incorporate a method that will insure the proper Digital Channel indications are received whenever an Engineered Safeguards Analog Channel trip occurs. These procedure changes were in place by December 29, 1987.

Planned corrective actions are to:

- Pursue an audit of the Engineered Safeguards System Maintenance procedures to insure that an adequate test is performed to verify the operability of each vital component in the Engineered Safeguards System;

- Issue a formal training letter (TSR-10) in order to make all appropriate Maintenance Personnel aware of this incident and the proper action that should be taken if a similar problem is identified in the future. This corrective action will be completed by February 1, 1988.

ANALYSIS OF OCCURRENCE

Oconee Nuclear Station Final Safety Analysis Report Section 6.0 states, that the purpose of the Engineered Safeguards (ES) System is to reduce the potential radiation dose to the general public from the maximum Hypothetical Accident to less than the guideline values of 10CFR100. If an accident occurs, the ES System initiates an automatic isolation of Reactor Building fluid penetrations that are not required for limiting the consequences of an accident. Long term potential releases following the accident are reduced by rapidly decreasing the Reactor Building pressure to near atmospheric, thereby reducing the driving potential for fission product escape. In addition, the ES System provides ample core cooling following the worst postulated loss-of-coolant accident. This is accomplished by large capacity, Injection Core Flooding (EIIS:BP) systems. These systems, coupled with the thermal, hydraulic, and blowdown characteristics of the reactors, reliably prevent metal-water reactions.

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

In the subject incident, even though a portion of the ES System was rendered inoperable as a result of a faulty rotary switch, the ability of the ES System to provide its intended safety function as described above was not inhibited. As discussed previously in this report, only the electrical path through the rotary switch which enables an Analog Channel B trip signal to be transmitted to ES System Digital Channel 2 was rendered inoperable. In other words, while Digital Channel 2 remained operable, only an Analog Channel A and C trip would have initiated a Digital Channel 2 actuation. Thus, the minimum redundancy of the Analog Channel trip logic required to initiate a Digital Channel 2 actuation was decreased. Hence, a 2 out of 2 coincidence trip logic existed instead of a 2 out of 3 coincidence trip logic. However, since both Analog Channel A and C were fully operable during this incident, ES System Digital Channel 2 would have actuated if the parameters monitored by Analog Channels A and C reached ES System set points. Therefore, the ability of the ES System to perform its intended safety function was not inhibited due to the faulty rotary switch, and the health and safety of the public were not affected.

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HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

January 6, 1988

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 287/87-09

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report (LER) 287/87-09 concerning a Technical Specification violation due to inadequate procedures.

This report is submitted in accordance with §59,73(a)(2)(i)(B). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

PJN/1202/sbn

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