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AUTH.NAME AUTHOR AFFILIATION
MORGAN,H.E. Southern California Edison Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 88-002-01:on 880219,spurious ESF actuation during surveillance testing subsequent manual reactor trip.

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LICENSEE EVENT REPORT (LER)

Facility Name (1)	Docket Number (2)	Page (3)
SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 3	0 5 0 0 0 3 6 2	1 of 0 6

Title (4)
SPURIOUS ENGINEERED SAFETY FEATURES (ESF) ACTUATION DURING SURVEILLANCE TESTING SUBSEQUENT MANUAL REACTOR TRIP

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 2	1 9	8 8	8 8	0 0 2	0 1	0 5	1 2	8 9	NONE	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)

___ 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)
___ 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 (AREA CODE)
H. E. Morgan, Station Manager	7 1 4 3 6 8 - 6 2 4 1

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 E	H S	C 7 7 0	NO					

SUPPLEMENTAL REPORT EXPECTED (14)

___ Yes (If yes, complete EXPECTED SUBMISSION DATE) XX NO

Expected Submission Date (15): Month ___ Day ___ Year ___

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

On February 19, 1988 at 1300, with Unit 3 in Mode 1 at 100% power, Trains "A" and "B" of both the Safety Injection Actuation System (SIAS) and Containment Cooling Actuation System (CCAS) were actuated during performance of 31-day Engineered Safety Features Actuation System (ESFAS) matrix logic relay testing. All components actuated as designed. There was no High Pressure Safety Injection System (HPSI) flow into the Reactor Coolant System (RCS) since RCS pressure remained above the shutoff head of the HPSI pumps.

At 1304, the reactor was manually tripped in accordance with procedures. As the result of steam generator water level "shrink" following the reactor trip, the Emergency Feedwater Actuation Systems (EFAS) 1 and 2 initiated feed water flow to the steam generators. All safety systems performed as required and operators satisfactorily completed standard post-trip action and stabilized the unit in Mode 3.

Investigation has determined that the spurious ESFAS actuations were caused by improperly assembled push button switch contacts. Due to apparent unreliable electrical operation of these contacts as the push button was being depressed or held in, the trip matrix being tested was prematurely de-energized initiating the above described SIAS and ESFAS actuations. All similar push button switches in Units 2 and 3 have been replaced with switches of a different contact design. Further, the wiring to the switch contacts has been redesigned to reduce the possibility of recurrence of such spurious actuations during testing.

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TITLE: Spurious Engineered Safety Features (ESF) Actuation during Surveillance Testing and Subsequent Manual Reactor Trip

Plant: San Onofre Nuclear Generating Station
Unit: Three
Reactor Vendor: Combustion Engineering
Event Date: February 19, 1988
Time: 1300

A. CONDITIONS AT TIME OF THE EVENT:

Mode: 1, Power Operation

B. BACKGROUND INFORMATION:

The Engineered Safety Features Actuation System (ESFAS) (EIIS System Code JE) monitors selected plant parameters and, when necessary, automatically actuates those systems necessary to mitigate the consequences of a postulated accident when plant conditions have exceeded normal operational limits.

The ESFAS design includes testing circuits which allow on line testing in order to ensure that the ESFAS remains capable of performing its design function without actuating the associated ESF system(s). This periodic testing is performed at least every 31 days pursuant to Technical Specification Surveillance Requirement 4.3.2.1.

The ESFAS circuitry is designed to preclude any single failure within the logic and logic actuation circuitry from spuriously initiating an ESFAS function during normal operation. During testing, however, ESFAS is susceptible to spurious actuation by the following types of failures:

1. A failure in any other measured channel, ESFAS logic matrix or actuation channel of the same function being tested; or

2. A failure in the testing circuitry being used for the test.

C. DESCRIPTION OF THE EVENT:

1. Event:

On February 19, 1988 at 1300, with Unit 3 in Mode 1 at 100% power, Trains "A" and "B" of both the Safety Injection Actuation System (SIAS) and Containment Cooling Actuation System (CCAS) actuated during performance of the 31-day ESFAS matrix testing. All components actuated as designed. There was no High Pressures Safety Injection System (HPSI) (EIIS System Code BQ) flow into the Reactor Coolant System (RCS) (EIIS System Code AB) since RCS pressure remained above the shutoff head of the HPSI pumps.

At 1304, the reactor was manually tripped in accordance with procedures. As a result of steam generator water level "shrink" following the reactor trip, the Emergency Feedwater Actuation Systems (EFAS) (EIIS System Code BA) 1 and 2 initiated feedwater flow to the steam generators. All safety systems performed as required and operators satisfactorily completed standard post-trip action and stabilized the unit in Mode 3.

On February 22, 1988 at 0230, following completion of the preliminary investigations discussed in detail below and satisfactory completion of the ESFAS surveillance tests, Unit 3 entered Mode 1.

2. Inoperable Structures, Systems or Components that Contributed to the Event:

None.

3. Sequence of Events.

TIME	ACTION
2/19/88	
1300	SIAS and CCAS actuates during surveillance testing.
1304	Operators manually trip the reactor.
	EFAS channels 1 and 2 actuate on low steam generator water levels initiating feed water flow to the steam generators.
1312	Operators complete the standard post trip action procedure, determine that the SIAS/CCAS actuation was spurious and begin reactor trip recovery.
2/22/88	
0230	Unit 3 enters Mode 1.

4. Method of Discovery:

Control room annunciation of the systems actuated by ESFAS.

5. Personnel Actions and Analysis of Actions:

Operators promptly verified proper operation of actuated systems and components. In accordance with procedures, operators verified that plant operating parameters were normal and that the ESF actuations were spurious, and then tripped the reactor.

6. Safety System Responses:

All safety and protective systems actuated by the SIAS, CCAS, RPS and EFAS operated in accordance with their design.

D. CAUSE OF THE EVENT:

1. Immediate Cause:

Spurious actuation of the ESFAS logic matrix "AB" SIAS and CCAS circuitry occurred during surveillance testing.

2. Root Cause:

Initial Investigations

As discussed in the background section of this report, ESFAS is susceptible to spurious actuation during testing. The circumstances of this event suggest the cause of the spurious actuation to be a momentary power interruption to the matrix logic actuation relay coils. Such actuations can result from certain types of failures in either the ESFAS circuitry or the ESFAS testing circuitry.

In order to determine the root cause of this event, the following preliminary investigations were completed:

a. The test circuitry, test power supply and the matrix actuation relay hold coil connections were inspected and tested for loose connections. None were found.

b. The matrix test power supply tests indicated that its DC output voltage was within specification.

c. The two power supplies for the involved matrix logic relays were tested. One power supply was found to be within specification. The other power supply was found to have a slow 0.2 volt oscillation in its output. This voltage oscillation is not sufficient to have caused the actuation.

d. The various switches in the test circuitry were tested and found to operate properly.

e. Inspection and testing of the AC power sources, switches and connections to the above power supplies revealed nothing abnormal.

Due to the fact that testing of ESFAS logic matrix "AB" relays was in progress at the time of the actuation, and as a result of information from another nuclear power plant having a similar ESFAS design, it was suspected that a mechanical and/or electrical mis-operation of the Matrix Relay Hold push button switch may have caused the actuation.

The suspect push button switch has a number of contacts, some of which operate when the button is partially depressed, and others which operate when the button approaches full depression. The primary functions of this contact arrangement are to sequentially: 1) Prevent the matrix from actuating during the tests, and 2) energize the matrix test circuitry while the button is depressed so that the tests may be performed. A defect in switch contact(s), or in their sequencing, could cause a spurious actuation.

This switch was removed and bench tested on-site. The observed contact closure and opening sequence has been determined to be correct within the limits of the tests permitted by on-site resources.

Following instrumentation of the involved matrix test circuitry with recorders, ESFAS surveillance testing was satisfactorily completed. The recorded data indicated normal operation of the test circuitry.

Subsequent Investigations

All six of the Unit 3 matrix hold push button switches were sent to an independent testing laboratory to determine if a cause for the trip could be identified.

These push button switches consist of a push button with three switch blocks mounted to it. Two of the switch blocks each contain one set of normally open contacts, and one set of Early Close Normally Open (ECNO) contacts. The third switch block contains one set of normally closed contacts.

The testing laboratory determined by x-ray and subsequent disassembly of the switch blocks, that in five of the six push button switches, the normally open/ECNO switch blocks were improperly assembled. Specifically, the switch blocks containing the normally open/ECNO contacts were determined to have their movable contacts installed backwards and misaligned.

The reversed and misaligned normally open/ECNO moveable contacts would result in unreliable operation which could, on occasion, result in de-energization of the matrix hold relays prior to energization of the matrix trip relays causing an actuation while the push button is being depressed or being held in.

E. CORRECTIVE ACTIONS:

All matrix hold push button switches in Units 2 and 3 have been replaced with switches having a different switch block design which is not susceptible to improper assembly of the movable contacts. Further, the wiring to the switch block contacts has been redesigned to reduce the possibility of recurrence of such spurious actuations during testing.

SCE is investigating design options which would preclude spurious actuations due to switch failures during matrix relay testing.

F. SAFETY SIGNIFICANCE OF THE EVENT:

Since all safety systems performed as required, there was no impact on the health and safety of plant personnel or the public as a result of this event.

G. ADDITIONAL INFORMATION:

1. Previous LERs on Similar Events:

   a. LER 86-19 (Docket number 50-361) reported a main steam and feedwater isolation and subsequent reactor trip during ESF surveillance testing due to a pitted contact on an actuation relay. High resistance in the contacts resulted in actuation of the Main Steam Isolation System.

   b. LER 86-22 (Docket number 50-361) reported a Main Steam Isolation System actuation during ESFAS testing due to failure of one of the two actuation relay power supplies. Closure of the main steam and feedwater isolation valves resulted in a reactor trip.

2. Component Failure Information:

   The matrix hold push button switches are manufactured by Cutler-Hammer and are model number 10250T. The normally open/ECNO switch blocks are part number T57. The T57 switch blocks which were determined to have been improperly assembled were marked with an assembly date of "8-74".

3. Results of NPRDS Search:

   No useful information was obtained from the search.

Southern California Edison Company
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May 12, 1989

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

Subject: Docket No. 50-362
Supplemental Report
Licensee Event Report No. 88-002, Revision 1
San Onofre Nuclear Generating Station, Unit 3

Reference: Letter, H. E. Morgan (SCE) to USNRC Document Control Desk, dated March 18, 1988

The referenced letter provided the required 30-day Licensee Event Report (LER) for an occurrence involving a spurious actuation of engineered safety features during surveillance testing. This submittal provides additional information concerning the cause and corrective actions applicable to this occurrence.

If you require any additional information, please so advise.

Sincerely,

H E Morgan

Enclosure: LER No. 88-002, Revision 1

cc: F. R. Huey (USNRC Senior Resident Inspector, Units 1, 2 and 3)

J. B. Martin (Regional Administrator, USNRC Region V)

Institute of Nuclear Power Operations (INPO)

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