

## SYSTEM

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SUBJECT: LER 89-007-00:on 890629,spurious recirculation actuation  
signal during surveillance testing.

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*Southern California Edison Company*

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July 31, 1989

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

Subject: Docket No. 50-362  
30-Day Report  
Licensee Event Report No. 89-007  
San Onofre Nuclear Generating Station, Unit 3

Pursuant to 10 CFR 50.73(a)(2)(iv), this submittal provides the required 30-day written Licensee Event Report (LER) for an occurrence involving a spurious actuation of engineered safety features during surveillance testing. Neither the health and safety of plant personnel or the public was affected by this occurrence.

If you require any additional information, please so advise.

Sincerely,

*R. K. Krieger for H. E. Morgan*

Enclosure: LER No. 89-007

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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LICENSEE EVENT REPORT (LER)																		
Facility Name (1) <b>SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 3</b>										Docket Number (2) <b>0   5   0   0   0   3   6   2</b>				Page (3) <b>1</b> of <b>0</b> <b>7</b>				
Title (4) <b>SPURIOUS RECIRCULATION ACTUATION SIGNAL DURING SURVEILLANCE TESTING</b>																		
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)					
				---		---					NONE		0   5   0   0   0					
<b>6</b>	<b>2</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>7</b>	<b>3</b>	<b>1</b>		<b>8</b> <b>9</b>					
OPERATING MODE (9) <b>1</b>			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)															
POWER LEVEL (10) <b>0   7   5</b> //////////////////// //////////////////// //////////////////// //////////////////// ////////////////////			<input type="checkbox"/> 20.402(b)				<input type="checkbox"/> 20.405(c)				<input checked="" type="checkbox"/> 50.73(a)(2)(iv)				<input type="checkbox"/> 73.71(b)			
			<input type="checkbox"/> 20.405(a)(1)(i)				<input type="checkbox"/> 50.36(c)(1)				<input type="checkbox"/> 50.73(a)(2)(v)				<input type="checkbox"/> 73.71(c)			
			<input type="checkbox"/> 20.405(a)(1)(ii)				<input type="checkbox"/> 50.36(c)(2)				<input type="checkbox"/> 50.73(a)(2)(vii)				<input type="checkbox"/> Other (Specify in Abstract below and in text)			
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LICENSEE CONTACT FOR THIS LER (12)																		
Name <b>H. E. Morgan, Station Manager</b>										TELEPHONE NUMBER AREA CODE <b>7   1   4</b>   <b>3   6   8</b>   <b>1   6   2   4   1</b>								
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																		
CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS				
<b>B</b>	<b>J   E</b>	<b>    H   S</b>	<b>C   7   7   0</b>	<b>Y</b>														
SUPPLEMENTAL REPORT EXPECTED (14)										Expected Submission Date (15)		Month	Day	Year				
<input type="checkbox"/> Yes (If yes, complete EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO																		
ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)																		

On 6/29/89 at 1722, with Unit 3 in Mode 1 at 75% power to perform maintenance on the main condenser, a spurious Train "A" and "B" Recirculation Actuation Signal (RAS) occurred during performance of the 31-day Engineered Safety Feature Actuation Signal (ESFAS) matrix testing. All components actuated as designed.

Based upon the results of investigational testing, the cause of the RAS actuation has been attributed to mechanical and/or electrical malfunction of the matrix "CD" relay hold pushbutton switch which resulted in loss of hold voltage to the matrix relay hold coils. The hold voltage is designed to be applied prior to de-energization of all of the matrix relays by the sequencing of contacts within the hold pushbutton. The intended sequencing precludes an actuation by holding all the relays in their unactuated state except for the relay being tested.

The pushbutton switch has been replaced, functionally tested, and the 31-day ESFAS surveillance completed. The faulted switch is being analyzed at an independent laboratory in an attempt to determine a more detailed failure mechanism. SCE is working with the ESFAS vendor to determine appropriate design enhancements to the switch and/or test circuitry to prevent similar spurious actuations.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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Plant: San Onofre Nuclear Generating Station  
Unit: Three  
Reactor Vendor: Combustion Engineering  
Event Date: 06-29-89  
Time: 1722

A. CONDITIONS AT TIME OF THE EVENT:

Mode: 1, Power Operation, 75% Full Power

B. BACKGROUND INFORMATION:

The Engineered Safety Features Actuation System (ESFAS) [JE] monitors selected plant parameters and, when required, automatically actuates those systems necessary to mitigate the consequences of postulated accidents when plant conditions have exceeded certain operational limits.

The ESFAS actuation logic consists of four channels which are arranged via bistables and relays such that there are six, two-out-of-four, logic matrices (AB, AC, AD, BC, BD and CD). Each logic matrix has two power supplies (i.e., the "AB" matrix has a Channel "A" and a Channel "B" power supply). This arrangement prevents an ESFAS actuation when any single power supply or channel is removed from service. Components powered by the power supplies are designed to actuate to their safety related state when de-energized.

The ESFAS design includes testing circuits which allow on-line matrix testing in order to ensure that the ESFAS remains capable of performing its design function without actuating the associated Engineered Safety Feature (ESF) [B] system(s). However, during testing, the ESFAS is susceptible to spurious actuation by certain single failures associated with the test and/or matrix circuits. This periodic testing is performed at least once every 31-days pursuant to Technical Specification (TS) Surveillance Requirement 4.3.2.1.

ESFAS matrix test includes the depression of a matrix relay hold pushbutton switch. The switch's internal sequencing is designed to preclude a spurious actuation by first providing power to a hold coil in each of the matrix relays. The hold coil maintains the four matrix relays in their unactuated state. The switch then simulates a trip in the matrix (for this event the RAS "CD" matrix) by removing power to the normal matrix relay coils. If the test hold voltage is not continuously applied to the hold coils, the associated matrix relay can de-energize, causing the logic to actuate as if a legitimate trip was present.

The matrix relay hold pushbutton consists of a spring loaded button unit connected to a series of three contact units. Each of the first two contact units contains one set of normally open contacts and one set of "Early Close, Normally Open" (ECNO) contacts. The third contact unit contains one set of normally closed contacts.

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The Recirculation Actuation Signal (RAS) is designed to automatically change the mode of operation of the Safety Injection System [BP,BQ] and the Containment Spray System [BE]. The RAS shifts the systems' pump suctions from the Refueling Water Storage Tank (RWST) [TK] to the containment sump, stops the Low Pressure Safety Injection Pump [BP,P] and concurrent with a high-high containment level signal isolates the minimum flow paths. The RAS is initiated by two-out-of-four low RWST level signals, loss of power or manually.

C. DESCRIPTION OF THE EVENT:

1. Event:

On 6/29/89 at 1722, with Unit 3 in Mode 1 at 75% power to perform maintenance on the main condenser, a spurious Train "A" and "B" RAS occurred during performance of the 31-day ESFAS matrix testing. All components actuated as designed.

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

None.

3. Sequence of Events:

<u>TIME</u>	<u>ACTION</u>
1722	RAS Trains "A" and "B" actuate during surveillance testing.
1740	Operators determine that the actuation was spurious and return RAS components to normal.

4. Method of Discovery:

Control room annunciation of the RAS actuation.

5. Personnel Actions and Analysis of Actions:

Operators (utility, licensed) verified proper operation of RAS components. In accordance with procedures, operators verified that plant operating parameters were normal and that the RAS actuation was spurious.

6. Safety System Responses:

All RAS components operated in accordance with design.

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D. CAUSE OF THE EVENT:

1. Immediate Cause:

Spurious actuation of the ESFAS logic matrix "CD" RAS occurred during surveillance testing. Actuation was initiated while a maintenance technician (utility, nonlicensed) was depressing the "CD" matrix relay hold pushbutton. It is believed that, contrary to the intended design of the test circuitry, power was lost to the hold coils of the RAS "CD" matrix relays causing the spurious actuation.

2. Intermediate Cause:

The following investigations and tests were conducted to determine the cause of failure:

- a. The test circuit, test power supply and matrix relay hold coil connections were inspected and tested for loose connections. None were found.
- b. Testing of the test circuit and hold pushbutton determined that the actuation occurred during pushbutton manipulation.
- c. Other switches associated with the test circuit were determined to be operating properly.
- d. The pushbutton was removed and visually examined for assembly errors and external faults. None were found.
- e. A replacement pushbutton was installed and performed properly.

The cause of the RAS actuation has been attributed to a failure in the ESFAS test circuitry. During subsequent inplace testing using the suspect switch, a momentary power interruption caused the "CD" matrix relay hold coils to de-energize, resulting in a RAS actuation. The hold voltage is designed to be applied prior to de-energization of all the matrix relays by the sequencing of contacts within the hold pushbutton. The sequencing precludes an actuation by holding all the relays in their unactuated state except the relay being tested.

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3. Root Cause:

It is believed that a mechanical and/or electrical malfunction of the matrix relay hold pushbutton switch resulted in a sequencing fault.

Discussions with the ESFAS vendor have revealed that although spurious ESFAS actuations attributed to the hold pushbutton have occurred at this and other facilities, a more detailed root cause within the switch or associated with the vendor's selection of the switch has not been previously identified. Investigations with the ESFAS vendor are continuing to determine a more detailed cause and to provide a corrective design change. The vendor selected the pushbutton switch design in order to provide direct manual and momentary hold voltage to the matrix relays. This design ensures matrix relay actuation is overridden only during the test and that the hold coil will not be left energized after testing. However, it is believed by SCE that separation of the hold and test functions into two switches (e.g., one nonmomentary switch to initiate hold voltage and one momentary switch to initiate the test signal) provides more positive hold voltage and reduces the possibility of spurious actuations.

The faulted switch is being analyzed at an independent laboratory in an attempt to determine a more detailed failure mechanism.

E. CORRECTIVE ACTIONS:

1. Corrective Actions Taken:

- a. The matrix "CD" hold pushbutton has been replaced.
- b. The ESFAS surveillance testing was satisfactorily completed.

2. Planned Corrective Actions:

- a. SCE is working with the ESFAS vendor to determine appropriate design enhancements. The design goal is to prevent spurious actuations resulting from malfunctions of the matrix hold pushbutton and/or test circuit while retaining the desirable features of the present design. When completed, all similar ESFAS matrix hold pushbutton switches in Units 2 and 3 may be replaced with that of an improved design, and/or a test circuit design change which reduces the likelihood of spurious actuations during testing may be developed. Final engineering of the design change is expected to be completed by September 1990. The design changes will be implemented at the first refueling outage following completion of final engineering for each unit.

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- b. Should further investigation or completion of the design change engineering reveal a root cause other than a sequencing inadequacy of the pushbutton switch design, or if it is determined that a design change will not be made, this LER will be revised.

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. In addition, the sequencing deficiency of the pushbutton switch affects the ESFAS only during matrix testing, and would, therefore, have no adverse impact during normal ESFAS actuation.

G. ADDITIONAL INFORMATION:

1. Component Failure Information:

The matrix "CD" hold pushbutton switch is a Series 10250T manufactured by Cutler-Hammer. The contact units "ganged" to the button are Cutler-Hammer Code T57 for the ECNO and normally open block, and Code T3 for the normally closed blocks.

The ESFAS vendor is Combustion Engineering.

2. Previous LERs for Similar Events:

1. LER 88-002 (Docket Number 50-362) reported a Safety Injection System and Containment Cooling System actuation during ESFAS testing believed to have been caused by a defect in the matrix "AB" hold pushbutton switch. The defective switch was sent to an independent laboratory where it was determined that switch internals had been installed incorrectly during the manufacturing process. As corrective action, all of the Unit 2 and 3 matrix hold pushbutton switches were replaced with switches that had been radiographed prior to their use to assure the internal assembly was correct. In addition, as reported in Revision 1 of this LER, the switch wiring was changed which permits a test trip signal only if the hold voltage switch contacts are made up. However, the same switch model was relied upon and the wiring change, although extensively tested upon installation, was eventually ineffective in preventing reoccurrence. The wiring change is effective only when the switch is initially depressed. The wiring change can not prevent the malfunction of the switch contacts.



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2. LER 89-005 (Docket Number 50-361) reported an Emergency Feedwater actuation during ESFAS testing believed to have been caused by incorrect assembly of the "AB" hold pushbutton switch. The switch was replaced with a switch having correct internals and the switch wiring changed as described above for LER 88-002. Since it is now believed that a switch malfunction caused a sequencing fault, these corrective actions could not have prevented recurrence.
3. Results of NPRDS Search:  
  
The NPRDS search revealed no additional Series 10250T Cutler-Hammer pushbutton switch failures caused by sequencing defects.