

*Southern California Edison Company*

SAN ONOFRE NUCLEAR GENERATING STATION

P. O. BOX 128

SAN CLEMENTE, CALIFORNIA 92672

H. E. MORGAN  
STATION MANAGER

September 5, 1989

TELEPHONE  
(714) 368-6241

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

Subject: Docket No. 50-206  
30-Day Report  
Licensee Event Report No. 89-021  
San Onofre Nuclear Generating Station, Unit 1

Pursuant to 10 CFR 50.73(d), this submittal provides the required 30-day written Licensee Event Report (LER) for an occurrence involving an automatic actuation of the reactor protection system. 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,

*H E Morgan*

Enclosure: LER No. 89-021

cc: C. W. Caldwell (USNRC Senior Resident Inspector, Units 1, 2 and 3)

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

Institute of Nuclear Power Operations (INPO)

*522*  
*11*

LICENSEE EVENT REPORT (LER)

Facility Name (1) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1						Docket Number (2) 0   5   0   0   0   2   0   6			Page (3) 1   of   0   7		
Title (4) REACTOR TRIP ON LOW FLOW DUE TO INSTRUMENT CABLE DEGRADATION											

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   8	0   3	8   9	8   9	...		...		0   9	0   5	8   9	NONE	0   5   0   0   0
											0   5   0   0   0	

OPERATING MODE (9) 1		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)																				
POWER LEVEL (10) 9   1		<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.36(c)(1)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	<input type="checkbox"/> 50.73(a)(2)(x)	<input type="checkbox"/> 73.71(b)	<input type="checkbox"/> 73.71(c)	<input type="checkbox"/> Other (Specify in Abstract below and in text)

LICENSEE CONTACT FOR THIS LER (12)											
Name H. E. Morgan, Station Manager								TELEPHONE NUMBER 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	MANUFAC-TURER	REPORTABLE TO NPRDS	//////	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	//////
					//////						//////
					//////						//////

SUPPLEMENTAL REPORT EXPECTED (14)							Expected Submission Date (15)		Month	Day	Year
<input checked="" type="checkbox"/> Yes (If yes, complete EXPECTED SUBMISSION DATE) <input type="checkbox"/> NO									0   3	0   5	9   0

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

At 1800 on 8/3/89, with Unit 1 at 91% power, a reactor trip occurred due to actuation of the Reactor Protection System (RPS) on low Reactor Coolant System (RCS) flow in one loop. All systems responded normally to the trip and the operators (utility, licensed) stabilized the plant in Mode 3. The RPS operated in accordance with design, with no malfunctions noted.

It is believed that the brief low RCS flow signal occurred in Loop C and was caused by a loss of insulation resistance of the flow transmitter cable, which is indicative of degradation caused by a moist substance. At this time failure due to a manufacturing defect (considered to be less likely) has not been discounted. The cable has been sent to an independent offsite laboratory to determine the exact mechanism for the loss of insulation resistance. The moist substance most likely entered the conduit during the installation of a temporary RCS level transmitter (during the recently completed Cycle 10 refueling outage) which utilized the cable. Although root cause conclusions are pending laboratory analysis of the cable, the most likely root cause is the unintentional introduction of a chemical substance onto the cable and the failure to evaluate and/or replace the cable following such an occurrence. A supplemental LER will be submitted upon completion of our root cause evaluation.

As corrective action, the cable was replaced and the RCS Loop C flow instrument was verified to be operating properly. The interim refueling level transmitter system, including the flow transmitter cable, will be provided with adequate protection from foreign substances. Personnel will be provided with adequate warning (such as a sign) of the significance of the instrumentation and the need for excluding foreign substances.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

SAN ONOFRE NUCLEAR GENERATION STATION UNIT 1	DOCKET NUMBER 05000206	LER NUMBER 89-021-00	PAGE 2 OF 7
---	---------------------------	-------------------------	----------------

Plant: San Onofre Nuclear Generating Station  
 Unit: One  
 Reactor Vendor: Westinghouse  
 Event Date: 8-03-89  
 Time: 1800

A. CONDITIONS AT TIME OF THE EVENT:

Mode: 1, Power Operation

B. BACKGROUND INFORMATION:

The Reactor Protection System (RPS)[JC] provides reactor trip functions to protect the core against Departure from Nucleate Boiling (DNB) and the Reactor Coolant System (RCS)[AB] against overpressurization. There are three RCS loops (A, B, and C), each containing a hot leg, flow measuring elbow, steam generator [SG], Reactor Coolant Pump (RCP)[P] (with associated circuit breaker [BKR]), and cold leg. The RPS generates a reactor trip on single loop loss of flow when flow in any loop is less than 85% of full flow, or when a RCP breaker opens. This trip is active when reactor power is above 49% of full power.

A RCS flow measuring elbow directs RCS flow from the horizontal hot leg up 60 degrees into the steam generator. The change in direction of the flow creates a higher pressure against the bottom of the elbow and a lower pressure at the top of the elbow. Pressure sensing lines run from taps (at the top and bottom of the RCS Loop C elbow) to a differential pressure measuring transmitter [FT]. The transmitters sense a pressure differential of between 0 and 198 inches of water and convert this measurement to a 10 to 50 milliamperes Direct Current (maDC) signal, respectively. The pressure sensing lines are approximately 6 and 10 feet long and consist primarily of stainless steel tubing. The signal is conducted from the transmitter by 2 conductor, Neoprene jacketed, control cable [CBL1]. The cable runs approximately 10 feet from the transmitter inside a conduit [CND] to a cable tray [TY] and then from the tray through a containment penetration [PEN] to the control room area. The conduit protects the cable from the harsh industrial surroundings near the transmitter. The conduit is open at the tray. In the control room area the signal is processed to provide the operator with indication of 0 to 100% full flow and a low loop flow alarm.

In response to Generic Letter 87-12, "Loss of Residual Heat Removal While the RCS is Partially Filled", modifications were implemented in mid-1988 to provide control room indication of RCS level during refueling and certain maintenance activities. As a result, design changes were initiated to provide the required instrumentation; however, completion is not expected until mid-1990. In the interim, when control room refueling level indication is needed, a temporary transmitter [LT] using RCS Loop C flow instrument pressure sensing lines and cable.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

SAN ONOFRE NUCLEAR GENERATION STATION  
UNIT 1

DOCKET NUMBER  
05000206

LER NUMBER  
89-021-00

PAGE  
3 OF 7

C. DESCRIPTION OF THE EVENT:

1. Event:

At 1800 on 8/3/89, with Unit 1 at 91% power, a reactor trip occurred due to actuation of the RPS on low RCS flow in one loop. All systems responded normally to the trip and the operators (utility, licensed) stabilized the plant in Mode 3.

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

None.

3. Sequence of Events:

<u>TIME</u>	<u>ACTION</u>
1800	Reactor trip on low RCS loop flow.
1809	RCPs were restarted and operated normally. Loop flow indications were normal.
1815	Operators complete trip response actions.
1851	Plant systems aligned for Hot Standby.

4. Method of Discovery:

Control room alarms and indications alerted the operators of the reactor trip.

5. Personnel Actions and Analysis of Actions:

The operators responded properly to the reactor trip and stabilized plant conditions utilizing trip procedures.

The operators also responded properly by restarting the RCPs and subsequently verifying that RCS flow indications were normal.

6. Safety System Responses:

The RPS operated in accordance with design, with no malfunctions noted.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

SAN ONOFRE NUCLEAR GENERATION STATION UNIT 1	DOCKET NUMBER 05000206	LER NUMBER 89-021-00	PAGE 4 OF 7
---	---------------------------	-------------------------	----------------

D. CAUSE OF THE EVENT:

1. Immediate Cause:

The RPS initiated a reactor trip on low RCS flow as recorded in the Event Recorder and "first out" alarm status. "First out" alarm status refers to the first alarm recorded in chronological order of occurrence. The Event Recorder showed that the trip condition existed briefly, indicative of a spike of the loss of flow signal. When the RCPs were restarted per procedure, all three loop flow indicators responded normally, indicating 100% flow. Since the response was normal and the individual loop flows are not recorded (which would have provided flow values prior to the trip) a determination of which RCS loop(s) initiated the loss of flow signal could not be made at the time of the event. Extensive troubleshooting was implemented to determine the cause of the low flow trip. The following items were included in the investigation:

- a) The RPS and flow instrument power supplies were checked and found to be functioning properly with no output spiking.
- b) The RCP electrical supply breakers were found to be normal.
- c) All three RCS loop flow instruments were function and calibration checked. All three were found to be functioning within specification.
- d) All three flow transmitters were verified to have correct "span". All three transmitters were found to have negative "zero" shift (considered to be nonconsequential) with Loop C having the largest (0.85 maDC). Negative "zero" shift causes the actual flow to be measured at a lower more conservative value, closer to the low flow set point. The transmitter sensing lines were verified to be filled with reactor coolant.
- e) All three instrument circuits were tested for grounds using an Electrical Characterization And Diagnostic (ECAD) system. RCS Loops A and B flow instrument circuits were found to be satisfactory. RCS Loop C flow instrument circuit was found to have significant loss of insulation resistance to ground. Follow-up ECAD testing determined the insulation resistance loss to be located in the approximately 10 feet of cable enclosed in conduit between the flow transmitter and cable tray. The conduit was opened and the cable withdrawn. Initial visual inspection of the cable revealed a moist substance on the cable and no physical defects were noted. The cable was replaced and the instrument thoroughly checked. The instrument was found to be operating normally after the repair. In addition all RCS loop flow instruments have been monitored and found to be operating satisfactorily since the event.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

SAN ONOFRE NUCLEAR GENERATION STATION UNIT 1	DOCKET NUMBER 05000206	LER NUMBER 89-021-00	PAGE 5 OF 7
---	---------------------------	-------------------------	----------------

2. Intermediate Cause:

It is now hypothesized that the brief low flow signal was caused by a loss of insulation in the RCS Loop C transmitter cable, which is indicative of degradation caused by the presence of a moist substance. At this time failure due to a manufacturing defect has not been discounted, however, this type of failure is considered to be less likely. The cable has been sent to an independent offsite laboratory to determine the exact mechanism for the loss of insulation resistance. The Neoprene cable jacket is known to be poorly resistant to various cleaners and solvents which are suitable for use at a nuclear facility. The RCS flow instruments are not required to function after the reactor is tripped. Therefore, they have not been designed to endure a harsh, post-accident, environment.

3. Root Cause:

Although root cause conclusions are pending laboratory analysis of the cable, the most likely root cause is the unintentional introduction of a chemical substance onto the cable and the failure to evaluate and/or replace the cable following such an occurrence. The moist substance most likely entered the conduit during the installation of a temporary RCS level transmitter (during the recently completed Cycle 10 refueling outage). During this time the conduit and cable are exposed. Extensive interviews with plant personnel have not revealed an exact mechanism for introducing the substance. A supplemental LER will be submitted upon completion of our root cause evaluation.

E. CORRECTIVE ACTIONS:

1. Corrective Actions Taken:

- a) The cable with indicated loss of insulation to ground was replaced and the RCS Loop C flow instrument was verified to be operating properly.
- b) The cable has been sent to an independent offsite laboratory to determine the exact mechanism for the loss of insulation resistance.

2. Planned Corrective Actions:

- a) The interim refueling level transmitter system, including the flow transmitter cable, will be provided with adequate protection from foreign substances. Personnel will be provided with adequate warning (such as a sign) of the significance of the instrumentation and the need for excluding foreign substances.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

SAN ONOFRE NUCLEAR GENERATION STATION	DOCKET NUMBER	LER NUMBER	PAGE
UNIT 1	05000206	89-021-00	6 OF 7

- b) The previously planned permanent refueling level instrument will be provided. The instrument will have adequate protection from foreign substances and will be installed during the next outage of sufficient duration after June 1990.
- c) The RCS Loop flow instruments' cables will be periodically (during refueling outages) tested using the ECAD or similar system to assess insulation integrity. This action was previously planned. However, the test implementation schedule was such that the cables had not yet been initially tested.
- d) Should the root cause analysis identify a chemical substance as the cause of the cable insulation failure, additional corrective actions will be taken. These corrective actions may include revision of programs and instruction of personnel of the need to evaluate and/ or replace cables following any unintentional contact of cables with the identified chemical substance.

F. SAFETY SIGNIFICANCE OF THE EVENT:

There was no safety significance associated with the reactor trip since all safety and protective systems operated in accordance with their design.

G. ADDITIONAL INFORMATION:

1. Component Failure Information:

Not applicable.

2. Previous LERs for Similar Events:

LER 87-008

On 6/2/87, with Unit 1 in Mode 5, meggering of Control Rod Drive Mechanism (CRDM) coil circuits revealed low insulation resistance in several circuits. The source of the low resistance was found to be in the containment penetration electrical "pigtailes". In several cases the insulation was found to be damaged, and in the balance of cases the insulation was damaged and the conductor corroded. As corrective action, the damaged penetration electrical "pigtailes" were repaired and appropriate administrative controls implemented which would prevent damage by work activities. Since these corrective actions were applicable to containment penetrations, they could not have prevented cable damage near the RCS Loop C flow transmitter.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

SAN ONOFRE NUCLEAR GENERATION STATION UNIT 1	DOCKET NUMBER 05000206	LER NUMBER 89-021-00	PAGE 7 OF 7
---	---------------------------	-------------------------	----------------

3. Results of NPRDS Search:

Not applicable.

4. Procedure Enhancements:

During the root cause analysis of this event, it was determined that a brief loss of flow signal could have been generated by the expulsion of an air bubble from the flow instrument tubing. However, based upon an interview with the technician who removed the level transmitter and placed the flow transmitter in service prior to the event, and verification during the post-trip troubleshooting, it was determined that the sensing lines were properly filled and vented. During this review, it was identified that the procedure for the installation and removal of the refueling level instrument did not specifically detail the steps necessary to fill and vent the RCS Loop C flow sensing lines. In order to correct this potential problem related to the event, procedural enhancements will be made to assure proper filling and venting of the flow transmitter.