

Southern California Edison Company

SAN ONOFRE NUCLEAR GENERATING STATION

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February 25, 1992

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

Subject: Docket No. 50-361
Supplemental Report
Licensee Event Report No. 91-018, Revision 1
San Onofre Nuclear Generating Station, Unit 2

Reference: Letter, R. W. Krieger (SCE) to USNRC Document Control Desk, dated
11/14/91

The referenced letter provided Licensee Event Report (LER) No. 91-018 (Revision 0), for an occurrence involving seismic qualification discrepancies on safety related instrumentation. The enclosed supplemental LER provides additional information concerning the cause, corrective actions, and safety significance. Neither the health nor the safety of plant personnel or the public was affected by this occurrence.

If you require any additional information, please so advise.

Sincerely,



Enclosure: LER No. 91-018, Rev. 1

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)

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LICENSEE EVENT REPORT (LER)														
Facility Name (1)										Docket Number (2)			Page (3)	
SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2										0 5 0 0 0 3 6 1			1 of 0 9	
Title (4)														
Safety Related Instrumentation Not Installed in a Seismically Qualified Configuration														
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)		
1 0	1 5	9 1	9 1	0 1 6	0 1	0 2	2 5	9 2	NONE			0 5 0 0 0		
OPERATING MODE (9)			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)											
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E. W. Krieger, Station Manager										<div style="display: flex; justify-content: space-between;"> <div>AREA CODE</div> <div>7 1 7</div> <div>3 6 8</div> <div>6 2 5 5</div> </div>				
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)														
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC					
SUPPLEMENTAL REPORT EXPECTED (14)										Expected Submission Date (15)		Month Day Year		
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)														

On 10/15/91, while Unit 2 was in Mode 5 during a refueling outage, an inspection of the safety related Foxboro Spec 200 Process Instrumentation cabinets [CAB] determined that several instrument modules were missing the upper and/or lower guide rails and/or vibration dampening material (bumpers). Without the guide rails and bumpers installed, this equipment would not conform to the vendor's generic seismic design requirements and was therefore considered inoperable, causing the applicable Technical Specification Limiting Condition for Operation for affected instrument loops to have been exceeded during previous periods of operation in Modes 1, 2, 3, and 4. Subsequent seismic testing demonstrated that without bumpers installed, the affected instrument modules would have functioned properly during and after the SONGS design basis seismic events. By 11/4/91, all missing guide rails were installed, and the affected instrumentation was returned to an operable condition.

The primary cause of this deficiency was determined to be inadequate vendor installation information. Additionally, although the information provided in the vendor qualification report presented an opportunity for SCE to identify the installation deficiency, this subtlety was not detected. To prevent recurrence, vendor technical manuals will be updated to include the latest revision of Foxboro MI 2AN-105 which clearly identifies these installation requirements. Lesson plans for in-house training courses will be updated to include a discussion on the seismic installation requirements. Although testing demonstrated that bumpers were not required, in order to maintain conservative margins, all missing bumpers will be replaced during the next scheduled refueling outage for SONGS 1, 2, and 3.

The safety significance was evaluated and determined to be inconsequential.

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Plant: San Onofre Nuclear Generating Station
 Unit: Two
 Reactor Vendor: Combustion Engineering
 Event Date: 10-15-91

A. CONDITIONS AT TIME OF THE EVENT:

Mode: 5, Cold Shutdown
 RCS Temperature: 130°F

B. BACKGROUND INFORMATION:

1. Foxboro Seismic Testing:

The seismic qualification tests of the Foxboro SPEC 200 instrumentation cabinets [CAB] were performed in 1974 by the Foxboro Company in accordance with IEEE 344-1971, "IEEE Guide for Seismic Qualification of Class I Equipment for Nuclear Power Generating Stations," and again in 1978 in accordance with IEEE 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations." As part of these qualification tests, the analog nests were equipped with upper and lower guide rails, vibration damping material (bumpers), and dummy instrument modules [IMOD] in all spare (empty) slots.

2. Instruments Affected by this Event:

a. Diesel Fuel Storage Tank (DFST) Level Indication:

Level transmitter [LT] 2LT-5903-1 provides DFST T035 level indication and initiates a DFST hi/low level alarm [LA] in the Control Room (CR). It also stops both DFST transfer pumps [P] on a low-low level in the DFST [TK].

b. Steam Generator (SG) Pressure:

Pressure transmitters [PT] 2PT-1013-1 and 2PT-1023-2 provide SG pressure signals to the plant protection system (PPS) [JC]. A low SG pressure signal will cause a Main Steam Isolation Signal (MSIS) [JE] trip in the associated PPS channel. These same transmitters are also used to generate the differential pressure signal which combines with a low SG level to make up the Emergency Feedwater Actuation Signal (EFAS) [JE] logic. Additionally, these transmitters supply signals to the Post Accident Monitoring Instrumentation (PAMI) [IP] for SG pressure indication in the CR.

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c. Containment Emergency Sump Level Indication:

Post Accident Monitoring Instrumentation (PAMI) Level transmitters [LT] 2LT-9387-1, 2LT-9388-2 and 2LT-9389-2 provide containment emergency sump level indication [BE, LI] in the CR. Additionally, 2LT-9389-2, when combined with a Recirculation Actuation Signal (RAS) [JE], provides a signal to close the High Pressure Safety Injection System (HPSI) [BQ] and Containment Spray (CS) [BE] mini-flow isolation valves on both trains.

3. Technical Specifications (TS):

- a. TS 3.8.1.1, "Electrical Power Systems, A. C. Sources," requires two separate and independent diesel generators, each with a separate fuel transfer pump, fuel day tank (min. 325 gallons), and fuel storage tank (min. 47,000 gallons) to be operable in Modes 1, 2, 3, and 4. With a diesel generator [DG] inoperable, the other A.C. offsite sources and the remaining diesel generator must be demonstrated to be operable within the time limits provided in TS 3.8.1.1, Action a2.

Additionally, the inoperable diesel generator must be restored to operable status within 72 hours or the Unit must be placed in hot standby within the next 6 hours and in cold shutdown within the following 30 hours.

- b. TS 3.3.1, "Instrumentation, Reactor Protective Instrumentation," and TS 3.3.2 "Engineered Safety Features Actuation System Instrumentation" requires the plant protection system instrumentation channels to be operable in Modes 1, 2 and 3. Any inoperable channel must be placed in bypass within 1 hour and must be returned to operable status no later than during the next cold shutdown.
- c. TS 3.3.3.6, "Instrumentation, Accident Monitoring Instrumentation," requires the accident monitoring instrumentation channels to be operable during Modes 1, 2, and 3. Any inoperable channel must be restored to operable status within 7 days or be in hot shutdown within the next 12 hours.

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C. DESCRIPTION OF THE EVENT:

1. Event:

On October 15, 1991, while Unit 2 was in Mode 5 during a refueling outage, an inspection of Foxboro SPEC 200 instrumentation cabinets determined that several instrument modules were missing upper and/or lower guide rails and vibration damping material (bumpers). The inspection also found empty slots in the nests without dummy modules installed. The equipment therefore did not conform to the latest configuration used by Foxboro for seismic qualification testing. However, subsequent testing and analysis (described in Section G), determined that modules without vibration damping material would remain operable during and after a design basis seismic event. This testing also demonstrated that dummy modules did not need to be installed in the empty slots.

During previous periods of operation in Modes 1, 2, 3, and 4, the instrumentation channels associated with the following transmitters are considered not to have satisfied all of the operability requirements of their respective TSS: 1) 2LT-5903-1, Diesel Fuel Storage Tank T035 Level Indication; 2) 2PT-1013-1, Steam Generator E089 Pressure; 3) 2PT-1023-2, Steam Generator E088 Pressure and 4) 2LT-9387-1, 2LT-9388-2, and 2LT-9389-2, Containment Emergency Sump Level Indication.

Although inspections of the Foxboro instrumentation cabinets in Units 1 and 3 identified similar deficiencies, no reportable conditions existed.

By November 6, 1991, guide rails had been installed on all affected instrumentation at Units 1, 2, and 3. This action, in conjunction with the testing described in Section G.1 below, returned all equipment to an operable status.

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

Not applicable.

3. Sequence of Events:

Not applicable.

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4. Method of Discovery:

These discrepancies were discovered as a result of information obtained from another utility which had experienced a similar problem. A subsequent site-specific follow-up inspection of all SONGS Foxboro SPEC 200 instrumentation cabinets identified the discrepancies.

5. Personnel Actions and Analysis of Actions:

Not applicable.

6. Safety System Responses:

Not applicable.

D. CAUSE OF THE EVENT:

The primary cause of this event was determined to be inadequate installation instructions and requirements in vendor documentation. The documentation provided by the vendor pertained to the generic line of SPEC 200 equipment and did not specifically address special installation requirements for Class 1E applications. Although the Foxboro Class 1E qualification report indicated that the generic line modules would need to be modified to meet seismic qualifications, the report did not provide any specific information describing the required modification. Consequently, although the information provided in the qualification report presented an opportunity for SCE to identify the installation information deficiency associated with Class 1E applications, this subtlety was not detected. In addition, since the material required to modify the equipment was provided with the delivery of the cards, this also represented a missed opportunity to identify the deficiency.

E. CORRECTIVE ACTIONS:

1. Corrective Actions Taken:

- a. The missing guide rails were replaced on the affected plant instrumentation.
- b. A Foxboro nest loaded with modules typical of those installed at San Onofre and also most sensitive to seismic motions (i.e. cards with contacts or relays, cards with the most mass or weight, etc.) was tested. The nest was tested with guide rails in place, but without the bumpers which Foxboro states are required to support the ends of the cards. In addition, one slot was left empty to simulate the absence of a dummy module.

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The test concluded that the Foxboro modules will remain operable during and after a SONGS design basis seismic event without the installation of the bumpers and dummy modules. Following the testing, it was determined that one module was installed with only the lower guide rail in place. Analysis of this specific configuration was performed and demonstrated that this module would have remained operable during and after a design basis seismic event.

2. Planned Corrective Actions:

- a. Recently, SCE received updated Foxboro SPEC 200 component information (Maintenance Instruction MI 2AN-105, dated October, 1991) which includes specific mounting and installation information for modules being used in Class 1E applications. This MI will be incorporated into the Foxboro Instruction Manual. Additionally, nest loading drawings will be modified to include a generic note referencing the special seismic support requirements described in the MI.
- b. In-house Foxboro Training Programs for Instrumentation and Control (I&C) Technicians and Engineers will be updated to include seismic installation requirements in the lesson plan.
- c. Although the testing performed demonstrated that bumpers and dummy modules did not need to be installed in the Foxboro cabinets, Edison has committed to install bumpers in all safety related Foxboro cabinets during the next scheduled refueling outage for San Onofre Units 1, 2, and 3.

F. SAFETY SIGNIFICANCE OF EVENT:

SCE has evaluated the safety significance of the conditions described in Section C.1 above. The Foxboro seismic test criteria is significantly higher than that at SONGS and therefore instrumentation which did not meet the Foxboro seismic test report configuration may still have been capable of withstanding a SONGS design basis seismic event. Nevertheless, in this evaluation, it was assumed that instrumentation without upper and lower guide rails would fail non-conservatively.

1. 2LT-5903-1: Diesel Fuel Storage Tank (T035) Level

DG 2G002 provides one train of emergency power to the plant safety systems in the event of a loss of power. This diesel is supplied with fuel oil from a day tank (T133). This tank is in turn supplied with backup fuel from underground DFST T035 by means of two redundant fuel transfer pumps. In the scenario involving a loss of power following a seismic event of

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sufficient magnitude, the DFST T035 level signal from transmitter 2LT-5903-1, is assumed to fail low (worst case). This will activate a DFST Hi/Lo alarm in the CR. When the fuel oil level in the day tank decreases to 33 inches, a day tank low level signal is sent to one fuel transfer pump to automatically start it, but due to the low level indication in the DFST, neither pump will start. When the day tank level decreases to 31 inches, a fuel oil day tank low level trouble alarm is activated in the CR. At this time, the day tank has at least a one hour supply of fuel available to keep the diesel generator running. The alarm response procedure for the fuel oil day tank trouble alarm identifies the need to check the day tank level and manually operate the transfer pumps as necessary. The diesel generator operating procedure recommends local manual control of the transfer pumps in the event of a pump trip.

The action of diagnosing the problem and subsequently starting up the fuel transfer pumps manually can reasonably be expected within one hour after the fuel oil day tank low level trouble alarm is activated (i.e. before the day tank is empty). Based on this information, the lack of guide rails for this instrumentation is of no safety significance.

2. 2PT-1013-1/1023-2: Steam Generator E089/E088 Pressure

Each of these transmitters supply one channel of Steam Generator (SG) pressure indication to activate the low SG Pressure and MSIS bistables (i.e. 2PT-1013-1 to Channel A for SG E089 and 2PT-1023-2 to Channel B for SG E088). Each SG also has three other channels of SG pressure indication from independent transmitters. The low SG pressure trip is credited in the safety analysis (UFSAR) to generate a reactor trip and MSIS in the event of a Main Steam Line Break (MSLB) or an MSIS in the event of a Feedwater Line Break (FWLB). The difference in pressure between the two steam generators is also used in the EFAS logic which together with a MSIS prevents auxiliary feedwater flow to the affected SG and feeds the unaffected SG in a MSLB or FWLB event.

A low SG pressure trip is generated if any two channels indicate a SG pressure below the TS setpoint. In the event of a MSLB or FWLB, one unreliable SG pressure indication in each SG caused by a seismic event of significant magnitude, will not adversely impact the ability of the plant protection system to initiate a low SG pressure reactor trip and MSIS due to the redundancy available through the other reliable channels.

Additionally, in the event of a MSLB or FWLB concurrent with failure of the transmitter signals due to an independent seismic event, the EFAS logic could initiate auxiliary feedwater flow to the wrong SG. However, using probabilistic risk assessment (PRA) techniques, the probability of core damage as a result of this scenario occurring is conservatively calculated to be $2E-8$ per year. This represents a negligible contribution to the overall core damage frequency for Unit 2, which is estimated to be $5E-5$ per year.

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The increased risk of instrument failure, as a result of the missing guide rails on these transmitter instrument cards, is therefore of minimal safety significance.

3. 2LT-9387-1/2LT-9388-2/2LT-9389-2: Containment Emergency Sump Level

The Containment Emergency Sump (CES) supplies recirculation water for reactor cooldown and containment pressure and temperature reduction in the event of a Loss of Coolant Accident (LOCA). When the Refueling Water Storage Tank (RWST) [BP, TK] level is low, a RAS is initiated. RAS opens the CES outlet valves [ISV] supplying water to the HPSI and CS pumps. RAS in combination with a CES high level indication signal from either transmitter 2LT-9386-1 or 2LT-9389-2 will close the HPSI and CS minimum flow isolation valves on both trains. If a seismic event of sufficient magnitude occurs, it is assumed that the CES level indication signal from transmitter 2LT-9389-2 will fail non-conservatively low; however, the signal from transmitter 2LT-9386-1 (which was demonstrated to remain operable throughout a design basis earthquake) will still provide the correct indication ensuring that the equipment will perform its safety function.

The containment sump level indications obtained through level transmitters 2LT-9387-1 and 2LT-9388-2 are used for post accident monitoring and have no active control function.

Therefore, the missing guide rails for the Foxboro Modules which interface with these transmitters have no safety significance.

G. ADDITIONAL INFORMATION:

1. SONGS Seismic Testing:

The inspection of the Foxboro SPEC 200 cabinets installed at SONGS, following discovery of the potential discrepancies, revealed that vibration damping material (bumpers) was not installed for a number of instrument modules in Unit 2 as well as Units 1 and 3. Also, empty slots in the nests did not have dummy instrument modules installed. Although modules missing these items did not conform to the Foxboro Seismic test configuration, engineering concluded that modules in this configuration would remain operable during and following a design basis seismic event. This conclusion was based on Foxboro's generic test accelerations being significantly higher than the seismic accelerations postulated at SONGS and the installed guide rails providing a large percentage of the required support.

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To confirm this conclusion, a Foxboro nest with modules typically used at SONGS was seismically tested on October 19, 1991, using SONGS specific response spectra. The tested nest and modules were assembled per Foxboro instructions, except that bumpers were not installed and one module was not installed (a slot was left empty). The test demonstrated that the Foxboro nest and modules would remain operable during and after a SONGS design basis seismic event.

Additionally, the inspection revealed that the module which interfaces with the signal from 2LT-9386-1 (containment emergency sump level) had only the lower guide rail in place; therefore, analysis of this configuration was also performed. This analysis showed that even with only the lower guide rail installed, the module would still remain operable during and after a design basis seismic event. Therefore, only those modules missing both guide rails, as described in Section C.1 above, were determined to have been inoperable and reportable.

2. Previous LERs for Similar Events:

None.