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 AUTH. NAME AUTHOR AFFILIATION
 KRIEGER, R.W. Southern California Edison Co.
 RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 92-006-00: on 920313, determined that ECCS & CS min flow isolation MOVs may not have been capable of full closure at design basis operating conditions. Caused by inadequate valve configuration. MOVs to be tested. W/920414 ltr.

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Southern California Edison Company

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STATION MANAGER

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April 14, 1992

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

Subject: Docket No. 50-361
30-Day Report
Licensee Event Report No. 92-006
San Onofre Nuclear Generating Station, Unit 2

Pursuant to 10 CFR 50.73(d), this submittal provides the required 30-day written Licensee Event Report (LER) for an occurrence involving a reactor shutdown required by Technical Specifications. As discussed with Mr. Howard Wong (USNRC) on April 14, 1992, submittal of this LER is delinquent due to additional time needed in order to provide a complete report. Neither the health nor the safety of plant personnel or the public was affected by this occurrence or condition.

If you require any additional information, please so advise.

Sincerely,

M. P. Short for
R. W. Krieger

Enclosure: LER No. 92-006

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) SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2												Docket Number (2) 0 5 0 0 0 3 6 1				Page (3) 1 of 0 8						
Title (4) Reactor Shutdown to Modify and Test Emergency Core Cooling and Containment Spray Minimum Flow Isolation Valves																						
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 3	1 3	9 2	9 2	---	0 0 6	---	0 0	0 4	1 4	9 2	NONE				0 5 0 0 0 3 6 2							
OPERATING MODE (9)			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)																			
POWER LEVEL (10) 1 0 0 //////////////////// //////////////////// //////////////////// //////////////////// ////////////////////			<input type="checkbox"/> 20.402(b)					<input type="checkbox"/> 20.405(c)					<input 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				
			<input type="checkbox"/> 20.405(a)(1)(iii)					<input checked="" type="checkbox"/> 50.73(a)(2)(i)					<input type="checkbox"/> 50.73(a)(2)(viii)(A)					Abstract below and in text)				
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LICENSEE CONTACT FOR THIS LER (12)																						
Name R. W. Krieger, Station Manager												TELEPHONE NUMBER AREA CODE 7 1 4 3 6 8 - 6 2 5 5										
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	//////											
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)																						

On 3/13/92, at 1040, with Unit 2 in Mode 1, it was determined that the Emergency Core Cooling System (ECCS) and Containment Spray (CS) minimum flow isolation Motor Operated Valves (MOV) may not have been capable of full closure at design basis operating conditions. Since these valves were not assured to meet the conditions for operability, Unit 2 was considered to be in a Technical Specification (TS) shutdown action condition. At 1120 on 3/13/92, a shutdown was initiated and an Unusual Event (UE) was declared. The UE was exited at 1528, and Mode 3 was entered at 1617.

The condition at Unit 2 was discovered as a result of completion of Generic Letter (GL) 89-10 testing of the similar valves on Unit 3 during the Cycle 6 refueling outage. Two of the four Unit 3 valves did not completely close during testing under the severe conditions postulated during design basis accidents. These results were applied to the Unit 2 valves since they were similarly configured.

These MOVs had been previously configured to the criteria given in IEB 85-03. This configuration did not include factors which have been determined to significantly affect MOV thrust requirements such as orientation, aging, and normal wear addressed in GL 89-10. The actuators for these valves are mounted horizontally, unlike all other valves tested to date. This configuration may increase the thrust required at design basis conditions.

The Units 2 and 3 ECCS and CS minimum flow MOVs have been re-configured and tested to satisfy GL 89-10 criteria. The evaluation, testing and modification of all MOVs pursuant to GL 89-10 will continue in accordance with SCE's program.

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Plant: San Onofre Nuclear Generating Station
Unit: Two
Reactor Vendor: Combustion Engineering
Event Date: 3-13-92
Time: 1120

A. CONDITIONS AT TIME OF THE EVENT:

Mode 1, Power Operation

B. BACKGROUND INFORMATION:

1. Emergency Core Cooling and Containment Spray Systems

The Emergency Core Cooling System (ECCS) [BP, BQ] functions to inject borated water into the Reactor Coolant System (RCS) [AB] to provide core cooling following accidents such as a Loss of Coolant Accident (LOCA) and to maintain the reactor subcritical following a LOCA or a Main Steam Line Break (MSLB).

The Containment Spray (CS) [BE] system is provided to cool and depressurize containment following a LOCA or MSLB by spraying borated water into the containment atmosphere. Redundant containment cooling is provided by the Containment Emergency Coolers.

Both Unit 2 and 3 are provided with three High Pressure Safety Injection (HPSI) [BQ] pumps, two Low Pressure Safety Injection (LPSI) [BP] pumps [P] and two CS pumps which are arranged into two redundant and independent trains designated train "A" and train "B". The third HPSI pump can be aligned to either train. The ECCS pumps in each train are normally aligned to inject water from the Refueling Water Storage Tanks (RWST) [TK] into the RCS or containment, as described above. As the RWST level is reduced, a Recirculation Actuation Signal (RAS) is initiated when the RWST level reaches approximately 18%. The RAS: 1) stops both LPSI pumps, and 2) switches the suction of the HPSI and CS pumps from the RWST to the Containment Emergency Sump (CES) by opening the normally closed CES suction isolation valves for each train. Each of the ECCS and CS pumps is provided with a minimum flow recirculation line from the pump discharge to the RWST which is isolated on RAS in combination with high CES level. As shown in Figure 1, the minimum flow lines for each train of pumps connects to a common header having a Train "A" and "B" isolation valve. Isolation of the minimum flow recirculation flow paths on RAS precludes pumping contaminated CES water to the atmospherically vented RWST following a RAS.

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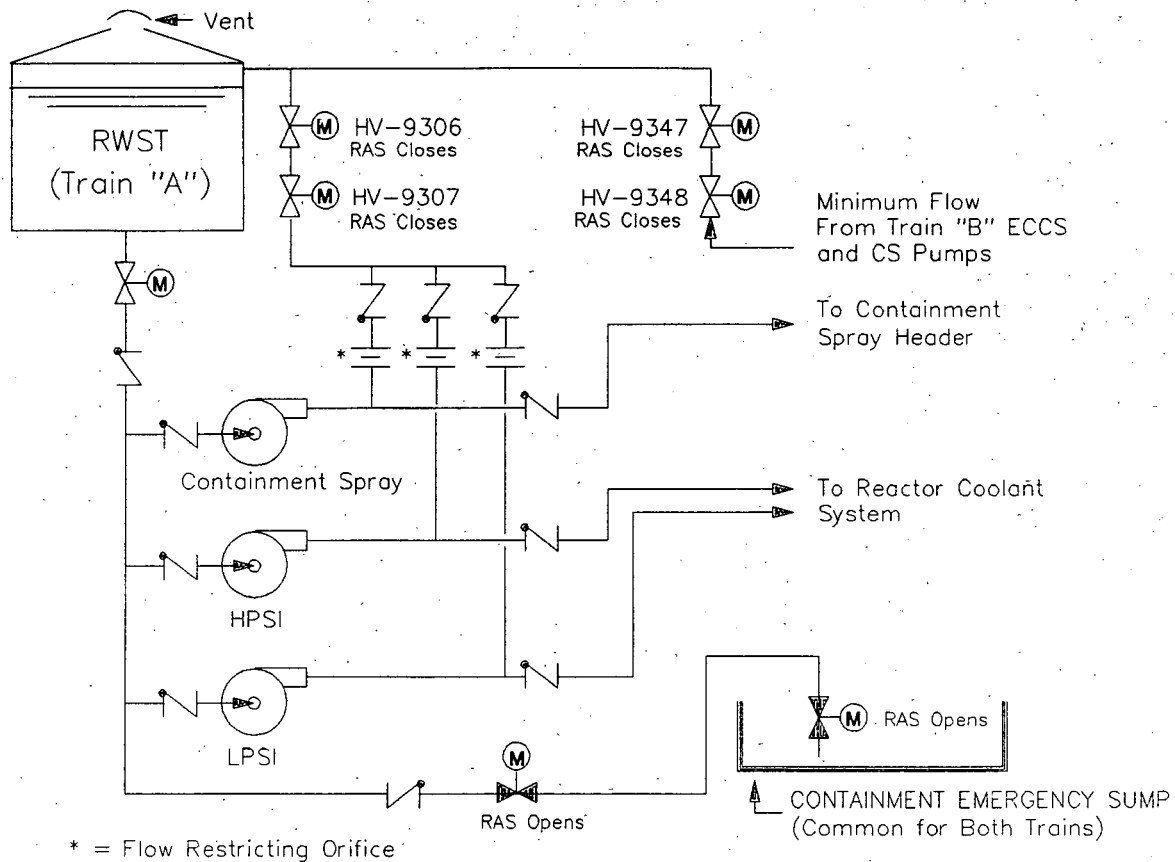


Figure 1 - ECCS and CS Minimum Flow Isolation Valve Arrangement

2. Technical Specifications:

Technical Specification (TS) 3.0.3, "Limiting Conditions for Operation (LCO)," requires that when a LCO is not met, except as provided in the associated action requirements, within one hour, action shall be initiated to place the Unit in a Mode in which the specification does not apply.

TS 3.5.2, "ECCS Subsystems - $T_{avg} \geq 350$ F," requires that two ECCS systems be operable in Modes 1, 2 and 3 with each system comprised of an operable HPSI pump, a LPSI pump, and a charging pump. An inoperable ECCS train must be restored to operability within 72 hours, or the plant must be placed in Hot Standby within the next 6 hours and in Hot Shutdown within the following 6 hours.

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TS 3.6.2, "Containment Spray System," requires that two CS trains be operable in Modes 1, 2 and 3. With one CS train inoperable, the train must be restored to operability within 72 hours or the unit must be placed in HOT STANDBY within the next 6 hours; if the CS train is not restored to operability within the next 48 hours, the plant must be placed in HOT SHUTDOWN within the following 6 hours.

3. Inspection and Enforcement Bulletin 85-03:

In IEB 85-03, "Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings," dated November 15, 1985, the NRC recommended that licensees develop and implement a program to ensure that valve motor-operator switch settings for MOVs in several specified systems be selected, set, and maintained so that they would operate under design basis conditions for the life of the plant. SCE developed and implemented such a program until it was superseded by the more rigorous and comprehensive Generic Letter (GL) 89-10 program described below.

4. Generic Letter 89-10:

Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," dated June 28, 1989, recommended that nuclear power plant licensees establish a new program to verify the capability of certain Motor Operated Valves (MOV) to perform their function under design basis conditions. The recommended program involves testing, inspection and maintenance of certain safety-related MOVs. In addition to the requirements of IEB 85-03, this program requires empirical test data for verification of factors which may affect MOV operation, such as orientation, internal friction, aging and normal wear. These factors are utilized to establish a valve configuration which will assure operability under design basis conditions. SCE has established such a program in response to this recommendation.

In response to this new requirement for the affected MOVs, SCE is:

- 1) validating the design basis operating conditions, 2) calculating the required torque switch settings, 3) testing the valves under actual design basis flow and pressure conditions, where possible, using the Motor-Operated Valve Analysis and Test System (MOVATS) to verify operability.

C. DESCRIPTION OF THE EVENT:

1. Event:

On March 13, 1992, at approximately 1040, with Unit 2 in Mode 1 at 100% power, it was determined that the ECCS and CS minimum flow isolation MOVs (HV-9306, HV-9307, HV-9347 and HV-9348) may not be capable of full closure under design basis operating conditions.

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Since this capability could not be ensured, TSs 3.5.2 and 3.6.2 were conservatively applied. Since both trains of ECCS and CS were potentially affected, and there is no Action statement provided in either TS 3.5.2 or 3.6.2 for more than one inoperable train, the shutdown requirements of TS 3.0.3 were considered to apply. At 1120 on March 13, 1992, a precautionary shutdown was initiated and an Unusual Event (UE) was declared in accordance with applicable emergency implementing procedures. The UE was exited at 1528 and Mode 3 was entered at 1617.

The condition at Unit 2 was discovered as a result of completion of GL 89-10 testing of the Unit 3 ECCS and CS minimum flow isolation MOVs. The Unit 3 testing revealed that one of the two isolation MOVs in each train (HV-9306 and HV-9348) did not completely close under the design basis condition required by the criteria of GL 89-10. Subsequent engineering evaluations concluded that the MOV drive gear sets and torque switch settings, which did satisfy the requirements of IEB 85-03, were determined not to satisfy the more stringent requirements of GL 89-10. (The ECCS and CS minimum flow valves in Unit 2 had not yet been tested under the GL 89-10 criteria.) Since the Unit 2 valves were configured similarly to those in Unit 3, it was concluded that they would not likely satisfy the GL 89-10 testing requirements.

Subsequent testing and analysis indicated that the original drive gear sets and torque switch settings for each of the four Unit 2 valves were such that full valve closure under the most severe design basis conditions might not occur.

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

Not Applicable.

3. Sequence of Events:

<u>DATE</u>	<u>TIME</u>	<u>ACTION</u>
3/13/92	1120	After thorough analysis of all available previous Unit 2 and current Unit 3 test data and calculations, the Unit 2 ECCS and CS minimum flow isolation valves were determined to be potentially inoperable. Initiated shutdown and declared UE.
3/13/92	1528	Exited UE in accordance with plant procedures.
3/13/92	1617	Mode 3 entered.

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4. Method of Discovery:

As described in Section C.1 above.

5. Personnel Actions and Analysis of Actions:

Not applicable.

6. Safety System Responses:

Not Applicable.

D. CAUSE OF THE EVENT:

The ECCS and CS minimum flow isolation MOVs had been previously configured to the generally accepted methodology and regulatory criteria given in IEB 85-03. This configuration did not include factors which have recently been determined to significantly affect MOV thrust requirements such as orientation, aging, and normal wear addressed in GL 89-10. Subsequent evaluation and testing of these valves to GL 89-10 criteria determined that the actuators were not configured (i.e., torque switch settings and gear drive sets) such that proper valve operation could be assured. In particular, the actuators for these valves are mounted in the horizontal plane, rather than vertically like all other valves tested to date. This configuration may increase the thrust required to operate the valves at design basis conditions.

E. CORRECTIVE ACTIONS:

1. Corrective Actions Taken:

The Units 2 and 3 ECCS and CS minimum flow MOVs have been re-configured and tested to satisfy the design basis testing requirements of GL 89-10.

2. Planned Corrective Actions:

- a. The evaluation, testing and modification of all remaining applicable MOVs pursuant to GL 89-10 will continue in accordance with SCE's program. No other valves previously evaluated and/or tested in accordance with GL 89-10 have been identified which would not be expected to function properly.
- b. A review of valves not previously tested or evaluated under GL 89-10 will be conducted to determine if there are any other valves in a similar horizontal orientation. Any valves identified by this review will be evaluated in an expedited manner.

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F. SAFETY SIGNIFICANCE OF THE EVENT:

The effect of incomplete closure of the ECCS and CS minimum flow isolation valves has been evaluated using realistic assumptions. This evaluation has concluded that the radiological consequences of this event combined with a postulated LOCA are within design bases acceptance criteria, for the postulated LOCA with the anticipated operator response to the event.

Based on GL 89-10 test results, the Unit 3 ECCS and CS minimum flow isolation valves did not fully seat against maximum differential pressure conditions. The maximum differential pressure used in the test is characteristic of a small break LOCA where ECCS flow to the RCS is small and HPSI pump discharge pressure is near shutoff head. For a large break LOCA, the expected HPSI pump discharge pressure, and hence differential pressure across the ECCS and CS minimum flow valves when closing, would be significantly lower, and the valves are expected to fully close.

Should the ECCS and CS minimum flow isolation valves not fully close, the primary impact would be on the radiological consequences of a postulated small break LOCA. This impact was evaluated assuming operator action to close the valves as indicated above. Assuming 1% to 10% failed fuel and 50% atmospheric dispersion factor, the operations staff would have from 8 hours to 4 days to isolate the minimum flow valves, thus limiting the dose at the Exclusion Area Boundary (EAB) and Control Room to 10 CFR 100 and 10 CFR 50 Appendix A, General Design Criterion 19 limits. These dose assessments are supported by the realistic assumptions contained in Chapter 15 of the Updated Final Safety Analysis Report, Table 15.6 addressing post-LOCA doses.

It is reasonable to assume that the operations staff would successfully isolate the minimum flow valves within this 8 hour to 4 day time period. Following a RAS, Emergency Operating Instructions (EOI) require the operators to ensure that the minimum flow isolation valves are closed. Operators have position indication in the control room and would close the valves manually if they failed to fully close automatically. The operations staff would then take steps to locally close the minimum flow isolation valves outside the control room if necessary. If the valves could not be closed manually, then a decision could be made to shut off one of the operating HPSI pumps momentarily to reduce the differential pressure across the valves and enable valve closure. This would have no effect on core cooling during the brief time the HPSI pump is shut off as one HPSI pump is adequate for long term core cooling.

There is no impact of the diversion of CES water on the Net Positive Suction Head (NPSH) available to the HPSI pumps or long term core cooling during post-LOCA recirculation following a RAS. Adequate reserve margin in CES inventory exists to ensure the NPSH requirements of the HPSI pumps following the potential diversion due to incomplete valve closure. The time of peak clad temperature and core recovery occurs well before RAS, and sufficient HPSI flow is available after RAS to maintain long term core cooling. Since the discharge head of the HPSI pumps is greater than that

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of the CS pumps, the CS check valves would close and effectively reduce the CS diversion flow to zero. Additionally, any diversion of flow to the RWST is available to be re-injected into the reactor coolant system if required.

G. ADDITIONAL INFORMATION:

1. Component Failure Information:

Not Applicable

2. Previous LERs for Similar Events:

None.