NRC FORM 366 (MMM-YYYY) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	Docket Number (2)	Page (3)
San Onofre Nuclear Generating Station (SONGS) Unit 2	05000-361	1 of 6

TITLE (4): Emergency Core Cooling System Inoperable Due To Inadequate Surveillance Test

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 NAME	DOCKET NUMBER
									SONGS Unit 3	05000-362
09	09	1998	1998	--018--	00	10	08	1998	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check One or More) (11)

20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area
R.W. Krieger, Vice President, Nuclear Generation	949-368-6255

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
Yes (If yes, complete EXPECTED SUBMISSION DATE)	X	No				

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

On September 9, 1998 at 1511 PDT (the discovery date) with both units at 100 percent, SCE engineers completed an evaluation of the Total Loop Uncertainty (TLU) for the Charging System flow instrumentation and determined the TLU to be plus or minus 15-20 gpm. Because the nominal charging pump flow is 44 gpm and the TS Surveillance 3.5.2.6 requirement is 40 gpm, SCE concluded the TS SR was not met and is reporting this occurrence in accordance with 10CFR50.73(a)(2)(i)(B).

SCE did not determine the cause because this condition has existed since initial plant startup (1982-1983). As allowed by TS SR 3.0.3, the required surveillance tests were successfully completed using local measurement and test equipment and calculating charging pump flow, rather than using the charging loop flow instrumentation and ECCS declared operable.

SCE concludes that even if the charging flow was reduced (which was not the case), it would have resulted in a negligible increase in plant risk and had no actual safety significance.

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R.W. Krieger, Vice President, Nuclear Generation	949-368-6255

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

On September 9, 1998 at 1511 PDT (the discovery date) with both units at 100 percent, SCE engineers completed an evaluation of the Total Loop Uncertainty (TLU) for the Charging System flow instrumentation and determined the TLU to be plus or minus 15-20 gpm. Because the nominal charging pump flow is 44 gpm and the TS Surveillance 3.5.2.6 requirement is 40 gpm, SCE concluded the TS SR was not met and is reporting this occurrence in accordance with 10CFR50.73(a)(2)(i)(B).

SCE did not determine the cause because this condition has existed since initial plant startup (1982-1983). As allowed by TS SR 3.0.3, the required surveillance tests were successfully completed using local measurement and test equipment and calculating charging pump flow, rather than using the charging loop flow instrumentation and ECCS declared operable.

SCE concludes that even if the charging flow was reduced (which was not the case), it would have resulted in a negligible increase in plant risk and had no actual safety significance.

Plant:	San Onofre Nuclear Generating Station Units 2 & 3	
Reactor Vendor:	Combustion Engineering	
Event Date:	September 9, 1998	
Event Time:	1511 PDT	
	Unit 2	Unit 3
Mode:	1, Power operation	1, Power operation
Power:	99.9 percent	99.9 percent
Temperature:	548 degrees F	546 degrees F
Pressure:	2250 psia	2250 psia

Background:

The Emergency Core Cooling System (ECCS) is designed to provide core cooling in the unlikely event of a loss-of-coolant accident (LOCA). The cooling must suffice to prevent significant alteration of core geometry, preclude fuel melting, limit the cladding metal-water reaction, and remove the energy generated in the core for an extended period of time following a LOCA. The ECCS fluid must contain sufficient neutron absorbers to maintain the core subcritical for the duration of a LOCA. In addition, the ECCS functions to inject borated water into the reactor coolant system (RCS) to add negative reactivity to the core in the unlikely event of a steam line rupture. Safety injection is also initiated in the event of a steam generator tube rupture or a control element assembly (CEA) ejection incident.

A train of ECCS consists of one train of High Pressure Safety Injection (HPSI), one train of Low Pressure Safety Injection (LPSI), and one train of Charging. Credit is taken for the inventory provided by the Charging System only for certain small break LOCAs. The positive displacement charging pumps take suction from the Refueling Water Storage Tank (RWST) or the Boric Acid Makeup Tank (BAMU) on a safety injection actuation signal (SIAS) and discharge directly to the RCS through a common header. The charging pumps deliver water through the charging header to the RCS Loops 1A and 2A injection lines. An ECCS train charging subsystem includes the train's respective charging pump, P-190 for Train A and P-192 for Train B, and the two RCS injection lines. The charging header and injection lines are common to both ECCS trains charging subsystems. The swing charging pump, P-191, can provide support to either Train A or B. See Figure 1.

The accident analyses assume Charging System flow to the RCS cold legs during the initial automated response to a LOCA. Considering single failure, 15.8 gpm charging flow through one injection line is credited in the small break LOCA analysis. Considering the worst case flow split, a charging pump flow rate of 36.2 gpm is required to ensure a flow rate of 15.8 gpm to the RCS. The nominal flow from each positive displacement charging pump is 44 gpm.

Technical Specification (TS) 3.5.2, ECCS - Operating, requires two ECCS trains to be OPERABLE in Modes 1 and 2, and Mode 3 with pressurizer pressure greater than or equal to 400 psia.

TS Surveillance Requirement (SR) 3.5.2.6 requires the flow from each charging pump be verified to be greater than or equal to 40 gpm in accordance with the Inservice Testing Program. Charging pump flow rate is determined by converting the delta-p across an orifice plate {OR} in the piping system with a delta-p transmitter {DPT} and square root extractor, and sending the resulting signal to a flow indicator {FI}.

Description of the Event:

On September 9, 1998 (the discovery date), SCE engineers completed an evaluation of the Total Loop Uncertainty (TLU) for the Charging System flow instrumentation used to perform SR 3.5.2.6 (see Additional Information section). The TLU was determined to be plus or minus 15-20 gpm. Because the nominal charging pump flow is 44 gpm and the TS requirement is 40 gpm, SCE concluded the TS SR was not met and is reporting this occurrence in accordance with 10CFR50.73(a)(2)(i)(B).

Cause of the Event:

This condition has existed since initial plant startup (1982-1983). Due to the passage of time, SCE did not determine the cause.

Corrective Actions:

1. On September 9, 1998, at 1511 PDT (the discovery time), both Unit 2 and Unit 3 entered TS SR 3.0.3. As allowed by TS SR 3.0.3, when a surveillance was not performed within its specified frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified frequency, whichever is less. This delay period is permitted to allow performance of the surveillance. The required surveillance tests were successfully completed and ECCS declared operable.

2. TS SR testing will be performed using local Measurement and Test Equipment (M and TE) and calculating Charging pump flow, rather than using the Charging loop flow instrumentation (which is subject to a large TLU).

Safety Significance:

While the large TLU required SCE to declare the charging pumps inoperable, it did not impact their availability for normal or emergency service. In addition:

In 1979, Combustion Engineering's (CE) SBLOCA calculations predicted fuel cladding temperature would exceed 10CFR50.46 limits (2200 degrees F) for three break sizes (0.025 sq. ft., 0.05 sq. ft., and 0.075 sq. ft.) without crediting charging flow. In response, the analysis was revised to take credit for 15.8 gpm of charging flow to supplement HPSI flow and thus be in compliance with 10CFR50.46.

For larger breaks (0.1 sq. ft. and 1.0 sq. ft.), charging flow is not required because RCS depressurization is rapid enough that HPSI alone can provide sufficient ECCS flow prior to initiation of safety injection tank (SIT) flow. SIT flow rapidly refloods the core and maintains cladding temperatures well below 2200 degrees F. For smaller breaks (0.01 sq. ft.), break flow is low enough that HPSI alone is sufficient to limit or even prevent core uncovery and maintain acceptable cladding temperatures.

The 1979 SBLOCA analysis results are conservative because:

1. The computer model uses a positive moderator temperature coefficient (MTC) even though TS 3.1.4 prohibits a positive MTC above 70 percent power. A non-positive MTC would decrease or eliminate the calculated power increase at the start of the transient. This would result in a faster depressurization, earlier reactor trip and SIAS on low pressure, and less RCS inventory lost.

2. The computer model uses 15.0 kW/ft for the peak linear heat generation rate (PLHGR) even though TS 3.2.1 limits PLHGR to 13.0 kW/ft. Using the lower value in the hot rod heatup analysis would result in a lower calculated peak cladding temperature.

3. The SBLOCA methodology itself contains additional conservatisms. ABB-CE has submitted and received NRC approval for an improved SBLOCA model which, when approved for use at San Onofre, will demonstrate that charging is not required to mitigate the consequences of SBLOCA.

Best Estimate LOCA analyses performed for SCE's PRA/IPE using EPRI's Modular Accident Analysis Program (MAAP) code indicate that one train of ECCS without charging will maintain peak cladding temperatures below 1500 degrees F.

Therefore, SCE concludes that even if the charging flow was reduced (which was not the case), it would have resulted in a negligible increase in plant risk and had no actual safety significance.

TS 3.1.2, Shutdown Margin (SDM) - Tave [less than or equal to] 200 degrees F, requires, among other attributes provided in the Bases for Surveillance Requirements, that no more than one charging pump can be functional in Mode 5. Because TLU applies in both the plus and minus direction, there is theoretically the possibility for higher than assumed charging flow. However, because the charging pumps are positive displacement pumps, it is not credible that a pump will deliver flow significantly greater than design flow. Therefore, the condition being reported herein has no safety significance with respect to higher than expected pump flow.

Additional Information:

In the past 3 years, SCE reported (LER 2-97-010-01) a condition involving check valves in the Charging System injection lines which failed to open completely, resulting in the charging flow distribution being different than that assumed in the safety analyses. The cause was a mechanical failure of the check valve, a cause not present in the condition being reported herein. Therefore, those corrective actions could not have prevented or identified this condition.

LER 2-1998-019 reported a missed TS SR due to TLU for oxygen monitors on the Waste Gas Handling System. That condition, discovered on September 11, 1998, also existed since original plant licensing; TLU concerns are being addressed within our 50.04(f) effort (see below).

Total Loop Uncertainties:

When this issue surfaced, the engineer was completing TLU calculations as part of our 10CFR50.54(f) commitment discussed in the SCE letter to the NRC dated July 31, 1997. The Third phase of this program addresses instrument uncertainties where the Technical Specifications Chapter 3 Surveillance Requirements provide specific surveillance test acceptance criteria.

The Southern California Edison Instrument setpoint/loop accuracy calculation methodology is based on ANSI/ISA S67.04-1988, "Setpoints for Nuclear Safety-Related Instrumentation" and ISA Recommended Practice RP67.04, "Methodologies For Determination of Setpoints For Nuclear Safety-Related Instrumentation". The Nuclear Regulatory Commission has endorsed the methods in ANSI/ISA S67.04-1988 through Regulatory Guide 1.105, Revision 2, "Instrument Setpoints for Safety-Related Systems".

Consistent with the above mentioned methodologies, the combination of uncertainties were developed for the charging pump flow instruments that utilize a Delta Pressure transmitter and orifice plate. Flow measurements that use orifice plates, annubars or other non-linear sensors, have inherently large uncertainties associated with their readings if operated in the lower portion of the indicated range. The uncertainties associated with the flow sensor, the transmitter and any electronics conversion modules act as the input uncertainties source to the linearizing device, in this case, a square root extractor (SRE). The non-linear nature of the SQE causes large slopes at the low end of its range and act as a multiplier to the input uncertainty terms. Measured flow values of less than 50% of full scale flow will be subject to magnified uncertainties at the SQE output. The charging flow is operating at 27% of full scale when measuring 40 gpm.

Therefore, the calculated TLU for charging pump flow is very large. However, the measured flow with M&TE instrumentation on September 10, 1998 showed actual flow verses indicated flow within 1 gpm.

FIGURE 1 - Charging System