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 8

TITLE (4): Inadequate Surveillance Test for Logarithmic Power Bypass Removal Function

EVENT DATE			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
06	17	1998	1998	-- 011 --	01	09	29	1998	FACILITY NAME	DOCKET NUMBER

OPERATING MODE	1	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)
POWER LEVEL (10)	100	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 6/17/1998 (the discovery date), an engineer (utility, non-licensed) reviewing instrument records realized the setpoints for the automatic removal of the high log power bypasses had not been verified to be within their setting tolerance. Subsequently, SCE determined; 1) the automatic bypass removal logic, as designed, cannot satisfy the Technical Specification (TS) as written, 2) the bistable setpoint was a "nominal value" resulting in some setpoints not complying verbatim with the TS, and 3) the UFSAR and TS uses different definitions of reactor power - setpoints complied with the UFSAR definition but not the TS. These conditions are being reported in accordance with 10CFR50.73(a)(2)(i).

These condition have existed since original plant design and startup (circa 1982). Because of the passage of time, SCE did not determine the cause.

SCE will submit proposed TS changes which will correct these conditions.

These conditions have minimal safety significance.

Plant: San Onofre Nuclear Generating Station Units 2 & 3
Reactor Vendor: Combustion Engineering
Event Date: June 17, 1998
Event Time: 1456 PDT

	Unit 2	Unit 3
Mode:	1, Power operation	1, Power operation
Power:	99.8 percent	99.9 percent
Temperature:	549 degrees F	546 degrees F
Pressure:	2250 psia	2250 psia

Purpose:

The purpose of this LER is to report, in accordance with 10CFR50.73 (a)(2)(i), four related conditions concerning the automatic removal of certain reactor trip operating bypasses. The four conditions are:

1. Technical Specification (TS) Surveillance Requirement (SR) 3.3.1.12 and SR 3.3.2.3 were not fully satisfied because the specific setpoints for the Logarithmic Power Level-High (IG) operating bypass removal channels had not been verified to be within their setting tolerance.

2. The Logarithmic Power Level-High and Departure From Nucleate Boiling Ratio-Low/Local Power Density-High/Reactor Coolant Flow-Low (DNBR/LPD/RCF) operating bypass removal logic, as designed, cannot satisfy the TSs as written. Consequently, the automatic Logarithmic Power Level-High operating bypass removal was set lower than permitted by TS 3.3.1.

3. The DNBR/LPD/RCF operating bypass removal setpoint was set using a "nominal value" which resulted in some of the setpoints being greater than permitted by TS 3.3.1.

4. TS 1.1 defines Thermal Power as the "total reactor core heat transfer rate to the reactor coolant." This definition includes both fission power and decay heat. Decay heat is not measured by the excore neutron measurement system which is used to measure logarithmic power. Because decay heat routinely exceeds 1E-4 percent Rated Thermal Power (RTP), TS 3.3.1 would require the DNBR/LPD/RCF trips to be enabled at all times. These trips are routinely bypassed during plant startup until logarithmic power approaches 1E-4 percent power as measured by the excore neutron measurement system.

Background:

The Logarithmic Power Level-High trip is provided to protect the integrity of the fuel cladding and the Reactor Coolant System (RCS) pressure boundary in the event of an unplanned criticality from a shutdown condition. A reactor trip is initiated by the Logarithmic Power Level-High trip at a less than or equal to 0.83 percent logarithmic power unless this trip is manually bypassed by the operator. The operator may bypass this trip when logarithmic power level is above 1E-4 percent. This bypass is automatically removed when the logarithmic power level decreases to 1E-4 percent logarithmic power.

The Departure From Nucleate Boiling Ratio (DNBR)-Low trip is provided to prevent the DNBR in the limiting coolant channel in the core from exceeding the fuel design limit in the event of anticipated operational occurrences. The DNBR trip variable (calculated by the Core Protection Calculator (CPC) and equal to 1.31) assures a trip is initiated prior to violation of fuel design limits. The DNBR algorithm used in the CPC is valid only within a limited parametric envelope. The DNBR-Low trip may be bypassed below 1E-4 percent RTP. However, the bypass must be automatically removed when thermal power increases to 1E-4 percent RTP.

The Local Power Density (LPD)-High trip variable (calculated by the CPC and equal to 21 kw/ft) ensures that a reactor trip occurs when the actual core peak LPD is sufficiently less than the fuel design limit such that the increase in actual core peak LPD after the trip will not result in a violation of the peak LPD Safety Limit. Like the DNBR-LOW, this trip may be bypassed below 1E-4 percent RTP, and the bypass must be automatically removed when thermal power increases to 1E-4 percent RTP.

The Reactor Coolant Flow (RCF)- Low trip provides protection against a reactor coolant pump sheared shaft-event, and a two pump opposite loop flow coastdown event. A trip is initiated when the pressure differential across the primary side of either steam generator goes below a variable setpoint. This variable setpoint stays a set amount below the pressure differential unless limited by a set maximum decrease rate or a set minimum value. The specified setpoint ensures that a reactor trip occurs to prevent violation of LPD or DNBR safety limits under the stated conditions. This trip also may bypassed when power is less than 1E-4 percent RTP, and must be automatically removed when power increases to 1E-4 percent RTP.

The operating bypass removal function for the above four reactor trips are all performed by a single bistable device for a given channel. The DNBR/LPD/RCF operating bypass removal functions are performed at the bistable's setpoint on increasing power. The setpoint is manually adjustable and set to approximately 1E-4 percent logarithmic power.

The Logarithmic Power Level-High operating bypass automatic removal function is performed at the bistable's reset point on decreasing power. The reset is not adjustable, but is fixed (offset) just below (lower in power) the setpoint, and changes by this fixed offset when the setpoint is adjusted. When the bistable is set at 1E-4 percent logarithmic power, the reset occurs at 8E-5 percent logarithmic power.

TS 3.3.1, "Reactor Protective System (RPS) Instrumentation-Operating," and TS 3.3.2, "Reactor Protection System (RPS) Instrumentation-Shutdown," require four RPS Logarithmic Power Level-High trip and operating bypass removal channels to be operable in Modes 2, 3, 4, and 5 when any reactor trip circuit breaker (RTCB) is closed and any control element assembly is capable of being withdrawn.

SR 3.3.1.12 and SR 3.3.2.3 require performing a "CHANNEL FUNCTIONAL TEST" on "each operating bypass removal function" once within 120 days prior to each reactor startup. The TS defines:

- CHANNEL FUNCTIONAL TEST for bistable channels as "... the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY, including required alarm and trip functions."

- OPERABILITY as "... the capability of performing its specified safety function(s) ... ."

Because the specified safety function of the Logarithmic Power Level-High bypass removal channels are to automatically remove the trip bypasses at or before reaching 1E-4 percent logarithmic power (decreasing), the CHANNEL FUNCTIONAL TEST must include verification of the bistable reset point. (Note: The TS uses RTP. The UFSAR uses logarithmic power. See the Description of the Event section.)

Description of the Event:

On June 17, 1998 (the discovery date), an engineer (utility, non-licensed) reviewing instruments that were found to be out of tolerance realized the specific setpoints for the automatic removal of the high logarithmic power bypasses had not been verified to be within their setting tolerance. Consequently, SR 3.3.1.12 and SR 3.3.2.3 were not fully satisfied. This condition applies to all four channels of the automatic bypass removal function on both Units 2 and 3. This condition has existed since original startup (circa 1982).

As discussed in the Safety Significance section below, when the operating bypass removal for the DNBR/LPD/RCF setpoint is verified, it can be concluded that the setpoint for the automatic removal of the Logarithmic Power Level-High bypass is also verified. However, for verbatim compliance with the TS definition of a channel functional test, a direct measurement of the removal point (bistable reset) should be made.

During the investigation of this condition, an engineer (utility, non-licensed) reviewing the reportability of the above described condition concluded the Logarithmic Power Level-High and DNBR/LPD/RCF automatic bypass removal logic, as designed, cannot satisfy the TS as written.

- TS 3.3.1, Table 3.3.1-1, Note (d) states the DNBR, LPD, and RCS low flow bypasses "shall be automatically removed when THERMAL POWER is [greater than or equal to] 1E-4 [percent] RTP."

- TS 3.3.1, Table 3.3.1-1, Note (a) states the Logarithmic Power Level-High bypass "shall be automatically removed when THERMAL POWER is [less than or equal to] 1E-4 [percent] RTP."

The only setpoint which satisfies both specifications simultaneously is exactly 1E-4 percent RTP, a precision which cannot be achieved. Moreover, because the DNBR, LPD, and RCS low flow bypasses are removed at the bistable setpoint when power is increasing, and the logarithmic power bypass is removed at the bistable reset when power is decreasing, the logarithmic power automatic bypass removal will always occur at a lower power than the DNBR/LPD/RCF. Therefore, when the DNBR/LPD/RCF automatic bypass removal functions were verified to be less than 1E-4 percent logarithmic power, that indirectly verified the logarithmic power automatic bypass removal was also performed at less than 1E-4 percent logarithmic power also. See Figure 1.

Subsequently, the methodology for setting the bistable setpoint was reviewed. That review identified that the setpoint was a "nominal value" of 1E-4 percent logarithmic power (i.e., 1E-4 plus or minus an allowable tolerance). Because of this, 1 of 4 setpoints for Unit 2 and 3 of 4 setpoints for Unit 3, contrary to the TS, were set slightly above 1E-4 percent logarithmic power prior to the last unit startups.

On September 21, 1998, while preparing the proposed TS change request (PCN-498) discussed in the Corrective Actions section, engineers noticed that TS 1.1 defines THERMAL POWER as the "total reactor core heat transfer rate to the reactor coolant." This definition includes decay heat because that heat is generated internally to the fuel and transferred to the reactor coolant. Decay heat is not measured by the excore neutron measurement system which is used to measure logarithmic power. Because decay heat will never drop to 1E-4 percent RTP, TS 3.3.1 would require the DNBR/LPD/RCF trips to be enabled at all times.

Cause of the Event:

The bistable design and the TS wording have existed since original plant design and startup (circa 1982), as has the practice of using a "nominal setpoint." Because of the passage of time, SCE did not determine the cause.

Corrective Actions:

- At the time of discovery, both Units were in compliance with the TS. Both units were in Mode 1.

    a. The Logarithmic Power Level-High bypass automatic removal function is required by TS 3.3.1 only in Mode 2 when any RTCB is closed.

    b. The DNBR/LPD/RCF bypasses were verified to have been removed during startup. TS SR 3.3.1.1 verifies the bypass is removed every 12 hours, assuring continued compliance with TS 3.3.1.

- All Logarithmic Power Level-High bypass channels have been declared "Restricted Operable", requiring the reactor trip breakers to be opened prior to 5 percent logarithmic power during plant. This prevents entry into Mode 2 (where TS 3.3.1 applies) during reactor shutdown.

- SCE will submit to the NRC a proposed TS change which will correct this condition.

- An emergency TS change request was submitted to the NRC (PCN-500) on September 22, 1998, to address the use of "logarithmic power" instead of thermal power.

- SCE is reviewing other similar bistables that are used to satisfy more than one TS setpoint or condition for similar discrepancies. See the Additional Information section below.

Safety Significance:

The set points for the automatic removal for all four channels of the high logarithmic power bypass are indirectly verified within every 120 days during the safety channel calibration test. The set point for the automatic removal of the high logarithmic power bypass is actually the reset point for the automatic removal of the DNBR/LPD/RCF bypass. The reset point is determined by the set point (based on the dead band of the bistable), and is not adjustable. When the operating bypass removal setpoint for the DNBR/ LPD/RCS low

flow is verified, it can be concluded that the set point for the automatic removal of the high logarithmic power bypass is also verified, because the probability of failure of the reset but not the trip point is very low. Subsequent testing of the bistable has shown this has not occurred. Consequently, the safety significance of this condition is insignificant.

The discrepancy between the use of "thermal power" and "logarithmic power" is insignificant. It is apparent in Chapter 15 of the UFSAR that the intent was to set the Logarithmic Power Level-High trip using logarithmic power and not thermal power. The UFSAR discussion of Control Element Assembly (CEA) withdrawal from subcritical and low power is based on logarithmic power.

The safety significance of the Logarithmic Power Level-High trip being bypassed at less than 1E-4 percent logarithmic power is also insignificant. When the bistable set point is at 1E-4 percent logarithmic power, the reset occurs at approximately 8E-5 percent logarithmic power . Therefore, the power "window" for a power transient from below 1E-4 percent is very small. The probability of a transient while in that window is insignificant, because:

1. Prior to startup, the operator verifies the Logarithmic Power Level-High trips are not bypassed.

2. The only way to have the Logarithmic Power Level-High trip bypassed at less than 1E-4 percent logarithmic power would be for reactor power to be increased above 1E-4 percent, the operator manually bypass the trips, and then reduce power to less than 1E-4 percent, but not below 8E-5 percent logarithmic power.

3. A significant reactivity insertion would have to occur after the scenario in Item 2. The increase in consequences between such a transient and one from 1E-4 percent logarithmic power with the Logarithmic Power Level-High trip bypassed are insignificant.

Additional Information:

- In Generic Letter 96-01, the NRC noted that some utilities had not been fully complying with the requirements of their TS regarding the surveillance testing of electronic circuits. Licensees were requested to review plant records to ensure all TS required surveillances were being completed. LER 2-97-006 reported that, during this review, SCE recognized that operating bypass circuitry for some trip parameters of the Reactor Protective System were not completely tested by the existing surveillance procedures. The surveillance procedures were verifying the operating bypass removal function (automatic and manual) for logarithmic power, pressurizer pressure, loss of load, and reactor coolant low flow. Although the bistable operation was being tested for DNBR/LPD/RCF, the automatic bypass removal function was not tested at the Core Protection Calculator (CPC). This surveillance omission had existed since the applicable surveillance procedure was first drafted (circa 1982). Due to the passage of time, the specific cause of the omission is not known.

  The Generic Letter 96-01 review was limited in scope to the review of logic testing, and did not include the verification of setpoints. Consequently, SCE would not expect the condition being reported herein to have been discovered at that time.

- LER 2-97-015 reported inadequate surveillance testing of charging pump relays. SCE concluded that this occurrence was caused by inadequate surveillance procedures written circa 1982. This is similar to the event reported herein in that the procedures did not adequately perform the required surveillance tests.

- LER 2-96-009-01 reported that surveillance testing for the Emergency Diesel Generators did not meet the TS requirements verbatim. The cause of that condition was an inadequate test procedure developed in 1983. Due to the passage of time and the lack of documentation, SCE did not determine the cause of the inadequate test procedure.

- Prompted, in part, by the condition reported in LER 2-96-009-01, SCE initiated a detailed review of the TS SRs. During that review, SCE identified three cases (reported in LER 2-97-001-03), each containing examples where the TS SRs were not adequately implemented by the surveillance procedure. The three cases were examples which resulted from:

  a. Inadequate project management of TSIP. SCE implemented new standard Technical Specifications (TS) for Units 2 and 3 on August 5, 1996. The TSIP reviewers, knowing it was not the intention of TSIP to change any requirements, continued to accept the testing as it had been done previously.

  b. Errors made at plant startup time circa 1982, and,

  c. Contemporary errors (errors which occurred between 1985 and 1995).

The scope of the original TS Surveillance self assessment was to 1) review all surveillances and their Bases, 2) verify compliance for the test of record, and, 3) verify the procedure was adequate to provide a level of assurance for compliance for future surveillances.

SCE concluded the condition reported herein was the result of an unclear or inadequate TS surveillance. A CHANNEL FUNCTIONAL TEST should include checking the setpoint on the bypass removal function. This assertion is supported by a statement in the Bases section of the TS under the LCO but not specified in the SR or the surveillance basis. Neither of the reviews performed required the TS or Basis be reviewed in its entirety. Consequently, this error is considered to be outside the scope of both reviews.

Figure 1-Bistable Logic

HIGH LOGARITHMIC POWER TRIP ABOVE 1E-4 PERCENT Logarithmic power

1. TS allows high logarithmic power trip to be bypassed above 1E-4 percent Logarithmic power. The bypass is a manual operator action.
2. High logarithmic power trip bypass must be automatically removed at greater than or equal to 1E-4 percent Logarithmic power decreasing.
3. Because high logarithmic power trip is enabled by the bistable reset, that function actually occurs below the DNBR/LPD RCS low flow set point..

DNBR/LPD/RCF TRIP ABOVE 1E-4 PERCENT Logarithmic power

1. DNBR/LPD/RCF trip bypasses must be automatically removed at less than or equal to 1E-4 percent Logarithmic power increasing.
2. Both the set point and function are verified by surveillance procedure.

_____1E-4 percent Logarithmic power _____

HIGH LOGARITHMIC POWER TRIP BELOW 1E-4 PERCENT Logarithmic power

1. Because this bypass is removed by the bistable reset, the bypass is actually removed at 7.94E-5 percent Logarithmic power when the set point is 1E-4 percent.
2. By procedure, the high logarithmic power trip is verified to be enabled prior to startup.

DNBR/LPD/RCF TRIP BELOW 1E-4 PERCENT Logarithmic power

1. TS allows DNBR/LPD/RCF to be bypassed below 1E-4 percent Logarithmic power. The bypass is a manual operator action.