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)

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TITLE (4): Emergency Chilled Water Inoperable Due To Faulty Temperature Control Unit

EVENT DATE			LER NUMBER (6)			REPORT DATE			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									SONGS Unit 3	50-362
08	06	1998	1998	-- 020 --	00	10	26	1998	FACILITY NAME	DOCKET NUMBER

		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check One or More) (11)							
OPERATING MODE	1		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.)

After reviewing plant records, on 10/21/1998 (the discovery date), SCE's concluded that unusual performance of Train B Emergency Chilled Water (ECW) ME335 chiller, observed on 8/6/1998, was caused by a combination of a faulty temperature control unit and non-condensible gases. Because the temperature control unit caused the chiller to be inoperable, and the condition had exceeded the allowable Technical Specification (TS) outage time (7 days), this condition is being reported in accordance with 10CFR50.73(a)(2)(i).

The reason the faulty controller went uncorrected since 8/6/1998 was an inadequate Operability Assessment (OA). The cognizant engineer and his acting supervisor (utility, non-licensed) failed to implement program requirements when completing and approving the OA. On 8/28/1998, the temperature control unit was replaced, and the chiller performed satisfactorily. The chiller was vented, and declared operable, returning Units 2 and 3 to full compliance with TS 3.7.10.

SCE estimated this condition had small safety significance.

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Plant: San Onofre Nuclear Generating Station Units 2 & 3
Reactor Vendor: Combustion Engineering
Event Date: August 6, 1998
Event Time: 1117 PDT

	Unit 2	Unit 3
Mode:	1, Power operation	1, Power operation
Power:	99.9 percent	99.8 percent
Temperature:	549 degrees F	547 degrees F
Pressure:	2250 psia	2250 psia

Background

Chilled water (KM) for the HVAC systems of the support buildings is divided into two systems: Normal Chilled Water System and Emergency Chilled Water System (ECW). ECW is composed of two 100% capacity loops or trains (each loop shared by Units 2 and 3). The purpose of the ECW system is to remove heat from emergency equipment rooms via room cooling coils that are in service when the normal cooling system is not available. For each train, chilled water is pumped by the chilled water pump(s) through a freon cycle chiller unit to its chilled water loop(s) which contain various cooling loads. Chilled water from the loads in each of two loops returns to the suction of the chilled water pump(s). The emergency chiller units remove heat from chilled water and transfers the heat to the component cooling water system. See Figure 1.

The ECW chiller (CHU) starts automatically on Safety Injection Actuation Signal (SIAS), Toxic Gas Isolation Signal (TGIS), Control Room Isolation Signal (CRIS) or Fuel Handling Isolation Signal (FHIS) from either Unit 2 or 3. The auxiliary building emergency HVAC system is designed to permit continuous personnel comfort, access, equipment safety and operation as applicable. Table 1 summarizes the design basis temperatures.

The ECW chillers are equipped with a protective circuit. The circuit includes, among others, a refrigerant low temperature cutout, chilled water low temperature cutout, and motor overload trip. The chiller unit will shutdown if the refrigerant low temperature cutout or motor overloads occur and must be reset before restart. Chilled water low temperature starts a recycle timer which stops the chiller. If there is a demand for additional cooling, the ECW chiller will automatically restart after at least 15 minutes.

"Dynamic calibration" of the chilled water low temperature cutout switch refers to the process of calibrating the trip setpoint. The dynamic calibration is performed with the switch's leads lifted, and the switch jumpered out to preclude tripping the chiller at the low temperature set point. The chilled water temperature is then lowered by lowering the unit's thermostat until the chilled water low temperature cutout switch changes state. At that point, the chilled water temperature is recorded, verifying the switch's setpoint, as adjusted.

Technical Specifications

Technical Specification (TS) 3.7.10 requires two trains of ECW to be operable in Modes 1, 2, 3, and 4. An ECW train is considered OPERABLE when:

a. The associated pump and compression tank are OPERABLE; and

b. The associated piping, valves, heat exchanger, refrigeration unit, and instrumentation and controls required to perform the safety related function are OPERABLE. A refrigeration unit is considered OPERABLE when it is aligned to either Unit's operating or standby OPERABLE Component Cooling Water (CCW) critical loop, provided that the OPERABLE CCW critical loop can be placed in operation within 2 hours after a design basis event is detected in the Control Room.

With one train inoperable, TS 3.7.10 Action (A) requires the train be restored within 7 days. If Action (A) is not met, Action (B) requires the Units to be in Mode 3 within 6 hours, and Mode 5 within 36 hours.

With both trains of ECW inoperable, TS 3.0.3 requires the Units be in Mode 3 within 7 hours, Mode 4 within 13 hours, and Mode 5 within 37 hours.

TS 3.7.10 has two Surveillance Requirements (SR).

1. SR 3.7.10.1 requires each ECW manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, be verified to be in the correct position at least every 31 days.

2. SR 3.7.10.2 requires the proper actuation of each ECW System component on an actual or simulated actuation signal be verified at least every 24 months.

Description of the Event

On September 25, 1998, at 0512 PDT, the Train B ECW chiller (ME335) failed to start when a control room operator (utility, licensed) pressed the control room start push button. The local start light illuminated but the oil pump did not start. After approximately 10 minutes, the control room operator pressed the stop push button and secured the chilled water pump. No ME335 associated alarms came in at the control room.

Subsequent investigation determined ECW chiller ME335 failed to start because the contact for the chilled water low temperature cutout switch (2/3TSLJ891B) was open and a contact wire was incorrectly terminated on the normally open (versus normally closed) switch contact. The switch had been incorrectly wired following the dynamic calibration on September 3, 1998. The switch's wiring was promptly corrected (see LER 2-1998-021).

During post-maintenance testing following the correction of the chilled water low temperature cutout switch's wiring on September 25, 1998, ME335 was started satisfactorily, but did not achieve its expected chilled water outlet temperature of approximately 43 degrees F until the chiller was drawing full load current after adjusting the controller. The cause of this condition was subsequently determined to be non-condensible gases in the chiller unit. The gases were vented and the chiller returned to operable status.

An engineering assessment later concluded the non-condensible gases had reduced the chiller's efficiency by approximately 11 percent. Because this degradation was within the existing overall approximately 35 percent margin in the chiller's design, the non-condensible gases did not cause ME335 to be inoperable or incapable of meeting its design basis as described in the UFSAR.

On October 21, 1998 (the discovery date), SCE's ongoing engineering assessment concluded that unusual performance observed on August 6, 1998, was caused by a combination of a faulty temperature control unit (this may be from incorrect thermostat, electrical demand, or electrical capacity settings or equipment failure) and non-condensible gases. On August 6, the chilled water temperature was observed to be higher than expected (approximately 51 degrees F versus 43 degrees F). The engineering assessment also concluded the faulty controller caused chiller ME335 to be inoperable. (As noted above, the non-condensible gases did not cause the chiller's inoperable condition.)

The faulty temperature control unit had been replaced, calibrated and set on August 28, 1998, during maintenance planned after the August 6, 1998, observation. Following that replacement, the chiller performed acceptably, in spite of the reduced performance caused by the non-condensible gases. Because the chiller had been inoperable between August 6, 1998 (the date of the observed degraded performance) and August 28, 1998 (the date the controller was

replaced), a period exceeding the time allowed by Action (A) of TS 3.7.10, this condition is being reported in accordance with 10CFR50.73(a)(2)(i).

Cause of the Event

The reason the August 6, 1998 controller failure went uncorrected prior to expiration of the time allowed by Action (A) of TS 3.7.10 was an inadequate Operability Assessment (OA). The cognizant engineer and his acting supervisor (utility, non-licensed) failed to implement program requirements when completing and approving the OA. As a result, the assessment did not identify the safety function nor assess the chiller's ability to perform its safety function in the "as found" condition, and the inoperable condition went uncorrected. The assessment nevertheless correctly identified possible causes of the degraded condition as the thermostat setting, the chilled water temperature sensor, or temperature control module. A Maintenance Order (MO) was written to investigate. However, because the chiller was believed to be operable, corrective actions were scheduled for the next normal maintenance period, about three weeks away.

SCE examined the faulty temperature control unit, but was unable to determine if the unit was mis-set or had failed, or when the failure might have occurred. (When the controller was tested after removal, it appeared to be functioning properly.) The chiller was previously operated on July 31,1998, and its performance was satisfactory. Therefore, consistent with the guidance provided in NUREG-1022, Rev. 1, the controller is considered to be "failed when found" on August 6, 1998 (the event date).

Corrective Actions

1. On August 28, 1998, the temperature control unit was replaced, and the chiller performed satisfactorily. The chiller was declared operable, returning Units 2 and 3 to full compliance with TS 3.7.10.

2. Effective on or before October 28, 1998, a summary of the inadequacy of the OA is required reading to "re-qualify" personnel prior to completing or approving new OAs.

3. The importance of this event will be emphasized during stand downs required by the Vice President-Nuclear Generation during which the responsible division manager will review this event, the event described in LER 2-1998-021, and associated management policies, with site personnel. This action will be completed by November 30, 1998.

4. A review of a representative sample (approximately 30) of recently closed OAs was performed. The review concluded the sampled assessments of operability were, in fact, correct. However, in some cases, the documentation of the basis (analysis, test or partial test, operating experience or engineering judgment) for declaring the affected system operable could be enhanced.

   A working group will reexamine the adequacy of OAs and revise the OA process, as necessary. The working group will provide a scope and schedule to senior management by December 31, 1998.

5. Additional controls will be implemented for maintaining the correct ECW chiller controller settings by November 30, 1998.

Safety Significance

SCE estimated the incremental increase in core damage probability due to the faulty temperature control unit to be approximately 1.3E-6 for Unit 2 and 5.4E-6 for Unit 3 from the period August 6, 1998, through August 28, 1998, the date the control unit was replaced. The risk assessment includes the effects of all actual plant configurations during

the period of emergency chiller ME335 inoperability. This increase in risk is characterized as small based on Regulatory Guide 1.174.

As stated in the Background section, the emergency chillers are common to both Units 2 and 3. During the period when ME335 (Train B) was unknowingly inoperable (August 6 through August 28), SCE did perform work on various Train A components in each unit. Consequently, there were cases when Train A and Train B safety equipment was simultaneously inoperable. However, because the normal room coolers were always available, the significance of this occurrence is limited to the unlikely Loss-of-Offsite-Power accident scenarios. For example, room cooler 3ME417 (the emergency room cooler for Train A HPSI, LPSI, and Containment Spray pumps) was out of service from between August 20, and August 21, 1998.

Additional Information

- In the past three years, SCE has reported two events which involved a failure to declare plant equipment inoperable or restricted operable due to personnel error.

  1. LER 2-96-001 - A Radioactive Waste Assistant Control Operator reported to the Assistant Control Operator (ACO) that waste gas surge tank hydrogen (H2) monitor AE-0574 was reading 0 percent H2. The ACO failed to recognize the monitor might have been inoperable and did not inform Control Room supervision. Corrective actions for that event included pre-shift briefings for all operating crews and coaching the personnel involved on performance expectations. The individuals responsible for the inadequate OA reported herein were not involved in this event. Therefore, the corrective actions would not be expected to have prevented this occurrence.

  2. LER 2-96-012-01 (report dated June 29, 1998) reported that an evaluation of potential losses from condensate storage tank T-120 identified that the 280,000 gallon TS limit for T-120 and plant procedures were not adequate to ensure meeting the 200,000 gallon design bases requirement described in the UFSAR.

     SCE determined that, in retrospect, sufficient information was available in February 1996 to conclude this condition was reportable because reasonable assurance did not exist that 200,000 gallons would be available from T-120 after a Design Basis Earthquake. That condition was not promptly identified because the OA performed in 1996 had credited compensatory actions in declaring T-120 operable. In fact, T-120 was restricted operable (operable with compensatory measures).

     As a result, SCE formed an OA review team which first met on July 29, 1998, to assess the OA program and make recommendations for enhancing the program.

- After extensive review of the event reported herein, SCE has been unable to identify a specific event or practice that introduced non-condensible gases into the chiller. While routine activities did identify the presence of non-condensible gases before they became an operability issue, SCE will establish, by December 31, 1998, an ECW performance monitoring program designed to detect degraded chiller performance before system operability is challenged.

- As a result of the prescribed retest on ME335 and the discovery of its shortcoming in proving design capability following maintenance, SCE evaluated its practices relative to prescribed retests and their ability to provide assurance of design capability following maintenance. The review consisted of looking at several surveillances, tests, and periodic monitoring to ensure that adequate assurance of design function capability exists following preventative or corrective maintenance. This evaluation provided confidence in the adequacy of the program as a whole but did identify some improvements that are being incorporated. The problem identified in this LER is considered to be an isolated occurrence.

TABLE 1 - ECW Design Basis Data
Aux Building Emergency HVAC System

System	Type (a)	Temperature Summer (b)	Temperature Winter
Control Room Active Areas	AC	75* (d)	N/A
Technical Support Center (TSC)	AC	84 (d)	N/A
Central Alarm Station	AC	94(d)	N/A
Control room cabinet area	AC	75(d)	N/A
Computer room	AC	84	N/A
ESF switchgear, and vital power/distribution rooms, evacuation room	V	95 75	50 70
ESF Battery rooms	V	95(c)	N/A(c)
Emergency chiller rooms	V	95(d)	N/A
Charging pump rooms and boric acid makeup pump rooms	AC	104	N/A
Lockers, rest rooms, equipment storage, Turbine Lab, etc.	V	85 (max.)	N/A
Telecommunication room	(e)	95	N/A
Offices	V	104	N/A

* Essential areas only. Temperature in non-essential areas could be higher than indicated.

(a) AC - Air conditioning
V - Ventilating

(b) If the emergency chiller(s) are not running temperature may increase beyond the design conditions listed here during a design basis accident in the areas served by the Emergency Chilled Water System (ECWS). Operations may be required to realign CCW to the emergency chillers and/or start the CCW pumps in order to establish cooling within two hours.

(c) Yearly average maximum for batteries = 77F; Minimum electrolyte temperature limit = 60F

(d) During a HELB temperature may increase beyond the design conditions.

(e) No air is supplied to this room.

Figure 1 - Emergency Chilled Water System