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MORGAN,H.E. Southern California Edison Co.
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SUBJECT: LER 88-008-01:on 880330,CCW sys outside design basis due to control program deficiencies.

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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 1 1

Title (4)

COMPONENT COOLING WATER (CCW) SYSTEM OUTSIDE DESIGN BASIS DUE TO DESIGN CONTROL PROGRAM DEFICIENCIES

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	3 0	8 8	8 8	--- 0 0 8	--- 0 1	1 0	1 4	8 8	SONGS, UNIT 3	0 5 0 0 0 3 6 2
										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)									
5		___ 20.402(b)	___ 20.405(c)	___ 50.73(a)(2)(iv)	___ 73.71(b)						
POWER LEVEL (10)	0 0 0	___ 20.405(a)(1)(i)	___ 50.36(c)(1)	X 50.73(a)(2)(v)	___ 73.71(c)						
		___ 20.405(a)(1)(ii)	___ 50.36(c)(2)	___ 50.73(a)(2)(vii)	___ Other (Specify in Abstract below and in text)						
		___ 20.405(a)(1)(iii)	___ 50.73(a)(2)(i)	___ 50.73(a)(2)(viii)(A)							
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		___ 20.405(a)(1)(v)	___ 50.73(a)(2)(iii)	___ 50.73(a)(2)(x)							

LICENSEE CONTACT FOR THIS LER (12)

Name	TELEPHONE NUMBER
H. E. Morgan, Station Manager	AREA CODE 7 1 4 3 6 8 - 6 2 4 1

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

		Expected Submission Date (15)	Month	Day	Year
___ Yes (If yes, complete EXPECTED SUBMISSION DATE)	XX NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On 3/30/88, an evaluation of the Component Cooling Water (CCW) System design criteria with respect to allowable system leakage rates was completed. From this evaluation and CCW operating history, it was determined that the system may have operated outside its design basis for leakage prior to a 1984 design modification which provided seismically qualified makeup capability to the CCW surge tanks. Because this condition was recognized in 1983, this LER is delinquent.

A recent Safety System Functional Inspection (SSFI) of the CCW system was conducted by the NRC. On 8/3/88, an NRC inspection report on the SSFI findings was issued which included Notice of Violations involving 1) a failure to adequately perform a High Energy Line Break Analysis (HELBA) for the CCW system during plant licensing, 2) the failure to report the fact that the combination of CCW leakage and Non-Critical Loop isolation valve closure time could have prevented the CCW system from functioning during a HELBA, and 3) the failure to include analyses of adverse effects of earthquakes in the design of the CCW surge tank outlet block valve motor operator control circuits.

Corrective actions taken include: 1) modification to CCW surge tank outlet block valve feeder breakers, 2) monitoring of CCW leakage, 3) test procedure revisions, and 4) analyses of CCW design basis transients. Planned corrective actions include 1) evaluating design alternatives for Seismic Category I makeup capabilities to the CCW system as an enhancement to long term operation of Units 2 and 3, and 2) performing a detailed operability assessment of the CCW system.

The root causes of the conditions described in this LER are related to deficiencies with programs for establishing and controlling design basis documentation. Corrective actions being taken for the root cause concerns are addressed in a 10/3/88 submittal to the NRC regarding SCE's assessment of engineering and technical support for San Onofre.

1/1 IE22

Plant: San Onofre Nuclear Generating Station (SONGS)
Unit(s): 2 and 3
Reactor Vendor: Combustion Engineering
Event Date: March 30, 1988

A. PLANT CONDITIONS AT TIME OF THE EVENT:

Unit 2: Mode 5 (cold shutdown)
Unit 3: Mode 1 (100% reactor power)

B. BACKGROUND INFORMATION:

The Component Cooling Water (CCW) System (EIIS System Code CC) has two redundant trains (critical loops) that supply cooling water to redundant trains of safety equipment needed for plant shutdown and emergency cooldown subsequent to a design basis event. A non-critical loop (NCL), which is aligned to either one of the two critical loops during normal operation, supplies cooling water to equipment and components for normal plant operation and for normal plant shutdown. Each CCW train contains a surge tank (EIIS Component Code TK) which has low level and low-low level setpoints. At the low level setpoint, the associated surge tank makeup supply valve from the Nuclear Service Water (NSW) System (non-safety related and non-seismically qualified) (EIIS System Code KG) automatically opens. At the low-low level setpoint, the NCL isolation valves (EIIS Component Code ISV) and the surge tank block valve (EIIS Component Code SHV) automatically close. The NCL isolation valves also close automatically on a Containment Isolation Actuation Signal (CIAS) within the Technical Specification response time of 20.9 seconds. Inservice testing (IST) program allowable stroke time for the NCL isolation valves had been established at 19.7 seconds, accounting for the response time of the actuation circuitry.

With regard to CCW water inventory requirements, the CCW system must be provided with (or have available) a Seismic Category I makeup water source or be capable of operating for 7 days without makeup following a design basis event. As indicated in response to FSAR question 010.49, which, as part of the FSAR, was accepted by the NRC during the licensing process, the CCW design leakage was analyzed to be sufficiently small to allow operation for 122 days without makeup; therefore, no seismically qualified makeup capability was provided. Consequently, the only water inventory that could be credited post-event to offset CCW critical loop leakage was inventory from the CCW surge tank associated with that loop. To meet this design criteria, critical loop leakage must be less than or equal to .142 gpm. Due to system interfaces with multiple systems, there are no positive means for measuring integrated critical loop leak rates of this magnitude.

C. DESCRIPTION OF THE EVENT:

1. Event:

In 1983, it was realized that the CCW leakage criteria (.142 gpm) was overly restrictive such that 1) the system could not have been practically maintained to ensure the criteria was met, and 2) minor leakage exceeding the criteria could not have been practically detected. In 1984, a design modification was implemented and appropriate operating instructions were revised which provided the capability to supply makeup water to the CCW surge tank from existing seismically qualified mobile fire tankers (EIIS Component Code TK)(EIIS System Code KP) (primary function is for fire suppression water supply). The FSAR was subsequently updated to reflect this design modification. Although no quantitative data exists which confirms that leakage was excessive, the design modification was installed to ensure that leakage would not adversely impact system operation.

During a recent evaluation for the relocation of the seismic mobile tankers, a review of CCW design criteria related to the tankers was performed. The evaluation determined that the compensatory measure using the seismic fire tankers is adequate to meet the design criteria of a seismically qualified makeup source. On March 30, 1988, an evaluation of the CCW design criteria with respect to allowable system leakage rates was completed. From this evaluation and CCW operating history, it was determined that the system may have operated outside its design basis for leakage prior to the 1984 design modifications and operating instruction revisions.

The evaluation addressed the CCW system's response to four postulated accident scenarios, including Critical Crack, Loss of Coolant Accident (LOCA), High Energy Line Break Accident (HELBA), and Safe Shutdown Earthquake (SSE). This evaluation resulted in the identification of several interim corrective actions as being necessary to ensure long term operability of the CCW system under certain leakage conditions. These actions included prestaging of fire hoses to ensure the capability to establish makeup to the surge tanks within 1 hour; operator training on the results of the evaluation; delineation of actions that must be accomplished following an SSE with indication of a NCL failure to ensure that room cooling is adequate; direction to quantify system leakage; and revision of the IST program allowable stroke time for the NCL isolation valves from 19.7 seconds to 14.5 seconds. These actions were either immediately implemented or determined to not be a prerequisite for system operability.

Between May 2 and June 10, 1988, a Safety System Functional Inspection (SSFI) was conducted by the NRC. The SSFI assessed the operational readiness of the Units 2 and 3 CCW and Salt Water Cooling (SWC) systems under normal and analyzed accident conditions. The NRC's SSFI team members also reviewed SCE's conclusions and corrective actions resulting from the March 30, 1988, CCW design criteria evaluation.

On August 3, 1988, an NRC inspection report on the SSFI findings was issued which included a Notice of Violation (NOV), among others, for failure to report 1) that the HELBA analysis for the system had not been adequately performed during plant licensing, and 2) that the combination of CCW leakage and NCL isolation valve closure time could have prevented the CCW system from functioning during a HELBA. The inspection report also included a NOV for failure to perform an analyses of the adverse effects of earthquakes on the design of the valve motor operator control circuits for the CCW surge tank outlet block valve. SCE's response to the inspection report included a commitment to report in an LER various aspects addressed by the NOV.

Concurrent with the SSFI inspection, a preliminary HELBA analysis was performed which has demonstrated that the CCW system will be capable of performing its safety function in mitigating a HELBA event (See Section F).

As previously discussed, it was initially determined that the IST criteria for NCL isolation valve closure time needed to be reduced from 19.7 seconds to 14.5 seconds. This action was deemed necessary in order to ensure adequate CCW system inventory following various accident scenarios. A review of IST records for these valves revealed that closure times for the last five years have remained well below the 14.5 seconds, and the valves were therefore, operable. Based on this, SCE made a judgment that this condition was not reportable. However, because Technical Specifications and IST procedures would have permitted longer stroke times, a condition existed which could have resulted in a loss of safety function, and therefore, this condition is now being identified. However, during the SSFI inspection, preliminary analyses of the CCW system response to design basis event operating scenarios was performed, utilizing a leakage rate of 3 gpm and a NCL isolation valve stroke time of 20.9 seconds. These analyses demonstrated that sufficient CCW inventory would be maintained following the postulated accidents to permit operators sufficient time for providing makeup water to the surge tanks.

The CCW surge tank motor operated outlet block valves are not supplied by a Class 1E power supply. Therefore, there was an extremely remote possibility that the valves would close spuriously during an SSE, creating a common mode failure that could prevent the fulfillment of the system function. On June 17, 1988, the overload devices were pulled from the CCW surge tank motor operated isolation valve feeder breakers. This action precludes the possibility of a common mode failure of the breaker relays, which could cause inadvertent closure of the surge tank isolation valves during an earthquake.

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

   None.

3. Sequence of Events:

   Not applicable.

4. Method of Discovery:

During a recent evaluation conducted for the relocation of the seismic mobile tankers, a review of CCW design criteria related to the tankers was performed. During this review, it became apparent that Units 2 and 3 may have operated outside the design basis of the CCW system prior to implementation of the design changes for seismic makeup water capability in 1984. Additionally, in the course of this review, it became apparent that the impact of HELBA on the CCW System had not been adequately considered by the original HELBA analysis. As a result of this review, NCL isolation valve closure time criteria was reduced from 20.9 seconds required by Technical Specifications to less than 15 seconds to ensure that adequate system inventory was maintained in all accident scenarios. The cause and corrective actions for the delinquency in reporting these deficiencies are discussed in SCE's NOV response dated September 2, 1988.

The failure to adequately consider the impact of a SSE on the CCW System was identified by both SCE and the NRC during the SSFI inspection.

5. Personnel Actions and Analysis of Actions:

Not applicable.

6. Safety System Responses:

Not applicable.

D. CAUSE OF THE EVENT:

1. Immediate Causes:

a. CCW Leakage:

The direct cause of the impact of leakage on the CCW system not being adequately assessed was that the CCW system design basis leakage was not clearly established and provisions for leakage monitoring were not included in the design.

The CCW system leakage value was not established because it was not recognized that leakage was required to be defined as a system design basis. The standard review plan, architect's System Design Guides, the FSAR and the design manual did not identify CCW leakage as a design basis requirement.

b. HELBA Analysis and NCL Isolation Valve Stroke Time:

The original HELBA analysis, which was performed by the architect engineer (Bechtel Power Corp.), did address NCL isolation valve closure times and identified that various high energy breaks would adversely impact the NCL. However, this analysis incorrectly dispositioned this impact as having no safety significance since the NCL is non-safety related. Consequently, the impact of a High Energy Line Break (HELB) on the NCL and its effect on CCW operability was not documented as part of the HELBA analysis.

The system design basis was not documented to a sufficient level of detail which would have identified these transients. This was consistent with the industry approach and in accordance with the licensing requirements for the time frame when the design was developed.

c. SSE Analysis:

The design of the CCW surge tanks outlet valves' motor operator control circuits did not 1) include analyses of adverse effects of postulated earthquakes and 2) reflect the combination of the effects of the CCW surge tanks outlet valves for both trains spuriously closing in conjunction with a safe shutdown earthquake. This is contrary to 10CFR50, Appendix A, Criterion 2 and 44.

The automatic closure of the CCW surge tanks motor operated valves (MOV) on low-low surge tank level is not required as a safety function. The function of the automatic closure of the MOV's is to prevent potential nitrogen ingress into the CCW system in the event of a significant water inventory loss. Because this function was not considered a safety function, the associated power and control circuits were not designed to Class 1E requirements. Additionally, the remote possibility of a common mode failure (earthquake) of control relays in the Motor Control Center (MCC) resulting in valve closure was not identified when the system was designed. Consequently, no evaluation of the occurrence was performed and the relays were not required to be seismically qualified.

3. Root Causes:

The root causes of the conditions described in this LER are related to deficiencies with establishing and controlling design basis documentation. These root causes can be summarized as follows;

a. The design bases for CCW System was not defined in sufficient detail to identify the logic that the associated analyses was based upon.

b. The programmatic requirements for identification and control of the design basis is not clear. Such requirements are contained in numerous procedures making implementation difficult.

c. The organizational responsibility for system design basis, licensability, functionability and operability is divided among multiple organizations causing difficulty in controlling the design process.

In response to general NRC concerns in this area as a result of the SSFI, SCE conducted a thorough review of it's programs for controlling design, engineering and technical related matters as they pertain to San Onofre. The principle conclusions and recommendations of this study are identified in SCE's October 3, 1988 letter to the NRC regarding this matter. This study concluded that the problems reported herein resulted from (1) the complexity of the current organization, (2) heavy reliance on engineering contractors combined with inadequate allocation of SCE engineering resources, and (3) the lack of readily accessible comprehensive design basis documentation.

E. CORRECTIVE ACTIONS:

1. Corrective Actions Taken:

a. The capability to provide makeup water to the CCW system following design basis events was implemented in 1984 through design modifications and operating instruction revisions.

b. Through procedure revisions, IST acceptance criteria for NCL isolation valve closure time has been reduced from 19.7 seconds to 14.5 seconds. This will provide additional assurance that sufficient CCW system inventory is maintained during all accident scenarios.

c. The power supplies have been disconnected from CCW surge tank motor operated valves (MOV) by removing the thermal overload devices from the MOV breakers. This action precludes the possibility of a common mode failure of the breaker relays, which could cause inadvertent closure of the surge tank isolation valves in an earthquake.

d. Preliminary analyses of the CCW system response to design basis event operating scenarios have been performed. These analyses have demonstrated that with a critical loop leakage rate of 3 gpm or less, the CCW system will continue to perform its intended safety function following all accident scenarios. Furthermore, it is anticipated that additional analyses, which are currently being performed, will establish that a leakage rate significantly greater than the conservatively assumed 3 gpm value is acceptable.

e. With respect to monitoring of CCW leakage, a formal leakage monitoring program is currently being developed. In the interim, operators are monitoring CCW surge tank levels each time system realignments are made. If surge tank levels change at a rate greater than a prescribed rate, then immediate action will be taken to locate and correct the source of the leakage.

2. Planned Corrective Actions:

   a. Operator action to implement CCW makeup has been demonstrated to be acceptable. Nonetheless, we are evaluating design alternatives for Seismic Category I makeup capabilities to the CCW system as an enhancement to long term operation of Units 2 and 3.

   b. The CCW system will be reviewed and analyzed in detail and appropriate action, if any, will be taken to comply with the requirements of 10CFR50, Appendix A, Criterion 2 and 44. This evaluation will occur concurrently with the completion of the second phase of SCE's CCW operability assessment discussed in our June 24, 1988 letter. This activity is expected to be completed by November 30, 1988.

   c. As described in the above root cause discussion, the principle conclusions and recommendations are identified in SCE's October 3, 1988 submittal to the NRC. Corrective actions to address these conclusions include (1) a re-organization with responsibility for design functions and the design basis focused in one department, (2) augmentation of in-house engineering resources and performance of the majority of conceptual engineering in-house, and (3) the establishment of a design basis documentation program to recapture and maintain the design basis.

F. SAFETY SIGNIFICANCE OF THE EVENT:

Significance of Not Having Any Makeup Capability (Pre-1984):

For postulated SSE, LOCA and HELBA scenarios, it is assumed that the critical loop which is not supplying the non-critical loop fails and the remaining operating critical loop loses inventory due to a major break in the non-critical loop. The operating critical loop automatically isolates from the non-critical loop and the surge tank. If the leak rate of the critical loop were less than or equal to .142 gpm, there was no safety significance since there was adequate inventory for operators to reopen the surge tank isolation valve and operate the critical loop for 7 days without makeup water. However, if a leak rate greater than .142 gpm existed during the time in which no formal provisions were in place for providing makeup (prior to 1984), there would have been a loss of CCW safety function, and depending on the magnitude of the leakage, the ability to mitigate the consequences of postulated accidents could potentially have been impaired.

For postulated Critical Crack scenarios, one train of CCW is unaffected and minor system leakage is not a factor.

Significance of Other Findings - (Post-1984):

For a postulated Safe Shutdown Earthquake (SSE), the largest limiting non-seismically qualified line/component serviced by the NCL is postulated to fail. Since CCW is a moderate energy system with its components located in a seismic category I building, a critical crack is postulated to occur in these lines, rather than a guillotine break. The critical loop initially not aligned to the NCL is assumed to be unavailable due to a single active failure. Water is lost from the critical loop aligned to the NCL until the surge tank reaches its low-low level set point, at which time the surge tank isolation valves and the NCL isolation valves close. At this time, the critical loop would be in a solid configuration. In this condition, with a critical loop leak rate of 3 gpm, the required CCW pump NPSH is maintained until operator action is taken within 30 minutes to reopen the surge tank isolation valves and restore inventory to the critical loop. From this point, the system will remain functional until the seismic fire tankers are utilized for makeup to the surge tank (after a minimum of 4 hours from event initiation).

Since the surge tank isolation valve motor operator control circuits are not seismically qualified, there was an extremely remote possibility that these valves could spuriously close during an SSE. Should this occur prior to the surge tank level reaching the low-low level set point, the NCL isolation valves would remain open and excessive inventory would be lost, thereby resulting in an eventual loss of CCW cooling.

In the HELB accident scenario, a postulated rupture of a 42 inch steam line inside containment causes the NCL inside containment to fail. Containment pressure reaches the containment pressure high setpoint within 1 second of event initiation, and the NCL isolation valves close on a CIAS within the Technical Specification response time of 20.9 seconds, isolating the leak. As before, the most limiting conditions are assumed (i.e., loss of one critical loop due to single failure, and surge tank level at the low level set point with a minimum nitrogen pressure of 27.4 psig). Neither normal nuclear service water makeup nor nitrogen to the surge tank are assumed to be available since these systems are non-safety related. Calculations have demonstrated that the surge tank will not reach a low-low level throughout the transient, precluding solid system operation. Assuming a leakage rate of 3 gpm, adequate inventory above the low-low level would exist allowing operators sufficient time to provide makeup water to the surge tank via the fire tankers. Throughout the event, adequate net positive suction head (NPSH) is maintained to the CCW pumps, and the heat removal of critical components is not impaired.

G. ADDITIONAL INFORMATION:

1. Component Failure Information:

Not applicable.

2. Previous LERs on Similar Events:

Recent LERs reporting similar design and design control related conditions:

Unit 1 (Docket No. 50-206)

LER 1-88-006 reported a condition where the Unit 1 Backup Nitrogen Systems (as designed, installed and operated) did not satisfy the licensing and design basis for the systems.

LER 1-88-001 reported that several components requiring environmental qualification were not included in the administrative controls for the environmentally qualified equipment. Additionally, other components were found to be in an unqualified configuration.

LER 1-87-015 reported that certain systems were susceptible to single failure.

LER 1-88-009 reported a condition in which the emergency diesel generators could have exceeded an intended electrical load limit.

Unit 2 (Docket No. 50-361)

LER 2-88-010 reported a condition in which both emergency chillers were rendered inoperable as a result of not addressing freon level as a critical design parameter.

LER 2-88-017 reported that a spent fuel pool siphon event occurred as a result of the failure to identify and implement the design intent to utilize administrative controls on certain locked valves.

3. Results of NPRDS Search:

Not applicable.

4. Administrative Failure Information:

Personnel involved with the identification of excessive leakage beyond the CCW leakage criteria in 1983 failed to initiate a Nonconformance Report (NCR) contrary to administrative procedures. The NCR process provides the mechanism for ensuring that a reportability evaluation is performed for such conditions. Consequently, NRC notification pursuant to 10 CFR 50.72(b)(1)(ii) and reporting pursuant to 10 CFR 50.73(a)(2)(ii) was not accomplished. Between 1983 and the present, the NCR process has been strengthened to ensure that conditions such as described in the LER are properly addressed. Through experience, continuing use of the NCR process, and, to some degree, formal training, personnel in various organizations involved with design review as well as with design modification implementation better recognize the need to initiate NCRs when discrepancies with existing design criteria are identified. Additionally, administrative procedures which involve the NCR process have been refined through normal review and revisions. It is believed that this maturation process has resulted in an effective NCR/reportability system and no further corrective actions are warranted at this time.

The cause and corrective actions associated with the failure to report the conditions cited in the SSFI inspection report are discussed in SCE's response to the NOV, dated September 3, 1988.

Southern California Edison Company

SAN ONOFRE NUCLEAR GENERATING STATION

P. O. BOX 128

SAN CLEMENTE, CALIFORNIA 92672

H. E. MORGAN
STATION MANAGER

TELEPHONE
(714) 368-6241

October 14, 1988

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

Subject: Docket No. 50-361
Supplemental Report
Licensee Event Report No. 88-008, Revision 1
San Onofre Nuclear Generating Station, Units 2 and 3

References: 1) Letter, H. E. Morgan (SCE) to USNRC Document Control Desk, dated April 29, 1988.

2) Letter, K. P. Baskin (SCE) to USNRC Director, Office of Enforcement, dated September 2, 1988.

Reference 1 provided the required 30-day written Licensee Event Report (LER) for a condition involving the Component Cooling Water (CCW) Systems in Units 2 and 3. Between May 2 and June 10, 1988, a Safety System Functional Inspection (SSFI) of the Units 2 and 3 CCW System was conducted by the NRC. On August 3, 1988, an NRC inspection report on the SSFI findings was issued which included a Notice of Violation (NOV), among others, for failure to report various deficiencies involving the CCW System. Reference 2 provided SCE's response to the inspection report which included a commitment to report in an LER various aspects addressed by the NOV. Enclosed is a supplemental LER which addresses these aspects, including the associated causes and corrective actions.

If you require any additional information, please so advise.

Sincerely,

HEMorg

Enclosure: LER No. 88-008, Revision 1

cc: F. R. Huey (USNRC Senior Resident Inspector, Units 1, 2 and 3)
J. B. Martin (Regional Administrator, USNRC Region V)
Institute of Nuclear Power Operations (INPO)

IE22
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