LICENSEE EVENT REPORT (LER)

Facility Name (1)	Docket Number (2)	Page (3)
SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1	0 5 0 0 0 2 0 6	1 of 1 1

Title (4)

DESIGN BASIS OF THE OVERPRESSURE MITIGATION SYSTEM NOT MET

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 5	2 5	9 0	8 9	0 2 2	0 2	0 7	0 3	9 0	NONE	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 0 9 2

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)

___ 20.402(b)	___ 20.405(c)	___ 50.73(a)(2)(iv)	___ 73.71(b)
___ 20.405(a)(1)(i)	___ 50.36(c)(1)	___ 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)	
___ 20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	___ 50.73(a)(2)(viii)(B)	
___ 20.405(a)(1)(v)	___ 50.73(a)(2)(iii)	___ 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

Name	TELEPHONE NUMBER (AREA CODE)
H. E. Morgan, Vice President and Site Manager	7 1 4 3 6 8 - 9 4 7 0

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)

___ Yes (If yes, complete EXPECTED SUBMISSION DATE) X NO

Expected Submission Date (15): Month ___ Day ___ Year ___

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

On 9/14/89, at 0845, with Unit 1 at 91% power, an engineering review of the Reactor Coolant System (RCS) Overpressure Mitigation System (OMS) determined that Technical Specification (TS) 3.20, "Overpressure Protection Systems" and its administrative controls, which permit operation with OMS out of service with a pressurizer level < 50% and RCS pressures < 400 psig, are non-conservative. Consequently, the potential to exceed 10CFR50, App. G RCS pressure limits at low temperature has existed and Unit 1 has been operated with OMS out of service when OMS protection was, in fact, required. Revision 0 of this LER indicated that an in-depth engineering review of the OMS was continuing. On 5/25/90, this review determined that the OMS does not meet its design basis requirements for the following reasons: 1) The system is susceptible to potential single failure scenarios which could disable one or both Power Operated Relief Valves (PORVs) resulting in the inability of the OMS to provide a relief path if required, and 2) One PORV has insufficient discharge flow capacity to protect against all possible low temperature overpressure transients.

The cause of this event is attributed to past weaknesses in SCE's engineering and technical support to San Onofre, which is described in detail in our 10/3/88 submittal to the NRC addressing this subject. The corrective actions identified in that submittal are also applicable to the causes of this condition.

Administrative controls applicable to plant shutdown and startup, and any time the OMS is required to be enabled, have been implemented which will ensure that the RCS pressure does not exceed the 10 CFR 50 Appendix G pressure limits with the OMS setpoint currently in effect. A TS change will be proposed to address the above issues.

Plant: San Onofre Nuclear Generating Station
Unit: One
Reactor Vendor: Westinghouse
Event Date: 05-25-90
Time: 1926

A. CONDITIONS AT TIME OF THE EVENT:

Mode: 1, Power Operations

B. BACKGROUND INFORMATION:

Overpressure Mitigation System

The Overpressure Mitigation System (OMS) [AB] is a portion of the Reactor Coolant System (RCS) [AB] which is provided to protect the reactor coolant pressure boundary from over pressurization transients while the RCS is at low temperature. The low temperature threshold (or enabling temperature) is currently 360°F, below which protection from low temperature overpressure transients is necessary.

Such over-pressurization transients could result from rapid temperature increases, uncontrolled makeup to the RCS, loss of letdown from the RCS, or starting a Reactor Coolant Pump (RCP) [P] with a hot steam generator.

The OMS consists of two redundant and independent trains each having: 1) a RCS pressure sensor [PE], 2) actuation logic [JG], and 3) a RCS pressurizer power operated relief valve (PORV) [RV]. Pressure transmitters PT-425-X1 and PT-425-X2 input to the OMS and are normally calibrated to a 0 - 3000 psig range during power operation. The electronics and control circuits associated with each PORV are powered from separate 120 VAC vital busses, #1 and #2.

The PORVs (CV-545 and 546) are two inch spring-loaded-closed, air operated globe valves. The valves are normally supplied by plant instrument air and a redundant back up nitrogen system (BNS) [LK] is provided to ensure that the valves are operable upon loss of plant instrument air. The BNS is automatically established in the event Instrument Air pressure drops below 60 psig. Nitrogen for the BNS is supplied by dedicated nitrogen cylinders located outside of containment.

Residual Heat Removal System

The Residual Heat Removal (RHR) System is designed to remove decay and sensible heat from the RCS during plant cooldown from 350°F, and to maintain the RCS <140°F during cold shutdown or refueling operations. The RHR system also provides long term core cooling for reaching and maintaining cold shutdown conditions following certain non-accident events. The RHR system requires overpressure protection (per the ASME Boiler and Pressure Vessel Code) when it is connected to the RCS. This protection is provided by an angle-globe relief valve, RV-206 [RV], which discharges to the pressurizer relief tank [TK]. RV-206 is not currently credited in either the UFSAR or the Technical Specifications as part of the OMS.

Present Technical Specification Requirements

Technical Specification (TS) 3.20, "Overpressure Protection System", Specification A, requires that the OMS (or an equivalent RCS vent) be placed in service when the RCS pressure is less than or equal to 400 psig and the pressurizer water level is greater than 50%. As described in the Basis of TS 3.20, these limitations provide a "cushion" of 10 minutes for operator action to terminate the over-pressurization transient prior to exceeding the 10 CFR 50, Appendix G, RCS pressure limits while below the low temperature threshold and OMS is not in service.

TS 3.2, "Chemical and Volume Control System", [CB] Specification A(1), requires that when the RCS pressure is < 400 psig and pressurizer water level is greater than 50%, a maximum of one of the two centrifugal charging pumps [CB,P] shall be operable. Thus, when RCS pressure is < 400 psig and pressurizer water level is less than 50%, two centrifugal charging pumps are allowed to be operable.

C. DESCRIPTION OF THE EVENT:

1. Event:

On September 14, 1989, at 0845, with Unit 1 at 91% power, it was determined that TS 3.20 and SCE's implementing administrative controls for that TS, which permit operation with OMS out of service with a pressurizer level < 50%, are non-conservative. Specifically, at low RCS pressures, the charging pump flow rate could exceed that assumed by the event analyses, such that less than 10 minutes is available for operator action prior to exceeding 10 CFR 50, Appendix G, pressure limits at low temperature. As a result of greater than assumed charging flow rate, OMS protection is therefore required when RCS temperatures are less than 360°F, even while the pressurizer level is ≤ 50%. Unit 1 has previously operated in Modes

4 and 5 with OMS out of service during conditions which are now known to require OMS protection. Since this condition alone could have prevented the OMS from fulfilling its function of ensuring that 10 CFR 50, Appendix G limits are not exceeded, a non-emergency 4-hour telephone notification was made to the NRC Operations Center.

Additionally, on September 18, 1989, during the ongoing review of OMS issues, it was determined that TS 3.2 was similarly non-conservative since it only restricts one charging pump operation when pressurizer level is above 50%, again based on a mass input transient equivalent to one operating charging pump. However, to ensure that Appendix G pressure limits are not exceeded during the postulated transient, it is necessary to restrict the number of charging pumps operating to one when RCS pressure is <400 psig, irrespective of pressurizer level.

In revision 0 of this LER, SCE indicated that an in-depth engineering review of the OMS was continuing. On May 25, 1990, this review determined that the OMS does not meet its design basis requirements (including consideration of instrument uncertainties) for the following additional reasons: 1) The system is susceptible to potential single failure scenarios which could disable one or both PORVs resulting in the inability of the OMS to provide a relief path if required; and 2) One PORV has insufficient discharge flow capacity to protect against all possible low temperature overpressure transients. Specifically:

a. Single Failure Evaluation

A review of event specific single failure effects associated with OMS identified the following two bounding single failure scenarios which could disable both PORVs:

1) The first scenario consists of an initiating event which results in loss of instrument air, concurrent with a single failure of the common PORV backup nitrogen supply.

2) The second scenario consists of an initiating event which disables Vital Bus No. 1 concurrent with a single failure of Vital Bus No. 2.

Other single failure scenarios exist where one PORV is available.

b. PORV Flow Assumptions

The PORV flow capacity was evaluated and we have concluded that the most limiting mass addition transient, taking into account the most severe single failure scenarios, would exceed the flow capacity of one PORV in the upper temperature ranges for which OMS protection is required.

c. Instrumentation

The uncertainty associated with the pressurizer pressure transmitters (PT-425-X1 and X2), which are an integral part of the OMS, were evaluated. These instruments, normally calibrated to a 3000 psig range during power operation, must be calibrated to a range of no more than 0 - 1000 psig for OMS service.

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

Not applicable.

3. Sequence of Events:

Not applicable.

4. Method of Discovery:

The conditions reported in Revision 0 to this LER were initially discovered as a result of a review of the OMS by SCE's newly re-structured and strengthened design organization. A subsequent analysis performed by Westinghouse confirmed that the 50% pressurizer level "cushion" provides significantly less than 10 minutes (about 3.5 minutes) for operator action. The additional conditions reported in this LER supplement were discovered during the continuing in-depth engineering review which was identified as a planned corrective action in the original LER.

5. Personnel Actions and Analysis of Actions:

Not applicable.

6. Safety System Responses:

Not applicable.

D. CAUSE OF THE EVENT:

1. Immediate Cause:

The 50% pressurizer water level was based on a plant specific "cushion" analysis performed in 1978. The analysis was based on limiting mass input and energy input transients. The limiting mass input transient was considered to be the isolation of RCS letdown with a maximum charging flow of 110 gpm. This is the normal charging flow at 2100 psia. The analysis showed that ten minutes for operator action was adequate to terminate the transient when OMS is not in service without exceeding 10 CFR 50, Appendix G pressure limits. This analysis failed to consider that charging flow could be greater than 110 gpm, thus necessitating OMS protection.

A single failure analysis was prepared for the OMS design in 1976 and was reviewed as part of the 1987 ESF single failure review. However, a control/protection interaction analysis, as specified in IEEE 270-1971, section 4.7.3, was not performed as part of either evaluation, since the OMS instrumentation has no other control functions and neither evaluation recognized the potential common-mode effects of event specific single failures in OMS support systems (i.e., air and electrical power). As a result, it was not recognized that an initiating event which challenged the protection feature of the OMS concurrent with a single random failure would disable the remaining OMS control features.

2. Root Cause:

The conditions being reported in this LER resulted from past weaknesses in the technical and engineering support of San Onofre Unit 1. These weaknesses included inadequate understanding of the basis for the OMS, and inadequate review and verification of design calculation assumptions or results. The reasons for these weaknesses are similar to those which were previously addressed in SCE's October 3, 1988 submittal to the NRC regarding SCE's assessment of engineering and technical support for San Onofre.

3. Contributing Cause:

In 1984, the OMS setpoint was revised based on a plant incident which indicated that charging flow rate could be as high as 320 gpm with the RCS de-pressurized. However, the 50% "cushion" analysis was not revised to account for the higher charging flow (mass input) observed during the event. Neither was the basis for TS 3.20 revised to address the reduced time available for operator action to terminate the event.

E. CORRECTIVE ACTIONS:

1. Corrective Actions Taken:

a. Administrative controls applicable to plant shutdown and startup have been implemented to ensure: 1) the OMS is operable per TS 3.20 whenever either the RCS temperature is less than 360°F, or the RHR system is aligned to the RCS 1/, regardless of the pressurizer level, 2) RV-206 will be operable and aligned to the RCS through the RHR whenever OMS is enabled, and 3) a maximum of one charging pump is operable whenever RCS temperature is below 360°F, (the OMS enable temperature). This modified an existing administrative control to refer to OMS enable temperature rather than RCS pressure.

b. The following administrative controls will be in effect from the time OMS is required to be enabled until the RCS is depressurized and an adequate vent established.

1). To provide additional overpressure protection capability for those events where one or both PORVs become inoperable and to accommodate the reduced PORV flow rate, RHR relief valve (RV-206) shall be operable and connected to the RCS via the RHR suction or discharge path.

2). To limit the mass addition transient to a flow rate less than the capacity of the combination of one PORV and RV-206, the long term recirculation flow control valves will be maintained in their normally closed position if in their manual mode of operation.

3). To minimize instrument uncertainties and ensure an accurate PORV actuation setting, PT-425 X1 and X2 will be recalibrated to a range of no more than 0 - 1000 psig from their initial range of 0 - 3000 psig prior to enabling OMS.

1/ Although OMS protection for the RHR System is not required by the Technical Specifications, SCE has committed to providing this protection. The in-depth revision of the OMS-related Technical Specifications, which is currently in progress, will also include OMS protection whenever RHR System is in operation.

4). To reduce the energy available for the most limiting energy addition transient to an amount which can be accommodated by the combination of one PORV and RV-206, operation of reactor coolant pumps (RCPs) will be administratively controlled.

5) To preclude the possibility of a common-mode loss of both PORV channels due to a single electrical failure, Vital Busses 1 and 2 will be aligned to their respective inverters with their auto-transfer switches operable and backup power to vital busses 1 and 2 will be available.

6) To prevent a common-mode loss of the instrument air and backup nitrogen motive sources for the PORVs due to a single active failure of Train B electrical power, at least one air compressor powered from Train A will be capable of automatically providing instrument air to the PORVs. This prevents an OMS transient, due to the common-mode loss of air/backup nitrogen plus an additional concurrent single active failure (such as the long term recirculation flow control valves), which could exceed the capacity of RV-206.

These administrative controls ensure that the RCS pressure does not exceed the 10 CFR 50 Appendix G pressure limits with the OMS setpoint currently in effect and that the RHR pressure will not exceed 110% of design. If these controls are not satisfied at the time OMS is required to be operable, the OMS will be declared inoperable and the existing 8 hour TS action statement will be entered.

c. A review of TSs has been performed and no other TS was identified which contains a reference to the non-conservative pressurizer level of 50% in relation to the OMS.

2. Planned Corrective Actions:

a. The corrective actions previously identified in SCE's October 3, 1988 submittal to the NRC concerning inadequate engineering and technical work are also applicable to the causes of this condition.

b. An in-depth engineering review of the OMS is continuing. To verify the conservatively calculated flow capacity of RV-206, a spare relief valve was tested. This test demonstrated that RV-206 has sufficient capacity to accommodate a mass addition for those scenarios where both PORVs are unavailable. Upon completion of the analysis, RV-206 will be incorporated into the design basis documentation for OMS. In addition, the administrative controls discussed in this LER will be reassessed and changes will be made as necessary.

c. TS 3.20, "Overpressure Protection Systems" Specification A, will be revised to eliminate the non-conservative 50% pressurizer level criteria for applicability. In preparation for this submittal, an evaluation of the OMS enabling temperature is continuing. Overpressure protection will be required whenever either the RHR system is in service or when the RCS temperature is below the OMS enabling temperature (currently 360°F). Additionally, the OMS design basis will be revised.

d. TS 3.1.3, "Combined Heatup, Cooldown and Pressure Limitations", will be revised to modify the associated heatup and cooldown curves.

e. TS 3.2, "Chemical and Volume Control System", will be revised to delete the 50% pressurizer level requirement. Therefore, a maximum of only one charging pump will be allowed to be operable when RCS temperature is less than the OMS enabling temperature, regardless of pressurizer level.

F. SAFETY SIGNIFICANCE OF THE EVENT:

Since TS 3.20 was approved by the NRC on May 23, 1988, no transients have occurred which required actuation of the OMS.

In 1989, there were three instances in which the OMS was not operable and providing low pressure protection when required. In all three instances, the OMS was not placed in service for RCS conditions which are now known to require overpressure protection. For each instance, analyses were performed to determine the effect of the occurrence of a worst case pressurization transient on the structural integrity of the reactor pressure vessel beltline region. These analyses were performed in accordance with American Society of Mechanical Engineers (ASME) Section XI, Appendix E, "Evaluation of Unanticipated Operating Events." These evaluations confirmed that, in all instances, the acceptance criteria provided in sub-article E-1200 to Appendix E would be satisfied and that the structural integrity of the reactor pressure vessel beltline region

(which is the limiting case, since it is exposed to the highest neutron flux) would be assured throughout the event.

A review of plant startup operating instructions revealed that the instructions would permit the plant to be operated in a condition in which it is possible that the criteria of ASME Section XI, Appendix E could have been exceeded in the event that a low temperature over-pressurization transient occurred. Unit 1 has not operated in this condition since issuance of TS 3.20. However, SCE has subsequently analyzed the effects of operation in this region and determined that, in the event of a low temperature over-pressurization transient, the reactor vessel would not have been damaged.

The assessment which was performed did not cover the full range of conditions requiring OMS. However, the acceptable results combined with the low probability of an initiating event which would challenge the protection feature of the OMS concurrent with a single random failure disabling the remaining OMS control features, yield conditions for which the safety significance is considered minimal. Subsequent to this assessment, testing of a valve identical to RV-206 demonstrated that if operable and aligned to the RCS, RV-206 could have provided the necessary overpressure protection under the most severe single failure scenarios in which both PORVs are unavailable.

G. ADDITIONAL INFORMATION:

1. Component Failure Information:

   Not applicable.

2. Previous LERs for Similar Events:

   LER 89-013 (Docket No. 50-206) reported a non-conservative OMS TS regarding the Power Operated Relief Valves (PORVs). Specifically, it was determined that the PORV set point specified by TS 3.20 was non-conservative with respect to the low temperature overpressure limits established by the heatup and cooldown curves of TS 3.1.3. In addition, it was discovered that the PORVs were not included in the In Service Test (IST) program contrary to TS 4.7. Corrective actions addressed the PORVs and IST Program issues. As a result of the LER and the subsequent in depth review of the OMS design basis, the discovery of the non-conservative pressurizer level setpoint (TS 3.20) and the non-conservative chemical and volume control TS 3.2 were identified.

3. Results of NPRDS Search:

   Not applicable.

4. OMS Operation During Plant Startup and Shutdown:

The present OMS setpoint is 420 psig. TS 3.20 requires that OMS be in service whenever the RCS pressure is less than or equal to 400 psig. This creates a margin of only 20 psig between the OMS setpoint and the pressure at which OMS is required to be in service. The basis for placing the OMS in service at less than or equal to 400 psig is intended to assure that protection is provided whenever RCS temperature is below 360°F. The combined inaccuracies of the OMS instrumentation and the RCS pressure recorder (0-600 psig), which is used by control room operators to determine the pressure at which OMS should be placed inservice, could exceed this 20 psig margin. As a result, an inadvertent OMS actuation is possible while the RCS pressure is near 400 psig. To ensure that an inadvertent OMS actuation does not occur and to ensure that the TS Basis for the OMS is satisfied, operating instructions for startup and shutdown now require that OMS be in service whenever the RCS temperature is below the OMS enabling temperature (currently 360°F) regardless of RCS pressure and pressurizer level. This, therefore, allows for placing the OMS in service below 400 psig as long as RCS temperature is greater than OMS enabling temperature. These administrative controls will ensure that the RCS pressure does not exceed the 10 CFR 50, Appendix G, RCS pressure limits. These issues were discussed with the NRC on October 26, 1989.