NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Sequoyah, Unit 1	0 5 0 0 0 3 2 7	1 OF 0 5

TITLE (4) An Unanalyzed Single Failure Could Cause Inadvertent Actuation Of The Cold Overpressure Protection System During A Postulated MSLB Resulting In Operation Outside The Design Basis

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	1 2	8 8	8 8	0 2 0	0 0	0 6	0 9	8 8	Sequoyah, Unit 2	0 5 0 0 0 3 2 8
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OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	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, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	XX 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
Don Siska K. E. Meade , Plant Operations Review Staff	AREA CODE 6 1 5 8 7 0 - 6 2 5 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)		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 May 12, 1988, with unit 1 in mode 5 (cold shutdown) and unit 2 in mode 3 (hot standby), it was determined that the cold overpressure protection system (COPS) could actuate during a postulated main steam line break (MSLB) accident. During an MSLB, the reactor coolant system (RCS) temperature in the affected loop could decrease below 350 degrees F, thereby automatically arming one train of the COPS. If a coincident single failure of a second wide-range temperature channel occurred in another RCS loop, the COPS could actuate and cause one or both power operated relief valves (PORVs) on the pressurizer to open. Opening of the pressurizer PORVs would exacerbate the decreasing RCS pressure transient associated with the MSLB and increase the potential for departure from nucleate boiling (DNB) to occur in the core. This event has not been analyzed as part of the Sequoyah Nuclear Plant's design basis. The event was caused by an inadequate design of COPS. The automatic arming feature of this system was designed to ensure COPS would be functional any time the RCS temperature decreased below 350 degrees F. However, this design did not consider the potential consequences of an inadvertent actuation of the COPS as a result of a credible design basis event. As immediate corrective action, plant operators closed the PORV block valves on unit 2, thereby precluding an inadvertent RCS depressurization if the COPS actuated. As an interim measure before unit 2 entered mode 1, TVA implemented a temporary alteration to disable the COPS system as soon as the plant enters mode 3 (i.e., RCS temperature exceeds 350 degrees F) and instituted administrative controls to ensure COPS would be placed back in service when the RCS temperature was decreased below 350 degrees F. As long-term corrective action, TVA is preparing a design change to install a selector switch which will delete the automatic arming of the COPS. The existing administrative controls will then be revised to require Operations personnel to manually arm the system when RCS temperature is below 350 degrees F.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

DESCRIPTION OF EVENT

On May 12, 1988, with unit 1 in mode 5 (0 percent power, 1 psig, 125 degrees F) and unit 2 in mode 3 (0 percent power, 2235 psig, 525 degrees F), it was determined that the cold overpressure protection system (COPS) could actuate during a postulated main steam line break (MSLB) accident coincident with a single failure of a reactor coolant system (RCS) (EIIS Code AB) wide-range temperature channel. Actuation of the COPS could open one or both power operated relief valves (PORVs) on the pressurizer and cause a subsequent decrease in RCS pressure that could result in operation outside the design basis of the plant.

The COPS is designed to mitigate potential overpressure excursions during low temperature operation (i.e., less than 350 degrees F) that could be produced by mass and/or heat input transients. One PORV is interlocked with one wide-range RCS pressure channel and four wide-range RCS temperature channels (two hot legs and two cold legs). The four temperature signals are auctioneered and the lowest of these temperatures is used to generate an RCS pressure setpoint (based on a programmed pressure/temperature curve) for actuation of the PORV. This auctioneered temperature signal is also used as an opening permissive signal for the PORV associated with the other COPS train. Thus, in order to actuate one train of the COPS, the wide-range RCS pressure input must exceed the programmed RCS pressure setpoint (based on auctioneered temperature) and the auctioneered temperature signal from the other COPS train must be less than 350 degrees F.

During a postulated MSLB accident, the RCS temperature in the affected loop could decrease below 350 degrees F, thereby satisfying the logic necessary to arm one train of the COPS. If a coincident single failure of a second wide-range temperature channel occurred, the COPS could actuate and cause one or both pressurizer PORVs to open. Opening the PORVs would exacerbate the decreasing RCS pressure transient associated with the MSLB and increase the potential for departure from nucleate boiling (DNB) to occur in the reactor core (EIIS Code AC). This event has not been analyzed as part of the Sequoyah Nuclear Plant's (SQN) design basis.

This event is applicable to both units 1 and 2 since the design of the COPS is the same for both units. Following the discovery of this condition, unit 2 operators closed the block valves associated with the two pressurizer PORVs. Closing the PORV block valves is allowed by Technical Specification 3.4.3.2 because the PORVs are not credited in the Final Safety Analysis Report (FSAR) accident analysis, and the COPS is not required at RCS temperatures greater than 350 degrees F. No immediate operator action was required for unit 1 since this unit remained in cold shutdown (mode 5) conditions.

CAUSE OF EVENT

The event was caused by an inadequate design of the COPS. The automatic arming feature of the COPS was designed to ensure that the system would be functional any time the RCS temperature decreased below 350 degrees F even if no operator action was taken. However, this design did not consider the potential consequences of a COPS actuation that resulted from a credible design basis event (i.e., an MSLB coincident with a single failure).

A contributing cause of this event was an inadequate review of the original COPS design by TVA when it was originally proposed by the NSSS vendor. During the preparation of the Engineering Change Notice (ECN) that was used to install the COPS, a TVA safety evaluation identified the potential for a spurious opening of a PORV because of a loss of power or as the result of a seismic event. These events were not considered to be significant because they would be less severe than the accidental depressurization of the RCS as described in Section 15.2.12 of the FSAR. However, this evaluation did not consider the opening of a PORV as a result of an MSLB accident coincident with a single failure.

ANALYSIS OF EVENT

This event is being reported in accordance with 10 CFR 50.73, paragraph a.2.ii.a, as an unanalyzed condition that could have compromised plant safety.

During an MSLB accident, the associated RCS cooldown can result in a significant increase in core reactivity if a highly negative moderator temperature coefficient (MTC) is present. With one rod cluster control assembly (RCCA) assumed to be stuck in the fully withdrawn position, the cooldown can be severe enough to cause the core to return to a critical condition. However, as described in section 15.4.2 of the SQN Final Safety Analysis Report (FSAR), the core does not remain critical long enough to cause a significant increase in core heat flux; hence, no fuel pins are predicted to experience DNB.

If actuation of the COPS occurred during an MSLB, the resulting decrease in RCS pressure would have an adverse effect on the margin to DNB. However, if an MSLB occurred from mode 1 or 2, the RCS temperature data shown in FSAR Table 15.4.2-1 indicate that it is not likely that the COPS actuation would occur before approximately 30 seconds. At this point, borated water from the safety injection system will have already entered the RCS. Thus, the adverse effects of RCS depressurization (with respect to DNB) should be compensated for by the increased boration capability of the safety injection system when operating at lower primary system pressures.

If an MSLB occurred during mode 3 operation at a temperature less than the no-load Tavg (i.e., less than approximately 547 degrees F), the COPS could actuate in less than 30 seconds. For example, if an MSLB occurred at an RCS temperature of 450 degrees F, the cooldown to 350 degrees F would take less time than it would take from 547 degrees F. However, in this case, the overall RCS cooldown would be of less magnitude, and therefore, the potential increase in core reactivity would be limited to less than that which has been discussed previously. In all cases, the operator has positive indication of PORV position in the main control room (MCR), and an alarm is annunciated in the MCR whenever a PORV is not in the fully-closed position. Thus, if a COPS actuation occurred during a postulated accident, plant operators would be alerted to this condition and could take action to close the PORVs and/or the PORV block valves.

CORRECTIVE ACTION

Since the COPS is not required when the RCS temperature exceeds 350 degrees F, SQN operators took immediate action to close the block valves associated with two unit 2 pressurizer PORVs. As a result, a COPS actuation would not cause an inadvertent RCS depressurization, and the MSLB described in section 15.4.2 of the SQN FSAR remained bounding. As interim corrective action (before unit 2 entered mode 1), TVA implemented temporary alteration change form (TACF) 2-88-2010-68 on unit 2. This TACF disables the COPS by lifting the arming signal leads and must be implemented when the RCS temperature reaches 350 degrees F (mode 3) in accordance with General Operating Instruction (GOI)-1, "Plant Startup from Cold Shutdown to Hot Standby - Units 1 and 2." Similarly, GOI-3, "Plant Shutdown from Minimum Load to Cold Shutdown," requires the TACF to be removed and power supplied to both the PORVs and their associated block valves (to ensure COPS can provide pressure relief) when the RCS temperature decreases below 350 degrees F.

As long-term corrective action, TVA is preparing a design change to install a selector switch which will delete the automatic arming capability of the COPS. As a result of this design change, Operations personnel will be required to manually arm the system when RCS temperature decreases below 350 degrees F and disarm the system when RCS temperature is greater than 350 degrees F. Following the installation of this selector switch, GOI-1 and GOI-3 will be revised to reflect the fact that a selector switch will be used in lieu of the TACF. In addition, TVA will issue a training letter to licensed SQN personnel describing the change to the subject GOIs and the reasons for installing the selector switch. Installation of the COPS selector switch on unit 2 and the revision of GOI-1 and GOI-3 (for unit 2) will be complete before restart (mode 3) following the next unit 2 refueling outage. Installation of the COPS selector switch on unit 1 and revision of GOI-1 and GOI-3 (for unit 1) will be complete before restart (mode 3) of unit 1.

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To prevent recurrence of this type of event in the future, TVA has instituted Nuclear Engineering Procedures (NEPs) to govern the design and design change processes at TVA's nuclear plants. Specifically, NEP-5.2, "Review;" NEP-5.5, "Engineering Specification Requirements;" and NEP-6.1, "Change Control," provide the necessary control to prevent recurrence of this event.

ADDITIONAL INFORMATION

There have been no previously reported occurrences where an unanalyzed single failure has resulted in potential operation of SQN outside of its design basis.

COMMITMENTS

1. TVA will install a selector switch which will delete the automatic arming of the COPS system. The switch will be installed on unit 1 before restart (mode 3) and will be installed on unit 2 before restart (mode 3) following the next unit 2 refueling outage.

2. TVA will revise GOI-1 and GOI-3 to delete the current reference to the TACF and incorporate instructions on the proper use of the COPS manual select switch. This revision will be complete before restart (mode 3) of unit 1 (for unit 1) and before restart (mode 3) of unit 2 following the next refueling outage.

3. Following the installation of the COPS selector switch and the revision of the subject GOIs, TVA will issue a training letter to licensed SQN personnel describing the change to the GOIs and the reasons for installing the selector switch. This training letter will be issued before restart (mode 3) of unit 1.

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TENNESSEE VALLEY AUTHORITY
Sequoyah Nuclear Plant
Post Office Box 2000
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June 9, 1988

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

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 1 - DOCKET NO. 50-327 - FACILITY OPERATING LICENSE DPR-77 - REPORTABLE OCCURRENCE REPORT SQRO-50-327/88020

The enclosed licensee event report provides details concerning an unanalyzed single failure that could cause an inadvertent actuation of the cold overpressure protection system during a postulated main steam line break accident. This condition could have resulted in operation outside the design basis and is reported in accordance with 10 CFR 50.73, paragraph a.2.ii.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

S. J. Smith
Plant Manager

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