NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Perry Nuclear Power Plant, Unit 1	0 5 0 0 0	1 OF 0 4

TITLE (4) Design Deficiency In Room Cooling Instrument Results In Inoperability of Reactor Core Isolation Cooling System During Cold Weather Operations

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 0 0 0
0 1	0 7	9 0	9 0	— 0 0 2	— 0 0	0 2	0 2	9 0		0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

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

	20.402(b)		20.405(c)	X	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)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		
	20.405(a)(1)(iv)		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)
Henry L. Hegrat, Compliance Engineer, Extension 6855	2 1 6 2 5 9 - 3 7 3 7

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)	X NO				

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

On January 7, 1990 at approximately 1209 the Reactor Core Isolation Cooling (RCIC) system isolated due to a high differential temperature (delta-T) signal as detected across the RCIC room cooler following a reactor scram from full power due to a loss of feedwater flow. Further evaluation determined the RCIC system was considered to be inoperable during cold weather operations during the second fuel cycle.

The root cause of the RCIC isolation was a design deficiency involving the delta-T isolation instrument setpoint. The RCIC room delta-T instrumentation did not have enough setpoint margin during the winter mode of operation due to increased capacity of heat removal systems during the winter months. Colder cooling water flow results in colder air temperatures at the exhaust of the room cooler which can cause unnecessary isolations of the RCIC system due to RCIC room delta-T. A secondary cause is the inaccuracy in cooling water flow rate associated with the throttling of the room cooler outlet valve.

To prevent recurrence, a change in Technical Specification 3.3.2 has been obtained which revised the delta-T isolation setpoint from 37.25 to 70.9 degrees Fahrenheit. Also, in order to maintain a constant cooler flow rate year round, the flow rate through the room cooler was increased from 4.3 gpm to its normal position of 15 gpm. These actions should reduce the potential for unnecessary RCIC System isolations while continuing to provide detection of steam leakage into the RCIC equipment room.

On January 7, 1990 at approximately 1209 the Reactor Core Isolation Cooling (RCIC) [BN] system isolated due to a high differential temperature signal as detected across the RCIC room cooler. At the time of the event, the plant was in Operational Condition 3 (Hot Shutdown), with decay heat at approximately 45 megawatts following a reactor scram from full power at 1132. The Reactor Pressure Vessel [RPV] was at saturated conditions at approximately 920 psig.

On January 7, 1990, the RCIC system was supplying water to the RPV following a reactor scram which was due to a loss of feedwater and a resulting low RPV coolant level (refer to LER 90-001). After approximately 37 minutes of operation, the RCIC system isolated due to a high differential temperature (delta-T) signal as detected by the room cooler leak detection instrumentation. The maximum room cooler delta-T reached during the event was 36 degrees Fahrenheit which is the setpoint for the delta-T instruments. Immediate inspection of the RCIC room verified that the high delta-T condition was not caused by a steam leak. Following the RCIC trip, coolant continued to be supplied to the RPV by the Motor Driven Feedwater Pump (MDFP) [P].

Followup investigation determined that the position of the cooling water outlet valve for the RCIC room cooler was providing cooling water flow of approximately 6.5 gpm instead of 4.3 gpm as intended by the System Operating Instruction (SOI-E51) "Reactor Core Isolation Cooling System." SOI-E51 required the room cooler outlet valve to be one-quarter turn open so as to provide a flow rate of 4.3 gpm. Additionally, a portion of the insulation for the RCIC turbine was not installed as required. It was concluded that the excess Emergency Closed Cooling (ECC) [CC] system flow coupled with the additional heat loading from the uninsulated portion of the RCIC turbine resulted in the initiation of the high delta-T system isolation. Because these conditions could be expected to have resulted in a RCIC system isolation after any initiation, RCIC is considered to have been inoperable since the throttle valve for the room cooler was adjusted for cold weather operations on approximately November 1, 1989.

On January 16, 1990 at 1112, RCIC was declared operable after cooling flow was properly adjusted and the previously removed turbine insulation was replaced. During the plant startup on January 18, 1990, a special test instruction was implemented to verify RCIC operability with existing conditions. The test instruction established an acceptance criterion for the margin to the differential temperature isolation setpoint which needed to be maintained during the test. Although the RCIC system did not isolate during the two hour test, the delta-T measurement failed to satisfy the specified acceptance criteria. In CEI's judgment the margin to the isolation trip setpoint was not sufficient to ensure the reliability of the RCIC system during future responses to plant transients or accidents. Therefore, the RCIC system was conservatively declared inoperable. Technical Specification 3.7.3 was entered at 1930 on January 18, 1990, placing the plant in a 14-day shutdown action requirement.

The root cause of the RCIC isolation was a design deficiency involving the delta-T isolation instrument setpoint. The isolation function provide by these instruments is required to be operable in accordance with Technical Specification 3.3.2. The setpoint for the RCIC room delta-T instrumentation during the winter mode of operation did not provide adequate setpoint margin for the trip due to the decreased temperature of the ECC system water. The Emergency Service Water [BI] system, using water from Lake Erie, is the heat sink for ECC; therefore, during the winter months the cold lake water increases the capacity for heat removal by the ECC system to the extent that an unnecessary isolation of the RCIC system can occur due to RCIC room delta-T. Previous occurrences of delta-T alarm initiations in 1987 led to testing to determine the optimum cooling water flow rates for cold weather operation. The data from these tests resulted in a revision to System Operating Instruction (SOI-E51) "Reactor Core Isolation Cooling System" to provide direction to throttle the cooler outlet isolation valve to one-quarter turn open when ESW temperature decreased below 55 degrees. This position was determined to provide a flow rate of approximately 4.3 gpm to the RCIC room cooler. This action was expected to prevent delta-T trips during the winter mode of operation; however, the effectiveness of this action has subsequently been found to be limited due to the throttling capabilities of the outlet isolation valve since minor variations in the valve position or changes in system characteristics may cause significant variation in cooler flow. This configuration compromises the reliability of the system by imposing a significant probability of an unnecessary RCIC isolation due to high room cooler delta-T.

As described in Section 5.4.6 of the Updated Safety Analysis Report, the RCIC system is designed to maintain RPV level for adequate core cooling under specific conditions. These conditions include vessel isolation in Hot Standby, vessel isolation with a complete loss of coolant flow from the reactor Feedwater System [SJ], and performance of a plant shutdown under pressurized conditions without availability of the normal Feedwater system until the point where the shutdown cooling system can be placed into operation. The system is designed to automatically start at low RPV level (Level 2), and align itself for injection into the vessel. The High Pressure Core Spray System (HPCS) [BG] system is also designed to automatically start and inject into the vessel at Level 2 providing the primary source of RPV makeup water under pressurized conditions. Although no credit is taken for RCIC in any of the design basis transients or accidents and RCIC is not considered an Emergency Core Cooling System, RCIC is included in Technical Specifications. RCIC and HPCS operability are cross-referenced such that if one system is inoperable but the other is available, plant operation may continue for up to 14 days. During the period of RCIC inoperability from approximately November 1, 1989 to January 16, 1990, the HPCS System had been declared inoperable on December 22, 1989 and January 5, 1990 due to low Division 3 Battery electrolyte temperature; however, the system was not removed from service in either event (refer to LER 89-032). The HPCS System was also declared inoperable on December 27, 1989 during the performance of required surveillance functional testing. The testing procedure would have allowed expeditious return to operability of the HPCS system, if required to respond to a plant transient.

During the event on January 7, 1990, the HPCS System functioned as designed to maintain RPV level. Additionally, since the RCIC system was being maintained in a standby readiness condition during this extended period of inoperability, the system functioned as designed until the high delta-T isolation occurred, 37 minutes into the event. This allowed adequate time to restore feedwater flow from the Feedwater System.

The RCIC Equipment Area Differential Temperature Leak Detection System is designed to provide signals to initiate isolation of abnormal leakage from the reactor coolant system. The RCIC equipment area differential temperature detection system consists of two thermocouples, one mounted on a wall across the room from the room cooler, and the other in the room cooler exhaust path. If the temperature differential increases to greater than the delta-T setpoint, a RCIC isolation will occur. The Leak Detection System remained operable and functioned as designed during this event. Based on the above considerations, this event is not considered to be safety significant.

To prevent recurrence, a change to Technical Specification 3.3.2 has been obtained on an emergency basis. This change increases the delta-T isolation setpoint to 70.9 degrees Fahrenheit to reduce the potential for unnecessary RCIC system isolations while continuing to provide detection of steam leakage into the RCIC equipment room. The proposed setpoint revision has been evaluated by Engineering Department personnel provide interim relief until lake temperature again exceeds 55 degrees Fahrenheit. Further modifications to Technical Specifications would be required to allow continued operation with warmer lake water temperatures. All technical justification and supporting information for the Technical Specification change request is provided in separate Licensing correspondence.

Additionally, all appropriate plant procedures have been revised to establish a 15 gpm cooling water flow rate for all environmental conditions, thereby eliminating the potential for improper cooling water flow rate caused by seasonal valve adjustments.

Energy Industry Identification System Codes are identified in the text as [XX].