NRC FORM 366
(4-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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

TITLE (4): RWCU Isolation on High Delta Flow While Operating in the Reduced Feedwater Temperature Mode of Operation

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	2 1	9 2	9 2	-	0 0 4	- 0 0	0 4	1 7	9 2		0 5 0 0 0
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OPERATING MODE (9)	2	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)	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)	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
Henry L. Hegrat, Compliance Engineer, Extension 5185	AREA CODE: 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 March 21, 1992 at approximately 1301, during a planned, manual shutdown of the plant, a Reactor Water Cleanup (RWCU) [CE] System containment isolation occurred as a result of high system differential flow. Immediate corrective action was taken to verify that no actual system leakage had occurred. The RWCU system was secured and subsequently returned to service.

The cause of this event is considered to be a design deficiency associated with unexpected formation of a steam void in the RWCU regenerative heat exchangers (RHXs) while operating in the reduced feedwater temperature mode of operation. As the RWCU system cooldown progressed, the void collapsed and return flow refilled the RHXs instead of returning to the RPV via the feedwater injection line. The high differential flow was sensed by the Leak Detection system and resulted in a RWCU containment isolation.

Pursuant to the corrective actions for previous similar events, a Technical Specification change to increase the differential flow timer setpoint was submitted to the NRC on October 30, 1991. This change would avoid unnecessary automatic isolation valve closure and shutdown of the system. Additionally, changes to computer monitoring programs to alert operators to the formation of a steam void are being evaluated. Potentially, this would allow operators to proactively respond to this voiding phenomenon. All licensed operators will be trained on the lessons learned with regard to this event.

I. Introduction

On March 21, 1992 at approximately 1301, during a planned, manual shutdown of the plant, a Reactor Water Cleanup (RWCU) [CE] System containment isolation occurred as a result of high differential flow. At the time of the event, the plant was in Operational Condition 2 (Startup) with a reactor cooldown in progress. The reactor vessel [RPV] pressure was approximately 171 psi with reactor coolant at saturated conditions. The NRC Operations Center was informed of the event via the Emergency Notification System at 1540 hours in accordance with notification requirements identified in 10CFR50.72(b)(2)(ii). This event is being reported under the requirements of 10CFR50.73(a)(2)(iv).

II. Event Description

On March 21, 1992, a planned manual shutdown of the plant was being performed to begin the third refueling outage. In accordance with approved operating instructions, operators placed the RWCU system into the reduced feedwater temperature mode of operation at approximately 0424. In this mode of operation return flow to the RPV effectively bypasses the regenerative heat exchangers (RHXs) [HE] for the RWCU system in order to minimize thermal stratification in the feedwater piping while the reactor is cooling down. At 1259, the RWCU discharge flow began to drop off while suction flow initially remained constant, then slightly rose. At 1300, a high differential flow signal was generated from the Leak Detection System [IJ] which initiated a 45 second differential flow timer. Alarm circuitry is provided to initiate alarm "RWCU Delta Flow High Timer Run" to alert operators that the 45 second differential flow timer has started; however, this alarm was not received. At approximately 1301, the RWCU system received a containment isolation signal from the Leak Detection System on high differential flow along with the accompanying alarm on "RWCU Isolation Delta Flow High". After the operators verified that no actual leakage existed, the RWCU system was secured in accordance with approved operating instructions. Operators placed the RWCU system into the reduced feedwater temperature mode of operation later that day at 1757.

III. Cause Analysis

The cause of this event is considered to be a design deficiency which results in the formation of a steam void in the RHXs while operating in the reduced feedwater temperature mode of operation. In this mode, the flow rate through the RHXs is reduced in order to reduce RWCU return temperature and thereby minimize thermal stresses in the feedwater piping. During this event, reduction in RHX return flow along with the reactor pressure decrease allowed water on the shell side of the RHXs (at reactor temperature and very close to saturation conditions) to flash into steam causing a void. As the RWCU system cooldown progressed, the void collapsed and return flow refilled the RHXs instead of returning to the RPV via the feedwater injection line. The high differential flow was sensed by the Leak Detection system and resulted in a RWCU containment isolation.

Investigation of the "RWCU Delta Flow High Timer Run" alarm following this evolution could not determine why the alarm was not received in the control room. Receint of this alarm would have alerted the operators of the impending system isolation. Operators in close proximity to the annunciator panel stated that the alarm did not come in. However, troubleshooting indicated that the alarm circuitry was working properly after the event.

IV. Safety Analysis

The Leak Detection System compares RWCU inlet flow to return flows (return flow to the reactor vessel through the feedwater line and blowdown flows to the main condenser and radwaste). All three flows are summed to generate a total flow value. A RWCU high differential flow signal is generated from the Leak Detection System when RWCU inlet flow exceeds return flow by 68 gpm. If this differential flow signal continues for 45 seconds, a RWCU system containment isolation will occur. This could occur as the result of a line break in the RWCU system. The 45 second time delay is intended to allow for system flow transients when operational configurations change. During this event, although no actual leak existed, RWCU high differential flow did exist due to the formation and subsequent collapse of steam voids in the RWCU RHXs. The Leak Detection system responded as designed to indicate high differential flow and initiated a containment isolation. All other plant systems responded as designed, with the exception of the failure of the "RWCU Delta Flow High Timer Run" alarm. Therefore, this event is not considered to be safety significant.

Following a RWCU containment isolation, the loss of the RWCU system may cause reactor coolant conductivity to slowly increase until the system is returned to service. In this event, the system was returned to service prior to a significant increase in conductivity.

V. Corrective Action

Perry has reported four previous LERs attributed to this RWCU system voiding phenomenon (LERs 89-025, 90-022, 91-011, 92-003). Past corrective actions taken specific to this phenomena included: evaluation of alternate means to re-pressurize/warm-up the system; implementation of procedural changes to reduce the probability that this event could reoccur; evaluation of long-term effects resulting from occasional RWCU system transients involving flashing or voiding; and initiation of a design modification to eliminate minor heat exchanger drain valve leakage. However, the effectiveness of these corrective actions has been limited.

Because the engineering evaluation showed no damaging effects resulting from occasional RWCU system transients involving flashing or voiding, on October 30, 1991, a Technical Specification Change Request (PY-CEI/NRR-1390L) was submitted to the NRC. This change, which included increasing the delta-flow timer setpoint, would avoid unnecessary automatic isolation valve closure and allow operators to manually shutdown the system, if necessary. Additionally, changes

to computer monitoring programs to alert operators to the formation of a steam void are being evaluated. Potentially, this would allow operators to proactively respond to this voiding phenomenon. All licensed operators will be trained on the lessons learned with regard to this event.

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