NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

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.

LICENSEE EVENT REPORT (LER)

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) Two Reactor Water Cleanup Containment Isolations Occur During Plant Shutdown Due to High Differential Flow.

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 9	0 7	9 0	9 0	—	0 2 2	—	0 0	1 0	0 8	9 0		0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
3		20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
0 1 0		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
	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
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		0 3	1 5	9 1

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

On September 7, 1990 at 0633 and 1422 hours, two Reactor Water Cleanup (RWCU) System containment isolations occurred due to high differential flow. The first isolation occurred following a planned, manual shutdown of the plant. The second event occurred during the subsequent RWCU system restoration. After an unsuccessful attempt at 1422, the RWCU system was returned to service at approximately 1500 on September 7, 1990. In response to the isolations, plant operators verified that no actual system leakage existed and completed securing the system. The root cause of these events has not been determined but may be attributable to a design deficiency associated with the Reduced Feedwater Temperature mode of operation.

Corrective actions were taken to verify that no actual system leakage had occurred. The RWCU system was secured and subsequently returned to service. As a result of these isolations, an engineering evaluation will be made to determine the root cause and to evaluate changes to the system design and/or operating procedures. In order to minimize the recurrence of isolations similar to the second isolation, a procedural change is being made to SOI-G33 "Reactor Water Cleanup System" to clarify startup requirements of the system. These events will be discussed with all Licensed Operators during continuing training.

On September 7, 1990 at 0633 and at 1422 hours, two Reactor Water Cleanup (RWCU) [CE] System containment isolations occurred due to high differential flow. The first isolation followed a planned, manual shutdown of the plant. The second isolation occurred later on during an attempt to return the RWCU system to service. At the time of the first event the plant was subcritical in Operational Condition 3 (Hot Shutdown) with all control rods inserted and pressure decreasing following a planned, manual, reactor scram. The reactor vessel [RPV] pressure was approximately 395 psig with reactor coolant at saturated conditions. At the time of the second event, the RPV pressure was less than 100 psig and reactor coolant temperature was approximately 225 degrees Fahrenheit. Corrective actions taken were to verify that no actual system leakage occurred, and to properly secure the RWCU system. The RWCU system was then returned to service.

A planned, manual reactor scram was initiated on September 7, 1990 at 0558 from 10 percent of rated power. The plant was shutdown with all control rods inserted and the main steam lines were isolated to reduce the cooldown rate. The RWCU system was operating in the Reduced Feedwater Temperature mode with one pump [P] running and a system suction flow of about 220 gpm. One filter/demineralizer [FDM] was in service. In accordance with approved operating instructions, two valves [V] that control the discharge flow of the system back to the RPV through the feedwater lines were throttled to minimize thermal stratification in the feedwater piping while the reactor was being cooled down. At 0600, a significant flow increase in the return to feedwater line occurred along with a 250 degree F. increase in the outlet temperature of the RWCU Regenerative Heat Exchangers [HX]. At 0633, the RWCU discharge flow dropped off from 170 gpm to zero with a simultaneous increase in suction flow from 220 gpm to 240 gpm. (All flows are as indicated and may not be actual values.) Approximately 45 seconds later both divisions of the RWCU leak detection system tripped as designed, resulting in an RWCU isolation. The RWCU system was not aligned for blowdown flows to either radwaste or the main condenser [COND] during this event. After the Licensed Operator verified that no actual leakage existed, the RWCU system was secured at 0700 and Chemistry personnel were notified to obtain samples.

On September 7, 1990 at 1421 during an attempt to return the RWCU system to service, the Licensed Operator received an "RWCU Delta Flow High Timer Run" alarm immediately after opening the containment isolation valves in accordance with approved operating instructions. The Licensed Operator performing the RWCU system hot startup evolution had assumed that the system was solid with water; however, it was apparently voided. With the RWCU pump suction isolation valves open, opening the divisional containment isolation valves aligned RPV pressure to a partially voided system. The resultant inrush of water filled the voided RWCU system causing the second high differential flow isolation at 1422. After reviewing the isolation with an oncoming Licensed Operator, the attendant Operator performed the additional steps specified for a depressurized system. This approach was successful and the RWCU system was returned to service at approximately 1500 hours on September 7, 1990 with no further difficulty. The NRC Operations Center was informed of both events via the Emergency Notification System at 0857 and 1500 hours on September 7, 1990 in accordance with reportability requirements identified in 10CFR50.72.

The cause of the first event has not been determined. While operating RWCU in the Reduced Feedwater Temperature mode, the system flow rate is reduced in order to minimize thermal stresses in the feedwater piping. During this event a significant increase in return to feedwater flow occurred along with a 250 degree F. increase in the outlet temperature of the RWCU regenerative heat exchangers. Reduction in RWCU flow along with the reactor pressure decrease may have allowed water to flash into steam causing a void. An engineering evaluation of the Reduced Feedwater Temperature mode of operation of the RWCU system is being made to determine the possibility and effects of steam formation within the system.

The second event has also been attributed to the steam void formation described above. The system operating instruction (SOI-G33) "Reactor Water Cleanup System" for hot startup to normal recirculation mode was written for normal RWCU system behavior under pressurized conditions without steam void anomalies. The instruction was previously changed on December 28, 1989 to minimize RWCU delta flow problems by instructing the operator to close the RWCU pump suction isolation valves if the system is not pressurized. The assumption behind the procedure change was that pressure indication would provide positive assurance that the RWCU system was solid with water. However, the procedural change provided no guidance to the Licensed Operator in the event of steam voiding. The Licensed Operator performing the hot startup evolution made the same assumption that the instruction writer made; that is, when the system is pressurized it must be full of water. After opening divisional containment isolation valves, an inrush of water filled the RWCU system and caused the second high differential flow isolation to occur indicating that the system was apparently voided. After reviewing the evolution with an oncoming Licensed Operator, the attendant Operator was successful in returning the system to service by assuming the RWCU system was depressurized and implementing the corresponding steps in SOI-G33.

The Leak Detection System compares RWCU suction flow to discharge flows (return flow to the reactor vessel through the feedwater line and blowdown flows to the main condenser and radwaste). All three discharge flows are summed to generate a total discharge flow value. A RWCU high differential flow signal is generated from the Leak Detection System when RWCU suction flow exceeds discharge flow by more than the 68 gpm setpoint. If this differential flow signal continues for more than 45 seconds, an 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. Following an 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 addition, during shutdown with little or no internal recirculation flow, reactor vessel thermal stratification may occur. However, since the out-of-service time was short during these RWCU isolations, the effects were minimal. Although no actual leak existed, an RWCU high differential flow did exist due to the apparent formation of a steam void, and

the Leak Detection system responded as designed to indicate high differential flow and initiated containment isolation. All other plant systems responded as designed. The reactor was already manually scrammed and remained in hot shutdown throughout this transient with all control rods fully inserted. Therefore, these events are not considered to be safety significant.

Other RWCU containment isolations have been reported in LERs 89-031, 89-025, 88-039, 88-013, 88-002, and 87-074. Other corrective actions previously completed as a result of prior events are described in their respective LERs. As a result of these isolations, an engineering evaluation will be made to determine the root cause and to evaluate changes to the system design and/or operating procedures. Results will be identified in the supplemental report.

In order to minimize the recurrence of isolations similar to the second isolation, a procedural change is being made to SOI-G33 to clarify startup requirements of the RWCU system. As part of the Licensed Operator Requalification training program, these events will be discussed with all Licensed Operators.

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