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)
Perry Nuclear Power Plant, Unit 1	0 5 0 0 0 4 4 0	1 OF 0 4

TITLE (4)

RWCU System Design Problems Cause High Differential Flow Isolations

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)
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0 9	0 2	8 6	8 6	—	0 5 6	— 0 0	1 0	0 1	8 6		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 0 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
Paul Russ, Compliance Engineer, ext 6472	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 September 2, 1986 at 1115, 1122, 1620 and 1625 and September 29 at 0247, unexpected Reactor Water Cleanup (RWCU) containment isolations occurred due to indicated high differential flow. The causes of the isolations have been identified to be flow control valve problems, the placement of the blowdown flow element and an insufficient operating instruction revision initiated as a result of previous events on July 24 and 28 (see LER 86039). Under certain plant conditions, indications of flow oscillation resulted in high differential flow isolations. In response to each isolation, operators restored the system to service in accordance with plant instructions.

Corrective actions to prevent recurrence include; Engineering design changes to replace the RWCU flow control valves and to relocate the blowdown line flow element. In addition, system operating restraints in the operating instruction will be revised to prevent differential flow isolations until the proper modifications can be completed.

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

On September 2, 1986 at 1115, 1122, 1620 and 1625 and September 29 at 0247, Reactor Water Cleanup (RWCU)[CE] containment isolations occurred due to indicated high differential flow. At the time of the September 2 events, the plant was in Operational Condition 3 (Hot Shutdown) conducting a reactor cooldown following a plant scram at 1102. Reactor coolant temperature was approximately 325 degrees at 1115 and decreased to approximately 220 degrees at 1625. Reactor vessel [RPV] pressure also decreased from approximately 90 psig at 1115 down to approximately 5 psig at 1625. At the time of the September 29 event, the plant was in Operational Condition 2 with reactor thermal power approximately 2% of rated, reactor coolant temperature was approximately 360 degrees and reactor vessel pressure approximately 160 psig.

On September 2, at 1102, an unplanned reactor plant scram occurred due to an upscale trip on the Intermediate Range Neutron Monitors [IG](see LER 86055). This transient caused the RWCU pumps to trip at 1104 on low suction flow as a result of system flow oscillations. While plant operators were in the process of restoring the RWCU system to service, an outboard containment isolation occurred at 1115 due to high differential flow. The operators attempted to recover the RWCU system and return it to service when an inboard and outboard containment isolation occurred at 1122 due to high differential flow. In response to these isolation, plant operators reset the isolation signal, completed the required system valve lineup and restarted an RWCU pump. The system was completely restored to service with blowdown to the main condenser [SG] established at 1126.

At 1620, while plant operators were adjusting RWCU blowdown flow to the main condenser, an outboard containment isolation occurred due to high differential flow. Operators then attempted to recover the RWCU system when a second outboard containment isolation occurred at 1625 due to high differential flow. In response to these isolation, plant operators reset the isolation signal, completed the required system valve lineup and restarted an RWCU pump. The system was completely restored to service with blowdown to Liquid Radwaste established at 1649.

On September 29 at 0247, while plant operators were adjusting RWCU blowdown to the main condenser, an outboard containment isolation occurred due to high differential flow. In response to the isolation, plant operators restored the system to it's original configuration. System restoration was complete at 0410.

The RWCU system responded to each high differential flow isolation signal as designed, causing an immediate actuation of the respective inboard and/or outboard containment isolation valves [ISV] to their closed position. In addition, RWCU pumps A and/or B automatically shutdown on low flow as designed following the isolation.

Troubleshooting, system testing and investigation of this and previous events on July 24 and 28 (see LER 86039) identified the cause of the isolations as oversensitive flow control valves and the location of the blowdown flow element. During startup of the RWCU system, difficulties in adjusting and maintaining the required flow conditions results in flow oscillations. The plant operators are not always able to recover from the flow oscillations before the system isolates on high differential flow. The RWCU blowdown flow element, 1G33-N011, is located downstream of the blowdown pressure control valve [PCV] and flow restricting orifice [OR]. This location subjected the flow element to turbulent flow conditions in the blowdown line due to the large pressure drop between the blowdown PCV and the main condenser (which was under a vacuum). These conditions caused the flow element to intermittently become uncovered due to the lack of back pressure in that portion of the system. This provided the indication of large flow oscillations which resulted in an RWCU high differential flow isolation. Additionally, a revision to the System Operating Instruction (SOI-G33), initiated as a result of the July events resolved atmospheric limitations, but did not sufficiently address the required operating restrictions when conducting RWCU blowdown to the main condenser with the reactor vessel pressurized.

The Leak Detection System [IJ] compares RWCU suction flow to the flow returning to the reactor vessel and flow being blowndown to radwaste or the main condenser. All three flows are summed to generate an indication of differential flow. An RWCU high differential flow signal indicates the suction flow entering the system is not being discharged via normal flowpaths (reactor vessel, and blowdown to radwaste or main condenser). This could be the result of a line break in the RWCU system. High differential flow for a duration of 45 seconds generates an isolation signal from the Leak Detection System. The 45 second time delay normally allows for system flow transients wher changing operational configurations. If an RWCU containment isolation were to occur at high reactor power, the momentary 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 also occur. However, the time out-of-service for RWCU would be short and these effects minimal. Since no actual RWCU high differential flow existed and the fact that the system did respond as designed to the high differential flow isolation, the event is not considered safety significant.

To prevent recurrence, the following corrective actions have been or will be completed:

1) SOI-G33 will be revised to completely address the system operating restrictions when conducting RWCU blowdown to the main condenser. The

revised instruction utilizes a one inch blowdown bypass line at all times during blowdown. This lineup provides the required additional system backpressure to maintain the system solid with water in the area of the RWCU blowdown flow element. The four inch main blowdown line will be utilized only when vessel makeup exceeds the blowdown capacity of the bypass line. These controls will remain in effect until the proper system modifications can be implemented.

2) An engineering design change has been initiated to relocate the 1G33-N011 flow element upstream of the existing blowdown PCV. This design change will ensure that sufficient system backpressure exists in the area of the flow element to maintain the four inch line solid with water and prevent the uncovering of the flow element. This design change will be implemented when operating condition constraints allow.

3) A second engineering design change has been initiated to replace the RWCU flow control valves. The replacement valves will provide the required flow throttling characteristics to reduce flow oscillations during startup of the RWCU system. However, this design change cannot be implemented until the first refueling outage.

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