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SUBJECT: LER 93-006-00:on 930206,manual reactor scram initiated due to reactor recirculation pump trip while operating in area of increased awareness.Caused by component design parameter. RRC sys operating procedure changed.W/930308 ltr.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352

March 8, 1993
G02-93-055

Docket No. 50-397

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

SUBJECT: NUCLEAR PLANT WNP-2, OPERATING LICENSE NPF-21
LICENSEE EVENT REPORT NO. 93-006

Transmitted herewith is Licensee Event Report No. 93-006 for the WNP-2 Plant. This report is submitted in response to the report requirements of 10CFR50.73 and discusses the items of reportability, corrective action taken, and action taken to preclude recurrence.

Sincerely,

J. W. Baker
WNP-2 Plant Manager (Mail Drop 927M)

JWB/MGE/cgeh
Enclosure

cc: Mr. J. B. Martin, NRC - Region V
Mr. R. Barr, NRC Resident Inspector (Mail Drop 901A, 2 Copies)
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Mr. D. L. Williams, BPA (Mail Drop 399)

120013

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Washington Nuclear Plant - Unit 2	0 5 0 0 0 3 9 7	1 OF 7

TITLE (4)
MANUAL REACTOR SCRAM INITIATED DUE TO REACTOR RECIRCULATION PUMP TRIP WHILE OPERATING IN THE AREA OF INCREASED AWARENESS

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 NUMBERS(S)
0 2	0 6	9 3	9 3	-- 0 0 6	-- 0 0	0 3	0 8	9 3		0 5 0 0 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)				
1					
POWER LEVEL (10)	20.402(b)	20.405(C)	X 50.73(a)(2)(iv)	77.71(b)	
0 3 0	20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.73(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
M. G. Eades, Licensing Engineer	AREA CODE 5 0 9 3 7 7 - 4 2 7 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 (16)

At 0947 hours on February 6, 1993, control room operators at WNP-2 initiated a manual scram after the Reactor Recirculation Pump 1A (RRC-P-1A) tripped during an attempt by the operators to transfer the pump from slow speed to high speed (15 Hz to 60 Hz). During the pump shift, RRC-P-1A tripped, leaving the unit in single recirculation loop operation while operating in the Area of Increased Awareness. A manual reactor scram is the required response to this event, in accordance with PPM 4.12.4.7, "Unintentional Entry Into the Region of Potential Core Power Instabilities".

After inserting the manual scram to exit the prohibited area, the immediate corrective action was the prompt response by the operators to bring the plant to a safe shutdown condition in accordance with approved plant procedures.

The root cause is that the risks and consequences associated with a change were not adequately reviewed or assessed. A second root cause for this event has been categorized as a component was not operated within the component design parameters in that the power level and feed flow conditions, at which the transfer to high speed was attempted were not within the acceptable parameters to satisfy to logic circuitry. As a corrective action the RRC system operating procedure was changed. Contributing factors were the operating constraints placed on the plant as a result of the power oscillation event which resulted in the RRC pump shift attempt at the lower power level.

Abstract (Cont'd)

The event posed no threat to the health and safety of either the public or plant personnel.

Plant Conditions

Power Level - 30%
Plant Mode - 1

Event Description

At 0947 hours on February 6, 1993, control room operators at WNP-2 initiated a manual scram after the Reactor Recirculation Pump 1A (RRC-P-1A) tripped during an attempt by the operators to transfer the pump from slow speed to high speed (15 Hz to 60 Hz). At 0916 hours on February 6, 1993, operators in the control room at WNP-2 began the series of actions necessary to transfer the two reactor water recirculation system pumps from slow to high speed. This sequence of events is not initiated until the reactor core power and control rod pattern are established as described in the Startup Plan. Reactor thermal power was 30.9%, core flow was 29%, and control rods were positioned at the target rod pattern. The parameters place the plant in the Area of Increased Awareness, which places additional restrictions on plant operations. The Area of Increased Awareness represents a region with a relatively low probability for core power instabilities. In accordance with PPM 2.2.1, "Recirculation System Operation", the operator began closing RRC-V-60A, the flow control valve for RRC-P-1A, in incremental steps, from full open to 75%, 50%, 25% to the 0% position. Reactor feedwater system (RFW) flow indications were fluctuating as indicated on the flow recorder, RFW-FR-604B. Intermittent low feed flow signals were received as indicated by amber lights on the RRC control panel and control rod blocks were initiating and clearing from the Rod Block Monitors (RBM A and B). Because there is a pump shift interlock that trips the RRC pump from high speed to slow upon low feedwater flow, it was decided to return the valve to the full open position and to evaluate the situation. Review of the drawings showed that the signal to the amber light indicating the low feed flow must be in for 15 seconds to initiate the pump shift to slow speed. That is, the instrumentation must detect the low flow condition for 15 seconds before the trip to slow speed is initiated. Feed flow values were verified from other sources, such as the Transient Data Acquisition Computer System (TDAS), to be 3.6 E06 lbm/hr, above the low feed flow alarm/trip setpoint. The decision was made to again close RRC-V-60A and to transfer RRC-P-1A to high speed. It was also decided that if the low feed flow alarms were received during the evolution, RRC-V-60A would be reopened and a new target rod pattern for a higher power and higher feed flow condition would be specified. If there was no indication of the low feed flow condition, the operators would proceed with the pump shift.

When RRC-V-60A was closed, the amber lights did not indicate low feed flow and RFW-FR-604B indicated mean feed flow value between 2.9 and 3.4 E06 lbm/hr. The Shift Manager proceeded with the pump shift.

The operator took the pump start switch S101A to the start position, and held it there as he verified that breakers 1A and 2A opened and that breaker RRC-RPT-3A closed (three second time delay). (The 1A and 2A provide a power source for RRC-P-1A during slow speed operation. The breaker RRC-RPT-3A is one of the three in series for high speed operation.) As expected, the pump speed increased. Core flow increased to about 29% and reactor power increased to about 36%. However, the 3A breaker tripped at about 95% of 1800 rpm and pump speed began decreasing. The control room operators expected the pump to pick up on the Low Frequency Motor Generator (LFMG) and return to slow speed operation. At about 450 rpm, when it became apparent the LFMG had not automatically closed in, the operator attempted to manually align the pump to the LFMG. Pump speed continued to decrease and at about 200 rpm the control room supervisor (CRS) directed a manual scram due to the prohibited single loop operation in the Area of Increased Awareness.

All control rods fully inserted and no safety relief valves actuated during the transient. Following the reactor scram, level decreased to -5 inches and increased to as high as +48 inches.

Immediate Corrective Action

Following the reactor scram, the control room operators promptly entered the Emergency Operating Procedure (EOP) 5.1.1, "RPV Power, Level, and Pressure Control", as required, when vessel level reached +13 inches following the scram. Reactor water level recovered using the reactor feed pumps, the plant was stable and the operator exited EOP PPM 5.1.1. At 1037 hours, RRC-P-1A was restarted and operated at slow speed.

Further Evaluation and Corrective Action

A. Further Evaluation

1. In accordance with 10CFR50.72(b)(2)(ii), this event was reported to the NRC Operation Center via the Emergency Notification System at 1047 hours as an unplanned manual actuation of the Reactor Protection System. This event is also reported in accordance with 10CFR50.73(a)(2)(iv) as an event that resulted in an unplanned manual actuation of the RPS.

2. There were no structures, components, or systems inoperable prior to this event that contributed to the event. However, a manual reactor scram was required action when the RRC-P-1A tripped.

3. The initial post scram investigation noted that no alarms or annunciators were received during the shift to indicate why the pump failed to transfer to high speed and tripped. The instrument that detects the low feed flow energizes a relay, K128A, and results in the down shift from high to slow speed also alarms and has an amber light on the control room panel P602. However, a different relay, C34-K10A, located in the pump start logic, changes state to direct the pump to the slow speed start logic or to the high speed start logic. There are no alarms, annunciators or other control room indications associated with this relay.

4. The pump start circuit is designed so that the relay C34-K10A selects the slow speed or high speed logic (see Figure 1). This relay only serves this function while the pump start switch S101A is held in the start position. Examination of the TDAS data indicated the operator held the switch in that position for about 12 seconds and that the breaker RRC-RPT-3A received the trip signal about four seconds after it closed. In order for the logic to cause this pump trip during the pump shift, the low feed flow signal must be received while the switch S101A is held in the start position, so as the time the switch is held in the start position increases the probability of receiving the spurious trip increases.

5. The circuitry design for transferring the pumps from slow to high speed has an unintended path resulting in tripping the 3A breaker if the attempt to shift the pumps is made at too low of a reactor power level. As installed, at a low power level as indicated by a low feed flow signal, the circuit will provide a path to seal in the logic for a slow speed start when the 3A breaker control switch S101A is held in the pump start position that causes the 3A breaker to open when the pump reaches 95% of rated speed. However, because of other components within the circuit, the actions taken to shift the pump to high speed also initiate interlocks that prevent connecting the pump to the LFMG. (The control switch for the RRC pump start is the breaker control switch for RRC-RPT-3A.) As designed, the status of the relay C34-K10A selects either the slow speed logic or the high speed logic. It was not intended, by the designer, for the shift to be attempted as near to the low flow condition as is currently required at WNP-2. The pump shift interlock to prevent high speed operation during low power and low feed flow conditions is provided with a 15 seconds time delay to avoid spurious signals resulting in pump trips.

6. Previous trips of the RRC pumps in similar operational conditions were prevented by bypassing the low power (i.e., low feed flow) pump start interlock with switch S118. However, these instructions were removed from the procedure when the feed flow interlock setpoint was lowered. The operational constraints in place in response to the core power oscillation event required the pump shifts at power levels low enough for the low feed flow signal to cause the trip of the 3A breaker and to prevent the high speed transfer. Although the pump trip had occurred in the past during attempts to shift to high speed, procedures at that time allowed another pump start attempt or single loop operation. When the procedures

were revised, requiring a manual scram for single loop operation while in the Area of Increased Awareness, it was not recognized that all of these factors would combine to require a plant scram during a failed pump shift attempt due to an instantaneous low feed flow signal.

7. A review of the history of PPM 2.2.1, "Recirculation System Operation", revealed that the first eight revisions did not contain instruction to bypass the low feed flow pump start interlock during the pump shift. Revision nine was deviated on December 14, 1988, to add directions for bypassing them in order to eliminate spurious trips on 15 Hz to 60 Hz transfer. The Safety Review for the deviation discussed the change as a commercial issue as opposed to a safety concern. Revision 11 (7/5/89) removed these instruction but there is not sufficient data to determine why the change was made.

B. Root Cause

1. The root cause of this event is that the risks and consequences associated with changes were not adequately reviewed or assessed. Instructions to allow bypassing the low feed flow pump start interlock while requiring a pump shift at a low power level were removed from the system operating procedure and additional restrictions in place to prevent core oscillations required the pump shift at low power levels.

2. A second root cause for this event has been categorized as a component not operated within the component design parameters in that the power level and feed flow conditions, at which the transfer to high speed was attempted, were not within the acceptable parameters to satisfy to logic circuitry.

C. Further Corrective Action

1. The recirculation system operating procedure, PPM 2.2.1, was deviated to allow bypassing the pump start interlock C34-K10A contact during pump shift from slow to high speed.

Safety Significance

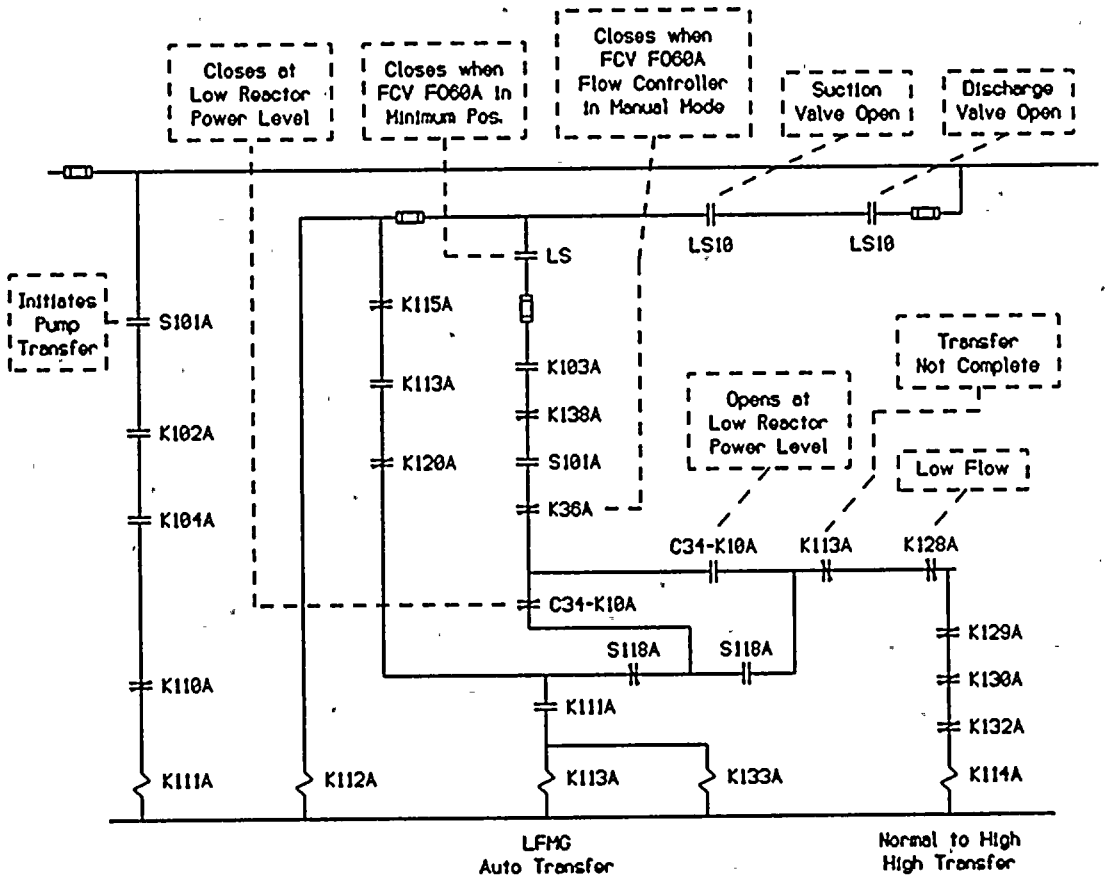
The plant operators reacted correctly in conjunction with installed plant systems to promptly bring the plant to a safe shutdown condition. Although reactor vessel level dropped below Level 3, to -5 inches, during the transient, plant responses were well within bounds of the WNP-2 safety analyses. A manual reactor scram is the required action in response to single loop operation while the plant was in the Area of Increased Awareness in order to minimize the potential for core power oscillations. The plant was actually in the Area for a short time during single loop operation and there were no indications of oscillations during that time. During the event, the plant demonstrated the ability to respond as designed to the reactor scram. Accordingly, this event posed no threat to the safety of the public or plant personnel.

Similar Events

There have been no similar events at WNP-2, in which the trip of an operating RRC pump required the manual scram of the reactor.

EIIS Information

Text Reference	EIIS Reference System	EIIS Reference Component
Reactor Recirculation System (RRC)	AD	
RRC-P-1A	AD-	P
Reactor Protection System (RPS)	IAB	
RRC Flow Control Valve		FCV
Reactor Feedwater System (RFW)	CHA	
LFMG		MG
Relay		RLY
Flow Recorder		FR
Breaker		BKR



LMFG SET "A" CONTROL AND INTERLOCK (PORTION)

FIGURE 1