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AUTH.NAME AUTHOR AFFILIATION
MACKAMAN,C.D. Washington Public Power Supply System
BAKER,J.W. Washington Public Power Supply System
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 93-002-00:on 930121,low RPV level reactor scram initiated by RPS in response to actual low water level condition.Caused by high thrust bearing wear trip of RFW Pump 1A turbine.Pressure reduction commenced.W/930222 ltr.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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

February 22, 1993
G02-93-039

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. 93-002

Transmitted herewith is Licensee Event Report No. 93-002 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/CDM/nw
Enclosure

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

IE22

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)

REACTOR SCRAM DUE TO LOW RPV LEVEL AS A RESULT OF LOSS OF REACTOR FEEDWATER PUMP CAUSED BY AN INADVERTENT ACTUATION OF THE DELUGE SYSTEM

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 1	2 1	9 3	9 3	-- 0 0 2	-- 0 0	0 1	2 0	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	20.402(b)	20.405(C)	X 50.73(a)(2)(iv)	77.71(b)
POWER LEVEL (10)	20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.73(c)
1 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
C. D. Mackaman, Compliance Engineer	AREA CODE 5 0 9 / 3 7 7 - 4 4 5 1

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)

On January 21, 1993, at 0948 hours, a low Reactor Pressure Vessel (RPV) level reactor scram was initiated by the Reactor Protection System (RPS) in response to an actual low water level condition. The low RPV level was caused by a "high thrust bearing wear" trip of the Reactor Feedwater (RFW) Pump 1A turbine. The trip signal was generated as a result of wetted vibration sensing circuitry caused by an inadvertent actuation of the RFW Pump Room "A" fire protection deluge system. The remaining RFW pump was unable to supply enough water to maintain RPV level above the reactor scram setpoint. This was due to the failure of the Reactor Recirculation (RRC) Pump Flow Control Valves to automatically reposition (runback) to reduce reactor power and steam flow to within the capacity of one RFW pump.

The immediate corrective action was prompt response by the Plant Operators to bring the plant to a safe shutdown condition in accordance with approved Plant Operating Procedures.

Three root causes for this event have been identified:

1. Personnel/work practices error causing the inadvertent actuation of the RFW Pump Room "A" fire protection deluge.

2. Management methods/work organization planning error in that there was no method in the painting pre-job planning process to provide the painters with precautionary information relating to sensitive equipment.

3. Plant equipment/design configuration and analysis error in that the RFW Pump Room fire protection manual discharge stations are not well suited for an industrial machinery environment.

This event posed no threat to the safety of the public or plant personnel.

Plant Conditions

Power Level - 100%
Plant Mode - 1 (Power)

Event Description

On January 21, 1993 at 0945 hours, the Plant Control Room Operators received a Reactor Feedwater Pump (RFW) Pump Room "A" fire protection deluge system actuation annunciator and several alarms relevant to the auto start of the fire pumps. At 0947 hours, the Control Room Operators received the RFW Pump 1A and 1B turbine vibration trouble annunciators, followed by the RFW Pump 1A and 1B turbine high thrust bearing wear annunciators.

At 09:47:57 hours, the RFW Pump 1A turbine tripped, and immediately, the Reactor Pressure Vessel (RPV) level decreased from +35 inches to +30 inches (Level 4). At which point, the Reactor Recirculation (RRC) System initiated an automatic RRC Flow Control Valve (FCV) Runback as designed. The "B" FCV repositioned to 26% open and the "A" FCV repositioned to 82% open. The setpoint for both valves was 20% open. The failure of the "A" and "B" Flow Control Valves to fully reposition caused reactor power and steam flow to remain significantly above the capacity of one operating RFW pump. As a result, the remaining RFW pump (1B) was unable to supply enough water to maintain RPV level above the reactor scram setpoint, and the RPS initiated an automatic Low RPV Level 3 (+13 inches) Reactor Scram at 09:48:20 hours.

Following the reactor scram, RPV level continued to decrease due to the normally encountered post scram level transient. The lowest RPV level reached was -19.4 inches at 09:48:55 hours. The main turbine tripped at 09:49:28 hours in response to the reactor scram, and immediately, RPV level began to rapidly recover due to the reduced steam flow and the continuous RFW Pump 1B feed supply. The RFW pump turbine controls could not respond quickly enough to prevent a RPV high level overshoot, and at 09:49:35 hours, the RFW Pump 1B turbine tripped on a RPV Level 8 (+54 inches) trip signal. The highest RPV level reached during the transient was +63 inches at 09:49:40 hours. All Control Rods fully inserted and no Safety Relief Valves were actuated during this event.

In accordance with 10CFR50.72(b)(2)(ii), this event was reported to the NRC Operations Center via the Emergency Notification System at 1034 on January 21, 1993, as an unplanned automatic actuation of the Reactor Protection System (RPS).

Immediate Corrective Actions

The immediate corrective action by the Plant Operators was to promptly enter Emergency Operating Procedure (EOP) 5.1.1, Reactor Pressure Vessel Power, Level, and Pressure Control, and initiate a Manual Scram (four seconds after the automatic low RPV level scram). Pressure reduction was commenced at approximately 8 psi/min in anticipation of utilizing the Condensate Booster Pumps for level control. Reactor Core Isolation Cooling (RCIC) was manually initiated to maintain RPV level in the normal range, and the plant was brought to a safe shutdown condition in accordance with Reactor Scram Recovery Procedure PPM 3.3.1.

Further Evaluation and Corrective Action

Further Evaluation

1. This event is being reported as an event that resulted in automatic actuation of the Reactor Protection System (RPS) in accordance with the requirements of 10CFR50.73(a)(2)(iv).

2. There were no structures, components, or systems inoperable prior to this event that contributed to the event.

3. The initial post scram investigation found that Supply System painters outside RFW Pump Room "A" had accidentally actuated a fire protection manual discharge station while preparing the area for painting. The discharge station actuation initiated the fire protection deluge system, which sprayed water on the RFW Pump turbine vibration monitoring cabinet. Water entered the cabinet causing the sensing circuitry to generate spurious RFW Pump turbine vibration trouble and high thrust bearing wear alarms, and finally, the high thrust bearing wear trip signal to the RFW Pump 1A turbine.

4. Troubleshooting of the RRC Flow Control Valves found that a "Servo Error" trip of both Hydraulic Pump Units for the valves caused the incomplete automatic valve runbacks. The "Servo Error" trip signals were generated as a result of slow valve responses and reduced velocity feedback signal gains. The cumulative negative effect being enough to prevent the feedback signals from properly tracking the velocity demand signals. When the signal differentials reached their setpoints, indicating valve position control failures, "Servo Error" signals were generated to shutdown the Hydraulic Pump Units.

Root Cause

Three root causes for this event have been identified:

1. Personnel/work practices error causing the inadvertent actuation of the RFW Pump Room "A" fire protection deluge system via the local manual discharge station. This initial root cause is considered by Supply System Management to be the primary cause of the chain of events that ultimately led to the reactor scram.

2. Management methods/work organization planning error in that there was no method in the painting pre-job planning process to identify sensitive system specific equipment and provide the painters with precautionary information relating to the equipment.

3. Plant equipment/design configuration and analysis error in that the RFW Pump Room fire protection manual discharge stations are of an older single action pull type not well suited for an industrial machinery environment. This type of pull station is designed for ease of manipulation (ie., schools, public buildings, etc.), making it vulnerable to inadvertent actuation when located where incidental contact is likely during machinery maintenance and inspections. WNP-2 has experienced inadvertent actuations of similar (alarm only) pull stations in the past.

Two contributing causes for this event have been identified:

1. The failure of system design reviews and analyses to anticipate the negative effects of component interactions following system design changes, modifications and maintenance. The combined negative effects of the component interactions caused the "Servo Error" trip of both Hydraulic Pump Units for the RRC Flow Control Valves, which resulted in incomplete automatic valve runbacks. The design changes, modifications and maintenance to the Flow Control Valves, Hydraulic Power Units, and the associated electronics in 1989 and 1990 resulted in slowed valve responses and reduced velocity feedback signal gains. The affected components were satisfactorily retested in accordance with Maintenance Work Request (MWR) post maintenance test requirements. However, the Flow Control Valve Runback system was not reviewed for the cumulative effects of the component work, or functionally tested as a system, since full runback conditions could not be simulated during plant shutdown.

2. The inability of the RFW pump vibration monitoring cabinet to protect the sensing circuitry from the fire protection deluge system water spray. Water entering the cabinet caused the sensing circuitry to generate a spurious high thrust bearing wear trip signal to the RFW Pump 1A turbine.

Further Corrective Action

1. Disciplinary action, including time off without pay, was taken against the painter who actuated the fire protection manual discharge station, his work partner and their supervisor. Completed February 5, 1993.

2. Conduct a "time out" session with the painters to re-emphasize the importance of constant vigilance when working around plant equipment. Completed January 25, 1993.

3. The RFW Pump vibration monitoring cabinet was inspected, dried out, cleaned, refurbished and tested with assistance from a manufacturer's representative called in for an independent system assessment. MWR AP2112 completed January 25, 1993.

4. Proper operation of the RFW pump and turbine thrust bearing wear sensing circuits was verified. MWR AP2113 completed January 26, 1993.

5. Velocity signal conditioning modules are located in the output circuits of the Flow Control Valve motion sensing Linear Variable Transformers to provide a velocity feedback signal output. The modules were readjusted and tested to produce the proper velocity feedback signal gains to track the velocity demand signals. MWR AP2142 completed January 29, 1993.

   NOTE: Supply System Management elected not to perform a runback test of the RRC Flow Control Valves since the test must be performed at full reactor power and could subject the plant to an undesirable transient. The runback control system is a commercial feature designed to enhance operational reliability, and not an engineered safety feature. Therefore, it is management's view that it would not be in the best interest of the plant to test a non-safety feature by potentially challenging safety features. However, the Supply System has the capability to evaluate system performance following future runback events. Furthermore, there was a significant amount of knowledge and information gained during the troubleshooting of the runback control system for this event. As a result, there is reasonable assurance that the post maintenance testing performed following completion of Corrective Action 5 (above) was adequate to ensure proper operation of the runback system.

6. Design, fabricate and install a temporary water shield for the RFW Pump vibration monitoring cabinet. MWR AP2167 completed January 26, 1993.

7. Procure and install permanent protective covers for the fire protection deluge system manual discharge stations located in RFW Pump Rooms A and B. This action to be completed by June 15, 1993.

8. Perform an evaluation to identify other systems and components important to plant operational reliability which are vulnerable to failure due to fire protection deluge system actuation. Provide recommendations for corrective action. This action to be completed by March 15, 1993.

9. Review the manual discharge stations located within the plant. Evaluate each station for proper mounting location and provide recommendations for either installation of permanent protective covers, or replacement with the 'new' dual action type station. This action to be completed by March 15, 1993.

10. Replace the temporary water shield for the RFW pump vibration monitoring cabinet with a permanent shield or vendor supplied weatherproof panels. This action to be completed by July 31, 1993.

11. Evaluate current administrative controls and work practices for painting inside the power block. This action to be completed by April 15, 1993.

12. Plant Procedure PPM 8.3.120, Recirculation Flow Control Valve - Alignment/Calibration, will be revised to include control system calibration and testing information gained during troubleshooting for this event. This action to be completed by April 15, 1993.

Safety Significance

The Plant Operators reacted correctly in conjunction with installed plant safety systems to promptly bring the plant to a safe shutdown condition. Although an actual RPV low level condition did exist for a short period, with vessel level decreasing to -19.4 inches, the transient was well within the bounds of WNP-2 safety analysis. A reactor scram was the appropriate plant response to an incomplete runback of the RRC Flow Control Valves during the loss of an RFW pump. In responding to the reactor scram, the plant satisfactorily demonstrated its ability to maintain adequate RPV water level under the resulting transient conditions. Accordingly, this event posed no threat to the safety of the public or plant personnel.

Similar Events

LER 89-031, "Reactor Scram Due to Low RPV Level as a Result of Loss of Reactor Feedwater Pump During Lube Oil Pump Surveillance Testing - Cause Indeterminate". The root cause of this event was indeterminate. However, a contributing factor for the reactor scram was identified as the inappropriate RRC Flow Control Valve Runback setpoint of 30% open. This setpoint maintained reactor power and steam flow above the capability of one RFW pump, causing RPV level to decrease, resulting in a Low RPV Level 3 reactor scram. The corrective action was to reduce the valve runback setpoint to 20% open. Since no Hydraulic Pump Units tripped, and runback appeared to function properly with the previous setpoint during the event, and during subsequent testing with the new setpoint, no further corrective action was identified. Apparently, the cumulative effects of later system work caused the current runback control system failure.

EIIS Information

Text Reference	EIIS Reference System	EIIS Reference Component
Reactor Pressure Vessel	AC	RPV
Reactor Recirculation System	AD	FU
Reactor Protection System	JC	---
Reactor Feedwater Pump Turbine 1A	SJ	TRB
Reactor Feedwater Pump Turbine 1B	SJ	TRB
Reactor Feedwater Turbine I&C System	JK	---
Reactor Feedwater Control System	JB	CAP
Reactor Recirculation Flow Control Valve	AD	FCV
Fire Protection System (Water)	KP	---