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SUBJECT: LER 89-005-00:on 890311,multiple control rod drifts caused by momentary low scram air header pressure due to trips..
W/8 ltr.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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

Docket No. 50-397

June 16, 1989

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

Subject: NUCLEAR PLANT NO. 2
LICENSEE EVENT REPORT NO. 89-005

Dear Sir:

Transmitted herewith is Licensee Event Report No. 89-005 for the WNP-2 Plant. This report is submitted as an informational LER and discusses the corrective actions taken, and actions taken to preclude recurrence.

Very truly yours,

C.M. Powers (M/D 927M)
WNP-2 Plant Manager

CMP:lg

Enclosure:
Licensee Event Report No. 89-005

cc: Mr. John B. Martin, NRC - Region V
Mr. C.J. Bosted, NRC Site (M/D 901A)
INPO Records Center - Atlanta, GA
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U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

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TITLE (4) Multiple Control Rod Drifts Caused by Momentary Low Scram Air Header Pressure Due to Multiple Rapid Half-Scram Trips and Resets

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 3	1 1	8 9	8 9	0 0 5	0 0	0 6	1 6	8 9		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)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)	0 7 8	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)	X 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)	Informational
		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
R.E. Fuller, Compliance Engineer	5 0 9 3 7 7 - 2 7 9 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
B	S B	M O N	G 0 8 0	Y					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	NO				

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

This is an informational LER.

On March 11, 1989, at 21:02 hours, 34 of the 185 control rods drifted inward from one to seven notches due to momentary low scram air header pressure. The low air header pressure occurred subsequent to a very rapid series of Reactor Protection System (RPS) half-scram trips and resets which occurred over a period of approximately 1 to 2 seconds. The cause was a cyclic failure in the Channel "B" Main Steam Line (MSL) radiation monitor (MS-RIS-610B) high-voltage low inoperable sensing circuit which occurred coincident with resetting (one operator action) the RPS half-scram condition.

The root causes of the rod drift event include: 1) a MSL radiation monitor design deficiency which failed to anticipate the effects of a cyclic failure, and 2) procedure direction was less than adequate in defining the actions required when the underlying cause of abnormal operation of a safety related device is indeterminate.

The immediate corrective actions to recover from the rod drift event included: 1) determine status of all control rods and verify no further drifting; 2) verify no thermal limit was being exceeded; 3) reduce fuel power below recommended fuel preconditioning limits; 4) reestablish the desired rod pattern; 5) trouble-shoot, rework, and test the MSL radiation monitor; and 6) restore reactor power to 78%.

Abstract (continued)

The corrective action to prevent recurrence is to perform a design review of the MSL radiation monitor drawer. Other corrective actions include: 1) Abnormal Response procedures will be evaluated for consistency during periodic reviews; 2) management policy relative to half-scram resets will be clarified and appropriate procedures revised; 3) multiple rod drift related procedures will be modified to provide consistent direction, and 4) multiple rod drift scenarios will be included in the operator training program.

There was no safety significance associated with this event. Calculations indicate that no thermal limit was exceeded. All safety systems were functional if necessary.

Plant Conditions

a) Power Level - 78%
b) Plant Mode - 1 (Power Operation)

Event Description

On March 11, 1989, at 21:02 hours 34 of the 185 control rods drifted inward from one to seven notches due to low scram air header pressure. The low air header pressure occurred subsequent to a very rapid series of Reactor Protection System (RPS) half-scram trips and resets which occurred over a period of approximately 1 to 2 seconds. The driving signal for the rapid RPS trips and resets was the Channel "B" Main Steam Line (MSL) Radiation Monitor (MS-RIS-610B) rapidly cycling in and out of the trip and reset-to-normal condition coincident with a single RPS reset action.

The MSL radiation monitor MS-RIS-610B is a Radiation Indicating Switch (RIS). An inoperable trip of this switch causes: 1) a Main Steam Isolation Valve (MSIV) half isolation trip on Channel "B"; 2) trip of the "B" Gland Steam Exhauster; and 3) a RPS Trip System "B" half-scram. This switch has automatic reset-to-normal capability when the incoming signal that causes the switch to trip returns to within the trip setpoints. However, the MSIV half isolation trip and RPS half-scram each require a manual reset. The "B" Gland Steam Exhauster trip is cleared with reset of the MSIV half isolation trip.

The same MSL radiation monitor had undergone a similar trip/reset-to-normal cycling a few hours earlier at 1813 hours. The Reactor Operator, within a few seconds of the RPS Trip System "B" half-scram trip, attempted to reset the half-scram. Operators subsequently heard the RPS relays (K14) cycle rapidly between the energized and deenergized state before the half-scram was reset-to-normal.

The MSL radiation monitor stabilized and Maintenance Technicians were requested to trouble-shoot the MSL radiation monitor drawer. Trouble-shooting activities were delayed since Technicians more knowledgeable on the radiation monitor instrumentation were due in at shift turnover, at approximately 22:30 hours.

At 21:01:47 a rapid series of trip/reset-to-normal cycles occurred, initiating another overall period of MSL radiation monitor inoperable instability. This overall period of instability lasted approximately 125 seconds until it was placed in "STANDBY", thus sealing in the inoperable trip.

There were six distinct periods within the event in which the MSL radiation monitor experienced rapid cycling and/or was stabilized in the tripped condition. It was during the first period of cycling that multiple control rod drift indications were observed. The control rod drift event is described as follows.

21:01:47.3 A RPS Trip System "B" half-scram occurred due to an inoperable trip on MS-RIS-610B. As a result, the 185 Control Rod Drive (CRD) scram air pilot valves (CRD-SPV-118), one on each Hydraulic Control Unit (HCU), moved to their scram position. This was the beginning the first period of the MS-RIS-610B instability.

The RPS scram contactor (K14 relay) de-energizes when the radiation monitor trips. The RPS reset pushbutton re-energizes the scram contactor when no trip signal exists. While the reset pushbutton is depressed, the tripping and resetting of the radiation monitor also cycles the scram contactor. Cycling of the scram contactor cycles the CRD scram air pilot valve (CRD-SPV-118) on each HCU. See Figure 1 for piping schematic of the scram pilot valves and the scram valves for one HCU in the normal operation configuration and Figure 2 for the RPS Trip System "B" half-scram configuration. Energizing the CRD-SPV-118 to the vent position vents a small portion of the instrument air piping between the scram air pilot valves (CRD-SPV-117 and CRD-SPV-118) to atmosphere. While the solenoid valve is rapidly changing position, a scram air header vent path is also established for a short time.

21:01:54 A scram air header high pressure alarm occurred.

NOTE: Historically, a high pressure alarm has occurred on the scram air header following a RPS Trip System "B" half-scram actuation. The high pressure response of the scram air header was attributed to air leaks in the HCUs, and regulator overshoot on a half-scram trip. This was concluded to have no effect on the rod drift event.

21:01:57.5 RPS Trip System "B" half-scram reset-to-normal was recorded. While the RPS reset pushbuttons were depressed for 1 to 2 seconds, the scram pilot valves cycled due to the radiation monitor drawer repeated trip and reset.

21:01:58.3 The high pressure scram air header alarm cleared and a low pressure alarm occurred. Between 21:01:57.5 and this point in time, a total of 13 trip/reset-to-normal cycles were recorded for MS-RIS-610B.

21:02:00.2 MS-RIS-610B reset-to-normal which was the end of the first period of rapid cycling. A total of 15 trip/reset-to-normal cycles were recorded since 21:01:57.5.

21:02:00.3 A rod drift alarm occurred at this time. The operator was aware that a rod drift alarm had occurred and saw several rod drift indications.

The MSL radiation monitor had five more periods of rapid cycling. The RPS Trip System "B" half-scram was reset-to-normal following each of the four periods. These later events did not affect the rod drift event or result in any additional rod drift events because the scram reset pushbuttons were not in the reset position during the MS-RIS-610B cycling.

21:02:04.3 The scram air header low pressure alarm cleared.

21:03:53.7 The MS-RIS-610B switch was placed in "standby", thus sealing in the inoperable trip.

Immediate Corrective Action

The following is a chronological description of the events and corrective actions immediately after placing the MS-RIS-610B switch in "STANDBY".

21:05 The Plant Operators reviewed the applicable procedures. Assessment of control rod status was begun by the Shift Technical Advisor.

21:08 The Shift Manager ordered a reduction in power from 78% to 75%. The Reactor Operator confirmed that a large number of rods were at incorrect positions.

21:15 Based on input from a Plant Nuclear Engineer, the Shift Manager ordered Plant power reduced 10%.

21:21 Reactor power was at 72.1%. A core performance monitor calculation was initiated at this point.

21:25 Reactor power was at 65.6%. A second core performance monitor calculation was initiated at this point.

21:30 The core performance calculation at the 72.1% power conditions was completed. Review of core performance edits indicated a wide margin to all thermal limits existed. Review of fuel preconditioning edits indicated 63 nodes had exceeded the fuel preconditioning envelope, up to a peak of 1.5 kw/ft.

21:35 The core performance calculation at the 65% power conditions was completed. Review of edits indicated there were only four nodes still over the preconditioning envelope, up to a peak of 0.67 kw/ft. Based upon further input from a Plant Nuclear Engineer, the Shift Manager ordered core power reduced to 35% to reestablish the rod pattern.

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22:30 Reactor power was at 47.3%. A core monitor performance analysis determined a wide margin (at least 16%) to all thermal limits existed throughout the event, and that the highest power node was 2.1 kw/ft above the fuel preconditioning envelope. There were no signs of fuel clad damage. Work had begun to recalibrate the high-voltage low inoperative setpoint of MS-RIS-610B.

22:45 Reactor power was at 36.5%. Plant Operators initiated restoration of the rod pattern..

22:54 MS-RIS-610B was returned to normal operation following recalibration.

23:47 Reactor power was at 36%. The appropriate control rod pattern for return to rated power was reestablished. Reactor power increase was started.

3-12-89

02:14 Reactor power was at 78%.

Further Evaluation and Corrective Actions

A. Further Evaluation

1. This event was determined to be nonreportable for the following reasons.

   a. There were no Technical Specification limits exceeded during or following the rod drift event.

   b. The rod drift event did not result in conditions that fell outside of the design basis or safety analysis envelope of the plant. The integrity of the plant safety barriers were not compromised or degraded.

   c. All safety systems were functional to perform their intended function in the event any would have been needed.

2. The cause of the Channel "B" MSL high radiation monitor indicating switch (MS-RIS-610B) was the "High Voltage Low" trip setpoint had drifted upward to equal the normal high voltage operating value. Since the logic circuit is a reset/set flip-flop, the condition "equal to" is indeterminate. Therefore, a high voltage just equal to the trip setpoint causes the rapid trip/reset-to-normal cycling to occur. A detailed review of other RPS trip inputs determined the possibility of this type of failure is less likely to happen from other similar input trips due to the design hysteresis of the trip logic, i.e., the dead band or the difference between the trip/reset-to-normal values is not zero.

The cause of the rod drift event was the rapid cycling of the RPS relays/solenoids during the period of time the RPS reset pushbuttons were depressed, thus allowing the scram air header (local effect only) to vent to atmosphere.

3. The root causes of the rod drift event include: 1) a design deficiency in that the MSL radiation monitor inoperable trip circuitry did not anticipate the trip/reset-to-normal cycling problem associated with voltages equal to the trip setpoints and 2) the Plant procedure lacked specific guidance regarding necessary actions to be taken when the underlying cause of abnormal operation of a safety related device is indeterminate.

   a. The problem was not anticipated in that the MSL radiation monitor inoperable trip is the only RPS trip signal in which the design values for trip and automatic reset are equal. Had the monitor been designed such that the trip/reset values were different, as is the case with the other monitors, e.g., intermediate range monitors, the rapid trip/reset-to-normal cycles would have been avoided.

   b. The Reactor Operator assessment and immediate response to the first inoperable trip of the radiation monitor was appropriate. Specifically, the cause or source of the trip was identified to be the MS-RIS-610B, the inoperable trip condition had cleared, the process variable indications were normal compared to redundant equipment, the trip circuitry was functional, and the RPS half-scram was able to be reset. Appropriate subsequent actions were taken by the Shift Manager which included initiating a Problem Evaluation Request (PER) per Plant procedures and requesting trouble-shooting for the underlying cause of the radiation monitor inoperable trip.

      When the second radiation monitor inoperable trip occurred, the underlying cause of the first trip had not been identified and corrected. The Reactor Operator response to the second trip was similar to the first and appropriate per the existing procedures. However, the Plant Abnormal Response procedures lacked specific guidance regarding appropriate response to subsequent abnormal operation of an inservice safety related device that has previously undergone abnormal operation and the underlying cause of the abnormality remains indeterminate.

4. The operational event was reviewed and analyzed to determine the best operational response to the event. It was determined that upon receipt of initial indication of any rod drift, the direction is to immediately reduce total core flow to 45% of rated within 30 seconds. This core flow represents a condition where even for extremely limiting control rod patterns, the power distribution would not violate either fuel thermal limits or fuel preconditioning guidelines. This was determined to provide acceptable compensation for the worst case event. If a complete loss of scram air header pressure is indicated, or if more than one control rod continues to drift in, direction is given to manually scram the reactor.

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5. The previous training on rod drift events involved only the inward drift of a single rod during simulated startups.

B. Further Corrective Action

1. Evaluate a design change of the MSL radiation monitor drawer which would preclude rapid trip/reset output signals from being generated.

2. Management has evaluated the current practice related to half-scram resets. Their expectations will be communicated to the Licensed Operators and appropriate procedures revised.

3. All Abnormal Response procedures will be evaluated during periodic reviews to minimize ambiguity and ensure consistency of direction.

4. All procedures related to multiple rod drifts have been identified and modified to provide consistent direction.

5. Multiple rod drift scenarios will be included in the licensed Operator simulator training program.

Safety Significance

There is no safety significance associated with this event. Calculations indicate that thermal limits were not exceeded. Calculations, performed for a reactor power of 100% at less than a half cycle core burnup with a worst case rod configuration, indicated that fuel power conditions might have reached or slightly exceeded Technical Specification thermal limits. Slightly exceeding thermal limits is not safety significant provided timely action is taken to restore the Plant to acceptable conditions. Technical Specification Safety Limits would not have been exceeded. For greater than half cycle burnups, no thermal limits would be exceeded. This event occurred near the end of the fuel cycle.

All safety systems were functional in the event cladding damage occurred. Had either immediate or latent cladding damage occurred, the Division I MSL radiation monitors were available to complete the RPS scram signal input if radiation levels exceeded trip setpoints. The MS-RIS-610B had been placed in "STANDBY", which sealed in a Division II half-scram. Also, Offgas System isolation capability was available to ensure against excessive radionuclide release to the environment in the unlikely event radiation levels exceeded preestablished setpoints from fuel failure. The administrative limits imposed by the WNP-2 Technical Specifications would also have prevented sustained plant operation at elevated radionuclide release rates. Therefore, this event posed no threat to the health and safety of the public or plant personnel.

Similar Events

None

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EIIS Information

Text Reference	EIIS Reference	
	System	Component
Instrument Air Supply (Control/Service Air System)	LD	---
Instrument Air Supply (Pressure Control Valve, CAS-PCV-2)	LD	PCV
Instrument Air Supply (Air Filter)	LD	FLT
Control Rod Drive System	AA	---
Control Rod Drive System (Scram Solenoid Pilot Valve, 185 each CRD-SPV-117)	AA	VTV
Control Rod Drive System (Scram Solenoid Pilot Valve, 185 each CRD-SPV-118)	AA	VTV
Control Rod Drive System (Scram Valve, 185 each CRD-V-126)	AA	LOV
Control Rod Drive System (Scram Valve, 185 each CRD-V-127)	AA	LOV
Main Steam System (Radiation Monitor, MSL-RIS-610B)	SB	MON
Offgas System	WF	---
Reactor Protection System	JC	---
Annunciator System	IB	---
Reactor Protection System	JC	---

*U.S. GPO: 1988-520-589 00070

NRC Form 366A
(9-83)

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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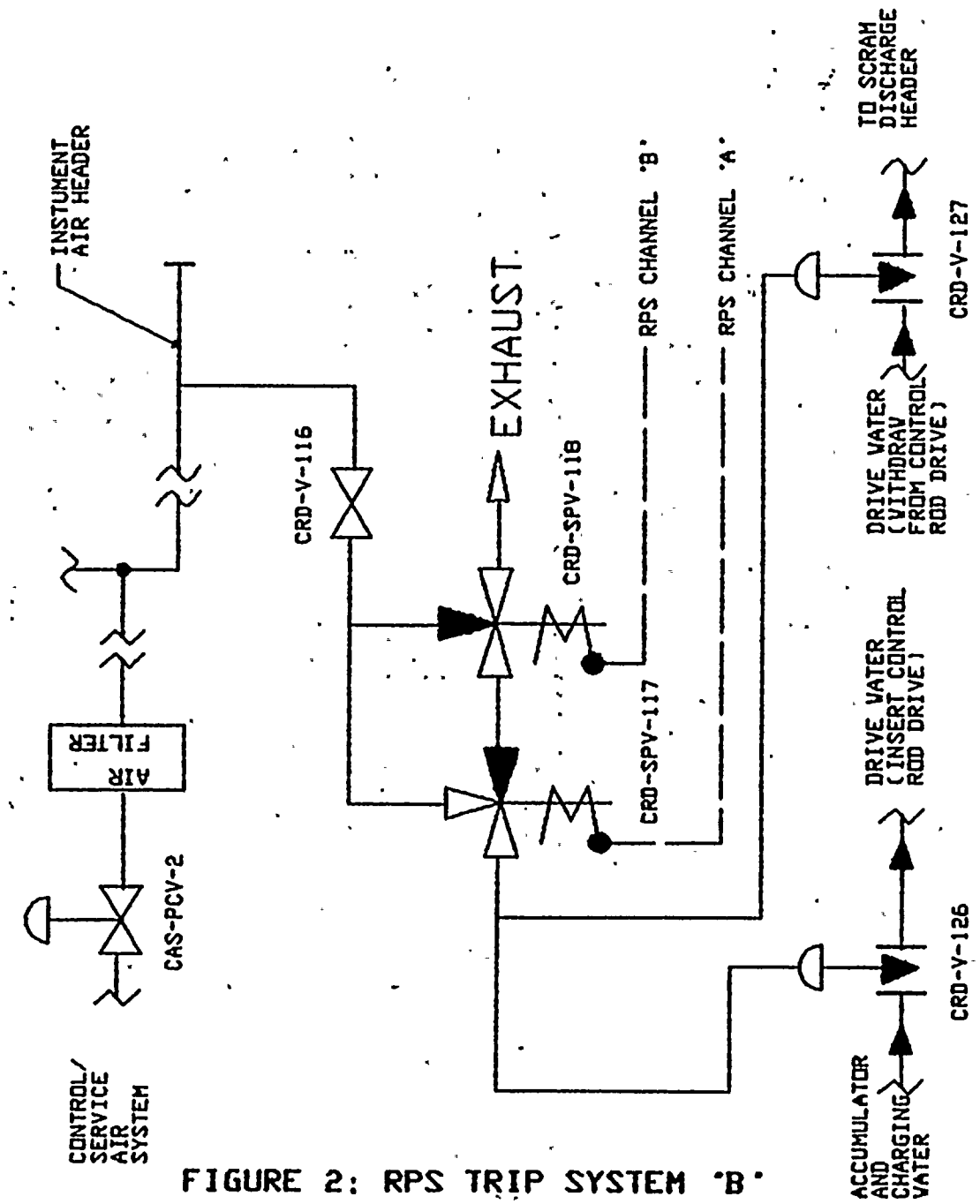

FIGURE 2: RPS TRIP SYSTEM "B" TRIP