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SUBJECT: LER 90-009-00:on 900430,ESF isolations & actuations due to
 loss of RPS bus during Mode 5 (refueling).

W/9 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

May 30, 1990

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

Subject: NUCLEAR PLANT NO. 2
LICENSEE EVENT REPORT NO. 90-009

Dear Sir:

Transmitted herewith is Licensee Event Report No. 90-009 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.

Very truly yours,

Smiley (for)

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

CMP:lg

Enclosure:
Licensee Event Report No. 90-009

cc: Mr. John B. Martin, NRC - Region V
Mr. C. J. Bosted, NRC Site (M/D 901A)
INPO Records Center - Atlanta, GA
Ms. Dottie Sherman, ANI
Mr. D. L. Williams, BPA (M/D 399)

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LICENSEE EVENT REPORT (LER)

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.

FACILITY NAME (1) Washington Nuclear Plant - Unit 2										DOCKET NUMBER (2) 0 5 0 0 0 3 1 9 7 1 OF 0 7										PAGE (3) 1 OF 0 7			
TITLE (4) Engineered Safety Feature (ESF) Isolations and Actuators Due to Loss of Reactor Protection System (RPS) Bus During Mode 5 (Refueling) - Cause Under Investigation																							
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	4	3	0	9	0	9	0	5	3	0	9	0	0 5 0 0 0					0 5 0 0 0					
OPERATING MODE (9) 5		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)																					
POWER LEVEL (10) 0 0 0		20.402(b)				20.405(c)				<input checked="" type="checkbox"/> 50.73(a)(2)(iv)				73.71(b)									
		20.406(a)(1)(i)				50.38(c)(1)				<input type="checkbox"/> 50.73(a)(2)(v)				73.71(c)									
		20.405(a)(1)(ii)				50.38(c)(2)				<input type="checkbox"/> 50.73(a)(2)(vii)				OTHER (Specify in Abstract below and in Text, NRC Form 366A1)									
		20.406(a)(1)(iii)				50.73(a)(2)(i)				<input type="checkbox"/> 50.73(a)(2)(viii)(A)													
		20.406(a)(1)(iv)				50.73(a)(2)(ii)				<input type="checkbox"/> 50.73(a)(2)(viii)(B)													
		20.406(a)(1)(v)				50.73(a)(2)(iii)				<input type="checkbox"/> 50.73(a)(2)(ix)													
LICENSEE CONTACT FOR THIS LER (12)												TELEPHONE NUMBER											
NAME R. C. Mertens, Compliance Engineer												AREA CODE 510 19 317 171-1 2131515											
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																							
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs													
B	JIC	BKIR	G 01812	Yes																			
SUPPLEMENTAL REPORT EXPECTED (14)												EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR							
<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)												<input type="checkbox"/> NO		111	310	910							

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

On April 30, 1990 at 1442 hours, an Electrical Protection Assembly (EPA) Breaker (RPS-EPA-3F) tripped causing a loss of power to Reactor Protection System (RPS) Bus B. Loss of power to RPS Bus B caused a half-scrum in RPS Division B and multiple primary and secondary containment isolations which are Engineered Safety Feature (ESF) actuations. At the time of the event the Plant was shutdown for the annual maintenance and refueling outage.

The loss of RPS B power causes Nuclear Steam Supply Shutoff System (NSSSS) Containment Inboard and Outboard Isolations for Groups 1,2,4,5,6 and 7. Plant Operators responded by restoring all systems, including Residual Heat Removal (RHR - Loop "A") Shutdown Cooling, to pre-event lineup status by 1503 hours.

A second spurious trip of RPS-EPA-3F was received at 1641 hours with subsequent loss of alternate power to RPS Bus B. This caused a second half-scrum, ESF actuations and isolations as before. Since the preparations to troubleshoot the EPA logic circuit board and breaker (initiated after the first breaker trip) were not complete, the -3F Breaker was reset and the various systems restored.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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.

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

At 1712 hours, a third spurious RPS-EPA-3F Breaker trip occurred. The Control Room Operator received the same alarms, valve actuations, and subsequent RHR pump trip. When attempts to reset the tripped breaker after a replacement logic circuit board card was installed were unsuccessful, the RPS-EPA-3F Breaker was declared inoperable. It was decided to establish alternate circulation/cooling using Reactor Recirculation and Fuel Pool Cooling. Alternate power was reestablished (using temporary 15 VDC to assure -3F Breaker reset) and RHR Shutdown Cooling was started for decay heat removal.

The cause of these events is still under investigation and a supplemental report will be issued by November 30, 1990.

There is no safety significance associated with this event. No actual plant conditions requiring the Engineered Safety Feature isolations and actuations existed, and all isolations and actuations occurred as designed.

Plant Conditions

- a) Power Level - 0%
- b) Plant Mode - 5 (Refueling)

Event Description

On April 30, 1990 at 1442 hours, an Electrical Protection Assembly (EPA) breaker (RPS-EPA-3F) tripped causing a loss of alternate power to Reactor Protection System (RPS) Bus B. The loss of power on RPS Bus B caused a half-scrum in RPS Division B and multiple primary and secondary containment isolations which are Engineered Safety Feature (ESF) actuations. At the time of the event, the Plant was shut down for the annual maintenance and refueling outage. Reactor water level was greater than 22 feet above the Reactor Vessel Flange.

The loss of RPS Bus B power causes Nuclear Steam Supply Shutoff System (NSSSS) Containment Inboard and Outboard Isolations for Groups 1 (Main Steam Line Drain Valves only), Group 2 (Reactor Water Sample Valves), Group 4 [Miscellaneous Balance of Plant (BOP) Floor Drain Radioactive System (FDR) Valves and Equipment Drain Radioactive System (EDR) Valves only], Group 5 [Residual Heat Removal (RHR) and Traversing In-Core Probe (TIP) Systems], Group 6 (RHR Shutdown Cooling), and Group 7 [Reactor Water Cleanup (RWCU) System]. At the time of the event, the RWCU System was out-of-service for maintenance. Also, RHR-V-9 (Inboard Containment Isolation Valve on RHR Shutdown Cooling supply) was open and inoperable due to maintenance activities.

RPS-EPA-3E and -3F Breakers are in series and upstream of the RPS Bus B. Since only the -3F overvoltage indicating light was 'On', a true overvoltage condition did not appear likely. Plant Operators deduced that the event resulted from an apparent spurious overvoltage trip of Breaker RPS-EPA-3F. The breaker was reset and the various systems that had actuated were restored. RHR Shutdown Cooling was restored at 1503 hours (SDC out-of-service for 21 minutes) and Plant operation in Mode 5 (Refueling) continued at 1530 hours.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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

Prior to this event and as part of the ongoing annual maintenance outage, modification of EPA Breakers RPS-EPA-3E and -3F was completed. The purpose of the change, which is being made to all six EPA Breakers (-3A through -3F), is to provide a more reliable RPS power source by installing GE's EPA Upgrade Kit. These changes have been developed to correct a number of problems associated with the RPS power transfer scheme:

- 1) Alternate power supply susceptibility to grid disturbances (LER 88-013).
- 2) Alternate power supply susceptibility to large in-house motor starts causing undervoltage EPA trips (LER 89-023).
- 3) EPA inherent design shortcomings documented in GE SIL No. 496.

RPS-EPA-3E and -3F were the first units to be upgraded. The undervoltage/over-voltage time delay settings had to be increased from .25 seconds to 2 seconds so the units could be calibrated. Since the -3E and -3F Breakers were the first units to be upgraded to reduce the past tripping problems, the first trip event raised concerns. It was decided by Plant Engineering to replace the new EPA Circuit Board and changeout preparations were initiated.

At 1641 hours, a second spurious trip of Electrical Protection Assembly Breaker RPS-EPA-3F was received with subsequent loss of alternate power to Reactor Protection System (RPS) Bus B. This caused another half-scam and the actuations and isolations discussed above. Since the circuit board changeout preparations were not yet complete, the breaker was reset and the actuated components realigned. With RPS Bus B repowered, Mode 5 operation resumed again at 1652 hours. RHR Shutdown Cooling was out-of-service for eleven minutes.

Shortly thereafter, at 1712 hours, a third trip of Breaker RPS-EPA-3F occurred which resulted in the same ESF actuations and isolations as before. Since the circuit board changeout preparations were now complete, the replacement logic board was installed. Upon completion of the installation, it was found that the breaker could not be reset. Consequently, at 1811 hours, Plant Operators started Reactor Recirculation Pump (RRC-P-1A) for reactor coolant circulation to ensure accurate monitoring of the reactor coolant temperature. Alternate decay heat removal was established using the Fuel Pool Cooling System.

At this point, RHR Shutdown Cooling had been out-of-service for 21 minutes and 11 minutes following the first and second trips respectively, and 59 minutes following the third trip. During the time the Reactor Recirculation Pump was on (from 1811 hours to 1915 hours), the average reactor cavity water temperature began to rise due to the mixing of the warmer fuel pool water (117°F at 1811 hours). This rise was minimal because only minor mixing occurred.

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

At 1905 hours, the RPS-EPA-3F unit was declared inoperable and the Technical Specification Action Statement (TSAS) 3.8.4.4.a was entered because only one of the two required RPS Electrical Power Monitoring channels was operable. The RPS-EPA-3F Breaker trip coil was connected to a temporary 15 VDC source so the breaker could be closed. At 1909 hours, RPS Bus B was repowered and RHR shutdown cooling through RHR was reestablished at 1919 hours.

It should be noted that after each of the RPS-EPA-3F breaker trips discussed above, TSAS 3.9.11.1, "Residual Heat Removal and Coolant Circulation", was entered and was then exited after each breaker reset and equipment realignment.

Immediate Corrective Action

The immediate corrective actions taken for each breaker trip are included in the Event Description above and were as follows:

1. After the first-3F Breaker trip and ESF actuations and isolations (1442 hours) the breaker was reset and the various systems realigned, including RHR Shutdown Cooling. Actions were initiated to replace the new circuit logic board.
2. Following the second -3F Breaker trip (1641 hours), Plant Operators responded by restoring all systems, including RHR Shutdown Cooling, to pre-trip lineup status.
3. Immediately after the third -3F Breaker trip (1712 hours), the replacement circuit board work package was initiated and the logic circuit board was changed out. The RPS-EPA-3F unit was declared inoperable when the circuit breaker would not reset and TSAS 3.8.4.4.a was entered. Alternate decay heat removal was established using RRC and Fuel Pool Cooling.
4. Subsequently, RPS Bus B alternate power was restored using temporary 15 VDC power to the -3F Breaker. This enabled the breaker to reset and the actuated systems were realigned. Decay heat removal using RHR Shutdown Cooling was reestablished at 1919 hours.

Further Evaluation and Corrective ActionA. Further Evaluation

This event is reportable under 10CFR 50.73(a)(2)(iv) as "an event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)".

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 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.

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

There were no systems, structures or components out-of-service prior to the event that affected these events. Residual Heat Removal Inboard Containment Isolation Valve RHR-V-9 was deenergized in the Open position prior to this event. If this valve had been operable, it would have closed on loss of RPS Bus B power. The closure of either RHR-V-9 or RHR-V-8 results in isolation of the RHR Shutdown Cooling supply path.

As noted in the "Further Corrective Action" section of this report, the cause of the events has not, as yet, been determined. The results of evaluations conducted thus far are discussed below.

The RPS-EPA-3F Circuit Board that was removed was returned to GE Nuclear Energy (San Jose, CA) for failure analysis. GE subsequently reported that this board and other GE boards were found to have time delay/frequency anomalies. Based on these anomalies, GE implemented a circuit board design change. As a result, the WNP-2 circuit boards in the GE upgrade kits for RPS-EPA-3A through -3F are being modified.

The problem encountered with resetting the RPS-EPA-3F Breaker after the third trip was intermittent operation of the 12 VDC supplied by the new circuit board to the undervoltage restraint (UVR) coil. Further checks showed that the breaker could be closed with 15 VDC, which was the voltage supplied to the UVR coil by the old, premodification circuit board. Plant Engineering decided to repower RPS Bus B by using temporary 15 VDC power to the -3F Breaker at 1905 hours.

As part of the annual outage effort, work on SM-8 was completed on May 1, 1990. RPS Bus B was returned to normal power through Motor Generator Set RPS-MG-B. With the alternate power supply no longer required, TSAS 3.8.4.4.a was exited at 2135 hours. Following removal of RPS-EPA-3F from service, a new circuit breaker was installed because of the intermittent operation encountered with the existing breaker. Both the logic circuit board and new circuit breaker were calibrated and functionally tested. No problems were encountered and RPS-EPA-3F was returned to operable status.

B. Further Corrective Action

1. After the third event, RPS-EPA-3F Breaker components were replaced as follows:
 - a. A new circuit board from another GE Upgrade Kit was installed.
 - b. A new circuit breaker was installed.
 - c. The system was calibrated and the RPS-EPA-3F Breaker was declared operable.
2. The circuit boards from RPS-EPA-3A through -3F will be modified to the revised GE design prior to proceeding with the EPA upgrade work (-3B and -3D have already been modified and installed).

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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Washington Nuclear Plant - Unit 2

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TEXT (If more space is required, use additional NRC Form 365A's) (17)

3. Concurrent with the installation of the modified circuit boards, new circuit breakers will be installed in RPS-EPA-3A through -3F (-3B and -3D have already been installed).
4. It is planned to ship the EPA Circuit Breakers that are removed to GE-Schenectady, NY for failure analysis.
5. The reportability of this event under 10CFR Part 21, "Reporting of Defects and Noncompliance", is under evaluation. A letter was sent to GE Nuclear Energy (San Jose, CA) on May 25, 1990 requesting their 10CFR Part 21 evaluation.
6. The root cause investigation and circuit board/breaker analyses will continue. The results will be reported in a Supplemental Report to be issued by November 30, 1990.

Safety Significance

There is no safety significance associated with this event because no Plant condition requiring the ESF isolations and actuations existed, and all ESF acutations occurred as designed and for the plant in Maintenance outage status.

It is believed that there is no safety significance associated with the RPS-EPA-3F Breaker trips because they were spurious and in the safe direction. The RPS EPA safety function is to protect RPS from power line transients, therefore, tripping a breaker is a planned safety action. RPS-EPA-3E is upstream of the -3F Breaker and also should have tripped during these events if a real trip condition existed. Both EPAs 3E and 3F successfully passed Technical Specification surveillance tests prior to these events. Further, in 1987, a study showed these power lines to be stable. Therefore, at this time, it is believed that the EPAs would have properly responded to a real trip condition. The final safety significance determination will be included in the supplemental LER.

Also, there is no safety significance associated with the loss of RHR Shutdown Cooling. Loss of RPS Bus B causes the inboard and outboard RHR SDC Isolation Valves RHR-V-8 and RHR-V-9 to close, while loss of RPS Bus A causes only outboard valve RHR-V-8 to close. Either valve closing causes a loss of shutdown cooling. Plant Technical Specifications require either one or two RHR Shutdown Cooling loops to be available and in operation during Operational Modes 4 and 5. In addition, if the technical specification requirement for RHR Shutdown cooling cannot be met, an alternate method of Reactor Core Circulation and Cooling must be established.

There are numerous ways that alternate shutdown cooling can be established at WNP-2. For this event, the Fuel Pool Cooling System was used. The loss of RHR Shutdown Cooling due to the isolation of the RHR Shutdown Cooling Containment Isolation Valves does not create a significant safety hazard.

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TEXT (If more space is required, use additional NRC Form 368A's) (17)

Similar Events

Three previous similar events have occurred at WNP-2.

- o LER 85-025-01, "Engineered Safety Feature Isolations and Actuations Caused by Reactor Protection System Equipment Failure", documented a loss of the RPS Bus A which was attributed to failure of the RPS-EPA-3A circuit breaker under-voltage relay coil.
- o LER 86-011-00, "Nuclear Steam Supply Shutoff System Actuation due to Momentary Loss of Instrument Power", documented a momentary loss of power to RPS Bus B. The cause of this event was not able to be determined.
- o LER 89-021, "Engineered Safety Feature (ESF) Isolations and Actuations Due to a Reactor Protection System (RPS) Electrical Protection Assembly (EPA) Breaker Trip", documented loss of power to RPS Bus B. The cause of the event was not conclusive and is unknown.

EIIS InformationText ReferenceEIIS Reference

Electrical Protection Assembly (EPA) Breaker RPS-EPA-3F
Reactor Protection System (RPS)
RPS Bus B
Nuclear Steam Supply Shutoff System (NSSSS)
Residual Heat Removal (RHR) System
Reactor Recirculation (RRC) System
Fuel Pool Cooling (FPC) System
Pump RRC-P-1A
Reactor Vessel (RPV) Flange
Main Steam Line (MS) Drain Valves
Reactor Water Sample Valves
Floor Drain Radioactive (FDR) System Valves
Equipment Drain Radioactive (EDR) System Valves
Traversing Incore Probe (TIP) System
Reactor Water Cleanup (RWC) System
Valve RHR-V-9
Breakers RPS-EPA-3A through -3E
Valve RHR-V-8
Critical Bus SM-8
RPS Motor Generator Set RPS-MG-1B.

System	Component
JC	BKR
JC	---
JC	BU
BD	---
BD	---
AD	---
DA	---
AD	P
AC	RPV
SN	LOV
AD	SMV
BD	LOV
BD	LOV
IG	---
CE	---
BD	ISO
JC	BKR
BD	ISO
EB	BU
EB	MG