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SUBJECT: LER 89-043-01:on 891121,HPCS sys immediately declared inoperable.Caused by equipment failure.Failure analysis & determination of root cause of HPCS-V-23 failure performed & HPCS operability surveillance revised.W/910515 ltr.

DISTRIBUTION CODE: IE22T COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 7
 TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

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G02-91-099

Docket No. 50-397

May 15, 1991

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

Subject: NUCLEAR PLANT NO. 2
LICENSEE EVENT REPORT NO. 89-043-01

Dear Sir:

Transmitted herewith is Licensee Event Report No. 89-043 Revision 1 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.

This supplement provides final root cause information.

Very truly yours,

J. W. Baker for
J. W. Baker (M/D 927M)
WNP-2 Plant Manager

JWB:ac

Enclosure:
Licensee Event Report No. 89-043-01

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)

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PAGE (3)

TITLE (4)

INOPERABILITY OF THE HIGH PRESSURE CORE SPRAY SYSTEM CAUSED BY EQUIPMENT FAILURE

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)							
1	1	2	1	8	9	8	9	0	4	3	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)															
POWER LEVEL (10)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)															
1		20.402(b)															
1		20.405(a)(1)(i)															
1		20.405(a)(1)(ii)															
1		20.405(a)(1)(iii)															
1		20.405(a)(1)(iv)															
1		20.405(a)(1)(v)															
1		20.405(a)(1)(vi)															
1		20.405(a)(1)(vii)															
1		20.405(a)(1)(viii)															
1		20.405(a)(1)(ix)															
1		20.405(a)(1)(x)															
1		20.405(a)(1)(xi)															
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1		20.405(a)(1)(xx)															

LICENSEE CONTACT FOR THIS LER (12)

NAME

M. P. Reis, Compliance Engineer

TELEPHONE NUMBER

AREA CODE

510 9 317 171-12131815

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
X	B	G	V A	3191	NO				

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

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

At 0524 hours on November 21, 1989, during performance of the High Pressure Core Spray (HPCS) system operability surveillance test, the HPCS minimum flow valve (HPCS-V-12) apparently would not open properly to maintain minimum flow through the pump when system flow was secured. The HPCS system was immediately declared inoperable and troubleshooting was initiated by the Plant operations staff. Initial troubleshooting showed that HPCS-V-12 was not malfunctioning. The problem was isolated to HPCS-V-23, the test return valve to the suppression pool. It was found to be approximately ten percent open. This allowed sufficient flow to cause HPCS-V-12 to close. The LCO Action requirement of technical specification 3.5.1 was imposed until the return of the HPCS system to operable status.

At 2150 hours that evening, as a result of continued troubleshooting efforts, the test return valve to the Suppression Pool (HPCS-V-23), was found to be approximately 10 percent open, even though it was indicating closed in the control room. After attempts to manually close the valve failed, the manual block valve for the test return line (HPCS-V-64) was closed to isolate the faulty valve. At 2230 hours, after successful completion of the system operability surveillance, the HPCS system was declared operable.

Initially the cause of this event was thought to be equipment failure since HPCS-V-23, the test return line isolation to the Suppression Pool, was not able to be closed by motor operator or by hand to prevent undesired diversion of system flow from the injection path. A failure analysis of HPCS-V-23 was performed after

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.

FACILITY NAME (1) Washington Nuclear Plant - Unit 2	DOCKET NUMBER (2) 0 5 0 0 0 3 9 7 8 9 - 0 4 3 - 0 1 0 2 OF 0 6	LER NUMBER (6)			PAGE (3)		
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TEXT (If more space is required, use additional NRC Form 368A's) (17)

Abstract (contd.)

disassembly and repair of the valve during the R5 outage and showed no internal damage or obstruction. The root cause was indeterminate. There is no safety significance associated with this event. Because HPCS is a "single train" system, its inoperability is reportable, even though at all times during the event the requirements of the WNP-2 Technical Specifications were complied with to maintain the plant within its design basis. The actions of the plant operators were prompt and correct. This event posed no threat to the health and safety of the public or plant personnel.

On October 23, 1990, during the performance of the HPCS operability surveillance test, HPCS-V-23 again indicated closed while HPCS-V-12 failed to open. This event is described in LER-90-025. A subsequent root cause analysis confirmed that HPCS-V-23 did not fully close, during system testing, due to premature torque switch actuation. The investigation also revealed the valve would not close further in the November 1989 event because the valve was already fully closed. When the HPCS pump was secured and the differential pressure relaxed, HPCS-V-23 had enough applied stem thrust to mechanically fully close the valve. Premature torque switch actuation is considered the root cause of both the 1989 and 1990 events.

Corrective actions include:

- 1) Resetting HPCS-V-23 torque switches to ensure closure under all conditions.
- 2) Review of design practices to ensure similar cases are identified and corrected.

Plant Conditions

- a) Power Level - 100%
- b) Plant Mode - 1

Event Description

At 0524 hours on November 21, 1989, during performance of the High Pressure Core Spray (HPCS) system operability surveillance test, the HPCS minimum flow valve (HPCS-V-12) apparently would not open to properly maintain minimum flow through the HPCS pump (HPCS-P-1) when system flow was secured. The HPCS system was immediately declared inoperable and troubleshooting was initiated by the Plant operations staff. Initial troubleshooting was not able to discover the exact reason for the fault. Observed symptoms suggested that the flow indicating switch (HPCS-FIS-6) for the system flow input to the minimum flow valve control circuit might be faulty. At 0910 hours the NRC Bethesda Operations Center was notified that the HPCS system was inoperable under the requirements of 10CFR50.72(b)(2)(iii) as a non-emergency four hour reportable event.



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LICENSEE EVENT REPORT
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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At approximately 1300 hours, troubleshooting of the HPCS system showed that the minimum flow valve (HPCS-V-12) functioned correctly and that the system was able to meet the design requirements for flow through the Condensate Storage Tank (CST) test return line (CST to CST flowpath). At 2150 hours that evening, as a result of continued troubleshooting efforts, the test return valve to the Suppression Pool (HPCS-V-23), appeared to be approximately 10 percent open. The valve, in fact, indicated closed in the control room. After attempts to close the valve with the motor operator and manual operator failed, the manual block valve for the test return line (HPCS-V-64) was closed to isolate the faulty valve from the remainder of the system. The attempts to manually close the valve failed because, in the absence of the differential pressure due to the pump operation, HPCS-V-23 had enough applied stem thrust to mechanically drive the valve fully closed. At 2230 hours, after successful completion of the system operability surveillance, the HPCS system was declared operable.

Immediate Corrective Action

Plant operators responded in a timely manner to follow the requirements of plant procedures and technical specifications. They initially identified the condition, applied the restrictions of the LCO Action requirement of technical specification 3.5.1 and then followed up with appropriate action to obtain resolution. Initially, the problem manifested itself as failure of the minimum flow valve to open when system flow was apparently secured. In fact, flow through the pump was just above the required value for minimum flow, most probably due to the pathway provided by HPCS-V-23 not being completely closed. Flow was just sufficient to pick up flow switch HPCS-FIS-6, thus preventing the minimum flow valve from opening. Subsequent troubleshooting verified that the minimum flow valve, HPCS-V-12, and its associated flow indicating switch and controls were operating correctly. The problem was then localized to the failure of HPCS-V-23 to completely close after it was discovered that the motor operator had stopped at the 90 percent closed position as a result of torque switch actuation.

Further Evaluation and Corrective ActionA. Further Evaluation

1. The original event was reported per the requirement of 10CFR50.73(a)(2)(v) as a "condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to: (A) Shut down the reactor and maintain it in a safe shutdown condition; (B) Remove residual heat; (C) Control the release of radioactive material; or (D) Mitigate the consequences of an accident." The inoperability of the HPCS system is a unique event at WNP-2. Unlike the other Emergency Core Cooling Systems, HPCS system inoperability is reportable even though all requirements of technical specification LCO action statements are being complied with. This is so because it is a "single train" Emergency Core Cooling System and, as such, is reportable any time it is unable to perform its safety function when it is required to be able to do so by plant conditions.

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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2. The preliminary cause of this event was thought to be equipment failure since HPCS-V-23 the test return line isolation to the Suppression Pool, was not able to be closed to prevent undesired diversion of system flow. The valve was initially unable to be closed either with the motor operator or by hand. The root cause of this event had not been determined due to the need to disassemble HPCS-V-23 in order to complete the investigation.

Technical evaluation by plant staff and communication with the valve manufacturer, Anchor-Darling Company, indicated that the cause of the failure could have been vibration induced loosening of the disk nut. This type of failure would allow the valve disk to become misaligned with the disk guides/valve seat area and possibly result in the failure of the valve to attain the completely closed position. Similar failures of this type of valve have apparently occurred at other plants which exhibited the same types of symptoms.

3. During the R5 Refueling Outage (5/90), HPCS-V-23 was disassembled and inspected. All mechanical parts were found satisfactory and no obstruction was present. At the end of the outage, the root cause investigation was completed and, based on available information, the root cause was concluded to be indeterminate.
4. After the event was repeated on October 23, 1990, another root cause analysis was performed. A Motor Operated Valve Analysis and Test System (MOVATS) diagnostic test of HPCS-V-23 under dynamic conditions confirmed that the valve did not close fully due to the premature torque switch actuation. Investigation revealed that the test conditions are more severe than the design requirements.

It was determined the root cause of the event was the less than adequate design specification, in that the calculation that determined the minimum required thrust for HPCS-V-23 did not consider differential pressure at surveillance test conditions.

B. Further Corrective Action

1. The failure analysis and determination of the root cause of the HPCS-V-23 failure was performed after completion of disassembly and repair of the valve during the Spring 1990 Refueling and Maintenance outage.
2. HPCS-V-23 thrust was recalculated and torque switches reset to ensure proper closure under both test and accident conditions.
3. A note was added to the MOV Master Data Sheet for HPCS-V-23 to state "This valve is routinely tested at higher differential pressure than the design differential pressure."

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 60.0 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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4. The HPCS operability surveillance procedure will be revised to verify HPCS-V-12 opens when HPCS-V-23 closes and to record the flow rate when HPCS-V-23 is stroked closed against differential pressure.
5. Valve thrust calculations based on test data will be reviewed to determine if operations differential pressures exceed design basis assumptions.
6. The design differential pressure calculation process will be revised to require valves be identified, whose surveillance conditions are more severe than their design differential pressure conditions.

Safety Significance

There is no safety significance associated with this event. Since subsequent analysis demonstrated that HPCS-V-23 fully closed after test condition differential pressures were removed, the HPCS function was not actually impaired. (The valve is assumed to be closed during HPCS injection.) The valve completed its full closure when returning the system to standby alignment. A demand for HPCS injection during test conditions would have reduced the differential pressure across the valve by providing an alternate flow path. The reduced differential would most probably have allowed the valve to fully close, directing all HPCS flow to the reactor vessel.

Failure of the HPCS system is within the bounds of the ECCS single failure criteria assumed in the FSAR safety analyses and does not prevent the ECCS from performing its safety function in response to a DBA.

At all times during the event, the requirements of the WNP-2 Technical Specifications (Section 3.5.1) were complied with. The LCO action for this section requires ensuring the operability of the redundant ECCS Divisions 1 and 2 and the Reactor Core Isolation Cooling system while the HPCS system is inoperable (a maximum of 14 days is allowed). The entire period of inoperability was less than one day. The actions of the plant operators were prompt and correct to ensure the plant was maintained within the bounds of the technical specifications and therefore within the bounds of the operational safety analysis. Since no safety significance is associated with this event, it posed no threat to the health and safety of the public or plant personnel.

Similar Events

There are four instances of HPCS system inoperability that were evaluated as similar to this LER. LER 84-030 "Unscheduled Lockout of the High Pressure Core Spray Diesel Generator (HPCS-DG)" documented an event during which a technician inadvertently locked out the HPCS Diesel Generator during surveillance activity by incorrect placement of an electrical jumper. The corrective action consisted of revising the procedure to add a caution note and to designate the proper contacts to be jumpered.

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LER 85-022 "HPCS System Inoperable" documented an event during which plant personnel inadvertently disconnected system initiation logic while repairing two sheared off HPCS initiation status lamp sockets. Corrective action consisted of notifying plant operations, maintenance and technical personnel to place additional reliance on electrical wiring diagrams, connection diagrams and approved vendor manuals when appropriate.

LER 89-030 "High Pressure Core Spray System Inoperable Caused by Suppression Pool Pump Suction Valve Failure Due to Motor Operator Manufacturing Error" documented an event during which the HPCS system was declared inoperable due to failure of the suppression pool pump suction valve motor operator during performance of the operability surveillance. The corrective actions associated with this LER consisted of: checking other valve motor operators during the next refueling outage, revising the plant maintenance procedures to add instructions for inspection of the motor operators, adding precautions to plant procedures regarding disposition of valves found difficult to operate, and initiation of a 10CFR21 report.

LER 90-025 "Inoperability of the High Pressure Core Spray System Caused by Equipment Failure" documented an event in which the HPCS-V-23 failed to fully close and HPCS-V-12 failed to open during the surveillance testing of HPCS. Because the events were so similar, the corrective actions are essentially the same.

EIIS InformationText Reference

HPCS System
HPCS-V-12
HPCS-V-23
HPCS-P-1
HPCS-FIS-6
Suppression Pool
HPCS-V-64
ECCS Division 1
ECCS Division 2
RCIC System
Condensate Storage Tank

EIIS Reference

<u>System</u>	<u>Component</u>
BG	---
BG	V
BG	V
BG	P
BG	FIS
BT	---
BG	V
BM	---
BM	---
BM	---
KA	TK