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VPNPD-96-032

May 21, 1996

Document Control Desk
US NUCLEAR REGULATORY COMMISSION
Mail Station P1-137
Washington, DC 20555

Gentlemen:

DOCKET 50-266
LICENSEE EVENT REPORT 96-002-00
AUXILIARY FEEDWATER PUMP DISCHARGE VALVES
FOUND SHUT WHEN CRITICAL
POINT BEACH NUCLEAR PLANT, UNIT 1

Enclosed is Licensee Event Report 96-002-00 for Point Beach Nuclear Plant, Unit 1. This report is provided in accordance with 10 CFR 50.73(a)(2)(i)(B), "any operation or condition prohibited by the plant's Technical Specifications". This report describes an event where the plant was taken critical with the turbine-driven auxiliary feedwater pump 1P-29 discharge valves closed.

If you require additional information, please contact us.

Sincerely,

for

Bob Link
Vice President
Nuclear Power

GDA

Enclosure

cc: NRC Resident Inspector
NRC Regional Administrator

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1/1

NRC FORM 366 (4-95) | US NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB NO. 3150-0104 EXPIRES 04/30/98

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), US NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

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TITLE (4)
Auxiliary Feedwater Pump Discharge Valves Found Shut When Critical

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 NAME	DOCKET NUMBER
										05000
4	22	96	96	-- 002 --	00	05	21	96	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)	0		20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
			20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		or in NRC Form 366A

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Glenn Adams, Licensing Engineer	(414) 221-4691

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 (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On April 22, 1996, with the Unit 1 reactor critical above 350°F, the 1P-29 steam-driven auxiliary feedwater (AFW) pump discharge motor-operated valves (1AF-4000 and 1AF-4001) were discovered shut. These valves were required to be in the throttled open position in this plant condition to ensure the operability of the steam-driven AFW pump flow path to automatically respond to AFW actuation signals. The valves had been verified to be in the throttled position during valve lineups done prior to criticality, but were later shut during post-maintenance testing. The valves were not restored to the throttled position upon completion of the post-maintenance testing. A control operator trainee discovered the valves shut approximately 3 hours after the reactor reached criticality. Upon discovery, the valves were immediately repositioned to the throttled position. The valves could have been opened from the control room in response to any auxiliary feedwater demand that may have occurred during the period in which they were shut.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Event Description:

During the Unit 1 refueling outage (U1R23), corrective maintenance was performed on the turbine-driver of auxiliary feedwater (AFW) pump 1P-29. The associated work order required a combination of special post-maintenance tests and routine inservice tests (ITs) prior to restoring the pump to service.

The maintenance work order specified that post-maintenance testing would consist of a hot fast start, cold fast start, and another hot fast start with the pump discharging to the minimum recirculation line for each test. These special post-maintenance tests were to be followed by the routine system operability tests described by IT-290B (an overspeed test of a decoupled pump) and IT-08A (a fast cold start test with full flow to the steam generators). However, during a planning meeting, the testing process was revised to better integrate with the routine tests planned for the pending startup. In particular, the testing plan was revised to consist of IT-290B, followed by the special hot fast start, then IT-08A. In this plan, credit for the cold fast start would be taken by completion of IT-08A, and the second hot fast start was canceled with the concurrence of the test engineer.

Checklist 13E Part 1 was completed prior to initiation of the post-maintenance testing and valves were verified to be properly aligned. Operations Checklist CL-1A, "Criticality Checklist" was also performed to verify that all four AFW pumps and associated flow paths and essential instrumentation were properly aligned for criticality. Similarly, CL-1D, "Heatup", was performed to verify that the associated AFW pumps were available to the unit being started. CL-1D includes the documented caveat that it is necessary to perform some turbine-driven AFW pump operability testing under LCO (Limited Conditions for Operation) periods during the startup. Neither Checklist 1A nor 1D specifically identifies the required position of the turbine-driven AFW pump 1P-29 discharge motor-operated valves (1AF-4000 and 1AF-4001).

Until the time that post-maintenance testing was started, Operations personnel considered the AFW system to be operable, with final verification for operability to be completed at-power. Routinely, an inservice test (IT-08A) to confirm AFW pump and flowpath operability (TS Table 15.4.1.1 Item 20 requires flow path operability verification prior to 2% power for shutdown periods exceeding 30 days) is performed within 24 hours of power operation (defined in Technical Specifications as >2% of rated power). The provision for this sequence is provided in Technical Specifications 15.4.8.1.b.

At 0834 on April 21, while the reactor was subcritical, the post-maintenance testing was started with the performance of IT-290B, "Overspeed Test Turbine Driven Auxiliary Feedwater Pump, Refueling Interval". Just prior to decoupling the pump for this test, discharge

MOVs 1AF-4000 and 1AF-4001 were shut in accordance with the procedure. The next Operations shift completed IT-290B; restoring the AFW System at the "direction of the Duty Shift Superintendent" (DSS). The discharge MOVs were left in the shut position. At this time the pump 1P-29 was returned to service. The DSS logged the pump as returned to service, but the control operator was not informed of that change in status. During the subsequent shift turnover, the Unit 1 control operator informed the relief operator that the 1P-29 pump was out-of-service.

During the next Operations shift, the special post-maintenance testing (PMT) of the work order was started. This test included the hot fast start of the 1P-29 pump. While aligning for the test at 0258 hours on April 22, the discharge MOVs were found shut and left shut to conduct the test procedure. The hot fast start was completed at approximately 0530 hours on April 22. The discharge MOVs were left shut at the conclusion of this test. No specific system restoration requirements had been specified in the work order test procedure.

Approximately 13 hours after completion of the special PMT, Unit 1 reached criticality at 1820 hours on April 22. As prescribed in Technical Specification 15.3.4.A.2.a for 2-unit operation, the unit may not be taken critical unless all four auxiliary feedwater pumps, together with their associated flowpaths and essential instrumentation are operable. Contrary to that specification, the 1P-29 flow path was not aligned; discharge valves 1AF-4000 and 1AF-4001 remained shut. At 2115 hours, a control operator trainee observed and questioned the shut position indication of the 1P-29 discharge MOVs. At this time, the MOVs were repositioned to their throttled open position per Operations Checklist CL-13E Part 1. The Duty and Call Superintendent (DCS) and Duty Technical Adviser (DTA) were informed and it was determined that there were no immediate reporting requirements. Although the 1P-29 pump was operable for automatic operation, its flow paths were not aligned for automatic operation. In the event of an accident or reactor trip, operator action from the control room would have been required to open the valves and provide flow to the Unit 1 steam generators if the electrically-driven auxiliary feedwater pumps failed to deliver sufficient flow to maintain adequate steam generator levels.

Component and System Description:

As described in the PBNP FSAR, the Auxiliary Feedwater System supplies high-pressure feedwater to the steam generators to maintain a water inventory for removal of heat energy from the reactor coolant system by secondary side steam release in the event of inoperability of the main feedwater system. Redundant supplies are provided by using two pumping systems, using different sources of power for the pumps. One system uses a steam turbine-driven pump capable of providing 200 gpm to each steam generator in the associated unit. The other system uses two motor-driven

pumps which are shared between the two nuclear units, and capable of providing at least 100 gpm to each of the steam generators aligned to its discharge.

The system consists of three AFW pumps; two motor-driven and one steam-driven. Each motor-driven AFW pump is dedicated to feeding one steam generator in either unit automatically. The steam-driven AFW pump feeds both steam generators in one unit. When an AFW actuation signal occurs, the AFW system is designed and analyzed to automatically provide emergency feedwater to the affected unit's steam generators within one minute of the actuation signal. The motor-driven pump's discharge flowpath is isolated by normally closed MOVs that automatically open to the affected unit's steam generators. The turbine-driven pump's discharge flowpath is normally open, and the flow-rate limited by normally throttled MOVs 1/2AF-4000 and -4001. These MOVs do not receive an automatic signal to open for an AFW actuation. Therefore, if aligned, there are no active motor-operated valves in the turbine-driven AFW pump's discharge flowpath.

Cause:

In response to this event, a team was established to review the event and perform a root cause evaluation (RCE for Condition Report 96-282). The results of that evaluation are summarized below:

Neither the work order post-maintenance test nor IT-290B contained explicit system recovery steps. Both test procedures directed the closure of 1AF-4000 and 1AF-4001, but neither provided specific instruction to open these valves upon completion of the test. Also, the work order PMT had not been written in the proper format (no signoffs), it had not been properly reviewed, the post-maintenance matrix had not been completed, and a maintenance supervisor had not reviewed the work order prior to closeout.

A lack of a questioning attitude was evident at several stages. Different Operations shifts were on duty concurrent with the discharge MOVs being in the shut position. The MOVs were not reopened after IT-290B was completed. The MOVs were found shut at the beginning of the hot start PMT, and left shut after the hot start PMT was completed. The 1P-29 test scheduling meeting did not discuss the required status of the system, but focused on the scheduling of the tests.

There was also a lack of communication between the Senior Reactor Operators - Duty Shift Superintendents (DSS) and control operators after the 1P-29 pump was returned to service. The control operators did not know the 1P-29 pump was declared "returned to service", and therefore had no urgency associated with having the associated discharge MOVs in the shut position.

Significantly, there was a general lack of understanding of the required status of the AFW system during startup of the unit. Several procedures which are used during startup are inconsistent in describing the required status. For example the Criticality Checklist verifies that the AFW system is "operable", while the Heatup Checklist verifies that the AFW system is "available". The primary source of these differing descriptions is the special allowance provided in the Technical Specifications to delay operability testing of the turbine-driven AFW pumps until power operation is achieved. Such a provision is somewhat unique in that the operability of most systems are completely verified prior to placing the plant in a condition requiring those systems to be operable. The case of a turbine-driven AFW pump is atypical in that it cannot be reasonably tested until adequate steam and plant heat are available to accommodate the feedwater inserted during the full-flow test. This atypical provision contributed to the misconception that the flowpath was not required to be aligned until the at-power testing was completed.

Corrective Action:

The individuals involved in poor communication of pump restoration following maintenance have been informed of the necessity for proper communication. The Operations Manager issued a memo stressing concerns for misoperation events. Each shift superintendent was required to document a crew discussion regarding valve misoperations. The Operations Manager is also visiting each crew to reinforce the importance of valve alignments and other concerns.

The individuals involved in the poor documentation of the subject work order were informed of the requirements and expectations of maintenance work package development and completion.

The appropriate AFW System inservice test procedures (IT-290B and IT-295B) will be reviewed to ensure that AFW system restoration requirements are explicitly identified.

The Heatup Checklist (CL-1D) will be reviewed to ensure that AFW system lineup requirements are explicitly identified, and more consistent with standard operability nomenclature.

A team will be established to review the AFW system operation and develop a means to clearly communicate the required status of the AFW System during startup. Appropriate procedure changes will be recommended and implemented by this team.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Reportability:

This Licensee Event Report is being submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(i)(B), "Any operation or condition prohibited by the plant's Technical Specifications".

Safety Assessment:

The turbine-driven AFW pump 1P-29 discharge MOVs (1AF-4000 and 1AF-4001) were capable of being opened from the control room in the event the electrically-driven AFW pumps failed to maintain level in both steam generators above the Lo-Lo level start-point. However, having the MOVs shut would have prevented delivery of water by the turbine-driven AFW pump. The flow path for the electrically-driven AFW pumps was unaffected. Automatic response requirements of the AFW System are discussed in the accident analyses of FSAR Section 14.1.10.

The low power history in the first three hours of critical operation following a refueling shutdown would have generated an insignificant decay heat load had an accident or plant trip occurred while the MOVs were shut. During this time there is also very little steam release from the steam generators (steam generators are batch fed as needed) and a reactor trip in this situation would not automatically start AFW. Automatic auxiliary feed would be actuated following a reactor trip from a power level high enough to cause significant shrink in steam generator level to reach the low level actuation setpoint. Automatic AFW would also actuate if a main feedwater problem developed to cause a rapidly decreasing steam generator level. Demand for AFW flow would be significantly less than the 400 gpm that is automatically provided by the turbine-driven AFW pump. In this case, the motor-driven AFW pumps would have provided more than enough emergency feedwater flow. In these cases, the AFW flow from 1P-29 would be secured altogether to prevent overfeeding the steam generators. Therefore, there is little consequence to isolating the turbine-driven AFW pump flow under these conditions.

Similar Occurrences:

Although there were no examples of safeguards system inoperability as a direct result of inadequate post-maintenance restoration, a search of the LER database provided several examples of system inoperability caused by system restoration following a routine operation or routine calibration. These examples include:

LER 266/91-005 Main Steam Isolation Valve Bypass left open

LER 301/81-08 High Head Safety Injection Discharge MOV found shut at Power

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

LER 266/82-004 AFW Recirculation flow instrument not re-opened after calibration

LER 266/80-13 Suction to Boric Acid Transfer Pump found isolated

LER 266/80-01 AFW Discharge Pressure Transmitters found isolated

LER 301/77-13 High Head Safety Injection Suction MOV found shut at Power

There were no reported events caused by the misunderstanding of the required AFW alignment for plant startups.