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NPL 97-0186

April 18, 1997

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

Gentlemen:

DOCKET 50-266 AND 50-301
LICENSEE EVENT REPORT 97-014-00
AUXILIARY FEEDWATER SYSTEM INOPERABILITY
DUE TO LOSS OF INSTRUMENT AIR
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

Enclosed is Licensee Event Report 97-014-00 for Point Beach Nuclear Plant, Units 1 and 2. This report is provided in accordance with 10 CFR 50.73(a)(2)(v)(D), "Any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident." This report describes a plant condition in which the Auxiliary Feedwater System may not have been able to perform as analyzed due to a loss of instrument air to the motor-driven AFW Pump flow control valves.

If you require additional information, please contact us.

Sincerely,

for Douglas F. Johnson
Manager - Regulatory Services
and Licensing

GDA
Enclosure

IE22 1/1

cc: NRC Resident Inspector
NRC Regional Administrator

9704220315 970418
PDR ADOCK 05000266
S PDR

NRC FORM 366 (4-95) | U.S. 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), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Point Beach Nuclear Plant, Unit 1	05000266	1 OF 6

TITLE (4)
Auxiliary Feedwater System Inoperability Due To Loss of Instrument Air

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
									PBNP Unit 2	05000301
03	21	97	97	-- 014 --	00	04	18	97	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)	000		20.2201(b)		20.2203(a)(2)(v)		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)	X	50.73(a)(2)(v)		Specify in Abstract below
			20.2203(a)(2)(iv)		50.36(c)(2)	X	50.73(a)(2)(vii)		or in NRC Form 366A

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Glenn D. 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 March 21, 1997, with Unit 1 in cold shutdown and Unit 2 in a defueled condition, licensee engineers discovered a condition that alone could have prevented the Auxiliary Feedwater (AFW) System from automatically performing its safety-related function during design basis accidents involving a loss of instrument air and reduced steam generator pressures. A loss of instrument air during the accident would cause both motor-driven AFW pump (MDAFWP) flow control valves to fail open. Without automatic flow control, the MDAFWPs' flowrate would be determined by steam generator pressure. If steam generator pressure is below the relief valve setpoints, which may occur for a low decay heat history, the pump motor breakers could trip on time-overcurrent. After discovery of these conditions, the AFW System was declared inoperable and the design was evaluated. The existing plant conditions did not require operability of the AFW system. The AFW system will be restored to operable status prior to establishing conditions that would require the system to be operable. The potential loss of both MDAFWPs during certain accidents has been attributed to a latent design characteristic of the original design of the AFW system.

Event Description:

At 1800 CST on March 21, 1997, with Unit 1 in cold shutdown and Unit 2 in a defueled condition, licensee engineers discovered a condition that alone could have prevented the Auxiliary Feedwater (AFW) System from automatically performing its safety-related function during certain design basis accidents involving a loss of instrument air and reduced steam generator pressures.

The loss of instrument air, which may be caused by a loss of offsite power, would cause both motor-driven AFW pump (MDAFWP) flow control valves to fail open. Without automatic flow control, the MDAFWPs' flowrate would be determined by steam generator pressure and feed line flow resistance. If steam generator pressure is below the relief valve setpoints, which may occur for a low decay heat history, the pump motor breakers could trip on time-overcurrent. Also, the loss of instrument air would disable the remote-manual capability to control AFW flowrate from the main control board.

Immediately following discovery of these conditions, the AFW system was declared inoperable. The existing plant conditions did not require operability of the AFW system.

Soon after discovery of these conditions, an AFW System design basis evaluation was initiated to ascertain those design basis accidents that would be most affected by this sequence of events. That design basis evaluation determined that any event involving a loss of offsite power (LOOP) could lead to the eventual loss of the MDAFWPs, but that the main steamline break (MSLB) accident would present the most-limiting conditions.

During a MSLB, one steam generator may blowdown at the maximum rate. The MDAFWP feeding the faulted steam generator would probably trip on low suction pressure. If the turbine-driven AFW pump fails to operate (i.e., the single active failure), then the requirement to maintain steam generator inventory would rely on the performance of the remaining MDAFWP.

The rapid cooldown of the reactor coolant system (RCS) would rapidly reduce the pressure of the intact steam generator to approximately 600 psig. The reduced pressure (below the steam generator relief valve setpoint) could result in the eventual tripping of the remaining MDAFWP on time-overcurrent. In this case, and other less-limiting cases where the MDAFWP(s) could trip later in the accident, manual action would be necessary to ensure adequate inventory in the steam generators.

The IEEE Standard 803A-1983 component identifiers for this report are:

Pump -	(p)	52 -	Circuit Breaker, AC
Valve -	(V)	PCV -	Pressure Control Valve

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

Component and System Description:

As described in the PBNP FSAR, the AFW 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 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.

Therefore, each unit is served by three AFW pumps; two motor-driven and one turbine-driven. Each motor-driven AFW pump is dedicated to feeding one steam generator in eithe unit automatically. The turbine-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 turbine-driven pump's discharge flowpath is normally open, and the flow-rate is limited by normally throttled MOVs 1/2AF-4000 and -4001. These MOVs do not receive an automatic signal for an AFW actuation. Therefore, if aligned, there are no active motor-operated valves in the turbine-driven AFW pump's discharge flowpath.

The motor-driven pump's discharge flowpath is isolated by normally closed MOVs that automatically open to the affected unit's steam generators. Also, the discharge pressure from each motor-driven pump is controlled by an air-operated control valve designated AF-4012 (for pump P-38A) and AF-4019 (for pump P-38B). These control valves will regulate upstream pressure to a setpoint established by a hand-controller in the main control room. Under normal operating conditions, the setting is approximately 1200 psig, which correlates to a pump flowrate of approximately 200 gallons per minute (gpm); the design point of the pump.

The control valves are supplied with instrument air. By design, the control valves will travel to the full open position for a loss of instrument air or power to the operating controllers.

Upon a loss of offsite power, the instrument air compressors are stripped and are not automatically re-energized. Therefore, any plant accident coincident with a loss of offsite power will result in the control valves failing to the full open position. The loss of instrument air will also disable the hand-controller on the main control board. Therefore, the flowrate of the MDAFW pumps will be determined by the steam generator pressure during the event, unless local-manual control of the control valve can be taken.

If emergency diesel generator loading allows, there is a procedural provision to load an IA compressor during an accident. This action would restore automatic operation of the control valve at the setting provided on the main control board.

The motor-drivers for AFW pumps P-38A and P-38B are provided with time-overcurrent devices which prevent overheating of the motor and cable at values of current that exceed the long-term current rating, but are less than the instantaneous trip setting that is indicative of a motor fault or stall. When the MDAFWPs operate at approximately 200 gpm (their nominal design operating point), the time-overcurrent settings are not broached. However, when the MDAFWPs operate at a flowrate greater than 200 gpm, the time-overcurrent settings may be broached and lead to a motor breaker trip after the prescribed time passes.

Cause:

The postulated event scenario is the result of a latent characteristic of the original AFW system design. Previous analyses of this scenario have considered that the steam generator pressure at the safety valve settings would limit MDAFW flow to approximately 200 gpm. However, the steam generator pressure would be maintained at the safety valve settings only when those accidents occurred with the maximum decay heat conditions described in FSAR Chapter 14. For less-limiting decay heat conditions, the actual steam generator pressure would be reduced below the safety valve settings.

Also, it is evident that the original design took credit for operator action to control MDAFW pump flowrate to the nominal 200 gpm value. There was not any documented basis for assuming the capability to restore flow control within a short period of time. However, the original design did have provisions for restoring instrument air following a LOOP, and it did provide the capability to reset a MDAFWP from the control room if the breaker did happen to trip on time-overcurrent. The original design basis did not specifically analyze the capability of the operating crew to take local-manual control for all events and preclude the loss of the MDAFWPs. Therefore, the original design did not provide ample assurance that the MDAFWPs would automatically function during all design basis events.

Corrective Actions:

A design evaluation was initiated following the discovery of the condition. Design modifications have been initiated to provide a reliable pneumatic supply to the control valves. *These design modifications, or another appropriate remedy, will be completed to restore AFW System operability prior to exceeding 350°F during the startup of either Unit 1 or Unit 2.*

Reportability:

A 4-hour report per 10 CFR 50.72 (b)(2)(i) was made to the NRC duty officer at 1800 CST on March 21, 1997. This Licensee Event Report is being submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(v)(D), "Any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident" and 50.73(a)(2)(vii), "Any event where a single cause or condition caused two independent trains to become inoperable in a single system designed to mitigate the consequences of an accident."

Safety Assessment:

As mentioned above, the limiting conditions may occur during a MSLB event with the failure of a turbine-driven AFW pump. The rapid cooldown of the reactor coolant system (RCS) and the resulting low pressure in the operating steam generator could result in eventual tripping of the remaining MDAFWP on time overcurrent. In this case, and other less-limiting cases where the MDAFWP(s) could trip later in the accident, manual action would be necessary to ensure adequate inventory in the steam generators. The capability to restore AFW operation within an acceptable amount of time is based on the following factors:

1. Prior to exceeding the time-overcurrent trip settings that would result in a motor breaker trip, manual action could be taken to reduce MDAFWP flowrate by closing one of the discharge motor-operated valves (MOVs) or the pump could be secured from the control room and restarted as necessary.

2. If operator staffing allows, an operator could take local-manual control of the MDAFWP flow and preclude a motor breaker trip.

3. If a MDAFWP were to trip on time-overcurrent, the breaker may be reset and the pump restarted from the control room.

4. The turbine-driven AFW pump (TDAFWP) operates independently of the instrument air system, and would not be affected by the loss of offsite power or the potential loss of instrument air. The historically high reliability (i.e., low unavailability) of the PBNP TDAFWPs provides reasonable assurance that sufficient AFW would be available to the steam generators, even with event scenario described in this report.

Another mitigating factor in these scenarios is that the initial MDAFWP flowrate above the nominal design basis value (i.e., greater than 200 gpm used in the accident analyses) will inherently provide a reserve steam generator inventory that would provide additional time to manually restore the AFW System.

Similar Occurrences:

Latent design flaws in the original design that affected the capability of safety-related equipment were reported in the following LERs:

LER	Description
266/97-006-00	Potential Refueling Cavity Drain Failure Could Affect Accident Mitigation
266/97-001-00	Safety Injection Delay Times Exceed Design Basis Values
266/96-005-00	Potential Service Water Flashing in Containment Fan Coolers