LER Full Text for LER Number: 26697031

ACCESSION #: 9707300023
NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Point Beach Nuclear Plant, Unit 1 PAGE: 1 OF 8

DOCKET NUMBER: 05000266

TITLE: Nonconservative Setpoint For Auxiliary Feedwater Low Suction Pressure Trip

EVENT DATE: 06/19/97 LER #: 97-031-00 REPORT DATE: 07/21/97

OTHER FACILITIES INVOLVED: PBNP Unit 2 DOCKET NO: 05000301

OPERATING MODE: N POWER LEVEL: 000

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Glenn D. Adams, Licensing Engineer TELEPHONE: (414) 221-4691

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:
On June 19, 1997, with Unit 1 in cold shutdown and Unit 2 in a refueling shutdown, the licensee's Design Basis team discovered that the auxiliary feedwater (AFW) pump low suction pressure trip setpoints may not ensure adequate suction pressure protection for the AFW pumps following a postulated seismic or tornado event. Portions of the AFW pump suction piping, including the condensate storage tank (CST), are not classified Seismic Class I and are not protected from tornado missiles. A postulated seismic or tornado event could cause a loss of offsite power, a loss of normal feedwater, and a break in the unqualified suction piping. At the postulated break locations, limited suction head will be provided to AFW pumps. If all pumps automatically start as designed, the suction piping could be swept of all water before the low suction pressure trip devices can secure the pumps; resulting in damage to the AFW pumps, and the potential loss of the secondary heat sink during the event. At the

A164

time of discovery, neither unit required the operability of the AFW System.

TEXT PAGE 2 OF 8

Event Description:

At approximately 1530 CDT on June 19, 1997, with Unit 1 in cold shutdown and Unit 2 in a refueling shutdown, the licensee's Design Basis team discovered that the auxiliary feedwater (AFW) pump low suction pressure trip setpoints may not ensure adequate suction pressure protection for the AFW pumps following a postulated seismic or tornado event. The potential for this scenario was first discovered by the Design Basis Document (DBD) group while researching the limiting stroke-time requirements for the turbine-driven AFW pump (TDAFWP) steam admission valves. During this research, it was conservatively postulated that a seismic or tornado event could cause a loss of offsite power (LOOP) and a consequential loss of normal feedwater (LONF); events which require AFW system operation. It was also postulated that the seismic event could cause pressure boundary failure of the non-seismic portions of the AFW suction piping. The design requires that timely actuation of the low suction pressure trip devices for each AFW pump will stop the AFW pumps prior to the intact suction piping being evacuated of water. If the pumps were not stopped in time, permanent pump damage could occur and the postulated event may be complicated by a loss of secondary heat sink. This condition affects both Unit 1 and Unit 2.

The DBD group conducted extensive analysis of potential scenarios and the time sequence of events to ascertain the limiting cases. Because AFW is a shared system between both nuclear units, the DBD group considered the potential for a two-unit event in addition to the single-unit scenarios. The licensee determined that the two-unit event would result in a greater AFW flow rate through common suction lines and would therefore present the greatest challenge for the suction trip devices. However, the single-unit response was evaluated in most detail to support the operability determination for Unit 2 (described later).

Walkdowns were conducted to identify vulnerable portions of the AFW suction piping. During a plant walkdown on or about July 3, 1997, it was discovered that a section of AFW suction pipe located in the Unit 2 turbine building truck access area was not adequately missile protected. Subsequent evaluation of a break at this location determined that the low suction pressure trips could not trip any of the associated AFW pumps in sufficient time to protect them from a loss of suction source (for any single-unit or dual-unit event). Based on this evaluation, immediate steps were taken to provide missile protection for this pipe section. Pending this remedy, walkdowns concluded that the next most-limiting piping section was located at the El. 26' of the turbine building.

To support the operability determination for single-unit operation, the DBD group evaluated the effect of a postulated suction line break that might occur at the El. 26' location. For a single unit event where one TDAFWP and two MDAFWPs draw water from the common suction line, the DBD group determined that an adequate inventory of water would be available in the pipe to protect the AFW pumps until they were stopped by the low pressure suction trip. However, when the DBD group conservatively applied the single failure criterion to the low suction pressure trip of a motor-driven AFW pump (MDAFWP), the evaluation showed that the TDAFWP would not trip in time. This evaluation considered the time delays associated with time delay relay actuation, isolation valve stroke time, plus instrument uncertainties.

On July 14, 1997, a detailed evaluation determined the operability of both motor-driven AFW pumps (P38A and P38B) and the Unit 2 TDAFWP (2P29) under single-unit operation (Unit 2). This operability determination was contingent on the completion of several actions including: (1) installation of a missile protection for the portion of AFW pump suction piping in the Unit 2 Turbine Building truck access area, (2) verification of the pump trip time delay relays actuate at their setpoint (20 seconds +/- 10% of setting), (3) raising the AFW low suction pressure trip setpoint from 6.5 psig to 7.0 psig, and (4) reducing the IST acceptance criterion for the steam admission valves to a value of 22.9 seconds.

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 each is capable of providing at least 100 gpm to each of the two steam generators aligned to its discharge.

The water supply source for the AFW system is redundant. The initial AFW source is gravity feed from the condensate storage tanks (CSTs), while the backup supply is taken from the plant service water system whose pumps are powered from the diesel generators if station power is lost. The backup supply is normally isolated and must be manually aligned.

In anticipation of the loss of the CST water supply, each AFW pump is configured to automatically trip on low suction pressure to prevent possible pump damage. A manual override capability exists so that the motor-driven pump breakers can be reshut and/or the turbine-driven pump steam supply valves can be reopened, which will restart the pumps so that

the remaining water from the CSTs or the backup SW supply can be used.

The CSTs and a short horizontal run of AFW pump suction supply piping were not designed with protection from all missile hazards and Seismic Class II/I hazards. The subject suction piping is an exposed section that runs from the CSTs along the El. 26' of the turbine building floor.

The AFW pump low suction pressure trip devices are provided to trip the respective AFW pump and prevent damage, so that they will be available after the AFW suction source is manually switched to the Seismic Class I service water system. If the existing low suction pressure trip does not occur (with instrument uncertainties, logic time delay, and steam supply valve closure times taken into account) in time to trip the AFW pumps prior to the suction pipe being swept entirely by the operating pumps, pump damage could occur.

Other applicable features of the AFW System include:

o Each AFW pump is tripped by a signal from its own suction pressure transmitter.

o The existing low suction pressure trip setpoint is set at 6.5 psig. This corresponds to an elevation at the centerline of the suction pipe from the CST, assuming a head loss term of 0.8 psig. No instrument uncertainties were included when establishing this setpoint.

o The low suction pressure trip control circuitry contains a 20-second time delay before the pumps are tripped due to a sensed low suction pressure condition. The purpose of this time delay is to prevent inadvertent pump trips following a decrease in pump suction pressure on pump starts. A test was performed to look at the effect on pump suction pressure (initial decrease and recovery) by single pump starts and by the simultaneous start of the three pumps which could supply one unit. The results of that test provided the basis for the 20-second time delay.

o The MDAFWPs receive a trip signal when the 20-second time delay times out and trip immediately.

o The steam supply valves (MS-2019 and MS-2020) for the TDAFW pumps receive a signal to shut when the 20-second time delay times out. The current IST acceptance criteria for closure of the Unit 2 valves is 26.24 and 25.71 seconds respectively.

o The PBNP FSAR, Section 14.1.10, also states that a maximum time of 5 minutes is assumed for operator action to switch over to Service Water as the alternate source of seismically qualified auxiliary feedwater.

The present setting of the AFW pump low suction pressure trip (6.5 psig) equates to a level in the CSTs approximately equal to the centerline of the discharge nozzle from the tank to the AFW pumps. The purpose of the trip is to protect the AFW pumps in the event of a seismically-induced loss of CST. The trip was installed in response to NUREG-0737 Item II.E.1.1, to ensure that the AFW pumps trip before damage occurs. The maximum total expected flow for this scenario is 1200 gpm when all four AFW pumps are assumed to be running.

The MDAFWPs require a minimum net positive suction head (NPSH) of 10 feet of water when delivering the design flowrate of 200 gpm. The TDAFWPs require a minimum NPSH of 15 feet of water when delivering the design flow rate of 400 gpm.

Cause:

The postulated event scenario is the result of a characteristic of the original AFW system design. The original system design did not provide an automatic low suction pressure pump protection for a loss of suction source that may result from a seismic or tornado event. This protection was later provided in response to NUREG-0737 Item II.E.1.1, when Wisconsin Electric committed to provide an automatic pump trip (Reference WE letter to NRC dated 9/14/81, "TMI Action Plan Update - Revision 2"). Automatic safety-grade trip devices were installed by plant modifications in the mid-1980s.

The modifications installed wide range pressure transmitters (0-100 psig) and provided a 20-second time delay to preclude pump trip during the pressure transients caused during pump startup. Based on the supporting calculations, the low level alarm setpoint was established at 7.0 psig and the trip setpoint for each pump was established at 6.5 psig. Therefore, the modifications provided a degree of protection that had not been provided in the original design; however, the design did not consider all the design basis factors that are now considered credible, particularly the worst-case instrument uncertainty applied to the 6.5 psig setpoint.

The supporting calculations for the modifications took credit for water level in the CST, so it is evident that a break in the suction pipe was not considered in the analysis. Also, the calculations did not consider the instrument uncertainties of the pressure transmitters and the water volume pumped during the delay caused by the time delay relays. Furthermore, the calculations did not consider the delay involved in closure of the steam admission valves for the TDAFWPs.

Corrective Actions:

As described in the operability determination that supports the operation

of Unit 2 and operability of AFW pumps 2P29, P38A, and P38B, the following actions will be taken prior to Unit 2 restart:

1. Installation of missile protection for the portion of AFW pump suction piping in the Unit 2 Turbine Building truck access area,

2. Verification of the pump trip time delay relays actuate at their setpoint (20 seconds +/- 10% of setting),

3. Raising the AFW low suction pressure trip setpoint from 6.5 psig to 7.0 psig,

4. Reducing the IST acceptance criterion for the closing stroke-time of steam admission valves to a value of 22.9 seconds.

Prior to the restoration of Unit 1 to power operation, a similar evaluation will be conducted to ensure the operability of all AFW pumps during two-unit operation.

Reportability:

On June 19, 1997, at 1741 CDT, a 4-hour report per 10 CFR 50.72 (b)(2)(iii)(D) was made to the NRC duty officer. 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."

Safety Assessment:

At the time of discovery, neither unit required the operability of the AFW System.

If the postulated events had occurred during plant operation, the low suction pressure trip time delays may not have stopped the AFW pumps prior to the suction piping being evacuated of water. Damage to all of the AFW pumps could have occurred and the secondary heat sinks would have been unavailable. Emergency Operating Procedures (EOPs) and Critical Safety Procedures (CSPs) provide guidance for the loss of the secondary heat sink. These procedures direct the restoration of AFW or the initiation of primary system feed and bleed to ensure that decay heat removal is achieved and that the health and safety of the public is not affected by the event.

It is highly unlikely that the motor-driven AFW pump trips would fail as postulated. The pressure transmitters and other control circuitry are Seismic Class I and should not fail mechanistically due to the initiating event.

Similar Occurrences:

The following reports also identify recent examples where original analyses or subsequent analyses did not include factors or scenarios that are currently considered to be credible:

LER Description

266/97-018-00 Potential Residual Heat Removal System Overpressure During Accident Conditions

266/97-014-00 Auxiliary Feedwater Inoperability Due To Loss Of Instrument Air

266/97-006-00 Potential Refueling Cavity Drain Failure Could Affect Accident Mitigation

266/97-002-00 Potential To Overpressurize Piping Between Containment Isolation Valves During A Design Basis Accident

266/97-001-00 Safety Injection Delay Times Exceed Design Basis Values

H
266/96-015-00 Main Steam Safety Valve Lift Setpoints Exceed Design Basis Values

266/96-005-00 Potential Service Water Flashing In Containment Fan Coolers

266/96-003-00 Plant Operation outside Of Design Basis Of The Low Temperature Overpressure Protection System

TEXT PAGE 8 OF 8

System and Component Identifiers

The Energy Industry Identification System component function identifier for each component or system referred to in this Licensee Event Report are as follows:

Component Identifier System Identifier

Pump P Auxiliary Emergency Feedwater BA
Valve, Isolation ISV
Tank TK

*** END OF DOCUMENT *** C

site.

To view the WWW Privacy Statement click on the link.

Last modified: May 9, 2002