LER Full Text for LER Number: 26697036

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NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Point Beach Nuclear Plant, Unit 1 PAGE: 1 OF 6

DOCKET NUMBER: 05000266

TITLE: Potential Common Mode Failure in DC Power Supply Could

Disable Auxiliary Feedwater System

EVENT DATE: 08/26/97 LER #: 97-036-00 REPORT DATE: 09/25/97

OTHER FACILITIES INVOLVED: 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)(ii)

LICENSEE CONTACT FOR THIS LER:

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COMPONENT FAILURE DESCRIPTION:

CAUSE: SYSTEM: COMPONENT: MANUFACTURER:

REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On August 26, 1997, while Point Beach Nuclear Plant (PBNP) Unit 1 was in a cold shutdown condition and Unit 2 was operating at 100 percent power, licensee engineers discovered a potential common mode failure in the DC power supply system that could result in the loss of three auxiliary feedwater pumps during seismic or tornado events that cause the loss of the normal AFW suction source. The remaining AFW pump

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would not be capable of providing the feedwater flow rate that is assumed in the accident analysis for both units. The common mode failure is not a consequence of the postulated earthquake or tornado, but has been considered to be a single failure that should be considered during this design basis event. The common mode condition was created in a modification that assigned a common DC power supply to three (of four) AFW pump low suction pressure trip devices. Plant modifications will be performed to eliminate the potential common mode failure described herein.

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Event Description:

On August 26, 1997, while Point Beach Nuclear Plant (PBNP) Unit 1 was in a cold shutdown condition and Unit 2 was operating at 100 percent power, licensee engineers discovered a potential common mode failure in the DC power supply system that could result in the loss of three auxiliary feedwater (AFW) pumps during seismic or tornado events that cause the loss of the normal AFW suction source. The remaining AFW pump would not be capable of providing adequate flowrate to both units.

Particularly, it was discovered that Train A low suction pressure trip circuits associated with AFW pumps P-38A, 1P-29 and 2P-29 are powered from a common 125 V DC distribution panel (D-17). Similarly, Train B low suction pressure trip circuits associated with P-38B, 1P-29 and 2P-29 are also powered from a common DC distribution panel (D-19). In addition, the loop power supply modules (PQ-4042, 1PQ-4044 and 2PQ-4044) that provide power for the pressure inputs to P-38A, 1P-29 and 2P-29 low suction pressure trip circuits are ultimately powered from a common 125 V DC main bus (D-03). Loss of D-03, D-17 or D-19 could therefore disable the low suction pressure trip function for three of the four AFW pumps.

The low suction pressure trip function is relied upon to prevent pump damage following a tornado-induced or seismically-induced loss of the normal AFW suction supply (i.e., from the condensate storage tanks). Thus, a tornado or seismic event resulting in a loss of the normal suction supply, combined with a single random DC bus failure, could significantly affect the capability of the AFW system to perform its safe shutdown function.

This potential common mode failure was discovered during a design review for modifications to improve the response of the existing low suction pressure trip circuitry. These modifications were being pursued to address the nonconservative low suction pressure trip setpoints reported in PBNP LER 266/97-031-00.

After considerable design basis and licensing basis review, it was determined that the random failure of a Seismic Class I DC bus should be considered to occur coincident with an earthquake or tornado event. This DC bus failure is not a consequence of the postulated earthquake or tornado.

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Cause:

Pending the completion of a thorough root cause evaluation, we have preliminarily determined that this postulated event scenario was caused by inadequate design and design review of the modification which installed the low suction pressure trip devices in the mid-1980s. Power supplies were assigned without regard for precluding the common mode DC bus failure postulated herein. Contributing to this design oversight is the fact that the PBNP Final Safety Analysis Report FSAR) and design basis documents had not explicitly stated that random DC bus failures were to be considered as single active failures during design basis events that require the achievement of safe shutdown.

Corrective Actions:

1. Plant modifications will be performed to eliminate the potential common mode failure described herein. These modifications will be completed prior to the initiation of dual-unit operation.

2. A thorough root cause evaluation is being completed. Additional corrective actions identified by that evaluation will be managed under the corrective action process.

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 (one per unit) 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 remote-manually aligned from the control room.

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In the event that the CST water supply is lost due to a seismic event or tornado, 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 CSTs or the backup service water (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 26-foot elevation 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 the pump 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, the operating AFW pumps will sweep the existing water from the suction pipe and, if not manually secured in an expeditious manner, pump damage could occur by running the pumps in a dry condition.

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").

As described in the PBNP FSAR, all electrical systems and components vital to plant safety, including the emergency diesel generators, are designed as Class I and designed so that their integrity is not impaired by the maximum potential earthquake, wind storms, floods, or disturbances on the external electrical system.

Safety Assessment:

At the time of discovery, Unit 2 was operating at power and Unit 1 was in cold shutdown. If the postulated events had occurred during the power operation of Unit 2 only, it is our estimation that AFW flow rate to Unit 2 would have met accident analysis requirements. In this scenario, significant feedwater would be contributed by the AFW pumps to the steam generators prior to the postulated pump damage caused by the failure of the suction piping and failure of the low suction pressure trip devices. This steam generator inventory, in combination with the feedwater contributed by the surviving AFW pump would have been

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sufficient to achieve and maintain safe reactor shutdown of Unit 2 following the postulated event.

If the postulated events had occurred during two-unit power operation, the failure of the DC bus in combination with the potential failures induced by the natural phenomena (loss of offsite power and loss of the unprotected AFW suction lines), the AFW pumps may not have stopped in sufficient time to prevent the AFW suction piping from being evacuated of water. Damage to three AFW pumps could have occurred and the secondary heat sinks would not have met their accident analysis performance requirements.

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 AFW pumps would fail as postulated because the scenario is predicated on the coincidental occurrence of an earthquake (or tornado) and a random failure to the DC power system. The safety-related 125 VDC electrical distribution system is Seismic Class I and should not fail mechanistically due to the initiating event. The scenario is also predicated on the earthquake or tornado causing a coincidental loss of offsite power and a pressure boundary failure of the AFW suction supply.

Based on the low probability of the precursors, the likelihood that this event could ever have occurred is extremely low. Based on the availability of procedures and equipment to address the consequences, the health and safety of the public were not at risk.

System and Component identifiers

The Energy Industry Identification System component function identifier for each component/system referred to in this report are as follows:

Component/System Identifier

Auxiliary Emergency Feedwater System BA

DC Power System EI

Pump P

Transmitter, Pressure PT

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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

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

266/97-031-00 Nonconservative Setpoint For Auxiliary Feedwater Pump

Low Suction Pressure Trip

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