NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Point Beach Nuclear Plant	0 5 0 0 0 3 0 1	1 OF 0 6

TITLE (4)
Rx Trip Due to Malfunction of Instr. Bus Power Supply Mech. Interlock

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)
0 4	0 7	8 8	8 8	—	0 0 1	— 0 0	0 5	0 7	8 8		0 5 0 0 0
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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) 1 0 0	50.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
	50.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
	50.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	50.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
	50.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
	50.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
C. W. Fay, Vice President Nuclear Power	AREA CODE 4 1 4 — 3 2 1 - 1 2 1 8

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	
B	E B	I M E C	S 3 4 5	NO							

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 fifteen single-space typewritten lines) (16)

At 0904 hours on April 7, 1988, a reactor trip occurred from 100% power. The trip was caused by a low pressurizer pressure signal. Safety injection also initiated due to a low pressurizer pressure signal. These and other anomalies were caused by red instrument bus voltage fluctuations resulting from the primary and alternate inverters feeding the red instrument bus with the inverters connected in parallel. The inverter parallel operation occurred due to the failure of the mechanical interlock, which is designed to prevent the simultaneous connection of the inverters to the load.

During the recovery, with primary pressure near the safety injection set point and safety injection reset, safety injection occurred a second time due to cooling of the primary coolant system when steam was restored to the turbine hall.

All systems operated as expected during the transient with the exception of one of the two source range nuclear instrumentation channels. This channel failed to energize after the trip. This channel remains out of service and was placed in the trip blocked condition as allowed by Point Beach Technical Specifications.

Immediate corrective action included the posting of an operator aid at the location of the instrument bus breaker cabinets, which provides instructions to reduce the probability of this type of occurrence in the future. The plant returned to power operation on April 12, 1988.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

EVENT DESCRIPTION

On April 7, 1988, Unit 2 was operating at 100% power. At 0901 a transfer of the red instrument bus 2Y101 from inverter 2DY01 to the swing inverter DY0A was required by a maintenance procedure for 2DY01. 2DY01 normally provides 120 VAC power to the red instrument bus 2Y101. Immediately after the red instrument bus was transferred from 2DY01 to DY0A, voltage oscillations occurred in the red instrument bus. A series of turbine runbacks also occurred. The pressurizer spray valves opened, causing pressurizer pressure to decrease. At 0904, a reactor trip occurred due to the low pressurizer pressure followed by initiation of safety injection. Two factors contributed to the cause of the pressure variations and the timing of the reactor trip and safety injection.

First, the red instrument bus supplies power to power range Nuclear Instrumentation channel NI-41. Due to voltage fluctuations on the red bus, about 21 half second turbine runbacks occurred within two minutes. The procedure for switching instrument buses calls for the control rods to be maintained in manual during the power supply switch over. This is required because of the possibility of a temperature error signal causing control rod motion during the switchover. The runbacks resulted in a mismatch between reactor power and turbine power. The mismatch would have caused a heat up of the primary system. The operator responded to this mismatch by restoring the rod control system to the automatic mode, allowing the rod control system to step the rods into the core and correct the mismatch.

Second, the red instrument bus also supplies power to the controlling channel for pressurizer pressure control. While the runbacks were happening, the voltage fluctuation on the red bus resulted in the pressurizer spray valve controlling channel momentarily indicating high pressurizer pressure and therefore causing the pressurizer spray valve controller to open the pressurizer spray valves. Pressurizer spray caused pressurizer pressure to decrease until the red instrument bus was returned to normal.

According to data accumulated by the plant process computer, the 2DY01 and DY0A inverters were tied in parallel for approximately 2 minutes from 0901 hours until 0903 hours. At the end of the two minutes, the controlling channel for pressurizer pressure control returned to levels near those indicated by the other three channels and pressure control returned to normal. However, due to the combination of pressurizer spray initiation because of the

malfunctioning controlling channel, and the rods stepping into the core because of the high Tavg, a reactor trip occurred at 0904 hours when rate compensated pressurizer pressure reached the reactor trip set point of 1810 psig.

Pressure continued to decrease, which resulted in an automatic initiation of safety injection at approximately 1757 psig. No actual water was injected into the reactor since the lowest pressure reached was about 1650 psig and the shutoff head of the safety injection pumps is approximately 1550 psig. With a low Tavg and safety injection, both Main Steam Isolation Valves went shut. After safety injection was reset, the Main Steam Isolation Bypass valve was opened to restore steam to the turbine hall. This resulted in a slight cooldown of the reactor coolant system and caused pressure to drop enough to initiate a safety injection. The pressure in this case also did not fall far enough to result in injection into the primary system.

CAUSE

The cause of the event is a combination of procedure inadequacy, personnel cognitive error, and probable design or installation deficiency. Operating instruction 37, "Shifting of Instrument Supply Bus Feeders," is the procedure controlling the transfer of an instrument bus from one supply to another. This procedure does not provide a caution or warning that the lever arm mechanical interlock is designed to reduce the probability of tying two inverters together in parallel while supplying an instrument bus. The operators followed the procedure for the transfer of the instrument bus from one inverter to another. However, as discussed in the system description, the lever interlock is not designed to be relied upon to ensure that the originally closed inverter breaker will open prior to the closing of the alternate power supply breaker. It is possible that the operator may have used the lever interlock to perform the function of opening the normal supply breaker while closing the alternate power supply breaker using the breaker handle.

The operator involved in this event was a Senior Reactor Operator trainee performing this evolution for the first time. He was familiar with the work area and the need for the mechanical interlock on the breakers involved. The procedure did not provide detailed instructions for the transfer and the correct method of transfer. Cautions were not included to warn of interlock malfunction and/or design concept.

It appears the operator did not read the manufacturer's warning written in fine print on a sticker placed on the interlock lever arm which said:

> "CAUTION HANDLE INTERLOCK Operate circuit breaker handles individually by hand only."

It should be noted that the sticker was damaged and incomplete. His correct use of the mechanical interlock was dependent on his cognitive understanding of the design of the mechanical interlock not the printed caution. Therefore, part of the cause of this situation was a cognitive error.

During a post trip investigation of the interlock operation, it was shown that the lever arm would ensure correct breaker open/close coordination if the transfer was taking place from the alternate supply to the normal supply, but coordination would not be assured when the transfer was made from the normal supply to the alternate supply. At present, the lever arm length from the interlock pivot point to the alternate supply breaker handle is 1/2 inch shorter than to the normal supply breaker handle. We believe that the lever pivot point should be at a location that results in an equal distance from the pivot point to each breaker handle. In the installations at four locations at Point Beach, the lever arms are of unequal lengths while used with equal sized breakers.

SYSTEM DESCRIPTION

The breakers, breaker cabinet and mechanical interlock device for supplying power to 2Y101 (red instrument bus) were manufactured by Square D Co. The breakers involved were type FA 100 amp single pole breakers. The mechanical lever arm interlock is an option offered with these types of breakers. The mechanical lever arm (part number HEK-3DT1) is for use with two FA breakers of the same size. We believe that the lever arm interlock failed to perform its function in that the alternate breaker closed but the interlock did not force the normal supply breaker to open.

GENERIC IMPLICATIONS

Other instrument bus panels also have lever arm interlocks identical to that found in the 2Y101 breaker cabinet. We have not had a history of misoperation of other mechanical interlocks of this type.

REPORTABILITY

This report is filed pursuant to 10CFR50.73(a)(2)(iv), "An event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature, including the Reactor Protection System."

The Energy Industry Identification System component function identifier for the breaker interlock malfunction is IMEC and for the system the designation is EE.

SAFETY ASSESSMENT

The trip and initiation of safety injection occurred as a result of fluctuating voltage levels in the red instrument bus. Systems required to operate responded as designed with the exception of one of two installed source range nuclear instrumentation channels which failed to energize after the trip. The occurrence happened at 100% power near the middle of core life and therefore did not happen under the most severe operating conditions. A more severe operating condition could have been at zero power at the end of core life. A cooldown under these conditions with a more negative moderator temperature coefficient could have resulted in more positive reactivity being added during the cooldown. It should be noted that we are analyzed for an accident at zero power at the end of core life with a more severe cooldown due to a steam line break. Therefore, the health and safety of plant personnel and the general public was not compromised by this event.

CORRECTIVE ACTIONS

The immediate corrective action was to return the instrument bus power to its normal supply (2DY01) and install an operator aid which provides explicit instruction as to how to perform the power supply transfer while reducing the probability of paralleling the inverters.

The spray valve operation was verified as operable prior to restarting the unit.

The breaker interlock supplier will be consulted to ascertain the correct method of mechanical interlock installation and the correct design application.

If an installation or design change is appropriate for the mechanical interlock, a modification will be made to the interlocks for each of the instrument busses by January 1, 1989.

Applicable procedures will be revised to include discussion of the proper method of transferring from one instrument bus voltage supply to another. Training on this LER will be conducted to increase the awareness of personnel responsible for transferring power supplies.

These changes will reduce the probability of an occurrence of this type in the future.

SIMILAR OCCURRENCES

No previous event attributable to the malfunction, design deficiency or misuse of the mechanical interlock for the instrument busses is known to have occurred at Point Beach. Other red instrument bus voltage perturbations have occurred (See LERs 87-004 Unit 1, 86-005 Unit 1, and 85-006 Unit 1.)