Wisconsin Electric
POWER COMPANY

Point Beach Nuclear Plant
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PBL-97-0054

February 12, 1997

Document Control Desk
U.S. NUCLEAR REGULATORY COMMISSION
Mail Station P1-137
Washington, D. C. 20555

Gentlemen:

DOCKET 50-266 AND 50-301
LICENSEE EVENT REPORT 97-004-00
POTENTIAL COMMON MODE FAILURE
IN VITAL DC ELECTRICAL SYSTEM
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

Enclosed is Licensee Event Report 97-004-00 for Point Beach Nuclear Plant, Units 1 and 2. This report is provided in accordance with 10 CFR 50.73(a)(2)(ii)(B), "a condition that was outside the design basis of the plant." This report describes a plant condition that could have resulted in a coincidental loss of opposite trains of safeguards equipment when design basis equipment failures and electrical faults in non-safety-related circuits are assumed during a postulated accident. The Point Beach safeguards systems are not designed to tolerate a coincidental loss of redundant equipment, so the condition is outside the design basis. Immediate corrective action was taken to isolate the potential source of the common mode failure.

If you require additional information, please contact us.

Sincerely,

Doug Johnson
Manager - Regulatory Services
and Licensing

GDA
Enclosure
cc: NRC Resident Inspector
NRC Regional Administrator

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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

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

LICENSEE EVENT REPORT (LER)

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

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

TITLE (4)
Potential Common Mode Failure In Vital DC Electrical System

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
01	13	97	97	-- 004 --	00	02	12	97	PBNP Unit 2	05000301
									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)	90		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)	X	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 January 13, 1997, with Unit 1 operating at 90% power and Unit 2 in a refueling shutdown condition, licensee engineers discovered the potential for a particular common mode failure in the Vital DC Electrical (VDC) System that could affect opposite trains of Unit 2 safeguards equipment. This flaw stems from the unreliability of VDC molded case circuit breakers (MCCBs) to trip in the magnetic-trip region and the lack of physical separation provided for non-safety-related circuits powered from VDC panels. For one postulated fault between two insulated conductors (fed from different VDC power panels), the calculated short circuit current exceeded the maximum operating limit of the thermal trip elements in the associated MCCBs. This would cause the associated upstream fuses to blow and deenergize opposite-train VDC panels; thereby disabling opposite-train safeguards equipment. The coincidental loss of opposite-train safeguards equipment is not analyzed in the FSAR. Subsequently, a similar common mode failure was identified for Unit 1. In each case, a non-safety-related circuit was deenergized to isolate the potential fault.

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Point Beach Nuclear Plant, Unit 1	05000266	97	- 004 -	00	2 OF 6

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

Event Description:

On January 13, 1997, with Unit 1 operating at 90% power and Unit 2 in a refueling shutdown condition, licensee engineers were reviewing a Justification for Continued Operation (JCO) to support the restart of Unit 2. This JCO had justified plant operation with unreliable molded-case circuit breakers (MCCBs) in the VDC electrical distribution system, based on the belief that there were no credible single failures that could result in simultaneous faults on non-safety-related circuits supplied from redundant DC trains. Further review of these circuits led to the discovery of a particular fault location that could result in coincidental failures of opposite-train safety equipment. Calculations showed that the magnitude of fault currents at this location would exceed the capability of the thermal elements of the associated MCCBs. Given the unreliability of the magnetic trip element to interrupt such fault current, it was determined that the associated breakers would not perform their required safety function.

Engineers discovered that non-safety-related cables downstream of 125 VDC breakers D-22-06 and D-19-09 are routed through several common raceways, including tray CB01. The potential therefore exists for a single initiating event to create simultaneous short-circuit faults on both cables. The maximum fault currents possible at these locations would exceed the maximum operating limits of the thermal trip elements in breakers D-22-06 and D-19-09. Failure of the thermal element along with the documented unreliability of the magnetic trip elements in these breakers could prevent the breakers from clearing their downstream faults and result in the loss of the VDC panels D-19 and D-22 when the upstream supply fuses to those panels open. The deenergization of D-19 and D-22 would result in the simultaneous loss of certain safeguards equipment of opposite trains.

Even though it had not yet been determined that loss of these two panels would affect redundant equipment on Unit 1 (Unit 2 is in a cold refueling shutdown), the DCS and the DSS were informed of the potential problem at 1040 CST on January 13, 1997. At 1115 CST, breaker D-22-06 was opened and danger-tagged. Opening this breaker and isolating the associated circuit removed the source which could result in the postulated common mode failure.

During further review of the VDC system, a similar common mode failure was identified on January 15, 1997 which could affect Unit 1 safeguards. The non-safety-related cable downstream of 125 VDC breaker D-12-03 (D-12 primarily powers A-Train equipment) is routed through tray CF03. This tray contains 16 safety-related cables associated with Unit 2 B-Train equipment. The potential therefore exists for a single initiating event to create simultaneous short circuit faults on the non-safety-related A-Train cable (D1203A) and the B-train safety-related cables in tray CF03. In such a case, the maximum fault current possible on cable D1203A would

exceed the maximum operating limit of the thermal trip element in breaker D-12-03. Failure of both the thermal and magnetic trip elements in breaker D-12-03 to clear the downstream fault would result in the upstream D-12 supply fuse opening, resulting in a loss of power to the panel and its associated A-train loads. Failure of these A-train loads could occur simultaneously with a loss of the B-Train loads associated with cables routed in tray CF03.

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

Circuit Breaker, DC (72)
Fuse (FU)

Component and System Description:

FSAR 8.1.1 defines the principle general design criterion (GDC-39) for the VDC system: "An emergency power source shall be provided and designed with adequate independency, redundancy, capacity, and testability to permit the functioning of the engineered safety features and protection systems required to avoid undue risk to the health and safety of the public. This power source shall provide this capacity assuming a failure of a single active component." The condition described by this report involves multiple failures caused by a single initiator (single active failure) that could result in the unavailability of the minimum required Engineered Safety Feature (ESF) and protection systems.

Technical Specification 15.3.5 defines the requirements for the operability of instrumentation associated with the initiation of Engineered Safety Features. Deenergization of panels D-19 and D-22 would result in an inability to generate any ESF signals for Unit 2 due to loss of DC power to the protection racks.

125 VDC system circuit breakers D-19-09 and D-22-06 protect the supply to a non-safety-related load which is supplied from a safety related DC distribution panel (D-19 and D-22 respectively). Each, therefore, has the safety function of isolating any fault on the non-safety-related circuit in a manner which precludes the interruption of power to any of the safety-related loads supplied from the same distribution panel.

Physical separation is not a design basis requirement for non-safety-related circuits.

Panel D-19 primarily supplies B-Train safety-related loads, and panel D-22 primarily supplies A-Train safety-related loads. The circuits supplied by breakers D-19-09 and D-22-06 are run together in the same raceways for some part of their route. It is therefore possible that simultaneous failure of these circuits could occur. If such a failure results in fault currents in excess of the capability of the thermal element of each of these breakers, it is possible that neither breaker will act to isolate

the fault on the associated circuit. If neither the magnetic nor the thermal element in each breaker act to interrupt the fault current, the fuses that supply panels D-19 and D-22 will act to interrupt the faults. This would result in the loss of all the VDC loads on these panels. D-19 and D-22 supply circuits which are necessary for the performance of redundant safety functions in Unit 2. For example, a loss of power to these two distribution panels would result in the loss of all ESF actuation in Unit 2.

Corrective Actions:

1. Immediately following the identification of the postulated fault in Unit 2, the breaker that feeds the A-train control rod drive motor-generator control circuit (D-22-06) was opened and danger-tagged to eliminate the potential for a common fault to cause failures in both safety-related trains of safeguards equipment.

2. With respect to the Unit 2 postulated fault between panels D-19 and D-22, the subject circuit breakers (D-22-06 and D-19-09) were replaced with Westinghouse EHD 2020 model breakers. The replacement provides assurance that the magnetic trip elements in both breakers will reliably function in the event of a fault downstream of either breaker.

3. An engineering review of similar circuit conditions in the VDC System was conducted and resulted in the discovery of only one other potential common mode failure. That condition applied to Unit 1, and is described in this report. The remedy of this Unit 1 condition is described below.

4. Immediately following the identification of the postulated fault in Unit 1 circuits, breaker D-12-03 was opened to eliminate the potential for common mode failure of opposite-train safety equipment due to cable faults in tray CF03.

5. With respect to the Unit 1 postulated fault between panel D-12 and other VDC panels, the subject circuit breaker in panel D-12 (D-12-03) was replaced with a Westinghouse HFD 3020 model breaker. The replacement provides assurance that the magnetic trip element will reliably function in the event of a fault downstream of the breaker.

Cause:

The existence of the aforementioned potential faults and the potential for a common mode failure is the result of two factors: (1) the unreliability of old MCCBs to trip in the instantaneous-trip region, and (2) the lack of physical separation provided for non-safety-related circuits.

Testing of the original molded-case circuit breakers (MCCBs) has indicated a higher-than-expected failure rate (approximately 12.5%) in the instantaneous trip region of breaker operation (i.e., the magnetic region). This unreliability of MCCBs greater than ten years old has been identified in several industry event notices, including NRC Information Notices IN 93-26 and IN 93-64. A failure of a single breaker to trip due to an overcurrent condition could affect the safety function of the electrical system to provide reliable power to those auxiliaries required during any normal or emergency mode of plant operation.

In the design of the VDC electrical distribution system, non-safety-related circuits were not required to be physically separated from circuits associated with opposite-train equipment. For any given fault condition, it was assumed that the safety-related MCCB that powered each non-safety-related load would reliably interrupt power to the fault and would not propagate a fault that could disable the associated power panel.

Reportability:

A 4-hour prompt notification per 10 CFR 50.72(b)(2)(i) was reported to the NRC duty officer at 1524 CST on January 13, 1997. This Licensee Event Report is being submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(ii)(B), "A condition that was outside the design basis of the plant."

Safety Assessment:

As described in the corrective actions, the postulated faults and common mode failures were eliminated by isolating a non-safety-related circuit associated with each postulated fault. The loss of these non-safety-related circuits has no effect on the power operation of Unit 1 or the cold refueling shutdown condition of Unit 2.

Prior to the isolation of these postulated faults, no actual cable faults of these circuits actually occurred, so the related MCCBs were never relied upon to function as postulated. Also, such faults in cable insulation are very unlikely, and particularly unlikely to occur at the same time as a design basis accident. Therefore, the health and safety of the public was not jeopardized by the existence of this condition.

If the fault were to result from a fire (or originate a fire) in the associated fire zone, plant procedures (Abnormal Operating Procedure AOP-10A) would direct the restoration of power to the required safe shutdown loads. Therefore, a fire-induced fault would not affect the ability to achieve safe shutdown.

Recent licensee testing of seven Vital DC MCCBs from the plant (five installed spares and two replaced breakers) confirmed the reliability of MCCB operation in the thermal region.

After the cable routing problems were remedied, the reliability of the system was restored and the potential for a common mode failure was eliminated.

Similar Occurrences:

The following reportable events involved a lack of independence between safety-related power supplies:

LER	Title
266/96-013-00	Potential Common Mode Failure in 120 VAC Instrument Power Supplies
266/96-007-00	Redundant Safety-Related Circuits in the Same Control Board Wireway
301/93-005-00	Molded Case Circuit Breakers Fail Trip Tests Due to Grease Solidification
266/90-012-00	Potential Single Failure in B03-B01 and B04-B02 Control Circuits