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

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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 7

TITLE (4)

Electrical Short Circuits During A Control Room Fire Could Affect Safe Shutdown Capability

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
05	07	97	97	-- 022 --	00	06	05	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 or in NRC Form 366A
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

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 May 7, 1997, with Unit 1 in cold shutdown and Unit 2 in a defueled condition, the licensee's Appendix R Rebaselining Project team discovered that a postulated Control Room fire may cause an electrical "hot short" that bypasses (i.e., disables) the limit or torque switches for certain motor-operated valves (MOVs) that are essential for achieving an Appendix R safe shutdown. Fifteen (15) MOVs may be affected by this "hot short" condition. The Auxiliary Feedwater System, Service Water System, Component Cooling Water System, and the Residual Heat Removal System are affected. Spurious operation of an MOV with a disabled limit switch could cause the valve operator to generate thrust and torque values which exceed the design limits of the valves; causing physical damage to the valve that precludes its manual-handwheel operation. The inability to operate these essential valves would affect the capability to achieve the Appendix R safe shutdown. This discovery was made by our Appendix R Rebaselining Project team during a review of NRC Information Notice IN 92-18. Modifications have been initiated to remedy the condition.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Point Beach Nuclear Plant, Unit 1	05000266	97	- 022	- 00	2 OF 7

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

Event Description:

On May 7, 1997, at approximately 1620 CT, with Unit 1 in cold shutdown and Unit 2 in a defueled condition, a team of licensee and contract engineers discovered that a postulated Control Room fire may cause an electrical "hot short" that bypasses (i.e., disables) the limit or torque switches for certain motor-operated valves (MOVs) that are essential for achieving an Appendix R safe shutdown. Fifteen (15) MOVs may be affected by this "hot short" condition. Spurious operation of an MOV with a disabled limit switch could cause the valve operator to generate thrust and torque values which exceed the design limits of the valves; causing physical damage to the valve that precludes its manual-handwheel operation. The inability to operate these essential valves could affect the capability to achieve the Appendix R safe shutdown. This discovery was made by our Appendix R Rebaselining Project team during a review of NRC Information Notice IN 92-18, "Potential for Loss of Remote Shutdown Capability During Control Room Fire".

IN 92-18 described an unanalyzed condition regarding fire protection and the safe shutdown capability for the plant. A fire in the control room could cause hot shorts for certain MOVs needed to achieve and maintain a safe shutdown. If a control room fire forces reactor operators to evacuate the control room, these MOVs may have to be manually operated. However, hot shorts in combination with the absence of thermal overloads could allow a short to bypass the torque switch / limit switch protection; causing valve damage before the operators could isolate the associated control room circuits. This mechanical damage may be sufficient to prevent manual operation of the valves.

A hot short is considered to be a fire-induced short, either between individual conductors within the same cable, or from an external cable, that applies voltage to a de-energized circuit and could result in the possible energization of the closing/opening coil. Per IN 92-18, this condition could cause damage to the MOVs prior to establishment of local operator control following a control room fire. The mechanical valve damage to the MOVs could result from power being applied to the valve motor without the protection offered by the torque and limit switches. With the motor stalled, current and torque could increase to values that are beyond the torque and thrust limits of the operator (or valve) before the thermal overload would actuate to protect the assembly. This could result in mechanical damage to the valve or valve operator. This mechanical damage could prevent the capability of manual valve operation.

In 1993, the initial evaluation of the IN concluded that PBNP was not vulnerable to these hot shorts, primarily based on the fact that the thermal overload protection devices were not bypassed at PBNP. Furthermore, the probability for such a hot short was considered to be extremely low. The issue was also considered to be adequately addressed

through procedural steps to isolate the associated circuits following a control room evacuation. Therefore, the hot short scenario described in IN 92-18 was not considered to be applicable to the PBNP design.

During a review of Information Notice IN 92-18, our Appendix R Rebaselining Project team recognized new regulatory perspective on the issue and challenged the original evaluation (Reference NRC News Announcement RIII-96-65). The team concluded that the original evaluation took too much credit for the thermal overloads in the control circuit. After further detailed evaluation of potential hot shorts on the MOV control circuits, it was discovered that the thermal overloads did not provide adequate protection of the valves. With the circuit shorted around the limit and torque switches, the motor could stall such that current and torque to the valve will exceed the allowable torque and thrust limits of the valve before the thermal overload would actuate to protect the valve.

A calculation was initiated to determine the highest possible values of stem thrust and torque that MOVs may experience if the hot short bypasses the limit switches or torque switches. A preliminary calculation has identified 45 MOVs that may be physically damaged by a fire-induced hot short. Of the 45 MOVs, we have identified fifteen (15) that, if damaged by hot shorts, could adversely affect Appendix R safe shutdown. Affected systems include the Auxiliary Feedwater (AFW) System, Component Cooling Water (CCW) System, Service Water (SW) System, and the Residual Heat Removal (RHR) System. The particular valves and their functions are listed below:

MOV	Required Position for Safe Shutdown
1-AF-4000 1-AF-4001 2-AF-4000 2-AF-4001	Open to establish AFW flow for decay heat removal in hot shutdown.
0-AF-4009	Opens to provide SW to the AFW Pump P-38A suction
1-MS-2019 2-MS-2019 1-MS-2020 2-MS-2020	Open to provide steam to operate turbine-driven AFW Pump
2-CC-738A 2-CC-738B	Open to provide CCW to the Residual Heat Removal (RHR) Heat Exchanger for achieving cold shutdown
0-SW-2869 0-SW-2870 0-SW-2890 0-SW-2891	Open to provide SW to safe shutdown equipment

The calculation determined that the above valves and/or operators could be mechanically damaged if they were closed by the postulated hot short. The calculation also determined that the 0-AF-4009 valve, as well as the four service water system valves could also be mechanically damaged if opened due to a hot short, since the allowable stem thrust for the valve could be exceeded on opening.

PBNP is committed to meet the requirements of Section III.G of 10 CFR 50 Appendix R. Consistent with the guidance provided in Generic Letter 81-12, manual operation of safe shutdown components is credited in certain fire areas to mitigate the effects of fire-induced circuit damage. IN 92-18 addressed a control room fire scenario such that a hot short could result in spurious operation (open or close) of a valve and physical damage to the valve such that manual operation is not feasible. This type of fire-induced circuit failure may adversely affect the ability to achieve and maintain the safe shutdown requirements of Appendix R.

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

Valve (v)
Breaker (BKR)

Cause:

Based on the non-intuitive nature of the failure mode described by IN 92-18, hot shorts which bypass torque switch / limit switch protection (and result in mechanical valve damage) were never considered in the original Appendix R safe shutdown analysis. Subsequent review of the IN took credit for the thermal overload characteristics of the motor controller to preclude such failure conditions. Subsequent review, applying the phenomena described in IN 92-18, led to the discovery of this condition.

Corrective Actions:

1. Modifications have been initiated to re-wire the control circuits for 14 of the 15 MOVs such that a hot short in the control room will not result in disabling the associated valve and inhibiting a safe shutdown. Therefore, as credited in the Appendix R safe shutdown analysis, operator action can still be taken to re-position the valves. *This design change will be completed prior to startup of either reactor plant from their current outages.*

2. *Valve 0-AF-4009 will be re-geared to ensure that, in the event of a postulated fire and hot short, the valve would not be physically damaged and that post-fire manual operation would be available.*

Reportability:

On May 7, 1997, at 1845 CT, a 4-hour report per 10 CFR 50.72 (b)(2)(iii)(A) was made to the NRC duty officer. This report was made during the preliminary stages of the problem evaluation and identified a quantity of 23 safe shutdown MOVs that were susceptible to damage induced by hot shorts. Subsequent evaluation described in this LER reduced the quantity of susceptible valves to 15. This Licensee Event Report is being submitted in accordance with the requirements of 10 CFR 50.73(a)(2)(v)(A), "Any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in a safe shutdown condition."

Safety Assessment:

The defense-in-depth approach to Point Beach Nuclear Plant's Fire Protection Program would mitigate the significance of the condition and provide a high likelihood that a postulated control room fire would have been controlled adequately and adequate safe shutdown equipment would have been available.

In the current plant shutdown conditions, the hot short conditions postulated herein do not have an immediate safety impact. However, had the hot shorts occurred as postulated in IN 92-18, the achievement of safe shutdown may have been complicated by any one of the following valve failures:

1-AF-4000
1-AF-4001
2-AF-4000
2-AF-4001

Open to establish AFW flow for decay heat removal in hot shutdown.

Unit 1 Turbine-Driven AFW Pump 1P-29 feeds the Unit 1 steam generator "B" through normally open valve 1-AF-4000 and feeds the Unit 1 steam generator "A" through normally-open valve 1-AF-4001. Physical damage which disables these valves in the closed position would prevent flow to the associated steam generator. To isolate all flow to one unit would require hot shorts to both AF-4000 and AF-4001 valves associated with that unit. The likelihood of this is extremely small. Therefore, there is a high likelihood that at least one steam generator would have been available for AFW and the safe shutdown would have been achievable. The Unit 2 configuration is similar to Unit 1.

1-MS-2019
1-MS-2020
2-MS-2019
2-MS-2020

Open to provide steam to operate turbine-driven AFW Pump

Unit 1 Turbine-Driven AFW Pump 1P-29 is started by steam admission through either 1-MS-2019 (from steam generator "B") or 1-MS-2020 (from steam generator "A"). Physical damage that disables these valves in the closed position would prevent steam flow to the associated pump turbine. To disable a unit's turbine-driven AFW pump altogether would require hot shorts to both MS-2019 and MS-2020 valves associated with that unit. The likelihood of this is extremely small. Therefore, there is a high likelihood that at least one valve would have opened and the safe shutdown would have been achievable. The Unit 2 configuration is similar to Unit 1.

0-AF-4009 Opens to provide SW to AFW Pump P-38A suction

This normally-closed valve must be opened for certain fires to provide a source of water to Motor-Driven AFW Pump P-38A for sustaining the safe shutdown condition after depletion of the condensate storage tank. Physical damage that disables this valve in the closed position would preclude the use of service water as a suction source to this pump. However, alternative sources of condensate may be available during the fire including the condenser hotwells.

2-CC-738A Open to provide CCW to the Residual Heat Removal (RHR)
2-CC-738B Heat Exchanger for achieving cold shutdown

Within 72 hours of a postulated fire, PBNP must demonstrate the capability to maintain a cold shutdown condition using available RHR System equipment. Valve 2-CC-738A must be opened to provide CCW to Unit 2 RHR heat exchanger "A" and valve 2-CC-738B must be opened to provide CCW to Unit 2 RHR heat exchanger "B". Physical damage that disables these valves in the closed position would prevent the use of the associated heat exchanger. To disable a unit's RHR capability altogether, would require hot shorts to both CC-738A and CC-738B valves of Unit 2. The likelihood of this is extremely small. Therefore, there is a high likelihood that at least one valve would have opened and the safe shutdown would have been achievable for Unit 2.

0-SW-2869 Open to provide SW to safe shutdown equipment
0-SW-2870
0-SW-2890
0-SW-2891

These normally-open SW butterfly valves must remain open to preserve the open ring-header configuration of the PBNP SW System. The closure of any of these valves would disrupt the ring header configuration and may temporarily restrict SW flow during postulated fires. In effect, the closure of any of these valves would partially isolate the north SW header from the south SW header. These flow restrictions could challenge the capability of the available SW pumps to supply all the necessary safe shutdown loads. To completely isolate an essential safe shutdown SW load

from the SW pump supply would require hot shorts to two or more of these valves. The likelihood of this is extremely small. In addition, there are several alternative means to cross-connect the SW headers if so isolated. Therefore, there is a high likelihood that adequate SW would have been available to achieve and maintain the safe shutdown.

In general, the likelihood of a significant control room fire without detection or suppression, with multiple sustained hot shorts on specific control circuits is extremely remote. This type of hot short scenario is not postulated to occur during normal plant operation or other design basis accidents.

Similar Occurrences:

The following report also identifies conditions that are outside the Appendix R safe shutdown analysis.

LER	Description
266/97-020-00	Conditions Outside 10 CFR 50 Appendix R Safe Shutdown Analysis