

LICENSEE EVENT REPORT (LER)

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

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

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

TITLE (4)
Inadequately Rated Electrical Buses Could Disable Switchgear And Cause Secondary Fires That Prevent Shutdown Per Appendix R

| 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 |
| 06 | 30 | 97 | 97 | -- 032 -- | 00 | 07 | 30 | 97 | PBNP Unit 2 | 05000301 |
| | | | | | | | | | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | | 05000 |

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|-------------------------|---|-------------------|------------------|---|--|--|--|--|--|--|
| OPERATING MODE (9) N | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (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: Glenn D. Adams, Licensing Engineer
TELEPHONE NUMBER (Include Area Code): (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 |
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| 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 June 30, 1997, with Unit 1 in cold shutdown and Unit 2 in a refueling shutdown, the licensee's Appendix R Rebaselining Team discovered that a previously-identified issue related to electrical switchgear ratings had implications on the plant capability to achieve a safe shutdown for Appendix R fire scenarios. A calculation concluded that for certain AC buses, the fault current for a postulated zero-impedance ("bolted") three phase fault may be larger than the current-interrupting capability of the equipment involved. The licensee evaluated the potential for a fire in one fire area to cause a bolted electrical fault that exceeded the interrupting capability of the associated switchgear. If the associated switchgear is located in a different fire area, the overcurrent condition of the switchgear could lead to another, secondary fire. The capability of the plant to achieve and maintain safe shutdown for fires in multiple fire areas has not been demonstrated. Calculations determined susceptible fire areas and electrical circuits. Compensatory measures were established to provide operability until full compliance is established.

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Event Description:

On June 30, 1997, with Unit 1 in cold shutdown and Unit 2 in a refueling shutdown, the licensee's Appendix R Rebaselining Team discovered that a previously-identified issue related to inadequate electrical switchgear ratings had implications on the plant capability to achieve a safe shutdown for Appendix R fire scenarios. On June 30, 1997, the Appendix R Rebaselining Team also determined that this previously-unreported issue was reportable.

The issue was first identified in a vendor calculation of short circuit currents that could be generated at PBNP under specified plant conditions. The calculation concluded that for certain 480 V, 4160 V, and 13.8 KV buses, the fault current for a postulated bolted three-phase symmetrical fault may be larger than the capability of the equipment involved. Both safeguards and non-safeguards buses were potentially affected by this condition. In 1993, the condition was documented in condition report CR 93-137.

Based on the low probability for an actual "bolted fault", the significant conservatism used in the calculation, and the judgment that actual cable impedance would limit any fault current to a value below equipment ratings, the original operability determination of CR 93-137 concluded that the system was operable under the postulated conditions. Likewise, the original reportability review determined that the issue was not reportable pursuant to 10 CFR 50.72 or 50.73. Therefore, no report to the NRC was made at the time of original discovery.

The vendor calculation used very conservative assumptions. Electrical current sources were assumed to include the normal source, a transformer or another piece of switchgear, and each motor connected to the switchgear. The motors were assumed to act as generators and contribute to the fault current. The fault current contribution of the motors acting as generators was considerable; up to 40% of the total calculated fault current. The initial design of the switchgear did not take into account the contributions of these motor currents. When the switchgear was analyzed taking these motor currents into consideration, it was determined that in many cases the equipment ratings were exceeded.

In addition, the vendor calculation assumed a fault of zero or very low fault impedance (i.e., "bolted fault"), which is a standard assumption for these types of calculations, but is extremely improbable. The only probable creation of a bolted fault would be a result of maintenance errors that directly connected two or more phase conductors. It is even less probable that physical damage to the cable from an external event, such as a fire, would result in a bolted fault of zero impedance.

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In 1994, recommendations were made to perform a calculation for each switchgear that had the potential to be overloaded by the postulated fault. These individual calculations would have had to account for a variety of local factors, including cable impedance, different breaker designs, etc. Because of the very low probability of a three-phase bolted fault occurring and because some corrective actions had already been accomplished, this action item was assigned a low priority and scheduled as a long-term project.

In 1995, the original vendor calculation was superseded by a different vendor's calculation conducted to support the PBNP diesel generator project that added two emergency diesel generators (EDGs) to the emergency power system. At this point, it became necessary to generate new fault current studies to accurately model the modified electrical distribution system at PBNP. Based on the aforementioned low probabilities, further evaluation of the issue was assigned a low priority and scheduled accordingly.

In June of 1997, the licensee's Appendix R Rebaselining Team reviewed the issue in context with Appendix R compliance. In particular, this team evaluated the potential for a fire in one fire area to cause a bolted electrical fault which exceeded the interrupting capability of the switchgear. If the associated switchgear is located in a different fire area, then the overcurrent condition of the switchgear could lead to another, secondary fire (as might be postulated under guidelines of Appendix R and other related NRC generic guidance). The capability of the plant to achieve and maintain safe shutdown for fires in multiple fire areas has not been demonstrated.

A revised short circuit calculation was initiated for each of the subject electrical switchgear. Each power cable was reviewed to determine the minimum distance away from the bus where a fault must occur such that the cable's impedance will reduce the magnitude of fault current to a value within the rating of the switchgear. Then each cable's route was followed to determine whether the cable's route, for the minimum distance, took it through different fire areas than that in which the bus was located. Thereby, the team identified those fire zones where the initiating fire has the potential to cause a secondary fire at the associated switchgear. The licensee identified the following fire zones where an initiating fire could lead to a secondary fire in related switchgear:

| <u>Fire Zone</u> | <u>Description</u> |
|------------------|-----------------------------------|
| 142 | Component Cooling Water Pump Room |
| 151 | Safety Injection Pump Room |
| 156 | MCC Room (1B32) |
| 167 | Monitor Tank Room |
| 304 | Auxiliary Feedwater Pump Room |
| 305 | 4160 V Switchgear Room |

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In July of 1997, a revised operability determination concluded that most of the originally-identified switchgear were operable based on the available impedance in the circuits. In these cases, the impedance would limit the fault current such that redundant safety-related circuits are not disabled for a postulated fault between the limiting fault point and the switchgear. For those cases where impedance was inadequate to preclude switchgear failure and secondary fires, switchgear operability was established based on the defense-in-depth of the PBNP fire protection program and newly-established compensatory measures. These compensatory measures include twice-per-shift fire watches in those fire zones where the postulated bolted faults (caused by the fire) provide inadequate impedance to prevent the postulated secondary fire.

(In this LER, the term "switchgear" includes enclosed electrical interrupting devices including breakers, electrical buswork, and motor control centers (MCCs).

Cause:

The postulated condition is the result of a characteristic of the original electrical distribution system design. The original system design did not account for the bolted fault scenario assumed in the current analyses, and did not account for such other conservative factors as system motors acting as current-generators and contributing significantly to the fault current.

The cause for not having reported the issue is the same as that reported in LER 266/97-020-00. As described in that LER, the licensee observed general policies and interpretations that did not consider Appendix R compliance failures to be reportable. As noted in that LER, corrective actions have been taken to remedy those interpretations.

Corrective Actions:

1. *Compensatory measures were taken to establish a twice-per-shift fire watch in the following fire zones:*

| <u>Fire Zone</u> | <u>Description</u> |
|------------------|-----------------------------------|
| 142 | Component Cooling Water Pump Room |
| 151 | Safety Injection Pump Room |
| 156 | MCC Room (1B32) |
| 187 | Monitor Tank Room |
| 304 | Auxiliary Feedwater Pump Room |
| 305 | 4160V Switchgear Room |

These fire watches will remain in effect until the switchgear are restored to full qualification for the fault conditions described herein.

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2. The review of calculations for each switchgear that has been calculated to be overloaded will be completed by October 1, 1997.
3. Appropriate modifications or other design provisions will be made to ensure that the subject switchgear is capable of interrupting the postulated fault currents that may be generated during Appendix R fire scenarios.
4. With respect to the failure to report this issue initially, reportability guidance contained in DCS 2.1.1 has been revised to broaden the interpretation of reportability criteria so significant Appendix R issues are reported in accordance with 10 CFR 50.72 and 50.73.

Reportability:

On June 30, 1997, a 4-hour report per 10 CFR 50.72 (b) (2) (iii) (A) 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) (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:

At the time of discovery, both nuclear units were in safe shutdown conditions, such that the postulated fire scenario and the potential loss of safe shutdown equipment had reduced probability and reduced consequences.

If fire prevention, detection, and suppression features had failed to a point that a significant fire had developed in any of the six fire zones identified in the Event Description, cable insulation failure may have resulted in shorting one of the subject power cables. Had the conductors in those cables become shorted to generate a bolted fault, the associated switchgear may have caught fire and started a secondary fire in a different fire area. If the detection and suppression features in that fire area had inadequately controlled that secondary fire, then redundant safe shutdown equipment may have been damaged and the capability to achieve and maintain a safe shutdown as described by the existing safe shutdown analysis may have been compromised.

The defense-in-depth approach to the PBNP Fire Protection program (prevention, detection and suppression) provides reasonable assurance that any fire would not have progressed to the point of causing a bolted fault condition in one of the subject circuits and that a secondary fire would not have started.

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Similar Occurrences:

The following reports also identify conditions that are not in compliance with Appendix R safe shutdown requirements.

| <u>LER</u> | <u>Description</u> |
|---------------|--|
| 266/97-033-00 | Non-Exempt Power Cables Do Not Meet Appendix R Separation Criteria |
| 266/97-023-00 | Noncompliant Emergency Lighting For Postulated Appendix R Fires |
| 266/97-022-00 | Electrical Short Circuits During A Control Room Fire Could Affect Safe Shutdown Capabili |
| 266/97-020-00 | Conditions Outside 10 CFR 50 Appendix R Safe Shutdown Analysis |

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:

| <u>Component</u> | <u>Identifier</u> | <u>System</u> | <u>Identifier</u> |
|------------------|-------------------|-------------------------------|-------------------|
| Cable | CBL | Emergency Onsite Power Supply | EK |
| Bus | BU | Medium-Voltage Power System | EA |
| Switchgear | SWGR | | |