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August 18, 1989

10 CFR Part 50
Section 50.73

Director of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Lack of Circuit Protection Coordination For Associated Circuits
on Two Appendix R Related Motor Control Centers

The Licensee Event Report for this occurrence is attached.

Please contact us if you require additional information related to this event.

Eugene Eckhardt
for Thomas M Parker
Manager
Nuclear Support Services

c: Regional Administrator - Region III, NRC
NRR Project Manager, NRC
Senior Resident Inspector, NRC
MPCA
Attn: Dr J W Ferman

Attachment

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PDR ADGCK 05000282
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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) PRAIRIE ISLAND NUCLEAR GENERATING PLANT UNIT 1	DOCKET NUMBER (2) 0 5 0 0 0 2 1 8 2	PAGE (3) 1 OF 0 9
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TITLE (4) **Lack of Circuit Protection Coordination for Associated Circuits on Two Appendix R Related Motor Control Centers**

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		
06	06	89	89	007	00	08	18	89	Prairie Island Unit 2		
									DOCKET NUMBER(S) 0 5 0 0 0 3 0 1 6		
									0 5 0 0 0		

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 8. (Check one or more of the following) (11)

OPERATING MODE (9) N	20.402(b)	20.406(c)	80.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10) 11010	20.405(a)(1)(i)	80.36(a)(1)	80.73(a)(2)(v)	73.71(c)
	20.405(a)(1)(ii)	80.36(a)(2)	80.73(a)(2)(vii)	XX OTHER (Specify in Abstract below and in Text, NRC Form 366A) Voluntary
	20.405(a)(1)(iii)	80.73(a)(2)(i)	80.73(a)(2)(viii)(A)	
	20.405(a)(1)(iv)	80.73(a)(2)(ii)	80.73(a)(2)(viii)(B)	
	20.405(a)(1)(v)	80.73(a)(2)(iii)	80.73(a)(2)(ix)	

LICENSEE CONTACT FOR THIS LER (12)

NAME Arne A. Hunstad, Staff Engineer	TELEPHONE NUMBER
	AREA CODE: 6 1 2 NUMBER: 3 8 8 - 1 1 2 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) NO NO

EXPECTED SUBMISSION DATE (15)

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On June 6, 1989, it was determined that two circuit breakers on Appendix R related motor control centers lacked adequate coordination for circuit protection. "Adequate coordination" ensures that in the event of fire, the loads required for safe shutdown will be unaffected by those not required for safe shutdown. That is, the loads not required for safe shutdown must have protected circuits so that in the event of a fault during a fire, the fault will be cleared by their circuit breaker and not by an upstream breaker that feeds safe shutdown loads.

Upon discovery, fire watches were established as compensatory measures. The breakers were replaced. The procurement and the receiving processes have been revised to prevent recurrence.

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

EVENT DESCRIPTION

On June 6, 1989, it was determined that two circuit breakers on Appendix R related motor control centers lacked adequate coordination for circuit protection.

In response to Appendix R of 10 CFR Part 50 (Fire Protection and Safe Shutdown) a coordination study was conducted in February 1987 to assess the state of circuit coordination for all loads required for safe shutdown under Appendix R and their associated circuits.

In March of 1987 NRC Region III personnel conducted an inspection to confirm Prairie Island's compliance with Appendix R. The inspection determined that, for certain Motor Control Centers (MCC's), circuit coordination between the load and feeder breakers was inadequate. The Appendix R circuit coordination requirement ensures that in the event of fire, the loads required for safe shutdown will be unaffected by those not required for safe shutdown. That is, the loads not required for safe shutdown must have protected circuits so that in the event of a fault during a fire the fault will be cleared by their circuit breaker and not by an upstream breaker that feeds safe shutdown loads.

The MCC's with inadequate coordination identified by the NRC inspection are sub-fed MCC's which are powered from other MCC's. In this case one molded case circuit breaker (MCCB) powers an MCC with several circuit breakers feeding individual loads. This differs from the more common practice of feeding an MCC directly from a 480 VAC bus. The use of "sub-fed" MCC's is a part of Prairie Island's original design.

For sub-fed MCC's, where one circuit breaker powers an MCC that uses Molded Case Circuit Breakers as load breakers, it is impossible to provide complete circuit coordination. The instantaneous region of the breakers' characteristic curves cannot be made to coordinate. However, it was determined that by utilizing an obsolete style breaker, General Electric style THEF, coordination could be achieved in all other regions of the characteristic curve. At that time it was believed this was the only option available to gain compliance with Appendix R requirements. This action was subsequently reviewed and judged to be adequate by the NRC's Appendix R reviewers.

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

An investigation was conducted to determine the availability of this obsolete style of circuit breaker with the following results:

1. Since this style of circuit breaker had not been manufactured since 1972, no new circuit breakers of this style were available.
2. Some spare circuit breakers of this style did exist in the plant.
3. Used circuit breakers of this style were available through Prairie Island's normal distributor.

During the time frame of this investigation, the General Electric Company would not sell safety related equipment to Prairie Island directly. This policy made the option of transferring installed used equipment to the necessary circuits unattractive because sources of new replacement circuit breakers were uncertain. Therefore, it was determined imprudent, from a plant availability standpoint, to transfer installed equipment (beyond installed spares) because spares might not be available and circuit coordination was a concern in other areas of the plant.

As a result, instead of transferring installed used breakers, used circuit breakers were purchased from Bud Ferguson Industrial Control and Supply. These breakers underwent receipt inspection and testing in accordance with the commercial grade dedication procedures in place at that time. The circuit breakers were installed during subsequent refueling outages for Unit 1 and Unit 2 (5/87 and 1/88).

In July of 1988 the NRC identified, via Information Notice 88-46, problems with circuit breakers that had been refurbished and fraudulently sold as new equipment. It was believed that the Notice was not applicable to the used breakers that had been purchased since:

1. The circuit breakers were sold as used and not as new equipment.
2. The source for the Prairie Island circuit breakers was not on the list of suppliers of potentially fraudulent equipment supplied by Information Notice 88-46.

During the Vendor Branch Inspection which concluded in November 1988, Prairie Island was informed that these used circuit breakers should, in fact, be considered suspect. A Justification for Continued Operation (JCO) addressing this subject was prepared and forwarded to the Region.

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On November 22, 1988, shortly after the conclusion of the Vendor Branch Inspection, the NRC issued Bulletin 88-10 regarding the existence of refurbished circuit breakers. The Bulletin required each plant to identify circuit breakers that were not directly traceable to the circuit breaker manufacturer, and specified testing procedures if suspect breakers were identified and no suitable replacements were immediately available.

As a result of discussions with the NRR Project Manager, it was concluded that we would not report the used circuit breakers that had been previously identified as suspect, as part of Prairie Island's response to Bulletin 88-10.

As a result of the NRC Vendor Branch Inspection, the associated justification for continued operation and discussions with the NRC Region III Staff, a program was undertaken to establish whether the subject used circuit breakers had been refurbished in any way. To accomplish this, NSP contracted the General Electric Company to test and examine the remaining used style THEF circuit breakers that had not been installed in the plant. The test program performed was in accordance with General Electric recommendations. On April 20 and 21, 1989 this inspection took place at General Electric's facility in Atlanta, Georgia with representatives from NRC Region III, Region II, NRR, and NSP in attendance. One style THEF circuit breaker that had been in service at Prairie Island since construction was removed from the plant and supplied as a control.

Three circuit breakers were opened for internal inspection. Two of the circuit breakers opened were those having test data out of the acceptable range. The third circuit breaker opened was the circuit breaker that had been removed from service at Prairie Island. The THEF circuit breaker uses a riveted case, so that once the circuit breaker has been opened for inspection the breaker can no longer be used.

The results of this examination were:

1. All of the used circuit breakers purchased from Bud Ferguson Industrial Control and Supply had other than original labels. All but one were in boxes that had other than original labels.
2. Some of the used circuit breakers exhibited characteristics that were outside the acceptance criteria by a small margin.
3. The used circuit breakers that were opened did not, in General Electric's opinion, contain any fraudulent parts nor did they show signs of internal refurbishment.

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TEXT (if more space is required, use additional NRC Form 366A 2) (17)

Based upon these results and discussions, NSP believed that continued operation was justified until a suitable engineering solution could be obtained. General Electric had agreed to support NSP on this issue.

On February 27, 1989 the NRC issued Information Notice 89-21. This Notice provided information that manufacturers of circuit breakers would, in some cases, change their circuit breaker internal design and hence the circuit breakers' characteristics curve without customer notification.

During the circuit breaker inspection at Atlanta, Georgia it was discovered that the characteristic curves used by General Electric were different from those used by NSP. Investigation revealed that the difference in the characteristic curves was due to a difference in voltage rating. General Electric used curves for a 600 VAC circuit breaker while NSP's curves were for a 480 VAC circuit breaker. The 600 VAC curves were correct for the used circuit breakers that NSP had obtained from Bud Ferguson Industrial Control and Supply.

In ordering the used circuit breakers, NSP had specified that 480 VAC circuit breakers be supplied. The supplier had furnished 600 VAC circuit breakers. Receipt inspection had identified this difference, but the nuances of the difference between the 480 VAC and the 600 VAC curves were not identified in 1987 and the 600 VAC circuit breakers were accepted.

After evaluation of the impact of the change in characteristic curves on the Appendix R coordination study, it was determined that adequate circuit coordination did not exist for two circuit breakers. These breakers supplied the Loop B Feedwater Isolation Valves for each unit. On June 6, 1989, fire watches were established for the Loop B Feedwater Isolation Valves for each unit as compensatory measures for the lack of coordination. The operators were informed of the reason for the fire watch.

A review of the coordination study for additional concerns raised by changes in circuit breaker characteristic curves revealed no additional problems.

On June 8, 1989 representatives from Prairie Island met with representatives from the NRC Region III Staff and representatives of the NRC Vendor Inspection Branch at the NRC Region III office in Glen Ellyn, Illinois. The purpose of this meeting was to discuss the Vendor Branch Inspection Report.

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During this meeting, NSP was informed that the opening of only two of the used circuit breakers was considered inadequate assurance that other used circuit breakers, including those installed at Prairie Island, had not been tampered with. As a result of this meeting, NSP agreed to test the uninstalled used circuit breakers in accordance with the requirements of NRC Bulletin 88-10. These tested breakers would then be used to replace the presently installed used circuit breakers. At that time it was noted that the replacement of the two circuit breakers supplying power to the Loop B Feedwater Isolation Valves might require a shutdown on each unit and that no engineering solution existed for the coordination problems identified for the Feedwater Isolation Valve breakers. NSP agreed to develop a schedule for replacement and to involve the NRC Region III Staff in the discussion.

Following the June 8 meeting, investigation revealed sufficient originally installed style THEF circuit breakers in service at Prairie Island that could be used to replace the used circuit breakers obtained from Bud Ferguson Industrial Control and Supply. This included circuit breakers of a size that would supply adequate coordination for the Loop B Feedwater Isolation Valves.

A testing program was developed for these originally installed breakers based upon Prairie Island's commercial grade dedication program for Molded Case Circuit Breakers. This acceptance test program included all of the attributes listed in NRC Bulletin 88-10 with the exception of acceptance criteria for contact resistance. The circuit breaker manufacturer, General Electric, recommended that a temperature rise test, as specified by ANSI/UL 489, would provide a better indication of contact condition than the contact resistance test. For completeness, both the resistance test and the temperature rise test were performed. All breakers passed the temperature rise test. Four of the breakers did not pass the acceptance criteria of Bulletin 88-10 for contact resistance. These results were reviewed internally and with the circuit breaker manufacturer and the breakers were judged to be suitable for their intended service.

An evaluation was performed and it was concluded that the breakers supplying the Loop B Feedwater Isolation Valves could be replaced and tested with the units at power. An operator was stationed at each valve during the breaker replacement to manually close the valve if required. The breakers were replaced during the week of June 26, 1989, with an out-of-service time of less than one hour for each.

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CAUSE OF THE EVENT

The cause of this event was an inadequate review process. The subtleties of the manufacturer's breaker characteristic curves were not recognized. When the breakers were received, the possibility of a subtle difference between the curve for the 600 VAC frame and 480 VAC frame was not recognized by cognizant personnel. It was believed, at that time, that one set of characteristic curves applied to both voltage ratings since they were for the same breaker frame. Although the condition was identified at the time of receipt, it was not formally reviewed through the nonconformance process. The informal review that occurred did not identify the problem with the breakers received. Further, the receipt testing performed did not test in the affected region of the characteristic curve.

ANALYSIS OF THE EVENT

Under non-Appendix R conditions, the single failure criteria were not violated, since only one Train B MCC for each unit was affected. Under Appendix R conditions, only Train B components are assumed to be operable from the Control Room. MCC's associated with the two breakers could be de-energized by the postulated fire-related fault; remote operation of "safe shutdown" components associated with one MCC for each unit would not be possible. However, combustible loading in the zone containing the cable and component (steam generator B feedwater isolation valve) is minimal, and transient combustible entry into the zone is administratively controlled. Therefore, the probability of fire of sufficient intensity and duration to cause the postulated fault is very small.

This event is not reportable under 10CFR50.73, but is being provided voluntarily for the information of the NRC Staff and the industry.

CORRECTIVE ACTION

The two breakers in question were replaced by breakers which provide proper circuit coordination. In addition, all the other installed breakers that were procured from Bud Ferguson Industrial Supply and Control have been replaced.

The used circuit breakers removed from service have been tested in accordance with the requirements of NRC Bulletin 88-10. This testing was completed on July 12, 1989. The results of this testing are as follows:

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1. None of these breakers passed the contact resistance test.
2. One breaker did not pass the temperature rise test at 100% of its current rating, 50 Amps. The test was re-run at 80% of rating (40 Amps) in accordance with ANSI/UL 489 and the breaker passed. This breaker was used for No. 11 Battery Charger, which has a full load rated current of 35 Amps; therefore, this breaker would have satisfactorily fulfilled its safety function.
3. One breaker did not pass the endurance test at 100% of rating (50 Amps). This breaker was retested at 35 Amps, which is the full load for No. 22 Batter Charger, which it fed while in service. The breaker performed satisfactorily at that load. This battery charger had, during the Unit 2 outage, successfully carried Safety Injection switching loads during the integrated SI test, and had carried all normal loads while the battery was out of service for a test discharge without problem.

Our safety evaluation regarding these breakers will be updated to reflect this information.

Additionally, all remaining used circuit breakers purchased from Bud Ferguson Industrial Control and Supply will be internally inspected at Prairie Island at a time to be agreed upon with the NRC to determine if any of the circuit breakers have been refurbished internally.

Since there are a limited number of Style THEF breakers installed at Prairie Island, NSP will continue to work with General Electric to obtain an engineering solution to the coordination problem that occurs when one molded case circuit breaker is powered from another. In the long term, this problem will be solved for safety-related MCC's by action proposed under Prairie Island's Station Blackout/Electrical Systems Upgrade Project. This action would eliminate sub-fed MCC's by providing sufficient 480 VAC buses to feed each safety-related MCC directly.

The procurement process has been changed to require verification of the characteristic curves for circuit breakers. Additionally, the procedures used to receive circuit breakers have been strengthened to provide for additional verification testing similar to that described in NRC Bulletin 88-10.

The receiving process has been revised to require more rigorous resolution of discrepant items received. Circuit breaker procedures have been revised to incorporate the testing methodology of NRC Bulletin 88-10.

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COMPONENT IDENTIFICATION

GE circuit breaker Catalog # THEF 136050. The newer style are THED.

PREVIOUS SIMILAR EVENTS

There have been no previous similar events at Prairie Island.