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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 91-006-00:on 901129,during design change process resulting in being outside design basis for separation of safety related & non-safety related circuits.Due to error of personnel.Design procedures revised.W/910823 ltr.

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August 23, 1991

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In accordance with the criteria established by 10 CFR 50.73 entitled Licensee Event Report System, the following report is being submitted:

91-006-00

Sincerely,

A. Alan Blind

A.A. Blind
Plant Manager

AAB:sb

Attachment

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NRC FORM 366 (6-89) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-630), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
D. C. COOK NUCLEAR PLANT - UNIT 1	0 5 0 0 0 3 1 5	1 OF 0 8

TITLE (4) PERSONNEL ERROR DURING THE DESIGN CHANGE PROCESS RESULTED IN BEING OUTSIDE THE DESIGN BASIS FOR SEPARATION OF SAFETY RELATED AND NON-SAFETY RELATED CIRCUITS

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 5 0 0 0
1 1	2 9	9 0	9 1	0 0 6	0 0	0 8	2 3	9 1		0 5 0 0 0

OPERATING MODE (9)	6	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)					
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)		
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)		
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)		
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)			
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)			
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)			

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
G. A. WEBER - PLANT ENGINEERING SUPERINTENDENT	AREA CODE 6 1 6 4 6 5 - 5 9 0 1

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
A	E K	D G	W 3 1 5	N					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

The design of an electrical distribution circuit associated with Unit 1 CD Emergency Diesel Generator (EDG) was discovered to be in non-conformance with 10CFR50 Appendix A, General Design Criteria 17 and 22, from November 29, 1990 through July 24, 1991. This resulted from a design change which, through the removal of a circuit breaker, caused a safety related Essential Safety System (ESS) power supply circuit to be directly connected to a non-safety related Balance of Plant (BOP) circuit. Had a fault on the BOP circuit occurred simultaneously with a condition requiring the diesel generator to operate, the loss of power to the DG1CD auxiliaries could have affected extended EDG operation. A design change was completed on July 24, 1991, which reinstalled the breaker and restored the required isolation point.

The design change which caused the breaker to be removed was based on an electrical breaker coordination study conducted in 1988 which incorrectly identified the BOP Motor Control Center as a safety related component. To prevent a recurrence of this type of error, design procedures were revised and extensive training of design personnel was completed.

Conditions Prior to Occurrence

Unit 1 in Mode 6 (Refueling), at 0 percent power.

Description of Event

On November 29, 1990, Design Change RFC 12-3008 removed a circuit breaker (EIIS:EC-BKR) from an Engineered Safety System (ESS) Motor Control Center (MCC 1-ABD-C)(EIIS:EK-MCC). The ESS MCC supplies power to certain safety-related diesel generator auxiliary systems (EIIS:EC-FAN), as well as, balance of plant (BOP) MCC 12-TSC-S. The circuit breaker which was removed by the design change provided isolation between the ESS and BOP circuits (See Figure 1). When it was removed, the BOP circuit was connected directly to the ESS source. If a fault had occurred on the BOP feeder cable subsequent to the removal of this breaker, the breaker feeding the ESS MCC (600V Air Circuit Breaker 11C10) would have tripped, causing a loss of power to the diesel auxiliaries. If a fault had occurred simultaneously with a condition requiring the diesel generator to operate, the loss of power to the diesel auxiliaries may have prevented the diesel generator from operating for an extended period of time.

During the period of time that the breaker, which fed MCC 12-TSC-S, was removed from MCC 1-ABD-C, Unit 1 AB Emergency Diesel Generator (DG1AB)(EIIS:EK-DG) was removed from service on one occasion for maintenance (June 3, 1991 at 0430 hours until June 4, 1991 at 1828 hours). With DG1AB out for maintenance, DG1CD was the only on-site emergency source of AC electrical power available to Unit 1.

Because of the lack of adequate separation between the ESS circuits associated with DG1CD and the non-safety related BOP circuits caused by the breaker removal, Unit 1 was considered to be in non-conformance with 10CFR50 Appendix A, General Design Criteria 17 and 22. On July 23, 1991, upon discovery of this condition, DG1CD was declared inoperable in accordance with Technical Specification 3.8.1.1, and the one hour notification call was made to the NRC as required by 10CFR50.72(b)(ii)(B). The discovery was made during a review of documents being performed in connection with an in-house Electrical Distribution System Functional Inspection (EDSFI). On July 24, 1991, a design change was completed which reinstalled the breaker and restored the isolation point required for ESS/BOP circuit separation. DG1CD was once again declared operable.

Cause

Design Change RFC 12-3008 was initiated as a result of an electrical breaker coordination study performed in 1988. This study correctly identified a problem in the coordination between the breaker supplying BOP MCC 12-TSC-S and the load breakers supplied by this MCC, but had incorrectly identified the MCC as an ESS component. On the basis of this error in safety classification, it was determined that the coordination problem could be resolved by simply removing the breaker supplying the BOP MCC and replacing it with a solid connection to the ESS MCC. RFC 12-3008 implemented this change. The error in safety classification which was made in the coordination study was carried over into the design change documentation. The design change verification process failed to detect and correct this error.

Had MCC 12-TSC-S been properly classified as non-safety related (BOP) in the coordination study, it would have been recognized that proper coordination existed between the BOP isolation point and the upstream supply breaker without the need for any modification. The lack of coordination that exists between the feed to MCC 12-TSC-S and the MCCs BOP load breakers is inherent to the current interrupting characteristics of molded case breakers and is acceptable for BOP circuit protection.

Analysis of Event

ESS MCC 1-ABD-C supplies power to BOP MCC 12-TSC-S and certain auxiliary system components associated with DG1CD. With the breaker removed from the feed to the BOP circuit, a fault occurring on the cable connecting the MCC 1-ABD-C to MCC 12-TSC-S would have prevented the MCC 1-ABD-C feeder breaker from being reclosed until the fault was removed from the circuit. A portion of the auxiliary system components associated with DG1CD would have been left without a source of power.

Many of the DG1CD auxiliary system components which are supplied from MCC 1-ABD-C are required to maintain the diesel in Standby but are not required during diesel operation. The loss of power to these loads concurrent with conditions requiring the diesel to operate would not affect its operability. The loss of power to these loads with the diesel in Standby would cause the diesel to be declared inoperable in accordance with Technical Specification until the condition was corrected. Thus, the loss of power to these Standby auxiliaries would not present a significant safety concern.

Analysis of Event Continued

Other auxiliary loads powered from MCC 1-ABD-C, including Jacket Water pump 1CD2 and Fuel Oil Transfer Pump 1CD1, are redundant to loads which are powered from a separate MCC (MCC 1-ABD-D). These loads, or their redundant counterparts must be available to support extended diesel operation. Since both of the redundant components are normally maintained in a state of readiness to support diesel operation, the loss of those loads powered from MCC 1-ABD-C would not prevent the diesel from operating. Thus, the loss of power to these redundant auxiliaries would not present a significant safety concern except during times when the auxiliaries from MCC 1-ABD-D were also out of service.

In addition to the loads discussed above, DG1CD room ventilation supply fan 1-HV-DGS-2 and motor-operated supply damper 1-HV-DGS-DCD are powered from MCC 1-ABD-C. Together with the room exhaust fan 1-HV-DGX-2, which is supplied from MCC 1-ABD-D, these components provide room cooling during standby and operating conditions. The supply damper is interlocked to the supply and exhaust fan run circuits such that the damper is open whenever either the supply or exhaust fan is in operation. A control room annunciator is provided to alert the operator to the condition of a running fan and a closed supply damper. The fans automatically start and run when the temperature in the diesel room exceeds 95° F. The fans run frequently during the summer months and would typically be running during diesel generator operation.

In the event of a loss of power to the supply fan and damper with either the supply fan or exhaust fan running and damper open, the supply fan would stop running and the supply damper would remain in the open position. The exhaust fan would either start or continue to operate and draw air into the diesel room via the open supply damper. With the damper open, the exhaust fan alone could provide a significant amount of the room ventilation required to support diesel operation. In the event of a loss of power to the supply fan and damper with both the supply and exhaust fan not running and the supply damper closed, it would not be possible to start the supply fan and the damper would remain in the closed position. If the room temperature exceeded 95° F, the exhaust fan would start, but with the supply damper in the closed position, the exhaust fan may not be capable of supporting diesel generator operation for an extended period of time.

Analysis of Event Continued

The diesel has been operated at full load with fans running and supply damper closed for a period of one hour as part of a test performed in June of 1986. This test demonstrated that the diesel would continue operating for at least a one hour time period. Based on these test results, it can be determined that the diesel would probably continue to operate for a period of several hours without any room ventilation available.

There is some doubt as to whether the diesel could be operated over longer periods of time without ventilation and without considering various mitigating factors. A potentially adverse impact on the health and safety of the public is mitigated by the following factors:

1) The scenario necessary to produce any serious safety concerns from the subject failure involves the coincidental occurrence of a loss of offsite power, the unavailability of the opposite train's EDG, and a fault in the BOP MCC with the resulting loss of the EDG room cooling. Preliminary results of the Cook Nuclear Plant Probabilistic Risk Assessment (PRA) reports the frequency of a loss of offsite power as 4.0E-2 events per year. This same study calculates the unavailability of a EDG as 1.8E-2. While no value is available in either generic or plant specific sources for the likelihood of the subject BOP fault, a value of 1.0E-2 is expected to be conservative. Using these values, the frequency of the event in question is 7.2E-6 per year.

   Another scenario which could lead to the same event involves the occurrence of a seismic event of sufficient magnitude to cause a loss of offsite power and simultaneously having the subject BOP fault. This, in coincidence with the unavailability of the opposite train's EDG, would result in the same event. The preliminary Cook Nuclear Plant seismic PRA reports the frequency of a design basis earthquake (DBE) (0.2g) as approximately 5.0E-5 per year. This value, combined with a EDG unavailability of 1.8E-2, yields an annual frequency of 9.0E-7.

   The probabilities calculated for these two sequences indicate that their likelihood is extremely low.

Analysis of Event Continued

2) If the above combination of events did occur with the supply or exhaust fan initially running and the supply damper open, the exhaust fan alone could provide the required room cooling for an extended period of time. If the above combination of events occurred with the fan initially not running and the supply damper closed, the exhaust fan would automatically start when the room temperature reached 95° F and a control room annunciator would have alerted the operator to the abnormal damper status (ie, damper closed with fan running). In response to this condition, an operator could have been dispatched to take action to open the damper locally. Opening the damper would restore the supply of ventilation air to the room. It is expected that this local operation could have reasonably been accomplished within one or two hours of a diesel generator start and would enable the diesel to continue operation for an extended period of time.

3) If the operator failed to recognize or take action to correct the abnormal damper status, and in the event that the diesel did eventually fail due to room overheating, the operator would most likely have resorted to the unit's Emergency Remote Shutdown procedure, 1-OHP 4023.001.001. This procedure relies on inter-unit system cross-ties to achieve safe shutdown of Unit 1. The Fire Safe Shutdown System Analysis (SSSA) demonstrates the ability of the plant's Alternate Shutdown Capability for fires which are postulated to cause both Unit 1 diesel generators to fail. This analysis bounds the event discussed in this report.

In conclusion, this event represents a negligible impact on public health and safety.

Corrective/Preventive Actions

Design Change 01-MM-228 reinstalled the removed breaker on July 24, 1991.

The Design Change deficiency occurred in 1989. A 1990 NRC Safety System Functional Inspection (SSFI - 50-315/90-201, 50-316/90-201) identified a lack of Engineering attention to detail for design activities .

Corrective/Preventive Actions Continued

As a result of the 1990 NRC ESW SSFI, Design Procedures were modified and in-depth training was conducted on all Nuclear Engineering Procedures covering design activities. Specifically, training was given for the entire Nuclear Engineering Department on Design Procedure NED 3.4 (Design Input) on January 22, and 29, 1991.

Failed Component Identification

Component Name: Unit 1 CD Diesel Generator

Plant I.D.: 1 DG CD (EIIS:DG)

Manufacturer: Worthington

Model No.: SWB 12 CYL

Previous Similar Events

Previous similar events include:

LER 050 - 315/90-008

FIGURE NO. 1

DISTRIBUTION SKETCH