UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

August 20, 1991

NRC INFORMATION NOTICE NO. 91-51: INADEQUATE FUSE CONTROL PROGRAMS

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is intended to alert addressees to potential problems caused by inadequate programs to control activities related to fuses. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

During recent inspections, the U.S. Nuclear Regulatory Commission (NRC) has identified numerous deficiencies involving fuse control programs. These deficiencies included inadequate root cause evaluations of blown fuses, inadequate verification of design information for installed and replacement fuses, inadequate identification and labeling of fuses, and lack of coordination between fuses and circuit breakers.

Other fuse control problems, especially those resulting from personnel errors, have been reported in licensee event reports (LERs). As reported in the LERs, these personnel errors have caused inadvertent operation or loss of vital plant equipment and, in some cases, have resulted in a loss of offsite AC power and the spurious actuation of engineered safety features (ESF).

Discussion:

The main function of a fuse is to prevent or minimize damage to the electrical distribution system (EDS) and related components and to limit the effect and extent of service interruptions whenever any portion of the system is subjected to a fault. Fuses are relied upon to isolate electrical faults to ensure minimum disturbance to the system. Fuses are also used as electrical isolation devices between a class 1E power supply and non-class 1E electrical equipment. Proper protection is achieved through the careful selection of the type and the rating of the fuse. If an oversized fuse is selected that has a higher capacity than the upstream fuse or breaker, the oversized fuse could make the entire

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bus unavailable in case of a fault within the circuit. In addition, a faulted circuit with an oversized fuse can degrade the voltage of a bus and impart excessive heat to adjacent cables. On the other hand, if an undersized fuse is selected, the undersized fuse could lead to a loss of the safety function of equipment by prematurely opening the protected circuit. Therefore, when selecting fuses, it is important to consider the voltage, current, interrupting rating, fuse type, and coordination with other fuses and circuit breakers.

Common deficiencies identified during recent NRC inspections of fuse control programs are as follows:

Inadequate Root Cause Evaluation of Blown Fuses

During an NRC inspection at Zion Nuclear Power Station, Unit 2 (NRC Inspection Report 50-295/90-13), the staff noted that on July 7, 1990, Unit 2 personnel declared an alert condition because of a partial loss of the annunciators in the control room for the nuclear steam supply system (NSSS) and the balance-of-plant (BOP) systems. The loss of the annunciators apparently resulted from blown fuses in the power supplies for the annunciators. On 11 different occasions between July 1 and July 7, 1990, fuses blew in various NSSS and BOP annunciator power supplies. The licensee's electrical maintenance personnel and operators continued to replace the blown fuses without contacting the technical staff engineers to determine the root causes of the excessive fuse failures until after the event on July 7, 1990. Subsequently, the licensee determined that some of the fuses installed in 125 VDC power supplies were rated for 32 VDC.

Inadequate Verification of Design Information for Installed and Replacement Fuses

In June 1990, during an NRC maintenance team inspection at Kewaunee Nuclear Power Plant (NRC Inspection Report 50-305/90-11), the NRC identified a number of discrepancies between design documents and fuses installed in AC and DC safety-related fuse panels. In addition, the NRC found that many design documents did not contain information regarding the size, rating, type, or manufacturer of the fuse. The discrepant fuses and the lack of design information could have caused inadequate system and component protection.

Inadequate Identification and Labeling of Fuses

In July and August 1990, during an electrical distribution system functional inspection (EDSFI) at the Trojan Nuclear Plant (NRC Inspection Report 50-344/90-200), the NRC determined that the licensee did not have an adequate program to control the identification, labeling, and replacement of fuses. The NRC also determined that the lack of a fuse control program had contributed to past problems with incorrectly installed fuses.

Improper Coordination of Fuses and Circuit Breakers

In May 1990, during a routine inspection at the Palisades Nuclear Generating Plant (NRC Inspection Report 50-255/90-10), three examples were found in which fuses and breakers did not coordinate in all regions on the coordination curves. This, in turn, might have resulted in a disturbance to the system under fault conditions not being minimized. In addition, the NRC found that the licensee's fuse procedure specified voltage and current ratings for fuse replacements but did not include the model and type. Without all of the proper information, such as the time/current characteristics of the fuse, proper coordination and protection may not have been obtained.

Personnel Errors

Although personnel errors cannot be totally eliminated from routine, emergency, or corrective plant maintenance, a review of LERs indicates that most errors are caused by either the plant staff not being adequately trained or plant procedures not being adequately detailed. Some examples of these LERs are included in Attachment 1. A well designed fuse control program along with trained personnel and clear procedures could reduce errors in fuse control significantly.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate NRR project manager.

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contacts: Zelig Falevits, RIII
(708) 790-5772

Roger Mendez, RIII
(708) 790-5589

Fred Burrows, NRR
(301) 492-3260

Attachments:
1. Examples of LERs Related to Fuse Problems Caused by Personnel Errors
2. List of Recently Issued NRC Information Notices

Examples of LERs Related to Fuse Problems Caused by Personnel Errors

Facility: Dresden Unit 2

LER No.: 50-237/88-023

Abstract: On December 31, 1988, with the unit in the refueling mode, an ESF actuation occurred and subsequently caused initiation of the standby gas treatment system and isolation of the reactor building ventilation system. The ESF actuation occurred when the wrong fuses were pulled after an operating shift foreman erroneously changed the fuse numbers on the equipment outage checklist. The operating shift foreman believed that the fuse numbers originally listed on the equipment outage checklist were incorrect. He changed the fuse numbers but failed to have a second operator independently verify the change. As a result of this error, the wrong fuses were pulled and an unexpected ESF actuation occurred.

Facility: Peach Bottom Unit 2

LER No.: 50-277/88-006

Abstract: On March 3, 1988, the unit experienced an actuation of the primary containment isolation system as the result of a loss of power to the "A" residual heat removal system logic bus. The loss of power was caused by an improperly filled out blocking permit which directed the individual performing the block to remove a fuse from a wrong panel.

Facility: Zion Unit 1

LER No.: 50-295/87-009

Abstract: On April 30, 1987, with the unit in hot shutdown, the unit experienced a safety injection and opening of the main steam isolation valves which pressurized the steam line to approximately 800 psig (from approximately 80 psig). The event occurred because an electrical equipment operator failed to pull fuses in the required sequence.

Facility: Fort Calhoun Unit 1

LER No.: 50-285/87-009

Abstract: On April 4, 1987, the unit experienced an unplanned loss of all offsite AC power because of personnel error. The loss of offsite AC power occurred when electrical maintenance personnel were performing maintenance on a transformer's secondary side non-segregated bus duct. They inadvertently pulled the wrong transformer fuses, resulting in the tripping of an on-line transformer, the opening of the secondary side breakers and, ultimately, the temporary loss of all offsite AC power to the plant.

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
91-50	A Review of Water Hammer Events After 1985	08/20/91	All holders of OLs or CPs for nuclear power reactors.
91-49	Enforcement of Safety Requirements for Radiographers	08/15/91	All Nuclear Regulatory Commission (NRC) licensees authorized to use sealed sources for industrial radiography.
91-48	False Certificates of Conformance Provided by Westinghouse Electric Supply Company for Refurbished Commercial-Grade Circuit Breakers	08/09/91	All holders of OLs or CPs for nuclear power reactors.
91-47	Failure of Thermo-Lag Fire Barrier Material to Pass Fire Endurance Test	08/06/91	All holders of OLs or CPs for nuclear power reactors.
89-56, Supp. 2	Questionable Certification of Material Supplied to the Defense Department by Nuclear Suppliers	07/19/91	All holders of OLs or CPs for nuclear power reactors.
91-46	Degradation of Emergency Diesel Generator Fuel Oil Delivery Systems	07/18/91	All holders of OLs or CPs for nuclear power reactors.
91-45	Possible Malfunction of Westinghouse ARD, BFD, and NBFD Relays, and A200 DC and DPC 250 Magnetic Contactors	07/05/91	All holders of OLs or CPs for nuclear power reactors.
91-44	Improper Control of Chemicals in Nuclear Fuel Fabrication	07/08/91	All nuclear fuel facilities.

OL = Operating License
CP = Construction Permit

Improper Coordination of Fuses and Circuit Breakers

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*SEE PREVIOUS CONCURRENCES

D/DOEA:NRR	*C/OGCB:DOEA:NRR	*RPB:ADM	*D/DRIS:NRR	*D/DST:NRR	
CERossi	CHBerlinger	TechEd	BKGrimes	AThadani	
08/15/91	08/ /91	08/07/91	08/06/91	08/05/91	
*OGCB:DOEA:NRR	*RIII	*RIII	*SELB:DST:NRR	*C/SELB:DST:NRR	
PCWen	ZFalevits	RMendez	FHBurrows	FRosa	
07/26/91	07/26/91	07/26/91	07/29/91	07/31/91	

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07/26/91	07/26/91	07/26/91	07/29/91	07/31/91	
	PER TELECON	PER TELECON			