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

July 7, 1988

NRC INFORMATION NOTICE NO. 88-45: PROBLEMS IN PROTECTIVE RELAY AND CIRCUIT BREAKER COORDINATION

Addressees:

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

Purpose:

This information notice is being provided to alert addressees to a potentially significant problem concerning the possible lack of protective relay and circuit breaker coordination. 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:

(1) Lack of Circuit Breaker and Protective Relay Coordination at McGuire Units 1 and 2

On September 6, 1987, a reactor trip and turbine trip occurred at the McGuire nuclear station. These trips resulted directly from a lack of proper circuit breaker coordination on the plant's onsite electrical distribution system. To facilitate component maintenance, the power supply to an auxiliary power panel board was shifted to an alternate source, a 600 V motor control center (MCC). This MCC also provides power to a compressor in the plant's instrument air system. A ground fault developed in the compressor's motor. This fault not only caused the compressor motor's feeder breaker to open but also caused the feeder breaker to the 600 V MCC to open. The interruption of power to the MCC precipitated the loss of the panel board. As a result, the turbine control system closed the main turbine throttle, governor, and intercept valves causing the reactor to trip on high pressurizer pressure.

(2) Lack of Breaker and Protective Relay Coordination at Salem Units 1 & 2

In October 1987, in response to staff questions raised during a fire protection audit, the licensee of Salem Units 1 and 2 determined that the lack of circuit breaker coordination in the plant could compromise

8806300347 ZA

the protection for redundant equipment and/or associated circuits from common mode failures. As a result, the licensee voluntarily shut down Unit 2 which was the only unit operating at the time. The resolution of this issue contributed significantly to the outage that lasted approximately 7 weeks.

(3) Lack of Coordination of Ground Fault Protective Devices at Monticello

In June 1986, the Monticello licensee installed electrical ground fault detection devices on circuit breakers throughout the onsite electrical distribution system. The installation of these devices altered the coordination between circuit breaker, motor control centers, and connected loads so that actuation of protective devices in the proper sequence was no longer assured. In June 1987, at least two operating events involving the loss of a train of emergency core cooling resulted from the lack of coordination between protective devices. These problems were caused by the June 1986 design change which had not adequately considered coordination of the protective devices in conjunction with the design modification.

Background:

Coordination is the selection and/or setting of protective devices so as to sequentially isolate only that portion of the system where the abnormality occurs. To achieve this isolation, it is necessary to set protective devices so that only the device nearest the fault opens and isolates the faulted circuit from the system. It is obvious that such selectivity becomes more important with devices that are closer to the power source, as a greater portion of the system can be affected.

Backup protective devices are set to operate at some predetermined time interval after the primary device fails to operate. A backup device is able to withstand the fault conditions for a longer period than the primary device. If a primary device fails to clear a fault and the backup device must clear it, then the design of the protective system becomes suspect.

To optimize the coordination of protective devices, good engineering practice requires that consideration be given to the following:

(1) available maximum short circuit currents;
(2) time interval between the coordination curves; and
(3) load current.

Discussion:

Other plants may also have problems with relay and breaker coordination. The staff relies on the exercise of good engineering practice by the designers of electrical power systems at nuclear power plants to provide for the proper functioning of protective devices. Breaker coordination is a key fire protection feature if cables for redundant trains pass through a fire area. NRC

Generic Letter (GL) 81-12, "Fire Protection Rule (45 FR 76602, November 19, 1980)," dated February 20, 1981 required licensees to submit information with regard to the design description of modifications necessary to meet Section III.G.3 "Fire Protection of Safe Shutdown Capability," 10 CFR 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979." This letter set forth general guidelines for protection of safe shutdown capability from the fire-induced failure of associated circuits. ANSI/IEEE Standard 242-1986, "IEEE Recommended Practices for Protection and Coordination of Industrial and Commercial Power Systems" provides detailed guidance on achieving proper coordination.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi

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

Technical Contacts: N. K. Trehan, NRR
(301) 492-0807

E. N. Fields, NRR
(301) 492-1173

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-44	Mechanical Binding of Spring Release Device in Westinghouse Type DS-416 Circuit Breakers	6/24/88	All holders of OLs or CPs for nuclear power reactors.
88-43	Solenoid Valve Problems	6/23/88	All holders of OLs or CPs for nuclear power reactors.
88-42	Circuit Breaker Failures Due to Loose Charging Spring Motor Mounting Bolts	6/23/88	All holders of OLs or CPs for nuclear power reactors.
88-41	Physical Protection Weaknesses Identified Through Regulatory Effectiveness Reviews (RERs)	6/22/88	All holders of OLs or CPs for nuclear power reactors.
88-40	Examiners' Handbook for Developing Operator Licensing Examinations	6/22/88	All holders of OLs or CPs for nuclear power reactors.
88-39	LaSalle Unit 2 Loss of Recirculation Pumps With Power Oscillation Event	6/15/88	All holders of OLs or CPs for BWRs.
88-38	Failure of Undervoltage Trip Attachment on General Electric Circuit Breakers	6/15/88	All holders of OLs or CPs for nuclear power reactors.
88-37	Flow Blockage of Cooling Water to Safety System Components	6/14/88	All holders of OLs or CPs for nuclear power reactors.
88-36	Possible Sudden Loss of RCS Inventory During Low Coolant Level Operation	6/8/88	All holders of OLs or CPs for PWRs.
88-35	Inadequate Licensee Performed Vendor Audits	6/3/88	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

Generic Letter (GL) 81-12, "Fire Protection Rule (45 FR 76602, November 19, 1980)," dated February 20, 1981 required licensees to submit information with regard to the design description of modifications necessary to meet Section III.G.3 "Fire Protection of Safe Shutdown Capability," 10 CFR 50, Appendix R, "Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979." This letter set forth general guidelines for protection of safe shutdown capability from the fire-induced failure of associated circuits. ANSI/IEEE Standard 242-1986, "IEEE Recommended Practices for Protection and Coordination of Industrial and Commercial Power Systems" provides detailed guidance on achieving proper co-ordination.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact one of the technical contacts listed below or the Regional Administrator of the appropriate regional office.

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

Technical Contacts: N. K. Trehan, NRR
(301) 492-0807

E. N. Fields, NRR
(301) 492-1173

Attachment: List of Recently Issued NRC Information Notices

*SEE PREVIOUS PAGE FOR CONCURRENCE

		*D:DEST:NRR	D/DOEA:NRR	*C/OGCB:DOEA:NRR
		LShao	CERossi	CHBerlinger
		6/27/88	07// /88	06/23/88
*OGCB:DOEA:NRR	*SELB:DEST:NRR	*C/SELB:DEST:NRR	*SAD/DEST:NRR	*RPB:ARM
PKadambi	NKTrehan	FRosa	AThadani	TechEd
06/15/88	06/15/88	06/15/88	06/16/88	06/21/88

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.

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

Technical Contact: N. K. Trehan, NRR
(301) 492-0807

Attachment: List of Recently Issued NRC Information Notices

NPK NPK
6/23 OGCB:DOEA:NRR
PKadambi
06/15/88

SELB:DEST:NRR
NKTrehan
06/15/88

C/SELB:DEST:NRR
FRosa
06/15/88

D/DOEA:NRR
CERossi
06/ /88

SAD/DEST:NRR
AThadani
06/16/88

C/OGCB:DOEA:NRR
CHBerlinger
06/23/88

RPB:ARM *
TechEd
06/ /88
[* See next sheet]

D/DEST:NRR
L.SHAO
6/27/88

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.

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

Technical Contact: N. K. Trehan, NRR
(301) 492-0807

Attachment: List of Recently Issued NRC Information Notices

			D/DOEA:NRR	C/OGCB:DOEA:NRR
			CERossi	CHBerlinger
			06/ /88	06/ /88
OGCB:DOEA:NRR	SELB:DEST:NRR	C/SELB:DEST:NRR	SAD/DEST:NRR	RPB:ARM
PKadambi	NKTrehan	FRosa	AThadani	TechEd – B Calure
06/15/88	06/15/88	06/15/88	06/16/88	06/21/88