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IN 86-49

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

June 16, 1986

IE INFORMATION NOTICE NO. 86-49: AGE/ENVIRONMENT INDUCED ELECTRICAL
CABLE FAILURES

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or a construction permit (CP).

Purpose:

This notice is intended to describe (1) age/environment failures of electrical cables that have occurred at San Onofre Nuclear Power Plant, Unit 1, and (2) actions that can be taken to improve in-service cable reliability. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, for identifying incipient failures before they occur. Suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On November 21, 1985, San Onofre Unit 1 experienced an incident that was investigated formally by the NRC and described in NUREG-1190. Offsite power was lost when a transformer was tripped by its differential relays because of a fault in the cable to the Class 1E 4160-V bus. Further inspection of the failed cable showed evidence of insulation degradation and arcing between two phases to the sheath of the cable. The most likely cause of the cable failure was determined to be temperature-induced accelerated aging and degradation of the cable insulation. The source of this heat was a bare high-temperature (400°F) feedwater line and pipe flange in the immediate vicinity of the cable. The thermal insulation had been removed from the pipe during previous repair of a gasket leak and not replaced.

Southern California Edison Company established a special Cable Evaluation Task Force which has investigated and tested both 4160 and lower voltage cables and has identified several other degraded cables that also would have failed over time. The faulted cable and other cables are being replaced at San Onofre Unit 1.

Discussion:

The November 21, 1985 event and subsequent investigations and inspections at San Onofre Unit 1 indicated a possible weakness in the surveillance and maintenance of station electrical cables. This weakness is characterized by lack of adequate monitoring of representative electrical circuits to obtain indications of changes in cable characteristics over time that would be indicative of degraded conditions. The lessons learned from this incident suggest a need to determine whether adequate surveillance and maintenance of medium voltage cables are being performed.


Proper selection and installation of cables is the basic requirement for assuring reliability. However, a good understanding of cable characteristics and the operational and environmental conditions that could affect these characteristics is a prerequisite for assurance of the long-term reliability of cable installations. Cables that provide power to the medium voltage safety buses are particularly vital components of the plant electrical system.

Many utilities, as well as other industries such as chemical production and processing, routinely conduct testing of critical cable circuits. Although these practices vary, the information obtained from such periodic testing is used to identify degraded cables and the need for corrective action. Timely corrective action for cables that provide power to Class 1E buses and other critical equipment would minimize unnecessary power losses, unplanned shutdowns, and challenges to the safety systems.

The Insulated Cable Engineers Association (ICEA), National Electrical Manufacturer's Association (NEMA), and Institute of Electrical and Electronic Engineers (IEEE) have developed standards which address the testing of new and in-service cables. These standards include cable tests such as: insulation resistance measurements, power factor measurements, and controlled dc overvoltage (high potential). It is suggested that the applicable industry standards be consulted for performing these tests.

Another important facet of the periodic maintenance and testing program for cable circuits is the walkdown inspection to identify actual or potential environmental conditions (heat, water, chemicals, etc.) in the immediate vicinity of the cables that could adversely affect the cable conditions.

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


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and Engineering Response
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Attachment: List of Recently Issued IE Information Notices

LIST OF RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
86-48	Inadequate Testing Of Boron Solution Concentration In The Standby Liquid Control System	6/13/86	All BWR facilities holding an OL or CP
86-47	Feedwater Transient With Partial Failure Of The Reactor Scram System	6/9/86	All BWRs and PWRs facilities holding an OL or CP
86-46	Improper Cleaning And Decontamination Of Respiratory Protection Equipment	6/12/86	All power reactor facilities holding an OL or CP and fuel fabrication facilities
86-45	Potential Falsification Of Test Reports On Flanges Manufactured By Golden Gate Forge And Flange, Inc.	6/10/86	All power reactor facilities holding an OL or CP and research and test facilities
86-44	Failure To Follow Procedures When Working In High Radiation Areas	6/10/86	All power reactor facilities holding an OL or CP and research and test reactors
86-43	Problems With Silver Zeolite Sampling Of Airborne Radioiodine	6/10/86	All power reactor facilities holding an OL or CP
86-42	Improper Maintenance Of Radiation Monitoring Systems	6/9/86	All power reactor facilities holding an OL or CP
86-41	Evaluation Of Questionable Exposure Readings Of Licensee Personnel Dosimeters	6/9/86	All byproduct material licensees

OL = Operating License
CP = Construction Permit