



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001

ACRSR-2198

June 15, 2006

Mr. Luis A. Reyes  
Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

SUBJECT: DRAFT FINAL GENERIC LETTER 2006-XX, "INACCESSIBLE OR UNDERGROUND CABLE FAILURES THAT DISABLE ACCIDENT MITIGATION SYSTEMS"

Dear Mr. Reyes:

During the 533<sup>rd</sup> meeting of the Advisory Committee on Reactor Safeguards, May 31 - June 1, 2006, we reviewed the draft final Generic Letter 2006-XX, "Inaccessible or Underground Cable Failures that Disable Accident Mitigation Systems." During our review, we had the benefit of discussions with representatives of the NRC staff and the Nuclear Energy Institute (NEI). We also had the benefit of the documents referenced.

#### RECOMMENDATION

Generic Letter 2006-XX, "Inaccessible or Underground Cable Failures that Disable Accident Mitigation Systems," should be issued.

#### DISCUSSION

Cables in inaccessible locations such as buried conduits or direct-buried installations can be exposed to moisture from condensation and flooding. Cables in these environments can fail due to water treeing or other mechanisms that reduce the dielectric strength of the insulation material. Some of these inaccessible or underground cables are used to energize safety-related systems.

On March 21, 2002, the staff issued Information Notice (IN) 2002-12 to alert licensees about the effects of moisture on cable performance. IN 2002-12 described medium-voltage safety-related cable failures at several plants as a result of long-term flooding problems in trenches and conduits. Upon further review of operating experience, the staff found 23 licensee event reports and two morning reports since 1988 on failures of buried medium-voltage cables due to insulation failure. The staff believes that this represents a small fraction of the total number of failures since not all cable failures are reportable. None of the failed cables was designed or qualified for long-term wetting or submergence.

The staff is particularly concerned that more than one safety-related cable could fail on demand as a result of undetected degradation of inaccessible cables exposed to wet environments for which they have not been qualified. This could result in multiple equipment failures. In certain applications, the incipient failure of cables can go undetected because they are not energized during power operation. In addition, degraded cables may survive short-term, periodic functional tests, but fail during the extended duty imposed by operation during accident mitigation. The staff further believes that condition monitoring would provide early indication of degrading insulation. The Generic Letter will allow the staff to gather more information on power cable failures experienced by the plants to-date and on plant-specific programs to detect degradation or reasons why such programs are not necessary.

A number of licensees and NEI commented on the proposed Generic Letter. NEI also summarized operating experience with medium-voltage, wetted, and energized cables at a large fraction of domestic plants in NEI 06-05, "Medium Voltage Underground Cable White Paper." The industry contends that only a small number of plants have experienced cable failures and that there does not appear to be an increasing trend. The affected plants have promptly replaced the failed cables and addressed the conditions that caused the failures. Based on this operating experience, industry concludes that the likelihood of common-cause failure of multiple systems is extremely low and reliance on functional testing is sufficient.

Since cable degradation and failure are assisted by aging, the number of failures experienced to-date, by itself, is not necessarily a good predictor of future performance. Also, functional testing of equipment powered by the cables does not provide information on whether these cables, exposed to an adverse environment for which they are not qualified, are experiencing incipient degradation that could lead to failure in service. The population of cables in this condition may be significantly larger than the number of failures experienced to date.

In addition to the experience reported in IN 2002-12, during our reviews of license renewal applications, we have encountered several plants that have experienced failures of inaccessible cables, as well as flooding of inaccessible cable raceways and conduits. Many of these cables were in safety-related applications and were not qualified for this environment. Regulations require that these cables be capable of performing their intended functions in anticipated environmental conditions. Consequently, the Generic Aging Lessons Learned Report describes an acceptable program for managing aging of cables such that their intended functions will be maintained consistent with the current licensing basis for the period of extended operation. This program includes periodic inspections to address water collection problems and assessments of insulation condition.

Since failures are occurring during the current licensing term, information should be gathered to determine if existing licensee programs are sufficient to address these issues now. The Generic Letter will allow the staff to better understand the extent of the problem with inaccessible or underground power cable failures and the current industry initiatives to detect degradation before failure occurs or the reasons why such initiatives are not needed. The Generic Letter should be issued.

Sincerely,

/RA/

Graham B. Wallis  
Chairman

References:

1. Memorandum from Michael E. Mayfield, Director, Division of Engineering, Office of Nuclear Reactor Regulation to John T. Larkins, Executive Director, ACRS, dated May 15, 2006, Subject: Request for Review and Endorsement by the Advisory Committee on Reactor Safeguards (ACRS) Regarding the Proposed Generic Letter 2006-XX, "Inaccessible or Underground Cable Failures that Disable Accident Mitigation Systems."
2. U.S. Nuclear Regulatory Commission, Information Notice 2002-12, "Submerged Safety-Related Electrical Cables," March 21, 2002.
3. Nuclear Energy Institute, "Medium Voltage Underground Cable White Paper," NEI 06-05, April 2006.
4. U.S. Nuclear Regulatory Commission, "Generic Aging Lessons Learned (GALL) Report," NUREG-1801, Rev. 1, September 2005.

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