February 5, 2004

Mr. Alex Marion, Director
Engineering Department
Nuclear Generation Division
Nuclear Energy Institute
1776 Eye Street, NW, Suite 400
Washington, DC 20006-3708

SUBJECT: POTENTIAL COMMON-MODE FAILURE OF MEDIUM VOLTAGE UNDERGROUND CABLES

Dear Mr. Marion:

The purpose of this letter is to engage the nuclear industry in an issue that the staff has identified regarding the potential common-mode failure of medium voltage (2Kv to 15Kv) underground cables. A staff review of operational experience has shown that medium voltage cables that are exposed to condensation and wetting in inaccessible locations such as conduits, cable trenches, cable troughs, duct banks, underground vaults or in direct buried installations can fail due to water treeing or a decrease in dielectric strength of the conductor insulation. The staff has identified 23 Licensee Event Reports (LERs) and morning reports since 1988 that describe failures of buried medium voltage cables where water treeing appears to be the common cause of the failures. These reported events should be seen only as a small portion of the failures since not all cables that fail lead to reportable conditions. In most cases, the failed cables were in service for about 10 years or more and none of these cables were identified to be designed or qualified for long-term wetting or submergence.

From a safety perspective, some of the medium voltage underground cables supply power to safety-related equipment at many nuclear stations [emergency diesel generator (EDG) feeder, emergency service water pumps, offsite power to safety buses, etc.,]. Some of these cables are not generally energized and therefore an impending or dormant failure may remain unnoticed. As evidenced by the medium voltage cable failures that were reviewed, there is an increasing probability of more than one medium voltage power cable failing during an accident because of continued degradation. When more than one cable fails during a plant accident scenario, emergency core cooling system could be significantly degraded depending on the particular cables that failed. Some of the risk-significant cable failure scenarios are (1) the loss of offsite power causing a plant trip and the failures of two cables that connect EDGs to respective safety buses, (2) the loss of service water and emergency service water from cable failures following a reactor trip, and, (3) the loss of offsite power through the loss of offsite power feeders to safety buses. Cable failures under degraded grid conditions could exacerbate emergency core cooling capability when there is a higher probability for loss of offsite power and a longer duration for the recovery of offsite power.

Information Notice 2002-12 addressed medium voltage cables failures at Oyster Creek and Davis Besse as well as several other plants known to have long-term flooding problems in manholes and duct banks in which safety-related cables were submerged. In response to the concern identified in IN 2002-12, several plants began manhole restoration projects to replace faulty dewatering equipment, and cable supports, and system modifications. Several other plants have reported water removal problems but have not yet reported any program for the early detection of potential failures.

Medium voltage cable failures can be prevented through the use of state-of-the-art methods of testing. Several effective methods of nondestructive cable testing are available to plants at this time, including (1) the partial discharge test, (2) dissipation factor testing, (3) very low frequency AC testing, (4) time domain reflectometry, and (5) DC step-voltage test. The NRC staff seeks a solution to ensure that periodic condition monitoring for these cables will prevent common-mode failures that may occur due to aging and water treeing during power operation.

As the underground cables continue to age, the probability of cable failure increases and the vulnerability for unanticipated challenges increases with it. The continued operability underground cables exposed to high moisture environment is questionable at best if not undetermined. In view of these concerns, we strongly encourage the industry to develop and present any proposals to us no later than April 30, 2004 to resolve this issue.

I look forward to future interactions with NEI as this issue proceeds on a timely path to resolution. Please have your staff contact Thomas Koshy of my staff at 301-415-1176 or e-mail txk@nrc.gov if you have any questions about this matter.

Sincerely,

/RA

Jose A. Calvo, Chief,
Electrical & Instrumentation and Controls Branch
Division of Engineering
Office of Nuclear Reactor Regulation

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