

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

January 3, 1992

NRC INFORMATION NOTICE 92-01: CABLE DAMAGE CAUSED BY INADEQUATE CABLE  
INSTALLATION PROCEDURES AND CONTROLS

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission is issuing this information notice to alert addressees to the possibility that inadequate cable installation procedures and quality control could cause safety-related cables to fail. It is expected that the 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 are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

In June 1989, the Tennessee Valley Authority (TVA) removed the cables from a conduit in the reactor protection system of the Watts Bar Nuclear Plant, Unit 2, to inspect for damage. TVA selected this conduit in response to an employee's concern that a welding arc that struck the conduit during construction may have damaged cables in the conduit. When the cables were removed, TVA found significant damage in the insulation of some cables. This damage was not attributed to heat generated by the alleged welding arc. The damage was principally attributed to the pulling stresses exerted during the initial installation of the cables. Some of the cables had insulation removed down to the conductors. To assess the extent of cable damage and determine the scope of its investigation, TVA removed more cables from conduits that constituted the most difficult pulls (worst case) and found varying degrees of damage that it attributed to pulling stresses.

To fill a conduit at Watts Bar, personnel used pull cords to pull more cables through the conduits over the top of existing cables. This practice is called "pull-by." This practice can cause damage to the existing cables from the

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sawing action of the pull cords and the friction of cables as they are pulled over existing cables. The University of Connecticut, under contract for TVA, evaluated damaged cables and determined the cause of damage to have been cable pull-bys. Usually such damage would be minimized by using the proper and adequate amounts of lubricants, controlling pulling tension, choosing appropriate pull cords, limiting the distance between pull points, and minimizing the number and angle of bends allowed in the conduit. Industry standards provide no specific guidance for performing multiple pulls of cables in conduits.


TVA instituted programs to assess the adequacy of cable installation at all its nuclear facilities and take appropriate corrective actions. At Watts Bar, TVA replaced cables in conduits which exceeded a calculated threshold value of side wall bearing pressure (SWBP) and performed high-potential (hi-pot) tests on a number of other cables in conduits with SWBP below the calculated threshold value. The hi-pot test voltage was 240 Vdc per mil of insulation thickness (based on the minimum qualified thickness) not to exceed 80 percent of the factory's test voltage. Before conducting the testing, TVA flooded the segments of conduits with the highest SWBP values with water to establish a continuous electrical ground at the external surface of the cable. TVA did not flood conduits with shielded cables because the shield provided adequate ground.

At the Sequoyah and Browns Ferry Nuclear Plants, TVA performed hi-pot tests on cables in a smaller sample of conduits with high SWBP values. TVA did not replace, but included in the test sample, cables at these plants that exceeded the threshold SWBP values of Watts Bar because it had not used the very abrasive nylon cord (parachute cord) at these plants that was extensively used at Watts Bar. This cord was used as pull cord and seemed to have caused the more severe damage to cables. Though TVA observed some failures during the hi-pot testing, it attributed none of the failures to the effects of cable pull-bys.

#### Discussion of Safety Significance

The damage identified in the reactor protection system cables at Watts Bar demonstrates that the safety function of safety systems could be lost if damaged cables are located in harsh environments. Such cable damage can be caused by the pulling stresses exerted during cable installation. If moisture enters the affected conduits, it can cause cables to short, which could cause the common mode loss of safety function of systems whose performance is required to mitigate the consequences of an accident.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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

Technical contact: H. Garg, NRR  
(301) 504-2929

Attachment: List of Recently Issued NRC Information Notices

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LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
91-87	Hydrogen Embrittlement of Raychem Cryofit Couplings	12/27/91	All holders of OLs or CPs for nuclear power reactors.
91-86	New Reporting Requirements for Contamination Events at Medical Facilities (10 CFR 30.50)	12/27/91	All licensees authorized to use byproduct materials for human use.
91-85	Potential Failures of Thermostatic Control Valves for Diesel Generator Jacket Cooling Water	12/26/91	All holders of OLs or CPs for nuclear power reactors.
91-84	Problems with Criticality Alarm Components/Systems	12/26/91	All Nuclear Regulatory Commission (NRC) fuel cycle licensees, interim spent fuel storage licensees, and critical mass licensees.
91-83	Solenoid-Operated Valve Failures Resulted in Turbine Overspeed	12/20/91	All holders of OLs or CPs for nuclear power reactors.
91-18, Supp. 1	High-Energy Piping Failures Caused by Wall Thinning	12/18/91	All holders of OLs or CPs for nuclear power reactors.
91-82	Problems with Diaphragms in Safety-Related Tanks	12/18/91	All holders of OLs or CPs for nuclear power reactors.
91-81	Switchyard Problems that Contribute to Loss of Offsite Power	12/16/91	All holders of OLs or CPs for nuclear power reactors.
91-80	Failure of Anchor Head Threads on Post-Tensioning System During Surveillance Inspection	12/11/91	All holders of OLs or CPs for nuclear power reactors.

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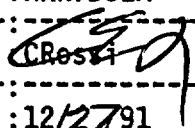
Original Signed By  
Charles E. Rossi

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

Technical contact: H. Garg, NRR  
(301) 504-2929

Attachment: List of Recently Issued NRC Information Notices

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Charles E. Rossi, Director  
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Technical Contact: H. Garg (NRR)  
(301) 492-0929

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