**Sandia National Laboratories (SNL)**

**National Institute for Standards and Technology (NIST)**

**University of Maryland (UMd)**

# Information Sheet: Fire-Induced Electrical Cable Failure Testing - Data Processing

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## Background

The results of the Individual Plant Examinations of External Events program and actual fire events indicate that fire can be a significant contributor to nuclear power plant (NPP) risk. The question of how to determine risk resulting from fire damage to electrical cables in NPPs has been of concern since the Browns Ferry fire in 1975. In earlier years, it was generally believed that any system that depended on electric cables passing through a compartment damaged by fire would be unavailable for its intended safety function. The Browns Ferry fire and recent testing have prompted wider realization that short circuits involving an energized conductor can pose considerably greater risk by creating "hot shorts." These hot shorts can cause systems to malfunction, for example, by inadvertently repositioning motor-operated valves and starting or stopping plant equipment. This risk should be accounted for in plant safety analyses.

Numerous testing programs have collected massive amounts of data on fire-induced circuit failures, including Nuclear Energy Institute (NEI)/Electric Power Research Institute (EPRI) 2001 testing, NRC Cable Response to Live Fire (CAROLFIRE) 2006 testing, and NRC Direct Current Electrical Shorting In Response to Exposure Fire (DESIREE-FIRE) testing.

An expert panel developed failure likelihoods from the NEI/EPRI results, documented the results, and identified configurations requiring additional research ("Bin 2 items") in Regulatory Issue Summary 2004-03, CAROLFIRE provided data for resolution of the RIS 2004-03 Bin 2 items.

## Approach

The insights and data gained from all test programs conducted to date will be applicable to a wide range of situations encountered in NPPs and will enable improved guidance to be written. Cable thermal response data from these programs also is being applied to reduce uncertainty in fire modeling and to more accurately predict the time of cable failure.

Following publication of the DESIREE-FIRE results, an expert panel will be convened to develop cable damage spurious actuation probabilities using both alternating current and direct current test data from all previous testing programs. These probabilities can then be used in fire probabilistic risk assessment (PRA) and National Fire Protection Association Standard 805 applications to support fire risk analysis.

In addition to providing improved probabilities of spurious actuations, efforts are underway to better document the uncertainties associated with the testing techniques and monitoring equipment, particularly for Sandia National Laboratories Insulation Resistance Measurement System (IRMS), a one-of-a-kind patented measurement system designed specifically to evaluate the cables' response to fire. Addressing uncertainties associated with this system will allow fire PRA practitioners to properly apply the IRMS data.

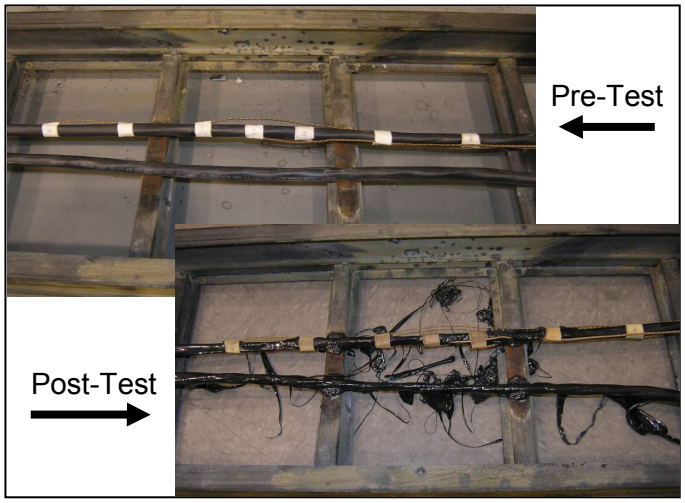


**Figure 1. Electrical Cable Fire Damage.**

**Program Management**

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**For More Information**

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