Residential Electrical System Aging Research Project

According to the National Fire Protection Association (NFPA), there is an annual average of 24,200 home fires attributed to electrical distribution systems or lighting equipment, causing 830 injuries, 320 deaths and $700 million in property damage.

A study conducted by the U.S. Consumer Product Safety Commission (CPSC) in the 1980s indicated that the frequency of fires in residential electrical systems was disproportionately high in homes more than 40 years old. Although several factors could be attributed to this high incidence of fire in the electrical systems of older homes, the aging of older electrical systems, combined with the fact that older homes were not built to the more rigid building codes of recent times, were deemed the most likely contributing factors.

It is relatively unknown what effect age has on these older wiring systems and electrical devices. Also, some homeowners, especially those without the resources to upgrade their electrical systems, may be reverting to unsafe wiring practices to accommodate more modern appliances and electronic equipment than their home's electrical system was originally intended to accommodate. To this end, the Fire Protection Research Foundation (FPRF), in conjunction with the CPSC, various electrical equipment manufacturers, insurance companies, testing laboratories and other interested parties, established the Residential Electrical System Aging Research Project. The project goal was to

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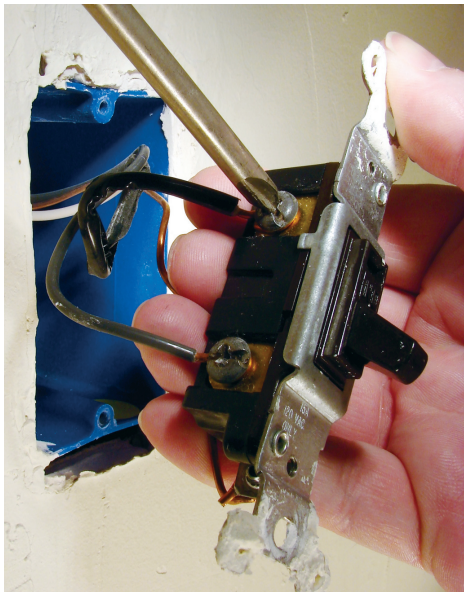

characterize the condition of various age groups of residential electrical systems and document how aging and installation may relate to the causes of residential electrical fires. This characterization would be accomplished by surveying, recovering and analyzing representative samples of actual installed residential wiring systems and devices from homes across the country.

Project sponsors recruited electrical experts from ten different parts of the country. These "champions," many of whom are electrical inspectors, identified homes ready for demolition and got building access permission from the owners. The helpers also organized small groups of additional volunteers to help survey and provide photo documentation of the building's electrical system. This work included identifying problems related to poor or unqualified workmanship, device damage, lack of code compliance and/or other hazards such as overlamping, permanent use of extension cords, etc. In all, 30 houses were analyzed.

Volunteers selected and harvested components of the building's electrical system. The selected components included the service entrance panel and overcurrent devices, examples of the building's original wiring system and any additions made throughout the life of the building: receptacle outlets, luminaires, junctions boxes and devices that showed evidence of problems such as overheating, arcing, water damage or corrosion. Devices that appeared to be very old or unusual were also recovered.

All recovered wiring and electrical devices were then sent to the Northbrook, Ill. UL laboratories for testing and analysis. In many cases, original product standard tests such as temperature rise, dielectric withstand and overcurrent device calibration were conducted while the aged devices were mounted and wired as though they were still in their original setting within the house. Recovered devices were also analyzed for damage, overheating, misuse, non-code compliance and poor workmanship. Once analysis was complete, a detailed report for each house was written.

Before the 1950s, residential wire installations traditionally used conductors with thermoset rubber insulation. In general, the study found them to still perform well in many residential environments and expected use conditions. However, older rubber compounds are known to become brittle with age, which can be a potential hazard when, over the years, these wires are subjected to bending, abrasion or harsh usage. Testing of older rubber wire samples harvested from the test houses demonstrated this fact. However, the thermoplastic insulated wires typical of the 1950s and later continue to perform with excellent results under most all conditions, even after many years of service. The study also tested more than 400 circuit breakers and 250 receptacle outlets recovered from the old houses.

Surprisingly, or maybe not, the study noted that most hazardous conditions found within the 30 houses could be attributed to a lack of compliance with a specific code requirement. Over 25 different code violations were found in at least one and, in most cases, several houses. Although some code violations could result in hazards that were more potentially dangerous than others, all involved some degree of risk to the occupant.

The study noted that most of the hazardous conditions found within the 30 houses could be attributed to a lack of compliance with a specific code requirement.

The final report from Residential Electrical System Aging Research Project was recent published, and will soon be available on the FPRF web site. The project data and analysis is intended to provide critical information to code writers, especially for NFPA 73, *Electrical Inspection Code for Existing Dwellings*, and the National Electrical Code®, as well as AHJs, electrical equipment manufacturers, testing laboratories, installers, property owners and insurers.