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IN-FLOOR CABLE DISTRIBUTION SYSTEMS

**Getting Down to the Wire**
Lights, computers, phone systems—the wires that power our buildings are made of a tangle of materials that raise environmental and health questions.

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Copper and aluminum wires and cables are typically insulated with a nonconductive material that allows wires to be in contact with one another without conducting electric current between them. The most common resins used for insulating wire are polyethylene (PE), polyvinyl chloride (PVC), and fluoropolymers. Nylon, various rubber compounds, silicone, and polyurethane are also used for insulation and jacketing, but less widely.

Polyethylene is the most common type of insulation and jacketing for high-voltage power-transmission cables, as well as for non-plenum-rated data cables, radio frequency wiring, and audio wiring. It has excellent dielectric properties (that is, it insulates well) but is inherently less flame resistant than other insulation materials. As a result, it's rarely used for power in buildings, and when used, other materials are often added to it to improve its flame resistance. It is widely used for data cable installations requiring no flame resistance, such as wire runs in conduit or behind fire-rated barriers.

Polyvinyl chloride (PVC) is the most common insulation and jacketing material for wiring in buildings, owing largely to its good flame resistance and low cost. In Romex-type wiring, for example, PVC is typically used both as the insulation on individual conductors and as the jacketing that surrounds the bundle of individual wires. PVC has significantly greater flame resistance than polyethylene, but other additives are required to make it flexible and stable.

In the past 10 years, PVC has come under attack by several groups because of a variety of health and environmental concerns. The biggest concern is that under certain conditions, highly toxic dioxins can be released—especially from accidental fires or incineration at the end of its life. According to the National Institute of Environmental Health Sciences (NIEHS), dioxins are known to be toxic to laboratory animals, causing cancer and altering reproductive, developmental, and immune functions. There are also concerns about the need to add stabilizers and plasticizers to PVC, some of which have health impacts, and PVC also releases hydrogen chloride, a toxic, corrosive gas, when exposed to extreme heat—both before and after it ignites.

Various fluorine-containing polymers, especially fluorinated ethylene propylene (FEP), are increasingly common in data wiring insulation because of their exceptional dielectric properties, superb flame resistance, heat resistance, chemical inertness, durability, and flexibility. For plenum-rated data cable, FEP-insulated wire is often the only option allowed by code, due to fire-safety concerns. Such wire is often wrapped in a PVC jacket, though newer, more stringent "limited combustible" ratings require FEP jacketing. In addition to these performance benefits of FEP, the polymer can be recycled easily, according to DuPont.

While superb performance has spurred rapid growth of FEP wire insulation, some significant environmental and health concerns have arisen about the whole class of fluoropolymer materials (see sidebar at right). FEP does not burn easily, but it can emit toxic gases when it gets very hot, even without actual combustion. The primary gas emitted is hydrogen fluoride, which is more dangerous than the hydrogen chloride given off by PVC. Other toxic chemicals can be given off by FEP during fires; these poorly understood thermal degradation products have been referred to collectively as "the supertoxin."