

Avoiding a Dangerous Journey

The Potential Dangers of Exposed Cabling in Environmental Air Plenums are Acute. to That End, Action Taken by Nfpa in Its 2002 Edition of the National Electrical Code Was a Bold Stroke for Life Safety.

By John Michlovic

In the past few years, much has been written about the potential dangers of exposed cabling in environmental air plenums.

The risks associated with the burning of combustible plastic coated cabling in ceiling or access floor plenums have been exposed in cabling and building construction magazines by a variety of industry experts. Although the evidence of a problem appears to be quite clear, the conclusions drawn by these industry reporters generally stop short of a condemnation of exposed cabling in these "concealed spaces". This article will attempt to summarize the evidence of a problem and "connect the dots" for those who have not read the evidence.

First, lets examine how combustible plastic coated cabling became Code acceptable. The standard that governs the types of acceptable materials in ceiling or access floor plenums is NFPA 90A -- Standard for the Installation of Air-Conditioning and Ventilating Systems. Since 1937, HVAC designers have used this for environmental air design issues. Prior to 1975 it required that all materials used in plenums be "non-combustible" or "limited combustible" with a maximum smoke developed rating of 50. Telecom cables meeting this requirement would be classified as "limited combustible".

Since environmental air (supply or return air) could eventually be breathed by the building's occupants, safe materials were required in the air stream so that in the event of a fire, dependence upon smoke dampers or smoke alarms to assure safety would not be paramount.

In 1975, the industry petitioned NFPA for relief from the stringent requirements of Standard 90A. Meetings were held to discuss the pros and cons of allowing cables of lesser fire and smoke performance to be exposed in plenums. Ultimately, NFPA agreed to allow combustible cables to be used -- intending the approval for limited use only (just a few cables). However, the limited use restriction was never written into the standard.

CMP cables (Communications Multipurpose Plenum) meeting a new less stringent criteria became the standard of the cabling industry from that time and designers, building owners and telecom specialists have used this fire retardant cable in unlimited amounts to solve their ever growing cabling demands.

Major issues regarding cable fire safety have been documented in research conducted in the USA and in Europe. Chemists and safety experts read the evidence with alarm, but designers and users are unaware of the dangers because the current cable constructions are "Code Approved".

POTENTIAL DANGERS OF PLENUM CABLING

What are the dangers of exposed combustible cables in plenums? Here's the downside if a fire occurs involving cables in a plenum:

- 1. Fuel Load** Combustible plastic insulation around the conductors in a typical 4 pr. twisted telecom cable weighs about 4.7 pounds per 1000 feet of cable. The fuel load or BTU content of certain types of plenum rated cable insulation, especially polyolefins, can rival that of gasoline. In heavily cabled plenums, it's like placing a gallon of gas within the plenum for every 10 to 30 feet of cable tray. The fuel load of CMP cable is 2.5 times the limit for the "limited combustible" cable described in the primary (pre-1975) requirements of NFPA90A.
- 2. Smoke Developed Index** The smoke developed by burning CMP plenum rated cable can be up to 17 times the level allowed for "limited combustible" cable in the pre 1975 NFPA Standard 90A.
- 3. Toxic Gasses** Burning plastics of any kind creates toxic gasses. In ceiling plenum fires these gasses will usually be diluted in the re-circulation system if smoke dampers do not exist or do not function. Under access floors, a cable fire can be more dangerous because the hot toxic gasses can exit anywhere and can be more concentrated than re-circulated and diluted gasses in re-circulated air. Also there is a higher probability that the gasses will exist within the breathing zone. One should not attempt to crawl out of an access floor fire; running is the preferred method.
- 4. Flame Spread** Fire retardant jackets on new cables will generally protect against ignition for at least ten minutes of exposure to a fire, depending upon its temperature. Flame spread or travel is limited to five feet in 20 minutes by NFPA Standard 262. Worn, heat aged, slit, or damaged jacketing that exposes cable insulation to a fire can ignite within minutes and spread flames more rapidly than the five feet in 20 minute criteria. Older cable of the latter type represents the bulk of existing cable, yet most testing of cables is performed on "new" cable with sound fire retardant jacketing. Thus, cable testing can seriously underestimate the actual danger of older cabling, since the cabling industry places no "time limit" on the fire safety or performance of its products.
- 5. Unauthorized Cable** Given the 2-1/2 times price differential between CMP plenum rated cable and non-rated CMG (Communications Multipurpose General) cable, it is highly likely that some CMG cable has been laid into plenum spaces, although it is not rated for plenum use. This scary scenario may occur in only rare cases, but when it does, it would create a fireman's nightmare if ignited. This non-fire retardant cable ignites quickly, burns like a candle, and creates large amounts of black sooty smoke. If interspersed with CMP cable, it can act as a fuse to ignite the cable bundle and spread flames quickly along its entire length.

THE CODE WRITERS REACT

The preponderance of evidence mounting over the years demonstrated an increasing life safety threat in environmental air plenums. The common practice of abandoning lesser performing cables in place and adding the next generation on top of the old was viewed as alarming by safety experts and code writers.

Something had to be done to reduce the threat of burning plastics in plenums. The action taken by NFPA in their 2002 edition of the National Electrical Code was a bold stroke for life safety. Abandoned Communications cables are no longer allowed to remain in plenums. This action by NFPA and the NEC would not have occurred except for the dangers outlined previously in this article. All involved parties should seriously pursue reduced fire loads in plenums through the removal of abandoned cable.

Although the fire safety record in office structures has improved over the years, there are still 16 office fires in the USA on an average day per the latest NFPA data available.

But, who will enforce such an expensive code requirement? Will cables be removed if covered by newer, higher performance cabling? Will cabling manufactures recommend a useful safe life for their products? If there is no limit on quantities of new plenum cabling, does the removal of abandoned cable have the intended positive impact?

ASHRAE CONCERNS

The American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE) has for years been concerned about the use of combustible plastics in environmental air plenums. HVAC Designers were loath to accept unlimited plastic cabling in plenums. Smoke from burning cables creates a real problem in their designs.

In 1999, ASHRAE embarked upon a research project to study the problem and make recommendations to the industry. The study is entitled "Cable Fire in Plenums" and is underway at the National Research Council Canada by Dr. G.D. Lougheed. The stated objective of the study is "to evaluate the hazard to human life of computer and communication cable fires in air plenums above ceilings and develop information that can be input to performance test standards and codes" also to determine the maximum quantities of exposed cable that can be safely allowed in plenums.

The study is expected to be completed in late 2002.

Exposed cabling within plenums will remain a viable wire distribution method for the foreseeable future. For existing applications, a safer cable should be used to replace old CMP Cables . . . namely, "limited combustible" cable. This is the only cable of which I am aware that retains its fire retardancy indefinitely.

For new construction, designers should carefully consider the use of in-floor systems such as underfloor duct for on-grade use or a cellular floor system for elevated building levels. These systems provide the ultimate safety against cable fire and smoke problems by encapsulating cables in steel cells below a concrete fill. Underside fireproofing assures against cable outgassing for two to three hours.

For new construction projects that must incorporate plenum cabling, "limited combustible" cable is the safer alternative. CMP cable suppliers should be asked to supply "aged" cable fire tests to simulate the effects of heat aging, abrasion, and the degradation effects of plasticizer migration which can lead to cable jacket slitting. Consider the placement of smoke detection and sprinkler systems above the cable trays rather than just at ceiling level.

Smoke detectors should be mandatory below all access floors whether used for air delivery or not. This is the absolutely worst place for a smoky fire.

Also, don't allow cable tray to be mounted below or supported by un-fireproofed steel members especially not bar-joists; and don't allow fireproofing to be removed from beams or joists during the cable tray hanging process.

Above all, remove all abandoned cable from your plenum systems. It's simply fuel waiting for the next fire. Tagging it for future use will not make it safe; not even if you double tag it.

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Common Sense Cabling Recommendations (and items you won't find in a building code)

- Keep fuel away from ignition sources. All plastics are fuel and certain types compare to gasoline by weight. Electrical wire overheating can ignite plastics.
- Toxic smoke kills people in a building fire (not heat or flame). Burning plastics create some of the most toxic gases known to man.
- Keep fuel out of concealed spaces if possible.
- Conduit, cells, and steel raceways are not concealed spaces; ceiling and access floor plenums are.
- The hottest part of the flame is at the top. Where are you locating your combustible cables?
- Carbon Monoxide (CO) gas can be produced at a temperature lower than that required to begin ignition.
- Minimize materials that will produce toxic smoke in a fire, especially in plenums. The intent of NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" should be to keep this from happening...it does not.
- Do not locate cable trays containing high fuel loads directly beneath horizontal structural members. Cable tray fires can produce temperatures exceeding 1400°F. Structural steel begins to weaken at less than 1000°F. Open web joists are most susceptible to collapse. Load Resistance Factor Design (LRFD) for steel members is less conservative than previous methods, producing lighter weight members.
- Fire detection devices should be located above ceiling level if combustible materials are present. Plastic coated cables are combustible.
- Fire suppression equipment should be located above the ceiling if combustible materials are present.
- The latest NFPA statistics available at this writing reveal an office building fire every 90 minutes in the USA (5800 fires per year; 16 per day, 7 days a week).
- There is no known limit to the number of ways a fire can start.

(Source: John Lebduska - Architect & Safety)