Fire Tests for Evaluating Wire & Cable Flammability
Scope:
• Fire Action and Cable Fires
• Performance of Cable Flame Tests
• Cable Fire Tests
  – NFPA 262 Plenum Steiner Tunnel Test
  – UL 1666 Riser Cable Fire Test
  – UL 1685 Vertical Tray Tests
  – UL 1581 / UL 2556 VW-1 Vertical Flame Test
• FR Material Implications
• Conclusions
Mechanism of Fire Action

- Fire Triangle - three essential ingredients
  - Heat
  - Fuel
  - Oxygen

- Combustion of cable materials lead to production of heat (and smoke)
  - Fraction of heat ($H_1$) is lost to the surroundings through radiation and convection
  - The heat feedback ($H_2$) pyrolyzes the polymers and promotes the further combustion resulting in flame spread and smoke generation
Fire Spread in Buildings due to Cabling

• Dusseldorf Airport, Germany, April, 1996
• Rockefeller Center, USA, October, 1996
• Garley Building, Hong Kong, November, 1996
• Bangkok President Tower, Thailand, Feb., 1997
• Credit Lyonnais Bank, France, May, 1997
• Heathrow Airport, UK, December, 1997
• Mont Blanc Tunnel, Switzerland, March, 1999
A series of large building fires have occurred that demonstrate the hazards of highly combustible materials (cable) in concealed spaces.
Performance Of Fire Cable Tests

• Evaluation of fire performance of cables can be achieved with different large scale fire test methods, depending on the degree of fire resistance required for a given installation.

• In accordance with the fire safety requirements, the criteria of cable fire tests may include:
  – Fire spread
  – Heat release
  – Smoke/gases production: sufficient visibility to permit escape and reduce the release of lethal gases
Cabling Paths in a Building

Cables run through open or concealed, vertical and horizontal passages in a building. These route(s) can facilitate flame and/or smoke movement.

Source: http://www.hubersuhner.ca
Requirements of Data Communication Cables

Air space above drop ceilings (Plenum Rated - CMP)

Office environment, desktop patch cables (General Purpose - CMG)

Vertical cable chase between floors (Riser Rated CMR)

Air space below raised floor systems (Plenum Rated - CMP)
Cable Flame Tests Ranked by Severity

1. NFPA 262 Plenum Steiner Tunnel Test
   – A large scale fire test, used to determine values of flame propagation distance and optical smoke density of plenum cables

2. UL1666 Riser Cable Fire Test
   – A large scale fire test used to determine the flame propagation characteristics of riser cables

3. UL 1685 Vertical Tray Tests
   – A large scale fire test used to determine values of cable damage height and smoke release (UL 1685) from general purpose cables,

4. UL 1581 / UL 2556 VW-1 Vertical Flame Test
   – A small scale, single cable fire test used to determine the resistance of wire, cable, and cordage to the vertical propagation of flame and dripping of flaming particles
# Fire Tests for Data Communication Cables

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<th>Application</th>
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<td>Methane, 86 kW</td>
<td>Horizontal cable tray</td>
<td>20 minutes</td>
<td>Plenum cable CMP, OFNP</td>
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<td>UL 1666 Riser Cable Fire Test</td>
<td>Propane, 154.5 kW</td>
<td>Vertical</td>
<td>30 minutes</td>
<td>Riser cable CMR, OFNR</td>
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<td>UL 1685 Vertical Tray Test</td>
<td>Propane, 20.6 kW</td>
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<td>VW-1 Vertical Flame Test</td>
<td>Methane, 500 W</td>
<td>Vertical single cable</td>
<td>15 seconds x 5 cycles</td>
<td>Restricted cable CMX</td>
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NFPA 262 Steiner Tunnel
NFPA 262 Design Test
UL 1666 Riser Test and Facility
UL 1685 Vertical Tray Test Facility
UL 1685 Vertical Tray Test Facility
VW-1 Vertical Flame Test Equipment

Flame Application on Vertical Specimen

[Diagram showing flame and specimen dimensions: Flame Indicator, Specimen, Flame, Inner blue cone, 20° Angle block, Handle, 20mm, 250mm, 238mm]
SUMMARY

• Different building spaces present unique fire risks to cable. It is essential to identify these risks and install the correct cable based upon local fire (and smoke) requirements.

• Large and small-scale cable fire tests are valuable tools to assess fire and smoke performance. These tests allow the evaluation of new materials and designs to reduce cable fire risks.

• More complex and higher performance materials are required to pass Plenum and Riser cable fire tests due to the severity of the test and the pass/fail requirements.

• UL has developed a wide array of tests to assess cable fire performance to ensure building safety.
MARKET SURVEY DATA

• Market survey for Telecom Cables conducted
• All samples selected from AP region manufacturers failed “catastrophically”
• Analytical testing showed that there was an absence of flame retardant and smoke suppressant properties in the materials used to construct the cables
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• Evaluation

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- Construction Evaluation
- Report Writing
Quotes from CCCA Articles
• “A disturbing growing trend of substandard Category cables from certain “no name” cable producers in China and Taiwan being sold in the U.S. and other regions has led to an initiative by a relatively new industry association that wants such fraud to stop.”

• “Observed the CCCA press release, “We believe that the manufacturers of these failing products are using substandard materials for profit motives, without regard to the safety of building inhabitants.”

• “The amount of substandard cable coming through could be in the millions of feet per year, he said, acknowledging that there is no way of knowing for sure.”

• “He added that this is an issue that is not going to go away, and that it is possible that some government agency, once aware of the risk to public safety, could take decisive and very public action that makes a clear statement to all concerned how important this issue is.”
THANK YOU ALL FOR YOUR ATTENTION