RESEARCH FOUNDATION

RESEARCH FOR THE NFPA MISSION

Project Summary

Evaluating Data and Voice Signals in Pathway Survivable Cables for Life Safety Systems

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Background: Many life safety systems require pathway survivability. Pathway survivability is defined in NFPA 72, National Fire Alarm and Signaling Code® as the ability of any conductor, optic fiber, radio carrier, or other means for transmitting system information to remain operational during fire conditions. An example of a life safety system that requires pathway survivability includes emergency voice/alarm communication systems (EVACS), which are one-way systems. In buildings with partial evacuation or relocation plans, EVACS are required to have a Level 2 or Level 3 survivability pathway. Pathway survivability Level 2 requires at least one of the following four conditions: (1) 2-hour fire-rated circuit integrity (CI) or fire-resistive cable (2) 2-hour fire-rated cable system (electrical circuit protective system(s)) (3) 2-hour fire-rated enclosure or protected area (4) Performance alternatives approved by the Authority Having Jurisdiction (AHJ) Pathway survivability Level 3 requires at least one of the conditions above and be installed in a building fully protected by an automatic sprinkler system in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

Other examples of life safety systems that require protection are in-building wired emergency services communications systems and Emergency Responder Communications Enhancement Systems (ERCES), which are two-way systems. First responders depend on two-way communication to protect people and property in emergencies. Fire department radio systems may not operate properly when signal strength inside buildings is impaired by building materials such as steel and concrete, obstructions, and by radio frequency interference. ERCES provides radio coverage in buildings to ensure the performance of public safety radio systems. ERCES functions by boosting the signal from the public safety radio repeater with a signal booster, commonly referred to as a Bi-Directional Amplifier (BDA). The signal booster receives and amplifies transmissions from radios inside to the repeater antenna outside. NFPA 1221, Standard for the Installation Maintenance and Use of Emergency Services Communication Systems¸ requires backbone cables of two-way ERCES to be routed through an enclosure that matches the building's fire rating.

As part of the Emergency Response and Responder Safety Document Consolidation Project, this content is being moved to NFPA 1225, Standard for Emergency Services Communications. Recently, new language was proposed as a second revision in NFPA 1225 to maintain the requirement for backbone cables in two-way ERCES in high rise structures, while recognizing that other types of building structures may not need the same level of survivability.

Although cables including but not limited to co-ax, fiber, ethernet and fire alarm signaling circuits are required to be protected from heat and physical damage, there are questions related to the impact of elevated temperature on alarm/data signals, and voice messages utilizing radio frequency (RF) transmitted across these cables and circuits and if that results in less reliable communications.

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Research Goal: Determine if temperature impacts the transmission and the functional and operational quality of alarm/data signals and voice messages in a fire rated and non-fire rated environment. If temperature does have an impact, identify the critical temperature and time at which the transmission of alarm/data signals and voice messages are no longer understandable to provide technical basis for any changes to NFPA 72 and NFPA 1225.

Project Tasks: This project involves the following tasks:

Task 1: Literature Review

- Task 1.1 Document types of life safety systems requiring pathway survivability.
- Task 1.2 Identify incidents of cable failures for life safety systems and, if possible, indicate if elevated temperatures played a role in the failure.
- Task 1.3 Review existing codes and standards for life safety systems requiring pathway survivability and identify the scientific substantiations for those requirements.
- Task 1.4 Review any relevant technical literature on the transmission and functional and operational quality of alarm/data signals and voice messages in the following conditions:
  (1) In a fire rated and non-fire rated environment
  (2) Use of cables in metal conduit or raceway vs not in metal conduit or raceway
  (3) Protected by automatic fire sprinklers
- Task 1.5 Review existing Manufacturer Literature to identify best practices for installation.
- Task 1.6 Develop an interim report summarizing the literature found in tasks 1.1 - 1.5.

Task 2: Research Plan

- Task 2.1 Analyze literature from task 1 and document the knowledge gaps.
- Task 2.2 Develop a research plan to fill the knowledge gaps that includes proposed fire testing for the transmission and functional and operational quality of alarm/data signals and voice messages to determine impact of temperature and time under the following conditions:
  (1) in a fire rated and non-fire rated environment
  (2) use of metal conduit or raceway vs not in a metal conduit or raceway
  (3) Protected by automatic fire sprinklers

Task 3: Final Report: Prepare a final report that includes the research plan and summary of findings and review from Tasks 1 and 2.

Implementation: This research program will be conducted under the auspices of the Research Foundation in accordance with Foundation Policies and will be guided by a Project Technical Panel who will provide input to the project, recommend contractor selection, review periodic reports of progress and research results, and review the final project report.

Schedule: This research project is scheduled to be completed within 6 months of project initiation.

Intellectual Property: The Research Foundation will retain rights to the project report which will be published on the Foundation website.