It's Not Your Father's Fire Alarm Code Anymore!

by:

Robert P. Schifiliti, P.E.,

Chair, Signaling Systems
Tech. Correlating Comm.

FIRE PROTECTION ENGINEERS
www.rpsa-fire.com

R.P. Schifiliti Associates, Inc.
P.O. Box 297
Reading, MA 01867
USA
+1 781.944.9300 Fax
+1 781.942.7500 Voice

In fact, it's not *just* a fire alarm code. The National Fire Alarm Code has evolved since its roots back in the late 1800s and early 1900s. The 2007[i] edition has branched out to address risks and solutions for more than just fire. This article takes a look at that evolution and how the evolution might continue in the next ten years.

[i] NFPA 72, *National Fire Alarm Code*, 2007 edition, National Fire Protection Association, Quincy, MA 2007.

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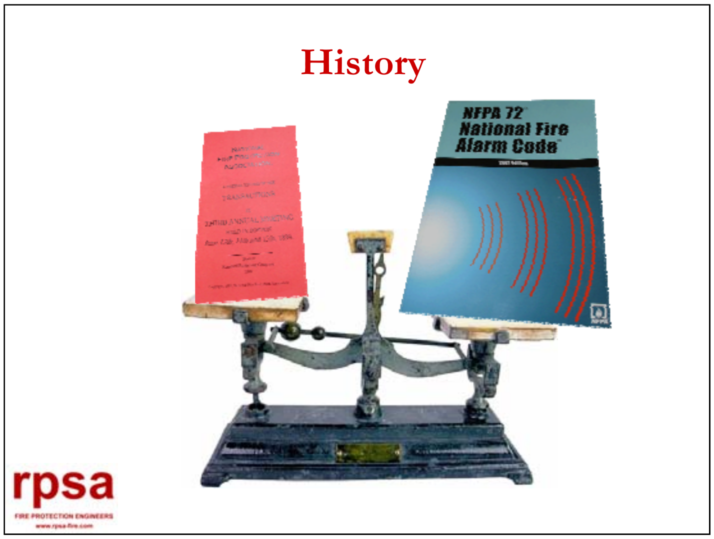
- Historical development
- Current efforts
- Future needs and trends

This presentation takes a look at that evolution and how the evolution might continue in the next ten years.

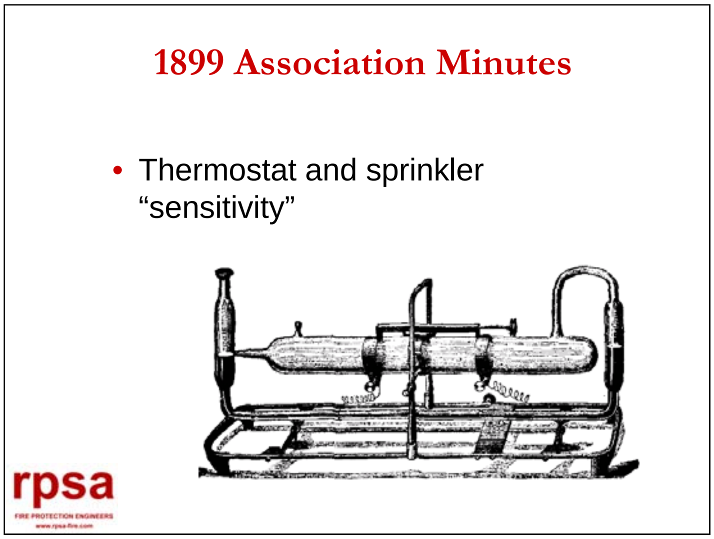


It all seems to have started with the *General Rules and Requirements for the Installation of Wiring and Apparatus for Automatic Fire Alarms, Hatch Closers, Sprinkler Alarms, and Other Automatic Alarm Systems and Their Manual Auxiliaries*[i] published in 1899. That document had nine, 5x8 pages that included requirements for what we now call the protected premises and the supervising station. Those pages also included requirements for all inside and outside wiring. In 2007, the National Fire Alarm Code now has 272 8.5x11 pages not including NFPA 1221[ii] and NEC 760[iii], which also had historical origins in the 1899 document.

[i] *General Rules and Requirements for the Installation of Wiring and Apparatus for Automatic Fire Alarms, Hatch Closers, Sprinkler Alarms, and Other Automatic Alarm Systems and Their Manual Auxiliaries,* National Fire Protection Association, Transactions of the Third Annual Meeting, Boston, June 13 – 15, 1899.

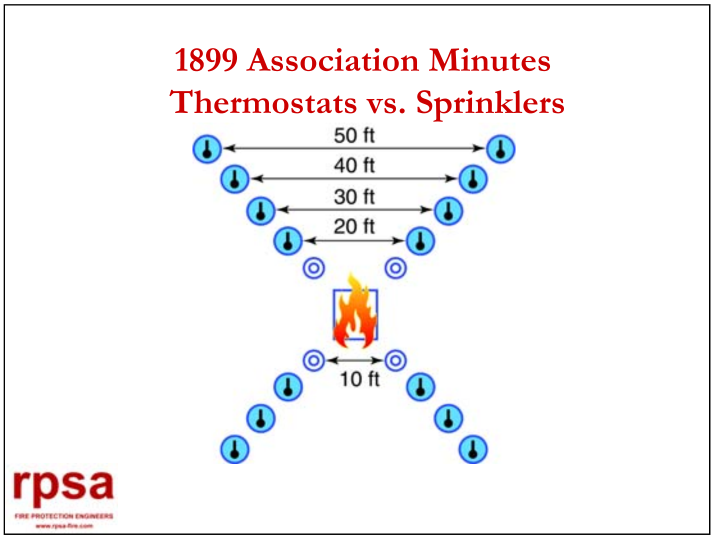
[ii] NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2007 edition, National Fire Protection Association, Quincy, MA 2007.

[iii] NFPA 70, *National Electrical Code, Article 760, Fire Alarm Systems*, 2005 edition, National Fire Protection Association, Quincy, MA 2005.

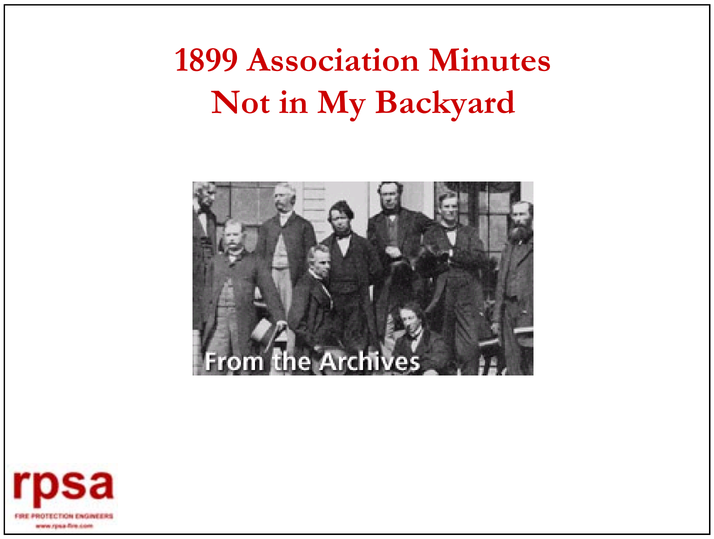


In 1899, 6.5 pages of association minutes were devoted to discussing heat detector spacing versus sprinkler spacing and the fact both had something called “sensitivity” related to velocity, not just temperature. They discussed the fact that two devices that operate at the same temperature in a slowly heated liquid bath, will operate at different times when subjected to flowing fire gases, The requirement for actually measuring and labeling heat detectors with this sensitivity number (RTI) finally becomes effective in July of 2008, 109 years later.

PRITCHETT'S ELECTRIC FIRE ALARM



Back in 1899 thermostat spacing was based on the need to operate before a sprinkler. Why? Because that was how they got an alarm and transmitted it to the nearest fire house. In cases where there was an alarm valve on the sprinkler, close spacing of the heat detectors was not required. In our current fire alarm code, what is the basis for the "listed spacing" of heat detectors? The listing test determines the spacing that will result in the particular model of heat detector operating before a standard temperature sprinkler, when exposed to one specific flammable liquid fire and when both are installed on a 14'-9" high ceiling. Is that test still relevant? Not really. However, it does provide one prescriptive solution for the spacing of detectors with different sensitivity ratings.

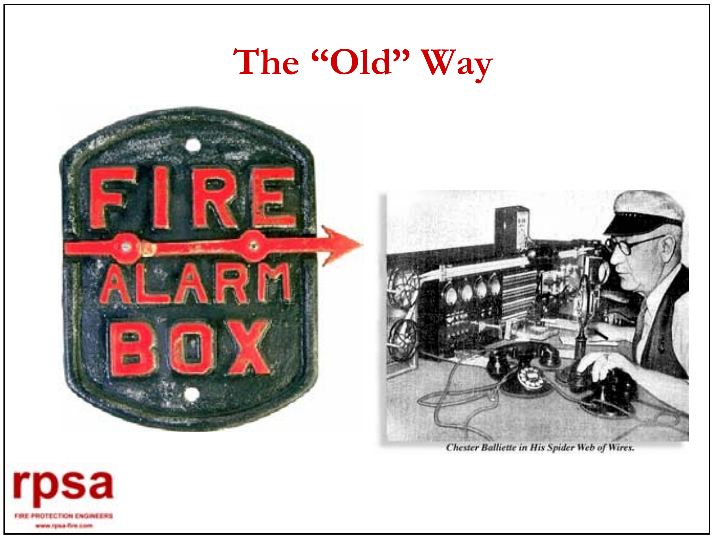


During the 1899 association meeting, representatives from New York, Philadelphia, Chicago and Boston argued that they should be allowed to have different rules:

"Mr. Wilmerding: In Philadelphia we have not found such spacing necessary, and I agree with Mr. Hexamer it largely depends upon the thermostat. If, in New England the thermostats require such a spacing, would it not be well for them to adopt such a spacing, but not ask us and New York City to adopt it."[i]

[i] A Partial record of the Transaction of the Third Annual Meeting, Boston, June 13 – 15, 1899, reprinted courtesy of Carmen Fire Protection Associates, Carmel-by-the-Sea, CA.

Well, now we mostly provide ONE solution and expect all to adopt it or go out of their way to adopt a change. As we move forward we need to provide a selection of the best and carefully thought out alternatives for other codes and AHJs to select from. More on that later.



It was not uncommon in the early 20th century to have initiating devices (thermostats, sprinkler waterflow switches and manual boxes) connected to a circuit that directly controlled bells connected in the fire house. One property, one bell. In another configuration, an automatic coded telegraph transmitter might be used on a city or privately owned telegraph circuit.

In 1911 municipal systems (transmission method and supervising station) were split off from the fire alarm, document.

NFPA 73, eventually NFPA 1221 and CH 9 PRS

Photo is of San Francisco municipal FAS circa 1931 which is technically a Public Fire reporting System, not SSFAS.

Evolved Configurations

- Local
- Direct connection
- Coded transmitters on a public telegraph circuit – one per bldg
- Coded transmitters in initiating devices on a private circuit to a "central" station
- Any of the above – with one owner

Over the years, fire alarm systems evolved into several configurations:

Systems with initiating devices that only sound an alarm in a building (Protected Premises Fire Alarm System)

Systems directly connected to fire stations or dispatchers (Remote Supervising Station Fire Alarm Systems)

Systems that used coded transmitters on a common signaling line circuit owned and originated at a municipal fire or emergency dispatch center (Auxiliary Fire Alarm Systems)

Systems connected to commercial monitoring equipment, often using coded transmitters right in the initiating devices themselves (Central Station Service)

Systems connected to commercial monitoring equipment all owned by the same person or entity, using either coded transmitters located in the initiating devices themselves or a direct switched connection (Proprietary Protective Signaling System)

Except for power supplies, initiating devices and notification appliances at the protected premises, the systems were generally quite a bit different – mostly in the amount and resolution of information and the manner in which that information was conveyed and in the ownership of the transmission medium and the supervising station itself. So, it became expedient to have separate standards for each system configuration.

There was enough redundancy that it made sense to treat the protected premises virtually the same, regardless of if or how signals might be sent elsewhere. Off-premises signaling systems, composed of a transmission method and a supervising station facility, could be treated separately from the protected premises system. Thus, the NFPA 72 alphabet series was born – NFPA 72A – E, plus NFPA 71[i].

[i] NFPA 72A, Standard for the Installation, Maintenance and Use of Local Protective Signaling Systems for Guard's Tour, Fire Alarm, and Supervisory Service,

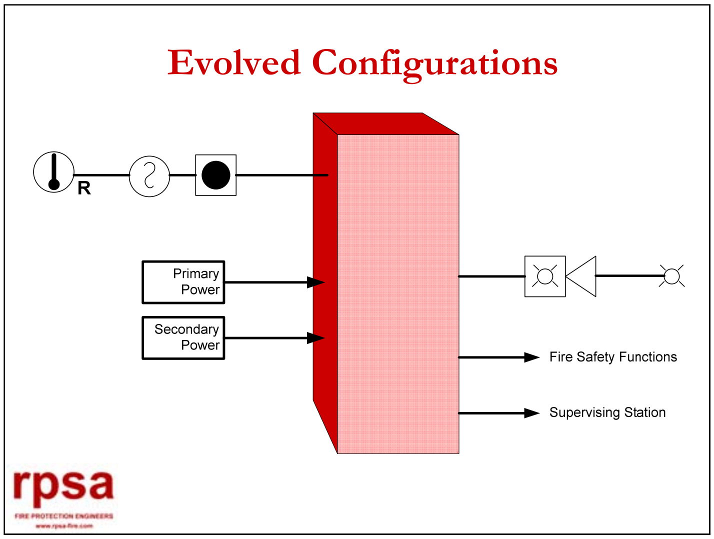
NFPA 72B, Standard for the Installation, Maintenance and Use of Auxiliary Protective Signaling Systems for Fire Alarm Service,

NFPA 72C, Standard for the Installation, Maintenance and Use of Remote Station Protective Signaling Systems,

NFPA 72D, Standard for the Installation, Maintenance and Use of Proprietary Protective Signaling Systems,

NFPA 72E, Standard on the Automatic Fire Detectors,

NFPA 71, Standard for the Installation, Maintenance and Use Signaling Systems for Central Station Service.



As technology advanced, the systems within a building all started to have an additional common element – a control panel. Earlier, many systems had components at the protected premises that were on circuits powered and controlled by the off-site supervising station. In order to provide local alarms and control as well as the off-premises transmission, systems started using control panels. Manufacturers and consumers wanted some commonality in these controls, regardless of if, how or to who alarms and other signals might be transmitted. Therefore, one model panel would be manufactured with modules or features that allowed it to work with all or most of the available types of supervising station equipment.

Growth

- Household protection
  - NFPA 74M and then 74
- High rise buildings
- Occupant notification
- Performance-based fire detection

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Until the early 1960s most fire alarm development was the result of commercial and insurance interests. Few homes had fire detection and alarm systems. In the 1960s NFPA produced a manual on home alarm systems which later evolved into a standard, NFPA 74, separate from the other fire alarm standards[i].

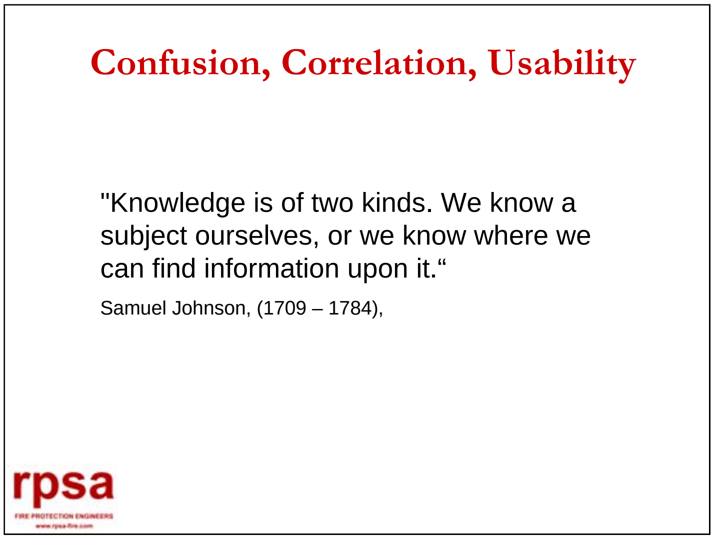
1975 to 1985 was a period of tremendous growth and development for the fire alarm industry and for the related standards. In 1975 it was realized that the basic standards for protected premises were not adequate for high rise buildings. It took ten years to develop NFPA 72F[ii] to address the needs of high rise occupancies. Similarly, in 1976 a subcommittee was formed to develop guidelines for occupant notification. That became NFPA 72G[iii]. Again, the process took almost ten years. Both documents were first approved during the 1984 Fall Meeting of NFPA. About the same time, testing methods and frequencies were compiled into NFPA 72 H[iv], approved during the 1983 fall meeting. Another significant major change came in 1984 as performance based fire detection was added as Appendix C to the old NFPA 72E.

[i] NFPA 74M, *Manual on Home Fire Alarm Systems* (origin date unknown, prior to 1965), later evolved into NFPA 74, *Standard for the Installation, Maintenance and Use of Household Fire Warning Equipment.*

[ii] NFPA 72F, *Standard for the Installation, Maintenance and Use of Emergency Voice/Alarm Communication Systems.*

[iii] NFPA 72G, *Guide for the Installation, Maintenance and Use of Notification Appliances for Protective Signaling Systems*.

[iv] NFPA 72H, *Guide for the*



Each of the different standards and guides continued to evolve. However, with so many different standards and guides, their use and enforcement was often confusing and difficult. Samuel Johnson is often quoted as having said, “The next best thing to knowing something, is knowing where to find it”[i]. So, to improve usability and correlation, all fire detection and alarm signaling system standards were re-consolidated in the late 1980s and early 1990s. That started with the publication of NFPA 72 (no letter) in 1990 and was “finished” in 1993. The partial recombination in 1990 required a name: NFPA 72, Standard for the Installation, Maintenance and Use of Protective Signaling Systems.

[i] Often attributed to Samuel Johnson (1709 – 1784), though his actual quote is reported to have been: "Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information upon it." Source: http://www.samueljohnson.com/apocryph.html#12 , 2007.

Consolidation

- NFPA 72, 1990
  - NFPA 72 A – D, F
- NFPA 72 1993
  - NFPA 71
  - NFPA 72 E, G, H
  - NFPA 74

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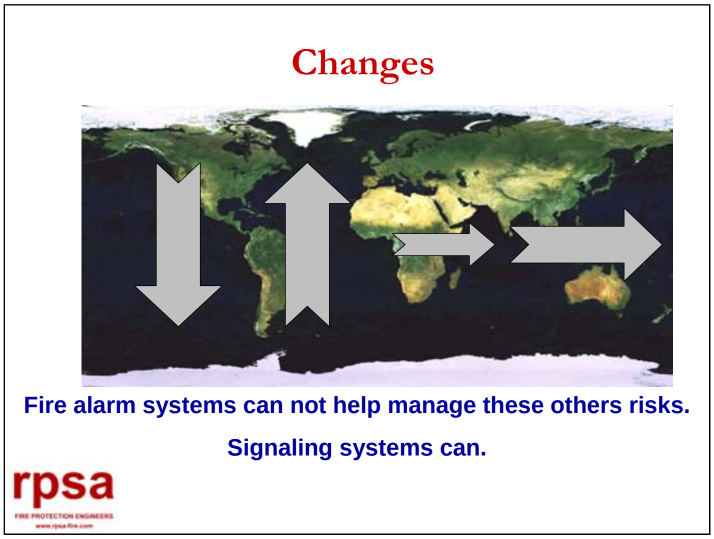
In 1993, NFPA 72 H, which had been a guide for system testing, was incorporated into the code and revised and expanded. That resulted in the first one step, comprehensive set of requirements for the Inspection, Testing and Maintenance of fire alarm systems. Given the number of changes since then, it's obvious that not everyone has agreed with the testing frequencies or the methods. However, most users agree that the chapter has made the enforcement of ITM easier and has resulted in improved maintenance, reduced false and nuisance alarms, and an overall improvement in reliability.

In addition to adding NFPA 72H, the 1993 edition of NFPA 72 also incorporated NFPA 71, NFPA 72E and G and NFPA 74. The final recombination of those standards and guides in 1993 also brought about another name change: NFPA 72, *The National Fire Alarm Code*.

Since the recombination, the code committees and the general public have been focused on the evolution of the fire alarm code. With everything in one place, it is easier to focus core requirements and easier to see gaps in requirements. The chapters on initiating devices (formerly 72E) and notification appliances (formerly 72G) have expanded and incorporated many performance based options, providing designers with flexibility to meet protection goals.



A lot has changed since 1899 – not just fire alarm systems and standards. The world has changed and the risks have changed. Fire risk is much lower, while other risks have either increased or at least received more attention. One of the reasons for the reduction in fire risk is the increased application and successes of passive and active fire protection measures. But those systems are not inexpensive. Signaling systems have design and installation costs and recurring life cycle costs. In the case of fire alarm systems, they often are installed right along with other systems that have parallel purposes: security systems, energy management systems, paging systems, telephone systems, computer networks, cable television distribution, etc. Some efforts have been made to design and install combination systems to reduce overall cost – fire alarm and energy management or fire alarm and security for example. However, the overall system complexity and the use of proprietary data networks have limited their use.

Containment – fire and smoke barriers – multi purpose.

Sprinkler – uni-task – but has a large impact on fire safety without a lot of AND gates

Fire alarms systems are also uni-taskers – no dual purpose

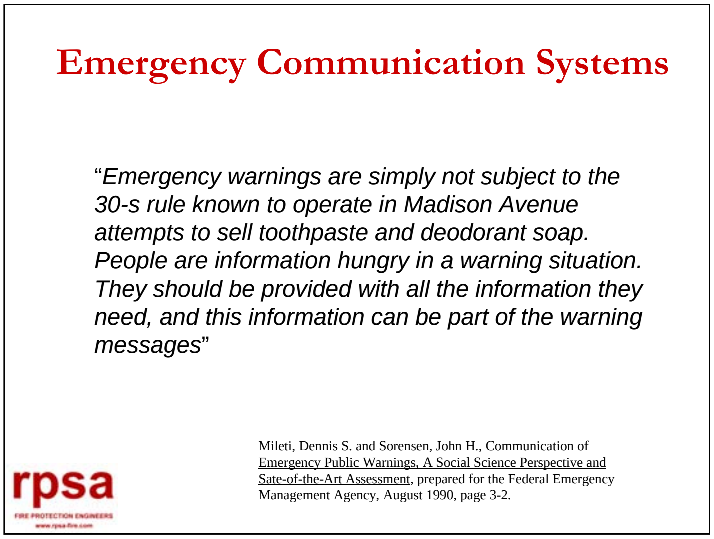
And they only warn they have no direct impact on fire safety without something else happening – evacuation, damper closing, door closing, call the FD to manually extinguish.

In the case of fire alarm systems, they often are installed right along with other systems that have parallel purposes: security systems, energy management systems, paging systems, telephone systems, computer networks, cable television distribution, etc.

NO – Fire alarm systems are not something that can be used to manage or reduce these other, non-fire risks.

BUT Signaling Systems can.

The overall direction of the signaling system industry and market is towards systems that have multiple uses.



You know those little buzzing coasters they give you when you're waiting for a seat at a restaurant? That's a signaling system. We're not in that business. We are in the business of Signaling Systems for the Protection of Life and Property – that's the title for the TCC.

The big buzz in the signaling industry these days is not about fire detection and alarm, it is about Mass Notification Systems (MNS) or Emergency Communication Systems (ECS)[i]. "*Emergency warnings are simply not subject to the 30-s rule known to operate in Madison Avenue attempts to sell toothpaste and deodorant soap. People are information hungry in a warning situation. They should be provided with all the information they need, and this information can be part of the warning messages*"[ii].

[i] "Mass Notification Systems", NEMA Supplement in <u>Fire Protection Engineering</u>, Society of Fire Protection Engineers, Bethesda, MD 20814, Fall 2005.

[ii] Mileti, Dennis S. and Sorensen, John H., <u>Communication of Emergency Public Warnings, A Social Science Perspective and Sate-of-the-Art Assessment</u>, prepared for the federal Emergency Management Agency, August 1990, page 3-2.

A fire alarm system can't warn of an approaching tornado – an ECS can

A fire alarm system can't tell you to exit to the rear of the building because there is a sniper outside on 2nd Street – an ECS can.

A fire alarm system can not tell you what parts of a building have been contaminated by a chemical or biological hazard – an ECS can.

Emergency Communication Systems: Challenges

- Effective communication
- In buildings and wide area distribution
- Different hazards
  - Who to alert and inform
  - When to alert and inform
  - How to alert and inform
- Mission survivability

How can we effectively communicate a bomb threat and the desired behavior to occupants of a building? How can we reach thousands of people in many different buildings and on the streets and fields of a campus or military base when a chlorine tanker has overturned or when a tornado is approaching? For different hazards, there are different answers to the questions of who to warn, when to warn and how to warn. How do we communicate, and *convince*, occupants in a high rise residential building to stay in their apartments during a fire? How do we continue top communicate and reassure or give new instructions? And, how do we ensure that these systems are both effective and continue to operate for the duration of the hazard? These are some of the challenges to be faced in the next ten-plus years as the National Fire Alarm Code evolves into an all-encompassing emergency signaling systems code or standard.

Emergency Communication Systems: Non-emergency Use

- Increased effectiveness
- Be$t u$e of re$ource$
- Increased use improves overall reliability and system availability

Why should airports, hospitals and schools be burdened with two systems that have the same function – communication to the occupants? If an “event” system is permitted to be used for emergency communications in a stadium, auditorium or large meeting room, how do we ensure system reliability and statistical availability of a system that by its very nature must have manual and automatic volume control and that will be used daily for non-emergency purposes?

The fire alarm industry has focused on audible, and more recently, single-bit visible delivery systems for occupant notification. Different hazards require different delivery “channels” for different population subgroups. Where information is desired, voice systems have traditionally been used. Depending on the hazard and the target group there are many possibilities for effective communication including phone systems, large displays such as dynamic highway signs used for Amber alerts or score boards in stadiums, cable television and computer (internet) override.

Emergency Communication Systems

- Security
- Connectivity
- Controllability

Given today's security risks and potential terrorist threats, most large buildings and large spaces will need hardened, secure communication systems. Can this be accomplished using a common building network infrastructure to reduce cost, boost coverage and increase statistical availability/reliability? Some systems will be connected to national or regional systems for the receipt of information. Some will require the ability to be controlled far from the threat area. Others will not require these specialized features.

Emergency Communication Systems

- Flexible solutions
- Menus
- User input
- Committee expertise
- Feedback loop

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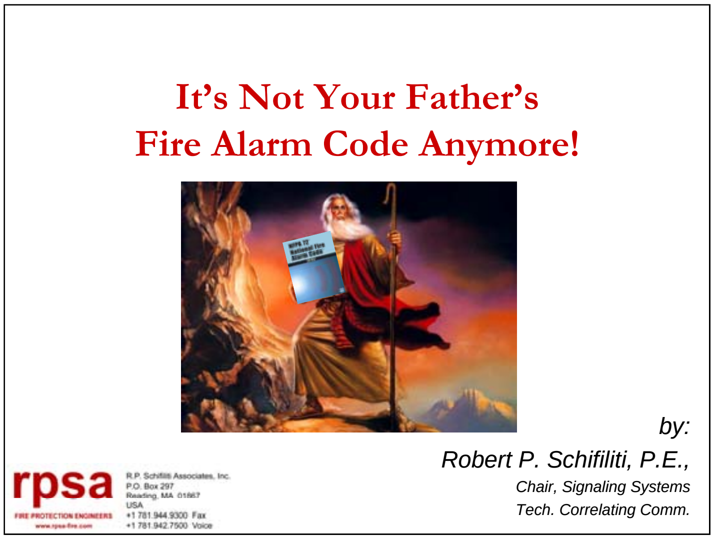
From a code and standards viewpoint, there needs to be options and flexible solutions to meet different needs. Also, it is insufficient for a standard to provide options and menus of protection and notification features if the referencing codes, AHJs and designers fail to specify the required system goals and configuration. The signaling system committees must receive input from the users regarding their goals and the features that they need in a signaling system. The signaling system committees must then apply their expertise to effect reasonable and flexible solutions. Finally, there must be a feedback loop to ensure proper adoption and correlation.

For example, in the 2007 edition of NFPA 72, an alarm is defined as a signal indicating an emergency condition or an alert that requires action, not as a warning of *fire* danger as it had been defined in previous editions. However, there are other NFPA documents that use the word “alarm” when referencing any type of signal – not just danger signals.

At a recent meeting of the Technical Correlating Committee for Signaling systems for the Protection of Life and Property, it was acknowledged that an *alarm* does not necessarily constitute an immediate need to evacuate an area, a building, a floor, or a room. The necessary action depends on the nature of the emergency. So, while the term *alarm* does mean *emergency*, the desired response may vary. Not all codes, AHJs and designers recognize this distinction. For example, a carbon monoxide signal may be an alarm or it may be a supervisory signal. It would be an alarm, when the intent is to warn occupants in the immediate area of the imminent danger (emergency) because of the presence of low levels of CO. The desired response may not have to include immediate evacuation. On the other hand, a CO signal generated by a detector in a rooftop mechanical space may sometimes be more appropriately categorized as a supervisory signal – a signal indicating the need for action in connection with the maintenance features of related systems.



How can a signaling standard be crafted in such a way that other codes or AHJs can pick and choose the features they want for certain occupancies or risks? The signaling systems committees (including NFPA 72 and NFPA 720) must address these challenges, all while never forgetting that the largest percentage of users simply need to know what is needed for a small, simple fire alarm system.

Trying to write and correlate separate documents for different risks has historically been proven difficult. Extraction of text from one to another, duplication of requirements and sending users from one document to three or four others to put a system together results in confusion, issues of jurisdiction and, ultimately, the potential for error. NFPA 72 is evolving to address all of these signaling needs, not just fire alarm.

It's not your father's fire alarm code anymore.