MNEC NFPA 72

WHITE PAPER

In 2010, the National Fire Protection Assocation (NFPA), significantly changed their code # 72 (National Fire Alarm Code) and has forever improved the importance of communicating during critical events. It was so important that NFPA 72 was given the new title of *Fire Alarm and Signaling* in order to reflect the broader importance of the sweeping changes – the likes of which hadn't been seen since 1993. The extensive changes took the fire alarm code and broadened its reach to include life-safety systems and functions all the while supporting the effort with 22 new chapters (some acting as placeholders for future chapters.) The most significant additions to NFPA 72 are Chapters 12, "Circuits and Pathways", Chapters 21, "Emergency Control Functions and Interfaces" and Chapters 24, Emergency Communication Systems and a section on Risk Assessment. Chapters 24, Emergency Communications Systems (ECS) details specific requirements to indicate and notify the existence of an emergency situation and the need to communicate the necessary information to all involved parties. Chapter 24 also established minimum levels of performance, reliability and quality for emergency communications systems. Moreover, it merged the various definitions and roles of communications systems into a single Emergency Communication System (ECS) with the intent of creating a single discussion platform that is all inclusive for the facility or campus.

This paper will highlight the need for an ECS and the considerations for system design. It outlines and explores the changes to NFPA's code 72 since 2010 and through the latest 2016 edition. The adoption process has already begun, and is occurring at a faster pace than with any previous edition of NFPA 72

- New, highlighted requirements from 2010, 2013 and 2016, and what they mean to engineers, architects, designers, building owners, facility managers and Authorities Having Jurisdiction (AHJs)
- What should building owners, specifying engineers and local fire officials know in order to apply the standards and prepare to comply as adoption occurs?

The NFPA has recognized the critical role that mass notifications play in fire- and non-fire, meaning weather and human-related, emergencies and the protection that it can help provide. The growing need for mass communications continues to be more and more relevant as certain acts take place across the country; these acts include not just terrorism and shootings, but also environmental accidents, plant explosions, earthquakes, hurricanes and more.

Historically, the US government, specifically the Department of Defense (DOD) has been a major supporter in furthering the efforts of communication during critical events. The DOD has outlined mass notification criteria in its Unified Facilities Criteria (UFC) 4-021-01. According to this criteria, mass notification is defined as: the capability to provide real-time information and instructions to people in a building, area, site or installation using intelligible voice communications, together with visible signals, text, graphics, and other communication methods.

Furthermore, the NFPA has long been involved with developing strategies and fire safety educational materials for people with disabilities. Congress created the Americans with Disabilities Act (ADA) in July 1990. The primary purpose was to provide equal access to facilities and services for all Americans with physical challenges through the removal of barriers in our built environment. The US Architectural and Transportation Barriers Compliance Board (Access Board) was tasked to develop architectural standards for compliance with this new law. These standards are called the Americans with Disabilities Act Accessibility Guidelines (ADAAG). Although local jurisdictions cannot enforce the law as a code, many local jurisdictions have adopted local laws with the same language as the ADA, providing them the ability to enforce the ADA as code. Moreover, the requirements found in NFPA 72 exceed the minimum requirements found in the ADAAG.

Adoption Is Happening Now

Adoption began in January 2011, most notably by the state of California. California is an early adopter state and they wanted to begin implementing the new emergency communication requirements immediately. New Jersey was quick to follow in the spring of 2011 and since then 38 of the 50 states have adopted the code and all 50 states have adopted parts of NFPA 72 at the local or county level.

Moreover, if a state or even a county has adopted a previous version of the code, they often will review the latest version and utilize the relevant parts for their current project. The Authority Having Jurisdiction (AHJ) has the authority at any time to adopt all or parts of a code if it makes sense for the project. It is important to review which code is required with the AHJ prior to bidding on the project.

It All Begins with a Risk Assessment

It order to properly design a communications platform it is critical to assess the risks to the facility. This analysis is used to identify and characterize the probability and the severity of different events (natural or human-related) requiring emergency support and response. The risk assessment provides the basis for developing an emergency communications system and action plan, which all culminates into an Emergency Response Plan. The 2010 NFPA 72 code states:

"Emergency planning requires a detailed risk analysis (vulnerability and failure analysis), which includes an evaluation of the risk to the asset; probability of occurrence and frequency of loss; and the loss effect. Risk mitigation includes dissemination of information, which is the role an MNS plays in an emergency." (MNS is a Mass Notification System)

The code suggests initial questions that should be asked and answered in order to properly develop a system:

1) What is the type of emergency event – fire, security, safety, health, environmental, geological, meteorological, utility service disruption, or another type of event?
2) What is the urgency of the emergency event – immediate danger, has it already occurred, is it expected soon or in the future, or is it unknown?
3) What is the anticipated or expected severity of the emergency event? How will it impact the facility and its functions – extreme, severe, etc.?
4) What is the certainty of the emergency event? Happening now, very likely, likely, or possible in the future?
5) What is the location of the event or from what direction is the emergency event approaching – North, South, East or West?
6) What zone or areas should receive the emergency message(s) – a floor of a building, multiple floors of a building, entire building, multiple buildings, a campus, an entire town or city, etc.?

The risk assessment process is meant to identify the types of expected emergency events and provides a basis for how they would be handled. Once the various scenarios are identified and understood, a reactive communication plan may be designed and put into place based on that need.

Timing is a critical component of operation along with the following four key criteria::

- Reach – is coverage to 100% of the intended audience to inform and instruct. Reach can be visible and/or audible.
- Clarity – is the degree to which the intended audience understands the message they are receiving. Is the message intelligible and clear?

- Redundancy – is about multiple methods of communication to ensure receipt as well as system fail safes for operability.
- Reporting – provides opportunity to react in the event of a system compromise or failure as well as an evaluation tool for operation optimization.

Systems must be supervised and monitored. Chapter 12 (Circuits and Pathways) of the NFPA 72 code provides survivability requirements that can be incorporated into specifications and designs. Part of the critical design path is to ensure that the primary facility, functioning as a command center or central control, must maintain functionality as determined by the risk analysis and/or have a secondary point of control.

Designing an Mass Notification Emergency Communications (MNEC) System

Once an organization has completed its risk analysis, it can begin designing a MNEC system. NFPA 72 Chapter 24: Emergency Communications Systems delivers specific requirements in order to deliver an effective and robust system which can be relied upon in the event of an emergency. Of significant note, Chapter 24 permits a mass notification control unit to take control of a fire alarm notification appliance or control panel. Furthermore, audible messages must be clear and intelligible throughout a building or structure and meet specific requirements as well as visible notifications as achieved through digital signage, strobes, textual, graphic or video interfaces.

As described above, a system must have reach and clarity. An Emergency Communications System must quickly inform and instruct people of the threat(s) and direct them to safety. This could be within a structure or a surrounding exterior environment. It could also be to other facilities not in the immediate threat area but involves those that are impacted by the incident.

Loud Voice or Wide Area speakers can be an effective means for informing the public audibly. This method of communication provides another level of communication to the surrounding community in order to help and/or protect based on the emergency event.

Each facility's design will be unique. The risk analysis, building configuration, and methods of communication should be specific to that particular facility. NFPA 72 does NOT describe specific means of required communications but rather allows the most effective methods of message delivery to be determined based on the facility and culture of that particular organization. The code does, however, advise on control and audio priorities in addition to requiring a redundant means of communication; meaning, there needs to be multiple methods (i.e., an audible message and a text message or digital display) of communication to help ensure the message is delivered.

Next Steps

Following are highlights of changes from the NFPA 72 code over the past six years. Developing an Emergency Communications System is important and system implementation can be broken into simple parts when assessing the design needs: Inputs, Headend, and Outputs.

Inputs are the means for controlling or triggering an emergency communications system. This could be as simple as a push button or a series of telephone inputs from a cell phone. The two main concerns are the method(s) of triggering the communication plan and training those that will be responsible for triggering the alert.

The headend is the brains and programming of the system. This will be a system or series of systems working together to ensure the operability and proper programming for activation in the event of the emergency. It is crucial to design with a system that is capable of talking to various third party devices as no one system accomplishes all communication tasks. Furthermore, the systems should be Underwriter Laboratories (UL) listed to interface with a fire alarm control panel and other system devices.

Outputs are the methods of communication. How is the emergency communication physically being delivered? With a wide variety of outputs it is important to have a familiar knowledge of the risk assessment as well as the culture of the organization and its employees and their preferred methods of communicating.

An Overview of the 2010 Edition

- Expanded the Title to include “Signaling”
- Expanded the code from seven (7) chapters to 29 chapters
- Removed the word “fire” wherever it made sense throughout the document
- Chapter 10 Renamed: Fundamentals and provides requirements for Emergency Communications Systems
- Introduced Chapter 12: Circuits and Pathways and described “monitoring” and “supervision” as a requirement with many systems
- Introduced Chapter 21: Emergency Control Functions and Interfaces
- Introduced Chapter 24: Emergency Communications Systems (ECS). The following mass notification systems were addressed in this chapter:
    - emergency voice/alarm communications (24.4.1)
    - in-building mass notification systems (24.4.2)
    - wide-area mass notification systems (24.4.3)
    - distributed recipient mass notification systems (24.4.4)
    - two-way telephone communication service (24.5.1)
    - radio communication enhancement systems (24.5.2)
    - area of refuge emergency communications systems (24.5.3)
- Chapter 24 further defines the interrelationship between different mass notification systems and fire alarm systems, and the means to establish priority and control between them
- The performance of risk analyses to provide the bases for design requirements and signal priority of Emergency Communications Systems / Mass Notification Systems
- The 2010 edition has been updated with new requirements in 18.4.10 relating to the identification of areas/spaces ("acoustically distinguishable spaces") that will require (or not require) voice intelligibility as specified by the system designer and approved by the authority having jurisdiction (if required).
- Signaling for those with hearing loss received new treatment in the 2010 edition of NFPA 72. Beginning January 1, 2014, audible notification appliances of commercial fire alarm systems that are provided to signal sleeping areas will be required to produce a low frequency alarm signal (520 Hz square wave or equivalent). (18.4.5.3)
- Evacuation and alert tones preceding voice messages associated with emergency voice/alarm communication systems must also produce the low frequency output.
- Several changes have been made in the supervising station alarm systems chapter. These include
    - a new requirement for qualification of supervising station operators
    - a new requirement for indication of remote station service
    - removal of four legacy communications methods:
        - active multiplex transmission systems
        - McCulloh systems
        - directly connected non-coded systems
        - private microwave radio systems
    - update of key definitions associated with digital alarm communicator systems
    - update of provisions for IP communicators
- Updated requirements for combination systems (23.8.4)

Clearly the most significant change to the code was in the development of the new emergency communications chapter (Chapter 24.) This chapter governs in-building emergency voice / alarm communications systems, including mass notification and its related components

An Overview of 2013 Changes

This edition builds on the scope and organizational changes started in 2010.

- Chapter 3 added three new definitions: Impairment, Emergency Impairment, and Planned Impairment – all related to a system, component or function
- Introduced Chapter 7: Documentation which provides a central location for all documentation requirements for the code; this chapter provides extensive information now on all documentation required
- The Fundamentals Chapter requires:
    - Supervising stations operators and fire alarm system service providers to report to the AHJ when monitoring service has been terminated or when a system has been out of service for more than 8 hours
    - Inspection, testing and service personnel qualifications to be updated to better reflect the level of qualification needed for each type of activity
    - System programmers to be certified by the system manufacturer
    - System Designer for Fire Alarm System and Emergency Communications Systems plans is further defined; should be experienced and/or licensed (10.5.1)
        - Same can be said for Inspection, Testing and Service Personnel (10.5.3.1-5)
    - 10.21 – The system owner or their designated representative shall be notified when a system or part thereof is impaired. Impairments to systems shall include out-of-service events.
- Much of Chapter 10 (Fundamentals) has been reorganized.
    - The requirement for protection of control equipment has been inserted in section 10.4.4, which requires smoke detection to be provided at the location of each fire alarm control unit, notification appliance circuit power extender, and supervising station transmitter unless the equipment is in a constantly occupied area
    - The requirements for qualifications of inspection and testing personnel have been moved from chapter 14 into chapter 10 as well.
- Chapter 12 (Circuits and Pathways) now incorporates specific circuit performance and integrity information, revised and relocated from the previous chapter protected premises fire alarm systems.
- Chapter 12 (Circuits and Pathways) has added a section to address prioritization segregation of life safety and non-life safety data in shared pathways
- Chapter 14 Updates:
    - A new allowance has been added in paragraph 14.2.3.2. It allows the property owner to delegate the authority and responsibility for inspecting, testing, and maintaining the fire protection systems to the occupant of a building. This delegation of authority has to be documented in a lease, written use agreement, or management contract
- Tables have been updated in Chapter 14 (Inspection, Testing and Maintenance)
- Modifications to Chapter 14 (Inspection, Testing and Maintenance) to clarify that the inspection, testing and maintenance requirements apply only to the systems, devices, and components covered by the code – not to components of other systems

- Clearer requirements for usability were established for:
    - Combination Systems
    - Video Imaging Detection
    - Carbon Monoxide Detection
    - Sprinkler Supervisory Service
    - Electronic Monitoring of Fire Extinguishers
- Chapter 18: Language has been added to the code (18.4.1.4.2 and 18.5.1.2) noting that audible signal and visual signal coverage are required only in occupiable areas. This clarifies the intent of the code. A definition of “occupiable” has also been added to chapter 3; it notes that an occupiable area is an area of a facility occupied by people on a regular basis
- Language has been added (18.4.1.4.1. 18.4.1.4.3, 18.5) that requires the designer to identify what areas will be provided with audible and visual signals, and the ambient and design sound pressure levels
- The criteria for application of the distinctive evacuation signal (three-pulse temporal pattern) have been expanded. The signal was required and allowed only to be used when signaling occupants to evacuate the building. The three-pulse temporal signal is now also required to be used to provide a signal for occupants to relocate from a zone to another zone within the building
- Reflecting the increased use of textual and graphical messages for emergency communication, a new section 18.9.4 addresses character and symbol requirements for these appliances and messages and includes a new table specifying minimum criteria
- Chapter 24: A new concept has been added to chapter 24 that requires emergency communications used for mass notification systems to be categorized into layers. The categorization must be included in the design documentation of the systems. The code defines the layers as:
    - Layer 1: notification of occupants using in-building emergency communication systems
    - Layer 2: notification of people outside the building and controlled by authorized users (wide area signaling)
    - Layer 3: notification of people through personal devices (distributed recipient mass notification, i.e., text messaging)
    - Layer 4: notification of people by public means such as radio or television

An Overview of 2016 Changes

- Additional language added to this section states that each floor of the building shall be considered a separate zone, and, for floors with multiple zones, each zone on the floor shall be considered separate, with a few exceptions.
- The NITMAM was introduced because of potential concerns for installations in small and mid-sized structures. The original purpose of this requirement is to ensure that a single SLC does not connect too many devices in a multistory building where a fault on that SLC could leave an extensive part of the building unprotected.
- To improve the code language, the committee also made many editorial changes, such as removing the word “evacuation” from “signaling zones” to make it more generic

The latest edition of NFPA 72 is the 2019 version with a new version due in 2022 and we will continue to report on the updates adopted in this important standard. The Fire Alarm and Signaling Code is a critical element in life safety communications and it will continue to guide best practices for building construction well into the future.