

Mass Notification Systems & You

This white paper examines the provisions of Annex E, Mass Notification Systems, to NFPA 72 (National Fire Alarm Code) and discusses the impact on organizations.

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Introduction

The mass notification system annex to NFPA 72 is a compendium of recommended system characteristics, capabilities, and performance standards that the National Fire Protection Association (NFPA) has developed and included in its latest version of the National Fire Alarm Code, which is the 2007 edition. Annex E makes maximum use of existing fire alarm equipment specifications and correlates these requirements accordingly. This simplifies the mass notification system requirements by tying them to existing and proven fire alarm standards that are already in common use.

What Annex E Is Not

Although included with NFPA 72, Annex E is not actually part of it. Instead, NFPA provides this annex strictly for informational and assistance uses, although the code frequently references technical provisions throughout NFPA 72. Further, Annex E, while quite prescriptive in detailing characteristics and capabilities of mass notification systems, provides neither supplier suggestions nor specific solutions on how to achieve the set-forth end states. There is therefore considerable latitude on how to comply with the solid recommendations Annex E offers.

Bottom Line

There are many reasons an organization would want a mass notification system (MNS). They include compliance with legal requirements, providing a solid baseline for personnel security and safety, enhanced operational capability, and an improved organizational environment. Adherence to the provisions of Annex E means the resultant technical solution will meet the universally accepted NFPA standards. While this is important for a stand-alone MNS, it is critical for one integrated with the fire alarm system, for which NFPA standards are typically prescribed by law.

FAQs

Here are some frequently asked questions regarding a mass notification system.

- Does the law stipulate when an organization needs a mass notification system?
- If the law doesn't require it, why might an organization want a mass notification system anyway?
- Isn't an existing fire alarm system a mass notification system?
- How would one go about selecting a mass notification system?

- Who will install the system, train the personnel on it, and maintain it in the future?

We'll look at the answers to these questions.

Does the law stipulate when an organization needs a mass notification system?

Predictably, the answer to that is: it depends. It's noteworthy to point-out that none of NFPA 72 is law – including Annex E. While it's quite prescriptive and correspondingly helpful for organizations, it constitutes no mandate in and of itself. The mandates typically come in the form of fire code that directs adherence to NFPA 72. Laws vary from country to country, jurisdiction to jurisdiction, and state to state. Just as fire codes often direct adherence to NFPA 72, there may also be laws requiring a MNS if certain hazards or risk factors are present. Since Annex E is relatively new, the law may reference a different document or may stipulate standards itself. Clearly, organizations must take into account the law having jurisdiction in their operating areas and tailor their overall security and safety programs to compliance with that law.

Laws directing mass notification capability, or international agreements calling for it, are generally overarching and require interpretation as to the specific aspects of their applicability – but they do exist.

Under the Canadian Occupational Health and Safety (OHS) directive, "A fire alarm system in a high building shall include provision for voice communication capability ..." (Chapter 3-4)

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In the US, the Occupational Safety and Health Administration (OSHA) states, "The employee alarm system shall provide warning for necessary emergency action ..." (Section 1910.165)

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In its 1991 publication, Prevention of Major Industrial Accidents, the International Labor Office, located in Geneva, stipulates "Works management should arrange for the onset of any accident or emergency to be quickly communicated to all appropriate workers and personnel off site." (Section 8.4.2)

One thing that makes Annex E to NFPA 72 a useful document is that it recommends well-researched and proven standards to apply to the MNS.

If the law doesn't require it, why might an organization want a mass notification system anyway?

It's probably in an organization's best interest. A MNS is one part of the solution to a multi-faceted security and safety program. As with most other security and safety concerns, it's often difficult to assess how much of an approach or posture constitutes too much. It's much easier to determine when safeguards were too little, provided it's done in a post-incident situation. Since the goal is incident prevention and damage

mitigation however, this reactive analysis is only helpful in preventing future incidents. To operate proactively, organizations must adopt a reasonably prudent level of security and safety. The organization would develop that baseline in consideration of these factors:

- All specific threats against which it needs to protect people and other assets
- The resiliency of the assets and their vulnerability to particular threats
- The impact a given type of incident would have on the organization
- The organization's ability to recover from an incident, including how long it would need to do so
- Regulatory requirements placed on the organization
- Ethical obligations and conduct requirements the organization incurs to adhere to its stated health, safety, and environment policies

An effective way to illustrate the value of an integrated MNS is to review some instances in which the ability to quickly transmit critical instructions to people was either missing or not implemented. Four insets within this paper detail incidents from which we can learn lessons. While the threats in all four cases – toxic gas, fire, bombing, and shooting – are all different, as there is a difference between accidental catastrophe and deliberate attack, these are nonetheless quite similar. All caused the loss of human life. All are examples of situations where a MNS was missing, inadequate, or not properly employed. Finally, all demonstrate how a properly functioning and correctly employed MNS could have at least partially mitigated the event severity.

- The 1984 gas leak at the Union Carbide chemical plant in Bhopal, India
- The industrial fire at the doll factory near Bangkok, Thailand, in 1993
- The 1996 bombing of US military facilities in Dhahran, Saudi Arabia
- Two different school shootings in the US: Columbine High School, Colorado, in 1999 and Virginia Tech in 2007

Chemical Release: Bhopal. In the early hours of 3 December, 1984, the Union Carbide plant in Bhopal, India, leaked a huge amount of toxic gas following the inappropriate introduction of water into one of its gas storage tanks. Controversy continues to this day as to how the water entered the tank. The company maintains the introduction of water could only have been a result of sabotage. Others point to alleged failings in equipment, training, and procedures. Even the number of casualties is in question. The Indian government's official report placed the number dead at about 3,800 with many more people sickened; however, other estimates place the casualty count much higher. What is clear is that neither the people working at the plant nor the nearby residents received timely or adequate warning that would have allowed them to possibly evade the slow-moving, heavier-than-air gas cloud. *Note:* Union Carbide never recovered from the Bhopal incident. The financial impact the tragedy had on the company directly contributed to its massive restructuring and loss of its independent incorporation. It now belongs to Dow Chemical.

Regardless of whether a law specifically directs an organization to have a MNS, few would likely argue that an overriding responsibility of employers, managers, facility administrators, etc. is to provide a safe environment for people working at, living in, or otherwise at or near the facility. The legal precedent for this, and consequences associated with a failure to provide a reasonably prudent level of security, likely speak for themselves. Also clear are the ethical issues associated with not providing a level of security for people that is appropriate with the deliberately analyzed threat.

Risk Matrix		Potential Severity of an Event's Damage or Injury			
		Slight	Moderate	Extensive	Catastrophic
Likelihood of an Event's Occurrence	Very Unlikely	Low	Low	Medium	Medium
	Unlikely	Low	Medium	Medium	High
	Likely	Medium	High	High	Extreme
	Very Likely	High	High	Extreme	Extreme

The above matrix is a tool organizations can use to determine relative risk for each of the possible threats. One should remember threats take many forms: chemical spill, toxic cloud, radiological contamination, fire, and terrorist attacks of various types. Add to that natural disaster hazards: flood, hurricane, tornado, etc. While specific threat analysis is beyond the scope of this paper, the matrix does show us how either a high possibility of an event or the severity of the impact can move the risk into the unacceptable range.

A versatile MNS can do more than facilitate emergency notifications. The organization can use it for routine or administrative information dissemination as well. The larger the physical size or dispersion of an organization, the more an emergency MNS can possibly help meet non-emergency requirements.

Workers will be more productive when they know their well-being is a top concern for management. Similarly, students will learn better when they feel secure in their surroundings. A MNS, when combined with regular exercises

Industrial Fire: Kader Doll Factory. The afternoon of May 10, 1993, saw a horrific fire in the Kader Industrial Doll Factory, near Bangkok, Thailand. Three multistory factory buildings contained hundreds of employees and plenty of combustible materials. When the fire broke out in Building One, security personnel initially attempted to extinguish it, only to witness the blaze grow in intensity. They summoned the fire department, which arrived about 20 minutes later. By then, there was no stopping the fire in Building One. Survivors reported the fire alarm never sounded; many of the building's occupants were not aware of the impending danger until they could smell the smoke or see the flames. The fleeing employees quickly overwhelmed the small, ground floor exits from the building. At 5:14 PM, a little more than an hour after someone first noticed the fire, Building One collapsed. Buildings Two and Three caught fire as well; and, both those buildings also burned and collapsed. Whether no one activated the fire alarm in Building One or it malfunctioned is unclear. What is clear is that the alarms functioned correctly in Buildings Two and Three, where the occupants were able to escape the fire that killed 188 people and injured 500 more.

and tailored responses to the full array of potential threats, can do a lot to improve the organizational environment.

Isn't an existing fire alarm system a mass notification system? Yes, but it's only one type of MNS. Traditional fire alarms are designed to provide chiefly an audible signal for occupants of a building to evacuate. While this can literally be a lifesaver, it's nonetheless very limited in its approach. Using a fire alarm to prompt a building evacuation may produce the intended results in response to a different type of threat. Quite possibly however, this could cause people to move toward a danger area or expose themselves to hazards. In the event of a gas release, for instance, a shelter-in-place response may be more appropriate. Similarly, implementing a lock-down may be a more effective way to protect people until first responders can control or resolve a crisis. This illustrates how, as important as raising a timely alarm is, it is only a

Bomb Attack: Khobar Towers. On June 25, 1996, a US Air Force noncommissioned officer working security duties stood atop Building 131 at the Khobar Towers complex in Dhahran, Saudi Arabia. Correctly recognizing a bomb threat unfolding, he sent airmen into the building to bang on doors and evacuate the inhabitants. He requested to use "Giant Voice," a siren and loud speaker system on the base. Giant Voice never arrived as a gigantic bomb sent a blast wave ripping into the face of the building. Analysis later showed the address system to have been inadequate and the procedures for its use too cumbersome. Worse, the building did not have a fire alarm, which would have been effective in initiating a building evacuation. Those who did get the warning reached a safer part of the building. 19 people were killed and 500 were injured.

component of overarching emergency communication. A modern and integrated, multi-capability MNS goes beyond simple fire notification to address the complete array of potential hazards. With speech capabilities, either through predetermined messages or human interface, such a MNS is essentially unlimited in its ability to provide correct instructions regardless of how an emergency unfolds.

Any MNS, including a fire alarm, is only going to be effective if rehearsed. The more varied the threats, the greater the number of potential responses and more pressing the need for training and practice. Audible alarms are practical and comparatively inexpensive MNS approaches. Yet people's understanding of actions to take on receipt of the alarm can limit their

effectiveness. Using different audible alarms – one for fire, one for shelter-in-place, and one for a bomb threat – requires a significant amount of personnel training and practice to assure the intended response.

In addition to the variety of signals, competing or conflicting ones can be an issue. The best solution is to integrate the fire alarm into a larger MNS. NFPA 72's Annex E provides direction on how to do that while maintaining compliance with standards in fire protection and simultaneously achieving the same high level of quality in the overarching MNS. Often, organizations face different threats to which they may have to respond. Complicating this are varying circumstances, conditions, and severities

under which it must respond. Depending on the analyzed threats, a multifunction, flexible MNS should include visual warnings such as flashing lights. It should be able to play prerecorded voice messages, disseminate tailored live broadcasts, and include visual display panel warnings and instructions. A comprehensive MNS should allow authorized personnel to access the system from a variety of locations, making real-time adjustments to the issued instructions as the situation develops. This type of MNS goes far beyond the traditional fire alarm in protecting people.

How would one go about selecting a mass notification system?

- Determine the threat. Focus on the most likely and most dangerous scenarios.
- Decide what mitigation measures to apply to the threat.
- Determine what characteristics the MNS must have to help with the emergency.
- Consider what additional functions the MNS might perform besides security or safety – general announcements, electronic bulletin board, conferencing, etc.
- Ask for help. Many companies specialize in risk management and have considerable experience in recommending an appropriate MNS.
- Consider off-the-shelf, but still flexible, solutions before starting from scratch.

Who will install the system, train the personnel on it, and maintain it in the future?

This depends on the system complexity as determined by the organization's earlier-discussed security and safety baseline. For two employees sitting in a

School Shooting: Columbine HS. At 11:19 AM on April 20, 1999, two students opened fire on their classmates outside of Columbine High School in Colorado, USA. 16 minutes later the last victim was killed, bringing the number dead to 13, with nearly twice that many wounded, before the gunmen killed themselves. During the course of the rampage, someone activated the fire alarm. This unfortunately signaled an evacuation response contrary to what would have been safer routes for the students to follow. In at least one case, a student was wounded because the attempted evacuation led directly into the gunman's line of fire. Ironically, the shrill fire alarm, which could not be shut off for a considerable time, hampered police efforts to clear the building.

School Shooting: Virginia Tech. On April 16, 2007, a lone gunman conducted two separate and lethal attacks on the sprawling university campus in Virginia, USA. In the course of about three hours, the attacker killed 32 of his fellow students before taking his own life. The subsequent investigation showed that although the university did have a composite system of mass notification, it was not capable of reaching a sizeable number of students quickly. Also revealed was that the school administration delayed initiating the notification procedure, incorrectly thinking the attacks were limited to the first two casualties. While a lockdown of the second attack area might not have been possible, more timely notification could have, at a minimum, prompted the student to be more observant of potential dangers. This underscores the importance of not only having a comprehensive MNS but also training with it on potential scenarios.

booth along the highway, a hard-wire telephone with a cell phone backup is about all the MNS they need. Thousands of employees in a sprawling oil refinery need a more robust system. Several companies produce and install MNS equipment. A well-qualified company can assist with threat analysis, response philosophy, site surveys, system design and engineering, equipment procurement, system installation or supervision of installation, commissioning, training, and ongoing support. In short, an experienced company can take a perhaps daunting process and turn it into a capable and reliable MNS for the recipient. Annex E states that only experienced, qualified personnel should determine the MNS specifications and conduct the equipment installation. That means there's much latitude in how to attain a MNS. Still, organizations should consider the benefits of getting a comprehensive MNS solution from an experienced firm when compared with a do-it-yourself or piecemeal solution.

Costs are important. In security and safety, there are three enhancement categories.

- No-cost. Procedural changes such as the location of rally points following an evacuation or establishing a memorandum of understanding with local first responders cost little or nothing to implement.
- Low-cost. This includes comparatively inexpensive security and safety equipment. A MNS is in this category. Services, such as safety assessments from outside agencies that charge fees for their services would fall here as well.
- High-cost. This is major building and process alterations as well as large equipment purchases.

Training of personnel is critical. Annex E stipulates only that personnel operating a MNS must be trained, so it's prudent to look beyond that to what a training program can comprise. An organization can best accomplish its initial training if that training comes from the manufacturer of the equipment. Subsequent training depends on the complexity of the system.

- Organizations with a relatively simple MNS can likely conduct in-house training, both periodic and for new personnel.
- An organization with a more complex and integrated system should consider periodic factory training. This can be linked to a calendar schedule, personnel turnover, a system upgrade, or a change in the analyzed risks.

One especially good thing about a MNS is it tends to not need much maintenance; and, the manufacturer can surely provide a schedule for it. For complex systems, periodic manufacturer check-ups can ensure the MNS remains fully functional. Modern MNSs enhance their own dependability via built-in diagnostics. These allow for prompt and automatic notification of system problems so that organizational personnel or factory representatives can resolve them.

Critically important is to test the equipment regularly, which has the additional benefit of facilitating personnel system training. MNS test activation must be comprehensive,

although not necessarily done full-up with every test. For example, if a MNS has six different ways to activate the system, the organization needs to ensure it tests all six input methods over the course of a system test schedule. One should note testing may also be a legal requirement; and, if the integrated MNS includes the fire alarm, it almost certainly is a mandate. To gain the most value from MNS testing, the organization should follow through with personnel actions – evacuation, sheltering, equipment shutdown, etc. – to the maximum practical extent. The more personnel rehearse on how to respond in an array of simulated emergencies, the greater the likelihood they will respond correctly in an actual emergency.

Organization of Annex E

Although Annex E to NFPA 72 is only six pages long, it contains links to other portions of the National Fire Alarm Code. For example, it stipulates that a MNS should have a backup power supply. To see what the power supply should be able to do, one follows the reference to Chapter 4 to learn that it must operate the system for up to 24 hours under a quiescent load and then power the regular alarm for at least 15 minutes. Three sections contain or reference technical information like this: Fundamentals of Mass Notification Systems, System Features, and Central Control Station.

Conclusion

The whole NFPA 72 is readily available for purchase online. Alternatively, instead of downloading and digesting the document itself, an organization might want to consider having a firm specializing in MNSs familiarize it with Annex E in conjunction with a site assessment. Regardless of who uses Annex E, when it is cross-referenced with the rest of the NFPA 72 document, it provides a solid technical guide to govern the selection, installation, and operation of a mass notification system. Selection of a system already designed to be compliant with Annex E, and opting for a compliant installation, will help ensure an organization meets its legal and ethical obligations to its personnel. It should also enhance operational flexibility and promote a healthy institutional climate.



Since 1964, INDUSTRONIC has designed and developed mass notification systems as well as tailored packages for organizations throughout the global market.



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