



**FEDERAL SIGNAL**  
Safety and Security Systems

*Advancing security and well being.*

## **Thought Paper: Emergency Communications and Mass Notification In a Post-9/11 World**

**Developing Effective Strategies to Address the Two-tiered Challenge of  
Today's Multi-layered Communications and Diverse Human Factors.**

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If you have comments on this publication or would like additional information from Federal Signal please contact us at:  
[elp@federalsignal.com](mailto:elp@federalsignal.com)

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## **Introduction**

In addition to triggering an exhaustive and long overdue examination of emergency preparedness strategies, the September 11th 2001 World Trade Center terrorist attack also sparked equally in-depth reviews of the nation's first responder emergency communications and mass notification warning systems.



It was not that long ago that those government agencies charged with the responsibility for issuing warnings and alerts to the general public depended almost exclusively on outdoor sirens and radio and television broadcasts. However, today's emergency managers must consider a much broader spectrum of communication technologies and messaging formats. This includes everything from landlines, cell phones, pagers, radios, text messaging, public address and intercom systems, LED signage, message boards and strobe alerts, to a variety of IP-based technologies, including email, instant messaging, RSS, smart phones, and even social networking technologies such as Twitter and Facebook.

Advanced technology and messaging formats are clearly playing an expanded role in the development of the newest generation of emergency warning and mass notification systems. By the same token, it has become evident that these new technologies must be considered in context with a host of human factors related to the diverse individual and group behaviors, perceptions, needs and cultural differences of the citizens being served. For this reason, Federal Signal seeks to add its own perspective on how the two major domains – increased communication layers and human factors – come together to directly affect the myriad of issues that must be addressed by today's emergency communications and mass notification planners.

### **Communication Layers and Human Factors: The Two Domains of Emergency Warning and Mass Notification**

It would seem to make sense that the flood of new technology has made it easier than ever to reach out and communicate with someone, right? Think again. While it's true that communicating with "someone" may indeed be easier, achieving dependable communications with "everyone" on a moments notice is at least as much of a challenge as ever. In fact, this profound increase in the number of communication layers has dramatically added to the complexity of developing emergency warning and communication systems that are both effective and reliable.

By the same token, the increased layers of communications being driven by continually evolving technologies is only one of two primary domains that must be considered in developing an emergency warning and mass notification strategy. Though a variety of human factors such as age, physical disabilities and cultural differences have always been a concern in planning emergency alert and notification systems, the rapid expansion of communication mediums further compounds the communications system development process as it relates to the perceptions, thoughts and actions of individual people as well groups of people.

## **Multi-layered Communications . . . and the Issues of Reach, Control and Variability.**

### *Employing technology to expand the reach of emergency communications . . . or at least until something goes wrong.*

Establishing an emergency communication system's reach encompasses issues specific to both individual technologies as well as various messaging formats, and demands emphasis on gauging both the advantages and the limitations of the particular technology.

In terms of technology, this includes evaluating the characteristics of one-way vs. two-way communications; "peer-to-peer" vs. "all-to-many" broadcast communications; stationary vs. mobile communications; and tone vs. voice vs. text; and tone and visual signals vs. voice and text.

In addition to greatly expanding the scope of messaging formats (e-mail, SMS, etc.), IP-based technologies have also opened up new avenues for more effective management of emergency events. This includes the introduction of multi-communications device interoperability, along with the integration of mass notification alerts from third parties (i.e., National Weather Service, Department of Homeland Security, etc.); and the subsequent development of sophisticated, real-time scenario management systems that employ tiered-response methodology, as well as citizen-alerting systems that feature, among other things, GIS targeting warning capabilities. It is certainly no coincidence that many of the developments associated with interoperable technology and advanced system integration can be traced directly to the RF communications failures experienced by police and fire first responders at the World Trade Center on 9/11.

It is becoming increasingly clear that today's emergency managers can no longer depend on a single mode of communications for emergency notification. This in turn verifies the industry wide emphasis on the integration of multiple modes of communications, and the subsequent emphasis on network-based, multi-device communications software platforms such as Federal Signal's Codespear SmartMsg, for instance.

Recognizing the limitations that accompany a particular technology is critical, as was illustrated in the case of the shootings at Virginia Tech and Northern Illinois Universities where cell phone towers were unable to cope with the overwhelming flood of call traffic. Cases such as this, as well as instances such as Hurricane Katrina where severe weather seriously damaged critical telephone and internet infrastructure, demonstrate the critical need for redundancy in warning and alert emergency communications. In cases where messaging technologies share the same physical platform for access (i.e., cell phones, texting and internet), traditional warning devices such as sirens and strobe lights continue to represent important components of emergency warning systems.

It is safe to say that technologies such as e-mail and text messaging were not originally intended for mass notification applications. Consequently, without taking steps to remedy their current limitations, including expansion of available bandwidth, it would be imprudent to rely on them to the exclusion of other warning and alert communication mediums, and the same could be said for cell phones. Nevertheless, industry experts express confidence that improvements in the speed at which voice and text messages can be sent and received, as well as in the sophistication of communication devices that will be available to the general public in the future will continue to have a positive impact on overall emergency communications.

***Are emergency managers really in total control of emergency communications?***

The second major element in addressing increased communication layers focuses on control. This includes controlling and monitoring individual communication devices; managing integration of multiple communication systems; and achieving and maintaining optimum interoperability.

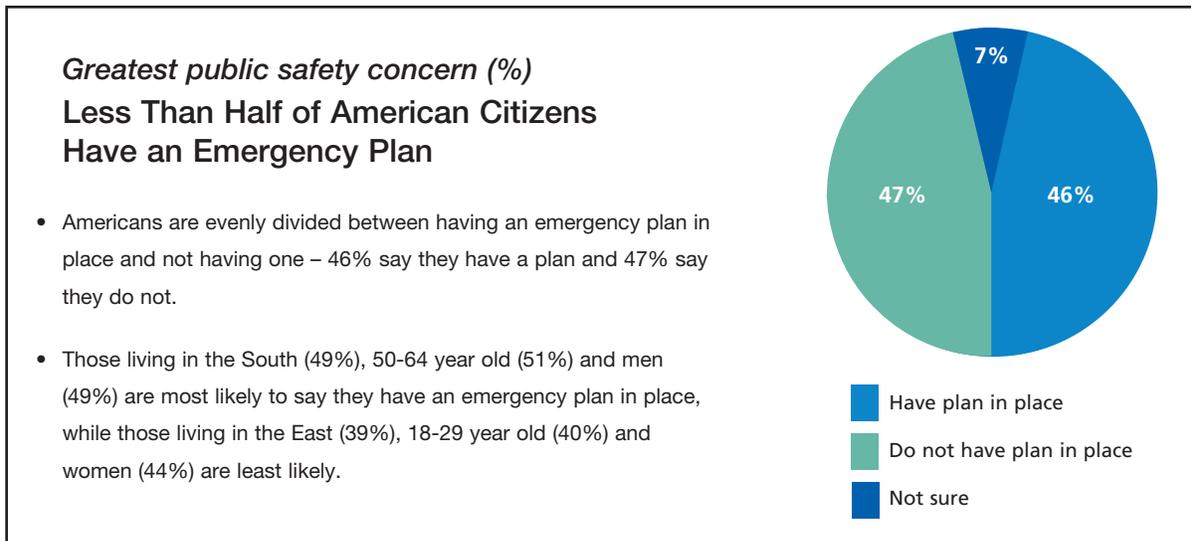
Emergency managers are obviously capable of controlling and regulating audible warning devices such as electro-mechanical horns and sirens, and radio and television broadcast communications. However, though traditional "one-to-many" warning platforms have evolved in terms of sophistication and overall capabilities (high-output horns offering multiple tones, coded blasts, etc.), emergency communications and mass notification planners must continue to equate system effectiveness in context with a variety of human behaviors that can often be difficult to accommodate if not impossible to predict.

Planners must also acknowledge that as the more that ubiquitous technologies such as cellular phones and internet access are adopted by the general public – and subsequently integrated into emergency warning and mass notification systems – the more emergency planners will have to consider the expanded role untrained civilians play in the process, and ultimately bear some responsibility for system performance.

Emergency managers and first responders understand how to use and maintain communication systems, as well as what steps to take in the event of an emergency. That is clearly not always the case with the untrained civilian population, many of whom may be prone to panic in an emergency situation. Complicating matters further, a civilian may not be concerned if their cell phone is fully charged, or even if it is turned on. It is also unlikely that most people know that text requires less bandwidth than voice communications, making them unaware that – when signal strength of the cell carrier is reduced – texting short messages may provide the preferred if not the only means of two-way communications.

Most importantly, whether they are notified or not, civilians cannot be counted on to think through what they need to do in an emergency. Do they even have an emergency plan? The recent Zogby survey commissioned by Federal Signal in partnership with the Safe America Foundation does not offer much encouragement on that point. In fact, it turns out that nearly half of all Americans admit they do not have a family/household emergency plan; and only slightly more than half say they have a household emergency kit.

Effective emergency communications clearly demands vigilance with regards to the source and credibility of information. When professionals control the network, and are in charge of broadcast information and instructions, there is going to be a much higher degree of confidence in its accuracy. When civilians start disseminating information, however, the emergency manager sacrifices some measure of control. Bad information and rumors have become the downside of easily accessible technologies such as cell phones and text messaging. It's safe to say that the last thing needed in the event of a weather or terrorist emergency is widespread distribution of inaccurate information to the general public through unofficial social networks.



From Federal Signal's survey "Uncovering the safety concerns of Americans".

Regular maintenance is of course crucial to assuring system readiness in the event of an emergency situation, and this includes testing the capacity of telephony and texting delivery systems (i.e., cell towers, internet servers, etc.) under emergency conditions on a periodic basis. When many of those devices are owned, operated and maintained by the civilian population, the emergency manager obviously sacrifices a good deal of control over system performance and reliability.

In the end, the only way an emergency manager can be completely confident in a system's readiness is to own it, maintain it, monitor it, and drill with it. If the system deployed depends on the civilians to "opt-in" or provide their own hardware, then the system is, at least to some degree, out of the manager's control.

***Planners must look at each communications technology available in context with the wide variety of emergency scenarios they face as well as the unique needs of the communities and audiences they serve.***

Finally, the multiple layers of communications must be evaluated in terms of the various available technologies, the possible emergencies that could arise, and the particular needs of the various segments of an audience that is generally considered to be among the most diverse in the world.

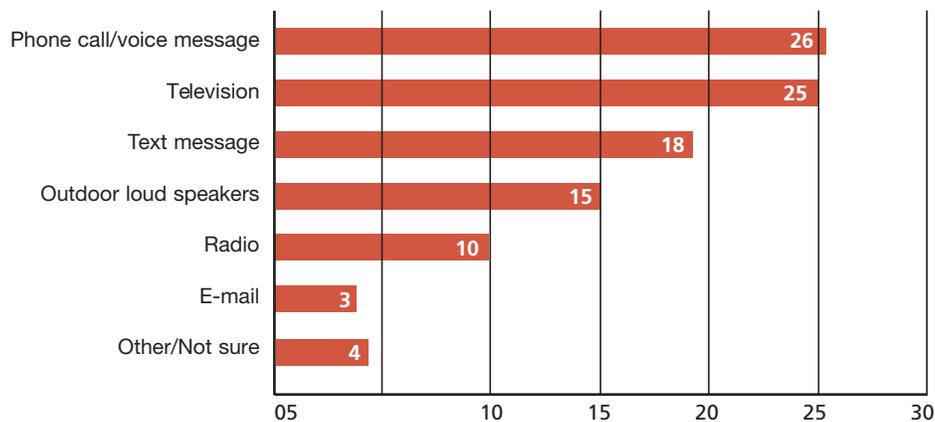
A warning system that relies on electro-mechanical tones, for instance, obviously does not provide the flexibility of either voice- or text-based messaging. Nevertheless, audible warning devices also require that those being alerted possess sufficient training and insight to correctly interpret the warning, and then know what action to take. Since an electro-mechanical siren typically only produces two or three tone variations, the emergency manager facing four distinct crisis scenarios requires that high-output audible devices are in turn augmented by either voice or text capability in order to ensure optimum communications flexibility. These voice messages could be via landlines or cell phones, while text messaging can take a variety of formats, including scrolling television messages, cell and smart phone texting, e-mailing and instant messaging.

It has become increasingly apparent that emergency communications and mass notification systems must demonstrate the capability to issue warnings and alerts through a variety of mediums, including telephones, texting and e-mail while also confirming receipt of those messages in real time. This not only stresses the inherent advantages of multi-device interoperability, it also underscores the need for redundancy in any discussion of emergency communications planning.

Much of today's communications technology is largely dependent on the availability of working landline and cell phone infrastructure, and this includes access to internet resources. Again, the necessity for back-up warning and communication systems is a response to the simple reality that no single alerting method is sufficient. This explains why the more traditional methods for general warning and mass notification, such as sirens, television and radio broadcasts, and even police car PAs, continue to represent valid elements of a successful emergency communications strategy.

### Americans Prefer Technology For Emergency Notification

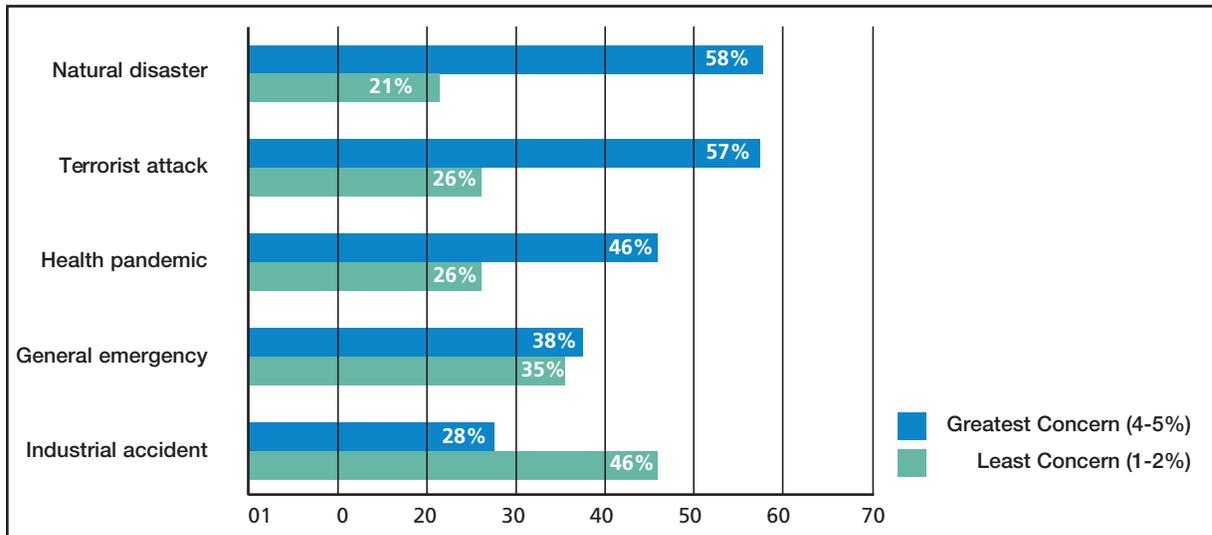
- One in four say they would prefer to be notified by a telephone call (26%) or by television (25%). Another 18% say they would like to be notified of an emergency by text message and 15% would like the announcement by outdoor loudspeakers. One in ten prefers to be notified by radio.
- Younger generation prefers TV and Texts:exception of those aged 18-29 most preferring to receive their notification on the Television (33%) or a text message (29%).
- When respondents proactively seek emergency information 39% would turn to their television, while one in three (32%) would search on the Internet. One in ten would make phone calls (11%) or use mobile Internet to find more about an emergency.
- Respondents age 18-29 (45%) are the most likely age group to proactively search for information on the Internet. Women (45%) are more likely than men (33%) to turn to a Television.



From Federal Signal's survey "Uncovering the safety concerns of Americans".

An effective emergency communications strategy must demonstrate the flexibility to respond to all the various types of emergencies that may occur in a given region. These emergency scenarios fall into five major categories:

- **Natural Disasters (i.e., tornadoes, floods, earthquakes, etc.)**
- **Terrorist Attacks**
- **Health Pandemics (i.e., bird flu)**
- **General Emergency**
- **Industrial Accidents (i.e., chemical spills, gas leaks, etc.)**



From Federal Signal's survey "Uncovering the safety concerns of Americans".

Each emergency situation would seem to call for its own unique combination of communications and warning technologies. A weather emergency such as a tornado, for instance, can typically be accommodated with a mass notification to everyone by employing horns and sirens, public address, e-mail and texting in combination. A campus intruder incident, however, would most likely call for a more targeted response to a more defined audience.

***Puedes hablar español? Ni shuo jong wen mah? Because it's a safe bet that at least a few of those you need to alert in the event of an emergency do.***

Though English may be the universal language, many of today's emergency managers are still faced with meeting the diverse needs of a multilingual audience. For those whom English is their secondary language, it is worth noting that they are likely to think faster and more clearly in their native tongue, a factor emergency planners must take into consideration.

Any comprehensive emergency warning and mass notification strategy demands the flexibility to accommodate the needs of different audiences. For instance, consider the needs of those unable to read English? or of people who are simply illiterate? The question begs to be asked: If someone cannot read a text message, then what good is a smartphone platform?

Since the U.S. is a diverse melting pot where adopting English is a generational issue among many immigrants, there will always be a need for multilingual capability. Siren tones can address many of these citizens' needs; however, it still requires some education or training in the receivers' native language. Though text and voice messages for non-English speakers do present some unique challenges, new and evolving technologies in computer-aided language translation offer a variety of readily deployable solutions for emergency planners.

***Citizens with special needs require special consideration.***

According to the latest U.S. Census Bureau figures, nearly 65 million Americans have some type of physical disability. These citizens, particularly the large number with hearing and vision impairments, present a diverse set of challenges for emergency managers. While blindness, for instance, calls for greater emphasis on audible warnings, hearing impairment obviously demands solutions that are more visual in nature such as alert lighting and text-based message formats.

Beyond the needs of residents, public safety managers and planners must be careful not to overlook the needs of tourists and visitors to the area who are probably unfamiliar with the existing emergency warnings and procedures. Among the many questions that need to be addressed: Is there an effective way visitors can quickly and conveniently familiarize themselves with the possible emergency scenarios? If the domestic system is based on citizens "opting in", how can tourists temporarily receive the same alerts? Can these visitors receive the alert in a language they understand? And do their cell phones work on the domestic network?

**Human Factors: The Second Major Domain Governing the Design of Effective Emergency Warning and Mass Notification Systems**

There is no question that new technologies are having a significant impact on the development of emergency communications and mass notification strategies. Unfortunately, this has had the effect of causing some to overlook or minimize human behavioral factors that had traditionally been addressed in the past. In some cases, these human factors have mistakenly been casually dismissed as problems readily resolved by one of the new technologies. In truth, however, the variables associated with human behavior are as critical to emergency communications planning today as they were before cell phones and IP-based technology came on the scene, with many experts concurring even more so.

***Just because people can hear you does not necessarily mean they are listening, understanding or paying attention to you.***

To illustrate how particular communications technologies are having their own unique effect on human behavior consider how the hundreds of e-mails an individual receives every day compares with the overuse of public address, fire alarm and other warning systems. Similarly, these issues related to increased communications volume that approach overload are making people immune to the actual messaging. This conceivably includes critical emergency warnings and alerts. Consider the fact that for many years commercial fire alarms in the U.S. could only be activated to signal a legitimate fire warning. Using the alarm for other reasons only serves to desensitize citizens to its importance, or unnecessarily confuse them.

***The general public has come to rely heavily on their cell phones to keep in touch. . . which is a good reason why emergency managers probably shouldn't do the same.***

The previously cited 2010 American Public Safety survey also revealed that 60% of U.S. households now rely on cell phones to the exclusion of landlines. Interestingly, however, many people who have cell phones do not use them the same way they use their landlines. For instance, many people – particularly those in older age groups – opt to keep them turned off until they decide to make a call. It is also important to note that, while emergency planners and technology providers may be cognizant of the limitations of each of these communication mediums, many members of the general public are unaware

that a large-scale disaster would almost certainly overload current cell networks and quite possibly internet-based communications as well. This not only points to why depending exclusively on telephone communications for mass notification is shortsighted, but effectively emphasizes the need for redundancy in emergency communications.

***Compensating for the variations in the audience's knowledge, skill and ability with new technology.***

Some people are simply more comfortable with technology than others. Peoples' knowledge and familiarity with using various communications devices clearly varies greatly from one group to the next. Though first responders will generally have an adequate comfort level with advanced technology, the general population's knowledge, familiarity and skill in using various communications devices can vary greatly from one group to the next. For example, younger age groups are likely to be much more familiar with the latest communications technology than older people, especially senior citizens who are often resistant to changes resulting from new technology.

A key finding of the previously mentioned 2010 American Public Safety survey conducted by Zogby highlights the need to evaluate the unique perceptions of different age groups, or what is often referred to as "generational" differences. Baby boomers, for instance, are generally more likely to use e-mail rather than text, while, to no one's surprise, teenagers believe e-mail is too slow and prefer text messaging. Another finding worthy of consideration is the fact that women are more likely (45%) than men (33%) to turn on the television for information in the event of an emergency. By the same token, 49% of 18 to 29 year olds will proactively search for emergency information on the internet.

The need to evaluate the technical sophistication of both the senders and the receivers as well as the communication resources available to the general population cannot be underestimated. For example, if the communication mode is limited to sirens then the receiver needs only to be able to hear it and take appropriate action. No specific technical ability is required. In moving beyond sirens, however, the technical know-how and abilities of the receivers clearly comes into play.

Put simply: Just because someone can afford to purchase and own a more technologically advanced communications product such as a smartphone is no guarantee that they understand how to use it, or will bother to familiarize themselves with its operation and upkeep. Is it possible that the reason why so many of today's consumer electronic products come with "quick-start" instructions is to keep consumer products manufacturers' help lines from being overwhelmed on Christmas morning?

When a communications system design is too complex for both emergency managers and the general citizenry neither will be able to extract optimum utility out of it. There is even the possibility that a high level of complexity will discourage people from using the system altogether. Finally, unnecessary complexity is the last thing anyone needs in a highly charged emergency situation where minutes, perhaps even seconds can mean a matter of life or death. Consequently, in order to assure the optimal outcome, an emergency system must employ tools that are both quick and easy to use even in times of high stress.

***Employing training and continuing education to make sure that when an emergency does occur everybody is on the same page.***

Over the years, emergency communications equipment and system suppliers such as Federal Signal have consistently stressed the part that training and on-going education have in emergency system performance. This not only includes emergency managers and first responders who have yet to familiarize themselves with rapidly evolving technologies, but also with the needs of the general public.

Not only is training critical to the success of any emergency warning system, this training must also be tailored to the specific needs of each age group or "generation." Children, for instance, learn differently than adults, while seniors present a host of unique challenges when it comes to using new technology. In some instances, it may also be necessary to evaluate the special needs of unique cultural groups, as well as persons who are physically or mentally handicapped.

Additionally, it must be acknowledged that the age-old axiom "use it or lose it" is as valid to the performance of a communications warning system as it is with anything else. Since emergencies are thankfully not an "everyday" event, education on how the system works needs to be conducted on a regular basis. It should come as no surprise that organizations such as Safe America are constantly encouraging the need for drills or practice to reinforce the initial training and education. Clearly this should likewise be a central concern to emergency system planners as well.

Training is just one of many aspects relating to human behavior, habits and predispositions that have a direct bearing on the effectiveness of emergency systems. Addressing these and other aspects of the human psyche in context with multi-layered communications is clearly just as crucial to planning the emergency warning and mass notification strategies for today as it was when sirens and broadcast mediums dominated the scene for decades.

## **Summary**

Though today's technology has certainly expanded the communications options available to emergency managers, it should be evident that, at least in many cases, these technical advancements have also placed a whole new set of concerns on the table. Clearly it would be impossible to address each and every one of the issues relating to the expanded layers of communication and diverse human factors in a presentation of this length. However, it is hoped that this sampling provides some perspective on both the scope and complexity that comes into play in the development of the next generation of emergency communication systems.

To conclude, Federal Signal believes that the most effective strategies for today's and tomorrow's emergency communications and mass notification systems will reflect the views of planners and decision makers who can answer "Yes" to three central questions:

- 1. Have you made every effort to understand the needs of your community inside and out?*** This encompasses researching and assessing the full scope of social and cultural norms, including language differences, as well as evaluating such behavioral factors as age and physical handicaps.
- 2. Have you applied this knowledge to available technologies and leaned on others' experiences?*** This includes a thorough analysis of current and potential mediums of communication with a focus on issues that relate to reach, control and variability.
- 3. Are you taking all the necessary steps to ensure that the citizens you serve are adequately prepared for an emergency situation?*** In addition to providing both initial and continuing education and training in emergency communications and procedures, this includes providing information on home emergency kits, checklists and instructional pamphlets while promoting awareness programs such as Safe America's Prepared not Scared campaign.

For more information on the subject of emergency communications and mass notification, and additional information regarding Federal Signal's involvement with the Safe America *Drill Down for Safety* initiative, please call Bob Patnaude 708-534-3400, or visit: [http://www.alertnotification.com/Survey\\_9099.aspx](http://www.alertnotification.com/Survey_9099.aspx)