Fire Alarm Testing Strategies Can Improve Occupant Response and Reduce the "CRY WOLF" SYNDROME

Setting Standards for Excellence

The title of this article could just as easily be "Fire Alarm Testing Strategies Can DETERIORATE Occupant Response and INCREASE the Cry Wolf Syndrome." Whether the glass is half full or half empty may be less dependent on a positive or negative attitude, than it is on whether the glass is being filled or emptied. Thus, the fire protection industry thinks of fire alarm testing as a positive thing, designed to uncover faults and increase reliability. However, a large segment of the public thinks of fire alarm testing negatively, as a nuisance and an interruption of their lives and work. Often, their perception of testing is no different than that of false or nuisance alarms.

If long, drawn out testing of alarm systems several times each year ensures an operable system, but causes occupants to delay egress or even stay when the desired action is for them to leave, has safety really been increased?

In the last article of this series, Messaging and Communication Strategies for Fire Alarm Systems, the very real problem of delayed occupant response was discussed.[1] This article looks at the reasons why testing may contribute to delayed occupant response and unwanted behavior. Strategies to use fire alarm testing for positive occupant behavior modification are then outlined.

CRY WOLF

The "Cry Wolf" syndrome occurs when someone is subjected to a high ratio of false-to-real alerts.[2] In this context, the word false is used to describe any non-fire or non-threat activation of the occupant notification part of a fire detection and alarm system. When a real (fire or other threat) activation of the alarm system occurs, occupant response and behavior depends on their confidence in the system. The "Cry Wolf" syndrome causes occupants to question the validity of the alarm. Any strategy to reduce the ratio of false-to-real alerts is likely to increase occupant confidence in the system or at least reduce the loss of credibility.

Certainly false activations and nuisance alarms contribute to slowed occupant response.[3] The fire alarm, fire service and engineering communities have gone a long way to reduce nuisance problems. Systems that are properly designed, installed and maintained tend to be very stable and free of false and nuisance alarms. However, it is possible for false alarm experiences at home and in other places to affect the credibility of any fire warning system.

THE PROBLEM

In general, testing of audible and visible alarms is likely to be the reason for the highest number of activations and the greatest amount of time that a fire alarm system is actively signaling. This is true even for systems that experience several false or nuisance alarms per year. For example, consider an existing apartment building being upgraded with a new fire detection and alarm system. There are 63 apartments on three floors with three wings per floor. Table 1 is a list of equipment for the system.

NFPA 72, the National Fire Alarm Code, requires a 100% test at the time of acceptance.[4] After acceptance, the code requires annual testing of all audible and visible appliances. The test method is the same for both acceptance and periodic testing. Specifically, for audible appliances:

> "Sound pressure level shall be measured with sound level meter meeting ANSI S1.4a, Specifications for Sound Level Meters, Type 2 requirements. Levels throughout protected area shall be measured and recorded. The sound level meter shall be set in accordance with ANSI S3.41, American National Standard Audi-

Table 1 – Equipment List

Equipment Estimates

Project#: 1167b **Project:** Apartment City **Location:** Hometown, AZ **Title:** Building 12

		Manual Fire Alarm Box	Smoke Detectors	Heat Detectors (R/F)	Horn/Strobes (15 cd eff.)	Horn/Strobes (30 cd eff.)	Horn/Strobes (110 cd eff.)	Horns (only) in Apts	Strobes (only, 15 cd eff.)	Strobes (only, 30 cd eff.)	FACU	Control Modules
Zone/Ref.	Description	A	B	C	G	H	I	K	L	N	O	P
1	Basement	2	11	30	2		1		1			3
2	Lobby-1	2	5	2		1			1		1	1
3	Lobby-2	1	4	2					1	1		1
4	Lobby-3	1	5	2		1			1			1
5	F1, W1	1	4	7	1			7	1			
6	F2, W1	1	3	7	1			7	1			
7	F3, W1	1	4	7	1			7	1			
8	F1, W2	1	4	7	1			7	1			
9	F2, W2	1	3	7	1			7	1			
10	F3, W2	1	4	6	1			8	1			
11	F1, W3	1	3	7	1			7	1			
12	F2, W3	1	3	7	1			7	1			
13	F3, W3	1	4	7	1			8	1			
	Total	**15**	**57**	**98**	**11**	**2**	**1**	**65**	**13**	**1**	**1**	**6**

ble Evacuation Signal, using the time-weighted characteristic F (FAST). Record the maximum output when the audible emergency evacuation signal is on."

For public mode signaling, such as in apartment buildings, the Notification Appliances chapter of the code sets a specific performance requirement for the audible signaling system as a whole:

..." 15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds or a sound level of at least 75 dB, whichever is greater, measured at the pillow level in the occupiable area, using the A-weighted scale (dBA)".

Therefore, measurements must be made "throughout protected area" to ensure audibility in the "occupiable area." Combined, these two requirements necessitate measurements in every room of a building. Large rooms or spaces may require multiple measurements. In addition, it is necessary to ensure that the system, with all appliances operating, does not exceed 120 dBA anywhere in the occupiable area. In some cases, a lower maximum is used where occupants are expected to be exposed for long periods during their egress from the space.[5]

Assume each apartment has five rooms where measurements will be made (bedrooms, bathroom, kitchen, living room) – in some cases there may be more. Each hallway, stair, laundry room, trash room, mailroom and storage space will require at least one measurement. For this three-story apartment building with a full basement, there might be about 350 different measurement locations.

All new audible evacuation signals are required to use a three-pulse temporal pattern. In order to measure the peak SPL (sound pressure level) in a particular location with a meter set for fast response, the signal will have to cycle several times. Then, the technician must move to the next space where the next measurement is required. Moving through an apartment, opening and closing doors and getting stable, repeatable measurements in each location takes at least one minute plus the time for the technician to move to the next space. Since this is an occupied apartment building, it is necessary to knock and have access keys ready as the tester moves from apartment to apartment. If the technicians are pre-dosed with highly caffeinated beverages, provided with ear plugs and roller blades and denied any breaks, it may be possible to get five measurements per minute – the actual speed may vary and the average will almost certainly be less.

How many ANSI S1.4a, Type 2 meters are available to conduct parallel testing? Most contractors show up with one – and it's usually not a certified ANSI Type 2 meter. The AHJ might have one. If an engineer is involved, they may supply one. Assuming there will be two certified meters and five measurements per minute, a 100% test of the above system will require about 35 minutes. To do this, each person taking measurements will require a scribe to follow them and record the results.

Unlike audible appliances, performance tests are not done for visible appliances. Instead, it must be "confirmed that each appliance flashes." The intensity (cd eff.) is verified by inspection of the nameplate or other indicator. So, as the audibility test is being done, the technicians must also observe each strobe. Checking of the nameplate for the correct intensity rating can be done without the system activated.

Realistically, for this example, testing would probably be done by turning the system on and off as the technician(s) and AHJ move around from space to space. The time required would be on the order of two hours, if all goes well. For two hours, the occupants are subjected to signal on, signal off, signal on, signal off. Chances are that the occupants have seen the technicians installing the system for several weeks. During the installation, the system has probably been activated several times to check the wiring and installation. The contractor may even have conducted a 100% pre-test before bringing in the owner, engineer and AHJ for the final, official acceptance test. In addition, if any faults or deficiencies are found during testing, changes may be made and the system may then be retested. How often are the occupants told when testing has been completed and that the system is now operational?

Following the acceptance test and any necessary retests, the system requires annual (periodic) testing. Because other parts of the fire detection and alarm system require more frequent testing, it is common to test one-sixth or one-quarter of the system every two or three months. Many technicians will include a percentage of the occupant notification appliances or circuits in this more frequent test cycle. The net result is a period of about one month before and several weeks after the "official" acceptance test where the occupants are desensitized to the alarm system. Then, every two or three months the occupants are again subjected to alarm testing, often with little or no notice or notice that only some occupants receive and remember. The occupants are desensitized before the acceptance test by the installation and set-up process. They are desensitized for some time after the test if they have not been told (and convinced) that testing has been completed and when they should expect the next test. They are also desensitized if they have been "trained" that testing can occur without their being informed in advance.

Most people's only experience or interaction with a fire alarm system is the result of the system being tested. They have been trained to ignore the system. They have probably not had any drills or real fires to train them for the correct response – evacuation or relocation. The next time the system goes off, they are annoyed and wonder why it's going off.

In order to reduce the Cry Wolf syndrome associated with fire alarm systems, it is necessary to decrease the ratio of false-to-real alerts. Assuming it is not desirable to increase the number of real alerts, it becomes necessary to decrease the number of false alerts. A second way to minimize the Cry Wolf syndrome is to reduce the impact of false alerts so that they are not perceived as being bad. ▲

Next issue – strategies for reducing the "cry wolf" syndrome.

REFERENCES

1 "Messaging and Communication Strategies for Fire Alarm Systems," NEMA Supplement in Fire Protection Engineering, Society of Fire Protection Engineers, Bethesda, MD 20814, Summer 2003.

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3 Proulx, G., "Why Building Occupants Ignore Fire Alarms," National Research Council of Canada, Ottawa, Ontario, Construction Technology Update, No. 42, 1-4, December 2000.

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5 Richardson, L.F., and Moore, W.D., editors, National Fire Alarm Code Handbook, National Fire Protection Association, Quincy, MA, 2002.

Editor's Note – About This Article

This is a continuing series of articles that is supported by the National Electrical Manufacturer's Association (NEMA), Signaling Protection and Communications Section, and is intended to provide fire alarm industry-related information to members of the fire protection engineering profession.