Strategies for Reducing the "CRY WOLF" SYNDROME

Part 2

ALTERNATIVE TESTING STRATEGIES

In some occupancies, such as office buildings, it is easy to separate the occupants from fire alarm testing. Background noise measurements can be taken during occupied times, and the audible system tests can be conducted at unoccupied times. Similarly, strobes can be inspected during occupied times and tested during unoccupied times. Unfortunately, this is not possible in many occupancies, such as apartment buildings, multiple-shift factories, and hospitals.

Can the number of tests and the total testing time be reduced? For audible testing, some authorities, owners, engineers, and service companies use an engineered, statistical approach and target specific locations where the system is most likely to produce the lowest SPLs. They then check all other areas subjectively and verify that all appliances are at least operating. This is not a simple statistical sampling that has, by definition, some probability of missing areas likely to fail. A careful engineering analysis and a thorough site inspection are needed to develop a successful testing plan. An engineered statistical test plan reduces the probability of missing areas that would fail. Because this method does not meet the intent of the code, it should only be used where specifically permitted by the AHJ and approved by the owner and engineer.

Testing time can be further decreased by the use of more meters and more personnel. It takes very little training to use a sound level meter – particularly one with a peak-hold function. One problem is that very few contractors, distributors, AHJs, and even manufacturers of fire alarm systems show up for a test with a certified and calibrated ANSI Type 2 meter. Most use a nonrated meter available at many electronic stores for about $50.

An informal test of five nonrated meters against a calibrated Type 2 meter showed that the nonrated meters had an error range of approximately +/- 6 dB.[1] Two of the analog-type meters were consistently within 2 dB of the ANSI Type 2 meter. A digital version ranged from -4 dB to +6 dB. A third analog-type ranged from -6 dB to 0 dB difference from the rated meter. The largest range for any single test was from -2 dB to +6 dB.

Because many system designs are trying to meet a +5 dB signal-to-noise ratio (S/N), these nonrated meters would clearly not be suitable for accurate testing. However, they may be useful in parts of the building where the signals are not expected to be marginally close to the required minimum or maximum. For example, for this batch of meters, one might use an error bar of +/- 10 dB based on +/- 6 dB in the tests and a factor of safety of 4 dB. If a measurement indicates a level of 100 dBA in a space where the goals is 85 dBA, it can be concluded that the system meets the minimum and does not exceed the maximum: 100 - 10 = 90 > 85 dBA minimum and 100 + 10 = 110 < 120 dBA maximum.

A good testing strategy is to designate short, exact times when the system will be tested. The test plan should be communicated to the occupants one week and again one day prior to the test using mail, e-mail, bulletin boards, posters, etc. On the day of testing, traffic cones can be placed with signs at all entrances before occupants arrive. If the building has an intercom, public address system, or if the fire alarm system has voice capability, it should be used (in addition to the other means of communication) on the day of testing to inform the building occupants.

The test should be planned on the hour, say 10:00 a.m., for exactly three minutes. One or two more test times can be scheduled with at least one or two

hours between. If a test time has been designated, the test team should test at the designated time, even if testing is completed in the first or second time slot. Expectations should be set, and the occupants should be trained that management, the test team, and the fire alarm system are reliable.

A good test plan includes provisions for what to do if a real fire occurs during the testing. This includes how occupants should report emergencies and how a real alarm will be communicated to the occupants and to the fire service. The comic piece "One Morning at the Office" is a story of an alarm technician's attempt to come up with such a plan after testing has already been announced.[2] To be effective, the plan needs to be thought out in advance and communicated in writing to the occupants. In offices, hospitals, and other buildings where many of the occupants are employees, the emergency procedures should be a part of employee training.

The regular occupants of the space can be solicited to assist in subjectively evaluating the fire alarm signal in their spaces. In facilities such as hospitals, offices, and factories, designated employees can be charged with walking through specific areas to subjectively evaluate the loudness and effectiveness of the system. Occupants can be given forms to record the room numbers or locations and their perceptions of the system. Properly done, the subjective part of an engineered statistical approach serves several functions. Using the regular occupants of the building, including residents in apartment buildings, makes them a part of the test, not an outside observer that is annoyed by the testing. They take on some ownership and develop some pride in being part of a safety team. They can be trained to remind others several minutes before a test starts. This sets up the expectation that any other time the system sounds, it must be real since they were not notified in advance and asked to participate. This helps to condition their response. Immediately after each test, occupants that assist the test team should be asked to relay their recorded perceptions to a central location – either by hand, fax, phone, or e-mail. Although they are subjective evaluations, they may uncover areas that should be investigated by the professional testing team. Sufficient time should be allotted before the second scheduled test time of the day to do a visual inspection of the "problem" areas and determine if measurements are warranted.

Often, occupants report many areas where they feel the system is too loud and some areas where they feel it is not loud enough. The test team can be "calibrated" with a little bit of informal training and education. The test team should be shown the code requirements and allowed to take a few readings with a meter using a test horn in an area where it won't disturb others. Systems that are too loud and too soft should be demonstrated, although they should not be exposed to noise levels that could damage their hearing. Instead, the system's design maximum should be used. Occupants should be invited to approach the sounder from a distance and allowed to stop when they feel uncomfortable. Occupants can be given hearing protection to approach closer and make measurements.

Newsletters, posters, mail, and e-mail should be used to inform occupants when testing has been completed. Occupants should be told that they will be given notice before the next scheduled test of the system, and reminded that any alarms they hear should be assumed to be real and that it is critical that they respond and evacuate quickly. Occupants should also be told that the next test won't be for X months, or better, for one year.

Although statistically it's better to test some part of the occupant notification system at each regular test, it causes failure in the occupant response part of the protection scheme by increasing the "Cry Wolf" syndrome. The wires of the system are monitored for integrity so that faults will be known. Between tests, the failure most likely to be undetected is a failure of the appliances themselves since they are not monitored. For example, the flash tube and lens of a strobe light can be broken without generating a trouble signal. Similarly a pillow or duct tape can be placed over audible and visible appliances, causing failure of their mission. These types of failures are not discoverable by the electrical supervision of the circuits. However, these failures can often be uncovered as part of the required visual inspection mandated by the fire alarm code. By testing the occupant notification portion of a system only once per year, the "Cry Wolf" ratio is reduced.

Several formats or methods should be used to provide information to staff and occupants, and use different sources.[3] For example, the owner may send a newsletter, management may send e-mails or place notices on video bulletin boards, the alarm contractor may provide posters and signs, and the fire department may post notices at entrances.

Professionals need to be cognizant that fire safety is a system that includes the occupants. It is necessary to weigh the effects of one part of the system – testing – on the other parts, such as occupant response and behavior. By using carefully planned testing strategies, the success of the system as a whole is increased. ▲

REFERENCES

1 These tests were not exhaustive scientific tests: The meters were not arranged to provide data logging; analog meters were read by eye; the meters being compared varied in age from 2 years to 10 years old; new meters were not included; and tests were done using only two different noise samples, one broadband and one dominant at approximately 3 kHz.

2 Shay, K., "One Morning at the Office," Timothy McSweeney's Ultimate Makeover, http://www.mcsweeneys.net/2001/08/20morning.html, August 2001.

3 Sorensen, J., "Risk Communication And Disaster Warning: Lessons For Counter-Terrorism," Oak Ridge National Laboratory, National Academy of Sciences Forum, February 28, 2002, http://www7.nationalacademies.org/ndr/1Sorenson_Presentation.pdf