

# Evaluation and certification of Public Address systems

*Public Address (PA) systems are widely used for announcements in buildings and public areas. In case of emergencies, the performance of a PA system may literally make a difference between life or death. International standards (based on measurement methods developed at TNO Human Factors) specify how to measure this performance, and what minimum-standards must be reached.*

Buildings are designed to protect the people inside against influences and threats from the outside. However, the greatest threat sometimes comes from within; most clearly in case of a fire. Even when buildings have been designed to prevent fires from spreading quickly, Public Address (PA) systems may be life-saving tools during emergency evacuations. In its simplest form, a PA system is nothing more than a combination of amplifiers and loudspeakers, used to play back spoken messages in a whole building at once. In practice, PA system designs may be quite complicated. Not every PA system is equally effective; the types of systems applied most often are not the best ones.

TNO Human Factors offers a range of services for evaluation and certification of PA systems, based on accepted international standards. To guarantee adequate performance, at least three different aspects of sound systems for emergency evacuations must be addressed properly: procedures, messages, and speech intelligibility.

### Procedures

Surprisingly, the most obvious questions are sometimes ignored: who operates the PA system, and when? Clear choices must be made, based on the applicable evacu-



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ation scenarios. These choices must be formalized in unambiguous procedures. TNO can help in developing these procedures, and in embedding the use of PA systems in your evacuation strategy as a whole.

### Messages

For generation and playback of spoken messages, basically three options are available:

- Pre-recorded, fixed messages
- High-quality speech synthesis ("artificial voice")
- "Live" human talker

In some cases, use of prerecorded messages may be the best option. The messages can be carefully composed beforehand, and converted into studio-quality recordings by trained speakers (as opposed to a poorly articulated confusing message by a panicking operator). In other cases, more flexibility with regard to message content is required. Prerecorded messages may then not be feasible, but high-quality speech synthesis can be a good solution.

However, quite often the most flexible source of all has to be selected: a human talker. Such a talker (normally an operator or security guard) must be carefully instructed. TNO can help in choosing the best option for your application, and in designing an optimal set of evacuation messages.

#### Speech intelligibility

Even a well-formulated message, which sounds at exactly the right time, will be ineffective if the acoustic qualities of your PA system are insufficient. Also, the intelligibility of the message depends on the acoustic environment. For instance, due to the detrimental effects of reverberation, speech intelligibility in churches is nor-

mally lower than in office buildings. Objective measures to determine the intelligibility of the spoken messages can be used to evaluate whether or not a PA system meets the requirements set forth by (international) standards. In order to evaluate speech intelligibility of existing PA systems, TNO carries out specific measurements. These measurements also provide diagnostic information that may be used to improve the performance of the system. To evaluate the (expected) intelligibility of a projected PA system in a building that still only exists on paper, TNO is able to carry out reliable acoustic simulations. These simulations incorporate effects of room acoustics, channel characteristics and noise source.

TNO Human Factors is focussed at human behaviour and performance in a demanding environment. Through innovative research we improve performance, safety and comfort. We work for the Netherlands' Armed Forces and, world wide for private enterprises and governments.

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