A Popular Science Summary of a Master's Thesis
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The Effectiveness of Evacuation Alarms in Multi-Hazard Environments

Evacuation alarms are an important part of a facility's safety. They are used to make building occupants aware of a danger and to make them understand that they should evacuate. In some facilities with multiple hazards, different alarms are used for the different hazards. But is it more effective to use multiple alarms or should we use a single alarm for all the hazards?

Earlier studies have shown that evacuation alarms are not always understood as expected or correctly recognized. The interpretation (or misinterpretation) of alarms is problematic because alarms play an important role for the evacuation of a building. Using effective evacuation alarms can help reduce the time it takes for building occupants to decide to evacuate. In turn, this will contribute to a faster evacuation.

A study was done to investigate the following: how people perceive the urgency of different evacuation alarms; how people interpret the meaning of different evacuation alarms; and the general opinions on the use of multiple alarms versus a single alarm for all hazards.

Data was collected by sending an online questionnaire to three multi-hazards facilities in Lund: the European Spallation Source (ESS), MAX IV and Kemicentrum (Lund University). The questionnaire included the audio files of 8 different evacuation alarms. Amongst other questions, the respondents were asked what they associated each alarm to and how urgent they thought it sounded. Interviews were held with safety experts at multi-hazards facilities to get their opinion and expertise on alarm use, including the pros and cons of using multiple or single alarms.

As suspected, the results indicated that people generally interpreted both urgency and meaning of alarms differently from each other. Some trends were however observed. The alarm that was perceived as least urgent was anticipated due to its acoustic properties (such as frequency and tempo) making it sound less urgent. On the other hand, the alarm that was perceived as most urgent was unexpected. It was not the alarm with the most urgent acoustic properties. This is why it is suspected that another acoustic property, not identified in earlier studies, has an important impact on perceived urgency.

Additionally, the results revealed a relationship between the urgency and meaning of evacuation alarms. Alarms with a higher perceived urgency are more often associated to hazards, requiring evacuation, while alarms with a lower perceived urgency are more often associated with situations not requiring an evacuation.

The opinions of questionnaire respondents and safety experts on the use of multiple alarms versus a single alarm varied amongst both groups. However, it seems like those who have experienced emergency situations prefer the use of multiple alarms to a greater extent than those who have not. A recurring opinion is that alarms should be based on the required evacuation response. This implies that the number of alarms used at multi-hazard facilities should depend on the number of necessary evacuation responses and not on the number of hazards present.

These findings can be considered when designing evacuation alarms at multi-hazard facilities to contribute to fast and safe evacuations.

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