Fire Safety Journal 79 (2016) 119–126

Contents lists available at ScienceDirect

Fire Safety Journal

journal homepage: www.elsevier.com/locate/firesaf

Review

False alarm ratio of fire detection and fire alarm systems in Germany – A meta analysis

Sebastian Festag

Hekatron, Head of Applied Science, Germany

ARTICLE INFO

Article history:
Received 28 January 2015
Received in revised form
7 October 2015
Accepted 29 November 2015
Available online 17 December 2015

Keywords:
False alarm ratio
Fire detection and fire alarm systems
FDAS

ABSTRACT

False alarms are – in terms of fire safety engineering – fire alarms in absence of a real fire condition. They are related to the exchange of information and occur as a side effect of system technologies and the alerting process. Fires often are associated with considerable damages. Because time is a critical factor, detection is often accomplished by installed Fire Detection and Fire Alarm Systems (FDAS). The highly sensitive sensors in fire detectors make the identification of fires in an early stage possible, but this also makes FDAS susceptible to false alarms. So far there is no reliable evidence on the ratio of false alarms to installed FDAS. The studies, which are described in the present paper, close this gap for Germany on the basis of an empirical analysis of data from fire brigades. This meta-analysis show that today the false alarm ratio triggered by installed FDAS (and connected to a fire brigade) is high in Germany. It is difficult to describe the ratio in one single value, because a great number of conditions and influencing factors are relevant. To reduce the false alarm ratio, we need a common understanding of false alarms and a consistent use of terms and categories.

Contents

1. What are false alarms?

False alarms[1] are related to the exchange of information and also occur as a side effect of alerts [1]. The exchange of information is based on an assessment since warnings usually refer to facts that are important and/or urgent from a subjective standpoint – or that have been objectified – such as hazards. Hazard-related events, such as a fire, often are associated with considerable damages and require fast reaction from the persons involved, such as occupants, emergency and rescue forces, as well as in a general context from other decision-makers. Warnings about hazards are characterized by the identification of hazards – in a technical point of view often referred as detection – and the alerting of persons. In

E-mail address: fes@hekatron.de

[1] The German term *false alarm* is often referred to as *unwanted alarm*, but in the present context the two terms refer to different circumstances (see Fig. 1). For example in the US the term unwanted alarm is used for the German term false alarm. This varies from country to country. At the moment, we are trying to develop a common understanding.

http://dx.doi.org/10.1016/j.firesaf.2015.11.010
0379-7112/

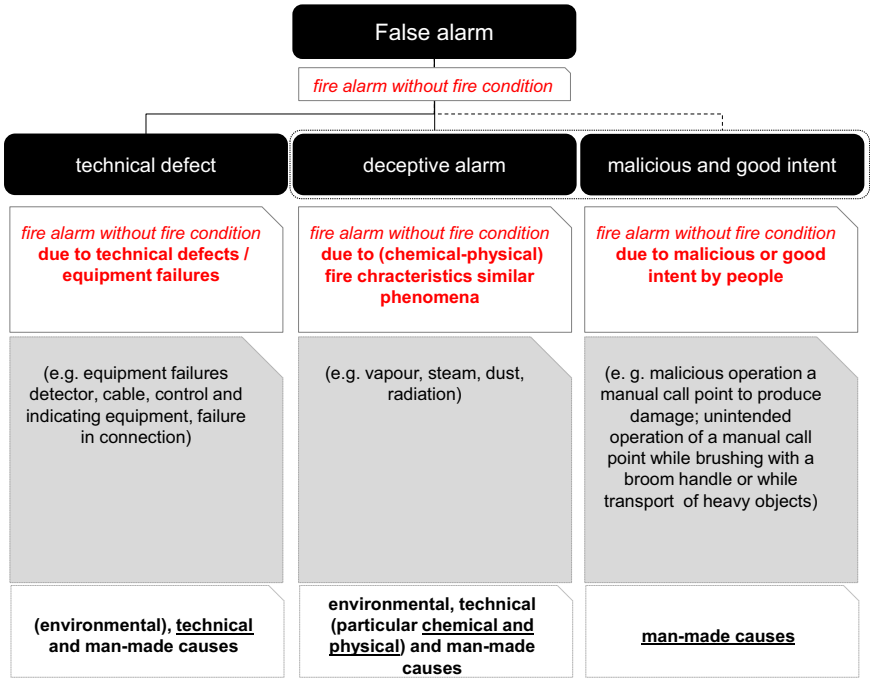

Fig. 1. Classification of false alarms triggered by installed FDAS (cf. [1]).

terms of safety engineering, false alarms are alarms that are not based on any dangerous situation. When referring to fire, a false alarm is a fire alarm when, in fact, there is no real fire condition at all [2]. False alarms occur in many situations, such as: (a) exchange of information, message or report (e.g., journalism), (b) diagnosis of diseases (e.g., skin, breast and prostate cancer) or (c) warning about accidents, malfunctions and attacks (e.g., fire, hazardous materials, intrusion, and terrorism). Hazards can be detected in a variety of ways. If hazards are critical in terms of time, their detection is often accomplished automatically. In this case, use is made of defined triggering mechanisms that are based on characteristic parameters of the observed phenomenon. In case of fire, such parameters are, e.g., triggering temperature, temperature gradient, light scattering, or the concentration of substances that are typical of fire. Usually installed Fire Detection & Fire Alarm Systems (FDAS) are used for the identification of fires in an early stage thanks to highly sensitive sensors. These sensors allow fire detectors to detect fires quickly, but they also makes installed FDAS susceptible to false alarms.

So far there is no reliable evidence on the ratio of false alarms of installed FDAS in Germany. The studies, which are described in the present paper, aim to close this gap on the basis of an empirical analysis of fire brigades data.

2. False alarms and fire detection in Germany

The first call for help about a (fire) event provides fire brigades with information through various paths. One of these paths is the automatic activation of an alarm via installed FDAS – based on the European product requirements of the DIN EN 54 series. The fire brigade can also be informed about a fire through calls via the fixed line or mobile network or (in a few cases) via automatic fire extinguishing systems – they are notified most often by installed FDAS. False alarms can occur in all of these paths. The present paper, however, addresses only the false alarm ratio of installed (and connected) FDAS; based on fire brigade reports.

In Germany, an installed FDAS is usually directly connected to the fire brigade via an automatic alarm transfer device, as required by DIN 14675 [3]. This is intended to ensure quick reaction in the event of a fire and a short response time of the rescue forces (cf. [4]). In Germany, the connection between the installed FDAS and the fire brigade can be established through various paths (cf. [3] and the regional-specific fire brigade's installation conditions). Since the installed FDAS are directly connected to the fire brigade, it can be assumed that the number of fire alarms due to FDAS transferred to the fire brigades approximately corresponds to the real fire alarms triggered by the installed FDAS. If there were an alarm receiving centre interconnected between the installed FDAS and the fire brigade, the systems are not connected directly to the fire brigade and the number of alarms could be different. In Germany that is rarely the case.

False alarms can have various origins and are essentially subdivided into three groups. These include “technical defects” which are triggered by defects of technical equipment or components (e.g., sensors, detectors, control panels, or cables). Another group is characterized by deceptive alarms. In such cases, there is no fire and the technical devices are functioning properly. However, the sensors react to parameters of fire-like phenomena (e.g. water vapour, dust, and solar radiation) in the absence of an actual fire. The third group contains malicious and alarms with good intent triggered by human activities. In the event of malicious alarms, for example, persons trigger manual call points or light matches underneath fire detectors with the intention of damaging. In the event of false alarms due to good intent, the persons alert the fire brigade in an act of good faith (mistake) although, here as well, there is no fire (cf. [5]). This third group of alarms is similar to deceptive alarms because, here as well, the equipment functions as intended, but, the alarms are not triggered by physical and chemical parameters as is the case with deceptive alarms. Instead, human behaviour plays a decisive role in this third group. The difference between malicious and good intent activities lies in the person's particular intention. Since this intention is often unknown, different types of alarm triggering are comprised in one group for investigation purposes (see Fig. 1).

To determine the ratio of false alarms, it has become common practice to specify it as a relative figure based on the absolute number of false alarms (fire alarms in absence of a real fire