THE CAUSES OF FALSE FIRE ALARMS IN BUILDINGS

False alarms from fire detection and fire alarm systems are a problem worldwide, but their underlying causes are not well understood. This article reports on research to investigate the causes of false alarms with the aim of identifying measures to reduce them. It also summarises plans for further work in this area.

What is a false alarm?

A false alarm is a fire alarm signal from a fire detection or fire alarm system which is not caused by a fire. Examples include:

- a fire-like phenomenon (e.g. a smoke machine triggering a smoke detector)
- accidental damage to the system
- inappropriate human action (e.g. malicious manual call point activation)
- equipment malfunction.

Why are false alarms a problem?

False alarms from remotely monitored fire detection and fire alarm systems cost businesses and Fire and Rescue Services (FRSs) an estimated £1 billion a year in the UK. In the period 2011-2012 FRSs in Britain received 584,500 callouts; 53.4% of which were false alarms. As well as being a considerable drain on fire authority resources, this causes business disruptions (leading to a loss of productivity) and reduces the confidence of the general public in fire alarms. More seriously there is also the risk of fatalities resulting from traffic accidents whilst brigades rush to attend false callouts.

The BRE Trust has funded a research project to collate information about the underlying causes of false alarms observed in buildings, with the aim of identifying measures that could reduce their occurrence.

Why research this topic?

Considering the losses associated with false alarms, one might expect the problem to be well understood. However, as there is no single organisation responsible for investigating false alarms or providing guidance on reducing them, there is little data available.

UK FRSs produce Incident Reporting System (IRS) reports on all callouts attended, but the section relating to false alarms produces generic descriptions from which little can be inferred about the underlying causes. While these are the closest we get to false alarm “investigations” in the UK, they are often conducted by untrained personnel with little technical knowledge of the detectors and fire alarm systems, the codes to which these have been installed, or the physics behind the plethora of “fire-like” phenomena.

Who has the data?

Identifying potential contributors with reliable false alarm data proved to be a time consuming exercise that confirmed the scarcity of those involved in gathering such information. However, two contributors were eventually identified, Kings College London and Buckinghamshire and Milton Keynes Fire Authority.

King College London (KCL)

KCL manages an estate comprising 74 buildings that include lecture theatres, residential accommodation, libraries, laboratories, teaching rooms, offices, restaurants and a chapel. These were built between 1830 and the present day and contain fire detection systems that were installed (or updated) at various times over the last 20 years. The KCL premises cover a floor area of over 400,000m^2 and, as with all premises of this size, have experienced a number of false alarms over the years.

Since 2007 KCL's Senior Fire Safety Officer has instigated and led a very proactive approach to the issue of false alarms, which involves engaging with KCL personnel, contractors and users on multiple levels to reduce their occurrence. The strategies adopted include:

- effective incident reporting
- follow-up investigations by suitably qualified personnel
- control of contractors
- procedural guidance
- suitable internal responses.

Results from KCL

KCL generates a yearly internal report with a log of all events leading to an alarm activation. This includes detailed information on the location, cause and current status of the incident. It can clearly be seen from the following table that the follow-up investigations, controls and guidance have led to a significant reduction in false alarms, particularly those generated in halls of residence.

Year	Academic Buildings Activations	Halls of Residence Activations
2009-2010	148	135
2010-2011	147	131
2011-2012	151	84
2012-2013	148	38

Some of the noteworthy strategies used by KCL for reducing false alarms include:

- gathering and maintaining reliable data
- communicating this data
- using pre-alarm states during which an investigation is conducted
- working closely with one fire alarm service provider – this ensures appropriate action is taken and effective maintenance is in place
- greater control over and communication with contractors to isolate zones and devices during works.

Review of KCL data

KCL provided data from 699 false alarm incidents. After a thorough review of this data, six types of physical interventions were identified that may have prevented false alarms. These are detailed below in descending order of the proportion of false alarms they can potentially resolve:

- replace single-sensor detectors with multi-sensors (69.2%)
- use appropriate approved detector/s that are correctly located (43.5%)
- use protective covers over approved manual call points with adequate signage and CCTV where required (16.7%)
- use EN 54-2 approved analogue addressable panels (10.2%)
- improve the control of contractors (9.7%)

- carry out more rigorous maintenance of the system (6.0%).

Of the solutions proposed, the replacement of single-sensor with multi-sensor detectors appears to be the simplest and most effective. Multi-sensor detectors respond to more than one of the fire signatures, i.e. smoke, heat and carbon-monoxide, released during a typical fire. Multi-sensors often increase sensitivity levels when more than one fire signature is present, thus ensuring a quicker alarm response than a single-sensor detector.

Cost benefits

The cost of false alarms to businesses is estimated to be around £2.9k per alarm. The cost of a standard optical/heat multi-sensor is reported to be between £5 and £10 more than that of a standard optical detector. This indicates that replacing problem detectors in areas where false alarm risks are high is a cost effective solution.

Summary of KCL data

The data supplied by KCL provides a snapshot of the types of false alarms that are observed in a wide variety of commercial and residential buildings. Although not representative of the UK as a whole, the data provides valuable information on common false alarm causes. However, in order to properly quantify the effectiveness of the proposed solutions for resolving false alarms, they would need to be implemented in the field and monitored over a period of time.

Buckinghamshire and Milton Keynes Fire Authority (BMKFA)

BMKFA employs perhaps the UK's only Unwanted Fire Signals Officer (UFSO). The UFSO's role is to investigate unwanted fire signals (UFSs) by making contact with offending premises, providing guidance when required and identifying corrective actions to reduce the likelihood of further UFSs. As a result BMKFA have successfully reduced fire alarm signals by 45% over a seven year period (from 3308 alarms in 2005 to 1815 in 2012) in Buckinghamshire and Milton Keynes.

BMKFA methodology

The UFSO reviews the data generated by his colleagues (recorded in the IRS database) to identify the worst offenders in relation to UFSs. He then engages with four or five premises a week, where a phone call or an email is often sufficient to identify and solve the problem. If not, a site visit is arranged with the designated "responsible person" to identify the cause and propose solutions.

The corrective measures implemented and their long term results have not been recorded electronically, so statistical data was not available for use in identifying the frequency and type of successful interventions. However, the UFSO was able to provide anecdotal accounts that provided valuable information.

Review of BMKFA data

The research was conducted by analysing data generated from the IRS for BMKFA. The common types of UFS observed and reduced over the years were also reviewed. In addition the methods implemented by building owners and users to reduce UFSs were analysed.

The following strategies have been shown to reduce false alarms:

- de-rating heat detectors (i.e. reducing their sensitivity)
- using domestic point smoke detectors for local warning, with a heat detector linked to an alarm receiving centre (ARC)
- isolating zones prior to construction works and cleaning smoke detector covers prior to their removal
- having processes in place to ensure that the cause of every UFS is picked up and measures are introduced to prevent re-occurrence

- ensuring that there are proper procedures in place to train new staff on how to deal with UFSs in premises with high staff turnover (e.g. hospitals)
- advising the fire alarm maintenance company when there is a change of building use
- educating users and responsible persons that they are connected to an ARC and an UFS will result in a callout, as well as providing guidance to identify and report false alarms effectively
- encouraging greater communication within an organisation, e.g. the fire safety manager should know when building contractors are due.

BMKFA recommends that for commercial buildings:

- a designated person is made responsible for, and is familiar with, the fire alarm system
- fire alarm systems are regularly checked
- the correct detection is in place and is situated in the most suitable location
- false alarms are investigated, when practical, before calling for help
- false alarms are followed up and action is taken to prevent re-occurrence.

Reducing the number of false alarms from domestic premises remains a challenge across the whole of the UK even though the vast majority are reportedly related to cooking incidents. Educating homeowners on effective installation and use of detectors in and around kitchens is likely to lead to the greatest reduction in false alarms.

Cost benefits

BMKFA has reduced the number of false alarms by 45% over seven years, which amounts to an estimated cost saving of around £450k a year. This confirms that their strategies provide an effective means of reducing UFSs and keeping them low as new buildings come “on-line”.

If the methods used by BMKFA could be used to the same effect in the rest of the UK, FRSs could save an estimated £42m a year. Furthermore the same percentage reduction could save UK businesses approximately £408m a year.

Conclusions and further work

As has been shown there are many ways of reducing false alarms, often using simple methods. Educating building owners, responsible persons and the general public can contribute significantly to false alarm reduction. Also, the increased use of multi-sensor detectors may avert false alarms from common causes such as cooking fumes and steam. Further details of this work can be found in a briefing paper available from the following website address: http://www.bre.co.uk/podpage.jsp?id=1752.

The use of a technical and experienced individual assigned to investigate and reduce false alarms has proven to work in the field for both KCL and BMKFA. It is recommended that such an approach is used to investigate and reduce false alarms.

Further work is due to take place with a number of interested parties, including the Scottish Fire and Rescue Service. As part of this work a false alarm investigator will assist FRS crews as they attend false alarm incidents. This will ensure rapid investigation of these incidents and an increased likelihood of accurate diagnosis of the cause.

This investigation, which has not to our knowledge been done before, is expected to gather sufficient data to conduct the statistical analyses needed to accurately identify and classify the causes of false alarms. It is hoped that the resulting measures and guidance, when incorporated, will lead to a wider reduction in false alarms and the losses associated with them.