Live investigations of false fire alarms

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Introduction

Fire detection and fire alarm systems (FDFAS) are used to provide early warning of fire in order to alert the local Fire and Rescue Service (FRS). FRS attendance at fires saves lives, prevents injury and reduces associated property damage costs. Successful fire detection is partly responsible for a two-thirds reduction of fire-related deaths in the UK, but FDFAS are also responsible for a large number of false alarms in the UK and worldwide. Losses estimated at around £1 billion a year have been attributed to false alarms in the UK, due largely to the disruption and loss of productivity in businesses.

Summary of previous work

A previous BRE Trust funded research project investigated the causes of false alarms using very basic data, and proposed solutions that could reduce their occurrence. The briefing paper generated from this work, completed in June 2014, is available from the BRE website (http://www.bre.co.uk/page.jsp?id=3391). That study noted that few organisations were gathering comprehensive data, and concluded that the services of a specialist fire alarm investigator would be required to gather more reliable and meaningful false alarm data.

Gathering live false alarm data

Following on from this work a more thorough investigation of false fire alarm causes was conducted by BRE in conjunction with the Scottish Fire and Rescue Service (SFRS), and with the support of a broad group of stakeholders. This work, reported here, was innovative in terms of the methodology used to gain reliable data. A fire alarm investigator assisted FRS crews as they attended live unwanted fire alarm signal (UFAS) events in the greater Glasgow area, from the last week of November 2014 to the first week of April 2015.

A comprehensive questionnaire containing 124 questions was generated by the stakeholder group. The questionnaire covered false alarm details such as location, management, detection systems, system maintenance, documentation, manual call point activations and environmental factors, and included a summary of the incident and recommendations for how the false alarm could have been averted.

Using this questionnaire BRE's Digital Products Team created a BRE UFAS online form that, once complete, allowed electronic reports of each false alarm to be generated (see Figure 1). The UFAS form could be accessed and completed by the fire alarm investigator using a tablet, smartphone, laptop or desktop provided there was internet access.

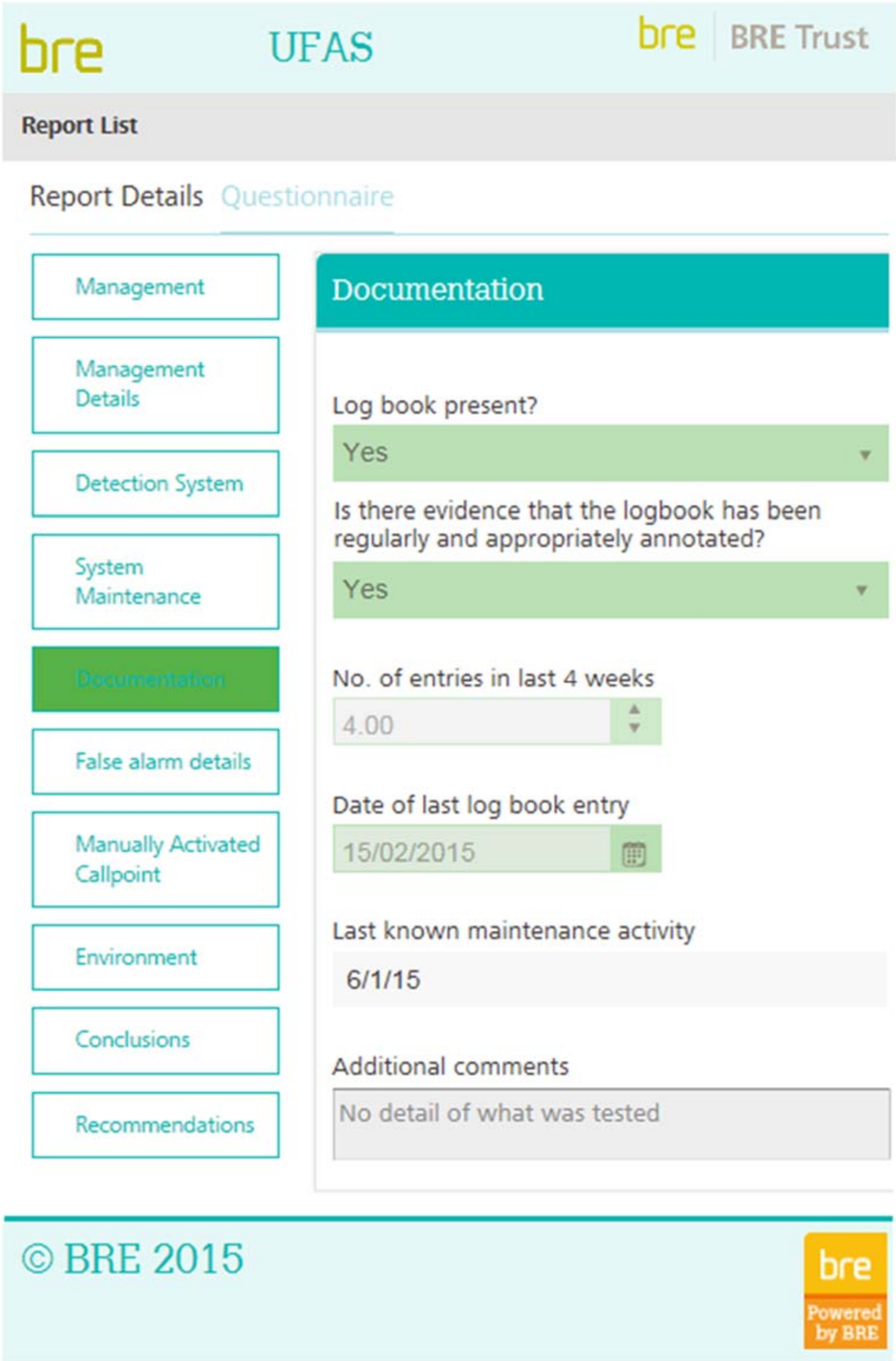

Figure 1: One of the tabs from the BRE UFAS online form

Additionally the SFRS developed a UFAS Form for the operational crews to complete when attending all callouts. This form allows more accurate details of the false alarm to be recorded than the one currently used by UK FRSs (Incident Recording System). The SFRS UFAS form provided concise supplementary data from a greater number of false alarm incidents than could be attended by the false alarm investigator, as comprehensive investigation of every false alarm would have been time consuming and costly.

Over the duration of this study the fire alarm investigator periodically produced detailed qualitative reports for the stakeholder group, which provided anecdotal accounts of his observations and findings. Over the investigation period eight such reports were generated.

Findings- SFRS UFAS form

Data for the period covered by this study was generated by FRS personnel, who used the SFRS UFAS form on all of their callouts. The false alarm causes observed were, in decreasing order of occurrence: Unknown, Fault, Dust, Cooking, Weekly testing, Accidental activations, Steam, Aerosol and Water ingress. The frequency of specific false alarm causes and the proportion of their occurrence are listed in the table below.

False Alarm Cause	Frequency	% of total
Unknown	374	19.6
Fault	325	17.0
Dust	216	11.3
Cooking fumes	169	8.9
Weekly testing of system	116	6.1
Accidental activations	116	6.1
Steam	98	5.1
Aerosol	73	3.8
Water ingress	65	3.4
Malicious activations	56	2.9
Smoke from toast	46	2.4
Smoke from smoking	41	2.1
No access to premises	17	0.9
Manual call point activation	16	0.8
Manual call point activated on smell of burning	16	0.8
Contractors performing works and triggering local detection	15	0.8
Artificial smoke (e.g. smoke machines)	13	0.7
Hot works	10	0.5
Sprinkler maintenance (triggering fire warning from sprinkler system)	6	0.3
Water pressure fluctuation (triggering fire warning from sprinkler system)	6	0.3
Others (45 other causes, including false alarms during system maintenance, power-cuts, candles, hairdryers, faulty heaters, smoke cloaks, light fittings, vandalism, vehicle fumes, ovens, microwaves etc.)	114	6.0

Total	**1908**	**100**

Findings- BRE UFAS form

Sixty-five false alarms were attended by the fire alarm investigator at premises including alarm receiving centres (ARCs), SFRS control rooms, hospitals, university premises, schools, care homes, hotels, community centres, restaurants, offices, factories, leisure centres, a library and a large hall. He completed BRE UFAS online reports for these events and the resulting data was analysed.

Figure 2: Fire alarm investigation

The data from these electronic reports and the eight reports written by the fire alarm investigator were reviewed by the stakeholder group and used to provide thirty five recommendations for the following nine key areas: Multi-sensor detectors, Smoke detectors, Manual call points, Alarm receiving centres, Sprinkler flow/activation switches, Staff alarms/investigation periods, Documentation, Panel capabilities and Communication. Of these nine areas, only multi-sensor detectors and manual call points are reviewed further in this article. Full details of all the recommendations are detailed in the briefing paper available from www.bre.co.uk/firedetectionresearch

Multi-sensor detectors

Data from the BRE UFAS forms and the SFRS UFAS forms indicated that none of the false alarms observed resulted from multi-sensors. Backed by anecdotal accounts, this finding is encouraging and suggests that multi-sensors do not cause many false alarms.

However, it should be noted that without knowing the proportion of multi-sensors installed in the dataset analysed, the conclusions that can be made are limited. Also, there are many operating multi-sensor modes with varying capabilities and with differing false alarm rejection criteria, which can produce a broad range of alarm responses. Some multi-sensor detectors may be configured to reject nuisance, fire-like phenomena (e.g. steam). This would mean that, though less prone to producing false alarms, they may also be less sensitive to detecting certain types of smoke.

The report of this investigation recommended further research to support the use of multi-sensor detectors, and to identify their performance variabilities and capabilities. It also recommended that the findings should then be used to support codes of practice or building regulations.

Manual call points

False alarms generated from the misuse or accidental operation of manual call points (MCP) were observed during the previous BRE False Alarm study. It was found then that the, "Use of protective covers over approved manual call points with adequate signage and closed circuit television (CCTV) where required", could reduce false alarms by up to 16.7%. This figure is similar to the 12.7% of false alarms due to MCPs identified during this study. These resulted from physical impacts to the sides of the MCP, and other activations that were by accident, or the result of malicious or good intent.

Activations that are accidental, malicious or made with good intent could be reduced by installing protective covers that require the dual action of lifting the protective cover and activating the MCP mechanism.

A number of MCP false alarms are caused by trollies striking the side of the MCP and triggering the mechanism that signals a fire. In this case, the use of deflectors or side impact protection to push the trolley away from the MCP would prevent the impact (see Figure 3).

Figure 3: Protective shielding for Manual Call Points

If the issues surrounding MCPs and false signals generated from Alarm Receiving Centres could be fixed, this could reduce false alarms by approximately 20% and cost savings from dealing with the MCP issues amounting to approximately £147m/year in the UK.

Unknown causes

Over the course of this investigation the top causes of false fire alarms were ‘Unknown’ and ‘Fault’, which together constituted 35% of all observed false alarms. Clearly false alarms reported specifically as ‘Unknown’ or ‘Fault’ need to be investigated further to identify the underlying causes.

Further investigations of false alarms attributed to ‘Fault’ found that in this study it was more likely to refer to a cause that was actually ‘Unknown’. This may be because end users have reported ‘Fault’ when they didn’t know the cause, for fear of being blamed for the false alarm. Also, false alarms that an FRS cannot define are generally attributed to ‘Fault’ when they should be ‘Unknown’.

Activations from real fires

As well as investigating false alarms, the fire alarm investigator also witnessed four cases of the fire alarm system operating during a real fire. These were:

- Shopping centre: This site had a failure in an electrical timer that controlled the sign outside the shop, causing a fire the middle of the night. The timer completely melted resulting in the optical sensor operating.

- Homeless shelter: This fire was caused by a spent cigarette placed in a metal dustbin beside the bed. There was paper in the bin and the smouldering cigarette created enough smoke to set off the optical sensor
- Halls of residence: A student had lit a scented candle in a glass container. To extend the life of the candle, the student used a piece of string when the wick was running out and then went for a shower. The FRS found the candle and the glass container still lit in the bedroom dustbin.
- Hospital: A light fitting failure resulted in smoke reaching the sensor and operated the fire alarm.

In these cases, if the policy of the FRS had been to not respond to unconfirmed fires the situation would have been a lot worse. These examples demonstrate the benefits of correctly installed detectors and a rapid response by the FRS.

Recommendations for stakeholder groups

The thirty-five recommendations made as a result of this investigation (listed at www.bre.co.uk/firedetectionresearch) could improve the integrity and reliability of fire detection systems and management processes. They have been grouped under the following categories of the organisations that will have the most responsibility for implementing them:

- Alarm Receiving Centres
- Businesses/End Users/Responsible Persons
- Certification and Inspection Bodies
- Committees for Test Standards and Codes of Practice
- Fire Alarm Contractors
- Fire and Rescue Services
- Fire Risk Assessors
- Research Bodies
- Trade Associations

Further work

Further work that adopts the methodology used in this study could benefit from the following guidance:

- The use of additional trained fire alarm investigators is recommended to balance out some of the subjective responses to questions from the questionnaire. The provision of training for all investigators at the same time would ensure a common knowledge base, and a more consistent approach to investigating and reporting false alarms.

- Performing these investigations at different times of the year would be useful for identifying false alarm causes that may be due to seasonal effects, such as insects in summer or smoke from bonfires drifting into buildings in autumn.

- It would be useful to conduct investigations in different geographic regions to identify whether false alarm causes are the same and observed in the same proportions.
- The development of a questionnaire specifically tailored for use by trained fire alarm investigators would be beneficial.

Further information

Guidance on reducing false alarms is available from the FIA website:
http://www.fia.uk.com/cut-false-alarm-costs.html
The briefing paper and a video of this research work is available from:
www.bre.co.uk/firedetectionresearch