Introduction

While fire sprinklers have been successfully used for the protection of property such as factories, department stores and shopping centres for well over 130 years (fire sprinkler protection is certainly not a new innovation), there is now a growing appreciation of their potential to save lives in other types of buildings – particularly our own homes where the majority of deaths and injuries from fire occur.

Each year in Great Britain the fire & rescue services attend approximately 40,000 fires in dwellings. Latest figures\(^1\) show that these fires resulted in the loss of over 250 lives and caused injury to nearly 8,000 people.

Although these statistics are far less than those experienced 10 – 20 years ago, despite this apparent downward trend, the situation should not be a cause for complacency – particularly in view of the type of persons who tend to become the victims of fire.

Evidence shows that it is the more vulnerable members of society: the elderly, the very young (under 5s), and the disabled and – it has to be said, those affected by substance and/or alcohol abuse – who primarily feature in this grim tally. These people are often unable to respond to a warning of fire quickly enough, so that they can get out of their home before it’s too late.

But unfortunately there are homes where fire alarms are not fitted or, where they are fitted they are not maintained; or, in some cases, they are actually disabled by irresponsible occupiers.

Alarms only are not enough

Although working smoke alarm ownership has dramatically increased from just 8% in 1988 to over 80% today, in 31% of recorded fires in dwellings\(^1\) no smoke alarm was fitted; and in 19% of fires a smoke alarm was present but did not work. Shockingly, nearly 40% of dwelling fire deaths in Great Britain occurred in properties where no alarm was installed.

The installation of sprinklers alongside smoke alarms can further reduce the number of fire deaths in the home.

\(^1\) Fire Statistics Great Britain, April 2013 to March 2014, published by DCLG

The benefits therefore of working smoke alarms should never be underestimated; however, an alarm on its own will not prevent a fire from spreading. This is an important concern because due changes in design and construction (e.g. open-plan living and timber frame), many fire safety experts are warning that the likelihood of fire spreading beyond the ‘room of origin’ may be increasing.

There is a growing case to be made for homes to be fitted with smoke detection and sprinklers so that both lives and properties can be saved. For this reason, all Fire and Rescue Services support and encourage the use of residential fire sprinklers such as in the homes built in Studley Green Wiltshire.

Sprinkler research

In February 2004 the findings of a study commissioned by the Office of the Deputy Prime Minister (ODPM)
into the “effectiveness of sprinklers in residential premises” was published.\(^2\)

At that time, here in the United Kingdom, it was not possible to determine the effectiveness of sprinklers solely on the UK fire statistics, so the research included a review of residential sprinkler experience from other countries. The general agreement for sprinkler and smoke alarm effectiveness in other countries was as follows:

- Alarms only: Reduced deaths by 53% and injuries by 70%.
- Sprinklers + Alarms: Reduced deaths by 83%, injuries by 45-85% and property loss by either 40-50% or 85%.

Whilst statistics can provide valuable data to aid decision making, the experience of real fires – or at least, realistic fire testing of materials and products - provides the most valuable information. For this reason a number of experiments were carried out by the BRE as part of the study.

**Experimental Programme**

Eight sprinklered and un-sprinklered lounge fires, using realistic fuel, were conducted inside a 2 storey detached house of traditional design, with loft conversion. Key findings included:

- Sprinklers operated after about 7 minutes from ignition
- The sprinklers controlled all the fires and most were extinguished.
- With sprinklers, the fire gases were cooled sufficiently that the occupants of the room of origin would not have experienced extreme pain due to convected heat.
- In all of the sprinklered fires, death would not have occurred

These results support the growing evidence available worldwide which shows that while sprinklers are primarily intended to contain or control fires, in a number of cases, people have survived in the room of origin as a result of the effectiveness of a sprinkler system.

**Residential Sprinkler Installations in the UK**

Domestic and residential sprinkler systems in the UK are installed in accordance with BS 9251:2014 - Fire sprinkler systems for domestic and residential occupancies - Code of practice. BAFSA recommends that installations and maintenance, should be carried out by a contractor with membership of an established third party certification scheme.

In the last 10 years there has been a significant growth in the number of sprinkler installations to protect residents in their own homes. These include high-rise blocks of flats, sheltered housing schemes and the protection of ‘vulnerable’ people.

In 2012 BAFSA sponsored the installation of a sprinkler system into a high-rise block in Sheffield in order to demonstrate that such an installation could be carried out cost effectively with minimum disruption to the residents. The report of the project ‘Safer High – rise Living’ generated widespread interest and as a result a number of social housing providers have installed sprinklers in their high and low rise properties. A number of these installations have been sponsored by fire and rescue services.

Housing providers have also use sprinkler systems to protect those who are particularly vulnerable due to age, illness or behaviour. The installation of sprinklers allows these people to live independently in their homes.
Protection of vulnerable person

Devon and Somerset Fire and Rescue Service conducted a Community Risk Profile analysis to identify most at-risk groups of people which was then mapped against service emergency response standards. This exercise identified four properties housing vulnerable people in remote locations for which they provided funding for the installation of sprinkler systems.

The first of these were to the home of a tenant who uses an electric wheelchair in the home, he is a heavy smoker who has ashtrays in a number of places. His hobby is model making and he regularly smokes while using flammable bonding glue.

The Domestic Fire Safety (Wales) Measure 2011 (Commencement No.1) Order 2013

A major change to UK fire safety law came into effect in 2014 when automatic fire sprinkler systems were made compulsory in certain new and converted residential properties in Wales.

The legislation is intended to reduce the number of deaths and injuries from fire, improve the safety afforded to fire-fighters and contribute to the sustainability of new developments.

A second tranche of legislation will now require all new and converted residential property, including houses and flats, to be protected by sprinkler systems as from 1st January 2016 in accordance with building regulations devolved to Wales.

Cost Benefit Analysis

Understandably, the issue of financial cost has been a major concern and questions have arisen regarding proportionality - especially from social housing providers and builders. For this reason therefore, the Building Research Establishment (BRE) was tasked with analysing the losses caused by fires in residential buildings in Wales and the projected costs of protecting new buildings with sprinklers.

Published in April 2012 the BRE’s report indicated that the average cost of a sprinkler system would be approximately £3,075 per house and £879 per flat; however, as has happened in other countries around the world where sprinkler legislation has been introduced, organisations such as the European Fire Sprinkler Network believes that the costs will reduce.

How do sprinklers work?

All of us have seen fire sprinklers in films and television programmes but few of us know how they really work. Each sprinkler has a water seal held in place by a glass bulb filled...
with a liquid. As the liquid is heated by a fire it expands and at a set temperature, usually 68°C, the glass bulb breaks and the sprinkler sprays water over the fire below. Sprinklers operate while the fire is small, so that little heat and smoke are generated.

Many people believe that sprinklers will regularly go off by accident but unlike in films, only those sprinklers close to the fire will operate and they only react to heat – and certainly not to smoke from burnt toast or cigarettes! Another common misconception is that all the sprinklers in the building operate together to cause more water damage than fire damage. In fact two-thirds of fires are dealt with by one or two sprinklers and they release far less water than a single fire service hose.

Concerns about water leakage from heads and distribution pipework are also frequently aired. In fact, a properly installed sprinkler system should be less likely to leak than any other water supply service within a building as the components of the system will have been subjected to a rigorous quality assurance regime and are listed by a third party certification body. The designer and installer of the system will also have been subjected to the scrutiny and approval process of the appropriate certification body.

As a final safeguard, systems are provided with an automatic alarm to give warning of water leakage from the system. Modern residential systems are easily connected to the fire detection system and can even summon the fire and rescue service should the sprinkler system operate.

Water Supplies

Provided sprinkler installations are properly designed and installed to the current British Standard (BS 9251: 2014) and that the co-operation of the local water company is obtained, a simple connection to the town main may be all that is needed. Indeed, the British Automatic Fire Sprinkler Association (BAFSA) is of the opinion that, given adequate pressures and flows in supply pipes, almost 90% of new single occupancy houses could be fitted with sprinklers in this way. Where the pressure and/or flow requirements cannot be met then a small pump and water tank will be required.

The support of the water supply companies both in Wales and throughout the UK has now been obtained. Working closely with the organisation Water UK, has resulted in the publication of a new protocol,3 which has been agreed between the fire and water industries.