

The myths surrounding automatic fire sprinklers are well understood in the sprinkler community who are active in publicly dispelling these with the support of the wider fire community. Perhaps one of the best ways to demonstrate the efficacy and reliability of sprinklers is to collect and publish information on real-life incidents showing what happens when real fires take place in sprinklered premises.

Testing Times

The current UK fire sprinkler¹ standards, BSEN 12845 for industrial and commercial premises and BS9251 for residential and domestic buildings require not only that sprinkler systems are properly designed and installed but also that they use only components which are rigorously scrutinised under test conditions to ensure that they are fit for their intended purpose.

One key element of the testing entails analysis of the components/systems under live fire conditions to ensure, as much as is possible, that they will perform as designed. To ensure that each fire test is as similar as possible, and that the data gained passes scrutiny, the fire test criteria are stringently set and monitored against a range of conditions.

Of course, real life fires, whether in the home or in businesses, do not follow a prescribed pattern of calorific content, flame propagation or heat release and so it is valuable to record and study how fire suppression systems perform away from the laboratory. To achieve this end it is important to gain as much information as is possible when automatic fire suppression systems have operated 'in anger' and to capture details of successes - and failures - so that test laboratories (and the manufacturers who are their clients) can be certain that test criteria remain relevant. The data can also be used to lobby legislators and regulators for wider use of sprinklers.

Sprinkler Reliability

Given that sprinklers have been around for more than 140 years, a vast amount of knowledge and data have been accumulated on the way they work and their effectiveness and reliability. From this data, it is now widely accepted that where systems are correctly designed, installed and maintained there is a better than 99% chance of a sprinkler system controlling or actually extinguishing a fire.

The most recent public domain data on sprinkler reliability can be found in an NFPA publication, Hall (2013)².

This shows that where a fire in a sprinklered building was large enough to activate them, wet sprinkler systems operated to control or extinguish fires in 93% of the cases. In the 7% of cases where the sprinklers did not operate successfully, the following defects or incorrect actions were responsible:

System shut off at time of fire	66%
Manual intervention (at time of fire) defeated system	16%
Lack of maintenance	10%
Inappropriate system for fire	6%
Damaged component	2%

Table 1: Reasons for Sprinkler Non-Operation (Hall:2009)

From this data, it is clear that in virtually all cases where a sprinkler system fails to operate as designed, this results from some form of inappropriate human intervention.

Arup Fire suggested that sprinklers would operate successfully with a probability of 0.93. That is, 93% of the time sprinklers will operate as designed. Nash and Young (1991) quote several studies undertaken between 1897 and 1972, which suggest a range of reliability of between 85 – 99.8%. The same text quotes a wide number of studies which analysed the reasons for sprinkler failure that are remarkably consistent with the 2009 NFPA data and the LFCDA data quoted below.

An analysis of sprinkler operations undertaken in 2005 by the London Fire Brigade details information on fires in 163 sprinklered buildings that took place in London between 1996 and 2005. The sprinklers failed to operate on 12 occasions. On a further 10 cases the sprinkler system failed to contain the fire.

Total no of fires in sprinklered buildings	163 (100%)
Sprinklers fail to operate	12 (7.4%)
Sprinklers fail to contain fire	10 (6.2%)
Fire extinguished or controlled	141 (88%)

Table 2: Sprinkler Effectiveness: LFCDA Study

1 Mist systems should be tested as a package as detailed in BS 8489-1 or BS 8458.
2 Hall J. (2013) *US Experience With Sprinklers and Other Automatic Fire Extinguishing Equipment* <http://www.nfpa.org/research/reports-and-statistics/fire-safety-equipment/us-experience-with-sprinklers>

3 'Shut-off' in virtually all of these cases means that the system was isolated from its water supply, however provided.
4 Arup: *Sprinklers for Safety*, 2006, BASA, ISBN 0-9552628-0-1
5 Nash and Young, (1991) *Automatic Sprinkler Systems for Fire Protection* p. 262: ISBN 0-947665-13-7

This data give an operational performance rate of >92% and an effectiveness rate of >93%. The reasons for 'failure', where determined, were reported to be:

System off or disconnected ⁶	2
Fire took place in unsprinklered area	3 (BAFSA would suggest that this is not a sprinkler failure)
Insufficient heat to operate sprinklers	3 (This is also probably not a system failure)
Unspecified fault	1
Water supply failure	1

Table 3: Reasons for failure, LFCDA Study

Case Studies

15th October 2014: Wisbech Children's centre



A fire in a bedroom was extinguished last night (October 15) by a sprinkler system before fire crews arrived, minimising the damage of what would have been a severe fire.

Two crews from Wisbech were called to a fire at an address in the town at around 10.15pm.

The fire was out before crews arrived and everyone had safely evacuated. Crews ensured the fire was fully extinguished and left around 11.10pm.

Group Commander Chris Parker said: "This is a great example of how a sprinkler system can reduce the damage caused by a fire. Had the building not been fitted with a sprinkler system, the fire would have caused significant damage to this residential building, costing thousands of pounds and causing huge disruption and upset for those living there."

"Not only do sprinklers save lives and prevent fire and smoke damage, they use less than five per cent of the water we would to extinguish a fire, so prevent significant water damage too."

11th November 2014: Sprinkler save at London school

At about 20:23 on Tuesday 11th November, fire crews were called to an Automatic Fire Alarm actuating at a three storey Secondary School St Mary's Road in Newham, East London.

On arrival they were met by the school caretaker who had been about to secure the building when the fire alarm actuated.

Fire crews searched the area of actuation and found a small extinguished fire in a cupboard within an Art and Technology classroom.

The cupboard contained a 12Kw kiln, able to run up to 1300 degrees Celsius, which is used to fire class pottery projects and fire had occurred involving some plastic trays which had been left on top of a kiln which had been switched on several hours earlier.

The school, built in 2010 was fitted with a sprinkler system and a single sprinkler head, located inside the cupboard, had operated and extinguished the fire. No fire-fighting action was required and crews were then engaged in 'salvage' operations.

29th November 2014: Humberside Factory sprinkler save

A fire is reported to have occurred at a Humberside facility manufacturing mobile homes. The incident occurred just after 1500hrs on Saturday 29th November. Crews arrived to find a large amount of smoke issuing from the building. The fire involved a caravan located on a production line.

The sprinkler system activated and contained the fire to an area of approximately 50m². At this point the roof of the caravan collapsed inwards, releasing a large amount of heat and flame which travelled up to the roof space, and then horizontally across. This resulted in the further activation of approximately another 80 (eighty) sprinkler heads. Despite the large number of operating heads, the sprinkler system continued to function as designed.

The Fire and Rescue Service attended but it is understood that the fire was controlled/ extinguished by the OH3 sprinkler system at the factory prior to their arrival. The result of the activation was that fire damage was limited and confined. It was estimated that the production line would be up and running approximately 1 week after the fire.

A factory spokesperson was reported to be very gratified that the system operated as intended and advised by FRS that fire losses may well have been substantial were it not for the sprinkler systems' operation.

2nd December 2014:

Hotel's sprinkler system prevents serious fire....



Sprinklers helped save a prestigious Park Lane hotel from serious damage after a fire broke out in a bedroom on the hotel's 25th floor.

One hundred people were evacuated from the hotel as a precaution but thanks to the operation of the sprinklers system the fire was out by the time the Brigade arrived and only a small part of one room was damaged. The Brigade was called at 1941 hrs and the incident was over by 2102 hrs.

Praising the hotel's good practice, London Fire Brigade Deputy Assistant Commissioner Mark Andrews said:

"This fire highlights the clear benefits of sprinklers to businesses like the hotel industry. There is no doubt that

⁶ This is the same category as 'shut-off' in Table 1

in this case the sprinkler system prevented a more serious fire from spreading into other areas of the hotel and causing thousands of pounds worth of damage. The fire successfully activated the sprinklers and it was out before our crews arrived.

“As well as being potentially life-saving devices, sprinklers help with business continuity by minimising disruption and allowing businesses to get back to normal as soon as possible.”

18th May 2015: Charlton warehouse fire

Ten fire engines and over 70 fire-fighters and officers were called to a fire in a large distribution warehouse on Lombard Wall in Charlton this afternoon. The building is a largely un-compartmented structure of 1 and 2 floors measuring 240 by 100 meters, standing 20 meters high with a structure of steel frame construction, clad in sandwich panels.

The fire, which started external to the building, damaged six lorries and the exterior part of the warehouse while four people were assessed on the scene for smoke inhalation by London Ambulance Service. The distribution centre was fitted with a sprinkler system which activated and this also helped reduce the impact of the blaze by preventing spread into the main building.”



At its height, the fire produced plumes of smoke which could be seen for miles around. Businesses and residents in the area were advised to keep doors and windows closed as a precaution and local road closures were put in place. London City Airport tweeted during the incident to confirm that the blaze was not impacting on flights.

Station Manager Bruce Grain who was at the scene said: “During its early stages this was a very intense fire. Crews wearing breathing apparatus attacked it extremely quickly and thanks to their efforts the fire was prevented from spreading any further into the warehouse and causing even more damage.

The Brigade was called at 1608 and the fire was under control by 1829. Crews from Greenwich, East Greenwich, New Cross, Deptford, Plumstead, Lea Green, Poplar and Shadwell fire stations attended the incident. Crews remained at the scene for some time to damp down the fire.

The cause of the fire is under investigation but is believed to have started in one of the parked vehicles.

26th June 2015: Ayr department store loading bay

Scottish FRS sources report that at just after 5:30pm on Sunday 26th June, a fire occurred in stacked waste cardboard in an enclosed loading bay area at a department store in Ayr High Street.

The 3 storey, steel framed and brick construction building, consists of sales on ground floor and storage of stock on upper floors. The approximate footprint is 2140m² x 3 = floor area of 6420m².

The fire caused one upright sprinkler head on the mains fed sprinkler system to operate and this suppressed the fire so that attending fire crews on the two pump attendance (plus salvage pod) were able to extinguish using only a hose-reel within 11 minutes of arrival.

It is reported that there were 100 persons in the shop at the time of the incident, none of whom were injured. 45 persons are employed at the store.

Although there was some disruption over the next two days, damage was limited to about £1000 with the total stock value at the store being put at £900,000.

5th August 2015: Nottingham Joinery workshop save

At around 15:45 hours on Wednesday 5th August 2015, Notts F&RS mobilised two appliances to a report of fire in a dust extraction unit at a joinery workshop in Catton Road, Arnold, Nottingham.

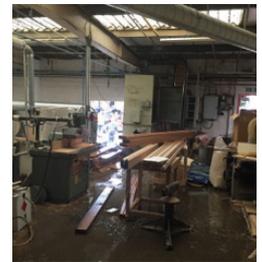
Upon arrival the fire was located inside the unit but in addition to deploying one hose-reel and one jet to cover the fire, it was noted that the sprinkler system had operated.

Crew manager Zac Goodspeed told Keith Rhodes that upon arrival they found one sprinkler head above the unit had been set off and had prevented the fire from spreading to other plant and materials. The unit was on fire internally and had badly smoke logged the workshop but, because the fire was contained, fire-fighters were able to extinguish it without too many problems.

Owner Paul Jeffries told Keith that he didn't realise the sprinkler system was live, but that it had saved his premises. His main concern was now fulfilling customer orders.

The sprinkler system is reported to be very old and had not been maintained for more than 15 years. It runs off the town main but has no means of isolation and so Nationwide were called to isolate the system. The activation has caused some fractures in pipe-work which the owners seem now willing to deal with and reinstate the whole system.

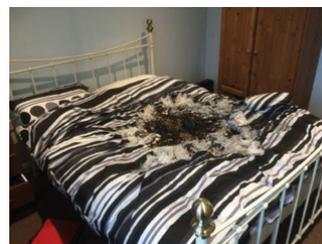
Fires in wood-working premises often take hold very quickly, resulting in extensive fire spread and damage. The sprinkler system had prevented this from happening.



15th September 2015: Woodbridge vulnerable person's flat

On 15th September a fire occurred at a flat in a block of 26 incorporated into a former 'work house' which had been converted into flats in the Suffolk town of Woodbridge.

The vulnerable resident had been smoking in bed and then



gone through to the kitchen where he had an epileptic fit. The bed subsequently caught fire due to smoking materials. Nearby residents were alerted to the fire by the alarms. (both Smoke and Sprinklers)

A single sprinkler head operated and fully extinguished the fire before the Fire Brigade arrived. Fire Brigade personnel had to break into the flat to gain access, finding the occupant unconscious in the kitchen following his seizure.

Although somewhat 'shell shocked', the occupier said he was very pleased with the system as, without it, the situation could have been much more serious due to his inability to escape the fire. He was also able to return to his flat following the incident with minimal disruption.

Pleasingly, it was noted that the sprinkler installer subsequently received an apology from the person who had tried to talk the Housing Association out of 'wasting their money' on fitting sprinklers into the scheme.

Collating Sprinkler Information

In 2011⁷, Steve Mills, BAFSA's Fire Service Coordinator, started to collate sprinkler incident information received from the fire and rescue service or sprinkler installers. His data in 2014 show there were 76 incidents of sprinkler interest, in a variety of premises types. At least one major incident, in Leicester on 7th August, involved a sprinkler system that had been decommissioned with the total loss of the building and contents and major disruption to the local community and transport ensuing. Though the reports threw up some anomalies concerning the number of sprinkler heads which actuated (for example, in an incident involving a dust explosion) the majority of commercial fires were controlled or extinguished with fewer than 4 heads while all the fires in dwellings were controlled by one head only.

Reporting Sprinkler Incidents

Until recently, most UK fire information has been collected from the fire and rescue services using the fire recording system that until relatively recently used the 'FDR1' form. The data contained in these was scanned and analysed by the Department for Communities and Local Government (CLG), being used to publish the *Annual Fire* reports. More recently, this data has been captured electronically via the 'IRS' (Incident Recording System) and published in *Fire Statistics Great Britain 2010/2011*,⁸ included, for the first time, data on sprinkler effectiveness. A detailed study of the data revealed there were major deviations between the information reported and similar data collected by, for example, London Fire Brigade, the FPA and the US NFPA.

7 In 2010 only 10 such sprinkler related incidents were reported to BAFSA.

8 CLG November 2011: ISBN: 978-1-4098- 3235- 5

It has been suggested by a number of groups that the collection of the data may be flawed for a variety of reasons including:

- an error by the fire and rescue service personnel concerned to determine what type of fire suppression system is installed and whether it should have operated.
- whether the fire suppression system has been deactivated - especially in former industrial buildings
- whether the fire suppression system was actually installed in the area where there was a fire

Unreported incidents

It is also known that many incidents where sprinklers have activated, especially when only one head operates or the system operates when the premises are unoccupied are not reported to the fire and rescue service. In an effort to combat this loss of information, there is a growing trend for interested parties to share and record these incidents (without prejudicing data protection) and groups such as BAFSA, the Chief Fire Officer's Association, Sprinkler Engineers Society, National Fire Sprinkler Network, the Business Sprinkler Alliance and the Sprinkler Coordination Group are working together to ensure that a fuller picture is being produced.

CFOA have produced a Sprinkler Incident reporting pro forma which has been circulated to all FRS but can equally be used by anyone with information about such incidents. This is available on the BAFSA website or from Steve Mills at stevemills@bafsa.org.uk

Presented by:

