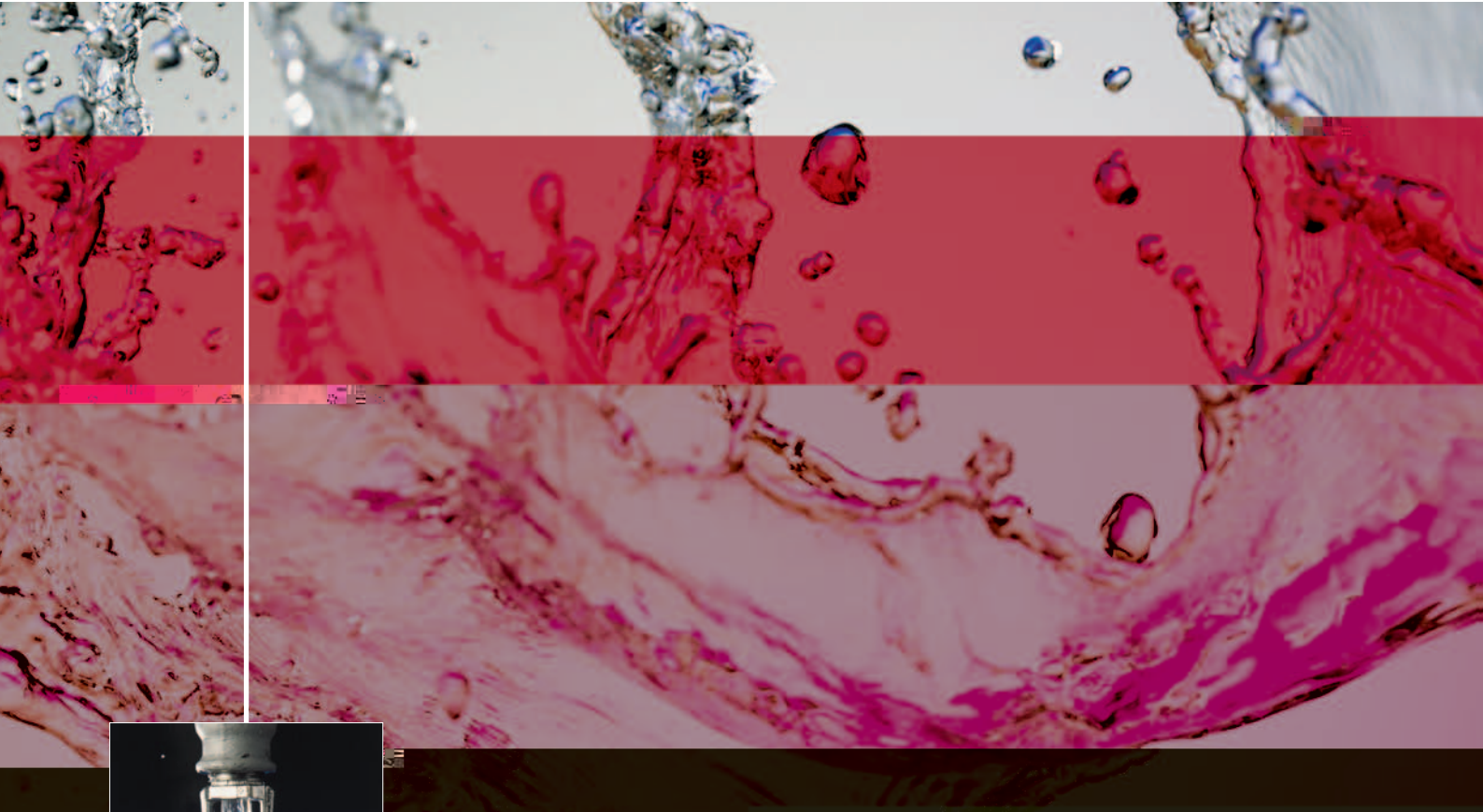

Sprinklers for life

A Fire Sprinkler Association supplement to Fire Prevention & Fire Engineers Journal

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Fire Protection Association

FSA
Fire Sprinkler Association

March 2004

Protecting life, property and the environment

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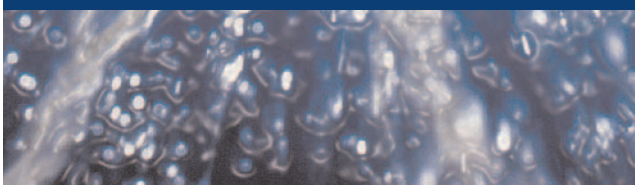
Life history

Sir George Pigot explains how the life safety role of residential sprinklers has developed



TODAY, MOST people assume fire sprinklers are property protection devices and are surprised when told that life safety was a major reason for their development back in the 1860s. This was a time before the Factories Act 1867, when dust and debris was allowed to accumulate in factories, so that if a fire started it was likely to spread rapidly out of control.

Despite claims that sprinklers originated in the UK, it was Henry Parmalee in the USA who, in 1874, first developed a commercial sprinkler system to protect his piano factory. The insurance industry quickly recognised how effective sprinklers were in controlling factory fires and so began a long and fruitful relationship between the sprinkler and insurance industries. This is why there is the popular misconception that fire sprinklers are property protection devices.

The life safety role of sprinklers was largely ignored until 1973 when the *America Burning* report was published in the USA. This report not only showed the scale of US fire losses, it also documented the fact that over three-quarters of all fire casualties occur in people's own homes – something that is equally true in the UK. The report was also notable in that it suggested that special fire sprinklers should be developed for use in residential properties.

Sprinkler development

Being ever pro-active, the Americans set out five principles for these life-safety sprinklers and spent the next eight years researching how they could be achieved. Those principles were:

- the main objective of the system was life safety, with property protection very much a secondary objective
- the system was only intended to control the fire long enough for occupants to escape or be rescued, and not necessarily to extinguish it
- the system must be compatible with domestic construction and décor, that is, it must be discrete and be built into the floors and walls of the property
- the system must be economic. It was argued that, since cost was likely to be the major factor in determining whether a system was fitted, the installation should not include any unnecessary operational features
- since 85% of the risk of death or injury comes from fires originating in kitchens, bedrooms and living rooms, these areas alone could be protected if this would generate significant cost savings. This debate is unresolved in the UK

From the start, the US Fire Administration was very much involved in the research and development of these residential sprinklers, as they became known. To show its commitment, it

also instituted a rule that all US Government employees must stay in sprinkler-protected premises when travelling on official business or their expenses would not be paid. This has resulted in hotel chains, such as the Marriott group, installing sprinklers in all their hotels, both in the USA and around the world.

By 1981, the first residential sprinkler heads became available and a few years later, in 1985, the city of Scottsdale became on of the first of over 2,000 municipalities throughout the USA was one of the first to pass an ordinance requiring sprinklers to be fitted in all new properties, both commercial and residential (see p.XX). No one has died from fire in a sprinkler-protected property in Scottsdale, or indeed anywhere else, and sprinklers have been responsible for very substantial reductions in fire-related injuries and property losses in all types of buildings.

The benefits to Scottsdale have not just been in lives saved, but also in the property and environmental damage that has been prevented. Those lobbying for this sprinkler law understood that it would be difficult to persuade the city council to make the installation of sprinklers mandatory in industrial and commercial premises on the basis of property protection alone. However, when coupled with the saving of lives, especially in residential property, this became a win-win proposal to the council.

UK situation

When looking at the UK, it would seem that all major safety legislation follows a disaster, and we seem reluctant to learn from the experience of others. Nevertheless, the Government is currently conducting an in-depth review of fire safety legislation and modernising the fire service in England and Wales. All UK fire safety legislation is geared to saving life, as are the Building Regulations in England and Wales. Therefore, if fire sprinklers are to be included in UK legislation and Building Regulations, it will be principally for their life-saving abilities.

Although UK fire deaths have declined in recent years, injuries continued to climb, reaching to over 18,000 in 2000. The Government has tasked the fire service with reducing these casualty rates and various initiatives have been launched in recent years. Unfortunately, chief fire officers freely admit that the current strategy, based on fire safety education and smoke alarms, has not been as effective as they had hoped and now recognise that they need another weapon in their fight against fire. That weapon they believe to be the fire sprinkler.

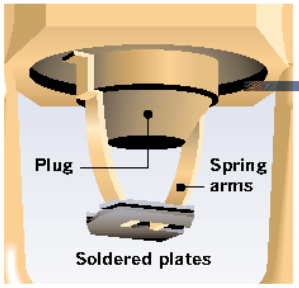
The Fire Sprinkler Assocaition believes that life safety is of paramount importance. It also recognises that although the market for residential sprinkler systems may always remain small, compared to the commercial/industrial sector, life safety will be the driving force behind the expansion of the wider fire sprinkler market in the UK, thus saving lives, property and the environment from the ravages of fire. A win-win situation for us all ❑

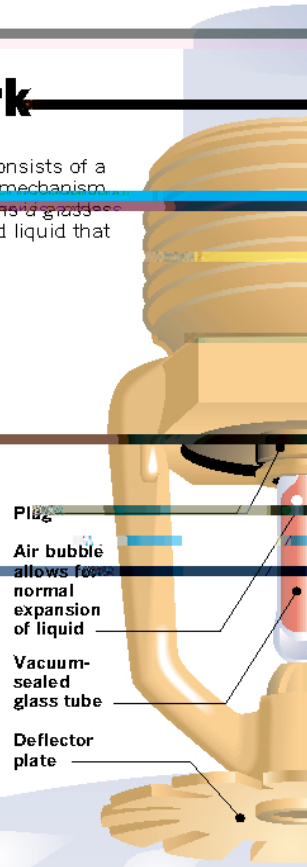
Sir George Pigot is the chief executive of the Fire Sprinkler Association

How fire sprinklers work

1 The typical sprinkler head consists of a plug held in place by a trigger mechanism. The most common type of trigger is a glass ampule filled with a glycerin-based liquid that expands when heated.

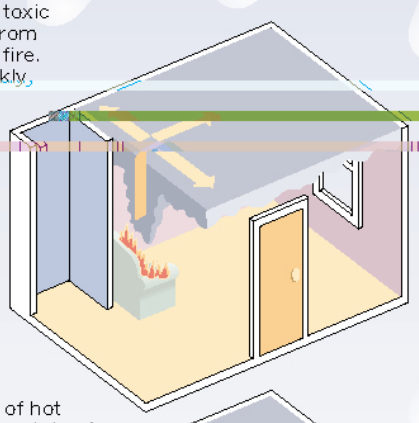
A less commonly used type of trigger consists of two metal plates held together by a solder point. When the solder melts, two spring arms pull the plates apart, releasing the plug.



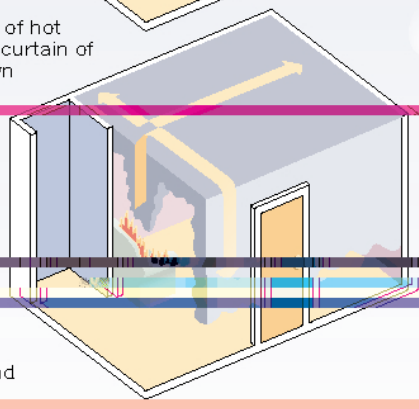


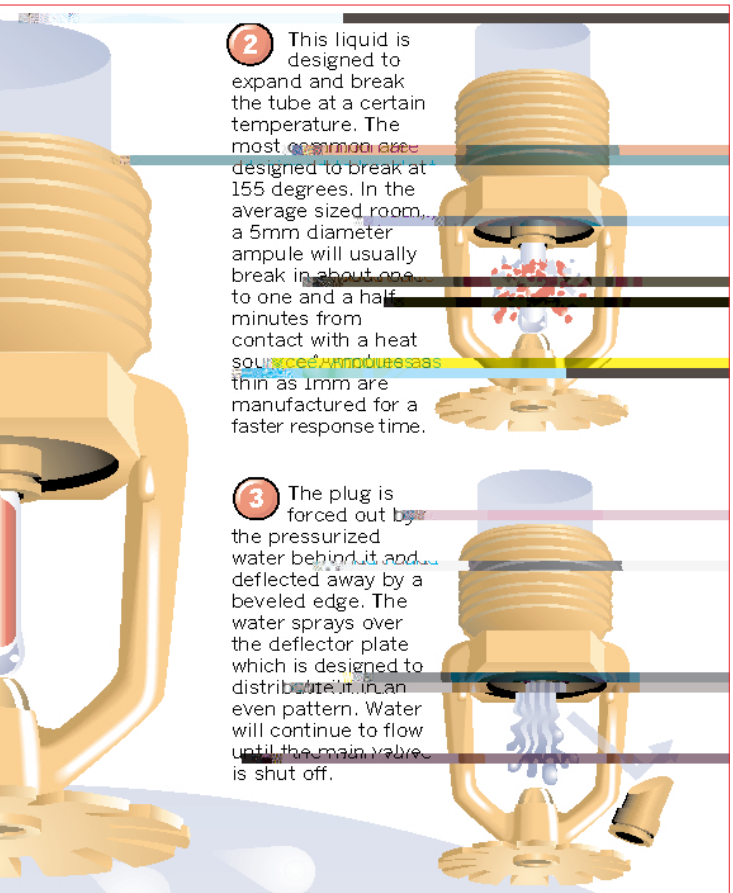
How an uncontrolled fire spreads

1 Smoke and toxic gases rise from the source of the fire. They spread quickly along the ceiling and heat the air in the room.



2 The current of hot air forces a curtain of deadly gases down the walls, making escape more difficult. In a few minutes the air will become so hot that the entire contents of the room will ignite spontaneously. This is known as flashover and usually occurs between 1,000 and 1,500 degrees.

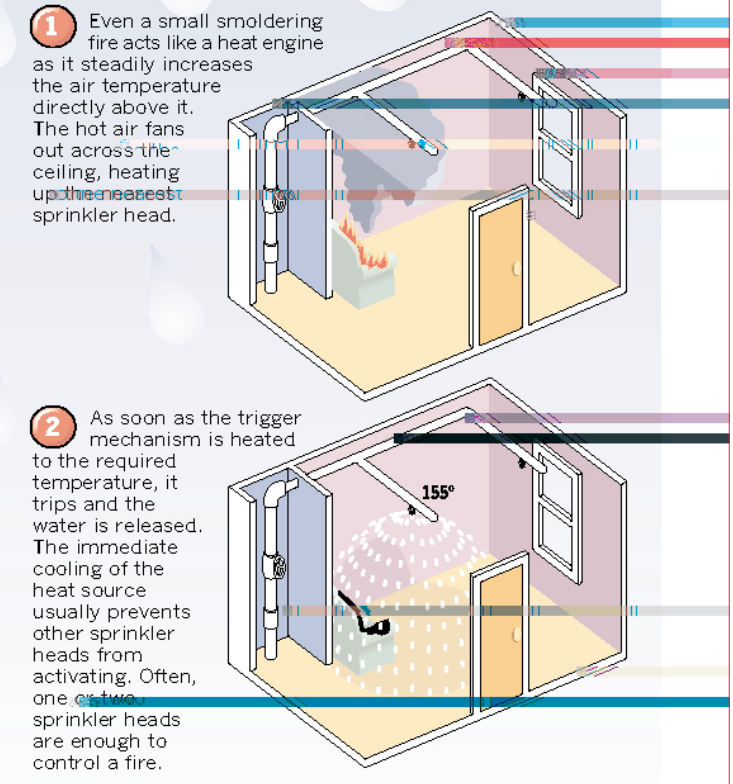




2 This liquid is designed to expand and break the tube at a certain temperature. The most common ampule is designed to break at 155 degrees. In the average sized room, a 5mm diameter ampule will usually break in about one to one and a half minutes from contact with a heat source. Ampoules as thin as 1mm are manufactured for a faster response time.

3 The plug is forced out by the pressurized water behind it and deflected away by a beveled edge. The water sprays over the deflector plate which is designed to distribute it in an even pattern. Water will continue to flow until the main valve is shut off.

How a sprinkler system puts the fire out



1 Even a small smoldering fire acts like a heat engine as it steadily increases the air temperature directly above it. The hot air fans out across the ceiling, heating up the nearest sprinkler head.

2 As soon as the trigger mechanism is heated to the required temperature, it trips and the water is released. The immediate cooling of the heat source usually prevents other sprinkler heads from activating. Often, one or two sprinkler heads are enough to control a fire.

WHETHER A RETROFIT OR NEW CONSTRUCTION

Trade Associate

Further education

More schools should be fitted with sprinkler systems, says Larry Stokes, particularly given the many benefits of such systems

SCHOOL FIRES have been recognised as a major problem by the UK fire industry since the late 1960s and serious fires in these premises often appear at the top of the Fire Prevention & Fire Engineers Journal statistical tables relating to the annual cost of £250,000+ fires.

There are two crucial issues relating to the number of fires on school premises and the large number of destructive fires. Firstly, the majority of fires are set deliberately by pupils, ex-pupils or their friends. The reasons for an arson attack may sometimes be complex but it is most often an extreme form of vandalism.

Secondly, most schools were never designed to protect against theft, break-ins, malicious damage or fires. These deficiencies are exacerbated by the presence in many schools of extensive roof and ceiling voids with non-existent or perforated cavity barriers – all of which gives the potential for large, spreading school fires of the kind regularly seen in most parts of the UK.

In addition, the full cost of school fires cannot be measured simply in losses paid by insurers. There are significant additional costs to local education authorities in terms of retained excesses or deductibles, which can be as high as £1m [per fire?].

Sprinkler benefits

There are a number of benefits of installing sprinkler systems in schools. Schools and local education authorities should undertake a cost-benefit analysis for the fitting of sprinklers, which should consider the following:

- the installation of sprinklers can lead to significant reductions in the fire elements of the insurance premium payable, whether the school is part of the local education authority, a foundation school or a Private Finance Initiative (PFI) project
- water savings – typically a sprinkler uses 5% of the water used by a single fire service hose
- the school will probably be back in action the same day if sprinklers are installed, whereas most unsprinklered schools hit by fire require a rebuilding period of two years
- a sprinkler system can reduce building costs on new-build or extension by virtue of a trade-off with partition walls and protection on escape routes
- school fires often involve the release of asbestos and other contaminants contained in fire service water run-off. This is unlikely to happen with a sprinkler system installed
- schools are becoming more difficult to insure because of the worsening loss record. A sprinklered school is a far more attractive proposition to a wider insurance market
- a large increase in the number of daytime school fires experienced in parts of the UK, such as London, the West Midlands and West Yorkshire, raises the issue of life safety, since children and staff could become trapped in burning buildings
- fire service response, which are typically two to five tenders with fire crew for six to 12 hours
- firefighters' lives are put at risk by entering a burning school, or on the fireground generally, especially in buildings made of lightweight, consortia materials, where fire spread in hidden voids has a high potential for flashover and building collapse

In addition, unsprinklered schools that suffer a fire can result in: a loss of community resource, since schools are often used for night classes, local events, etc; a loss of irreplaceable teaching notes and aids; the stress of managing a school following a serious fire; and a loss of childrens' schoolwork, which could include examination coursework. (A serious fire involving loss of these items will require submissions to examination boards and could upset and cause disruption to children, parents and teaching staff.) Furthermore, a school fire may prompt parents to vote with their feet and enroll their children in another school, with potential loss of viability for the damaged structure.

Given the range of arguments for fitting sprinklers in schools, it is surprising that these systems have not been more readily embraced, although, particularly with PFI schools, this is becoming part and parcel of a more enlightened approach.

Dispelling the myths

The old myths about the disadvantages of sprinkler systems continue to be articulated, including a recent exchange in the House of Lords which discussed the fact that sprinkler

systems in schools can be subject to vandalism, and that sprinkler protection will not be extended to roof voids, where fires may sometimes originate.

Both these issues have been dealt with extensively before but, to reiterate, Zurich Municipal understands that, in the 150 schools fitted with fire sprinklers to date, there have not been any malicious activations of the system. The design parameters are such that sprinkler heads, in suspended ceilings, are hidden by unobtrusive metal plates that fall away when the system is activated, and exposed pipework is kept to a minimum or is generally out of reach or otherwise protected, such as in sports halls. The Loss Prevention Council's Sprinkler Rules are quite clear that where extensive roof voids occur they shall be protected by sprinkler systems.

But the continuing confusion about sprinklers and how they work is not helpful, particularly as there is currently an excellent opportunity to improve the fire performance of schools through the Government's Schools for the Future scheme – which includes initiatives to ensure school buildings provide excellent educational facilities for pupils, staff and the wider community – and through the Exemplar project, under which specialist teams will develop plans to design and construct new school buildings during 2004.

Early indications of the proposed Exemplar designs suggest that there will be little improvement in the passive fire resistance of this new generation of schools compared to the existing infrastructure, unless there is a further amendment or a fire engineered approach using sprinkler systems. If no such improvements are made, an opportunity will have been missed and the damage and disruption caused by large school fires will continue ❑

Larry Stokes is XXX with Zurich Municipal

Councils with building-sprinklered schools

Aberdeen
Bradford MBC
Bridgend CBC
Cambridgeshire CC
Cheshire CC
Coventry CC
Darlington BC
East Ayreshire DC
Essex CC
Halton DC
Hertfordshire CC
Leeds CC
Leicester CC
Lincolnshire CC
London - Barking
London - Ealing
London - Enfield
London - Haringey
London - Sutton
Manchester City
North Tyneside MBC
Nottingham City
Nottingham County
Oxfordshire CC
Peterborough CC
Rhonda Cynon Taff
Salford CC
Sheffield CC
Staffordshire CC
Swansea CC
Swindon CC
Telford & Wrekin
Trafford MBC

Oldham MBC are the leading user of sprinklers in schools with an average of one a year being built

CBC: County Borough Council
CC: County Council
DC: District Council
MBC: Municipal Borough Council

Source of agreement

Sir George Pigot reports on a proposed new agreement setting out how sprinkler systems should be connected to water supplies in the UK

A WORKING party, including representatives from the water industry, fire sprinkler industry, and HM Fire Service Inspectorate, have reached agreement on the principles of how fire sprinkler systems should be connected to the water mains and the status of sprinklers within the framework of UK water industry legislation.

The agreement comes after the working party, which was set up in early 2002, sought to develop a protocol setting out the agreed principles concerning the connection of sprinkler systems to water mains and to agree solutions to the various technical problems that had arisen (see *FP&FEJ*, November 2003, p.33).

The agreement is based on the Loss Prevention Council's Guidelines for the Supply of Water to Automatic Sprinkler Systems for Fire Protection but has been extended to include residential sprinkler installations. Initially the working party made good progress but work was delayed due to water industry concerns over the possibility of water being stolen from the sprinkler supply pipes if they were not metered.

A final draft of the agreement has been distributed to the constituent members of the working party for ratification and it is hoped it will be published in Spring 2004. It is intended that the water supply companies will all adopt the guidelines and that they will be recognised by the Office of the Deputy Prime Minister and the economic regulator for the water and sewerage industry in England and Wales, OFWAT. Full details of the agreement will not be available until it has been ratified.

The fire sprinkler industry is pleased to have reached agreement on these matters and looks forward to working more closely with the water industry in the future. Such co-operation will ensure more fire sprinklers are installed, thus saving many more lives and substantially reducing both property and environmental damage cause by fire ❑

Sir George Pigot is the chief executive of the Fire Sprinkler Association

Agreed principles

Within any legal requirements placed upon their member companies regarding the proper supply and use of public water, 'The Parties' (members of the working group referred to above) agree that they will encourage their members, insofar as they are able to:

- co-operate with each other at every level within their organisations in facilitating the provision of properly designed fire sprinkler systems and the provision of appropriate water supplies
- provide clear and transparent methods of working with each other, at national and local level, in a spirit of mutual co-operation and goodwill
- provide water supplies and install fire sprinkler systems in accordance with relevant legislation, British or European Standards, and other recognised guidelines
- with regard to a specific installation, where a deviation from such standards or guidelines affects the interests of the water supplier, agree that deviation in writing between the parties concerned
- in the event of a dispute concerning the interpretation or application of these guidelines, make every attempt to resolve the matter locally, and at the appropriate level, as swiftly as possible
- take all reasonable precautions to prevent the misappropriation of water, or the commission of a related offence

Conclusions

'The Parties' recognise that automatic fire sprinkler systems have a valuable role to play in the protection of both life and property from fire, and in the reduction of environmental damage such fires can cause. 'The Parties' also recognise that the water used by automatic fire sprinkler systems:

- is a legitimate use of water
- need not be metered if there are adequate safeguards in place to minimise the possible fraudulent use of water
- is free of charge
- should preferably be supplied to the property independently from domestic or commercial use of water
- must pass through an appropriate and approved backflow prevention device
- need not normally be stored as a condition of supply
- may be supplied through a booster pump directly connected to the service pipe subject to the agreement of the water supplier'