



## **BRE and the Introduction of Automatic Water Sprinkler Systems**

The BRE have undertaken extensive research into the use of Domestic Sprinkler Systems and continues to do so, it provides detailed risk analysis and solution implementation to the Construction Industry and is the Author of the Loss Prevention Certification Boards – List of Approved Fire and Security Products and Services Red Book.

In this written evidence a synopsis of the stance and findings of the BRE in this matter is outlined and will form the basis of the evidence submitted to the Committee.

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### **Domestic Sprinkler Systems**

The factors which influence exit choice are complex, and quantitative data is scarce. In qualitative terms, people tend to stick to familiar routes. A distinction can therefore be made between buildings where the occupants are familiar with the geometry (e.g. office workers, domestic dwellings), and buildings where they are not (e.g. public assembly). Even in the former types of buildings, it is good design to ensure the fire exits are part of the normal circulation routes. A clearly-signed “Fire Exit” may be ignored in preference to the familiar route. However, building visitors given directions by building staff are more likely to choose unfamiliar exits, so therefore any measures that extend the potential evacuation time should be encouraged.

### **Factors effecting Exit from Buildings**

The current factors built into the Building Regulations for Evacuation in the event of Fire are mainly, travel distances to exits, and designated widths of escape corridors for population of building (high rise).

Studies undertaken by the BRE indicate that:-

- q People will not necessarily choose their nearest exit.
- q People will not choose exits on the basis of their width, i.e. the number of people using each exit will not be optimised to minimise the total evacuation time.
- q Unfamiliarity with building layouts increases numbers of deaths in the event of Fire.

## Measures to be Supported

Although the figures given below relate to statistics for sprinklers within Europe over a ten-year period, the advantages of all water suppression systems is likely to give similar benefits.

In buildings fully protected by sprinklers:

- Sprinklers alone controlled 99% of fires
- 93% of fires are controlled within the design area of operation
- The spray from no more than 4 sprinklers controlled 60% of fires Remember that suppression systems react quickly to fire, the speed of operation not only reduces actual fire damage, but both smoke, (toxicity) and water damage are reduced with the often-additional benefit of summoning assistance by raising an alarm.

## Why should we consider water suppression systems to new building projects?

Residential suppression systems are now being installed for around £1000 in new build three bedroom semi-detached properties. Although generally of a smaller economic loss fire in the home is of devastating proportion to the occupier and sadly results in approximately 300 preventable fire deaths each year.

The graph below outlines the time line for two scenarios of fire, the first gives the time line for the uncontrolled growth of fire and the second outlines the same fire potential when using Automatic Water Sprinkler Systems (AWSS).

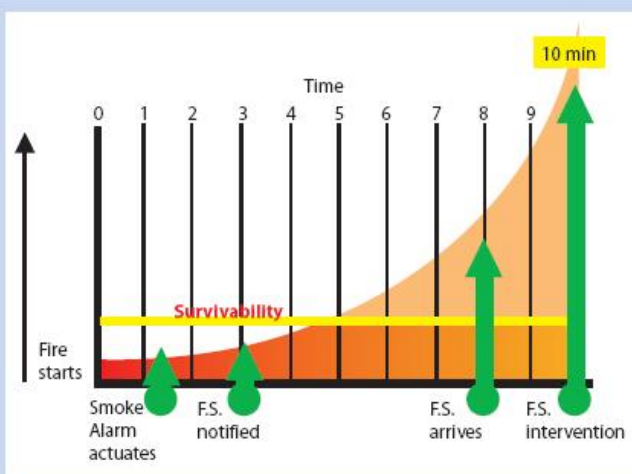


Fig.1 Uncontrolled fire growth

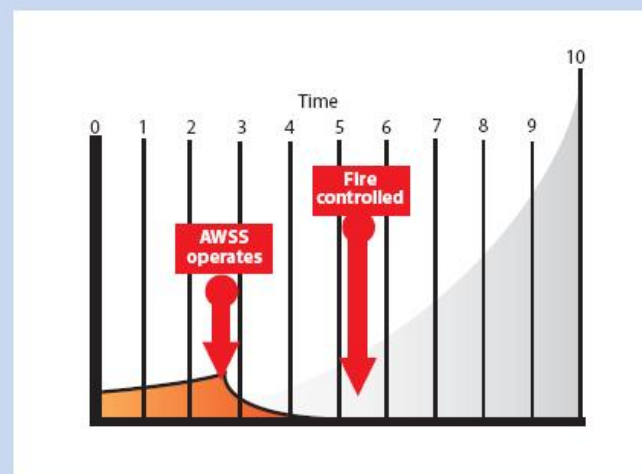


Fig.2 Controlled fire growth using AWSS



## **AWSS, The Building Regulation requirements and Flexibility in Design**

The BRE have been involved over the years in many studies and a synopsis of one of the latest studies we have been involved in is outlined below, and helps to highlight the issues and design flexibility that AWSS may provide in the domestic market.

This section covers those occupancies detailed within the Approved Document B, Volume 1 (Dwellings), and the areas to be considered. These occupancies being 'residential' (Purpose Group 1) which include dwelling house, apartments, and HMOs or registered group homes of up to six residents.

To compare with other UK Building Regulations, The Scottish Building Standards Technical Handbook (Non Domestic) includes a mandatory functional standard 2.15 stating "Every building must be designed and constructed in such a way that, in event of an outbreak of fire within the building, fire and smoke will be inhibited from spreading throughout the building by the operation of an automatic life safety fire suppression system.

Including:

- A residential care building;
- A high rise domestic building; or
- Any building that forms the whole or part of a sheltered housing Complex

Note: When design freedoms are put forward for occupancies covered by this section, it is important to take account of possible reliability issues affecting AWSS due to maintenance shortfalls. A number of the occupancies covered by this section (e.g. private dwellings) have as yet no ongoing legislative or enforcement control. Difficulties can therefore arise in ensuring that these active systems are maintained to an appropriate standard, thus ensuring they operate effectively when needed. Therefore caution should be exercised, especially in the departure from traditional designs that may have an effective and proven track record. There is a balance to be struck, and undue or total reliance on any one system should receive very careful consideration.

## **Design Flexibility Considerations**

**Listed below are common design freedoms or applications in dwellings:**

(It must be stressed that not all AWSS systems will be appropriate to allow all types of design freedom. For example, a 10-minute duration domestic sprinkler system may not be considered appropriate to relax a requirement for 30 minutes fire resistant structure requirement)

**Tall Apartment buildings:** Possible future Building Regulations may require Apartment buildings above a specified height to be fitted throughout with an AWSS. CFOA believe the height threshold should be 11m to take account of fire fighting and external rescue capability. The Scottish Building Standards Technical Handbook contains a mandatory standard 2.15 for automatic life safety fire suppression systems to be fitted within high-rise domestic buildings

**Multi-storey apartments:** Consideration could be given to use AWSS and a protected stairway in lieu of alternative escape route in multi-storey apartments.

**Houses of four or more storeys:** Consideration could be given to use AWSS in lieu of alternative escape route in houses of typically four storeys and above.

**Boundary distances and unprotected areas:** Sprinkler system permits boundary distances to be half that for an otherwise similar, but unsprinklered building, subject to there being a minimum distance of 1m. Alternatively, the amount of unprotected area may be doubled if the boundary distance is maintained.

**Fire fighting shafts:** Where fire fighting shafts are required (i.e. buildings with a floor level over 18m), fewer shafts are required where sprinklers are installed. Consideration could be given to allow greater distances from fire main outlets if sprinklers protect the building.

**Travel distances:** Authorities having jurisdiction may give consideration to allowing increased travel distances. The provision of a correctly specified, designed and installed AWSS will significantly reduce the risk of a fire developing and spreading beyond the room of origin. This reduced risk to occupants, allows the potential for greater evacuation times. Therefore, there is scope to introduce increased flexibility in travel distances. Special care would be required in situations involving single direction escape scenarios and single stair conditions.

**Open plan designs and protected stairway enclosures:** HTM 888, LGA sprinkler guide for domestic premises together with some locally produced building control technical guides permit a residential sprinkler system as an alternative to a protected stair enclosure, thereby allowing an open plan stairway forming part of the escape route. This concept has also received support from a number of designers and fire consultants as it has formed the basis of applications submitted for building control approval (sometimes as a 'fire engineered solution').

A fundamental principle of fire safety and building regulations is that building occupants should not have to make their escape through smoke filled areas. Current guidance to the building regulations, proposed amendments and the relevant British Standard require dwelling houses of 3 storeys and above to be provided with a protected stairway. This effectively precludes the use of open plan staircase delivering into ground floor living room in a house exceeding two stories.

The residential sprinkler research conducted by BRE13 does not bring into question the ODPM and BSI recommendations

The sprinkler controlled fire tests showed escape routes with higher levels of toxicity and, on occasions with untenable conditions in 'open lounge' layouts when compared with an enclosed stair configuration.

The research project also highlighted the benefits of doors, even if they were partially or fully open, in achieving lower toxicity levels on escape routes when compared with an open stair design. ODPM determinations and some technical journal articles also offer opinion on this subject, which is consistent with the BRE research findings.

AWSS have been proven to reduce smoke toxicity; however this reduction is not always sufficient to ensure tenable conditions are maintained on escape routes. When combined with protected routes, AWSS considerably enhance the protection given to the means of escape thereby allowing flexibility in travel distances/escape times. Without further research, AWSS would not usually be an acceptable alternative to a protected stairway enclosure.

**Periods of fire resistance:** Since the provision of AWSS will effectively confine a fire to room of origin by controlling or extinguishing the fire, periods of fire resistance required to the elements of structure and escape routes could be reduced in certain circumstances. However, it should be ensured that where necessary, doors, floors, walls and partitions are of sound construction, integrity and maintained in good condition to enable escape routes to be safely used during the evacuation period. In certain situations, any glazing between habitable rooms and the stair enclosure (excluding glazing to a bathroom or WC) may still be required to be fire-resisting and retained by a suitable glazing system and beads compatible with the type of glass. Consideration should be given, where necessary, to under-stair cupboards used for storage as these may require protection by AWSS or be upgraded to a fire resisting standard.

## Case Studies

The following case studies are presented as examples of where AWSS has been successfully used as part of a risk based solution to overcome a fire safety problem or to provide an enhanced level of fire protection. Each scenario sets out the context of the specific case and describes briefly the solution adopted,

These are not determinations such as those published by the ODPM in respect to Building Regulations and therefore cannot be used in the same way, however they do provide a starting point for considering the many different ways in which AWSS can be used and each scenario has been approved and is currently in use somewhere in the UK. Each proposal to install AWSS must be considered on its own merits alone, and be subjected to a specific fire risk assessment to determine the best possible range of fire safety solutions for the situation, which can then be considered by the applicant and a final proposal submitted for approval. In most cases AWSS will be a very effective solution as discussed elsewhere in this document, but this approach will need to be positively marketed by the Team proposing its use, as while sprinkler technology is not itself new, and its fire safety benefits well known, the idea that it should be used more extensively is seen by many as simply a tool to drive down the annual cost of fire in the UK which is considered to be an issue for the Fire Authorities who they see as the sole beneficiaries of the use of AWSS in reducing service demand.

The benefits to the community, its people, its business and commercial enterprises, the UK economy, and both the built and natural environment, are of course equally important if not more so.

Clearly fewer and less serious fires means potentially less fire fatalities and injuries, less disruption to business or service provision, less damage to the environment or the economy, and as explained earlier the business case for provision of sprinklers is sound, but as with all new ideas and changes to policy it needs Fire Officers to actively promote its use, or legislation to allow its implementation.

The case studies that follow are not exhaustive but just some of the examples captured during the research carried out. It is acknowledged that each solution will be able to and should wherever possible relate to the many local examples of where AWSS has been effective in delivering the best fire safety solution in a given set of circumstances; these should be used to promote the installation of AWSS wherever possible.

### **Restricted Access Scenario**

The proposal required a Fire appliance to access 25 metres into the alleyway in order to fall in line with B5 access requirements. However, inspection of the site revealed that this proposal was not feasible due to the lack of space available which would restrict safe, effective, and efficient fireground operations. Effectively fire appliance access could not be provided within 80 metres of the front door of the nearest proposed new residence. Suffolk Fire and Rescue Service considered this proposal unacceptable without the provision of a domestic sprinkler system in each new build bungalow. The Local Authority Building Control Officer (LABCO) was initially unsure about using sprinklers as compensation for fully compliant B5 access arrangements. However, after some lengthy debate, and several weeks of correspondence, the LABCO agreed with the guidance offered by SFRS.

All parties were ultimately happy as the developer was able to build the properties more or less as proposed, the LABCO and local planning officer were able to facilitate the local need for this type of housing, and SFRS are satisfied that the occupants of the new bungalows (who are likely to be elderly and at risk from fire) are safer than most people from a fire in their own homes despite the onerous access arrangements provided.

### **Type of Water Suppression System**

BS 9251 Domestic sprinkler system

### **Description of Building**

Two bungalows built on land only accessible through an alleyway between terraced housing.

### **Installation Details**

The life safety benefits highlighted by recent BRE research into the effectiveness of residential sprinkler systems, damage limitation advantages, SFRS IRMP and local housing needs were all considered before all party agreement was reached regarding this proposal. Both bungalows were fitted with a domestic sprinkler system, supplied by the local water mains, complying with BS 9251. Rapid response residential sprinkler heads were used throughout using recessed housings for aesthetic reasons.

### **Compensatory feature for excessive travel distance**

This building is now used as a residential care home having recently been converted from a Public House. Concerns from the Fire Authority included excessive dead ends in ground first floor sleeping corridor escape routes, and space limitation which physically restricted options to protect principal escape routes including the main escape.

### **Type of Water Suppression System**

Residential Sprinkler system fitted partially in premises otherwise in accordance with DD251 (Now BS 9251: 2005)

### **Description of Building**

Abbeyfields is now used as a residential care home. The building is very old with timber construction, comprises ground and first floor with a basement (approximately 35 m x 15 m) and provides 12 residential care bedrooms.

### **Installation Details**

The consultation was satisfied by providing a combination of traditional means of escape and fire precautions, and a partial Residential Sprinkler system conforming to DD 251 to provide a means of escape solution, which satisfied functional requirements and the Fire Authority. The sprinkler system was provided in a manner that effectively cut the building in half leaving a sprinklered half (where the problematic structural issues were present) and unsprinklered side where traditional measures were sufficient. Cut off sprinklers were provided on the unsprinklered (risk side) of all non-structural openings in the separating wall communicating with the sprinklered side. Recessed heads were provided in most other compartments on the sprinklered side including the basement, sidewall sprinklers suitably located on boundary walls as ceiling depth was insufficient to house the pipe work necessary for centrally located recessed heads. All heads were rapid response and provided in accordance with DD 251.

### **Compensatory feature for excessive travel distance**

Increase in travel distance in a single staircase 23-storey residential development.

### **Type of Water Suppression System**

BS 5306 Part 2 sprinkler system

### **Description of Building**

The building consists of residential apartments covering some 23 storeys, access to these floors are by means of a single staircase and lift for the residents coupled with a fire fighting shaft, riser and fire fighting lift. An extended travel distance has been proposed at 23m travel in one direction with smoke clearance in the corridor. A fire engineered solution was considered to address equivalence to the 7.5m suggested by ADB, this equivalence has been achieved by the installation of smoke flushing and sprinklers installed within the building

### **Installation Details**

A relaxation of Building Regulations has been approved by the Local Building Control and the Fire Authority in respect to extending the travel distance in a residential corridor. As a result, all residential flats will be fitted with a sprinkler system in accordance with BS 5306 Part 2. At the present time the building is under construction

## **Conclusion**

In conclusion the BRE would support the implementation of a directive to allow the installation of AWSS to be considered or even made mandatory.

## **Considerations to be Made**

- Consideration should be given to the issues surrounding sprinkler reliability and on going maintenance issues that may arise in certain circumstances
- No blanket moving away from traditional fire design principles
- Sufficient risk analysis undertaken at submission stage
- Further research to be undertaken into the actual benefits and issues around integration into building design for AWSS in the domestic market.
- Training should be offered to the Construction Industry on how to engineer and benefit from the use of AWSS.