

West Hampstead Square, Automatic Fire Suppression System Activation Case Study

Date of incident: Tuesday 3 July 2018

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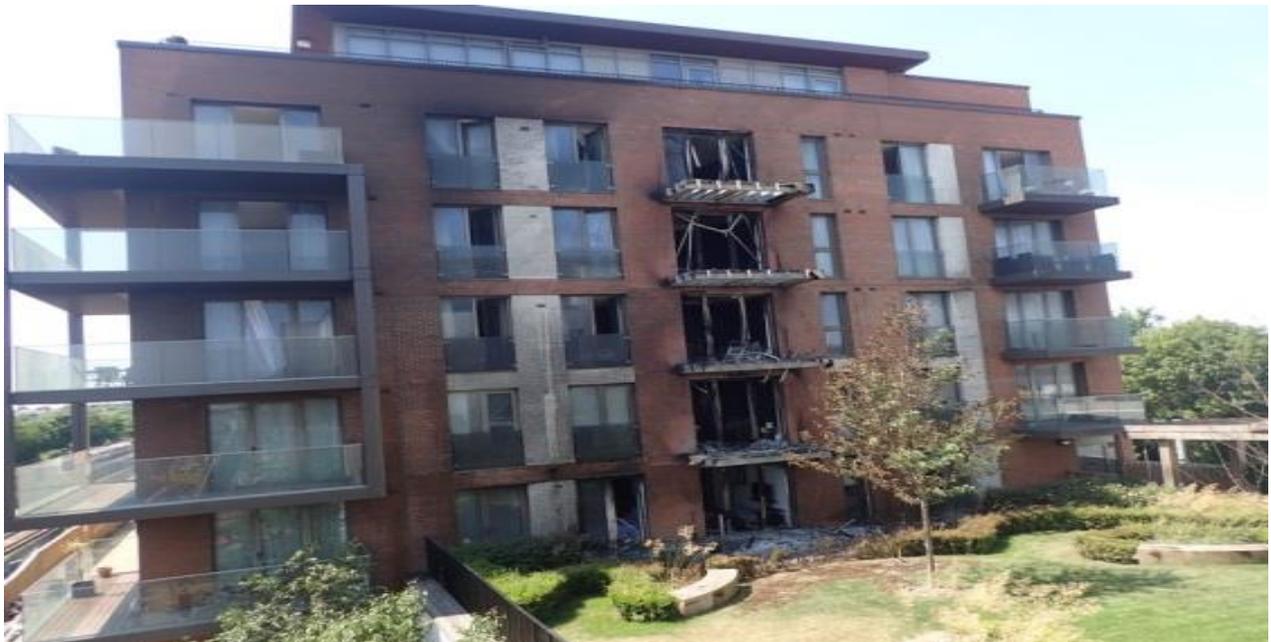
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1 Executive Summary

- 1.1 The main purpose of producing this report is to raise awareness in the residential sector of the beneficial/effectiveness impact that incorporating Automatic Fire Suppression systems (AFSS) can have in a multi-point residential high rise fire.
- 1.2 In this case a external balcony fire where In the space of 19 minutes from the actuation of the first nozzle head, 5 apartments were exposed to fire and heat activating 12 nozzle heads which is unprecedented in a residential fire.
- 1.3 It summarises:-
 - Without the installation of the AFSS the outcome could have been more serious and potentially fatal resulting in 5 separate compartment fires over 5 floors.
 - The importance of employing a third party accredited sprinkler contractor allowing a correctly designed AFSS to be installed to the appropriate standard.
 - Careful consideration must be given to materials and structural design to mitigate the risk of a balcony fire spreading to other parts of the building.
 - Business continuity, AFSS can help to protect valuable assets from fire or can significantly mitigate the effects that a fire has upon assets, helping to achieve business continuity.
 - AFSS can lead to cost savings, innovative and flexible design options, open plan living is one example because the need for fire doors, walls and compartmentation is removed.



2 Introduction

- 2.1 The London Fire Brigade (LFB) plays a key leadership role in promoting a better understanding of the benefits of AFSS and works to encourage the promotion of AFSS both within London and nationally to meet the aims and objectives contained within the Authority's London Safety Plan and AFSS Position Statement
- 2.2 Evidence and research gathered over many years proves the effectiveness of AFSS in the rapid suppression of fires by providing a vital additional layer of fire safety before the arrival of the Fire and Rescue Service
- 2.3 The most recent UK research was commissioned by National Fire Chiefs Council and National Fire Sprinkler Network (NFSN) in the publication, "Efficiency and Effectiveness of Sprinkler Systems in the United Kingdom: An Analysis from Fire Service Data" . Key data revealed that:
 - Sprinklers are 94% efficient in their ability to operate.
 - Sprinklers are 99% effective in extinguishing or controlling a fire
- 2.4 This report supports this evidence.
- 2.5 The location of the fire was on the third floor of an external balcony, spreading to a further three apartment balconies and an additional apartment on the podium level. Twelve nozzle heads actuated suppressing the fire from spreading into five apartments.
- 2.6 The LFB vision for residential AFSS, is that it should be mandatory to install AFSS in all high rise residential buildings above 18m in height . In England it is mandatory only to install AFSS in residential buildings over 30m in height.

3 Building Description

- 3.1 The development comprises of seven individual residential buildings ranging in height between 14m (5 floors) and 35m (12 floors) and has been occupied since 2016.
- 3.2 The buildings within the development are constructed as follows :
 - Traditional reinforced concrete frame/brickwork.
 - Triple glazed aluminium tilt and turn windows/doors.
 - Balconies constructed of steel frame with aluminium fascia and composite decking and plastic soffits with toughened balustrade glazing.
 - Podium levels.



3.3 This report will be focusing on the Orwell building only.

Description

- Seven floors .
- 34 Apartments ranging from studio flats to 1,2 and 3 bedroom apartments.
- Balconies fitted to a selection of apartments.
- Large entrance lobby with 24/7 on site estate management .
- Gymnasium.
- Health spa facilities.
- Access to podium level.

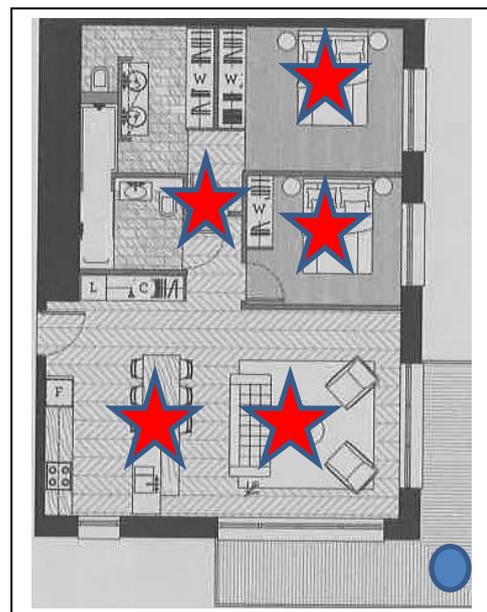
3.4 Typical layout of apartment/location nozzle heads, the three bedroom apartments were not involved in the fire.

3.5 Dimensions 2 bedroom flat

- Internal area:- 77.8 sqm
- Living area:- 7700 x 4500mm
- Bedroom 1:- 3400 x 3150 mm
- Bedroom 2:- 2800 X 2790 mm
- Balcony:- 13.9sqm

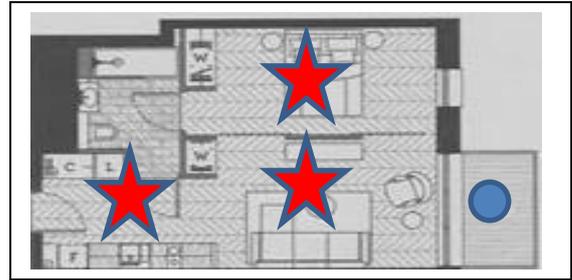
 Location of nozzle heads

 Balcony



3.6 Dimensions Suite/Studio

- Internal area:- 41.4sqm
- Living area:- 6600 x 3080 mm
- Bedroom:- 4290 x 2500 mm
- Balcony:- 3.9sqm



4 Fire Safety Arrangements

- *Residential AFSS.
- Firefighting Shaft/pressurised staircase.
- Smoke ventilation.
- Dry riser.
- Automatic fire detection L3(M) in non residential areas.
- Stay put policy/defend in place.
- 24/7 on site concierge/security.

*Unless identified by a fire strategy or risk assessment external balconies that permanently open to the outside may be excluded from the provision of AFSS protection.

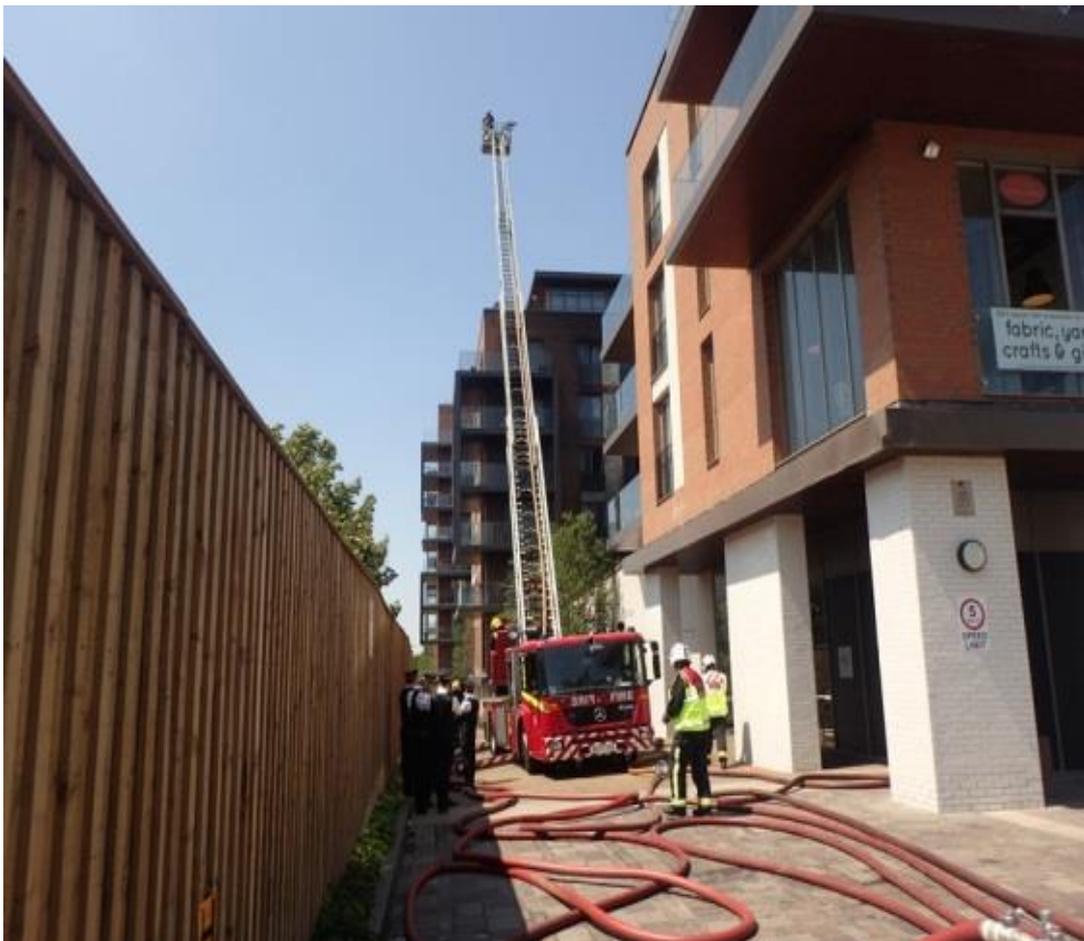
5 Residential Automatic Fire Suppression System

- 5.1 Designed, installed in accordance with BS9251:2005 by a third party certified *FIRAS contractor, member of the British Automatic Fire Sprinkler Association and Residential Sprinkler Association.
- 5.2 The above mentioned standard gives the requirement for sprinkler systems designed to provide life safety for the occupancy of two classes of residential systems; Domestic and Residential.
- 5.3 The system used in this building was residential (multi-occupancy). It should be noted that the above mentioned standard has been replaced by BS9251:2014 which refers to 3 classes or categories of residential systems, category 1,2 and 3. In this case, the Residential category of BS9251 is split between category 2 and 3.
- 5.4 The water supply was via a cold water boosted system; a combined tank using the domestic water supply with a capacity of 6,300 litres. Infill top up was provided via the town mains, a major advantage compared to a stand alone AFSS capacity tank.
- 5.5 An isolation valve set located on each floor with the flow switches linked to the automatic fire alarm panel. AFSS coverage was provided for the residential apartments only compensating for the open plan living design.
- 5.6 Viking VK457 residential concealed nozzle heads installed, temperature rated to 74°c, the cover plate rated to 57°c which were designed for installations on concealed pipe systems where the appearance of a smooth ceiling is required.

*FIRAS is a voluntary, third party certification for installation contractors of both passive and active fire protection systems.

6 Description of Incident

- 6.1 The fire started on the third floor external balcony, spreading vertically affecting three additional balconies from the fourth to sixth floor level. A further apartment located directly below the seat of the fire at second floor level (podium level) was also damaged by fire due to falling fire debris.
- 6.2 Fire and heat penetrated 5 apartments in total activating multiple nozzle heads ranging from 1 to 3 nozzle heads in each apartment, 12 in total. The cause of the fire has been recorded as careless disposal of smoking materials (cigarette butt) into a plant pot on the balcony of the third floor.
- 6.3 Footage of the fire click on the link <https://www.youtube.com/watch?v=2j8zk19qW3Y>
- 6.4 Attendance, eight pumping and one aerial appliance, the fire was extinguished using 5 jets and a aerial appliance used as a water tower.
- 6.5 Eight people in total evacuated the building with no fire related injuries reported.





6.6 All four balconies' glazing units were completely destroyed by the fire with only the steel frame remaining, lateral fire spread did not occur and façade was of brickwork construction.

6.7 The windows located either side of the balconies sustained heat and smoke damage. The Podium level apartment sustained fire damage due to fire debris landing on the podium level adjacent to the apartment.



7 Time line

7.1 Timeline of incident

- Activation nozzle heads, logical order of operation.
- Time of call to LFB 11:26am by on site concierge who observed the fire on the balcony level
- Indicator panel recorded apartment 402 as the first nozzle head that actuated at 11:32.

Time of nozzle head operation	Apartment number /floor	Type of apartment	No, of nozzle heads that operated	Number of nozzle heads fitted
11:32	402/4 th floor	Suite/studio	3	3
11:32	302/3 rd floor	Suite/studio	3	3
11:34	502/5 th floor	Suite/studio	3	3
11:38	602/6 th floor	Suite/studio	1	3
11:51	201/2 nd floor	2 bedroom	2	5

7.2 In the space of 19 minutes from the actuation of the first nozzle head, 5 apartments were exposed to fire and heat activating 12 nozzle heads which is unprecedented in a residential fire. At most only one or two heads activate during a fire.

7.3 Under BS9251:2005 the maximum number of nozzle heads that are designed to operate simultaneously is only 4 and only if the 4 heads reside in one compartment.. However when a AFSS is fed from the cold water boosted supply, more heads can operate as the cold water booster supply is far more powerful than required under the standard

8 Photograph Time line

8.1 **11:32 4th Floor Level/Room 402 Suite/Studio Flat**, six minutes after time of call three nozzle heads actuated throughout the apartment.





8.2 **11:32 3rd Floor Level/Room 302 Suite/Studio Flat**, six minutes after time of call three nozzle heads actuated throughout the apartment





- 8.3 **11:34 :- 5th Floor level/Room 502 Suite/Studio Flat**, Eight minutes after the time of call, three nozzle heads actuated. The kitchen nozzle head spray coverage was found to have been compromised. It is not conclusive, one logical reason provided by the Residential Sprinkler Association was due to the fact that the nozzle head set was located too high in the ceiling void. If it had been installed another 5-10mm higher the front door and kitchen units would not have been wetted by the nozzle head.





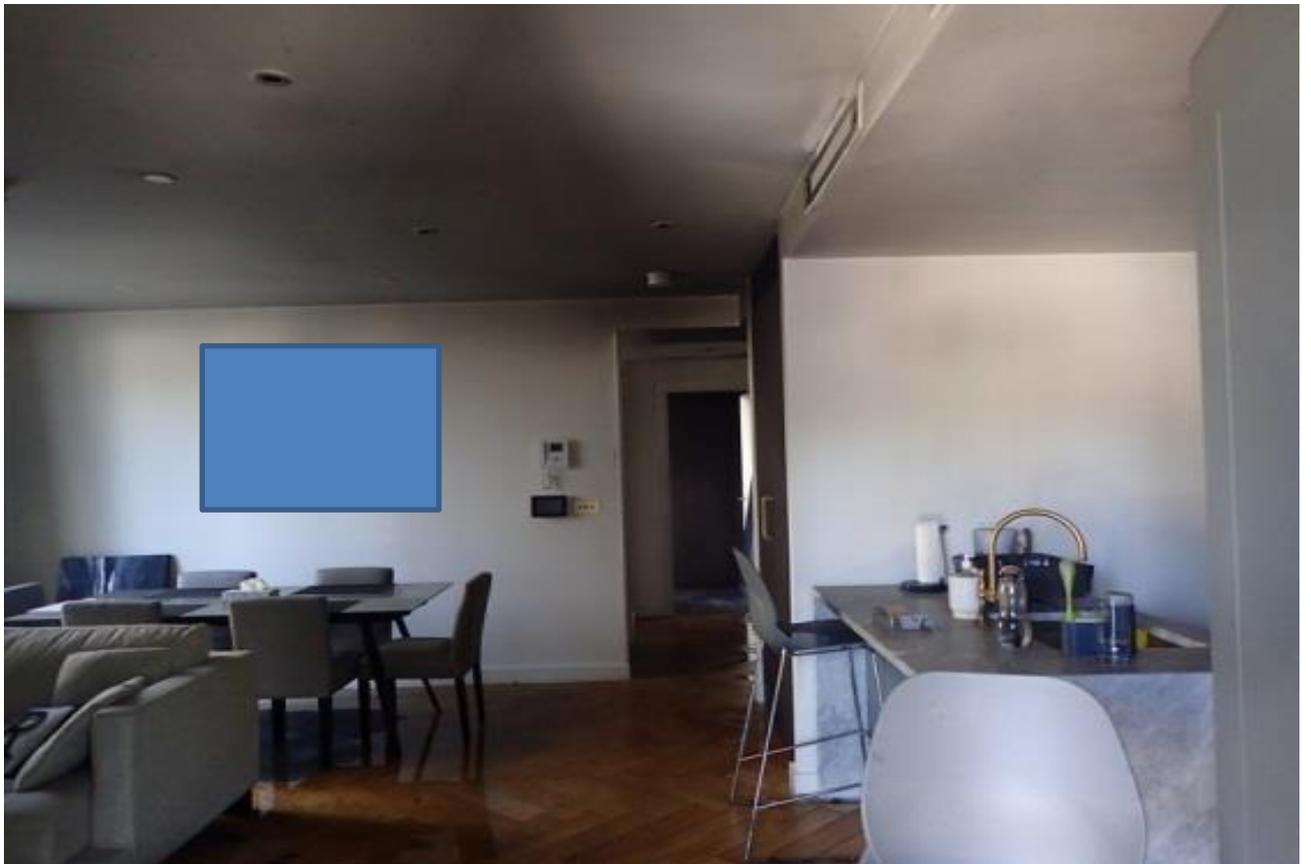
8.4 **11:38 :- 6th Floor level/Room 602 Suite/Studio Flat.** Twelve minutes following time of call, only one nozzle head operated in the living room area compared to the previous apartments where all three nozzle heads operated.





8.5 **11:51:- 2nd Floor level/Room 201, 2 bedroom flat**, Twenty five minutes after time of call 2 nozzle heads operated, 1 in each bedroom.





9 Financial Costs

- 9.1 Installing AFSS during the construction phase is relatively inexpensive in residential blocks of flats costing between *£1000 and £2000 per flat. In comparison the ¹Association of British Insurers (ABI) identify that the cost of the average fire claim for a domestic property was £15000 in 2016. However, there has not been a recent analysis of the value for money of installing AFSS.
- 9.2 The installation of the AFSS allowed an extra layer of fire safety protection to be installed into the apartments. This allowed for a more innovative and flexible design option reducing overall building costs because the need for passive fire measures and further compartmentation is removed.
- 9.3 It should be remembered that for this incident the AFSS suppressed the multi point fires preventing it from spreading into the apartments. If the fire had been allowed to spread the remaining 8 flats located in this elevation would have been involved in the fire. The impact cost to insurers would have been extremely more.
- 9.4 A large fire can disrupt communities, business operations in a matter of minutes. Developers, real estate owners and building operators need to be made aware of the financial benefits and design freedoms provided by AFSS and consider the installation of AFSS at the start of a new project, by doing so gain a significant return on investment.

10 Benefits/Impact of AFSS

- 10.1 The primary objective of a residential AFSS is life safety, controlling any fire that occurs within the protected premises to allow time for occupants to escape or to be rescued. The operation of any AFSS will also provide a significant degree of property protection by minimising damage to the room of origin of the fire and its contents.
- 10.2 AFSS allows freedom of design which in turn can lead to savings in initial capital costs, lifecycle costs and on construction. Within this development, the installation of AFSS was an appropriate and cost effective solution for the open plan flat design.
- 10.3 It was fortunate this was the case, otherwise the outcome of this incident may have been more serious with the potential for five multi point fires which would have seriously compromised the safety of both residents and firefighters.
- 10.4 The fire did not spread within the apartments due to the prompt activation of the AFSS. Fire damage was restricted to the glazing units/frames with heavy smoke logging confined to the ceiling level of the apartments.
- 10.5 The contents/personal possessions contained in the apartments were virtually untouched by the fire, no fire related injuries were reported

*London Assembly "Never again: Sprinklers as the next step towards safer homes" Table 3
Estimates the cost of installing sprinklers in new high rise flats

¹Independent review on Building Regulations and Fire safety written evidence from the Association of British Insurers

11 Water Supply-Cold Water Boosted Supply

- 11.1 Typically in a purpose built apartment block, a tank of water will be pumped to guarantee pressure and flow of cold water services to the flats as it was in this installation. This system can also be used for AFSS supplies however *special measures must be in place to safeguard sprinkler supplies and prioritise them in accordance with the above mentioned standard.
- 11.2 The effective stored volume must be able to provide the AFSS demand for the determined AFSS run time for the installation, with a minimum of 30 minutes duration. Residential x 4 heads operating for x 30mins (49 l/min x 4 x30 = 5880ltrs) provides for a worst case scenario not allowing for the infill, capacity of the tank was 6,300 litres.(60% of full holding is permitted with provable infill)
- 11.3 A permanent record of a system's design data can be found attached or fixed adjacent to or on the sprinkler riser next to the main stop valve.
- 11.4 Where a multi-point fire starts on multiple floors the system may become overrun resulting in the water supply running out /unable to maintain adequate water pressure to provide a flow rate to those nozzle heads which have been activated. This may have been the case if a AFSS capacity tank had been the preferred method.
- 11.5 Photographic evidence identifies that where the nozzle heads actuated the spray pattern/coverage wetting of the walls/ceiling was consistent throughout the majority of the apartments suppressing the fire.
- 11.6 Advantages of the cold-water booster system compared to an independent capacity tank are as follows:

- **Stored water capabilities**

Tanks are likely to be holding more than the sprinkler requirements as they have to allow for domestic usage on top.

Infill rate would normally be greater due to the size infill into the tank.

- **Pump setup**

Daily Running of the pump therefore you are immediately made aware of a defect.

Most pumps are twin or triple pump variable setups allowing for larger flow rates per second

*Where a priority demand valve is fitted, the pump only needs the capacity to run the most unfavourable of one of the other demands, and not both simultaneously.

In the event of an actuation all the available water will be automatically diverted to the sprinkler system

If a shut-off valve is not installed, (a shut-off valve closes on sprinkler activation thus leaving all the power of the pump and the volume of the tank to the sprinkler system only), then the tank must be large enough to hold the water for domestic use plus the sprinkler water for the duration of the chosen run time of the sprinkler system.

Capacity tank and pumps location, first floor plant room



12 Information for Operational Crews

12.1 On arrival crews were unable to immediately interact with the fixed installations including the AFSS due to the lack of appropriate information available on site including:

- No block/schematic plans identifying coverage of the AFSS, location of the AFSS tank room/floor isolation valves provided
- Signage not displayed on the riser cupboard doors housing the floor AFSS isolation valves
- No Premises Information Box

12.2 Following the actuation of the AFSS, water damage can be an issue, particularly if insufficient information is available to allow operational crews to isolate the supply following the successful extinguishing of the fire which was the case with this incident.

12.3 Considerable damage was sustained to a number of riser cupboard doors by crews trying to locate the landing isolation valves. Upon gaining access a number of isolation valves were visible, which one would you isolate?



13 Balcony fires

13.1 Balcony fires, are becoming more frequent. This was the second 8 pump residential fire involving the actuation of multiple nozzle heads in London during June /July 2018. On both occasions the cause of the fire recorded as careless disposal of smoking materials.

13.2 This is supported by The [Building Research Establishment Report, Fire Safety Issues with Balconies](#) carried out for the Department for Communities and Local Government which found that :-

Fires on balconies are increasing:-

- A number of case studies found that fires starting on balconies through careless disposal of smoking materials/barbeques can spread to adjacent balconies.
- Lack of available fire design guidance relating to balconies within approved document B except where a means of escape is provided.
- Building regulations are open to interpretation in the absence of specific spread of flame requirements related to balconies.
- Property developers, specific designers and risk assessors all need to be aware of the potential fire risk.

13.3 [New legislation](#) came into force on 21st December 2018 for the requirements of external balconies in England and Wales, balconies are, for the first time counted as part of the external wall: classified as a "Specified attachment"

13.4 Previous incident, Elma Street, Lewisham.

- Purpose built residential block of flats.
- Date of Incident 20 June 2018.
- Residential apartment, 6 residential nozzle heads actuated suppressing the fire from spreading into the apartment.



14 Conclusions and recommendations

- 14.1 In England residential apartment blocks of over 30m in height must be fitted with AFSS. This residential block was 21m in height. AFSS would not have been installed into this building without the concessions offered in the appropriate building control standards, in this case open plan living).

- 14.2 Without the installation of AFSS, the outcome could have been much more serious and potentially fatal resulting in 5 separate uncontrolled compartment fires located over five floors, thereby significantly increasing the risk to residents and firefighters .
- 14.3 The production of heat and smoke was also greatly reduced and allowed time for occupants to escape to safety by detecting and controlling the external fire and preventing it from spreading to adjoining apartments.
- 14.4 Employing a third party accredited sprinkler contractor is paramount which was the case for this installation. This approach allowed a correctly designed AFSS to be installed to the above mentioned standard reducing the risk to life and the degree of damage caused in a fire event preventing flashover.
- 14.5 Cold water booster supply or capacity tank? If the latter had been chosen due to the multi-point fires the limitations of this system would have been exposed.
- Supply exhausted under 30mins
 - Supply overrun
 - Performance of pumps exceeded
- 14.6 Careful consideration must be given to materials and structural design to mitigate the risk of a balcony fire spreading to other parts of the building.
- 14.7 Consideration should therefore be given to promote the BRE publication, "[Fire Safety Issues with balconies](#)" to Fire Safety Inspecting officers. This approach would allow the dangers of fire spread from balconies to be highlighted to a wider audience property developers, designers, managers and risk assessors. Who need to be mindful of the potential fire risks associated with fires on balconies
- 14.8 A common myth regarding AFSS is water damage. As with many incidents this was no exception due to the fact that inadequate information was available for crews to isolate the supply once the fire was extinguished.
- 14.9 Business continuity. AFSS can help to protect valuable assets (People, buildings, machinery and supplies) from fire, or can significantly mitigate the effects that a fire has upon assets, helping to achieve business continuity as clearly demonstrated in this incident.

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