Inspection of the Mid & West Wales Fire and Rescue Service to consider the effectiveness of its response to domestic dwelling fires

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Inspection of the Mid & West Wales Fire and Rescue Service to consider the effectiveness of its response to domestic dwelling fires

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Contents

Executive summary

1. This report sets out the findings of an inspection of the Mid & West Wales Fire and Rescue Service undertaken in October and November 2024 using the same methodology as that for the inspection of South Wales Fire and Rescue Service undertaken in July and August 2024.

2. The purpose of the inspection was to assess the operational effectiveness of the Service when responding to domestic dwelling fire incidents.

3. The incident type selected for analysis was dwelling fires where fire and heat damage was recorded beyond the room within which the fire had started. These incidents present significant risk to firefighters, trapped occupants and to the dwelling itself.

4. A total of 146 incidents occurring between 1 April 2021 – 31 March 2023 were analysed in detail.

5. The findings of the incident analysis are consistent with that of the South Wales inspection, set out within the report published on 9 October 2024.

6. Given the weight of evidence available to me I consider that the operational tactics employed by the Service, at a substantial number of incidents, have placed firefighters at unnecessary risk and/or resulted in avoidable damage to properties.

7. The underlying reasons for this are that some of the content of operational guidance and training packages still reflects tactics partially introduced in the late 1990s, several of which were not scientifically proven at the time or designed for use within the UK.

8. In Section 2 of this report, I analyse the content of relevant Standard Operational Procedures and Operational Information Notes along with the content of related training packages.

9. There is a lack of clear and consistent alignment between guidance and training materials. There is however some very good content, particularly within the training materials, which is a solid foundation on which to develop high quality operational guidance and training material.

10. The training facilities available to instructors cannot fully recreate scenarios that are reflective of the modern fire environment. There is an opportunity for the Service to send personnel to the Netherlands to view training and test rigs there that if replicated in Wales would address this concern. This opportunity should be seized and acted upon.

11. Operational assurance is a challenge for the Service particularly in remote rural locations.

12. The operational assurance arrangements within the Service largely reflect the available resourcing. There is no dedicated Operational Assurance Team to attend incidents solely for the purposes of active monitoring and to undertake post incident audit and review. Instead, active incident monitoring is undertaken by on duty Tactical Managers. These arrangements are basic, but they have the potential to be effective.

13. There is a well embedded debrief and post incident learning capture process which has the confidence of firefighters. While the issues of concern highlighted through the incident analysis in this report have not been identified and addressed, I was provided with evidence of where improvements have been made because of the operational assurance process.

14. The lack of any available near miss reports from incidents is a concern. I was however provided with an example of when an Officer tasked with fire investigation identified risk critical occurrences at an incident then developed a case study to highlight them to firefighters. This is a positive practice that should be integrated within the operational assurance process as a matter of routine.

15. I have been mindful to try to avoid replicating the recommendations within the South Wales report in this report other than where the issues identified are identical. This is the case in respect of operational guidance and training so in these circumstances I recommend a pan Wales approach (without predetermining the outcome of the forthcoming inspection of North Wales but in anticipating that many of the issues may also be identical).

16. The underlying issues highlighted in this report predominantly relate to legacy National Operational Guidance. The publication in October 2024 of the ‘Foundation for firefighting’ and ‘Firefighting’ operational guidance and the relevant recommendations in this and the South Wales inspection report should serve as a catalyst for the pan Wales development of operational guidance and training based on the most current research and designed in such a way to be of maximum utility to firefighters.

17. The recommendations made in relation to the operational assurance process are tactical rather than strategic in nature but if acted on in fast time I believe will have an immediate and positive impact on firefighter safety and effectiveness.

18. It is important that I again make the point that the observations made in this report are not intended and nor should they be taken as a criticism of Mid & West Wales firefighters, officers or their training instructors.

19. The levels of engagement with all staff throughout the inspection were excellent. Firefighters, officers and training instructors were very receptive to the adoption of evidence-based tactics and enhancements to the operational assurance process.

20. The Service has started to make real tangible progress on previous Thematic Review recommendations which is positive. This momentum should be maintained,

such that I would expect to see all the recommendations made in this report fully addressed by October 2025.

Introduction and background

21. The inspection of Mid & West Wales Fire and Rescue Service (M&WWFRS) during October and November 2024 is the second in a series of three inspections to consider the effectiveness of the Welsh FRS when responding to domestic dwelling fires. This report references the first inspection in the series (South Wales FRS) but is written in such a way so that it can be read in isolation. For that reason, there is significant duplication between the two inspection reports. This duplication occurs predominantly with the explanation of how a fire in a room develops, how the tactics employed by the FRS affect the outcomes of the incident and with the description of the background to the development of recent operational guidance in the UK FRS. There is also some duplication with the findings as many of the issues identified are the same.

22. The incident type presenting greatest risk to firefighters, members of the public and their homes are fires in domestic dwellings, whether they be started accidentally or deliberately. Information relating to these incidents is captured through the Incident Recording System (IRS) and is published on the Welsh Government StatsWales website[1].

23. To maintain consistency, I analysed the same data set as I had for the South Wales FRS inspection. The figures for M&WWFRS are as follows:

- 2020/21 (450 incidents);
- 2021/22 (491 incidents); and,
- 2022/23 (453 incidents).

24. I again focused specifically on dwelling fire incidents where fire or heat damage was recorded beyond the room in which the fire started, referred to from here on in as the Room of Origin (ROO). This is because these are the most serious of this incident type.

25. Over the 3-year period this amounted to a total of 205 incidents, although on analysing each incident log in detail I established that 59 incidents had been incorrectly coded leaving an actual total of 146 incidents that met what I considered to be the true definition of fire or heat damage spread beyond the ROO within a domestic dwelling.

26. The definitive point of reference for any incident is the incident log held on the mobilising system. The incident log is a digital record that is generated from the first 999 call to the Service and contains every single transaction relating to the incident including all messages sent from the incident ground. I was given full access to the M&WWFRS mobilising system by the Chief Fire Officer (CFO). To triangulate the

[1] Fires and false alarms (gov.wales)

information contained within the incident logs I accessed fire investigation reports where they were available.

27. Prior to undertaking the inspection fieldwork, I reviewed all relevant operational guidance and associated training materials which I accessed live through the M&WWFRS intranet (Insight) and pdrPro/Learn Pro Operational Learning System. This consisted of Standard Operational Procedures (SOPs), Operation Information Notes (OINs) and Procedural Guidance Documents (PGDs) for firefighting and operational monitoring along with training materials relevant to the same.

28. The fieldwork included structured interviews with Compartment Fire Behaviour Training (CFBT) instructors, the Operational Procedures and Learning (OPAL) Team, Operational Equipment and Assurance (OEA) Team, the Group Manager with responsibility for fire investigation and station visits at 3 wholetime shift, 2 wholetime day crewed and 3 Retained Duty System (RDS) stations.

29. This report sets out the findings of the inspection and builds on the recommendations made in previous Thematic Review inspection reports.

30. The **first section** of the report contains:

- a review of the data;
- an explanation of how a fire develops within a room;
- how the tactics employed by the FRS affect the outcome of the incident; and,
- what the data shows for M&WWFRS.

31. The **second section** of the report is aligned to the Health and Safety Executive (HSE) publication HSG 65 Managing for health and safety (pre 2013 version) and considers M&WWFRS operational policies, the organisational arrangements to deliver operational policy and how operational performance is monitored, audited and subject to review.

32. The **third section** of the report contains a series of recommendations designed to improve firefighter safety and the operational effectiveness of M&WWFRS.

Section 1

A review of the data - Incident Recording System (IRS)

33. The IRS report for a domestic dwelling fire is typically completed by the Crew or Watch Manager in charge of the first attending appliance.

34. The IRS records the extent of damage caused by the fire along with details of any injuries or fatalities. It also records where there is no structural damage and no firefighting action. An example would be where residual oil in a grill pan momentarily ignites to generate sufficient smoke to actuate a smoke alarm, resulting in the mobilisation of the FRS. This is the largest single subset of data accounting for around 60% of all dwelling fire incidents responded to by M&WWFRS and is shown in Table 1 below.

Table 1: No structural damage or firefighting action (overall %)

	2020/21	2021/22	2022/23
Total incidents	450	491	453
No structural damage	265	298	281
No structural damage %	59%	61%	62%

35. The IRS records whether fire or heat damage is contained to the ROO or if it has spread beyond the ROO. It also records the extent of fire or heat damage at the arrival of the FRS. Table 2 below shows the % of dwelling fires confined to the ROO.

Table 2: M&WWFRS dwelling fires confined to the ROO (overall %)

	2020/21	2021/22	2022/23
Total incidents	450	491	453
Confined to ROO	393	406	390
Spread beyond ROO	57	85	63
Confined to ROO %	88%	83%	86%

36. The subset of incidents where there is fire or heat damage beyond the ROO can be further broken down to incidents where there is (a) no fire or heat damage beyond the ROO on the arrival of the FRS (i.e. the fire is still in the ROO on the arrival of the FRS and then spreads subsequently) or (b) where it is recorded that there is fire and heat damage beyond the ROO on the arrival of the FRS.

37. Table 3 below shows a breakdown of fire and heat damage beyond the ROO broken down into reported as beyond ROO on arrival or fire and heat damage in ROO only on arrival.

Table 3: M&WWFRS dwelling fires spread beyond ROO

	2020/21	2021/22	2022/23
In ROO on arrival	11	18	12
Beyond ROO on arrival	46	67	51
Total fires spread beyond ROO (IRS)	57	85	63

38. As previously stated, of the 205 incidents in the data set, 59 had been incorrectly coded which left an overall total of 146 incidents that fell within the analysis parameters. A typical example of a miscoded fire from the M&WWFRS analysis was where the fire occurred within a caravan as opposed to within a house or a flat. Where a fire starting externally had extended into the property to cause fire or heat damage within a room, which then spread beyond the ROO I included these incidents in the analysis.

39. Table 4 shows a breakdown across the 3-year reference period of the 146 incidents that fell within the parameters of the analysis split between in ROO on the arrival of M&WWFRS or beyond the ROO on the arrival of M&WWFRS.

Table 4: M&WWFRS dwelling fires subject to detailed analysis in this report

	2020/21	2021/22	2022/23
In ROO on arrival	8	15	8
Beyond ROO on arrival	34	45	36
Total fires spread beyond ROO (inspection analysis)	42	60	44

An explanation of how a fire develops in a room within a dwelling

40. The following is intended as a simplified explanation of how a fire develops in a room within a dwelling. It duplicates the corresponding section in the South Wales FRS inspection report published in October 2024 and is provided to set context for the reader without going into excessive detail. It is concerned with a fire that has already ignited in a room within a dwelling and not the mechanisms that cause ignition.

41. For a fire to be sustained it requires heat, fuel, oxygen and an ongoing chemical chain reaction.

42. On the arrival of the FRS a fire in a room within a dwelling will be in one of two states, fuel controlled, or ventilation controlled. The fuel-controlled fire will have sufficient oxygen available such that its growth will be limited only by the item or items (fuel) on fire and their heat release rate (HRR).

43. The HRR is the amount of thermal energy generated by the items (fuel) involved in a fire, measured in Kilowatts (KW) or Megawatts (MW). HRR is not the same as temperature. As an example, a modern single upholstered chair may burn with a flame temperature of 800 degrees centigrade and generate a HRR of 2MW, whereas a modern 3-seater sofa may also burn with a flame temperature of 800 degrees centigrade but generate a HRR of 5MW. Modern, synthetic (plastic) based materials generate a significantly greater HRR than traditional materials. They also consume approximately twice the amount of oxygen than traditional materials to generate the increased HRR.

44. Research demonstrates that an item on fire with a HRR of 2MW (a modern single upholstered chair), can with sufficient available oxygen, cause all the combustible items (fuel) in a room to ignite simultaneously[2]. This transition is called a flashover and will almost certainly result in fire and heat damage beyond the ROO. Suffice to say conditions within a post flashover room are almost certainly unsurvivable for trapped occupants or firefighters wearing personal protective equipment (PPE) and Breathing Apparatus (BA)[3].

45. In the incipient stages of a fire, it is most likely to be fuel controlled.

46. In steady state the concentration of oxygen in air is 21%. A fire becomes ventilation controlled when the oxygen concentration in a room on fire drops from 21%, to below 16%, because of the fire consuming the available oxygen faster than it is replenished by air circulating from outside the room. At this point flaming combustion cannot be sustained and the fire goes into decay.

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[2] Fire Dynamics in Structures| FSRI Safety Academy

[3] Heat Transfer and PPE| FSRI Safety Academy

47. The substantial amounts of international research undertaken over the past 10 – 15 years have shown that in rooms furnished with synthetic based materials this occurs within 2-3 minutes, and before a fire in a room transitions to flashover[4]. In essence, this is no different from the science experiment in which a lit candle placed inside an upturned glass jar will burn out after a few minutes, once it has consumed more of the oxygen within the jar than is needed to support combustion.

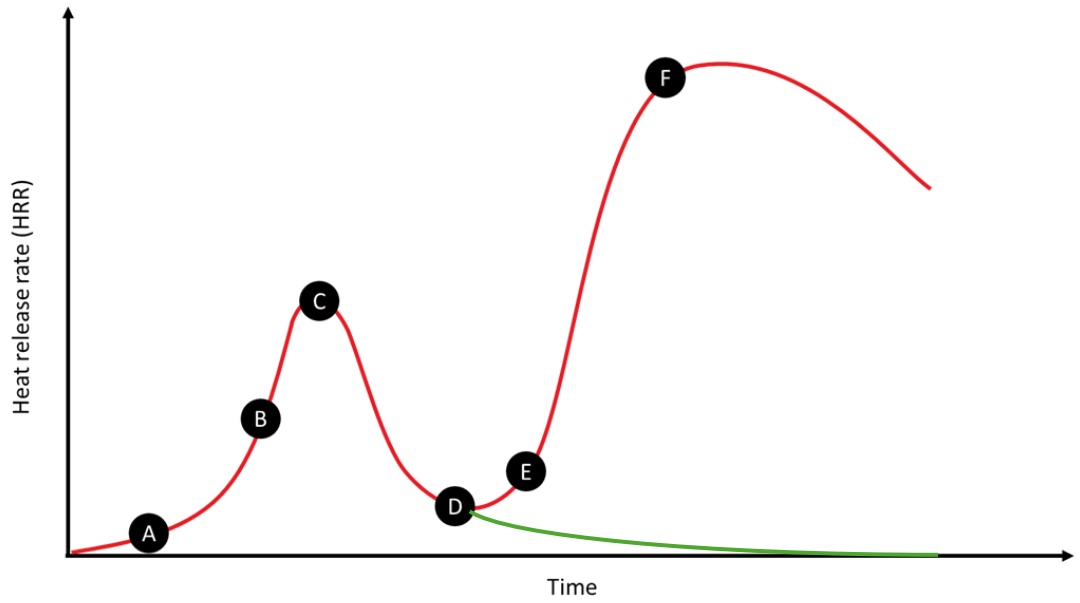
48. A fire in this state can smoulder for an extended period before eventually it will self-extinguish if there is no change to the supply of oxygen to the fire (the ventilation profile). Such a fire will however generate large volumes of turbulent smoke which is itself combustible, and which will contribute to rapid fire development if there is a change in the ventilation profile.

49. While the fire is stable for as long as the ventilation profile remains unchanged it still presents very significant hazards to trapped occupiers and firefighters. In all likelihood it will not extend beyond the room of origin without outside intervention (such as firefighters making entry through an external door and introducing oxygen), nor will it reach flashover.

50. The graph at Figure 1 below shows the typical progression of a fire in a room with a fuel load that has a sufficient HRR to transition the room to flashover (and therefore extend beyond the ROO).

[4] 20150116-ba-ul-fsp-it-depends-descriptive-research-into-fire-growth-and-the-chances-of-survival.pdf (nipv.nl) (Dutch research)/All UL FSRI research studies

Figure 1: Typical progression of a fire in a room with a fuel load that has a sufficient HRR to transition the room to flashover



51. Points A - C indicate the development of a fire in a closed room from ignition through to the point where the oxygen content in the room drops below 16%.

52. Point C – D shows a reduction in HRR because of there being insufficient oxygen available within the room to sustain flaming combustion. The fire at this stage is ventilation controlled. If there is no outside intervention, the fire will slowly decay, smoulder and self-extinguish, as shown by the green line.

53. Point D – F shows a change in the ventilation profile which can occur when firefighters make an entry into the property to fight the fire. This is because firefighters often do not close over the door through which they have made entry into the property, to control the inflow of oxygen. At this point the HRR and temperature accelerate rapidly. If air flow into the room isn't controlled or if enough water isn't directed onto the fire or into the room on fire, then the room can transition to flashover in less than a minute.

54. This is an extremely hazardous situation and has resulted in firefighter injuries and fatalities in the UK and across the world.

55. Science dictates that the high pressure generated by the expansion of gases heated by the fire will move towards the lower pressure at the ventilation opening and that the hot fire gases will move towards the cooler air at the ventilation opening. This can place firefighters in between the fire and the outlet (exhaust) vent for the fire gases. In the absence of refuge behind a closed door, their only defence in these circumstances is a high flow rate of water directed at the fire.

56. The combination of uncontrolled ventilation and/or the utilisation of ineffective firefighting tactics has been a factor in almost every UK firefighter fatality occurring within a structure fire in the last 30 years[5].

57. It may be very difficult, if not impossible, for the first attending Crew or Watch Manager to determine the status of the fire on their arrival. Flaming combustion will be evident with a fuel-controlled fire. A ventilation-controlled fire however is likely to generate large volumes of turbulent smoke which would make it very difficult for the first attending Crew or Watch Manager to determine whether there was fire or heat damage beyond the ROO even if they were undertaking thermal scanning using a Thermal Imaging Camera (TIC).

58. As stated previously international scientific research[6] shows that any fire involving an item or items which have a sufficient HRR to transition the compartment to flashover, will become ventilation controlled with 2-3 minutes unless there is an unlimited supply of oxygen available.

59. Typically, this would require the room door to be open and the front or back door to the property or several large windows to be fully open. In Mid & West Wales and across the UK, other than on the warmest of days, this is unlikely[7].

60. That being so, it is possible that many of the fires subject to this analysis were contained in the room of origin at the time the FRS arrived. Some of the fires that extended beyond the room of origin most likely did so because of the actions of firefighters in re-ventilating the fire prior to the application of sufficient volumes of water, by them not controlling the door by which they entered the property.

61. In the section on incident analysis, I highlight the number of incidents when the first attending Crew or Watch Manager describes smoke issuing from the property. This would be an indication of an under ventilated fire.

62. In the interests of accuracy, I should highlight the deficiencies within the IRS in this context. Field 8.20 of the IRS asks, 'What was the extent of flame and/or heat damage on arrival?'. A drop-down menu then offers several choices including 'Limited to the room of origin', 'Limited to the floor of origin (not whole building)' right the way through to 'Whole building'. Depending on the position of the fire within a compartment it is possible that there would be heat damage in an adjacent compartment without fire spread, for example a synthetic based material starting to

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[5] Fatal incident reports – Wealmoor Warehouse fire, Atherstone on Stour/ Balmoral bar fire, Edinburgh/Shirley Towers, Southampton/Bethnal Green Road, London et al

[6] All UL FSRI studies 2010 – present, Brandweeracadamie (2014, 2015, 2016, 2018)

[7] Equations 18 and 19 (p.91 -92) within 'Enclosure fires' written by Lars-Goran Bengtsson reference Thorntons rule and the calculations for required ventilation openings to generate HRRs (1m x 1m = 1.5 MW, 2m x 1m = 4.5 MW, 1m x 2 m + 1m x 1m = 10.5 MW)

melt. To remove any ambiguity this question might be better phrased ‘What was the extent of fire damage on arrival?’.

63. For most incidents, the messages on the incident log made it clear that there was fire and heat damage beyond the ROO. As a due diligence exercise, I reviewed where available fire investigation reports for incidents where it was reported through the IRS that there was fire and heat damage beyond the ROO on the arrival of the FRS.

64. The photographic evidence available to me showing fire progression confirmed that there was substantial fire damage beyond the room of origin.

65. What the photographs also showed was that the initial tactics employed (high pressure hose reels capable of low flow rates on an interior attack) would have exposed firefighters to unnecessary risk and would have taken longer to supress the fire than using a low pressure, high flow alternative (therefore resulting in unnecessary damage).

66. At one incident the Station Manager tasked with the fire investigation developed a case study to show how wind driven fire conditions had occurred and how alternative tactics would have reduced risk to the responding crew. I cover this in further detail under the section on Incident Monitoring.

How the tactics employed by the FRS affect the outcome of the incident

67. Over the 3-year data analysis period there was a total of 1394 domestic dwelling fire incidents across Mid & West Wales at which for 205 incidents fire or heat damage was recorded beyond the ROO.

68. Through access to the M&WWFRS mobilising system I was able to analyse the incident logs of each of the 205 incidents in detail. Through this analysis I established that 59 incidents did not meet the criteria of fire and heat damage beyond the ROO so were discounted from any further analysis leaving a total of 146 incidents.

For each incident I recorded the following information:

- The response time of the first attending appliance (taken from time of alert to time in attendance)
- The elapsed time from the time of the first appliance in attendance to the time of the first informative message which stated the operational tactics in use
- The elapsed time from the time of the first appliance in attendance to the time of the second appliance in attendance
- The content of the first informative which stated the operational tactics in use (i.e. 2BA 1HRJ which stands for a 2-person Breathing Apparatus team deployed with a high-pressure hose reel)

- Any significant information from the first caller or first appliance in attendance (i.e. ‘Smoke issuing’ or ‘Well alight’)
- Room of origin and property type (i.e. Kitchen, Living Room, Bedroom, Terrace, Semi Detached, Detached)
- Any relevant information from the Stop[8] message including the extent of overall damage

69. This information allowed me to establish what the initial caller had witnessed and how long it had taken the first fire appliance to arrive from that point. For example, a caller reporting heavy smoke issuing is an indication of a ventilation-controlled fire. Similarly, I could establish what the first attending Crew or Watch Manager had witnessed to give me a sense of the state of the fire at that point and how it might have developed from the time of the first call.

70. The room of origin gives an indication of the fuel loading, and the type of property gives an indication of the likely size of the compartments within the property. As an example, a 3-seater sofa in a living room or a mattress on a king size bed in a bedroom can generate a HRR of 5MW whereas chipboard kitchen units may only generate a HRR of 1.5MW. The intensity of a bedroom or living room fire is therefore likely to be greater than that of a fire in a kitchen.

71. The first informative message gives definitive information on the tactics in use at first intervention which is critical to the subsequent development or otherwise of the incident. The extent of damage, typically stated on the Stop message confirms the amount of overall damage sustained at the dwelling.

72. At the time of this inspection (October/November 2024) the extant FRS National Operational Guidance (NOG) for dwelling fires was contained predominantly within ‘Foundation for firefighting’, ‘Firefighting’ and ‘Fires in buildings’. ‘Foundation for firefighting’ and ‘Firefighting’ were published on 1 October 2024.

73. FRS NOG can best be described as generic risk assessments presented in the form of hazard and control measure statements which are developed by the National Fire Chiefs Council (NFCC) for policy writers within each FRS to use to form the basis of local Standard Operational Procedures (SOPs) or equivalent. NOG also includes a small number of ‘Foundation’ publications which provide technical information to support Operational Guidance. Once such example is ‘Foundation for firefighting’.

74. I will address NOG and M&WWFRS SOPs and Operational Information Notes (OINs) in so far as they concern dwelling fires later in this report but for the purposes of this section, I offer the following definitions which are deliberately simplified and

[8] A Stop message is sent from the incident ground by the Officer in Charge to confirm that no further FRS resources will be required at the incident

assume no knowledge on the part of the reader. These definitions, offensive exterior attack' and 'offensive interior attack', are drawn from the Dutch 4 Quadrant Model[9].

75. Similar terminology has been introduced within 'Firefighting' (proactive exterior fire attack and proactive interior fire attack') but the Dutch 4 Quadrant Model is well established, recognised and long predates the 'Firefighting' operational guidance.

76. A Crew or Watch Manager in charge of the first appliance to arrive at a dwelling fire incident should undertake an initial assessment of the scene to gather hazard information to inform decision making in respect of the control measure tactics they will employ to safely resolve the incident.

77. International research[10] identifies that the most effective control measure tactic to reduce risk to firefighters and trapped occupants at a dwelling fire is to apply water onto the fire or at least into the room on fire in the shortest possible time. The quickest method to do this is to direct water into the room from outside the structure using either a high-pressure hose reel jet or a low-pressure jet on a straight stream which in M&WWFRS will be via a 45mm delivery hose (preferably the latter for reasons explained below). For the purposes of this report, I will refer to this control measure tactic as an 'offensive exterior attack'. To be effective it is however reliant on using sufficient flow rate alongside the correct techniques to minimise air entrainment and maximise internal water coverage within the compartment.

78. An offensive interior attack is when firefighters, typically in 2-person team multiples wearing BA (from here on in referred to as a BA team), enter the affected property to locate and then fight the fire with some form of firefighting media. This can take longer to achieve, even when the location of the fire, and the quickest route to it, is known.

79. This is because firefighters must progress through heavy smoke, heat and humidity while manoeuvring a high-pressure hose reel or a low pressure 45mm delivery hose, sometimes through several rooms and around numerous obstructions.

80. At this point it is necessary to make a distinction between the capabilities of the high-pressure hose reel versus the low pressure 45mm delivery hose.

81. Every fire appliance in M&WWFRS carries 2 x high pressure hose reels. They are stowed in lockers on either side of the fire appliance and coiled on a drum for ease of deployment. Each hose reel consists of 3 x 20m lengths of 19mm diameter hose with the final length of hose terminating in a branch (the device that controls the flow of the water discharged out of the end of the hose, usually supplied with a pistol grip). They operate at between 25 – 30 bar pressure and can flow around 110 litres of water per minute (lpm). This is known as the flow rate. The primary advantage of the high-

[9] 201411-BA-Quadrant-Model-for-Fighting-Structure-Fires.pdf (nipv.nl)

[10] 20170926-BA-The Offensive exterior approach (nipv.nl)/All UL FSRI research

pressure hose reel is that it can be quickly deployed and that it is easier to manoeuvre than a low pressure 45mm delivery hose. A significant disadvantage is that the 110 lpm flow rate is inadequate to effectively supress a fully developed (post flashover) fire in a room.

Note: Hose reel tubing of 22mm diameter provides almost twice the flow rate of 19mm hose reel tubing and is in use in several UK FRS[11].

82. Each fire appliance in M&WWFRS carries 4 x 25m lengths of 45mm low pressure delivery hose and 6 x 25m of 70mm low pressure delivery hose. At one end of the hose is a male coupling and at the other end of the hose is a female coupling. The male coupling on the first length of hose is inserted into an outlet (delivery) on the fire pump and the branch is inserted into the female coupling at the other end of the hose. If more than one 25m length of hose is required, the male coupling on the second length of hose is inserted into the female coupling on the end of the first length of hose and so on until the required total length of hose is reached. The total length of hose is known as a line. In M&WWFRS there are typically 3 delivery outlets on fire appliances so each appliance can supply 3 low pressure hose lines consisting of 2 lengths of 70mm and 2 lengths of 45mm hose or any combination thereof.

83. The 70mm low pressure delivery hose is used to supply water from a fire hydrant into the fire appliance water tank to augment the water supply or to initiate a hose line prior to adding low pressure 45mm delivery hose at the end of the line to be used on an interior attack, as it is easier to manoeuvre than the 70mm variant. Appliance tanks in M&WWFRS hold either 1800 or 2300 litres of water.

84. A low pressure 45mm delivery hose typically operates at between 3 – 7 bar pressure and can flow up to 965 lpm dependent on the type of branch utilised. The primary advantage of the low pressure 45mm delivery hose is that the flow rate is sufficient to effectively supress a fully developed (post flashover) fire in a room. It is however more difficult to manoeuvre than a 19mm high pressure hose reel. Hose management can be a physically demanding task which requires regular practice to perform effectively.

Note: Research undertaken through the Building Disasters Assessment Group (BDAG) following the 11 September 2001 terror attacks identified that 51mm hose provides greater flow rates than 45mm hose in a high-rise scenario although the same is true for any structure fire[12]. Several UK FRS utilise 51/52mm low pressure delivery hose.

85. In some UK FRS fire pumps are equipped with flow meters which allow the pump operator to observe the actual flow they are delivering to the firefighters through the low-pressure hose line. M&WWFRS pumps are not equipped with flow meters, but

[11] Flow method | Fire Protection Association (thefpa.co.uk)

[12] Fire Service Circular 55-2004, The Building Disaster Assessment Group – Key Research Findings

this is something that they should consider providing as it is difficult for a pump operator to accurately estimate flow rates without them.

86. M&WWFRS training packages cover flow rates and refer to the fireground calculation developed by the late Paul Grimwood to determine the Optimum (or Tactical) flow rate with which to attack a fire. The training packages do not expressly reference peak HHR associated with typical room types although there is a presentation developed by Paul Grimwood from the now archived Eurofirefighter website accessed via the National Operational Guidance section of the OPAL home page on the Service intranet that does provide input on HRRs. I will return to this point in Section 2 of this report when reviewing training package content.

87. At all 146 incidents at least one high pressure hose reel was utilised. From analysis of the incident logs, it is almost certain that the high-pressure hose reel was the first and subsequent firefighting media deployed, and at almost all the incidents in an offensive interior attack. As an example, the first informative message on almost every occasion was either 2BA 1HRJ or 4BA 2HRJ which means a BA team of 2 firefighters equipped with a high-pressure hose reel or 2 x BA teams of 2 firefighters each equipped with a high-pressure hose reel.

88. At only 13 incidents was a low pressure 45mm delivery hose stated as being utilised. However, at 115 of the 146 incidents the Crew or Watch Manager completing the IRS recorded that there was fire or heat damage beyond the ROO on their arrival which indicates a fully developed (post flashover) fire.

89. On a small number of informative message reference was made to a safety jet. This is a line of low pressure 45mm delivery hose which should be charged with water and of equal length to any hose line (high or low pressure) deployed for the purposes of interior attack. It is intended to be available for use should there be any adverse development with the incident, particularly one that renders the primary attack line inoperable. While the logic for this is sound, it does not negate the need for the primary attack line to be capable of effectively dealing with any fire for which it is deployed.

90. A safety jet deployed outside the dwelling primarily as a back-up will be of no use to BA teams deployed on an interior attack with a high-pressure hose reel in the event of a deterioration of the fire conditions.

91. By the time any subsequent BA team had deployed the safety jet it would be too late to mitigate the effects of rapid-fire development on any BA teams already within the dwelling.

92. On station visits firefighters stated to me that they had attacked dwelling fires externally when the fire had vented through a window on their arrival. There were a small number of incident logs when the first informative message expressly stated that the fire was being fought externally mostly due to the severity of the fire but in some instances because the roof of the property was involved. Having reflected on the comments from firefighters I believe that they have attempted to attack the fire externally as an initial tactic but that this has been more of an instinctive than deliberate action. I believe it is most likely that they have used a high-pressure hose reel (as

opposed to a 45mm low pressure hose line with a much higher flow rate) and that the direction of the stream may not have achieved optimal water distribution in the fire compartment. This would account for why the tactic would have had limited success and that fire and heat damage would have been subsequently recorded beyond the ROO.

93. I expressly asked firefighters how they attacked a fire when deployed on an offensive interior attack. The responses varied dependent on the levels of exposure the firefighters involved had to dwelling fires (mostly them having had very little) so it was not possible for me to form a definitive conclusion around tactics commonly employed.

94. Over the last two decades UK firefighters have been trained to cool fire gases using pulses of water on a spray setting from a high-pressure hose reel as they progress towards the fire. This will almost certainly be ineffective against a high HRR fire. It can result in firefighters being subject to excessive thermal insult and unnecessary damage being caused to the property through taking longer to control the fire.

95. Dutch research demonstrates that arching a straight stream of water from a low-pressure high flow delivery hose achieves greater temperature reductions than pulsing with a high-pressure hose reel when advancing towards a fire[13]. In addition, it was found to be an easier technique to achieve than pulsing in a spray pattern.

96. A low-pressure delivery hose can also achieve a substantial reach (more than that achievable by a high-pressure hose reel) which places a greater distance between the firefighters and the fire thus reducing thermal insult.

97. I return to these issues in greater detail further on in this report however one of the Dutch principles set out within the 2018 publication 'The Renewed View of Firefighting'[14] is of relevance here:

'Gas cooling has limitations and is predominantly effective in small spaces (maximally 70 m2 and with a maximum height of 4 metres) (Lambert & Baaij, 2011). It is important to keep the depth of the attack as short as possible and to apply water to the fire as quickly as possible. Extinguishing the fire is the best form of gas cooling'.

[13] 20211207-BA-When-water-goes-up-in-smoke.pdf (nipv.nl)

[14] 20180423-BA-The-Renewed-View-on-Firefighting.pdf (nipv.nl)

What the data shows for M&WWFRS

98. To help inform my analysis I created a table for the 3-year data set that captured critical information that described the state of the fire from the perspective of the first arriving Crew or Watch Manager. Despite the exact terminology differing slightly, I was able to determine two distinct groupings.

99. The first was when the property was described as ‘well alight’ or words to that effect. This indicated to me a well-developed post flashover fire that may well have spread beyond the ROO on the arrival of the FRS. This amounted to 73 incidents from the 146 total.

100. The second was where the term ‘smoke issuing’ or words to that effect were used. This indicated to me a ventilation-controlled fire that was unlikely to have spread beyond the ROO on the arrival of the FRS. This amounted to 23 incidents from the 146 total.

Table 5: Incident ground messages describing the state of the fire on arrival at the incident

	2020/21	2021/22	2022/23	Total
Well alight	28	25	20	73
Smoke issuing	6	6	11	23
				96

101. At all 73 incidents when the property was described as well alight a high-pressure hose reel flowing in the best case 110 lpm and almost always on an offensive interior attack was utilised. On occasions this has almost certainly exposed firefighters to peak HRRs well in excess of what a high-pressure hose reel is capable of suppressing.

102. At all 23 incidents when smoke was described on arrival of the FRS as issuing from the property, thus indicating a ventilation-controlled fire contained to the ROO, fire and heat damage beyond the ROO has subsequently been recorded as having occurred. This strongly suggests that full room involvement and fire spread has occurred after the deployment of firefighters on an offensive interior attack using a high-pressure hose reel. It is likely that this has happened through an absence of door control at the point of entry thus causing the fire to become reventilated with the corresponding rapid increase in temperature and HRR that is more difficult to supress with a high-pressure hose reel capable of a low flow rate. The heightened risk to firefighters and of additional damage to the property will be self-evident in these circumstances.

103. At 31 further incidents the Crew or Watch Manager completing the IRS stated that the fire was in the ROO on their arrival but subsequently spread beyond the ROO. At 30 of the 31 incidents the first tactic employed was an offensive interior attack using a high-pressure hose reel. This strongly suggests that insufficient weight of attack combined with the absence of ventilation control has contributed to the deterioration

of the incident following the arrival of the FRS. The heightened risk to firefighters and of additional damage to the property will again be self-evident in these circumstances.

104. Not all the 73 fires at the incidents described as well alight on the arrival of the FRS will have been burning at peak HRR. Some of the response times to these incidents were in excess of 20 and on one occasion 30 minutes which was typically significantly longer than for the South Wales analysis. In these circumstances much of the available fuel may have been consumed by the fire prior to firefighters commencing their attack resulting in considerably lower actual HRRs.

105. However, given the weight of evidence available I consider that the control measure tactics employed have on a substantial number of occasions resulted in firefighters being unnecessarily exposed to a level of hazard that had the potential to cause serious injury or worse and/or that avoidable damage to property has occurred.

106. In the next section of this report, I consider the underlying causes as to why this might be.

Section 2

Operational policy – background

107. Regulation 3 of the Management of Health & Safety at Work Regulations 1999 places a duty on employers to make a suitable and sufficient assessment of the risk to the health and safety of its employees to which they are exposed to while at work. FRS are therefore required to produce risk assessments setting out hazards and control measures for all activities including responding to dwelling fires.

108. The NFCC produces NOG on behalf of the FRS sector across the UK. NOG can best be described as incident specific generic risk assessments presented in the form of hazard and control measure statements which are developed nationally for policy writers within each FRS to use to form the basis of local Operational Risk Assessments, SOPs or equivalent. This is intended to assist the FRS to meet its duties under Regulation 3 of the Management of Health & Safety at Work Regulations 1999.

109. When NOG was conceived the intention was to replace all previous nationally published FRS guidance (Generic Risk Assessments (GRAs), Fire and Rescue Service Manuals, Dear Chief Officer Letters etc) by consolidating it in one place and with a structure that was simple to understand and easy to navigate. The following description is copied directly from the NOG website[15]:

'Operational Guidance spans a wide range of activity. There is a structure to make sense of it all; it uses the hazards encountered at incidents and the measures used to control or eliminate them. The guidance is structured so that it starts with the elements that affect all incidents, then explores the environments in which fire and rescue services work, and finally the activities that are carried out'.

110. At the time of writing the 'Foundation for firefighting', 'Firefighting' and 'Fires in buildings' is the relevant extant NOG in the context of this inspection. 'Firefighting' and 'Fires in buildings' fall within the 'Activity' section of NOG.

111. The 'Foundation for firefighting' and 'Firefighting' were published on 1 October 2024 to replace the legacy operational guidance 'Fires and firefighting'. Both pieces of guidance have not yet been adopted by M&WWFRS who are still utilising 'Fires and firefighting' which was archived by the NOG Content Assurance Officer on 1 October 2024.

112. The content of 'Fires and firefighting' was largely based on the Fire and Rescue Service Manual 'Compartment Fires and Tactical Ventilation' which was first published in 1997 to replace amongst others the legacy Manual of Firemanship Book 6a 'Practical Firemanship' (the legacy Manuals date back many years hence the archaic and sexist terminology). The contents of Book 6a were to an extent still based on the

[15] About Operational Guidance - NFCC

essays of James Braidwood (the founder of what is now the London Fire Brigade and the first CFO to have introduced internal firefighting) written in the 1800s and which strongly advocated tactics such as controlling the flow of oxygen into a structure (anti ventilation) along with applying enough water onto a fire in the shortest possible time (all the control measure tactics advocated through international research and supported by science).

113. 'Compartment Fires and Tactical Ventilation' was strongly influenced by two studies commissioned by the Fire Research Development Group in 1994, and which are referenced in the 'Compartment Fire Behaviour Training' section of the Thematic Review report on Operational Training[16]. These reports considered firefighting tactics developed in Sweden and the approach to tactical ventilation utilised in America at the time. The reports recommended both tactical approaches for adoption by the UK FRS. It should be noted that the intent of both reports was to reduce losses to the insurance industry rather than to achieve any improvements to firefighter safety.

114. The Swedish approach[17] had been developed by Matts Rosander (a fire behaviour training instructor) and Krister Gisselson (a fire engineer) in the late 1970s in response to a spate of firefighter fatalities at incidents in Sweden. This consisted of a full system inclusive of new equipment, tactics and training facilities.

115. The Rosander and Giselsson system was designed primarily for use in Swedish apartments built from concrete, that were well insulated, with triple glazed windows that could be expected to still be intact when the FRS arrived. Fires in these circumstances will almost certainly be ventilation controlled. Unlike in the UK and in M&WWFRS, BA teams in Sweden consist of three firefighters. The third firefighter, who performs the role of team leader, holds the door closed behind the two remaining firefighters in the team to prevent the ingress of oxygen into the room on fire, thus limiting the chances of rapid-fire development. Critically, the system was only ever intended for use in small residential compartments with limited fire loads (and therefore HRR potential) when compared to larger commercial or industrial compartments.

116. When creating their system, Rosander and Giselsson spent two years working with a manufacturing company to develop the Fogfighter branch. This became the universally used firefighting branch in Sweden for over 20 years. It was designed to have the optimum droplet size on a spray setting for the purposes of cooling fire gases through pulses of spray as the firefighters progressed through the structure towards the room on fire. It was (and still is) used with low pressure 38mm delivery hose and can deliver a flow rate of 300 lpm. This cooling of fire gases through the pulsing technique combined with controlling the inflow of oxygen is what in very simplistic terms prevents a ventilation-controlled fire developing as rapidly as is seen in Figure 1 in Section 1 of this report.

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[16] Thematic Review of operational training within the Welsh Fire and Rescue Services

[17] This description is taken from a comprehensive report into NOG written in 2017 by Lee Johnston, a Station Manager in West Sussex FRS

117. Once the firefighters close in on the room on fire, they switch from pulses of water in a spray pattern at the branch to a straight stream of water to extinguish the fire with the maximum achievable flow rate.

118. In M&WWFRS (and across much of the UK), the door through which firefighters enter a property is not routinely controlled to prevent the inflow of oxygen other than at incidents at high rise flats when smoke curtains are now deployed as a matter of procedure.

119. As has been demonstrated through the analysis of incident data in Section 1, the default firefighting medium in M&WWFRS is the 19mm high pressure hose reel which is capable of a flow rate of 110 lpm on a straight stream but in practice would deliver far less than 110 litres each minute when discharging pulses of water using a spray pattern for the purposes of gas cooling when progressing towards the fire. The pulsing technique, albeit with a 19mm high pressure hose reel as opposed to a low pressure, high flow delivery hose, is the only substantive element of the Rosander and Giselsson system that has been adopted and embedded as a tactic across the UK and within M&WWFRS.

120. The position is compounded when considering the American approach to ventilation advocated within 'Compartment Fires and Tactical Ventilation', namely 'vent early, vent often' which is the opposite of what the UK FRS had practiced up until 1997 when ventilation overwhelmingly took place only once a fire was extinguished.

121. There are many differences between FRS in the UK and Fire Departments in America. Fire stations in America are typically crewed by an Engine Company and a Ladder Company. Both will typically arrive at an incident at the same time.

122. The Engine Company provide large volumes of water for the purposes of offensive exterior or interior attack through 1 ½, 1 ¾ or 2-inch diameter low pressure delivery hoses (38mm, 45mm or 51mm). In America the domestic water supply is drawn from the fire main (400mm diameter plus) which is the opposite to the position in the UK where fire hydrants are located on domestic water mains (100mm diameter) so there is usually no shortage of water available in urban areas across America.

123. Ladder Company firefighters have typically utilised their apparatus (the equivalent of an extendable turntable ladder in the UK) to access the roof to cut a vertical outlet (exhaust) vent through which smoke and fire gases exit the structure using natural buoyancy. When coordinated with an offensive interior attack to supress the fire this is undoubtedly an effective tactic, (notwithstanding the damage to the roof made by creating the vertical vent) and will result in improved conditions for firefighters and trapped occupants. If, however, water is not applied to the fire at the same time as the fire is ventilated then rapid-fire growth inevitably follows when modern building contents are involved leading to a significant deterioration in conditions.

124. This technique may well have been successful in the days when lower HRR building contents would have been involved in fire as the fires may well have been fuel controlled rather than ventilation controlled. There is however very little, if any, margin

for error with the typical modern fire loads of today when dealing with a ventilation-controlled fire. As a result of research carried out by Underwriters Laboratories Fire Safety Research Institute (UL FSRI) many US Fire Departments no longer practice this tactic.

125. Vertical ventilation (creating an outlet vent in the roof) is not a tactic which has gained significant traction in the UK. Horizontal ventilation through opening doors or windows is however much easier to achieve. Up until 1997 and the publication of 'Compartment Fires and Tactical Ventilation' UK firefighters would not routinely ventilate at fires within buildings until the fire had been extinguished. That undoubtedly changed after 1997.

126. 'Compartment Fires and Tactical Ventilation' strongly advocated the advantages of ventilation but was less explicit over the disadvantages and the imperative to simultaneously apply water to the fire at the same time as ventilation is undertaken. To an extent this was reflected in the 'Fires and firefighting' and 'Fires in buildings' NOG although there were/are several explicit references to the effects of uncontrolled ventilation on a fire without concurrent water application within NOG. This has been addressed to an extent in 'Foundation for firefighting' and 'Firefighting'.

127. The following is copied directly from the Executive Summary of the 2017 report authored by Station Manager Lee Johnston of West Sussex FRS entitled 'Firefighting guidance in the UK: A proposal to move to an evidence-based strategy'.

'UK firefighting guidance underwent a complete transformation between 1994 and 1997. Following a programme of research aimed at reducing the financial losses from large fires, UK fire service guidance began advocating an American-style ventilation strategy combined with a Swedish-style suppression strategy.

However – neither strategy was fully implemented; neither was fully suited to the UK fire environment; the two approaches had not been designed to work together; US ventilation theories were not based on scientific evidence and have since been disproved; and both the US and Sweden have moved on in many ways from the strategies that they used in the 1990s, while the UK has not'

128. In my view this is an accurate reflection of the position in the UK and in M&WWFRS in respect of the control measure tactics typically employed at dwelling fires and why that is.

Operational policy – M&WWFRS SOPs and OINs

129. Operational guidance within M&WWFRS is contained within SOPs and OINs. There is also a NOG section on the OPAL intranet page from which the now archived 'Fires and firefighting' operational guidance can be accessed along with a presentation from Paul Grimwood under the heading '**Firefighting flow rates guide**' mentioned previously in Section 1 of this report.

130. M&WWFRS SOPs are aligned to the legacy GRA index that was replaced by NOG. GRAs were published by the UK Lead Government Department for the FRS which at various times has transitioned between the Office of the Deputy Prime Minister, the Department for Communities and Local Government (and various iterations thereof) and the Home Office. The purpose of GRAs was broadly similar to that of NOG, to provide guidance to FRS policy writers when developing local Operational Risk Assessments, SOPs or equivalents.

131. M&WWFRS SOP index is structured as follows:

- Section 1 – Responding to an emergency
- Section 2 – Rescues
- Section 3 – Fighting fires
- Section 4 – Incidents involving Transport Systems
- Section 5 – Generic hazards
- Section 6 – Other procedures

132. For the purposes of this inspection, I reviewed the following SOPs in detail:

- SOP 3.01 Fires in buildings
- SOP 3.02 High rise firefighting
- SOP 3.06 Positive pressure ventilation (PPA/PPV) – archived on 8 November 2024
- SOP 5.08 Backdraught and flashover – archived on 8 November 2024
- SOP 6.02 Breathing Apparatus procedures

133. The format of the M&WWFRS SOP is standardised. At the beginning of the SOP is an Aide Memoir which lists in bullet point format prompts on actions to be taken on arrival at the incident followed by the Sections listed below:

1. Scope
2. Specific Hazards & Risks
3. Key Control Measures
4. Operational Procedures
5. Additional Considerations
6. References

134. M&WWFRS OINs cover 7 category areas.

1. OIN 1 – Transport
2. OIN 2 – Incident Command
3. OIN 24 – Breathing Apparatus
4. OIN 3 - Operations
5. OIN 4 - Environmental Protection
6. OIN 5 – Fires and firefighting
7. OIN 6 – Fires in tall buildings

135. Fires and firefighting OINs were introduced on 8 November and replaced **SOPs 3.06 Positive pressure ventilation (PPA/PPV)** and **SOP 5. 08 Backdraught and flashover**. For the purposes of this inspection, I reviewed the following OINs in detail:

- OIN 5.04 Backdraught and flashover
- OIN 5.05 Tactical Ventilation
- OIN 5.07 Firefighting techniques and flow rates

136. The format of the M&WWFRS OIN is standardised and consist of the following sections:

- Introduction
- Service Policy
- Hazards
- Operational Considerations
- Reference Documents

137. The 'Fires and firefighting' Operational Guidance accessed via the OPAL intranet page is a PDF version of the content that was accessible through the NOG website up until it was archived after being superseded by 'Foundation for firefighting' and 'Firefighting' on 1 October 2024.

138. On the structured interview with the OPAL and OEA Teams I was given copies of a draft **OIN Operational Monitoring** (no ION designation, v01 issued November 2024) and a draft Procedural Guidance Document **PGD OEA 2.0 Operational Monitoring**. I will reference these both in detail later in this report under the 'Organisational arrangements for monitoring, reviewing and auditing operational performance section'.

M&WWFRS SOP and OIN content analysis

139. M&WWFRS does not have a single definitive Policy that sets out its position in respect of firefighting tactics in dwellings or any structure fire for that matter. Structural firefighting guidance is instead spread across Section 3 SOPs (Fighting fires) and Category 5 (Fires and firefighting) and 6 (Fires in tall buildings) OINs.

140. On several station visits firefighters expressed a preference for one single point of reference for firefighting guidance. I consider that there would be much merit in M&WWFRS pursuing this as an outcome. I return to this point in the summary section below.

141. **SOP 3.01 Fires in buildings** is the obvious single point of reference for dwelling fire hazard knowledge and control measure tactics. While there were only a very limited number of control measure tactics referenced within the 'Key Control Measures' section most of the content of the SOP would still be of value to firefighters. I did however note some obvious omissions and causes for concern in this and the other SOPs and OINs I reviewed.

142. On p. 14 of the 'Specific Hazards and Risks' section of SOP 3.01 the hazard of 'Minimal use of water' is listed:

… Incident Commanders should understand the importance of balancing the competing needs of providing a sufficient weight of intervention to extinguish a fire against the damage that could be caused by firefighting water runoff. The aim should be to use the minimum number of extinguishing media required to extinguish the fire without compromising firefighter safety…

143. Under the heading 'Minimal use of water' I would expect to see guidance on flow rates and the need to use sufficient flows against peak HRR fires. There is however no mention of flow rates anywhere in SOP 3.01 either under 'Specific Hazards and Risks' or 'Key Control Measures'.

144. While minimising water damage should be a consideration, the absolute priority from a firefighter and occupant safety perspective should be to supress the fire as quickly as possible. Fire damage is permanent whereas water damage is not necessarily so. A useful American perspective on this issue is that '*you can dry things out, but you can't unburn them*'.

145. On p. 17 of the 'Specific Hazards and Risks' section the hazard of 'Fire loading' is listed.

…The level of fire loading will, given adequate ventilation, help the Incident Commander to predict the likely extent and severity of fire spread that may be experienced during firefighting operations. Problems of high fire loading may be worsened by poor housekeeping, by lack of site management by owners and occupiers, or by emerging issues such as hoarding in domestic properties; these factors increase the potential for rapid fire spread or unusual fire development…

146. This is true however there is no reference to the fact that modern synthetic based materials generate significantly higher HRRs than traditional materials and consume twice the amount of oxygen. Rapid fire spread of well-ventilated fires should be considered the norm not the exception and therefore should be explicitly referenced as a standalone hazard.

147. Under the heading 'Specific tasks' on p. 20 'Gaining entry' is listed with the following text:

The consequences of inappropriate entry to either a building or a compartment involved in fire are:

- *The creation of a flashover and/or backdraught*
- *The intensification and spread of the fire*

148. For both bullet points these outcomes would most likely be as a direct consequence of failing to control oxygen inflow (uncontrolled ventilation). There would be merit here in expressly stating this to be so. An effective control measure tactic would be the routine deployment of the Smoke Blocker which is currently only considered for high rise incidents.

149. The hazard 'Ventilation of the fire' follows immediately after and lists the following:

Ventilation of a fire in a building occurs in one of three ways:

- *The fire will vent itself by burning through the structure that may or may not be designed for the purpose*
- *As a consequence of other firefighting actions*
- *Deliberate ventilation*

In the case of deliberate ventilation this is carried out either to aid casualty survival and facilitate Service operations or as an integral aggressive part of firefighting.

150. The text in the bullet points is a description of how ventilation might occur not of the hazard it can give rise to. The sentence that follows suggests that deliberate ventilation will aid casualty survival and facilitate FRS operations when the reality is that the opposite will happen without concurrent suppression of the fire. This needs to be expressly stated.

151. The only occasion when the negative impact of ventilation on a fire is expressly referenced is on p. 25 under the heading 'Undetected fire spread' with the following text:

'Ventilation can increase the speed of development of undetected fire spread'

152. The 'Specific Hazards and Risks' section of the SOP would benefit from the inclusion of a standalone hazard for 'Uncontrolled ventilation' with specific reference

to the rapid increase in fire development and HRR which inevitably follows in a clear and unambiguous way that firefighters will understand.

153. On p. 31 of the 'Key Control Measures' section the control measure 'Maintain fire compartmentation' is listed with the following text:

During an incident, closing doors or leaving unopened doors closed may prevent the unnecessary spread of smoke, fire gases and subsequent damage. This action should be balanced against the need to maintain access, egress, tactical ventilation, and evacuation.

154. The first sentence describes anti ventilation which was strongly advocated by James Braidwood and is undoubtedly good practice. While actively closing doors and leaving unopened doors closed is maintaining compartmentation it might be better to describe this as 'Anti ventilation' which it is and as a substantive control measure tactic in its own right.

155. 'Ventilation' is listed in the 'Key Control Measures' section at p. 33 with the following text:

Creating an opening to a concealed space, compartment or building may impact on ventilation. Natural or mechanical ventilation can have a considerable effect and may intensify the speed of fire spread through a concealed space. Sources of ventilation in buildings (including inlets, pathways, and outlets) should be identified, evaluated, and monitored to establish the potential effects on fire development.

156. While this may sound pedantic, this text does not describe a control measure tactic. It does however describe, albeit possibly unwittingly, flow paths which would best be included under the 'Specific Hazards and Risks' section within 'Uncontrolled ventilation' as suggested above.

157. These are the only two references in the 'Key Control Measures' section to what could reasonably be viewed as control measure tactics. I consider this to be a substantial omission. I will return to this point in the summary chapter below.

158. In the 'Operational Procedures' section under the heading 'Breathing Apparatus procedures' on p. 37 the following guidance is provided:

…Directing main jets from an aerial appliance or handheld branches into a compartment fire where crews are working in BA is an extremely high-risk action. Conditions for BA wearers can deteriorate due to the volume of water being applied into the compartment and the potential for structural damage along with the risk of accelerating inwards flow of air, which can increase the potential of a backdraught occurring.…

159. I agree that jets should not be directed into a compartment when crews are deployed in BA, however conditions would be unlikely to deteriorate due to the volume of water applied if the compartment is involved in fire. Research shows that directing water into a compartment on fire on a steep angle while holding the branch steady will

achieve minimum air entrainment and maximum water coverage thus significantly reducing temperature, HRR and improve conditions for firefighters and casualties. Essentially this is an offensive exterior attack which is a control measure tactic, and which should feature within the 'Key Control Measures' section. This text features repeatedly throughout SOPs and OINs.

160. On p. 38 under the heading 'Maintain fire compartmentation' the following bullet points are listed amongst others:

- *Consider maintaining fire door integrity until firefighting media and resources are ready to commence firefighting operations*
- *Consider the opening and closing of doors as part of the firefighting tactics…*

161. This adds to the guidance under the same heading within the 'Key Control Measures' section but more clearly articulates the control measure tactic. For that reason, it would fit better in the 'Key Control Measures' section, preferably under a standalone heading of 'Anti ventilation', rather than being duplicated here.

162. The heading **'**Firefighting facilities and firefighting lobbies' is included under the 'Specific Hazards and Risks' section within **SOP 3.02 High rise firefighting** (p. 8) with the following text:

Water availability may be affected by the height of the building, water main characteristics, and FRS equipment water pressure and flow may be insufficient to extinguish fire

163. This statement is undoubtedly true however the hazard is insufficient flow rates, not the facilities themselves. A simple description of how low water main flows, frictional loss and static head affect pressure and flow when pumping through a dry rising main would be useful hazard knowledge to add to this statement. Tactics to be employed to mitigate these hazards such as parallel or series pumping could then be included under 'Key Control Measures'.

164. 'Wet and dry rising mains' are included within the 'Key Control Measures' section on p. 14 with the following text:

The Incident Commander must ensure that a water supply has been established and an adequate supply made available to the Bridgehead. Should any circumstances prevent the immediate supply of water via the wet or dry riser installation, the Incident Commander must be advised immediately to enable additional appliances to be requested as required.

165. This is sound guidance however further guidance is required as to how the additional appliances should be deployed to mitigate this hazard.

166. It goes on to state the following:

…At the discretion of the Incident Commander, it may be advantageous to utilise hose reels or jets direct from the appliance pump when dealing with fires up to and including fourth floor level…

167. This is contradicted further on in the SOP in Section 5 'Additional Considerations; Defective Rising Mains' (p. 29/30):

…Internal hose reel systems provided in some buildings are intended for first-aid fire suppression only. They do not provide the necessary protection for personnel to deal with what may become a rapidly developing fire situation…

168. Research demonstrates that FRS hose reels also do not provide the necessary protection for firefighters to effectively suppress peak HRR fires. Dependent on the location of the fire it might be necessary for FRS hose reels to be extended to reach the furthest point on the fourth floor of a high-rise premise. This would result in additional frictional loss which would further reduce flow at the branch. I strongly urge that the references to hose reels are removed and that caution is also expressed over the effects of static head and frictional loss on low pressure flows using a main jet in these circumstances.

169. Under the heading 'Appropriate Intervention: Fires in tall buildings' on p. 17 sound guidance is offered around delaying intervention if it has the potential to compromise escape routes.

It may be necessary to prioritise the evacuation and rescue of occupants rather than intervention, if:

- *Operational activity is likely to compromise escape routes and make them unsafe for occupants without RPE;*
- *Allocating resources to firefighting is likely to prevent successful evacuation.*

It is generally most likely that an appropriate speed and weight of attack will contain or control the fire sufficiently to allow evacuation or remove the need for a change in evacuation strategy.

170. There is however no specific guidance on what tactics might be employed to achieve appropriate speed and weight of attack. Indeed, there is no mention of any specific firefighting control measure tactics within the 'Key Control Measures' section.

171. Within the 'Operational Procedures' section under the heading 'Confirming a fire - Dynamic Risk Assessment' (p. 24) the following text is repeated from **SOP 3.01 Fires in buildings**:

Directing main jets from an aerial appliance or handheld branches into a compartment fire where crews are working in Breathing Apparatus is an extremely high-risk action. Conditions for BA wearers can deteriorate due to the volume of water being applied

into the compartment and the potential for structural damage along with the risk of accelerating inwards flow of air, which can increase the potential of a backdraught occurring…

172. The same comments as I made previously apply however M&WWFRS have issued floor below branches to stations in the Swansea area. A floor below branch is designed, as the name suggests, to be operated from the floor below the fire at a high-rise incident to direct a jet into the room on fire. To use Dutch 4 Quadrant Model terminology this is an offensive exterior attack, the benefits of which have been previously articulated. This should be considered for inclusion within the 'Key Control Measures' section as should explicit reference to the Smoke Blocker which has also been issued to stations that form the pre-determined attendance to high rise premises.

173. On p. 28 of the 'Operational Procedures' section under the heading 'Situational awareness: Fires in tall buildings' the following guidance is offered:

…Consider the effects of uncontrolled ventilation on fires at height when developing tactical plans…

174. This is correct however the consideration should not be limited to fires at height (my earlier observation over 'Uncontrolled Ventilation' being listed as a hazard in its own right refers).

175. **SOP 3.06 Positive Pressure Ventilation (PPV/PPA)** was withdrawn on 8 November 2024 and replaced by **OIN 5.05 Tactical Ventilation** however in the interests of completeness I include it in this report as it would still have been the point of reference for many of the firefighters I spoke to during the inspection fieldwork.

176. On p. 6 under the heading 'Significant Hazards and Risks' within the 'Specific Hazards and Risks' section the following is stated:

…Although the benefits of using forced and positive pressure ventilation are well documented, there are several hazards and risks associated with its use including:

- *Uncontrolled spread of fire,*
- *Acceleration of potential backdraughts and flashovers,*
- *Initial deterioration of internal conditions…*

177. This is correct but it is not limited to forced and positive pressure ventilation and will occur with any ventilation that is not sequenced with concurrent fire attack (my earlier observations refer).

178. Also, on p. 6 under the heading 'Covering jets and exhaust vents' the following is stated:

Directing jets into an exhaust vent at a developing compartment fire is an extremely high-risk option. This can seriously compromise PPV/PPA operations and the safety

of BA crews in the risk by reversing the flow-path inwards flow of air, which can increase the potential for and the effects of a backdraught occurring.

Appropriate control measures need to be in place at incidents to ensure that this does not occur.

179. International research as previously referenced in this report demonstrates that the opposite is true.

180. On p. 8 under the heading 'Uncontrolled ventilation' the following is stated:

The rate of development of any fire is directly linked to the supply of oxygen available to it. Establishing control over ventilation should form a key part of the overall incident plan. Incident commanders should be aware that any increase in the supply of oxygen to a fire will accelerate the development of the fire. Experience has shown that where ventilation is not properly controlled or coordinated, firefighter safety has been compromised and serious consequences have followed…

181. The first sentence is a quote from James Braidwood which is as true now as when he made it in the 1800s. The remaining text is also true and would best be located within **SOP 3.01 Fires in buildings** under the heading 'Uncontrolled ventilation' as a standalone hazard as previously suggested.

182. In the 'Key Control Measures' section there are only very limited references to actual control measure tactics when undertaking ventilation operations.

183. On p. 14 under the heading 'Consider employing tactical ventilation' the following text is provided:

The efficiency of smoke clearance will depend on a whole range of factors including the wind direction and strength, the size, type and number of fans, the proportion of the fan's air that enters the building (fan performance), ***the relative sizes of inlet and outlet vents*** *(*my emphasis*), the size of the compartment to be cleared and the temperature of the fire gases (smoke) in the compartment.*

184. When undertaking PPA the outlet vent should be at least twice the size of the inlet vent and preferably up to five times greater. That is not clear from the reference above and is a risk critical omission. This is repeated again on p. 27 under the heading 'Factors that govern the efficiency of PPV'.

185. **OIN 5.05 Tactical Ventilation** does make three references to outlet vents but on only one occasion is explicit guidance provided that the outlet vent **must** (my emphasis) be bigger than the inlet vent when using PPA as a tactic.

186. On the table within the ‘Introduction’ section on p. 2 the following text is included:

The effectiveness of PPV/PPA will depend on a range of factors, including the:

…Relative sizes of inlet and outlet vents

187. Under the heading ‘Hazards’ on p. 3 within the ‘Service Policy’ section the following text is included:

…Inefficient outlet when using PPA, which can cause backpressure of fire gases/smoke into compartment

188. This is true however it does not explicitly state the optimal size differential between the outlet and inlet vent when undertaking PPA (up to 5:1 but no less than 2:1).

189. Under the heading ‘Limitations and disadvantages’ on p. 9 within the ‘Operational Considerations’ section the following bullet point is included which is the only occasion when specific guidance is offered on the required size ratio:

Important considerations, limitations and disadvantages of PPV and PPA:

- *The relative size of inlet and outlet (exhaust vent must be larger than inlet for PPA)*

190. Returning to **SOP 3.06 Positive Pressure Ventilation (PPV/PPA)** the following text is provided under the heading ‘Strategy’ on p. 18/19:

The decision to use or commence tactical ventilation activities must be part of an overall strategy and ***should invariably be undertaken with a simultaneous combined fire attack or suppression plan*** (my emphasis).

191. The use of the word ‘invariably’ is unnecessary here. It should be unambiguously stated that tactical ventilation should only ever be undertaken with a simultaneous combined fire attack or suppression plan.

192. There is only one occasion throughout SOP 3.06, under the heading ‘Operational considerations - Initial’ (p. 22/23) when it is expressly stated that tactical ventilation should only ever be undertaken in conjunction with suppression:

Tactical ventilation must be used in conjunction with rapid, effective fire suppression and media application. Neither tactic should be used in isolation.

193. The exact same text is repeated within **OIN 5.05 Tactical Ventilation** on p. 4 under the heading ‘Initial’ within the ‘Operational Considerations’ section.

194. In the 'Key Hazards and Risks' section of **SOP 5.08 Flashover and backdraught** under the heading 'Flashover, Backdraught and Fire Gas Ignition' (p. 5) the following text is provided:

Firefighters need an adequate understanding of the development of fires in ventilated and fuel-controlled states, so they can recognise any potential fire development conditions…

195. It may be a typographical error, but to make sense this should read '***under** ventilated and fuel-controlled states*' (my emphasis) rather than '*ventilated and fuel-controlled states*' which is likely to be one and the same thing.

196. In the 'Key Control Measures' section under the heading 'Understand Signs and Symptoms of Flashover' (p. 6) the following guidance is offered:

Where it is necessary to use a combination of direct and indirect firefighting techniques and gas cooling, firefighters should take care at all times to ensure that direct firefighting jets/sprays do not impact negatively on the conditions or on firefighting teams as they move through a structure when deployed for internal firefighting operations.

197. UL FSRI research demonstrates that directing a straight stream into an unventilated room does not result in a deterioration in conditions. To the contrary, it improves conditions. This text is repeated within **OIN 5.04 Backdraught and flashover** on p. 2/3 in the 'Key Control Measures' section under the heading 'Training'.

198. Under the heading 'Gas Cooling' on p. 8/9 the following guidance is offered:

…It is extremely important to understand that gas cooling is predominantly a means of reducing the likelihood of flashover and should not be considered as a technique for dealing with either a fast developing or post-flashover fire. In such cases a solid stream (jet) directed at the fuel base becomes the dominant technique for fire suppression.

199. This is correct. The only minor point of accuracy relates to the use of the term 'solid stream' which can only be achieved with a smooth bore branch. This text is repeated within **OIN 5.04 Backdraught and flashover** on p. 4 in the 'Key Control Measures' section under the heading 'Gas Cooling'. The use of the term 'straight stream' should be considered rather than 'solid stream' unless the intention is to default to smooth bore branches for offensive interior attack (which would have much merit in my view).

200. Under the heading 'Intervention' on p. 9 the following is stated:

When water evaporates it expands to water vapour (steam); this can be anywhere within the ratio range of 1,700:1 and 3,400:1 depending on the temperature. When restricted to a compartment, this can have significant benefits but it also carries some risks, for example, the expansion can lead to a significant increase in pressure in the compartment.

201. Pressure does not increase in the compartment in these circumstances. Pressure and volume are directly related to temperature. When the temperature is reduced, which results from water being directed into the compartment on a straight stream, then so does the volume of the gases and therefore pressure. The text continues:

However, when properly applied, the contraction of the fire gases can be greater than the amount of water vapour formed…

202. This is correct for the reasons previously stated.

203. An accurate and scientifically correct explanation would be of value here to give confidence to firefighters to use appropriate flows and branch techniques without creating unfounded concerns over their use. This is repeated within **OIN 5.04 Backdraught and flashover** on p. 5 in the 'Key Control Measures' section under the heading 'Intervention'.

204. Under the heading 'Main jets and aerial appliances' (p. 11) in the 'Operational Procedures' section the following text is repeated:

Directing main jets from an aerial appliance or handheld branches into a compartment fire where crews are working in BA is an extremely high-risk action. Conditions for BA wearers can deteriorate due to the volume of water being applied into the compartment and the potential for structural damage along with the risk of accelerating inwards flow of air, which can increase the potential of a backdraught occurring.

205. This is the third occasion that this text appears in an SOP. It is also repeated within **OIN 5.04 Backdraught and flashover** on p. 6 in the 'Operational Considerations' section under the heading 'Main jets and aerial appliances'. My previous observations refer.

206. Under the heading 'Understand Signs and Symptoms of Flashover' on p. 11 the following guidance is provided:

Incident Commanders should:

- *Where flashover conditions are suspected, consider direct firefighting techniques;*
- *Consider employing a combination of direct firefighting and gas cooling to control conditions…*

207. The second bullet point undermines the first. The first bullet point would be better phrased if '*consider*' was replaced with '*use*' to remove any ambiguity.

208. Under the heading 'Use of BA in Conjunction with Aerial Appliances and Ladders' (p. 54/55) within the 'Operational Procedures' section of **SOP 6.02 Breathing Apparatus Procedures** the following is repeated:

Directing main jets from an aerial appliance or handheld branches into a compartment fire where crews are working in Breathing Apparatus is an extremely high-risk action.

Conditions for BA wearers can deteriorate due to the volume of water being applied into the compartment and the potential for structural damage along with the risk of accelerating inwards flow of air, which can increase the potential of a backdraught occurring.

209. This is the fourth occasion that this text appears in an SOP. My previous observations refer.

210. The only explicit reference to Flow Rates I could locate across the SOPs and OINs that I reviewed was in **OIN 5.07 Firefighting techniques and flow rates**. The following guidance is set out under the heading 'Flow rates' on p. 3 in the 'Operational Considerations' section:

At its simplest, the flow rate is the amount of extinguishing media being applied to a fire at any one time, referred to in litres per minute (L/min). Required flow rate may be simply viewed as the amount of firefighting media required to control and ultimately extinguish a fire.

This introduces many variables; more precisely two flow rates need to be considered:

- *Critical Flow Rate (CFR): typically this would be the absolute minimum amount of firefighting media flow needed to fully suppress a fire at any given level of involvement*
- *Tactical Flow Rate (TFR): the target flow for a primary attack hose line or lines*

211. This is an abridged version of the text contained within Eurofirefighter, Chapter 12, Adequate 'Firefighting Water' – you need this! (p. 235) authored by the late Paul Grimwood. The actual text from Eurofirefighter is as follows:

Critical flow-rates, below which a developing fire is unlikely to be controlled during the growth or steady state periods. (2.0 L/min/m2)

Minimum flow-rates where suppression is achievable but firefighters may be exposed to longer duration fires and more punishing conditions. (3.7 L/min/m2)

Optimum (adequate) flow-rates where control of the fire is achievable without unnecessary punishment to firefighters. (6.0 L/min/m2, two dwelling rooms totalling 32m2). 6.5 L/min/m2 (commercial building fire 50-100m2)

Note: 'Optimum' means the absolute minimum amount required to extinguish a certain sized fire effectively and safely. A secondary safety (back-up) line of at least equal flows should always be provided in addition, in support.

212. There is a substantial difference between the Paul Grimwood definition of the Critical Flow Rate and that in the OIN. If the definition of Critical Flow Rate is to remain in the OIN then it should reflect the version from Eurofirefighter.

213. The guidance continues with the following:

…The mathematical calculations for the amount of water required to extinguish a given fire are relatively complex. However, as a fire ground rule of thumb, for fires from 50 to 600m2 the following calculation could be considered:

Optimum flow rate (L/min) = fire area (m2) x 5

214. This again is an abridged version of text contained within Eurofirefighter, Chapter 12, Adequate 'Firefighting Water' – you need this! (p. 236/7). The actual text is as follows:

Based on the author's earlier research from 100 fires in London in 1989 and the GCU research described here, a series of rough fire ground rule of thumb guides were developed for UK national operational guidance (NOG) as follows:

- *Area of fire (m2) multiplied by 5 (for fires involving between **100-500 m2** of floor area) A x 5 = required flowrate (L/min) - (A = Area of floor in m2)*
- *One low flow handheld fire stream (350 L/min) (say 100 galls/min) per 75 m2 of floor area fire involvement*

***Where the fire area is less than 120m2 the fire-ground rule-of-thumb is inadequate** and where fire areas >600m2 it begins to estimate very high flow-rates. Therefore, the fire-ground formula A x 5 is only suited for use within the parameters as discussed above. **Where deployment is for a fire area less than 120m2 , the minimum target flow-rate on any primary attack hose-line should be 200-500 L/min (1 or 2 x 22mm hosereels) on high pressure or 350-500 L/min on low pressure.** (Also, see guidance in chapter 3 – Fire Dynamics).*

215. I have highlighted the areas of divergence in bold. The fireground calculation is of critical importance to firefighter safety therefore should be accurate. Again, **OIN 5.07 Firefighting techniques and flow rates** should be updated to reflect the actual content of Eurofirefighter as should the references that appear in training packages which I address later in this report.

216. An issue that was raised in the South and Mid & West Wales FRS inspections was poor water supplies from fire hydrants. This is not something that is limited to either FRS, but it is a legitimate concern.

217. Front line appliances in M&WWFRS have either 1800 or 2300 litre water tanks. UL FSRI research demonstrates that a fully developed peak HRR compartment fire can be supressed with an effective offensive exterior attack (straight stream, low pressure high flow) using 200 gallons (approximately 900 litres) of water. This would

still leave at least 900 litres remaining in an appliance water tank for an offensive interior attack to achieve full extinguishment.

218. Poor water supplies are not therefore a reason to default to a high-pressure hose reel at a domestic property or indeed any structure fire when HRRs are beyond the suppressive capability of the high-pressure hose reel. To do so exposes firefighters to unnecessary risk as demonstrated within this report.

219. That said, M&WWFRS training materials show there are water districts where hydrant flows are estimated at 300-400 lpm. Domestic use must overrun these flows let alone setting into a hydrant to augment tank supply for firefighting purposes.

220. The hazard of low water flows does not feature in any SOP or OIN and nor therefore do the control measure tactics to mitigate the hazard and any related training. I do not make recommendations on this issue within this report, but it was discussed at a follow up meeting with the Area Manager with responsibility for Organisational Risk and the Group Manager who leads the OPAL Team. At this meeting I suggested that predetermined roles (base pump, short length into the hydrant, using the hydrant to tank inlet and then into an intermediate pump to minimise frictional loss) could be allocated to second and subsequent appliances attending incidents in known low pressure areas. I believe that this is worthy of further consideration by the OPAL Team.

Operational policy - summary

221. On station visits the view was expressed by firefighters that a single point of reference for firefighting control measure tactics would be helpful. The absence of a definitive single point of reference for firefighting control measure tactics (or tactical options) is an omission but is one which can be easily remedied.

222. The Group Manager that leads the OPAL Team explained to me that the intention was to replace SOPs with OINs and that there would be an overarching OIN for structural firefighting to replace **SOP 3.01 Fires in buildings**.

223. There is a logic to this however my view remains that whatever index or format is used for operational guidance all reasonably foreseeable hazards should be clearly and unambiguously set out along with the corresponding control measure tactics to mitigate the hazards.

224. The following is repeated from the South Wales FRS inspection report.

225. The National Fire Protection Association (NFPA) 1700 'Guide for structural firefighting' is the American version of the 'Foundation for firefighting, 'Firefighting' and 'Fires and firefighting' and 'Fires in buildings' NOG. The 'Tactical Considerations for Fire Control and Extinguishment' set out in Chapter 10 have been developed from the UL FSRI research undertaken over the last 15 years and referenced heavily in this report.

226. Chapter 10 is the best example I have seen of a clear and unambiguous articulation of control measure tactics ranging from what would be considered in the Dutch 4 Quadrant Model as a Defensive Exterior Attack, right the way through to an Offensive Interior Attack with an easily understandable explanation of how each is executed in practice. What Chapter 10 also does is to differentiate firefighting attack control measures from tactical ventilation control measures using the distinct headings of 'Water' and 'Air'.

227. Following the inspection fieldwork, I shared with the OPAL Team operational guidance developed by Fire Rescue Victoria (FRV) that closely replicates the NFPA 1700 Chapter 10 format. I have done likewise with South Wales FRS and in the interests of consistency I will do the same for North Wales FRS prior to conducting the same inspection in early 2025.

228. The three Welsh FRS will have to fundamentally review their firefighting guidance following the publication of the 'Foundation for firefighting' and 'Firefighting' NOG.

229. There would be much merit to the three Welsh FRS collaborating on a pan-Wales basis to develop standardised operational guidance that would then form the basis of standardised pan-Wales training packages. I made a very similar recommendation within the Grenfell Tower Thematic Review report published in February 2021. Now is the time for this to be acted upon. Accordingly, I make a recommendation to that effect in Section 3 of this report.

Organisational arrangements for the delivery of operational policy

230. Operational Policy is predominantly imparted to firefighters through their initial and ongoing training. There are three phases to firefighter training in M&WWFRS:

231. Phase 1 Initial Skill Acquisition – Wholetime duty system firefighters undertake an initial 14-week training course at the Earlswood Training Centre covering all core skills. The RDS firefighters initial acquisition program is delivered over three modules. The Module A induction is followed by a 13-day foundation firefighting skills course, Module B. Module C is a 4-day RTC course. A BA initial course and a trauma course is undertaken within 12 months of the completion of Modules A and B. The wholetime 14-week initial course and RDS Module B cover input on hazard knowledge and control measure tactics for fighting fires in dwellings.

232. Phase 2 Development to Competent - For wholetime and RDS firefighters' initial skill acquisition training is followed by a 24-month period within which the wholetime firefighter is expected to move from development to competent to achieve the Skills for Fire & Rescue (SFJ) diploma apprenticeship and the RDS firefighter to achieve the SFJ custom certificate. Wholetime and RDS firefighters undertake 6 monthly one day assessments against all core skill areas with a two-day assessment at 24 months.

233. Phase 3 Maintenance of Competence – M&WWFRS utilises the pdrPro competency recording system to implement a risk-based approach to competency maintenance training and assessment. The pdrPro system is linked to the Learn Pro Learning Management System which consists predominantly of theoretical training packages, some of which are linked to SOPs and OINs through tabs on the introduction slide. This is supplemented by periodic structured recertification training courses delivered by instructors at the Earlswood Training Centre including BA and Compartment Fire Behaviour refresher courses.

234. For the purposes of this inspection, I reviewed the following training packages relevant to dwelling fire hazard knowledge and control measure tactics which I accessed through the pdrPro Learning Management System (Learn Pro).

- Additional skills learning materials - Tactical Ventilation Initial
- Core skills learning materials/Breathing Apparatus material/Module 1 - Tactical Ventilation Initial
- Core skills learning materials/Breathing Apparatus material/Module 4 – Fire Behaviour
- Core skills learning materials/Breathing Apparatus material/Module 4 – Compartment firefighting
- Core skills learning materials/Breathing Apparatus material/Module 4 – Branch techniques

235. I also reviewed a presentation titled '**Firefighting Flow Rates**' accessed via the Insight intranet (OPAL/National Operational Guidance/Fires and firefighting/Additional information). This is a PDF file of a presentation Paul Grimwood uploaded to the now archived Eurofirefighter website which covers matching flow to HRR.

M&WWFRS training package analysis

236. From the 'Additional Skills learning materials' section of Learn Pro, I reviewed the '**Tactical Ventilation - Initial**' presentation.

237. On Slides 7 and 8 the terminology '*Unilateral flow'* and *'Bilateral flow'* is used to describe the two commonly recognised types of flow path. This is not terminology I have seen before. In all publications including 'Foundation for firefighting' the terminology used is 'Unidirectional' and 'Bidirectional'.

238. In the focus group with the CFBT instructors at Earlswood I explained that this was not common terminology and enquired as to its origin. The instructors advised me it had been used on a course at the Fire Service College. My view at the time, and remains, that this should be changed to reflect the commonly recognised terminology.

239. Slide 14 '*Types of ventilation*' describes how M&WWFRS define Positive Pressure Ventilation (PPV). Slide 21, also 'titled '*Types of ventilation*' describes how M&WWFRS define Positive Pressure Attack (PPA).

240. The text on Slide 14 to describe PPV is '*Post fire: after extinguishment of the fire, rapid removal of fire gases, steam and heat'*. The corresponding text on Slide 21 to describe PPA is '*Crews committed – fire under control – steam and hot fire gas clearance*'.

241. The point of difference is extinguishment of the fire versus fire under control. The theory behind PPA is that it should be used in conjunction with concurrent suppression but in practice that is likely to be a challenge to achieve as the firefighting attack team must communicate from within the structure to request 'fans on' when they judge the fire to be under control. In heat, smoke and humidity that is likely to be a difficult judgement to make.

242. There were only two occasions from the incident analysis when PPA was expressly stated as being in use. On station visits the majority of Crew and Watch Managers were of the view that the procedure for PPA was onerous and not something they tended to use.

243. I have far less concern over the M&WWFRS approach to PPA than I did over the way I understand PPA to be used within South Wales FRS. I had limited confidence during the South Wales inspection that the fire was being suppressed concurrently with the introduction of a positive pressure air flow into the structure and no confidence at all that outlet vents were at least twice the size of inlet vents (both safety critical issues). That said, it is my view that M&WWFRS should consider the value of retaining PPA as a control measure tactic or whether to instead focus on PPV, hydraulic and natural ventilation tactics which are more straightforward and carry less risk.

244. On Slide 22 '*Positive Pressure Attack considerations*' there is no mention that the outlet vent must be at least twice the size of the inlet vent which is safety critical to the effectiveness of PPA.

245. On Slide 32 '*Advantages/disadvantages of Tac Vent*' the only disadvantage listed is noise. There is no warning that the opposite of the advantages listed will occur if the fire is not suppressed concurrently with the commencement of the fan.

246. On Slide 36 'Airflow management' under the heading '*Outlet*' there is no explicit mention that the outlet vent must be at least twice the size of the inlet vent if PPA is undertaken.

247. Another presentation also titled '**Tactical Ventilation – Initial**' is located on the 'Core skills learning materials' section of Learn Pro under 'Breathing Apparatus Material/Module 1'. There is some replication between presentations however there are several additions which are worthy of comment.

248. Slide 6 is a West Sussex FRS (GM Lee Johnston) video demonstrating the effect of ventilation on fires using tea lights and a tray of paraffin.

249. Slide 7 is a Frisco Police Department video showing the effect of uncontrolled ventilation on a fire in a dwelling.

250. Both videos are very effective, and I have no doubt would resonate with firefighters. That was certainly the feedback I received on station visits. The real-world outcomes that they demonstrate are not however expressly and unambiguously captured in any hazard statement within M&WWFRS SOPs or OINs. My earlier comment over the need for a standalone hazard statement for 'Uncontrolled ventilation' refers.

251. Slide 8 'Offensive exterior attack' contains the following text:

'Incident Commanders should consider an offensive exterior attack prior to the deployment of crews into a structure'

252. Slide 9 is a video from the National Institute of Science and Technology (NIST) showing the effect of an offensive exterior attack on a fire in a first-floor bedroom.

253. Slide 10 is a video showing the distribution of water within a compartment from an offensive exterior attack.

254. Both videos are very effective and highlight the value of the guidance contained on Slide 8. Again however, there is no obvious read across to any guidance contained within SOPs or OINs advocating the tactic of offensive exterior attack in clear and unambiguous terms alongside a simple explanation about how this can be achieved.

255. Slides 12 and 13 replicate Slides 7 and 8 from the presentation of the same name reviewed previously using terminology '*Unilateral flow'* and *'Bilateral flow'* to describe unidirectional and bidirectional flow paths. My earlier comments refer.

256. Slide 19 '*Anti Ventilation*' contains the following text:

Anti ventilation is a defensive tactic. If there is saveable life inside the compartment this tactic must not be used.

Anti ventilation is the tactic of applying water into a compartment before shutting the compartment down.

257. Anti ventilation is something first advocated by James Braidwood in the 1800s which is the act of closing doors and windows to starve a fire of oxygen thus reducing its HRR. In the focus group with the CFBT instructors at Earlswood I again explained that this was not common terminology for the technique being described and enquired as to its origin. The instructors advised me it had been used on a course at the Fire Service College.

258. The definition of Anti Ventilation within the 'Firefighting' NOG is as follows:

Anti-ventilation is a technique that can:

- *Support a planned and co-ordinated confinement of products of combustion*
- *Prevent the development of the fire*
- *Prevent fire and products of combustion from spreading*
- *Protect access and egress routes*

It relies on controlling or limiting the amount of available oxygen, in order to reduce fire development. It can be achieved by reducing air flow into the fire through:

- *Closing doors, windows or shutters*
- *The use of equipment, such as portable smoke curtains*

The use of this technique may create an under-ventilated fire, with the potential for backdraught.

259. As counter intuitive as it may seem anti ventilation can and should be used as an offensive technique prior to and during an offensive interior attack. Any action that reduces the HRR of a fire will benefit firefighters and by extension trapped occupants. Slide 19 should therefore be amended to reflect this.

260. Slides 27, 37 and 41 are identical to Slides 22, 32 and 36 from the first presentation so my earlier observations apply.

261. The presentation '**Fire Behaviour**' is located on the 'Core skills learning materials' section of Learn Pro under 'Breathing Apparatus Material/Module 4'.

262. Slide 22 is titled '*Under ventilated compartment*' and contains the following text:

An unvented or under ventilated compartment is the type of fire scenario that firefighters are most likely to encounter.

This is due to new building design and continued message to the public to close doors on discovering a fire.

This reduction of oxygen supply will produce a different fire phenomenon. This scenario has the potential to produce a backdraught.

263. A backdraught is one possible outcome when the ventilation profile is changed however rapid-fire growth is inevitable if ventilation is not combined with concurrent suppression. The text should make that clear and should reflect any hazard knowledge statement for uncontrolled ventilation which should feature within SOPs or OINs as previously referenced.

264. The presentation '**Compartment firefighting'** is also located on the 'Core skills learning materials' section of Learn Pro under 'Breathing Apparatus Material/Module 4'.

265. Slide 13 '*Flow rates'* uses the following example of the fireground calculation applied to a 5m x 4m compartment:

Calculating a required flow rate

L x B x 5

5 x 4 x 5 = 100lpm

These calculations are based on a fully developed compartment fire

266. As highlighted previously when reviewing the content of **OIN 5.07 Firefighting techniques and flow rates** I made the point that the fireground calculation produces inadequate flow estimates when the surface area is less than 120m2 as explained within the text from the Eurofirefighter publication authored by Paul Grimwood:

*'Where deployment is for **a fire area less than 120m2, the minimum target flow-rate on any primary attack hose-line should be 200-500 L/min** (1 or 2 x 22mm hosereels) on high pressure or 350-500 L/min on low pressure'.*

267. The slide should be updated to reflect the above.

268. Slide 23 'Anti Ventilation' is identical to Slide 19 of the **Tactical Ventilation – Initial** presentation. The observations made earlier refer.

269. Slide 28 is a video titled 'Locating the fire'. The video includes the following guidance:

- *Prioritise fire attack and get water onto the fire as soon as possible to stop fire development, reducing the risk to firefighters and increasing survivability for any saveable life*
- *Follow the flow of fire gases to locate fire compartment (high pressure moves towards low pressure)*
- *Using a TIC to identify the flow path*

- *Use TIC to confirm which rooms can be isolated through closing doors*
- *Velocity and turbulence of fire gases is quicker as you get closer to the fire*
- *Identify the air track*
- *Gas cool as you progress*
- *BA team to make a fire attack as soon as possible*
- *Get low to stay cooler and utilise improved visibility*

270. This is exactly the type of content that should feature either within the 'Key Control Measures' section of the extant **SOP 3.01 Fires in buildings** or in the OIN that is developed to replace it. That it does not already is in my view an omission.

271. The final presentation located on the 'Core skills learning materials' section of Learn Pro under 'Breathing Apparatus Material/Module 4' is titled '**Branch Techniques**'.

272. The video titled 'Direct attack' contains the following guidance:

Direct firefighting has the potential to generate large amounts of steam. Firefighters should consider taking measures to ensure they are protected from steam burns and the increased heat in the fire compartment…

273. This statement is factually and scientifically incorrect as proven by research[18]. Direct application of water into a room on fire using a straight stream result in significant temperature reductions, not '*increased heat in the fire compartment*'. Any expansion of water into steam is more than offset by the contraction of the gases in the fire compartment because of the reduction in temperature.

274. On the first page of the Paul Grimwood '**Firefighting Flow Rates**' presentation accessed via the OPAL page on the Service intranet a table sets out the minimum flow rates required for the first hose line deployed into standard rooms:

Room fire	*>200 lpm (HP)*
Apartment fire	*>350 – 600 lpm*
Open plan office floor	*>750 lpm*
Industrial or storage	*>750 – 1000 lpm*

275. This is followed up by additional guidance:

Never underestimate your needed flow rate and if your second hose line is more than sixty seconds away from the fire then deploy the next higher flow rate on the chart first.

[18] Study of the Impact of Fire Attack Utilizing Interior and Exterior Streams on Firefighter Safety and Occupant Survival | UL's FSRI – Fire Safety Research Institute

276. This is simple but very effective guidance which should feature alongside any slides showing the fireground calculation. It should also be included within **SOP 3.01 Fires in buildings** and **OIN 5.07 Firefighting techniques and flow rates**.

277. On station visits several firefighters I spoke with were not aware of the '**Firefighting Flow Rates**' presentation. Given the quality of the input there would be benefit in the presentation being located more prominently.

Issues raised on previous Thematic Review inspections

278. The 3 previous Thematic Reviews I have undertaken have raised issues which are relevant to this inspection and to the organisational arrangements through which operational policy is delivered.

279. Recommendation 4 of the Learning the lessons from Grenfell Thematic Review[19] (copied below) concerned tactical flow rates as I had noted the default to high pressure hose reels at incidents during this inspection.

Recommendation 4 – that input on tactical flow rates for firefighting attack and fire ground calculations be included on the syllabus for Breathing Apparatus and Compartment Fire Behaviour initial and refresher courses. This should be supplemented by an online training module for skill maintenance within the station work routine.

280. **OIN 5.07 Firefighting techniques and flow rates** and the **Compartment firefighting** training package contain input on flow rates but as previously identified it does not accurately reflect the findings of the Paul Grimwood Glasgow Caledonian University research. The chart on p. 1 of the '**Firefighting Flow Rates**' PDF is simple and effective, but as stated above it should be located more prominently so it is easy to access for firefighters and Watch Officers.

281. Recommendation 5 was concerned with the FRS establishing a robust method by which to ensure the recommendations of the Thematic Review were embedded. The text of the recommendation is copied below:

Recommendation 5 - Should the 3 FRS be minded to accept the recommendations contained within this report the Operational Assurance criteria in use within each of the FRS should be amended to capture specific evidence in relation to the recommendations in order to demonstrate they are being applied on the incident ground. Alternatively the 3 FRS could utilise a Thematic Assurance process to target the issues identified within this report.

[19] Chief Fire and Rescue Adviser thematic review: learning from Grenfell Tower Inquiry recommendations | GOV.WALES

282. The Learning the lessons from Grenfell Thematic Review report was issued on 25 February 2021. The incident data analysed in this report covers the periods 1 April 2020 – 31 March 2023 and includes over 2 full years after this recommendation was made. As with South Wales FRS there is no evidence from the analysis to suggest the default position of using a high-pressure hose reel (the tactical option offering the lowest flow rate and therefore lowest level of protection to firefighters) has in anyway shifted in M&WWFRS. I consider the effectiveness of the M&WWFRS operational assurance process further on in this report.

283. In the Broadening of the role of firefighters Thematic Review[20] report published in December 2021 I raised a concern that the current shift system, dating back to the 1970s, does not allow sufficient time for training, exercising and risk reduction activities.

284. M&WWFRS have undertaken an analysis of the existing shift system and have identified significant amounts of available capacity. As a result of this analysis the Service opened consultation with the FBU over shift duration equalisation during the desktop review phase of this inspection (October 2024). Shift duration equalisation allows the night shift rest period to be significantly reduced or removed completely thus releasing up to 14 hours of additional time to be used for training or risk reduction activity. This is welcomed and should be pursued to a successful conclusion as a priority.

285. In the Operational Training Thematic Review report published in October 2022 I raised several concerns which remain directly relevant to the issues highlighted throughout this inspection.

286. The first was that none of the Welsh FRS know definitively the amount of time that should be allocated within station work routines to skill maintenance training.

287. I made the point that each Service first needs to carry out a strategic risk assessment to understand the threats, hazards and risks across its area from fires and other emergencies and the capability required to mitigate them. This would typically be through the development of a Community Risk Management Plan (CRMP)

288. M&WWFRS published a CRMP on 10 April 2024. Section 4 of the CRMP is concerned with reviewing and changing the way the Service responds to emergencies to meet the changing demands of the community. Action 4.3 commits to the implementation of new firefighting tactics and techniques within a two-year timeframe (2024/26).

289. M&WWFRS have previously undertaken an analysis of the time required for firefighters to maintain competence. I have corresponded with the Service over this analysis so I will not revisit the views expressed within this report. The point I will make however is that this analysis was undertaken against the National Occupational

[20] Fire and rescue service capacity: thematic review | GOV.WALES

Standards for the core skill areas rather than against individual control measure tactics forming part of the Operational Risk Assessment for all reasonably foreseeable incident types required to meet the Service's duty under Regulation 3 of the Management of Health & Safety at Work Regulations.

290. I have made the point previously that each control measure tactic or tactical option and associated hazard knowledge should be articulated within an Operational Risk Assessment, SOP or OIN. Each should then have its own training package inclusive of theoretical and practical aspects. These training packages can be subject to a time and motion study which gives a time value for each. Time is a commodity that wholetime firefighters have in abundance. The opposite is true for RDS firefighters but having a time value for each control measure tactic allows Services to prioritise control measure tactics and match them against the available time for their RDS resource.

291. This was the driver behind Recommendations 1, 2a, 2b, 3 and 4 from the Operational Training Thematic Review.

292. I remain of the view that the Service still need to undertake this exercise to determine accurately the amount of time required for skill maintenance which will then determine the achievable operational capability for the wholetime and RDS duty systems.

293. That said the development of a comprehensive CRMP is a positive strategic commitment from the Service and gives a solid foundation on which to build.

294. Recommendations 5 and 6 are directly relevant to the substantive issues raised throughout this inspection.

295. I make the point within the Operational Training Thematic Review that there are significant challenges for the FRS in replicating real world modern fire conditions in a training environment.

296. The fire behaviour training facility at Earlswood has similar limitations to those at the South Wales FRS facility at Cardiff Gate around the HRR that can be achieved with training fires and the effect of ventilation profiles on the scenarios that can be created.

297. In the Dutch report 'When water goes up in smoke' referenced earlier, the experiments to determine the safest and most effective firefighting method of advancing through a property towards a room on fire were conducted in a purpose-built rig.

298. The text copied below directly from the report describes the construction of the test rig:

'One base scenario was applied to all experiments:

A major fire in a living room (6 – 8 MW) where the door from the fire room to the corridor is open, smoke is flowing into the adjacent corridor and the front door to the residence is open; no fire attack…

…In order to best approximate the real-life situation, the research was conducted in a brick building. The building was L-shaped, with the long part of the L-shape consisting of a 2- metre wide, 2.5 metre high and 20-metre long corridor. The fire room was located in the short part of the L-shape. This shape was chosen so that it would be impossible for the seat of the fire to be reached directly while carrying out the smoke cooling methods'.

299. Following the South Wales FRS inspection, I liaised with Dutch colleagues to arrange access for representatives of the 3 Welsh FRS to visit the rig referenced above to observe the next round of research work planned for June 2025. This will be an opportunity for M&WWFRS instructors to view the facility and consider if it would be possible to replicate something similar within the Service.

300. In the Operational Training Thematic Review, I referenced the UL FSRI Hose Stream prop. The text copied below describes its evolution:

'The idea for the innovative Hose Stream Prop was sparked when FSRI research studies began to yield thought-provoking findings around the fundamentals of hose stream mechanics – specifically air entrainment and water mapping. These concepts are the ground-level building blocks needed to understand the impact of varying suppression tactics on the fireground. From these findings, FSRI research engineers began by building a prototype training prop to visualize and interactively demonstrate these concepts.

With the help of trusted fire service partners and live training demonstrations throughout the country, FSRI research engineers designed several enhancements to optimize usability, increase the suppression concepts able to be visualized with the prop and much trial and error – leading up to the final version and current construction plans'.

301. UL FSRI have shared the plans online to allow FRS to build their own Hose Stream props along with instructional videos and lessons plans. It should not be that cost prohibitive for M&WWFRS to provide one of these training props on every fire station.

Organisational arrangements for the delivery of operational policy - summary

302. SOPs/OINs and Training are dealt with by separate areas of the Service.

303. The OPAL team is responsible for SOPs, OINs and NOG implementation along with Operational Learning which includes the Operational Learning System (OLS), National Operational Learning (NOL) and Joint Operational Learning (NOL). OPAL sits within the Organisation Risk function alongside OEA, Corporate Risk and Contaminants. These Teams are located at Service Headquarters. This function is the responsibility of the Area Manager who reports to the Deputy Chief Fire Officer (DCFO).

304. Training instructors work within the Training Delivery Department and are located at the Earlswood Training Centre. The Training Delivery Department are responsible for Foundation, BA, Compartment Fire Behaviour, Road Traffic Collision Manual Handling, Line Rescue, Emergency Response Driving and Fire Trauma training. The Training Department sits within the Training & Development function along with the People and Organisational Development Team and Joint Fire Control. This function is the responsibility of an Area Manager who reports to the Assistant Chief Fire Officer (ACFO).

305. That OPAL and Training Delivery are not together in the same function or co-located is not of itself a cause for concern.

306. During the focus groups with OPAL and the Compartment Fire Behaviour instructors both Teams talked about a close working relationship that they had with each other. I do not doubt that however there are areas of divergence between SOPs/OINs and training packages highlighted within this report which need to be addressed.

307. There are links within the **Tactical Ventilation – Initial, Fire Behaviour** and **Compartment Firefighting** presentations on Learn Pro to related SOPs or OINs however I could only access **OIN 5.05 Tactical Ventilation** from the **Tactical Ventilation – Initial** presentation.

308. This is promising practice if applied across all guidance but only if content is accurate and aligned. Operational guidance must be accurately reflected in training packages and vice versa. At present it is not.

309. The creation of an overarching OIN to replace SOP 3.01 is the opportunity for a reset that should act as a driver to review all training package content to ensure full alignment. This is substantively addressed through Recommendations 2 and 3 set out within Section 3 of this report.

Organisational arrangements for monitoring, auditing and reviewing operational performance

310. A robust operational assurance process is a critical component of any safety performance management system. In the FRS it consists of the active monitoring of incidents (either remotely or on scene), incident ground audits and reviews including through the debrief process. Done properly it allows the FRS to continually check the effectiveness of operational procedures, equipment and training and to make changes were necessary. It is critical to firefighter and public safety which is why it featured so prominently in this inspection.

311. **Procedural Guidance Document (PGD) OEA 3.0 – Strategic Assurance** sets out the overarching framework for operational assurance within M&WWFRS. The process is the responsibility of the OEA Team and includes strategic assurance audits as well as operational monitoring and review of performance at incidents, exercises and training events.

312. Strategic assurance audits are described as follows:

Strategic Assurance Audits are undertaken under a short notice basis to capture a realistic analysis of the day to day running of a station, and to identify areas of good practice and areas where improvements can be made…

The Strategic Audit focuses on key areas from the Business Assurance Audit, including an assessment of the crew's knowledge and understanding of the risks within their local area and their ability to respond safely and effectively to these risks.

313. Reactive assurance visits are carried out in response to unforeseen events or to test the extent to which a new procedure has been embedded.

314. Reactive assurance inspections are described as follows:

The purpose of the Reactive Assurance Inspection is to provide the Service with a method to react to trends, patterns, or events to identify issues, analyse their causes and to implement corrective actions, if required. Where a new policy/procedure or item of equipment is released, the Reactive Assurance Inspection can be used to sample the knowledge and understanding of personnel.

315. Operational monitoring in M&WWFRS is carried out predominantly by Tactical Officers conditioned to the flexible duty system. This will be supplemented from October 2024 during a 6-month trial with day duty system Station Managers who will respond to incidents during their contracted hours (Monday – Friday, 0900 – 1700) as set out within draft **PGD OEA 2.0 Operational Monitoring** and **OIN Operational Monitoring**.

316. Observations from incidents, exercises and training events are submitted via an electronic Operational Monitoring (OM) form which is available via Insight. Issues raised on OM forms are considered by the Operational Learning Group (OLG) and

then progressed through either the Firefighting, Technical Rescue or Special Operations Board, each of which is chaired by an Area Manager. If an issue gives rise to the need for a policy change, training or equipment need it is escalated to the Operational Strategy Boad (OSB) which is chaired by the ACFO. Final approval for any substantive change rests with the Executive Leadership Team chaired by the CFO.

Incident monitoring

317. Unlike in South Wales there is no dedicated Operational Assurance team in M&WWFRS to undertake active monitoring at incidents. As explained in the last chapter active incident monitoring is typically undertaken by Tactical Officers conditioned to the flexi duty system (Station and Group Managers). The variations to this are at a small non-complex incident when an Incident Command System (ICS) Level 1 (Operational) competent Watch Manager would carry out active monitoring or at a large significant incident when an ICS Level 4 (Strategic) competent Area or Brigade Manager would carry out active monitoring.

318. Because of the size of the area covered by M&WWFRS the Joint Fire Control mobilises the nearest Tactical Officer (ICS Level 2 - Tactical) irrespective of rank to the incident. Tactical Managers can be mobilised to take charge of the incident or to undertake active monitoring. I was unable to locate any guidance that contained predetermined triggers for Officers at a designated role to take charge of an incident once it reached a certain size (normally determined through numbers of appliances in attendance). At the focus group meeting with the OPAL and OEA Teams it was confirmed to me that specific guidance did not exist and the decision to take charge was at the discretion of the Officer.

319. From the analysis of the incident logs there were limited occasions when it was clear that a Tactical Officer was undertaking the active incident monitoring role in that it was not expressly stated on the log. This was more obvious when an ICS Level 4 Officer attended or if the Tactical Officer took charge of the incident which typically was expressly stated.

320. I recognise the significant geographic challenges faced by M&WWFRS in responding Officers to remote rural locations. That said I consider that there would be merit in undertaking an analysis of incident ground roles and responsibilities to predetermine the point at which spans of control for an Incident Commander are likely to be exceeded. This would typically be based on the numbers of appliances in attendance and would allow Joint Fire Control to mobilise an Officer for the purposes of assuming command. In these circumstances an Officer of the next highest rank would be notified or mobilised for the purposes of active incident monitoring.

321. In any event for management of road risk purposes when any Officer is mobilised to an incident irrespective of the purpose, I strongly recommend that M&WWFRS formalise the process of immediately notifying an Officer of the next highest rank for the purposes of active incident monitoring. The notified Officer would log into the mobilising system, familiarise themselves fully with the incident log and progress of the incident and monitor incident ground messages on their main scheme

radio. This would allow the Officer responding under emergency response conditions to focus solely on driving without having to also attempt to monitor any developments with the incident. Once in attendance they would contact the Officer undertaking active incident monitoring who would update them fully on the incident and share with them their appraisal of progress and any potential areas of concern. I make a substantive recommendation to this effect in Section 3 of this report.

322. There is clear guidance within **OIN Operational Monitoring** and **PGD OEA 2.0 Operational Monitoring** over the role and responsibilities of the Officer tasked with active incident monitoring.

323. Section 3.0 '*Roles and Responsibilities*' lists the following:

Operational Monitoring officers will carry out some, or all, of the following functions:

- *Observe the performance of the crew to safely resolve the incident*
- *Review radio messages for quality and accuracy*
- *Evaluate and review tactical decisions at the conclusion of the incident*
- *Act as a mentor and provide advice if required.*
- *Check completion of administration e.g. ARA, IDL, Incident Handover*
- *Gain an overview of the effectiveness of new procedures and/or equipment*
- *Take command of an incident if necessary* ***(see Section 3.4)***
- *Check completion of Protection and Prevention activities e.g. Simple BFS Audit, Hot Strike.*
- *Report on operational performance via the Operational Monitoring form.*
- *Participate in the on scene debrief and provide feedback, where required.*
- *Attend subsequent structured debriefs as necessary.*
- *Attend the Health, Safety and Welfare Consultative Committee if requested*
- *Attend Operational Learning Group (OLG) if requested.*

324. This is comprehensive guidance. I will return to the practical application of the guidance later in the report acknowledging that both pieces of guidance were first issued in November 2024.

Incident review and debriefing

325. On station visits firefighters and Watch Officers confirmed that it was standard practice to undertake a hot debrief at the conclusion of an incident.

326. They explained that this would either be single or multi agency dependent on which Services were in attendance and would consider what went well and what did not go well. It was well understood that any issues of good practice or concern would be captured on the OM form.

327. On every station visit there was an awareness of the OM form, its purpose, where it could be found and where it should be submitted to. At one station visit I was given an example of when an OM form was submitted post incident highlighting that a socket set was required to successfully resolve the incident. My understanding is that at that time socket sets were not carried on front line appliances.

328. Following initial consideration by the OEA Team the matter was referred to the Operational Learning Group (OLG) who authorised the procurement of sockets sets for issue to front line appliances using the process described earlier in this report.

329. There was confidence expressed on all station visits in the process alongside a degree of pragmatism that not every issue raised would be resolved due to funding and other constraints.

330. The process by which a structured debrief is convened is less clear. Section 8 '*Debriefing*' within **PGD OEA 2.0 Operational Monitoring** describes the purpose of debriefing but only expressly references the '*On-scene Debrief*' which I refer to previously as the hot debrief.

To enable the Operational Monitoring Officer to capture all learning outcomes applicable to the incident, an on-scene debrief should be conducted with all personnel, and other responding agencies, if deemed practicable. This should be carried out as soon as possible after closure of the incident (either at the scene or upon return to station), and should consider the following:

- *Mobilisation.*
- *Information gathering, enroute and upon arrival.*
- *Dynamic Risk Assessment.*
- *Operational decision making and rationale.*
- *Resources required.*
- *Specialist appliances.*
- *Structure of Incident Command.*
- *Communications and briefing.*
- *Procedures adopted.*
- *Use of equipment and PPE.*
- *Health & safety events.*

The rationale behind this process provides an opportunity for individuals to review and reflect on their performance, identify areas of achievement & areas for improvement, and gain an overall understanding of tactical decisions made.

331. **OIN Operational Monitoring** contains a flow chart which includes a text box directly below the '*Completion of Operational Monitoring form'* text box which states the following:

If structured debrief required, conduct within timeframe (6 weeks)

332. No further guidance is offered around who should be contacted to arrange the structured debrief, who would carry it out and where the outcomes would be considered.

333. There were 15 structured debriefs undertaken across 2021/23 inclusive.

334. To ensure immediate capture and review of issues identified at incidents the OEA Team should host daily meetings at the change of shift to be attended by all on duty Tactical Officers to review all incidents occurring over the last 24 hours. This would give the OEA Team advance notice of identified issues that they could act on immediately without having to await the submission of the OM form. I make a recommendation to this effect in Section 3 of this report.

335. The process for the review of Analytical Risk Assessments (ARAs) is set out within **OIN 2.05 Risk assessment at incidents**. The M&WWFRS ARA form is designated HSRA 10. The guidance states that completed HSRA 10 forms are to be forwarded to the OEA Team at the conclusion of an incident to be assessed for any trends or anomalies. It is not clear what would then be done by the OEA Team with trends and anomalies that were identified as it is not expressly stated but the inference I draw is that they would be submitted to the OLG for consideration.

336. At the focus group with the OPAL and OEA Teams I asked how many near miss reports had been submitted for issues identified at dwelling fires. The answer I was given was none that they were aware of.

337. At my initial meeting with the Group Manager responsible for fire investigation I explained the purpose of me requesting fire investigation reports, specifically that my interest was in fire development rather than cause and origin. We reviewed numerous scene photographs from incidents that I had highlighted through the analysis and were able to identify incontrovertible evidence of fire development and progression particularly in respect of bidirectional and unidirectional flows at the point where firefighters made an entry into the premises.

338. The Group Manager referenced one incident where the fire investigator had created a short case study presentation which showed the development of what was identified as a wind driven fire where the BA team entered through the front door, which was functioning as a unidirectional outlet vent, with a 19mm hose reel. The extent of the fire damage was such that the firefighters would undoubtedly have been exposed to significant thermal insult. They were also extremely fortunate that a couch and single

upholstered chair had not become involved when they were in the compartment as the outcome would have been catastrophic. The analysis showed that there were more favourable tactical options available which were an offensive exterior attack into the ROO which was easily accessed from the side of the property or an offensive interior attack through the rear patio doors which would have been through the inlet vent with the wind at the backs of the BA team.

339. This is an example of a near miss that was not recognised as such, but it also highlights the significant contribution that fire investigation can make to the process of incident review. I strongly recommend that M&WWFRS utilise the fire investigation expertise they have within Service to the fullest extent to support the operational assurance process.

Organisational arrangements for monitoring, auditing and reviewing operational performance - summary

340. In respect of geography M&WWFRS are the third largest FRS in the UK. Apart from Aberystwyth all their wholetime stations are in the South of the territorial area (Southern and Western Divisions). They are not resourced in relative terms to anything like the extent of South Wales FRS. RDS availability is becoming increasingly challenging and can result in extremely long response times (more than 30 minutes) for fire appliances and even longer for Tactical Officers due to their travel distances.

341. I do not therefore underestimate their challenges in achieving a robust process of operational assurance and particularly active incident monitoring.

342. M&WWFRS have a clear and well-established process from hot debriefs, the submission of the OM form through to the OLG and the decision-making mechanisms thereafter. There is evidence referenced in this report to demonstrate the effectiveness of the process and I have been provided with further evidence post inspection. That said, the issues of concern I have highlighted in Section 1 of this report have not been identified other than through the fire investigation case study and have not been acted on to change the default tactical approach. I am of the view however that is more because of deficiencies I have highlighted within the content of SOPs, OINs and training packages than it is because of deficiencies with the operational assurance process.

343. The OEA Team have corporate responsibility for operational assurance alongside research and development, operational equipment, hydrants & water supplies and operational intelligence (Site Specific Risk Information and Operational Tactical Plans). This covers several risk critical areas which no doubt give rise to a substantial workload.

344. I consider that there would be much value in a dedicated Operational Assurance Team with the sole focus of actively monitoring, auditing and reviewing operational

incidents. I recognise however that resource challenges may mean that this is not practical.

345. The arrangements for active incident monitoring make sense given the resources available to the Service and the geography. I believe that these arrangements could however be strengthened.

346. The purpose of declaring a tactical mode on the first informative message at an incident is to record on the log the outcomes of the dynamic risk assessment undertaken by the Incident Commander. This first informative message presents an opportunity to capture the extent of the hazards the Incident Commander has identified and the control measure tactics they intend to deploy to mitigate them and resolve the incident.

347. The typical content of an informative message from the analysis in this report is '*2BA, hose reel, offensive mode'*. This typically follows an initial message stating *'smoke issuing*' or *'well alight'*.

348. If the Incident Commander was required to state the primary hazard alongside the control measure tactics this might look something like the following:

'Ground floor fully involved in fire, offensive exterior attack using a 45mm jet, transitioning to an offensive interior attack using a 45mm jet once knockdown is achieved, offensive mode'

349. Such a message would serve two purposes.

350. Firstly, from an active monitoring perspective it would give confidence to the Officer monitoring the incident that appropriate control measures were being deployed to mitigate the identified hazard. In the example used above, if the tactical option was anything less than a 45mm jet (i.e. a 19mm high pressure hose reel), then there would be an opportunity for the Officer monitoring the incident to intervene, albeit remotely. It would also serve to reinforce the Decision Control Process being used by the Incident Commander and avoid the possibility of adopting a default tactic as, in my view but supported by the analysis of tactics adopted at the 146 incidents considered in this report, is the case now.

351. Secondly, from an incident audit and review perspective there would be no doubt as to the tactics that had been employed. Their effectiveness could be assessed by the extent of the damage at the conclusion of the incident, which would be stated on the Stop message, and by analysis of any fire investigation report.

352. The Service would need to determine how such a message should be framed and articulated but discharged as a fast time action I believe it would have an immediate and beneficial effect on firefighter and public safety. For that reason, I make a substantive recommendation to that effect in the next section of this report.

Section 3

Recommendations

353. The recommendations from the 3 previous Thematic Reviews referenced within this report are all directly relevant to issues identified during the inspection. M&WWFRS have made progress against several of the recommendations which is welcomed however they all need to be fully implemented to maximise their effect.

Recommendation 1: All previous Thematic Review recommendations should be fully implemented and by no later than July 2025

354. 'Foundation for firefighting' and 'Firefighting' operational guidance was published on 1 October 2024. All 3 Welsh FRS must now review and revise their firefighting operational guidance. There is no logic that supports each Service doing this individually. Accordingly, I have revised Recommendation 2 of the South Wales inspection report to reflect a pan Wales intent.

355. The operational guidance developed by Fire Rescue Victoria that has been shared with M&WWFRS and SWFRS is a good starting point for this work alongside 'NFPA 1700 Guide to structural firefighting (Chapter 10 Tactical Considerations)' and the Brandweeracadamie publication 'The renewed view of firefighting – An evidence-based approach'.

Recommendation 2: M&WWFRS should collaborate with South Wales and North Wales FRS to undertake a fundamental review and rewrite of firefighting SOPs, OINs or equivalent. The outcome of this review should be that firefighting hazard knowledge and control measure tactics are scientifically correct, reflect the most current research and are clearly and unambiguously expressed in one piece of guidance that is easily accessible to all firefighters. Work on this recommendation should commence immediately with updated guidance published no later than March 2025

356. As identified within the South Wales inspection report rewriting operational guidance will only be the first step in changing well embedded practices. A comprehensive program of retraining will be required to shift the current default approach followed by an ongoing program of maintenance training. This will require a substantial investment of time and effort, but it is critical to improving firefighter and public safety.

Recommendation 3: In parallel with Recommendation 2 a comprehensive training program must be developed. This should be done in collaboration with South Wales and North Wales FRS. Underpinning knowledge packages on the LearnPro system must fully reflect the content of the updated SOPs. Micro teaches should be developed for every control measure tactic to give Crew and Watch Managers the best possible resource library of training aids to support the delivery of on station practical skill maintenance training. Combined, and subject to a time and motion study, these packages will give a meaningful time

value to inform the allocation of blocks of time within the station work routine. Work on this recommendation should commence immediately with updated training packages published no later than July 2025.

357. The operational assurance arrangements within the Service largely reflect the available resourcing. There is no dedicated Operational Assurance Team to attend incidents solely for the purposes of active incident monitoring. Instead, active incident monitoring is undertaken by on duty Tactical Managers. The function of operational assurance is overseen by the OEA Team but there is the potential for a delay in them being made aware of risk critical occurrences at incidents due to the time it may take for an OM form to be submitted.

Recommendation 4: To ensure immediate capture of issues identified at incidents the OEA Team should host daily meetings at the change of shift to be attended by all on duty Tactical Officers to review all incidents occurring over the last 24 hours. This would give the OEA Team advance notice of identified issues that they could act on immediately without having to await the submission of the OM form.

358. The first informative message from an incident at which the tactical mode is declared presents an opportunity to capture the extent of the hazards the Incident Commander has identified and the control measure tactics they intend to deploy to mitigate them and resolve the incident.

359. If this message stated the primary hazard and the control measure tactics in use alongside the tactical mode this would be recorded on the incident log but could also be monitored live via main scheme radio. Any obvious disconnect between hazard and control measure tactic could be picked up in real time and addressed possibly prior to an adverse safety event.

Recommendation 5: M&WWFRS should introduce the concept of a first informative message that states the primary hazard and control measure tactics in use alongside the tactical mode. The same would apply to any subsequent informative messages.

360. The geographic size of the M&WWFRS area is such that Tactical Officers mobilised to incidents may have to travel excessive distances, sometimes at night on rural roads. Notifying a second Officer to undertake active monitoring of the incident to allow the mobilised Officer to focus solely on driving would serve as an effective control measure in these circumstances.

Recommendation 6: For management of road risk purposes M&WWFRS should formalise the process of immediately notifying an Officer of the next highest ICS Level for the purposes of active incident monitoring. This would allow the Officer responding under emergency response conditions to focus solely on driving without having to also attempt to monitor any developments with the incident. Once in attendance they would contact the Officer undertaking active incident monitoring who would update them fully on the incident and share with them their appraisal of progress and any potential areas of concern.

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