

BEFORE SIR MARTIN MOORE-BICK, MS THOURIA ISTEPHAN, & MR ALI
AKBOR OBE

ON BEHALF OF THE CLIENTS REPRESENTED BY THE TEAM 2 FIRMS

1.1.1. Dr Stoianov's report goes far beyond the role of a mains water riser as an active fire control measure to the Tower; in addition, the report also covers the delivery of water to the Tower itself and LFB liaison with Thames Water. Regrettably this has identified far reaching systemic failures on the part of the LFB and Thames Water Utilities Limited (TWUL). The report is an ardent critique of the failure within the LFB to comprehend, utilise and deploy water for fire fighting purposes. It amounts to a root and branch criticism of the LFB insofar as water management is concerned; painting a picture of an inability to engage with the technicalities of all that is concerned with delivering water to the site of a fire. In practice the LFB's actions amounted to little more than accepting the supply immediately available without being able to advise upon, or affect, how a higher level of supply could be achieved and delivered to the Tower; a principal concern of a fire service at a major fire. Dr. Stoianov's report chimes with the reports of other M5 engineering experts; Professor Johnson who is highly critical of an inability to adapt to changing environmental and operational communication requirements and Professor Torero who similarly makes trenchant criticism of the LFB's inability to dynamically risk assess and the absence of integrated structured and formal engineering assessment processes within the LFB's standard operating procedures. The same theme of failing to dynamically assess and optimise the assets available at the time emerges clearly from Dr. Stoianov's evidence.

2.1. A mains riser is an *absolutely essential active fire prevention system* and was described as such by Mr. Millet in his examination of Clare Williams on the same subject¹. The

BSR00000081/1

2.2. Chubb undertook an inspection of the dry riser on the 27th October 2014², the service certificate noted that "*Dry riser stack failed, bar at inlet, fault report attached*". On the 13th April Claire Williams emailed Adrian Frith of Chubb asking that they *carry out a service to the dry riser ... as soon as possible?*³ Ms. Williams accepted in evidence that the dry riser had been left unrepaired between 23rd October 2014 and April 2015⁴. She also accepted that she had not taken this matter any further with either Alex Boseman, the normal Chubb contracts manager or his manager, Peter Maddison. This was in all respects entirely typical of the TMO, content to assume that safety critical systems were dealt with by others, with no appreciation as to the gravamen of risk and no inclination to follow up the failing to ensure that the fire safety system was brought back into operation.

2.3. The fact that the fire main should have been kept in good working order is all the more important mindful that the fire main outlets were in the lobbies as opposed to the contemporary requirement that they be located in the protected stairway as required by Diagram 52 of Approved Document B. The differing locations and their concomitant effect on firefighting operations had plainly not troubled either the TMO or Exova when they considered the performance of the building at the early stage of the regeneration project⁵. In fact, Ms. Cooney paid so little attention to the fire fighting main that she didn't include any assessment of its location in her fire strategy assessment:

A. The outlets being in the lobby -- and I'm fairly sure on this -- were a requirement of section 20 at the time. Terry is probably your man to clarify that for you. But the section 20 Act asks for it to be in the protected lobby, rather than in the stair, so that's probably why it was originally constructed in that

⁴ 122 28/04/21.

manner. As an existing condition of a provision that was put in specifically under firefighting legislation, it was considered to be satisfactory.

Q. Yes, that wasn't my question. My question wasn't about compliance, my question was about the absence of and discussion or assessment in your report about the impact of the fire main outlet being in the lobby as opposed to: the stair and its potential impact on firefighting operations. You don't mention anything in your report about that, and my question is: why didn't you do that?

A. We didn't do an assessment on it in terms of outlining how we came to that conclusion, but that process has been gone through and come to the conclusion we didn't -- I suppose I didn't feel it necessary to put it in if I'm ultimately going to say it was satisfactory.

- 2.4. It seems that the riser location was not considered as its location was thought by Ms. Cooney to have been compliant at the time of construction. The traditional gap review that takes place with a legacy system when upgrading a building or when carrying out one of the many different types of engineering risk assessment was not undertaken on the basis that Ms. Cooney *didn't feel it necessary to put it in if I'm ultimately going to say it was satisfactory*. This approach chimes with the failing to draft a fire safety strategy, it amounts to yet another obviation of an engineering safety assessment, predicated on superficial reasoning and unsustainable reasoning.
- 2.5. Had Ms. Cooney spent more time on the mains riser and examined further the contents of CP3 she would have concluded that compliance with CP3 chapter IV, part 1 required a wet as opposed to a dry riser to have been installed. Dr Lane's evidence in Phase 1 was that CP3 applied and both Dr Lane and Mr. Todd agree that the building should have been provided with a wet riser given the height of the building was more than 60 metres.
- 2.6. When asked about the need for a wet main riser Mr. Ashton was unaware that CP3 applied⁷. Neither did he consider, at all, whether the existing installation was compliant with current requirements:

⁷ Day 17 8/7/2020 Terry Ashton page 59.

Q. Did you give any consideration to whether the existing dry riser system was compliant with current requirements?

A. No.

Q. Did you consider whether the creation of new residential units on the lower floor would increase the load on the existing dry riser system?

A. No, because the design of residential buildings, if you exclude the non-residential elements in this building, assume that you're only going to get a fire in one apartment or one flat, and that will not alter the requirements for the rising main in any way.

Q. Did you consider whether the creation of new residential units would make access and availability of adequate facilities for the fire service more unsatisfactory than before the refurbishment works?

A. No, I didn't consider that to be the case. It was quite low down in the building.

Q. Yes. Did you consider whether the non-compliance of the dry riser with current regulations should be drawn to the TMO's attention so that they could take the potential risks of retaining the existing system into account when determining how to manage the building?

A. I think I said earlier that, in statutory terms, there is no obligation on a building owner to bring his or her building up to current building regulation standards. If there were, then the only mechanism for that would be the Regulatory Reform Order.

2.7. Mr. Ashton and Ms. Cooney seem to have adopted a cavalier approach to the mains riser having not consider the initial basis of the design, the extent of the regulatory requirements for compliance, the requirement for a wet as opposed to a dry riser or having communicated any of the above considerations to their client in the process of developing a fire safety strategy. Neither thought it necessary to advise the TMO that design guidance had moved on since CP3. Further Mr. Ashton thought it the responsibility of a fire risk assessor to advise the client⁸, that a design or installation is

⁸ Within the meaning of the Construction, Design and Management, Regulations. Day 17 8/7/2020 Terry Ashton page 61/4-25; 62/1-10

non compliant. Fire risk assessors are not professionally qualified engineers they have not progressed through the ranks of academic and vocational qualification. In fact, there is no requirement that a Fire Risk Assessor is professionally qualified, very few are. As Mr. Todd put it:

*There are currently no express or statutory requirements in relation to the education, training, skills and qualifications of fire risk assessors; the Fire Safety Order does not even require that fire risk assessors are competent, but only that the FRAs themselves are suitable and sufficient, a phrase that is very open to interpretation.*⁹

- 2.8. The general thrust of the TMO evidence was that Mr. Stokes had been asked to carry out work which, we submit, would normally fall within the skill set of a practising engineer. This approach is fundamentally misconceived. A Fire Risk Assessor should not be assumed to be suitably qualified to carry out design risk assessments. It would in our submissions be dangerous to do so and have the effect of circumscribing professional engineering advice. The course a building design takes is invariably established very early in a project long before any building work starts, long before fire risk assessors have anything to fire risk assess; the nature of a Fire Risk Assessment is retrospective, not prospective.
- 2.9. In all respects it appears that the fire consultant had taken a nonchalant if not dismissive attitude to the fire main. This approach is very far removed with having taken all reasonably practicable steps to ensure that a safe design was delivered.
- 2.10. Mr. Stokes' knowledge of the rising main appears to be confined to its existence and to having requested updates on any testing. There is no evidence that he in fact received any evidence of testing or that he sought any further confirmation beyond an initial request. Section 19, Fixed Fire Systems and Fire Equipment of his Fire Risk Assessments are completed on a proforma basis with a tick box checked 'yes' to indicate that a Dry Riser, Evacuation/ Firefighting Lift and Automatic Opening Ventilation System are present. The narrative which follows gives no indication of what testing has been carried out or when it was carried out. Neither does it indicate whether the system

⁹ CTA00000011 para 2.20

was operational or fit for purpose¹⁰. There is no evidence that Mr. Stokes had been aware that the system was out of operation for a considerable period of time.

3. Water delivery conditions

3.1. The Water Supply and Sewerage Services (Customer Service Standards) Regulations (WSSS(CSS)R) 2008 require a minimum pressure of 7 m in the delivery pipe supplying the premises with water. However, the Water Services Regulation Authority (Ofwat) recommends a working pressure requirement or a 'reference level of service' of 10 m (approximately 1 bar g) pressure on the customer's side of the main stop tap. Antithetical to the 2008 regulations Ofwat suggests that water companies instead use as a reference a 15 m pressure head (approximately 1.5 bar gauge under standard conditions of temperature and pressure) in the distribution main serving the property, this is in fact the common industry practice for normal everyday use.

3.2. There is, however, no specific regulatory requirement for a minimum pressure of water for firefighting purposes. As Dr. Stoianov puts it:

Whether the 7 m or 15m pressure head (0.7 bar or 1.5 bar) requirement provides a useful or reliable guide of the pressure that is needed for firefighting is questionable because they do not take into account the required pressure head to achieve a particular flow discharge from a fire hydrant or multiple fire hydrants as required for firefighting.¹¹

3.3. It is the same engineering infrastructure that conveys the water to the property irrespective of its eventual utility. It is important that the piping design is able to deliver fire water at the correct flowrate and pressure. This objective is more readily achieved by mandating the pressure and flowrate required for fire water at the curtilage of the property or the stop cock. That pressure and flowrate could then be reduced, if necessary, for normal use as required.

3.4. The (WSSS(CSS)R) 2008 appears, in practical terms, to be inconsistent with s. 38(1) Fire and Rescue Services Act (FRSA) 2004 that provides that a:

¹⁰ RBK00013251_0028.

¹¹ ISTRP00000010 at 8.2.1(2)

"fire and rescue authority must take all reasonable measures for securing that an adequate supply of water will be available for the authority's use in the event of fire."

3.5. As the regulations stand the water provider, TWUL in this case, is obliged to provide water at approximately 0.7 bar g; the regulator, in the guidance documentation recommends twice that. However, in point of fact neither would ensure that water is provided at a pressure that is capable of meeting the fire fighting needs of buildings in the local area. A legislative requirement that the water demand is assessed, and that nominated parties are responsible for ensuring that the water infrastructure is capable of meeting the assessed demand would provide both clarity and accountability for all to see. It should also be noted that neither do the regulations provide for a minimum volumetric flowrate. It is unlikely that this state of affairs will promote efficacious firefighting facilities. One can appreciate that a local fire and rescue service should be an integral part of the decision-making cycle to determine the delivery conditions of the water. However, it is not for the fire and rescue services to *secure ...an adequate supply of water*. That responsibility rests in practice, at least in the majority, with the utility provider. There appears on the face of the regulations, as drafted, to be a friction between the regulations and the regulatory guidance; neither of which are cognisant of the local fact specific requirements.

3.6. The National Guidance Document on the Provision of Water for Fire Fighting¹² recommends a flow rate of (1,200 l/min to 2,100 l/min) for firefighting in multiple occupancy housing developments of more than two floors. Dr. Stoianov's view is that the National Guidance Document:

is deficient in detail and clarity and lacks the consideration of critical issues that are required for the provision of adequate water for firefighting and the use of modern firefighting equipment in England and Wales. These issues include:

a) *The size of the building;*

¹² LGA & Water UK (2007) National guidance document on the provision of water for fire fighting, p.37. <https://www.water.org.uk/wp-content/uploads/2018/11/national->

guidance-document-on-water-for-ffg-final.pdf(Accessed: August 2019).

- b) *The building materials used and the extent of compliance with current building regulations;*
 - c) *The presence and status of other passive and active systems for fire protection (such as sprinklers and dry/wet fire mains)¹³.*
- 3.7. Dr. Stoianov is therefore of the view that the national guidance on the provision of water for fire fighting is deficient in breadth and detail and lacks cognizance of the existing building regulations and the existence of fire protection systems.
- 3.8. Under s. 57 Water Industry Act (WIA) 1991 fire hydrants are installed, owned and maintained by the utility company. Fire and Rescue Services carry out functional inspections of hydrants but are not required to carry out flow testing, which would allow the installed hydrant's flow coefficient to be modelled at different flow rates, thereby allowing required flows for different fire scenarios with different firewater demands to be calculated. The flow coefficient describes the flow discharge characteristics of a fire hydrant for any particular pressure in the water distribution network. BS 7 50:2012¹⁴ stipulates that hydrants should have a flow coefficient (K_v) at least $92 (m^3 / hour) / \sqrt{bar}$ ¹⁵ Furthermore, the National Guidance Document recommends *against* flow testing hydrants¹⁶.
- 3.9. There does not appear to be any good routine operational reasons for not testing the flow through a fire hydrant. We are troubled, by what appears to be an absolute position, that Fire and Rescue Services do not test the capability of a fire hydrant on a regular, as opposed to frequent, basis to ensure that it is fit for purpose. In the absence of test data there appears to be no accurate way of predicting fire hydrant flow and thereby no accurate way of calculating the quantity of water to be delivered to a hydrant to meet any given operational requirement.

¹³ ISTRP00000002 0014 at line 33 *et seq.*

¹⁴ {BSI00001767}, Specification for underground fire hydrants and surface box frames and covers.

¹⁵ Denoting gauge pressure measured in Bar.

¹⁶ LGA & Water UK (2007) National guidance document on the provision of water for fire fighting, p.15. Available

at: <https://www.water.org.uk/wp-content/uploads/2018/11/national-guidance-document-on-water-for-ffg-final.pdf> (Accessed: 5 August 2019).

4. Fire Hydrant location and identification

- 4.1. Whilst s.42 Fire and Rescue Services Act 2004 requires water companies to ensure the location of hydrants are clearly marked. This seems to be of diminished effect unless there is a requirement that the locations of the fire hydrants are well documented and the Fire and Rescue Services have a reliable method of quickly locating them. Lessons from phase 1 show this not to be the case.
- 4.2. Similarly, whilst wash-out hydrants, which are not used for firefighting, should be clearly marked with a 'WO' label to avoid confusion it would no doubt assist the Fire and Rescue services to have reliable and up to date layout drawings, available in both a durable and digital format, that ensure that there is no risk of confusing fire hydrants with wash out hydrants.

Short Cut estimates to determine 'adequate' fire flow rates

- 4.3. PD 7974-5 (2014) provides a guidance methodology to assess the requirements for an "adequate" supply of water for firefighting in large complex buildings. The methodologies take into consideration occupancy type, fire load energy density (antithetically expressed as a unit of energy per unit of surface area, MJ/ m²), floor area (m²), passive or active fire protection measures, vent penetrations, and dry and wet fire mains. The methodologies are based upon data retrieved from studies of full-scale test fires, fire research undertaken by the Fire Research Station (FRS)¹⁷ from 1955 to 1970 and recent evidence about the use of water for firefighting from over 6,000 building fires in the UK from 2009 to 2017.¹⁸
- 4.4. Dr. Stoianov explains that when the PD 7974-5 methodologies are applied to Grenfell Tower an 'adequate' fire flow rate is computed to be in the range of 1,200 l/min to 10,000 l/min.
- 4.5. It is not known whether the LFB or other FRS make any use of the PD 7974 methodologies to estimate operational water requirements. However, they do not seem to incorporate these flow rate calculation tools into their s.7(2)d visits and operational risk assessments. There is no evidence that any form of quantitative dynamic modelling

¹⁷ Part of the Building Research Establishment.

¹⁸ ISTRP00000010 at section 8.2.2. para 6

took place at the time of the fire, a point which Professor Torero is particularly critical of.

- 4.6. The use of these short cut calculations are potentially of enormous benefit to incident commanders allowing rapid estimates to be made of water requirements. It may be that there is benefit in preparing a range of estimates (based on varying circumstances) for different buildings as part of the LFB's (and other Fire and Rescue Services) s.7(2)d and operational risk assessments.
- 4.7. Dr. Stoianov points out that adopting the approach taken by other nations to estimating adequate fire flow for Grenfell Tower, give a range from 2000 l/min to 8,500 l/min. This range is broadly consistent with the 1,200 l/min to 10,000 l/min range. In contrast, the UK National Guidance Document recommendation applicable to Grenfell Tower is significantly lower than international approaches, with a range of 1,200 l/min to 2,100 l/min. Consequently Dr. Stoianov concludes that England and Wales have fallen behind other international standards and codes in Europe and the USA which:
- a) Specify a minimum residual pressure in the water distribution network for the supply of water for firefighting;
 - b) Take into account the variations in building materials, fire loads and types of use in determining the required/recommended flow rate; and,
 - c) Require/recommend the periodic verification of flow rates from fire hydrants (*e.g.* the experimental validation of flow coefficients from flow testing fire hydrants). Note that the UK National Guidance Document on the Provision of Water for Fire Fighting discourages the flow testing of fire hydrants.

5. **Regulatory requirements and guidance relating to the provision of water for fire fighting**

- 5.1. Dr. Stoianov is at odds to explain that notwithstanding a preponderance in certain quarters to concentrate on the flow and discharge coefficients when considering water distribution systems, the real consideration is that the flow rate at the point of use is optimised. Further, there can be little doubt that it should also meet the demand required. However, the national guidance documents recommend against flow testing of

hydrants¹⁹. It is submitted this position is anachronistic and lacks any appreciation of future requirements and demands.

- 5.2. S. 38(1) Fire and Rescue Services Act 2004 provides that *a fire and rescue authority must take all reasonable measures for securing that an adequate supply of water will be available for the authority's use in the event of fire.*

S.38 appears to have the converse intention to that of the national guidelines, which eschew flow testing.

- 5.3. Further at line 9, Dr. Stoianov explains that:

*Fire hydrants are installed, owned and maintained by the relevant water company in accordance section 57 of the Water Industry Act 1991. Fire and Rescue Services carry out functional inspections of hydrants but are not required to carry out flow testing, which would allow the installed hydrant's flow coefficient to be experimentally validated.*²⁰

- 5.4. There is no evidence that Fire and Rescue Services routinely carry out flow testing of water hydrants. Such testing and live verification is not only advantageous but potentially event changing in the event of a fire.
- 5.5. The Water Supply and Sewerage Services (Customer Service Standards) Regulations 2008 mandate a minimum pressure head of 0.7 bar. However, as Dr Stoianov points out there is no distinct minimum regulatory pressure standard for fire-fighting conditions.

6. Insufficient deployment of water on the 14th June 2017

Ineffective equipment set up

- 6.1. Dr. Stoianov concludes that:

insufficient flow rates delivered by LFB on the night of the fire limited the jets' vertical reach. The insufficient flow rates into the on-board tanks of pump appliances also resulted in frequently stopping the operation of the on-board

¹⁹ ISTRP00000002_0015: LGA & WaterUK (2007) National guidance document on the provision of water for fire fighting, p.15. Available at: <https://www.water.org.uk/wp-content/uploads/2018/11/national-guidance-document-onwater->

[for-ffg-final.pdf](#)(Accessed: 5 August 2019) {BS100001767}, Specification for underground fire

²⁰ ISTRP00000002_0015

6.2. The effect of this appears to be two-fold. Firstly, the supply of fire water to the LFB fire engines was insufficient to allow the on-board pumps to operate continuously. Secondly, refilling the on board feed tanks had an effect on the discharge flow and reach of the on board pumps. It follows that the inability of the LFB to procure feed water had a direct knock-on effect that limited the effectiveness of the water delivery to the Tower. Dr Stoianov emphasises this conclusion by pointing out that:

6.3. Dr. Stoianov is also highly critical of the LFB for not having optimally set up the pumping arrangement. He complains that the LFB appear to set up pump discharge pressures at 10 bar g as a default position²⁴, without considering the maximum operational pressure on the inlet of the pump nozzle, or pressure losses in firehoses, or elevation differences between the pump and the supply nozzle in the cage²⁵. All of which are capable of either varying the water delivery pressure to the suction side of the pumps or the effective discharge pressure of the pumps. These are basic functional requirements which are capable of affecting the different appliances utilised by the LFB. Further there appears to have been no proper consideration by the LFB of the dry fire main on the night.

a) The fire hydrants had low flow coefficients which limited flow from the hydrants. This was the case for the three fire hydrants and one wash-out hydrant. This

²³ ISTRP00000010 section 8.3.4 at para 3

conclusion shows a lack of operational engineering assessment and a basic and operational planning failure.

- b) In the case of A245 ALP and S13A1 ALP, the use of a wash-out hydrant (H5), which was wrongly labelled as a fire hydrant. A wash-out hydrant is not designed for the supply of water for firefighting. This we submit amounts to a basic and fundamental error. Incorrect labelling of a hydrant is a basic and fundamental error. Coupling a fire hose to a wash-out hydrant is inevitably ineffectual.
- c) The use of a single fire hydrant to supply all of the projected water jets on the North and West sides of the Tower which limited the vertical reach and flow rate of those jets. This, we submit, is a basic error and one which affected the discharge of water onto the North and West Sides of the Tower.
- d) A lack of coordination between LFB and TWUL. Including an insufficient delivery pressure in the water distribution system by TWUL and the refusal to turn on the pumps at the Hammersmith Pump Station. The pumps at Hammersmith were not managed as a consequence of the fire they were turned off at 00:30 and turned on again at 05:30 as part of their routine daily control cycle.
- e) Pressure losses between a hydrant (H3) and Pump G272 due to the long length of fire hoses. This was in part due to an insufficient number of fire hydrants proximate to the Tower.

6.5. Notwithstanding the above failures Dr, Stoianov suggests there were solutions which could have been utilised at Grenfell to ensure that fire hydrants were able to supply water at adequate flow rates to fire fighting equipment.

- a) The LFB could have used multiple hydrants to supply pump and aerial or monitor equipment. There is no evidence of multiple hydrants being used in this way at Grenfell.
- b) Kensington Leisure Centre's swimming pools were close by. Those three pools store over 800 m3 water which would have been sufficient to provide a water supply of 2,000 l/min for 5 hours and 35 minutes. The pump installed in the aerial appliance A213 TL on the East side of the Tower had a net positive suction head

of around 7 m to 8 m which was sufficient to draw water from the swimming pools. There is no evidence that the LFB considered the use of alternative water sources or the ability of their equipment to perform this function.

- c) Had the LFB ensured that the pressure reduction scheme had been switched of in the water distribution network and the pumps in the water transmission network at Hammersmith Pumping Station had been switched on the pressure in the adjacent fire hydrants would have increased.
- d) A greater use of pumps to maintain the in-line pressure between fire hydrants and the point of discharge.

6.6. The LFB did not have information from the TWUL about the hydraulic (pressure) conditions in the network. There is no evidence that TWUL provided any advice on how to increase the volumetric flowrate from the water distribution network for firefighting. Such advice could have included whether it was hydraulically feasible to use multiple fire hydrants and prioritising the use of fire hydrants.

7. **Poor communications**

7.1. Whilst there is evidence that the LFB made at least four requests to TWUL for increased pressure and/or flow rate between 01:28 and 10:24 as a matter of generality communication between LFB and the TWUL's NSTs occurred on an *ad-hoc* basis, consequently, the communication was qualitative, imprecise and lacked technical rigour. LFB Control/Incident Command did not articulate, quantify and communicate their water supply and flow rate needs to the TWUL's NMC. Dr. Stoianov suggests that quantitative requests could have included:

- a) A clear statement about the required flow rate for a particular appliance: e.g. the aerial appliance at the East side requires a flow rate of 2,400 l/min (40 l/s), and how can this be achieved.
- b) Periodic updates by the LFB Control to TWUL's NMC as the mobilisation of appliances with significant water flow requirements progressed.

7.2. Such updates could have included the required water flow rate on the incident ground: e.g. *"LFB requires 'X' l/min in this area, and this includes an aerial appliance on the East side of Grenfell Tower {2,400 l/min}, a ground monitor on the South side (~1,900*

l/min}, a water supply to the dry fire main(~ 1,600 to 2,000l/min) [... etc]. These are the approximate locations of the mobilised appliances and equipment; can this flow rate be achieved and how?"²⁶

- 7.3. Furthermore, the TWUL's NSTs do not appear to have requested a quantitative indication of LFB water supply and flow needs which, if not forthcoming from LFB, TWUL's NSTs could have proactively requested themselves.

8. Miscommunication

- 8.1. A number of other factors appear to have contributed to the miscommunication between LFB and the TWUL's NSTs:

- a) LFB firefighters and officers commonly use words such as "poor pressure" to describe "inadequate flow rate" from a hydrant, which leads to misunderstandings with the TWUL's NSTs. A similar confusion is caused by the use of "volume" (e.g. "The officer was happy with the volume of water") to describe flow rate.
- b) LFB personnel make wrong assumptions that if the flow rate from a single hydrant is inadequate, there is little that can be done in terms of providing adequate flow rates (e.g. it seems the common approach was is to "just use what you get" in terms of flow rates and projected water jets (see for example, WM Beale's statement at the GTI hearing on the 2nd of August 2018³⁵ also {MET00010813/36 and MET00007782/37}).
- c) The TWUL's NMC and NSTs have no knowledge of the flow rate requirements for appliances used by LFB (e.g. aerial appliances) so that TWUL can proactively and pre-emptively support LFB with the provision of adequate flow rates.
- d) The TWUL's NSTs (and NMC) define "poor pressure" as water pressure below one bar (10m as a pressure head), which is based on the performance and serviceability requirements for water distribution networks under normal operating conditions. From TWUL's perspective, a water pressure of 3 bar is not

²⁶ ISTRP00000010_0051 7(b)

defined as "poor pressure", and consequently, the requests for "more pressure" by LFB were not proactively addressed or met.

9. The role of the Bulk Media advisor in key conclusions

- 9.1. GM Welch was mobilised as Bulk Media Advisor at 01:19 but was re-allocated to the role of Fire Sector Commander shortly after his arrival on the incident ground at 01:57. There was no handover of the BMA role to another LFB officer at this time. Consequently, LFB did not have a dedicated Bulk Media Advisor until 06:30 hrs when SM Payton took over the role of a BMA {LFB00004606 }²⁷, {MET00010 821}²⁸ During this time critical period of 5 hours and 11 minutes (between 01:19 and 06:30) the LFB did not have a Bulk Media Advisor to monitor the water supply requirements and problems for the fire sectors, and to holistically manage and coordinate the provision of large flow rates from the water supply network with TWUL.

10. Alternative water sources

- 10.1. The LFB (e.g. WM Beale, SM Payton and GM Trew) did not proactively look for alternative water sources, such as the Kensington Leisure Centre swimming pools. The Kensington Leisure Centre swimming pools, which were in close proximity to A45 ALP, stored around 800 m³ of water, which would have been sufficient to support the operation of A245 ALP at its rated flow rate of 2,400 l/min for a period of around 5 hours and 33 minutes. Or alternatively, support the operation of S13Al ALP at a flow rate of 3,800 l/min for a period of 3 hours and 30 minutes.

11. Increasing the provision of water from the water distribution network (without changing to the pressure management setup)

- 11.1. Dr Stoianov asserts that an increase in water delivery was still achievable had the LFB worked with TWUL:

67. *Either in addition to or even without the control interventions summarised above, TWUL could also have assisted in increasing the available flow rate to LFB appliances by recommending:*

²⁷ Spreadsheet of LFB operatives deployed to Grenfell Tower fire, Line 384.

²⁸ Witness Statement of Christopher Payton, pp.8-9.

a) *The use of alternative fire hydrant(s) to washout hydrant HS. TWUL (and LFB) failed to identify that the wash-out hydrant HS was not a fire hydrant. Alternative fire hydrants with significantly higher flow rates were available in close proximity (e.g. fire hydrant H4), and pump relays could have been set from fire hydrants located in neighbouring streets. In addition, fire hydrant H4 was outside the pressure reduced area PBARHT08, had a higher pressure in the connected pipe, and it was in close proximity to a water transmission pipe.*

b) *The use of multiple hydrants to supply a pump appliance: In this way, the cumulative flow rate would have significantly increased the available flow rate in comparison to a single fire hydrant (refer to Chapter 6).*

68. *Such operational decisions would have required the proactive support and expertise of the TWUL's NMC, who should have been able to analyse the hydraulic conditions in the water distribution network by using the hydraulic model of the water supply network and near real-time flow and pressure data; and, on the basis of this expert analysis, guide the NSTs.*

11.2. The NMC appeared to prioritise flushing to reduce the risk of discolouration against the urgency to increase the flow rate available for firefighting, seemingly failing to consider the following factors:

a) Flushing introduces time significant delays to open a district boundary valve in order to increase the pressure and flow rate.

b) The by-pass of the pressure reducing valve (PRV2310609) could have also been achieved by fully opening the pressure reducing valve (e.g. a minor modification to the pilot rail of the valve and venting the cover chamber). This solution would avoid the need to flush the by-pass of the pressure reducing valve.

c) Flushing has no apparent benefit on the delivery of water, either in terms of flow or pressure, for the LFB's use.

12. Professor Torero

- 12.1. Professor Torero makes entrenched criticism of the LFB's outmoded approach to fire fighting. At line 832 et seq. Prof Torero states²⁹:

"The fundamental misunderstanding that the primary role of the Fire and Rescue Services is to fight the fire is apparent at all command ranks. There is clear evidence that the LFB considers that if the fire cannot be fought there is no alternative path of action or role. The perception that the fire has to be fought, subordinating all other actions, is shared by all ranks of the LFB command. This perception was at the heart of the inadequate dynamic risk assessment conducted during the Grenfell Tower fire and is a key weakness of the training and structure of the LFB."

- 12.2. He goes on to attack the culture in the LFB that eschews all technical issues inherent in modern day firefighting strategies opining that there is a culture within the LFB that:

...manifests itself as an enormous level of unawareness of the key technical issues to be considered³⁰

a complete disregard of the need to enhance the technical competency of the fire service, and an absolute insensitivity to the mistakes made³¹.

- 12.3. and further:

Currently, the culture of the London Fire Brigade exhibits, at all levels, a total disregard for technical competency and the understanding of building performance³².

- 12.4. Professor Torero's comments are consistent with Dr Stoianov's observations on the absence of a bulk media advisor for a large and early part of the LFB's presence at the Tower. Similarly, the inability to dynamically risk assess was manifest in the LFB's inability to optimize fire water for their appliances from the TWUL distribution network. This failure is rooted in a lack of technical competence and a lack of technical knowledge coupled with an abject lack of appreciation of what could have been achieved. Such is the scale of change faced by the LFB that Professor Torero describes

²⁹ JTOR00000002_0024

³⁰ Section 27.17 - Grenfell Tower Inquiry: Phase 1 Report, Report of the Public Inquiry into the Fire at Grenfell Tower on 14 June

2017, Chairman: The Rt Hon Sir Martin Moore-Bick, Volume 4, October 2019.

³¹ JTOR00000002_0024 at line 845, *et seq.*

³² JTOR00000002_0028 at line 961.

the task as *a drastic change of culture within the Fire and Rescue Services will face many complex barriers.*

- 12.5. In Professor Torero's second report he further emphasises the importance of firefighter and the Fire and Rescue Services technical competence:

If a form of poor building performance is foreseeable, then it is the responsibility of the Fire and Rescue Services to put in place provisions, within their protocols, to mitigate for this poor performance. If this foreseeable poor building performance is disabling, then it is incumbent on the fire service to identify this and explicitly require rectification. This is normally done through the process of inspection³³.

- 12.6. These comments raise the issue of the extent to which the LFB have utilised their enforcement powers under the Order since the fire mindful of the large number of ACM and other clad buildings there are now within England and Wales.

- 12.7. Lastly, Professor Torero concludes with an assessment of LFB's competence:

The evidence shows' that, the real competency is so low that it leads to practices that endanger the public and LFB staff and prevents the organization from learning.³⁴

13. Conclusions

- 13.1. The mains water riser suffered from a lack of testing and maintenance in 2014 and 2015. The fact that it was not functioning was known to the TMO who acquiesced to its inoperability.
- 13.2. Neither the NMC, NSTs or the LFB identified that a wash-out hydrant was in service as a fire hydrant or that it was unsuitable for the delivery of water for firefighting.
- 13.3. TWUL delegated the complex task of supporting the key task of water delivery for a large fire to technicians who had limited expertise and knowledge; while at the same time TWUL did not provide the NSTs with the required technical guidance and

³³ JTO000000005 at line 498 *et seq.*

³⁴ JTO000000005 0004 lines 81-82

assistance. In all circumstances the technicians were not properly qualified, either professionally or by experience to take on such a key safety engineering function.

- 13.4. Similarly, the TWUL's operational response on 14 June 2017 relied on the improvisation and knowledge of NSTs at the Tower. This task was beyond the training, skills and expertise of NSTs.
- 13.5. The LFB did not have information from the water company about the hydraulic (pressure) conditions in the network and more generally had not appreciated the importance of marshalling key hydraulic data required to service fire water appliances and optimise fire water delivery to the Tower.
- 13.6. The three experts Torero, Johnson and Stoianov evidence that the LFB has failed to engage with technical matters within their various areas of expertise. Johnson evidences that poor communication in built up areas is well documented from recent disaster scenarios and has been well known by the emergency services for many years. There are further technical incongruences accepted at face value within the LFB. For example, the use of BARIE sets on a low wattage, so called IS or inherently safe sets, for the apparent purposes of complying with the ATEX Directive 99/92/EC, notwithstanding an absence of scientifically proven data to support the need to operate at low power: the corollary of which in practical terms resulted in limited radio communication of relatively short distances in built up environments. A more apparent failure being the absence of a structured study, on a fact sensitive basis of the LFB to optimize the use and deployment of leaky feeders and repeaters. Professor Torero paints the picture of the LFB as being both outmoded and one dimensional, capable only of fighting the fire they are presented with and even then only with the equipment that is immediately available to them. Incapable for deeply entrenched cultural reasons of be able to adapt to the modern built environment and simply obvious to the requirement to do so.

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