

REVIEW OF CLADDING FIRES

PROF JAMES F LYGATE, CHRIS BATEMAN | February 10, 2022

Cladding Fires



Why do we clad buildings?



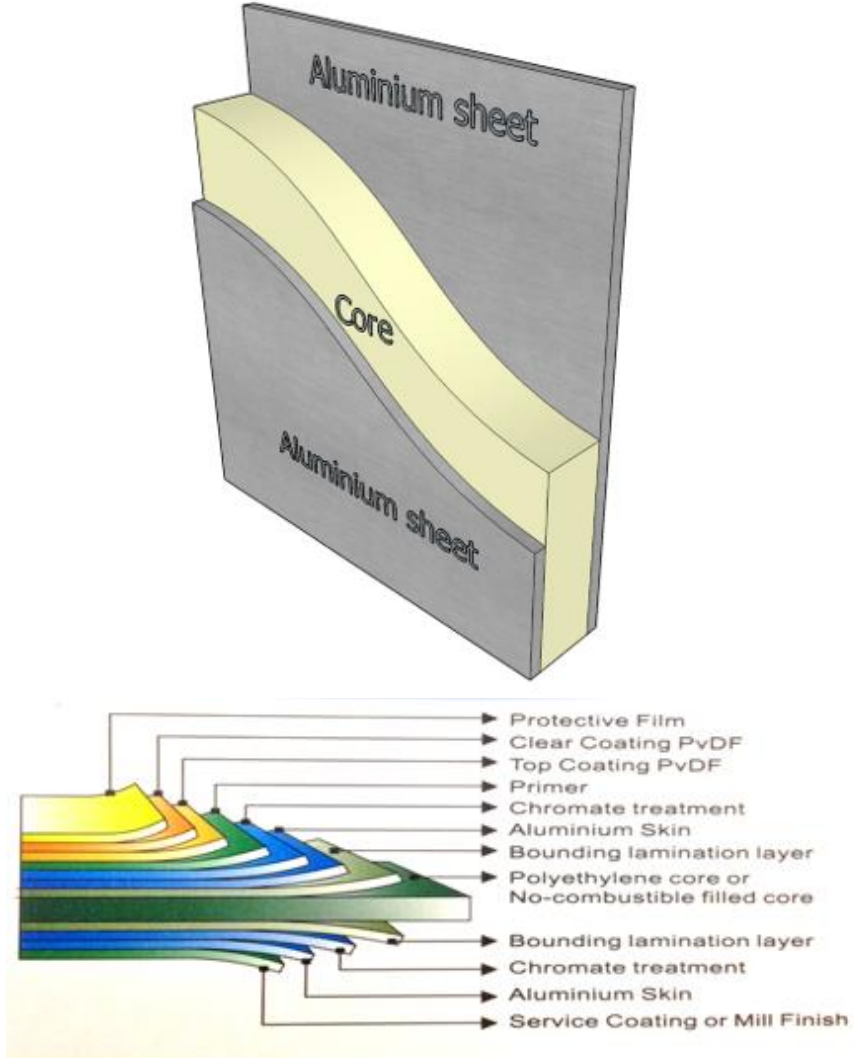
Why do we clad buildings?



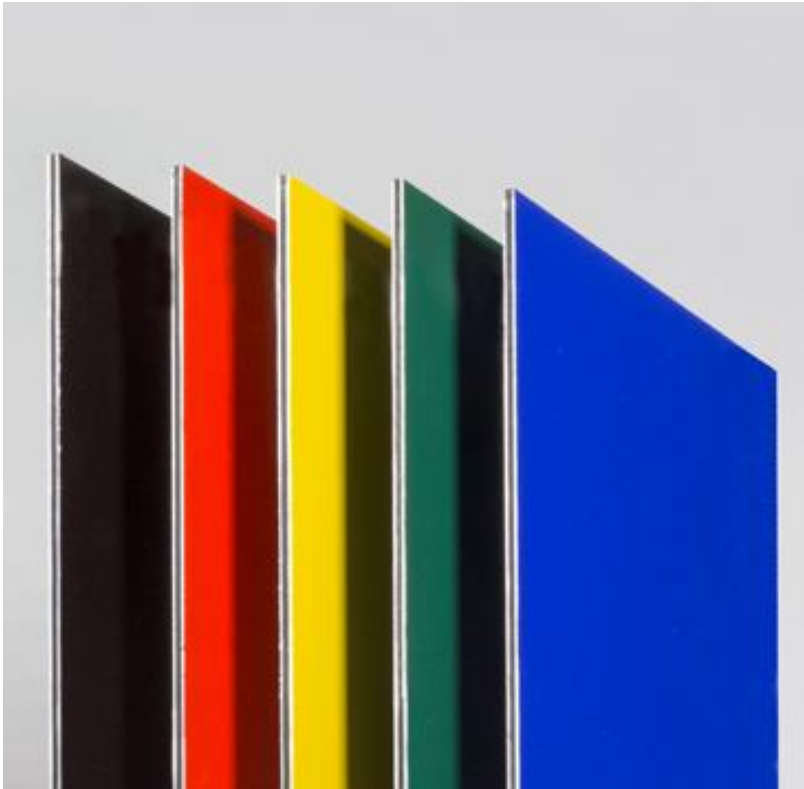
Types of cladding on buildings

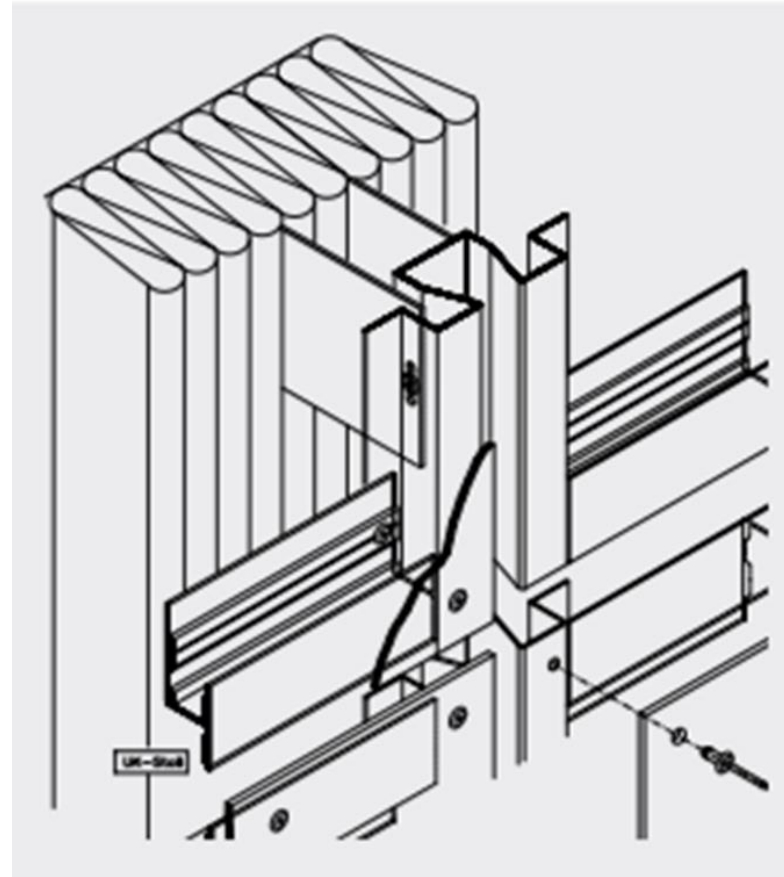
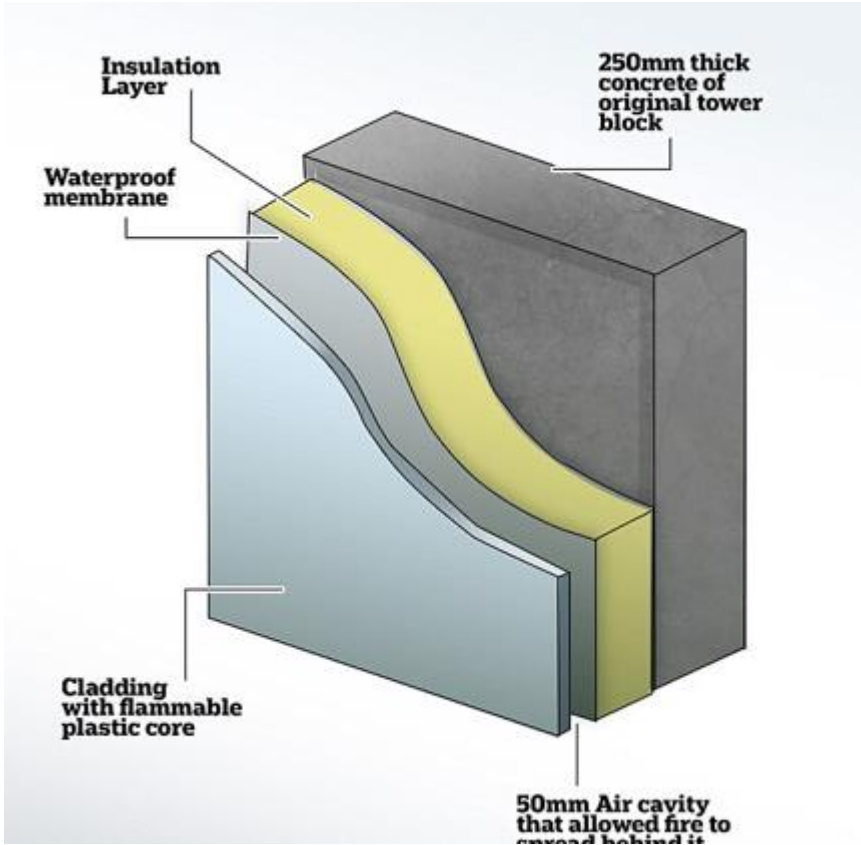


What is Aluminium Composite Cladding (ACM)?



ACP Structure





Star Princess Fire 2006



- + Garnock Court Irvine 1999
- + Television Cultural Centre Beijing February 9, 2009
- + Lacrosse Building, Melbourne November 25, 2014
- + The Address Hotel, Dubai December 31, 2016
- + 30 Toh Guan Road, Singapore May 4, 2017
- + Grenfell June 14, 2017
- + The Torch, Dubai August 4, 2017
- + Ulsan, South Korea October 9, 2020

Garnock Court Irvine 1999



Television Cultural Centre Beijing February 9, 2009



Lacrosse Building, Melbourne November 25, 2014



The Address Hotel, Dubai December 31, 2016



30 Toh Guan Road, Singapore May 4, 2017



Grenfell Tower June 14, 2017



Grenfell Inquiry Phase 2

‘the decisions which led to the installation of a highly combustible cladding system on a high-rise residential building and the wider background against which they were taken’

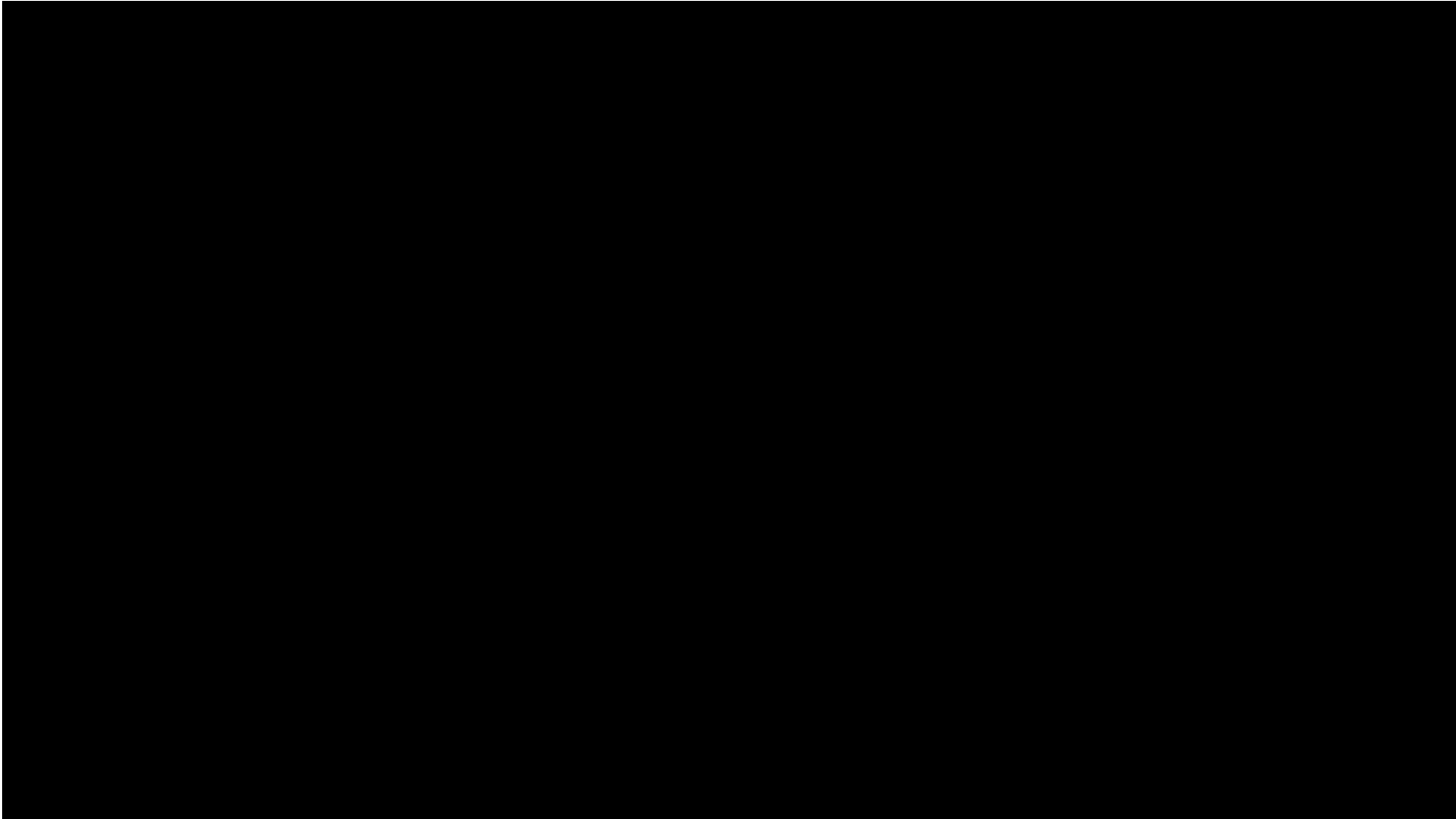
The Torch, Dubai August 4, 2017



Ulsan, South Korea October 9, 2020



Professor Luke Bisby expert report exhibit - CLG10000381 BRE test video



HPL Fires



- + The Royal Marsden Hospital, 2008
- + Lakanal House, 2009
- + The Cube, 2021



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Fire forces hospital's evacuation

Patients and staff were forced to flee onto the streets as a major fire swept through a leading cancer hospital.



The fire has destroyed much of the top floor

The fire broke out at the Royal Marsden Hospital in Chelsea, west London, at 1320 GMT but is now under control.

Much of the roof was destroyed and a number of operating theatres were badly damaged by the blaze, which was tackled by up to 125 firefighters.

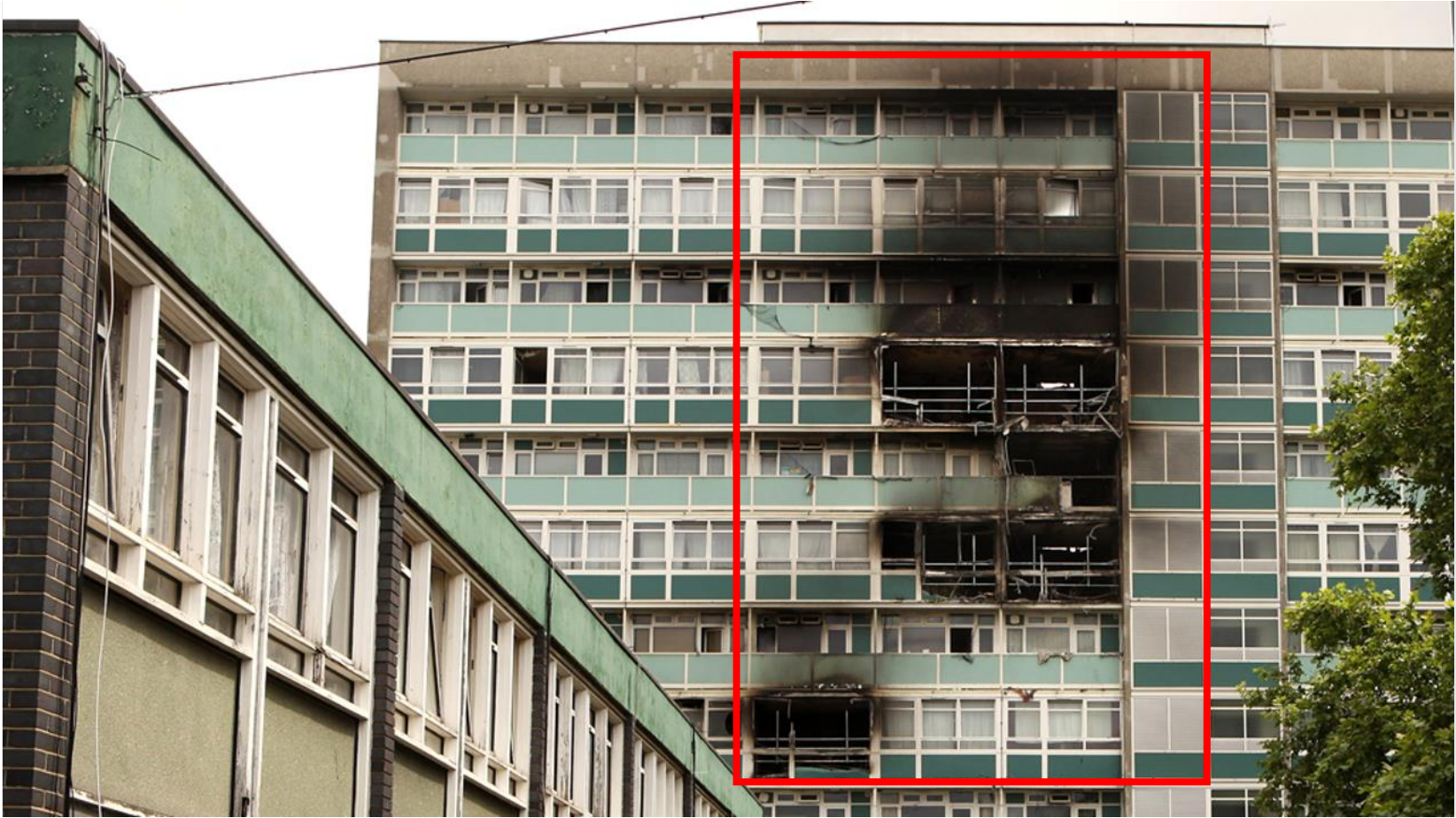
Two patients and two hospital employees were treated for the effects of breathing in smoke.

The hospital said two patients were having surgery at the time of the evacuation but were safely taken off their anaesthetic and ventilators and were recovering at a neighbouring hospital.

Royal Marsden NHS Trust chief executive Cally Palmer said the fire had broken out on the fourth floor of the building, close to where construction work had been taking place.

Ms Palmer said a "large proportion" of the hospital's five operating theatres and two wards had been badly affected, which had "compromised" its ability to perform operations.

Lakanal House July 3, 2009



'The Cube' Student Accommodation Bolton – November 2019

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Bolton fire: Crews tackle huge blaze at student flats

© 16 November 2019

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Bolton flats blaze



Firefighters are tackling the blaze at The Cube in Bolton

GMFRS

Firefighters have been tackling a huge blaze at a university student accommodation block.

Crowds of students were evacuated from The Cube in Bolton when the fire broke out at about 20:30 GMT on Friday.

At its height about 200 firefighters from 40 fire engines were tackling the blaze which was affecting every floor.





Fire behaviour of modern façade materials – Understanding the Grenfell Tower fire



Sean T. McKenna, Nicola Jones, Gabrielle Peck, Kathryn Dickens, Weronika Pawelec, Stefano Oradei, Stephen Harris, Anna A. Stec, T. Richard Hull*

Centre for Fire and Hazard Sciences, University of Central Lancashire, PR1 2HE, UK

ARTICLE INFO

Keywords:

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Toxicity
Insulation
Building
Polymer

ABSTRACT

The 2017 Grenfell Tower fire spread rapidly around the combustible façade system on the outside of the building, killing 72 people. We used a range of micro- and bench-scale methods to understand the fire behaviour of different types of façade product, including those used on the Tower, in order to explain the speed, ferocity and lethality of the fire. Compared to the least flammable panels, polyethylene-aluminium composites showed 55x greater peak heat release rates (pHRR) and 70x greater total heat release (THR), while widely-used high-pressure laminate panels showed 25x greater pHRR and 115x greater THR. Compared to the least combustible insulation products, polyisocyanurate foam showed 16x greater pHRR and 35x greater THR, while phenolic foam showed 9x greater pHRR and 48x greater THR. A few burning drips of polyethylene from the panelling are enough to ignite the foam insulation, providing a novel explanation for rapid flame-spread within the facade. Smoke from polyisocyanurates was 15x, and phenolics 5x more toxic than from mineral wool insulation. 1 kg of burning polyisocyanurate insulation is sufficient to fill a 50m³ room with an incapacitating and ultimately lethal effluent. Simple, additive models are proposed, which provide the same rank order as BS8414 large-scale regulatory tests.

Key Points

- + Compared to least flammable panels
 - ACM PE: 55x peak heat release rate (pHRR); 70x total heat release (THR)
 - HPL: 25x pHRR; 115x THR
- + Compared to least flammable insulation
 - Polyisocyanurate foam: 16x pHRR; 35x THR
 - Phenolic foam: 9x pHRR; 48x THR
- + A few burning drips of polyethylene from the panelling are enough to ignite the foam insulation

The Extent of the Problem

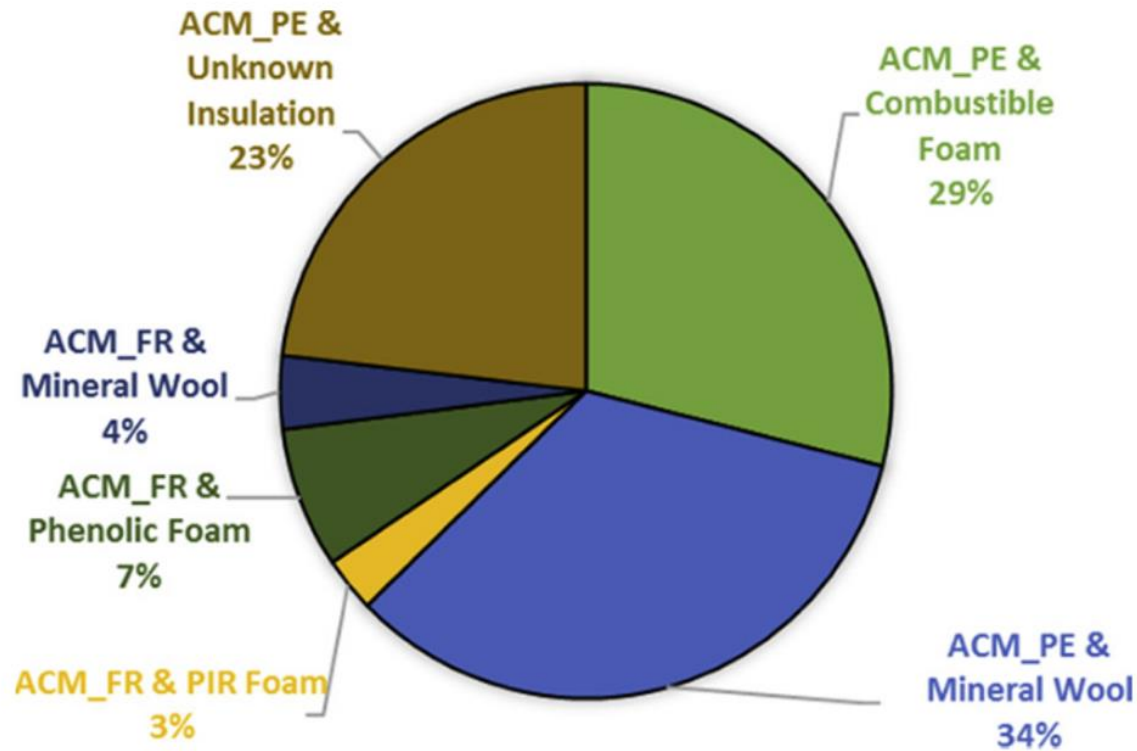


Fig. 9. Tall buildings in England with ACM panels.

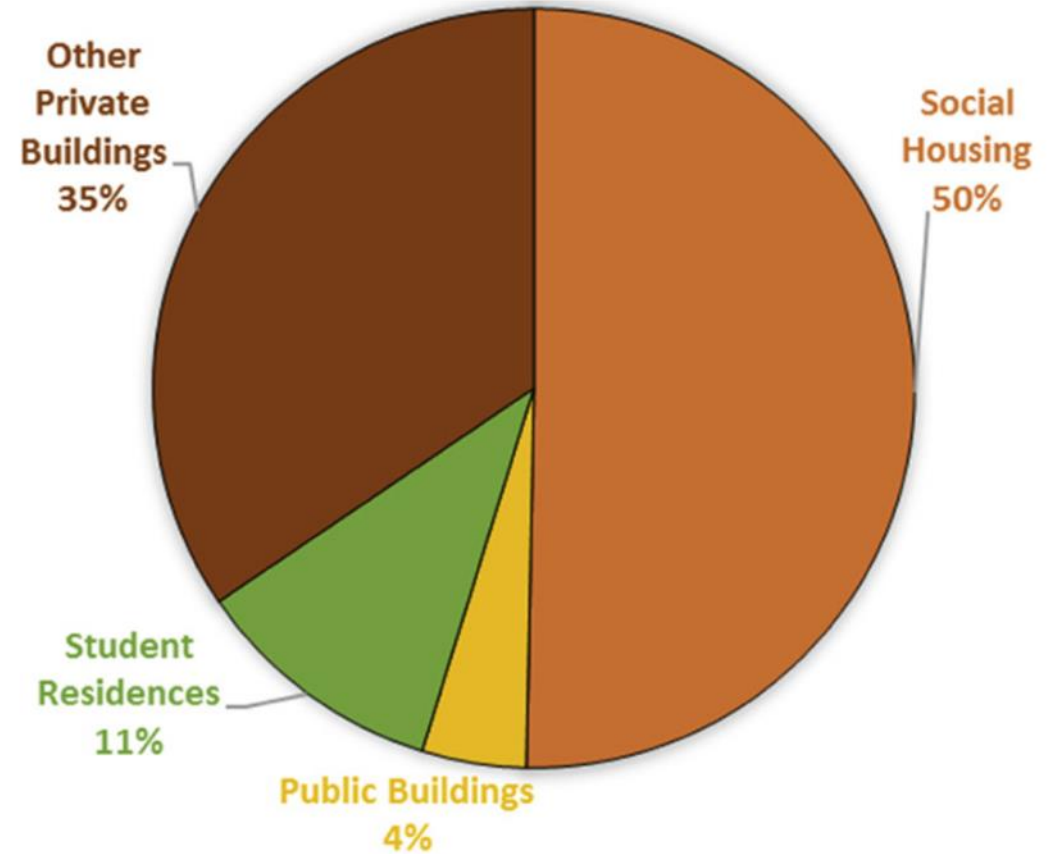


Fig. 10. Use of tall buildings not meeting Building Regulations.

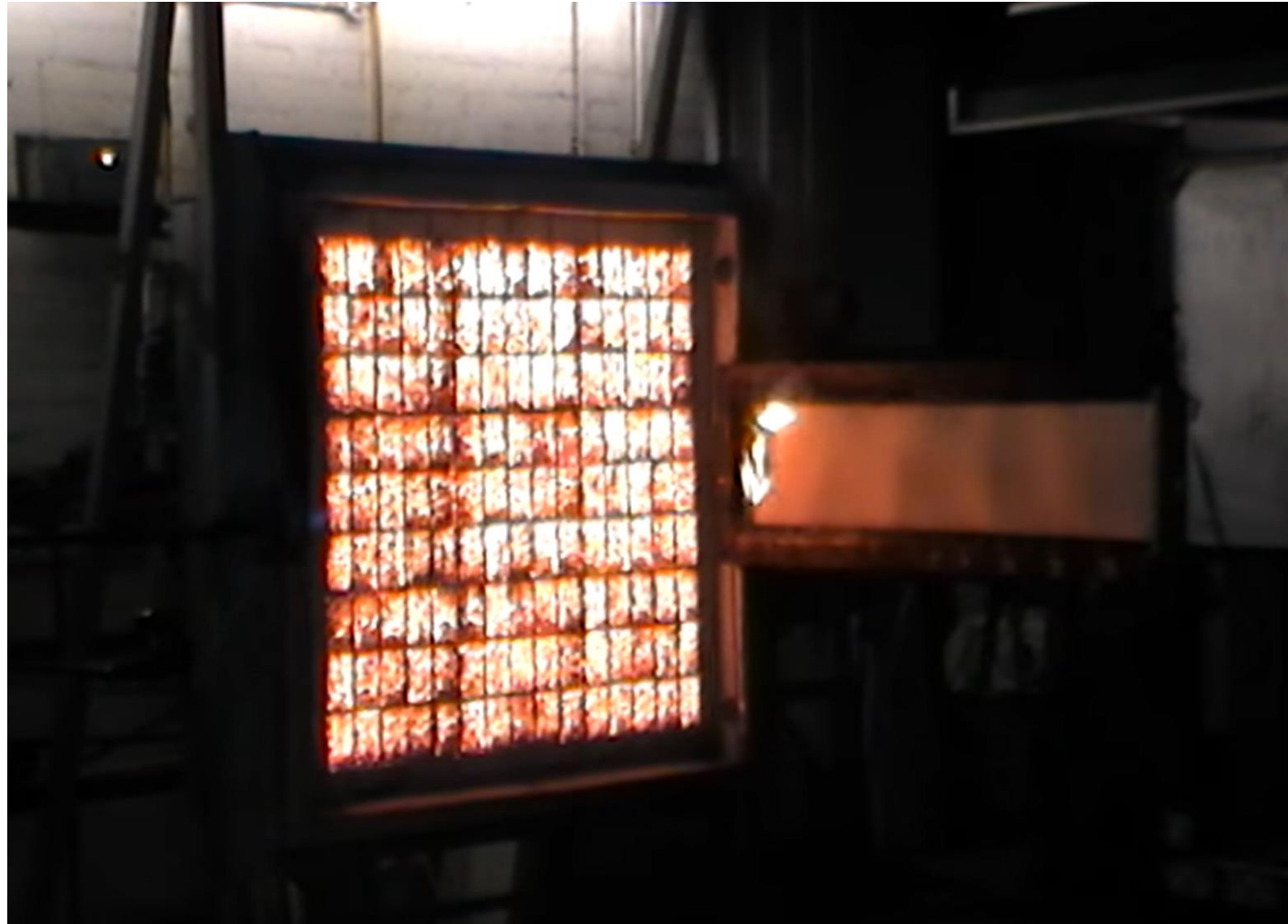
Understanding the Building Regulations

- + Building Regulations
 - vary in England and Wales, NI and Scotland
- + B4 (1), states:
 - *” The external walls of the building shall resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.”*
- + Focus
 - Life safety
 - NOT property safety
- + Follow guidance
 - Approved document B (ADB) England and Wales; Technical Standards (Scotland, NI)
 - Keeps changing
- + Or present a fire engineered solution(not accepted in E&W for Residential >18m)

Fire Tests and Regulations have not kept up with new materials

- + Class 0 =
 - BS 476 Part 6 – Fire propagation – $I < 6$ $I < 12$
 - BS 476 Part 7 – Fire Spread – Class 1 < 165 mm
- + Problem – ACM = Class 0
- + Part 7 designed in 1947 to test wall finishes
- + ACM “beats” the test
- + Some countries require the “core” to be tested.
- + Grenfell: what is “filler”? Is the core of ACM filler?

BS 476 Part 7 Surface spread of flame apparatus



Limited Combustibility

- + Some limited combustibility materials which have been used to replace ACM do not meet the BS 8414 test standard.
- + They “BEAT” the test.



Response of Lenders

EWS1

- + The certificate
- + The scope
- + The effect
- + Who certifies



Form EWS1: External Wall Fire Review

Objective - This form is intended for recording in a consistent manner what assessment has been carried out for the external wall construction of residential apartment buildings where the highest floor is 18m or more above ground level or where specific concerns exist ^(Note 1). It should not be used for other purposes. It is to be completed by a competent person with the levels of expertise as described in Notes 2 and 3 below.

This review is for the sole and exclusive use of the client organisation named below. No responsibility is accepted to any third party for the whole or any part if its contents ^(Note 4). For the avoidance of doubt, the term 'third party' includes (but is not limited to): any lender who may see the review during the process through which they come to make a loan secured on any part of the Subject Address; and any prospective purchaser who may see the review during the process through which they come to purchase an interest in any part of the Subject Address.

Client organisation:.....

Subject Address (One form per block)

Block or building name	Street	Town	Postcodes (all built)

I confirm that I have used reasonable skill and care to investigate ^(Note 5) the primary external wall materials (typically insulation, filler materials and cladding) and attachments of the external walls of the above building/block.

OPTION A ^(Note 1) - Where external wall materials are unlikely to support combustion

I confirm that:

- I meet the professional body membership and competence criteria as described in Note 2
- In relation to the construction of the external walls, to the best of my knowledge the primary materials used meet the criteria of limited combustibility ^(Note 6) or better and cavity barriers are installed to an appropriate standard in relevant locations (Note 7)
- In relation to attachments to the external wall (tick one of the following):
 - A1** - There are no attachments whose construction includes significant quantities of combustible materials (i.e. materials that are not of limited combustibility ^(Note 6) or better);
 - A2** - There is an appropriate risk assessment of the attachments confirming that no remedial works are required
 - A3** - Where neither of the above two options apply, there may be potential costs of remedial works to attachments ^(Note 8)

OPTION B ^(Note 1) - Where combustible materials are present in external wall

I confirm that:

- I meet the professional body membership and competence criteria as described in Note 3
- I have used the reasonable skill and care that would be expected of the relevant professional advisor to assess the level of fire risk ^(Note 9) presented by the external wall construction and attachments (tick one of the following)
 - B1** - I have concluded that in my view the fire risk ^(Note 9) is sufficiently low that no remedial works are required
 - B2** - I have concluded that an adequate standard of safety is not achieved, and I have identified to the client organisation the remedial and interim measures required (documented separately).

Name Qualifications

Organisation Professional body

Signature Date

Outcomes

OPTION A (Note 1) – Where external wall materials are unlikely to support combustion

I confirm that:

- + I meet the professional body membership and competence criteria as described in Note 2
- + In relation to the construction of the external walls, to the best of my knowledge the primary materials used meet the criteria of limited combustibility (Note 6) or better and cavity barriers are installed to an appropriate standard in relevant locations (Note 7)

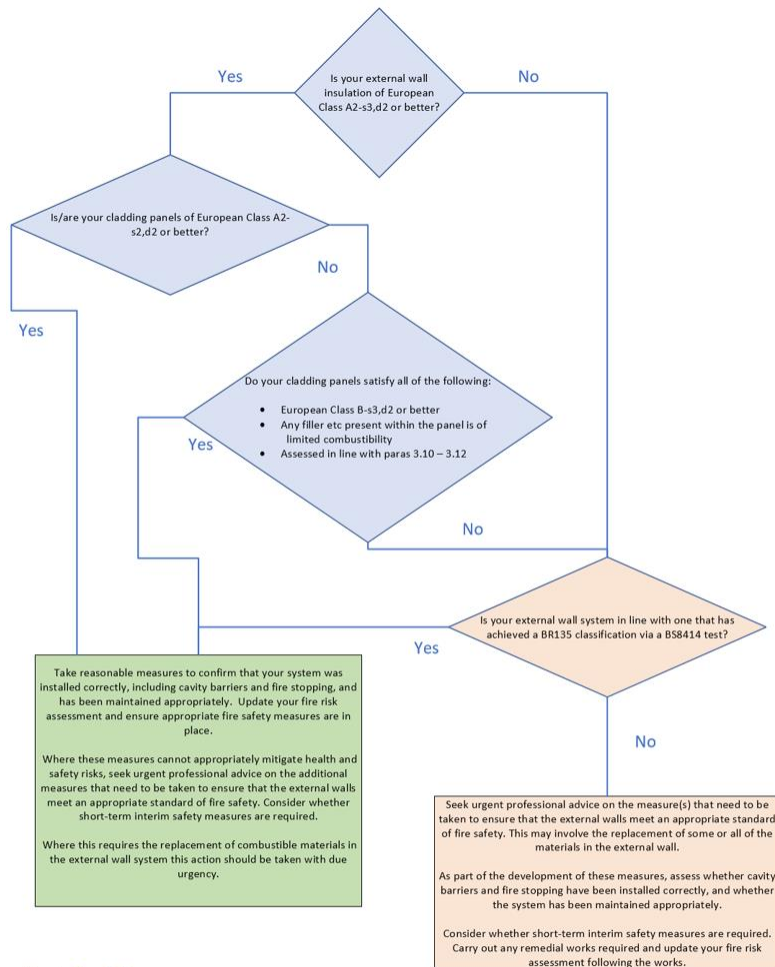
In relation to attachments to the external wall (tick one of the following):

- + A1 - There are no attachments whose construction includes significant quantities of combustible materials (i.e. materials that are not of limited combustibility (Note 6) or better);
- + A2 - There is an appropriate risk assessment of the attachments confirming that no remedial works are required
- + A3 – Where neither of the above two options apply, there may be potential costs of remedial works to attachments (Note 8)

OPTION B (Note 1) – Where combustible materials are present in external wall

I confirm that:

- + I meet the professional body membership and competence criteria as described in Note 3
- + I have used the reasonable skill and care that would be expected of the relevant professional advisor to assess the level of fire risk (Note 9) presented by the external wall construction and attachments (tick one of the following)
- + B1 - I have concluded that in my view the fire risk (Note 8) is sufficiently low that no remedial works are required
- + B2 - I have concluded that an adequate standard of safety is not achieved, and I have identified to the client organisation the remedial and interim measures required (documented separately).



Key to Box Colour

Can be carried out by a Building Surveyor with suitable experience of fire safety in high-rise residential buildings

Can be carried out by a Fire Safety Professional with suitable experience of the fire safety of high-rise residential buildings

Requires a Chartered Engineer with suitable experience of fire safety in high-rise residential buildings

Seek urgent professional advice on the measure(s) that need to be taken to ensure that the external walls meet an appropriate standard of fire safety. This may involve the replacement of some or all of the materials in the external wall.

As part of the development of these measures, assess whether cavity barriers and fire stopping have been installed correctly, and whether the system has been maintained appropriately.

Consider whether short-term interim safety measures are required. Carry out any remedial works required and update your fire risk assessment following the works.

Requires a Chartered Engineer with suitable experience of fire safety in high-rise residential buildings

EWS1 Scope

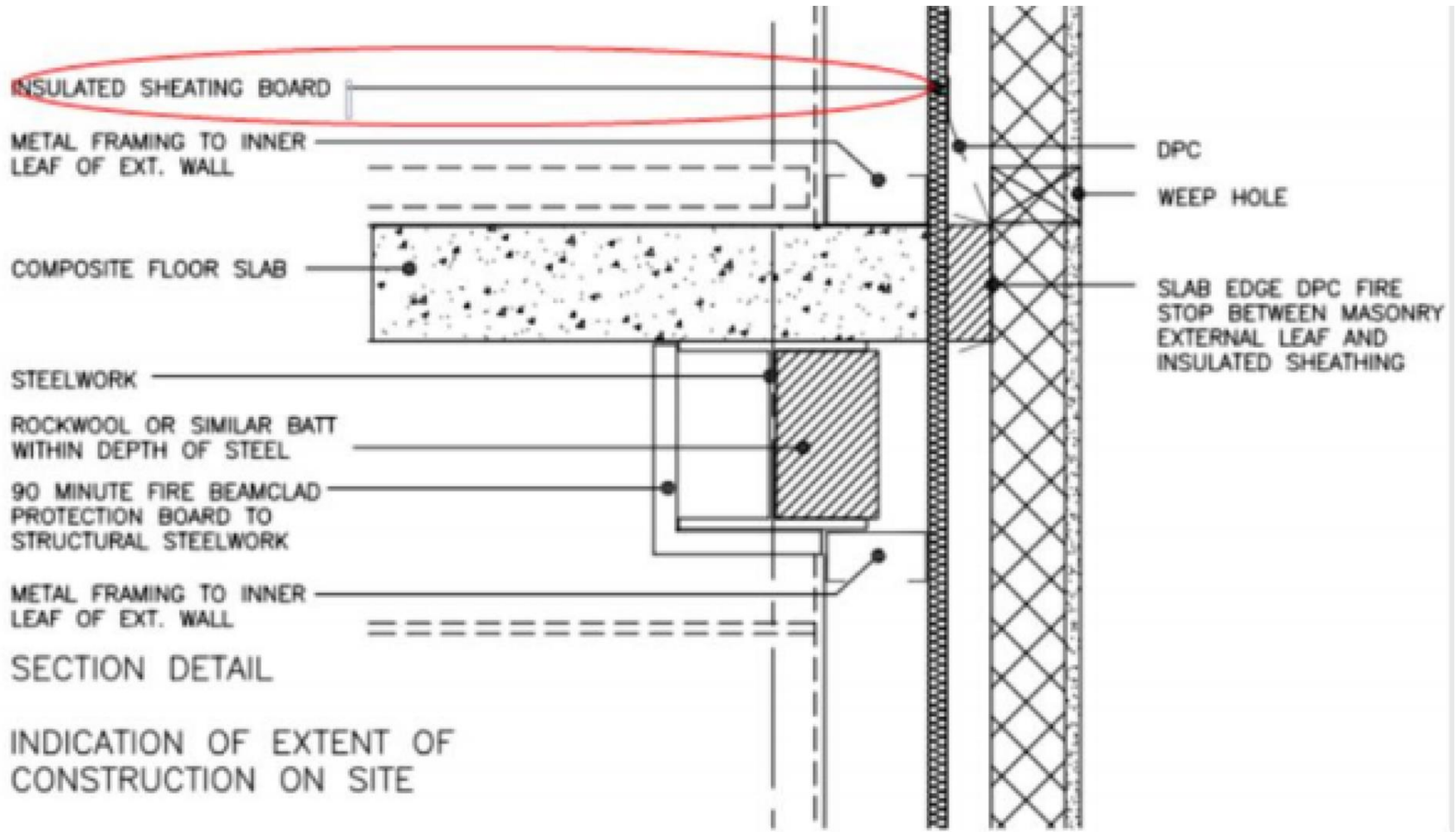
+ Unacceptable Cladding

- ACM
- HPL
- Metal over timber

+ Non-combustible cavity materials

+ Adequate fire stops and cavity barriers

- Intumescent barriers?
 - Photograph of intumescent burning (Carnival Splendor)
- Tension between vented and closed cavity



1.4. The view of the Expert Panel is that the removal and replacement of any combustible material used in balcony construction is the clearest way to prevent external fire spread from balconies and therefore to meet the intention of building regulation requirements and this should occur as soon as practical.

1.5. Building owners should inform residents about the risks arising from the presence of combustible materials on balconies. They should make clear that smoking, the use of barbecues and storage of flammable property on balconies can increase that risk. Advice from fire and rescue authorities is clear that barbecues should not be used on balconies.

Advice Note on Balconies on Residential Buildings

This Advice Note provides advice on the risks arising from balconies on residential buildings.

This Advice Note is written for residents and building owners of residential buildings with multiple dwellings (i.e. blocks of flats), although the principles may also apply to other building types.

1. Summary

- 1.1. Balconies made with combustible materials are a potential source of rapid fire spread on the external wall of residential buildings.
- 1.2. The department's position, endorsed by the Expert Panel, is that the building regulations required that the material and construction of balconies should have been such that balconies should not compromise resident safety by providing a means of external fire spread, even before the introduction of the ban on combustible materials in December 2018. We have previously issued Advice Note 14, which advises building owners to ensure they have assessed the risks with regards to external walls, and this note clarifies the advice in relation to balconies.
- 1.3. Building owners should be aware of the materials used in the construction of their external wall, including the construction of balconies and the potential for any horizontal and vertical fire spread due to their arrangement on the external wall. These should be considered as part of any fire risk assessment.
- 1.4. The view of the Expert Panel is that the removal and replacement of any combustible material used in balcony construction is the clearest way to prevent external fire spread from balconies and therefore to meet the intention of building regulation requirements and this should occur as soon as practical.
- 1.5. Building owners should inform residents about the risks arising from the presence of combustible materials on balconies. They should make clear that smoking, the use of barbecues and storage of flammable property on balconies can increase that risk. Advice from fire and rescue authorities is clear that barbecues should not be used on balconies.

2. Balconies

- 2.1. Balcony fires can spread to the adjacent balconies or into the building. If combustible materials have been used in the balcony or external wall system, it is possible that fire may spread rapidly across the façade. The risk is increased if combustible materials are used extensively (i.e. in floors and

Building Safety Programme

The programme was established to make sure that residents of high-rise buildings are safe – and feel safe – now, and in the future.

Published 20 July 2017

Last updated 20 January 2020 — [see all updates](#)

From: [Ministry of Housing, Communities & Local Government](#)

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Building safety advice for building owners, including fire doors

PDF, 374KB, 35 pages

This file may not be suitable for users of assistive technology. [Request an accessible format.](#)



EWS1 - Effect

- + Buildings blighted
- + London residential market will grind to a halt
- + Owners can't sell
- + Buyers wont buy
- + Lenders wont lend
- + Surveyor putting “nil” value on properties
- + Lender's are going to have to write down debts
- + The system is broken

- + Remove combustible cladding and insulation
- + Reclad buildings
 - With what?
- + Fire barriers
- + Recognise difference between life safety and property safety
- + Improve alarm systems
 - Building wide evacuation if spreads to more than two compartments
- + Sprinklers?

Owners Response

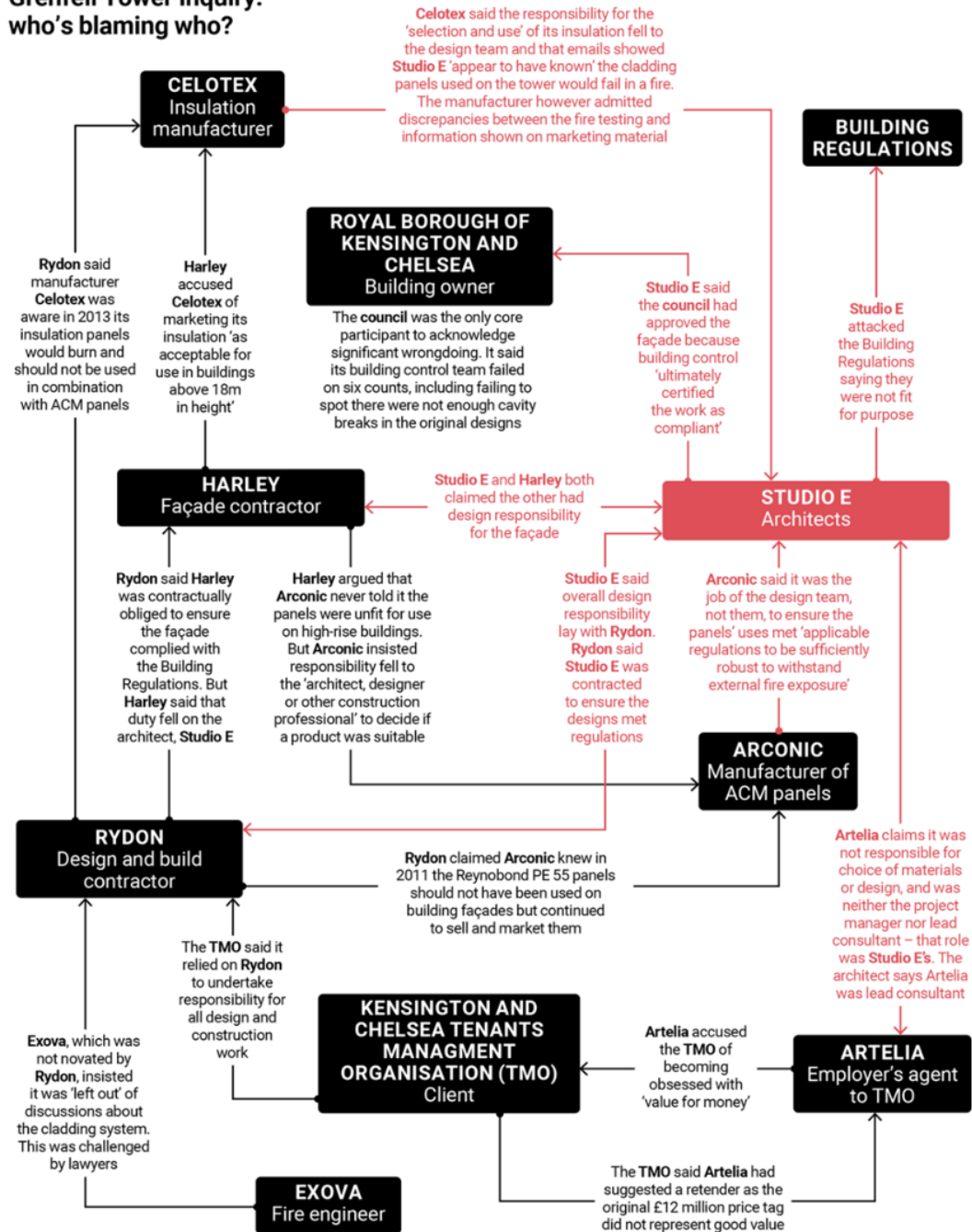
- + Claim on their NHBC/Building Insurance
- + Pursue their losses
- + Building wide assessment

Owners' targets

- + Insurers
- + Developer
- + Designer
- + Architect
- + Specifier
 - Cladding
 - Cavity barrier / fire stops
- + Certifier
- + Contractor
- + Façade Contractor
- + Fire Engineer
- + Chartered Surveyors
- + Lenders



Grenfell Tower Inquiry: who's blaming who?



How can Jensen Hughes help?

Cannot always be on the side of the angels

Sometimes we have to defend the indefensible as best we can

These are complex issues

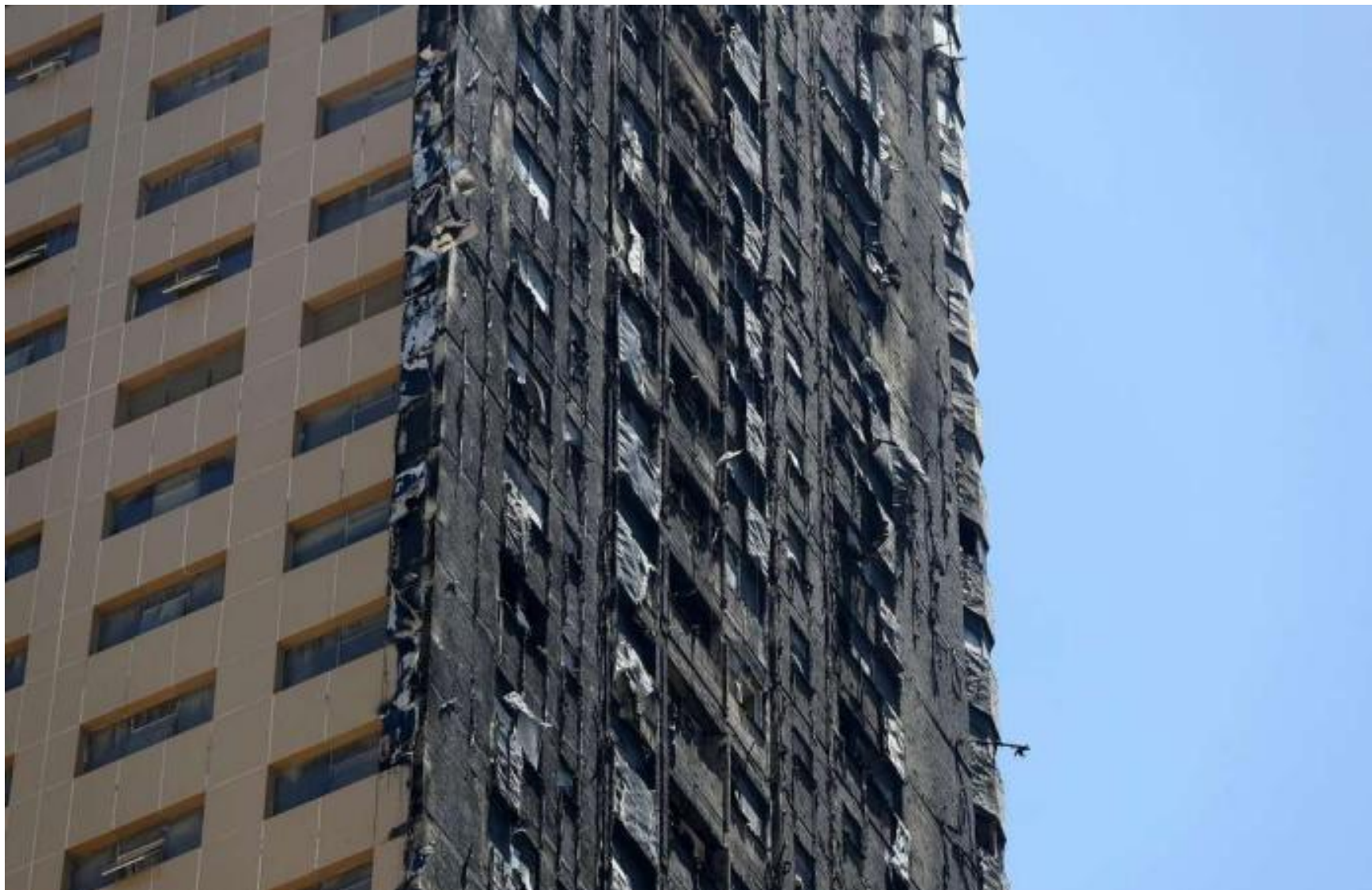
Rarely one single material, company or individual at fault

Proper perspective of liability

Use of alternative strategies to minimise costs



Final Thoughts



Thank You!



(i)

Prof James F Lygate

Principal Investigator

Chris Bateman

Investigator

jensenhughes.com