FAÇADE FIRE SAFETY – A RISK ASSESSMENT METHODOLOGY

BUROHAPPOLD ENGINEERING

9th April 2019

BuroHappold Engineering is an independent, international engineering practice that over the last 40 years has become synonymous with the delivery of creative, value led building and city solutions for an ever changing world.

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TIMELINE

January 2018 – Committee Meetings Commence

→

August 2018 – First Draft Issued for SFS Comment

→

October 2018 – Second Draft Issued for Public Comment

→

Nov/Dec 2018 – Updates Made

→

February 2019 – Practice Guide Presented to State Building Ministers Forum

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SCOPE

The following itemises the scope of this Guide:

- Providing an industry recognised **fire risk assessment methodology** for **suitably qualified and competent professionals** to determine the likelihood and consequences of fire spread via the facade of buildings.

- The Guide will be applicable to all façade designs, and not exclusively aluminium composite panels (ACPs), or ACP type systems, with **the purpose of demonstrating that vertical compartmentation is maintained.** Focus will be placed on occupant life safety and prevention of fire spread to adjacent property, but can also be utilised for property protection, business continuity and fire-fighter safety.

- The Guide will be **applicable to all buildings – both old and new** – to enable consideration of risk factors such as building height, use, materials, and occupancy.

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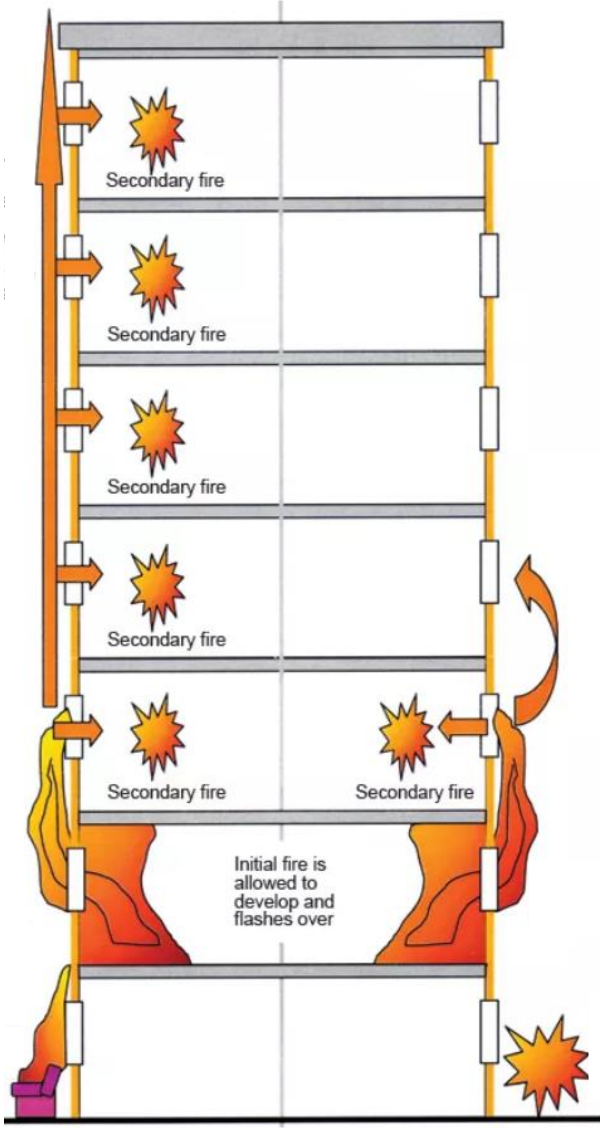

VERTICAL COMPARTMENTATION

The most fundamental premise for fire precautions and life safety strategy for apartment buildings ***is effective fire compartmentation.*** *This translates to enclosing each apartment and common means of escape (corridors and stairs) with fire resisting walls, the concept being that a fire within an apartment will be contained within that apartment for sufficient time to allow the contents to be burned out or for the Fire Service to extinguish the fire without the fire transferring to other areas of the building.*

Dr H Phylaktou & Prof GE Andrews **23/06/2017**

STAKEHOLDER ENGAGEMENT

The assessment should be developed in **collaboration with the relevant Stakeholders** for the project. These could include, but are not limited to;

- Clients
- Architect
- Building Surveyors
- Tenants
- Project Managers
- Council
- Owners/Operators
- Engineers
- Fire Brigade
- Insurers
- Designers
- Builders

An efficient and thorough risk assessment should **involve Stakeholders from the beginning**. It is expected that, much like the International Fire Engineering Guidelines (IFEG), the stakeholder engagement should have occurred before any detailed assessment is carried out.

The Engineer should have identified who needs to be involved in the decision process, so that the project goals can be agreed, and the objectives of the assessment met.

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GOALS & OBJECTIVES

Goal (Examples)	Objective (Examples)
Life Safety	To ensure the building occupants, people within immediate vicinity, and, in adjoining properties, are able to reach a place of safety in tenable conditions.
Fire-Fighter & Emergency Personnel Safety	To ensure attending fire crews and emergency personnel can undertake operational procedures in tenable operational conditions.
Business Continuity	To limit the impact on the commercial viability of the building or its use as a direct result of a fire event.
Insurance Requirements	To ensure the insurability of the property at a reasonable cost by reducing the residual risk to a mutually acceptable level.

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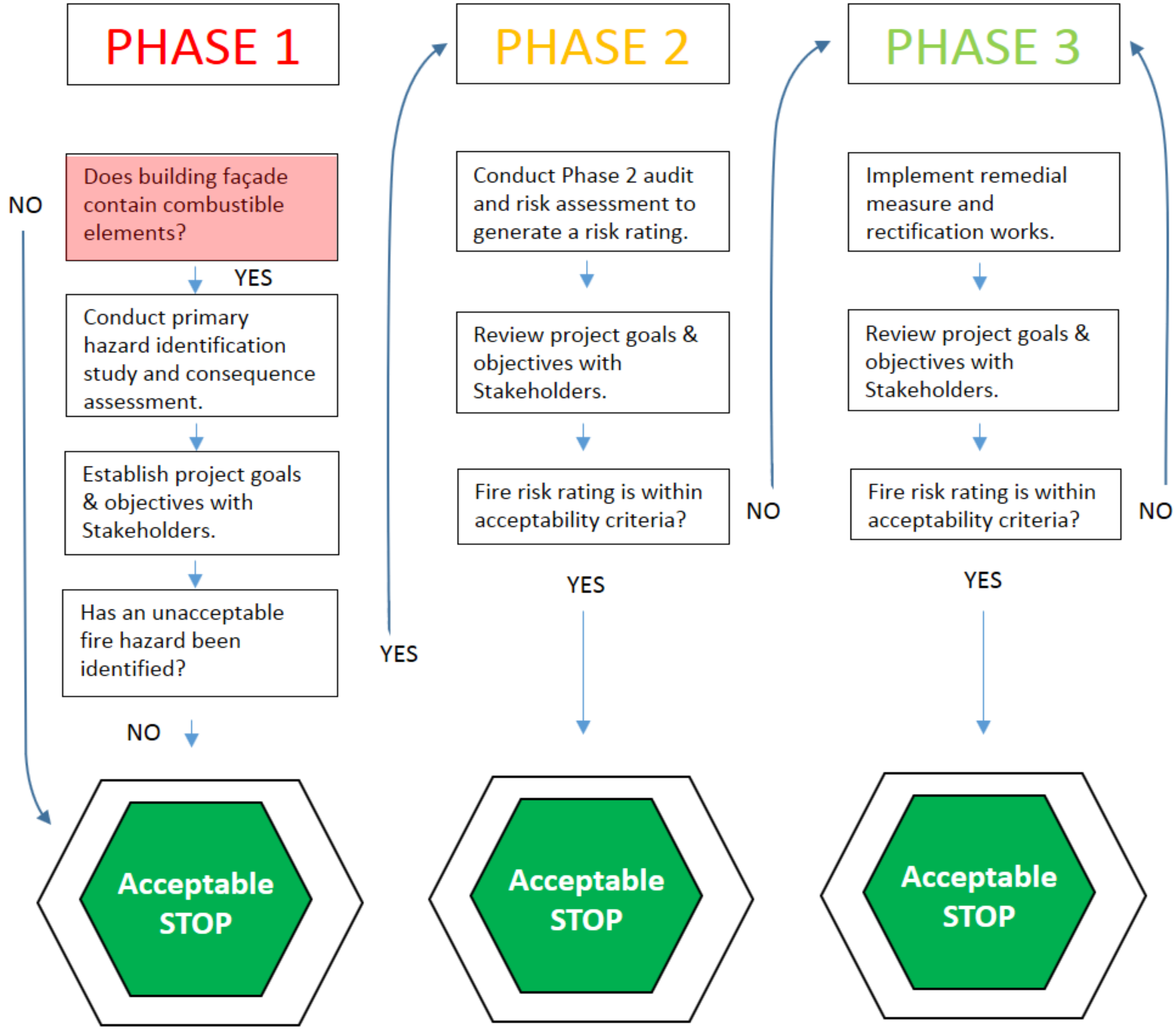
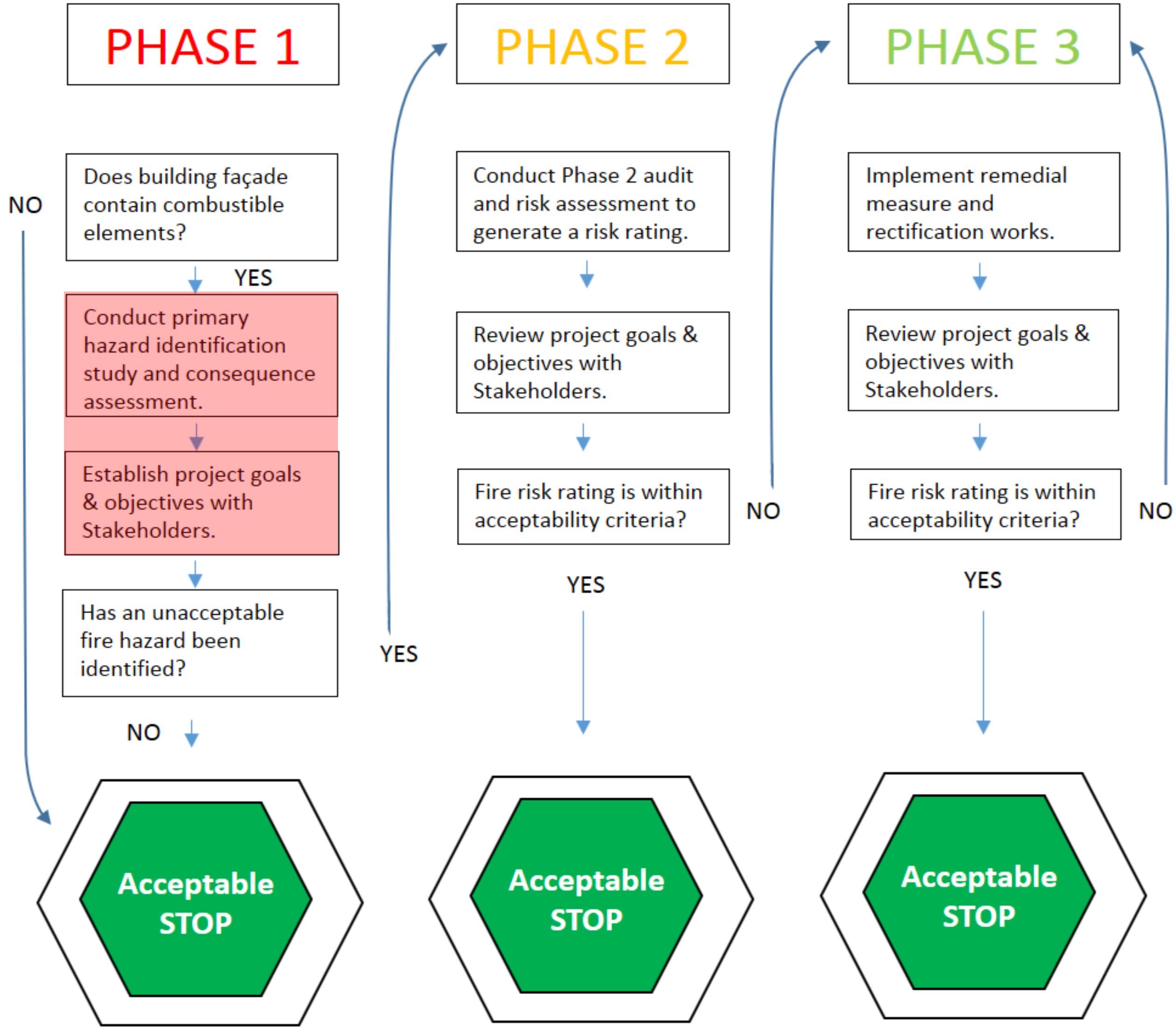


PHASE 1
PHASE 2
PHASE 3
Does building façade contain combustible elements?
NO
YES
Conduct primary hazard identification study and consequence assessment.
Establish project goals & objectives with Stakeholders.
Has an unacceptable fire hazard been identified?
NO
YES
Conduct Phase 2 audit and risk assessment to generate a risk rating.
Review project goals & objectives with Stakeholders.
Fire risk rating is within acceptability criteria?
NO
YES
Implement remedial measure and rectification works.
Review project goals & objectives with Stakeholders.
Fire risk rating is within acceptability criteria?
NO
YES
Acceptable STOP
Acceptable STOP
Acceptable STOP

EPS
LR
VF
PUR
REV
PHE
PIR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HAZARD IDENTIFICATION STUDY

The objective of the hazard identification study is to undertake a systematic review of the subject building and façade design. It is expected that this study will form the basis for Phase 1 of this methodology.

Typical fire hazards relating to building façade design include:

- Presence of combustible material – Polyethylene, Expanded Polystyrene, Wood, PIR/PUR Insulation, etc. – **causing compartmentation to be breached by vertical upward fire spread** and combustible materials, e.g. thermoplastics, causing vertical downward fire spread
- Façade system **fixing failing and causing vertical compartmentation to be breached by downward s**pread, or, a falling hazard for egressing occupants/attending emergency personnel
- **Fire spread via cavities**, or, **fire spread from the interior of the building spreading to the exterio**r of the building via openings, balconies, windows, doors
- **Means of escape capacity** being insufficient to accommodate multiple floors evacuating simultaneously
- **Sprinkler system cap**acity being insufficient to effectively suppress a fire involving multiple floors
- **Fire-fighters having insufficient access** to adopt effective external fire-fighting where the building has been design for internal fire-fighting

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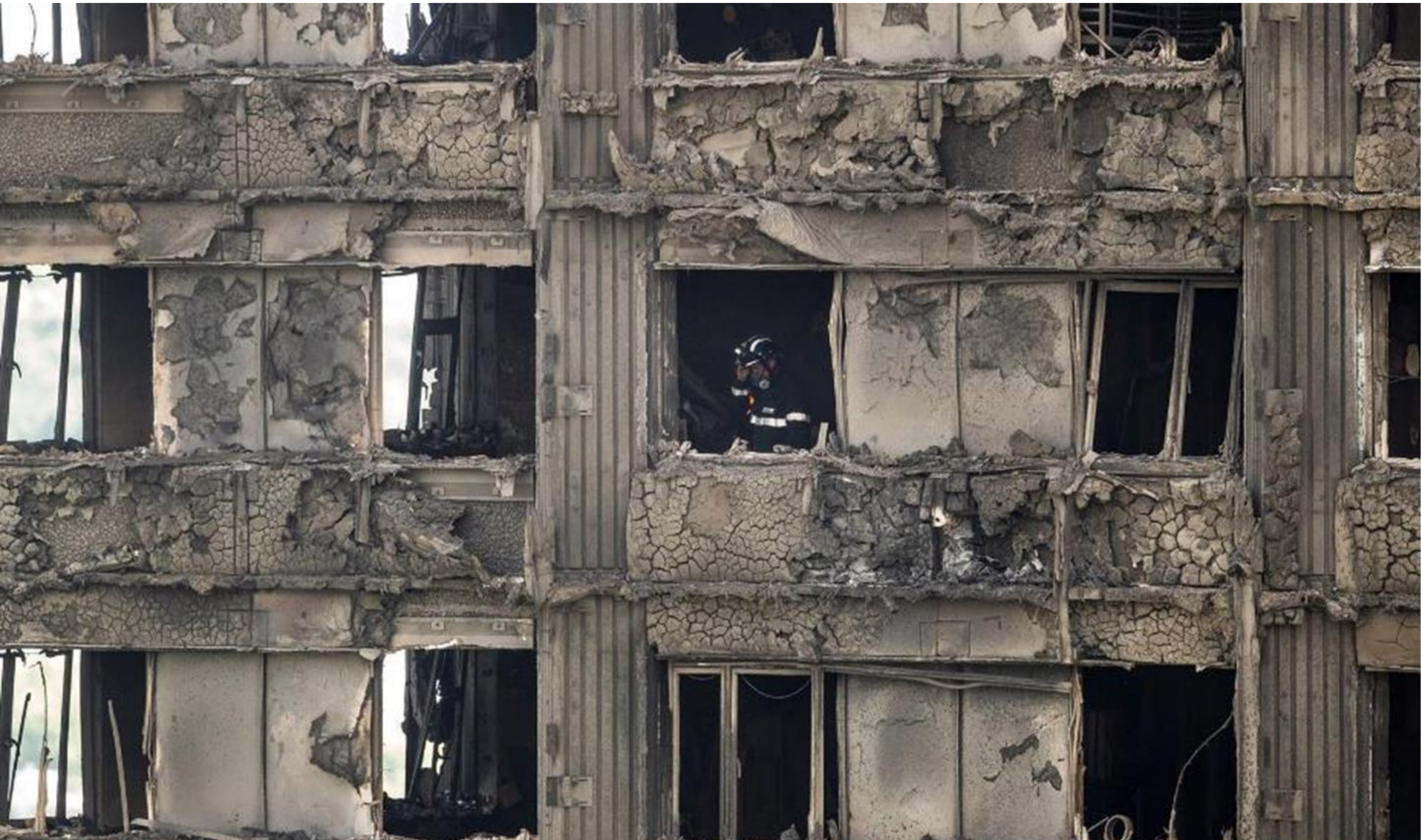
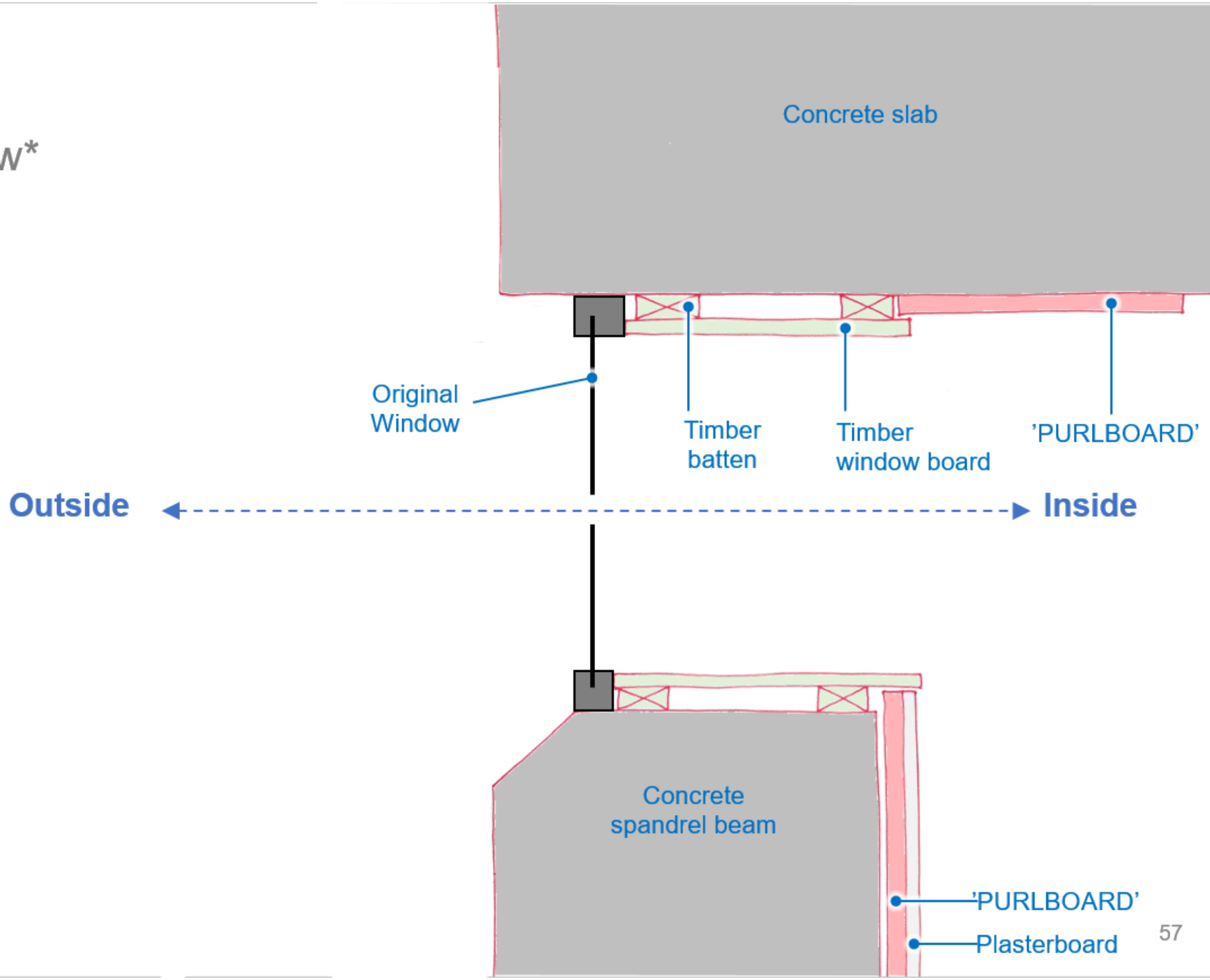


Vertical Section

Through Kitchen Window*



*Indicative sketch – not to scale

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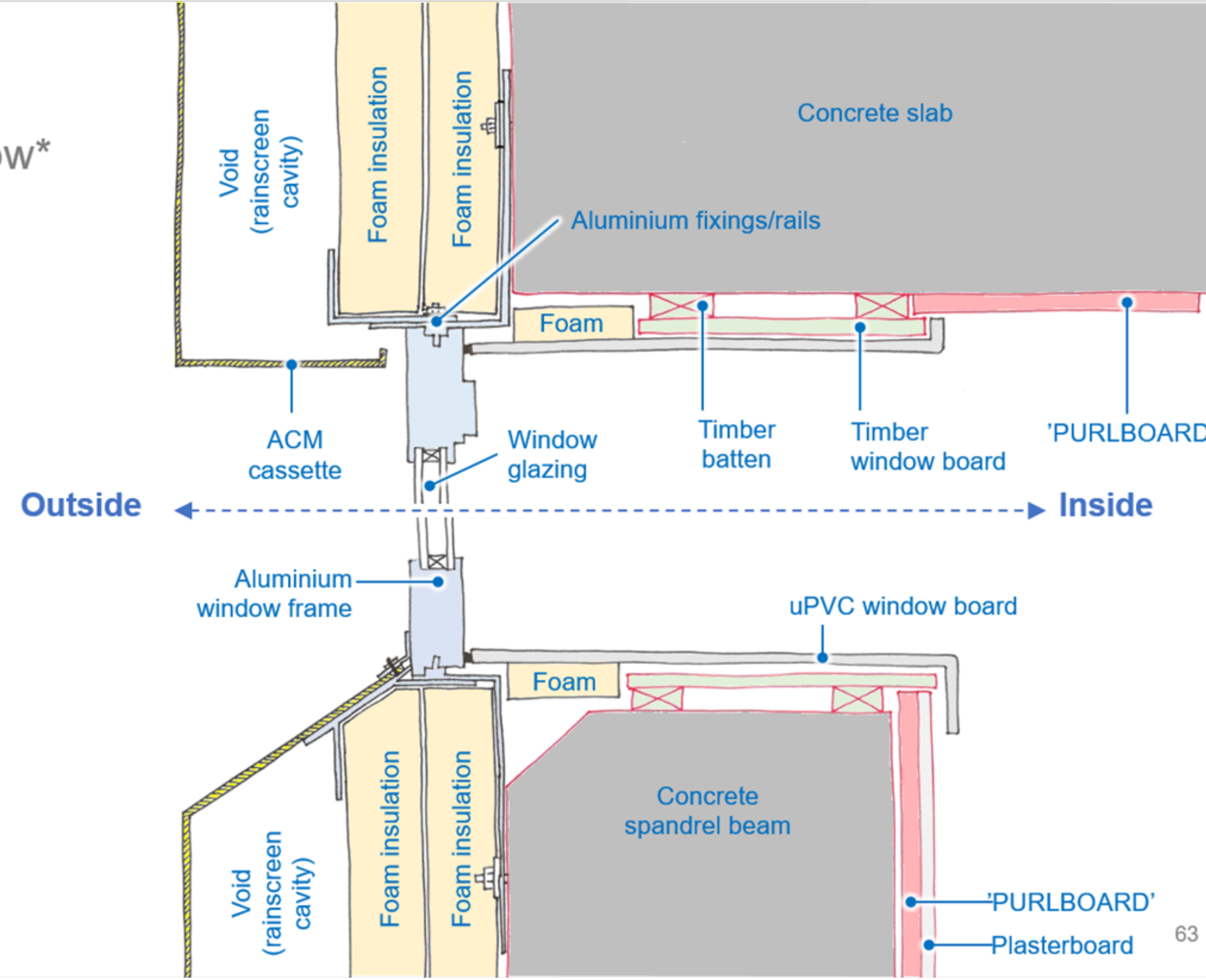
Through Kitchen Window*



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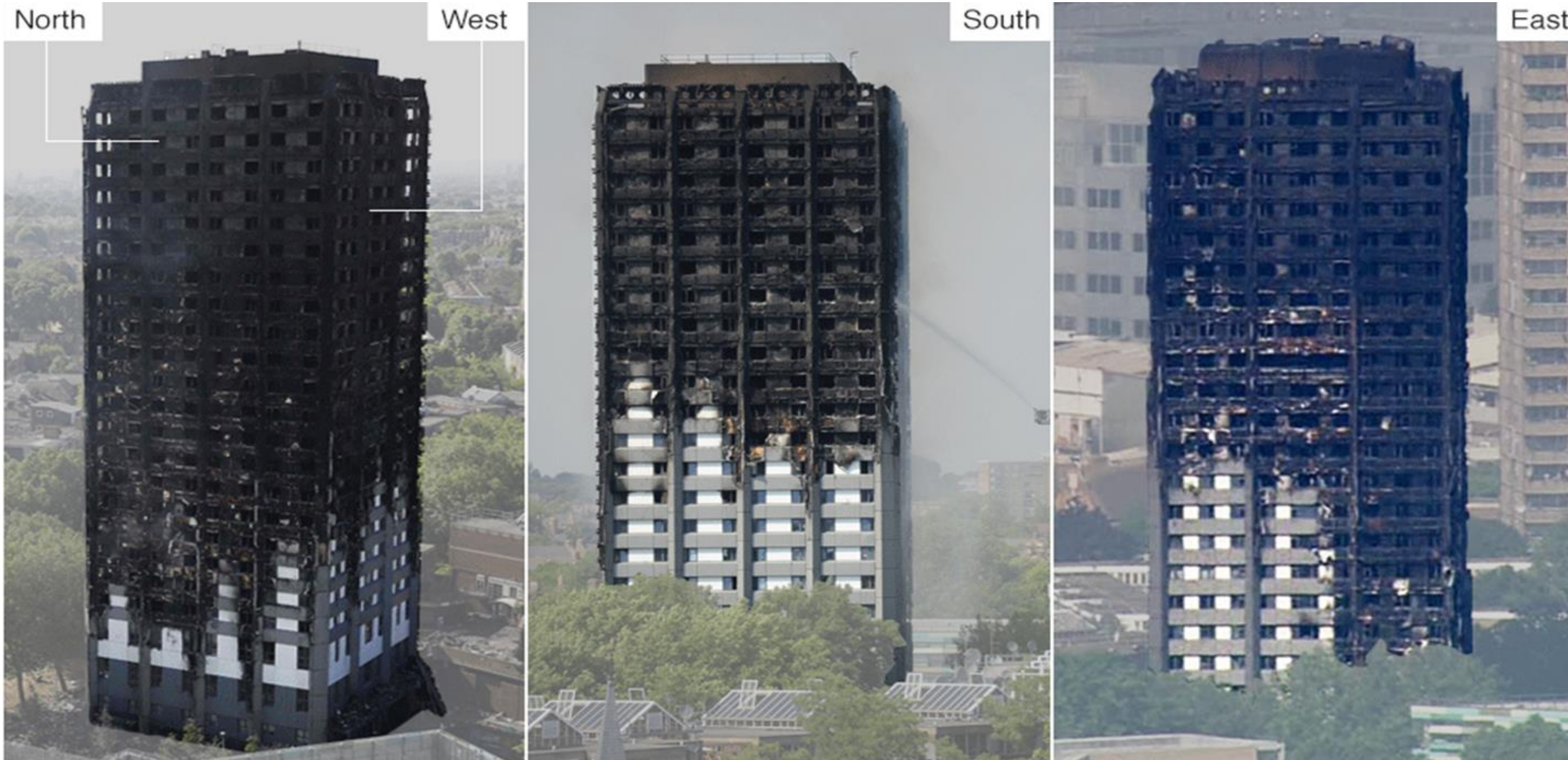

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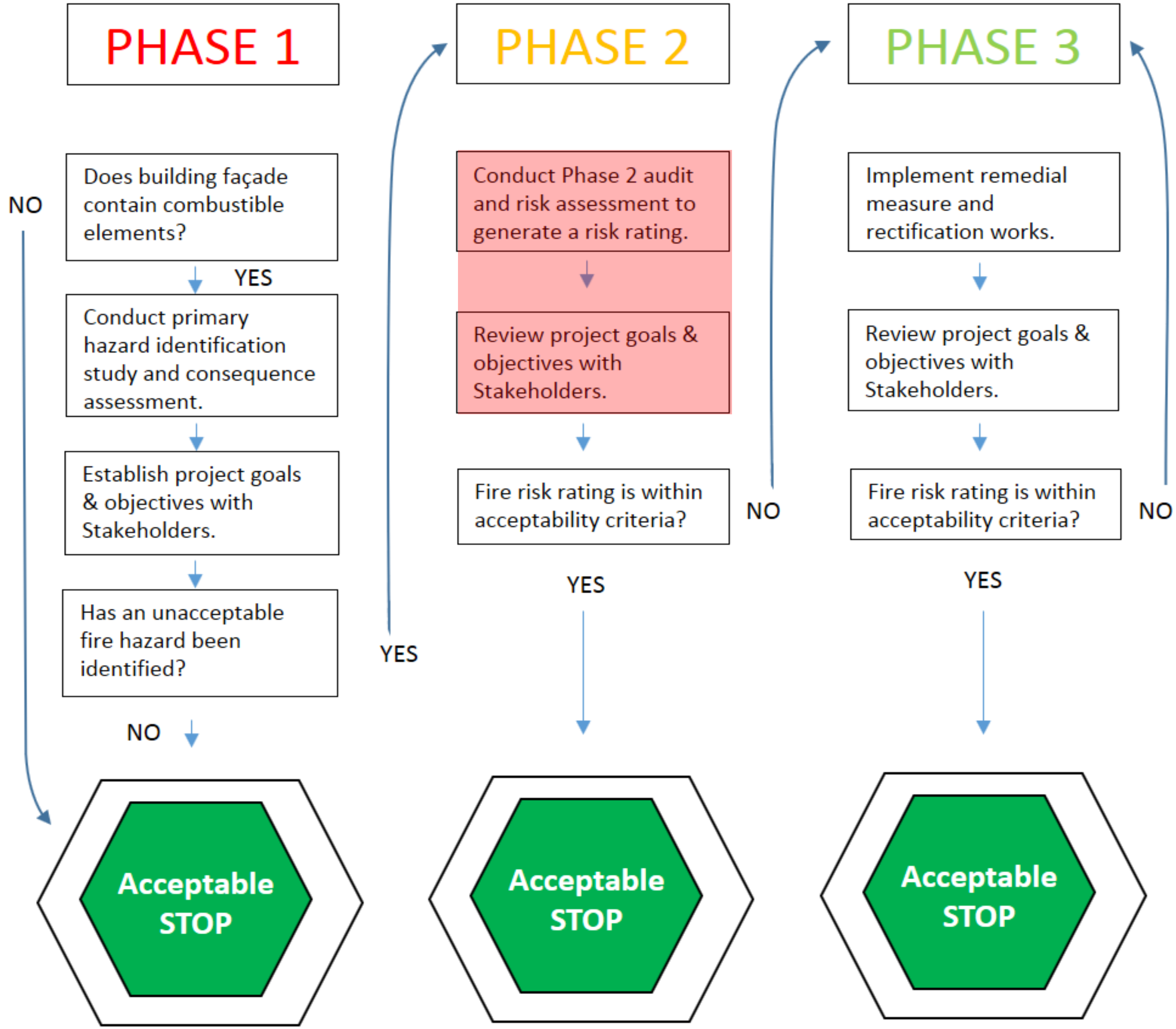
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EFFECT:

External Façade Fire Evaluation and Comparison Tool

NFPA's online tool based on methodology developed by Arup

Fire Scenario	Description
Internal Fire	Fire on the floor plate
	Fire in the kitchen
	Fire on the balcony
External Fire	Fire in car underneath building façade/awning
	Fire in the external seating area
	Fire from discarded cigarette in smoking area
Fire Across the Boundary	Fire in building across the title boundary
	Bush fire event

Likelihood

The initial risk rating should be presented to the Stakeholders. At this stage the project goals should be reviewed again, and consensus met on the categorisation of risk.

Those scenarios that pose an unacceptable conflict with the projects goals should be identified.

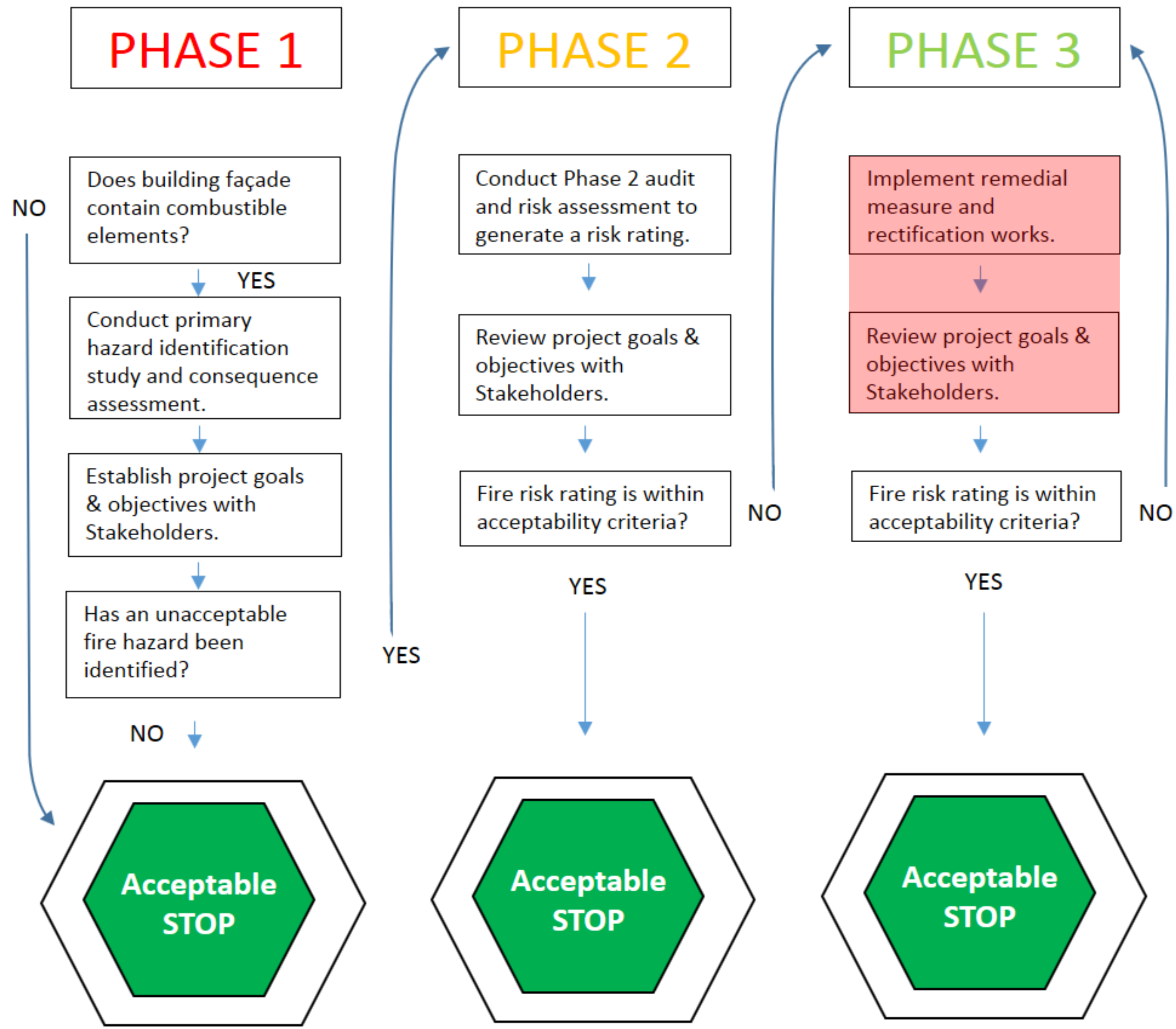
These again will be limited in number meaning that the Stakeholders can approve which scenario requires further study by the Engineer.

Level of Risk	Action Required
Extreme	Immediate action is required. Building should not be occupied until rating is reduced.
High	Risk(s) shall be eliminated if possible, or mitigated if not possible to eliminate in a reasonably short timeframe.
Moderate	Risk(s) shall be mitigated and controlled/managed in a medium timeframe. It shall be ensured that these risk(s) do not become high or extreme if not mitigated.
Low	No further action is required and a record of the decision process is to be kept.

System	Elements
External Wall	External wall components, insulation materials/products, weatherproofing materials/products, unseen fire spread routes and cavity barriers, structural walls elements, attachments/ancillary element, orientation of façade to building compartments and to the title boundary, design of balconies, ignition hazards and fuel sources.
Fire Safety Systems	Automatic suppression (sprinklers), Internal Hydrants, Hose Reels, and Detection & Alarm.
Passive	ation.
Populat	n.
Means o	nts, Assess an "all-out" scenarios involving a multi-level/high-rise external cladding fire.
Fire-Fighting	Access, Facilities, Intervention, Building, Landscape, External operations, Fire-fighter Tenability.
Existing Condition	Maintenance of systems, condition of the passive fire protection, warden training, fire safety management, occupant training.
Construction Fire Safety	Construction Staging, interim temporary fire safety measures, staff training, critical inspection stages.

The resultant risk rating should be presented to the Stakeholders. It is expected that the resultant risk rating will vary from the initial risk rating with the input from the further studies.

With the resultant risk rating it is expected that a reduced number of fire scenarios will have been identified that will require remedial measure or rectification works.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REMEDIATION & RECTIFICATION

The **number of fire scenarios** that conflict with the project goals & objectives are **expected to be limited** in nature.

From this, the **choice of remedial measures and rectification works will be limited** by the project goals, financial and timeline constraints, and the agenda for each of the Stakeholders. It is expected that the **building insurer will play an important part during this decision process**.

Short/Medium/Long Term
The choice of when to make changes to an existing building will be driven by urgency and the time to undertake, and the impact on its occupancy/use;

- Short term measures are those that can take immediate effect within **1-2 weeks**
- Medium term measures are not expected to require a building permit/statement and should be take effect within **1-2 months**
- Long term measures are expected to involve refurbishment or redesign and could require significant changes to the active, passive and operational fire safety design, and possibly require a building permit/statement

For new buildings the impact of change may be easier to manage. However, the implementation of change is recognised as being less where this is introduced early in the design.

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System	Elements
Active Systems	Upgrade of automatic suppression (sprinklers) – to enhance coverage and system capacity, Upgrade to fire brigade facilities (hydrants) – to enable shorter response times, Enhance detection & alarm system to reflect building façade fire hazard.
Passive Protection	Removal or replacement of panels – partial or complete depending on the results of the risk assessment, Introduction of separation – barriers within [illegible]
Oper	
Means of Escape	Afford people greater choice of escape routes along with effective training, Demonstrate that the total building evacuation time can be decreased.
Fire-Fighting	Enhance access routes to and within the building to reflect the building facade fire hazard, Increase information – building info packs, signage, staff interface – for attending crews.

Once the rectification measures have been defined again these should be presented to the Stakeholders for approval.

Integral to this will be the practicalities of implementing these measures and the impact they have on the building, its occupancy and its operation.

As such all parties will need to be consulted to determine a strategy for the adoption of the measures.

Fire-resistance cladding developed by University of Melbourne researcher

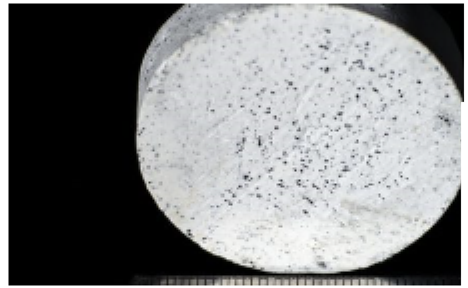
November 21, 2018 News

A University of Melbourne researcher has led the successful development of an organic, non-combustible and lightweight cladding core – a product that was previously thought to be impossible to create.

Typically, lightweight cladding is made from organic, carbon-based, composite materials like plastic, but these materials by their nature are combustible. Non-combustible materials like steel, ceramic tiles or concrete are much heavier and more expensive to produce and install.

University of Melbourne Innovative Fire Engineering Group research leader Kate Nguyen has discovered that the plastic insulation around electrical cables uses tiny ceramic particles that activate and chemically interact with each other, forming and spreading a heat resistant network through the material.

In partnership with construction materials company Envirosip, who commissioned the research, Dr Nguyen began experimenting with different ceramic particles at the University's testing furnace at



The lightweight cladding core material showing the particles. Image: Sarah Fisher/University of Melbou

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Thanks for your attention!

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