Protocols for Mitigating Cladding Risk

Cladding Risk Policy

E.01 – Trivial and Tolerable Cladding Risk

Version 3

Date: 2 July 2025

Aboriginal acknowledgement

Cladding Safety Victoria respectfully acknowledges the Traditional Owners and custodians of the land and water upon which we rely. We pay our respects to their Elders past, present and emerging. We recognise and value the ongoing contribution of Aboriginal people and communities to Victorian life. We embrace the spirit of reconciliation, working towards equality of outcomes and an equal voice.

Application of Minister's Guideline 15

These documents contain information, advice and support issued by CSV pursuant to Minister’s Guideline 15 - Remediation Work Proposals for Mitigating Cladding Risk for Buildings Containing Combustible External Cladding. Municipal building surveyors and private building surveyors must have regard to the information, advice and support contained in these documents when fulfilling their functions under the Act and the Regulations in connection with Combustible External Cladding on buildings:

a) which are classified as Class 2 or Class 3 by the National Construction Code or contain any component which is classified as Class 2 or Class 3;

b) for which the work for the construction of the building was completed or an occupancy permit or certificate of final inspection was issued before 1 February 2021; and

c) which have Combustible External Cladding.

For the purposes of MG-15, Combustible External Cladding means:

a) aluminium composite panels (ACP) with a polymer core which is installed as external cladding, lining or attachments as part of an external wall system; and

b) expanded polystyrene (EPS) products used in an external insulation and finish (rendered) wall system.

Disclaimer

These documents have been prepared by experts across fire engineering, fire safety, building surveying and architectural fields. These documents demonstrate CSV's methodology for developing Remediation Work Proposals which are intended to address risks associated with Combustible External Cladding on Class 2 and Class 3 buildings in Victoria. These technical documents are complex and should only be applied by persons who understand how the entire series might apply to any particular building. Apartment owners may wish to contact CSV or their Municipal Building Surveyor to discuss how these principles have been or will be applied to their building.

CSV reserves the right to modify the content of these documents as may be reasonably necessary. Please ensure that you are using the most up to date version of these documents.

Document Notes

The Protocols for Mitigating Cladding Risk (**PMCR**) is an approach developed by Cladding Safety Victoria (**CSV**) on behalf of the Victorian Government to consistently and systematically address the risk posed by the presence of combustible cladding on Class 2 and Class 3 buildings.

For many buildings, combustible cladding on the façade:

- does not present a high enough level of risk to warrant substantial or complete removal of the cladding; but
- presents enough risk to warrant a tailored package of risk mitigation interventions to be introduced that provide a proportionate response to the risk.

Some buildings may only comprise limited elements of combustible cladding or cladding in configurations such that no intervention or removal of cladding is required.

A set of documents has been assembled to describe the purpose, establishment, method and application of the PMCR. The full set of PMCR documents and their relationship to each other is illustrated in a diagram in Appendix A: PMCR Document Set Diagram.

There are **seven** related streams of technical document in the PMCR document set:

A. Authorisation	Codifies the Victorian Government decisions that enable PMCR activation.
B. CRPM Methodology	Specifies the Cladding Risk Prioritisation Model (CRPM) method used for assessing cladding risk and assigning buildings to three risk levels.
C. PMCR Foundation	Defines the PMCR method, objectives and the key design tasks.
D. Support Packages	Captures the relevant risk knowledge and science-based findings necessary to systemise and calibrate PMCR application.
E. CSV Cladding Risk Policy	Establishes key CSV policy positions in relation to cladding risk.
F. PMCR Interventions	Identifies and describes the interventions that the PMCR method can employ to mitigate risk associated with combustible cladding.
G. Implementation	Specifies the standards and procedures that guide PMCR application.

The document set has been developed by CSV. Each document has a function in supporting the delivery of the PMCR and in communicating the PMCR risk rationale and method.

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1 Introduction

Cladding Safety Victoria (**CSV**) has developed and is implementing the Protocols for Mitigating Cladding Risk (**PMCR**) to provide a structured framework for responding to the risk posed by combustible external cladding on Victorian Class 2 and Class 3 buildings.

The **function** of the PMCR	is to provide evidence-based risk mitigation standards and procedures for designing and delivering tailored cladding remediation works for buildings of different risk levels.
The **objective** of the PMCR	is to ensure that the risk mitigation solutions applied utilise fire safety measures that are proven and available, and that the level of intervention is proportionate to the risk presented by cladding on each building.

Cladding has attracted attention across the world due to the propensity for cladding to combust relatively easily and spread fire rapidly across a building façade. Where cladding use on a building is extensive and the cladding material has the highest combustibility properties, façade materials can contribute to large scale fires and present a significant threat to life safety.

These rare fire events have been witnessed sporadically on high rise buildings in different parts of the world over the past two decades, the worst of which have contributed to significant fires and sometimes high casualty rates.

Governments around the world have introduced legislation and regulations and initiated special purpose programs to assess cladding fire risk in their built environment and to guide action to make those who live in or use buildings with cladding safer.

In buildings where the risk posed by cladding is highest, the best way to mitigate risk is often to remove the cladding material from the façade and replace it with an alternative non-combustible façade material. CSV's residential cladding rectification program has resulted in the removal of combustible external cladding from 300 Victorian apartment buildings by the end of the 2023 calendar year using the 2019 Victorian Government investment of $600 million.

In assessing hundreds of buildings since 2019, CSV has developed an understanding about the way the risk posed by cladding varies from building to building. As the science of façade fire dynamics and cladding materials advances and the knowledge of risk-based intervention progresses, the opportunity to give structure to a risk proportionate cladding remediation approach has presented.

The approach to cladding remediation has evolved quickly over a short period of time. While initially guided by a compliance driven mindset dictating that certain façade products should be removed, the move towards a risk-based approach has led to the inevitable question about whether cladding needs to be removed in all instances to promote life safety.

The question as to whether to retain or remove cladding ultimately comes down to the issue of risk tolerance.

In determining what risks can be tolerated under the PMCR, CSV has considered both the:

- **likelihood** of a fire igniting cladding and spreading via cladding under different scenarios; and
- **consequence** (harm to people) that would most likely result due to a cladding fire in each scenario.

This paper presents a number of discrete fire scenarios involving cladding in typical configurations observable across numerous buildings reviewed by CSV.

For each scenario, a discussion of the risk posed by cladding is presented and a CSV cladding risk policy determination specified about the conditions under which cladding risk in each scenario is considered tolerable. Any risk deemed tolerable will require no action in a Remediation Works Proposal (**RWP**) developed for the purposes of the PMCR.

These positions on the tolerance of cladding risk are informed by expert fire engineering judgement, risk engineering principles, fire engineering science and detailed knowledge of the regulatory requirements for fire safety in Australia.

2 Policy determination - tolerable cladding risks

Cladding risks deemed or reduced to '***tolerable***' require no further intervention under the PMCR.

The following cladding risks have been assessed by CSV as being tolerable for the purposes of cladding risk mitigation assessments and RWPs under the PMCR.

These cladding risk policy determinations are released under the provisions of *Minister's Guideline 15*.

Category of risk	Policy determination
ACP with Flame Retardant filler (ACP-FR)	**<u>Up to and including the 4th storey:</u>** Any cladding cluster containing ACP with a higher proportion of flame-retardant filler relative to polyethylene presents a risk that is tolerable and will not require an intervention through the application of the PMCR. **<u>At the 5th storey and above:</u>** Any cladding cluster containing ACP with a higher proportion of flame-retardant filler relative to polyethylene (ACP-FR) presents a risk that is tolerable in application of the following: ***1. In a sprinkler protected building:*** o For every 6 vertical levels of cladding retained, a non-combustible fire break of 1 vertical level is required (i.e. 6 levels on, 1 level off)[1], ▪ Maximum cluster size in total of **10 SOUs** *and* ▪ Maximum of **10 levels connected vertically** in total, being 4 SOUs below the 5th storey plus 6 SOUs at the 5th storey and above; and o Smoke alarms to be installed to bedrooms in line with E.02 ***2. In a non-sprinkler protected building:*** o **2 SOUs in** total from the 5th storey and above In these scenarios, these products will not require an intervention through the application of the PMCR subject to the limits of application below. **<u>Combustible cladding less than 1000mmm total width</u>** Where ACP-FR cladding is installed as thin vertical strip with a total maximum width of 1000mm in total, no fire break is required. **<u>Limits of application</u>** Further consideration (engineering advice) is required on a case-by-case basis where: 1. Cladding clusters are adhesively fixed and installed at the 5th storey and above; 2. Brigade access is compromised; 3. Cluster values exceed the above thresholds Note: Where cluster values exceed the above thresholds, cladding clusters may be separated by fire breaks as articulated in: 1. ***Section 4.2 of this document - cladding connectivity, or*** 2. ***As articulated in the sprinkler policy of Doc E.02,***
Fire breaks in cladding to limit horizontal fire spread	When counting SOU connectivity as part of a CFSR assessment for an area of cladding on a façade, 2 adjacent SOUs on the same building level are not considered to be connected where there is a horizontal break in the cladding (extending from floor to ceiling) that is at least 450mm (diagrams available in document G.03)

[1] This is based on of fire testing sponsored by CSV.

Category of risk	Policy determination
Fire breaks in cladding to limit vertical fire spread – 900mm fire breaks SOU separation	***900mm fire breaks to separate cluster 2 SOUs*** **Up to and including the 4th storey:** Cladding clusters below the 5th storey of a building with non-combustible vertical fire breaks installed that are at least 900mm high separating individual SOUs pose a tolerable risk, provided these breaks separate all individual SOUs within cladding clusters not exceeding: ▪ 2 SOUs total in a building where SOUs are not sprinkler protected; and ▪ 6 SOUs total in a building where SOUs are sprinkler protected. Where a non-combustible vertical break in Combustible External Cladding is in place, which is at least 900mm and extends across the entire horizontal span of the cladding between two SOUs, these SOUs are to be considered not connected by cladding (*i.e. IFSCAN= 1= acceptable*) for the purpose of cladding risk rating under the Cladding Risk Mitigation Framework. **5th storey and above:** Cladding clusters at the 5th storey or above of a building with non-combustible vertical fire breaks installed, that are at least 900mm high separating individual SOUs, pose a tolerable risk, provided these fire breaks separate individual SOUs within cladding clusters not exceeding: ▪ **2** SOUs in a building where SOUs are not sprinkler protected; and ▪ **3** SOUs in a building where SOUs are sprinkler protected Where cladding cluster values exceed the thresholds prescribed above, these buildings will be subject to further consideration and internal engineering advice on a case-by-case basis. ***Note.*** This policy decision applies only to breaking the cladding connection between 2 individual SOUs. Further information pertaining the installation of larger 'floor level' fire breaks for the purposes of reducing large clusters into manageable clusters can be found in PMCR cladding policy document 'E.02 – Sprinkler Protection'.

Category of risk	Policy determination	
ACP-PE and EPS Attachments	A CFSR or IF-SCAN count will NOT be incremented due to an attachment with Combustible External Cladding that meets the following conditions/criteria:	
	ACP-PE balcony attachment	▪ does not return back into a wall that is combustible OR does return back into a wall that is non-combustible; ▪ no adjacent SOU window or door openings within 450mm of the ACP attachment; ▪ the attachment is not more than 1.2m in height; ▪ is constructed of non-combustible material on the inside face; ▪ spacing between vertical balustrade attachments is greater than 1.2m; and ▪ soffits are non-combustible.
	EPS balcony attachment	▪ does not return back into a wall that is combustible OR does return back into a wall that is non-combustible; ▪ no adjacent SOU window or door openings within 450mm of the EPS attachment; ▪ the attachment is not more than 1.2m in height; ▪ is constructed of non-combustible material on the inside face; ▪ spacing between vertical balustrade attachments is greater than 900; and ▪ soffits are non-combustible.
	Box capping to balconies	▪ cladding wrapping round the corner from a balcony face and onto the balcony return wall towards the SOU wall must not exceed a maximum of 150mm from the balcony face.
	Cladding attachments above openings	▪ the cladding is only located in positions above the highest SOU opening for that SOU.
	Attachments separated from openings	▪ cladding is separated from openings by at least 450mm horizontally.
	Attachments not connected to wall	▪ is physically separated from the external facade of the wall; and ▪ does not extend vertically beyond the fifth level of the building.

3 CSV cladding risk policy assessment framework

A risk proportionate response to cladding risk should not generally require a mitigation intervention where the cladding scenario presents a risk that is either trivial or non-trivial (but tolerable).

Terms such as trivial and tolerable in relation to fire risk entail subjective judgment, and their application to inform a cladding risk policy requires a structured framework for their consideration. This ensures that there is a level of consistency in the considerations made under different fire scenarios that may lead to a judgment that a cladding risk is trivial or tolerable.

3.1 Dimensions of risk

In assessing the tolerability of cladding risks, CSV has considered two dimensions of risk:

1. Likelihood	The likelihood that a fire spread via cladding will reach a scale and intensity that threatens multiple dwellings
2. Consequence	The likely level of harm to people that will be experienced as a result of a façade fire involving cladding

These dimensions of risk are focussed on the spread of fire via cladding between independent dwellings (or sole occupancy units – **SOU**) in multi-storey buildings. This recognises that, for the purposes of the PMCR, cladding risk crosses a threshold acceptance boundary from tolerable to intolerable when:

- Cladding can quickly spread fire via the façade to engage multiple SOUs, and present a fire of scale and intensity that represents a credible threat to building occupants; AND
- The probable extent of harm to people as a result of the threat provides for a reasonable chance of death or injury.

The 'AND' in the dot point list above is important as it recognises that the need for a mitigation intervention is not triggered merely because cladding can carry fire across a façade to multiple dwellings, but only when the most likely outcome of a cladding fire (consequential harm to people) will be significant.

The CSV risk tolerance judgements reflected in this paper are informed by consideration of:

- The combustibility of cladding products;
- The amount and configuration of cladding materials;
- Façade fire spread dynamics; and
- The history of building fires and their ignition causes and impacts.

Consideration of the fire-fighting response

> The PMCR is designed to provide a proportionate response to the risk posed by Combustible External Cladding on Class 2 and Class 3 buildings.
>
> The PMCR design is underpinned by a reasonable expectation that a fire fighting response will commence at a building fire within 20 minutes of fire fighters being alerted. For buildings where there may be added complex in delivering a timely response, the PMCR introduces additional safety measures.

Another important aspect of a fire risk assessment is the delivery of a fire-fighting response. Any fire that is left unchecked has the potential to grow and spread beyond a manageable level and potentially produce significant adverse consequences, whether associated with a façade fire or otherwise. Where fire-fighters arrive quickly at the scene of a fire there is reasonable expectation that routine fire suppression actions will be effective and that building occupants will be safely evacuated.

Fire Rescue Victoria (**FRV**) is the agency responsible for providing the first response to fire on Victorian buildings, and has a strong record of responding to fires in a timely fashion. The target response time[2] for FRV is 7.7 minutes and the FRV record of response indicates that an acceptable response is achieved for the majority of emergency incidents[3].

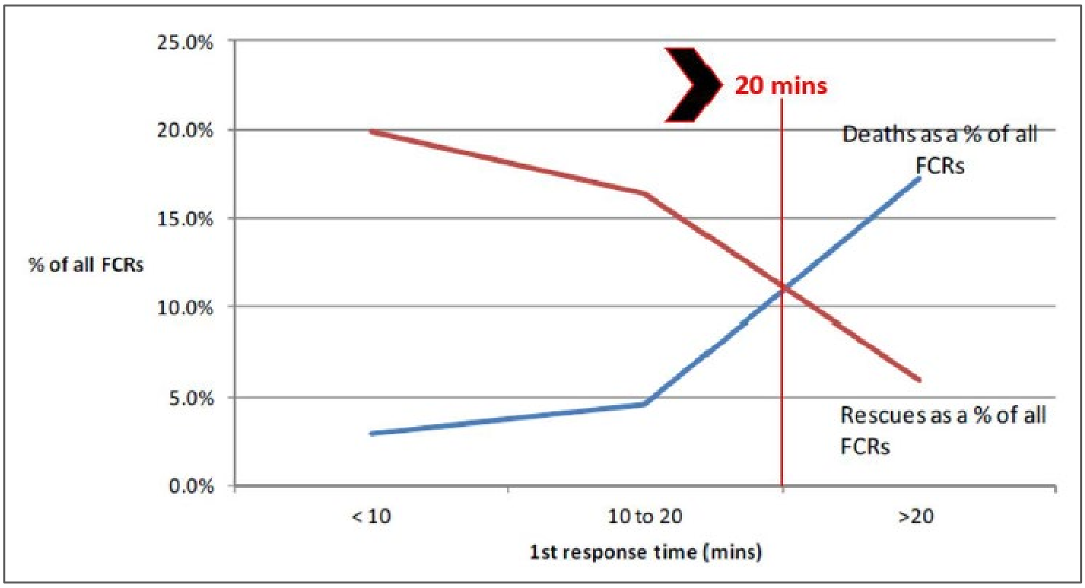
The emphasis on the response time to a fire suggests that there is a veritable 'Golden Window' of time within which fire-fighting activity must be delivered to increase the probability that a fire will be suppressed and building occupants safely evacuated.

Evidence exists to show that delays in fire services arriving at an incident and setting up equipment to commence suppression/evacuation activity:

- Decreases the probability of the successful rescue of all occupants; and
- Increases the probability of death and injury.

Research of fire incident data in England shows the relationship between the fire-fighting response time and the probability of fatalities, casualties and rescues (**FCR**). It shows that where it takes more than 20 minutes to respond to a fire, the probability of a fire related death exceeds the probability of safe rescue.

Figure 1: Percent of Fatalities, Casualties (all grades) and Rescues (FCRs) that die versus percent that are rescued, against response time



Source: The Fire Risks of Purpose-Built Blocks of Flats: An Exploration of Official Fire Incident Data in England, S.Hodkinson and P. Murphy, July 2021.

For the buildings that are the focus of the PMCR it should is noted that:

- 99% are located within greater metropolitan Melbourne, where firefighting resources are generally in close proximity to buildings; and
- over 80% of buildings are under 18 metres in height (3 to 5 storeys), providing opportunity for a suppression response to be applied from the ground in the majority of cases.

These data suggest that it is reasonable to expect a timely firefighting response in relation to the buildings that are the focus of PMCR assessment and risk mitigation planning.

Questions of risk tolerance have been considered by CSV in the context of the risk profile of the target building population for the PMCR.

CSV's assessment of risk tolerability applies a reasonable expectation that in all probability FRV will arrive at the scene of a fire in a timely fashion and that suppression and evacuation actions will be effective.

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[2] 'Response time is defined as the interval between appliance dispatched and the arrival of the first vehicle at the scene." (https://www.frv.vic.gov.au/response-times)

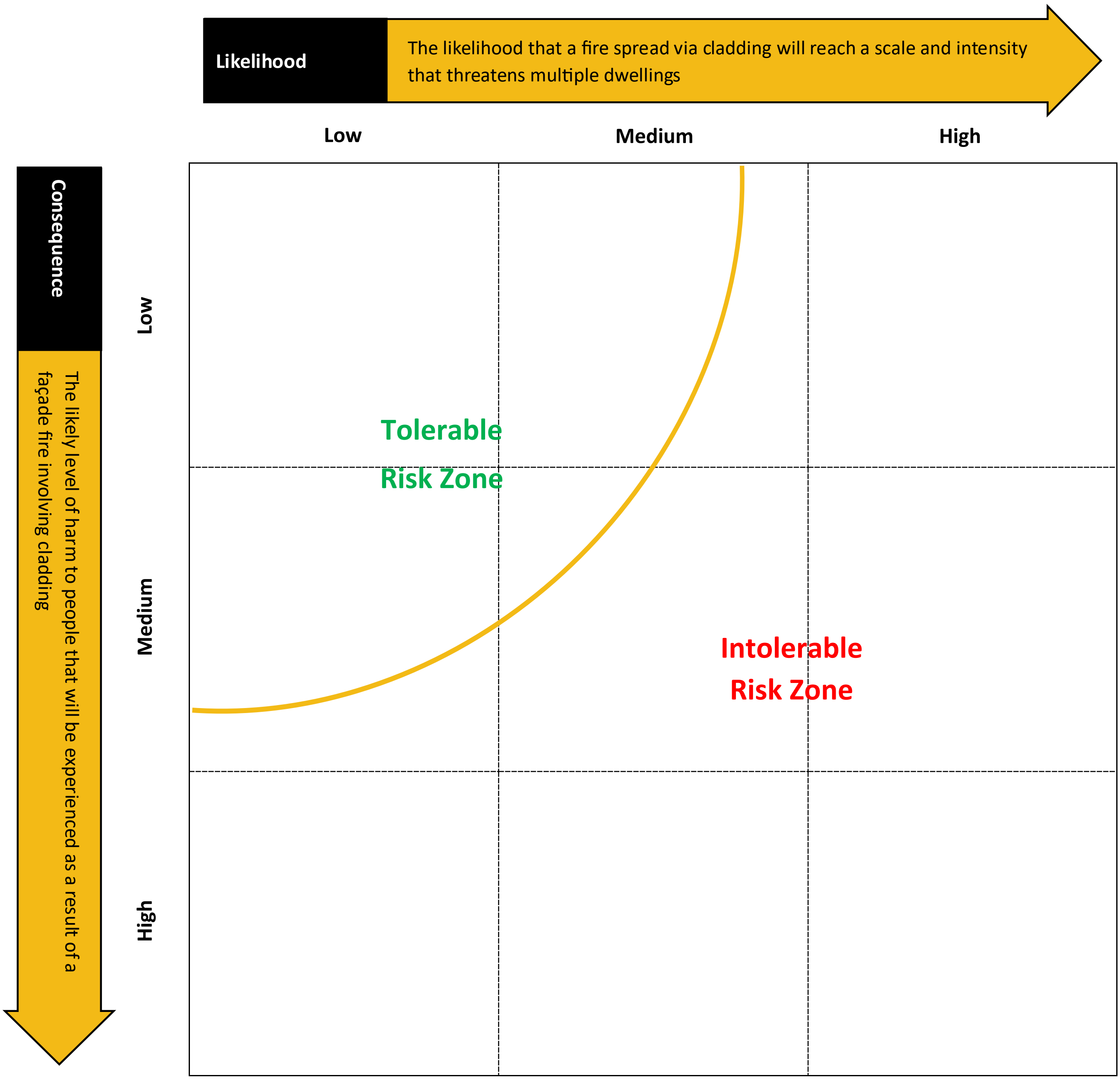
[3] For the most recent quarterly period for which response tome performance is published (1 April 2023 to 30 June 2023), FRV reported that 90% of fire incidents were responded to within 8.7 minutes.

3.2 A model for the assessment of risk tolerability

The focus of risk assessment on likelihood and consequence provides for a risk matrix approach to the assessment of building fire scenarios, employing discrete levels of likelihood and consequence.

Using the two dimensions of risk identified in section 3.1, a gridded matrix would take the following form.

Included in the diagram below is an illustrative boundary between tolerable and intolerable risk.



British standards as a reference for PMCR design

In 2020, the British Standards Institution (**BSI**) released publicly available specifications (**PAS**) for conducting a fire risk assessments (**FRA**). Separate volumes of PAS 79, were prepared for:

- Premises other than housing (PAS 79 – Part 1); and
- Housing (PAS 79 – Part 2).

The BSI has subsequently released PAS 9980: 2022 – *Fire risk appraisal of external wall construction and cladding of existing blocks of flats*.

The scope of PAS 79-2 aligns to the PMCR approach in that it seeks to apply interventions (or precautions) that provide a risk proportionate response to fire risk, noting:

> *"The recommended approach to carrying out fire risk assessments is intended to determine the risk proportionate fire precautions required to protect occupants of housing premises, particularly residents, but also employees, contractors and visitors of the premises."*[4]

The PAS 79 standards adopt a matrix type approach for conducting fire risk assessments and this approach provides a model that CSV has used to test and apply to the concept of risk tolerance in relation to fire scenarios.

An indicative risk matrix is presented in PAS-79 that uses three levels of likelihood and three levels of consequence (see the illustration below).

Table 1 – An example of a simple risk level estimator

Likelihood of fire	Classification of fire risk		
	Likely consequences of fire		
	Slight harm	Moderate harm	Extreme harm
Low	Trivial risk	Tolerable risk	Moderate risk
Medium	Tolerable risk	Moderate risk	Substantial risk
High	Moderate risk	Substantial risk	Intolerable risk

The commentary accompanying this table describes the common uses of such an approach and its advantages:

> *"The category of fire risk for any premises can be determined by combination of the likelihood of fire and the likely consequence of fire, using a matrix: this is a method of risk assessment commonly adopted in the field of health and safety.*
>
> *The advantage of this approach is that it tends to result in relatively consistent assessments of risk (and, hence, fire risk) by different risk assessors; the risk assessor need select from the matrix only one of three levels of likelihood and three levels of likely consequences, but can derive thereby any one of five levels of risk."*[5]

CSV has developed its own method for assessing and triaging buildings on the basis of cladding risk (the Cladding Risk Prioritisation Model – **CRPM**). The CSV use of a risk matrix model, like that presented in PAS-79, has a narrow scope of focus, which is to distinguish between tolerable and intolerable cladding risks with regard to specific cladding scenarios. The CSV purpose is to differentiate between the cladding scenarios that a PMCR design solution must respond to and those scenarios that require no response under the PMCR.

While PAS 79-2 has been developed for the assessment of a building's fire risk overall, the standard notes the applicability of this approach to individual fire scenarios:

> *"It would be possible, in theory, to associate different consequences arising from each of the hazards identified in the fire identification step of the FRA (see clause 13). However, this would make the FRA process unnecessarily complex and unduly lengthy."*[6]

CSV's own application of this approach has been to assess individual classes of cladding risk scenarios separately in order to develop a general risk policy position of risk tolerance in relation to each scenario.

This is consistent with the CSV approach of identifying each cladding cluster[7] and independently considering the risk treatments necessary, if any.

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[4] PAS 79-2:2020, *Fire risk assessment – Part 2: Housing – Code of practice*

[5] ibid

[6] ibid

[7] A cladding cluster is an area of cladding on a façade that connects one or more SOUs.

Adoption off a risk matrix approach in other jurisdictions

In 2018, the National Fire Protection Association (**NFPA**) in the United States (US) released research about the development of a fire risk assessment tool under the project *High Rise Buildings with Combustible Exterior Façade Systems: Fire Risk Assessment Tool*.

The stated goal of the project was as follows:

> *"The goal of this project has been to develop and make available a risk assessment methodology to assist global authorities to assess the risks and prioritize inspection/remediation efforts for the high-rise building inventory in their jurisdiction with exterior wall assemblies containing combustible components."* [8]

To inform its risk assessment and remediation prioritisation method, the NFPA adopted the matrix-based risk assessment process outlined in PAS 79.

The NFPA research referenced[9] a matrix extracted from the 2012 version of PAS 79, which the NFPA used as a foundation element in the development of its own risk-based assessment matrix.

	Likelihood of fire hazard *(definition in PAS 79)*		
Potential consequences of fire hazard ***(definition in PAS 79)***	**Low (***Unusually low likelihood of fire as a result of negligible potential sources of ignition***)**	**Medium** *(Normal fire hazards (e.g. potential ignition sources) for this type of occupancy, with fire hazards generally subject to appropriate controls (other than minor short comings)*	**High***(Lack of adequate controls applied to one or more significant fire hazards, such as to result in significant increase in likelihood of fire)*
Slight harm *(Outbreak of fire unlikely to result in serious injury or death of any occupant (other than an occupant sleeping in a room in which a fire occurs)*	Trivial risk	Tolerable risk	Moderate risk
Moderate harm *(Outbreak of fire could foreseeably result in injury (including serious injury) of one or more occupants but unlikely to involve multiple fatalities)*	Tolerable risk	Moderate risk	Substantial risk
Extreme harm *(Significant potential for serious injury or death to one or more occupants)*	Moderate risk	Substantial risk	Intolerable risk

Figure 7 PAS 79 matrix (figure extracted from [26])

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[8] *High Rise Buildings with Combustible Exterior Wall Assemblies: Fire Risk Assessment Tool*. Lamont & Ingolfsson, 2018

[9] ibid

The NFPA developed its own two-tiered fire risk assessment framework[10] based upon the PAS 79 risk matrix approach, in which:

- Tier 1 activities are informed by desktop-based study techniques to enable the risk-based ranking of buildings for the purpose of prioritising more detailed assessment; and
- Tier 2 activities, which incorporate more detailed assessment incorporating site-based inspections undertaken in a sequence that reflects the ranking from the tier 1 activities.

CSV's own approach to cladding risk assessment and prioritisations under the CRPM, involving the risk prioritisation of buildings using the Initial Fire Spread in Cladding Assessment Number (**IF-SCAN**), entails a similar two-level risk assessment process including both desktop and site-based assessment phases.

The NFPA fire risk assessment methodology also applies two parallel assessment processes, applicable to both tiers, focussed upon:

- A) Façade fire hazards and ignitions sources; and
- B) Internal fire safety provisions.

The consequence dimension of the NFPA assessment has been linked to the building height and occupancy type (office or residential). The tying of consequence to building height reflects the increasing complexity that is created for fire fighters the further up a building the fire is located as well as the additional time and resource required to evacuate building occupants in taller buildings where travel distances are greater and the number of evacuees is larger on average.

PAS 79 has provided a standardised framework for applying a risk matrix approach to fire risk assessments.

The NFPA work to develop its own fire risk assessment tool provides a case study for how the PAS 79 standard can be applied in an adaptive way to fulfil a specific fire risk assessment scope and objective.

3.3 CSV approach to assessing risk tolerance

Scope

CSV's approach to the assessment of risk tolerance applies only to a discrete number of frequently occurring cladding scenarios identified through CSV's cladding risk assessment work under the PMCR design work.

Their selection for assessment follows detailed consideration by CSV's inhouse team of building surveyors, fire safety engineers and façade material specialists.

In each case, there is a shared expert opinion that cladding's contribution to the threat to life safety is very low or insignificant in each case, sufficient to deem the risk presented by cladding in each case to be tolerable (within defined parameters).

Risk factors that inform the selection of cladding scenarios

The degree of risk posed to life safety by cladding and the level of response required is impacted by:

- the cladding types/products used;
- the connectivity of cladding in a continuous run (i.e. constituting an unbroken fuel load that could conceivably facilitate fire spread across a facade);
- the exposure of the cladding to a credible/plausible ignition source;
- the configuration of the cladding (part of an external wall system, on a balcony., as an attachment, on a canopy, etc); and
- the architectural features of a building to which cladding is affixed and the influence of these features on the spread of fire via cladding.

[10] High Rise Buildings with Combustible Exterior Wall Assemblies: Fire Risk Assessment Tool. Lamont & Ingolfsson, 2018

Categories of likelihood and 'likely' consequence

This section describes the categories used for likelihood and consequence in the risk matrix approach adopted by CSV for assessing the tolerability of cladding fire scenarios.

Likelihood

The relatively infrequent occurrence of building fires involving cladding limits the opportunity to reliably compute a quantitative estimate of cladding fire likelihood.

As building fires involving cladding are very rare events, a typical measure of likelihood would appropriately categorise all cladding fires as unlikely.

For the purpose of the CSV assessment of cladding fire risk tolerability, a focus on plausibility has been adopted as a proxy for likelihood. The assessment of each cladding fire scenario considers the plausibility of a cladding fire 'reaching a scale and intensity that threatens multiple dwellings'.

The Oxford Learner's Dictionary defines plausibility[11] as:

> *"the quality of being reasonable and likely to be true"*

The concept of plausibility as applied here can be thought of as the credibility (or veracity) of the cladding fire scenario producing a particular outcome (or consequence). PAS 79 expressly caution against expenditure on precautionary interventions for scenarios that are not 'realistic and credible'.

> *"Equally, if significant capital expenditure on fire precautions is recommended in the action plan (see 3.2), it needs to be possible to justify the expenditure by articulation of a* ***realistic*** *and* ***credible*** *scenario, in which unacceptable fire risk to occupants would occur. In such cases, it is not, for example, acceptable simply to justify significant capital expenditure on the basis of a departure from current guidance or practice, particularly in the case of premises designed and constructed prior to the introduction of such guidance or practice".*[12]

This latter point in PAS 79 is particularly relevant to the PMCR, where risk interventions will need to be funded by building owners. This policy, and its focus on plausibility, forms part of the endeavour to assess cladding risk and support the design and delivery of risk proportionate mitigation solutions.

The assessment of plausibility relies on the application of expert judgement to reduce uncertainty about the likelihood of individual cladding risk scenarios occurring. The type, amount and connectivity of cladding are the key considerations in this assessment, where it is assumed that a credible ignition threat exists.

Three levels of plausibility have been selected for the likelihood dimension of the CSV assessment:

What is the likelihood (plausibility) that a fire spread via cladding will reach a scale and intensity that threatens multiple dwellings?

Not plausible	Somewhat plausible	Plausible
(not realistic or credible)	(marginally realistic/credible)	(realistic and credible)

[11] https://www.oxfordlearnersdictionaries.com/definition/english/plausibility

[12] PAS 79-2:2020, Fire risk assessment – Part 2: Housing – Code of practice

Consequence (likely)

The focus of the consequence assessment is on the most likely outcome that would be expected if the hazard were to occur (i.e. cladding under the particular cladding fire scenario being ignited). The aim is to identify credible and realistic outcomes (in an overall risk context – i.e. likelihood x consequence) that are sufficiently minor/negligible to warrant them being ignored for the purpose of regulatory intervention.

The *de minimis* rule is a concept in law that applies to low risks that may be considered trivial:

> *"The term de minimis is used in law to describe trivial issues not deserving of a court's time and attention. When applied to health and safety risks and their regulation, the term refers to a risk that avoids regulatory attention by virtue of its small size. This concept has several potential regulatory applications. A de minimis rationale can be used either to determine the regulatory standard or to decide that no standard is required. In the latter case, whole classes of small risks may be excluded from regulatory consideration. In addition, de minimis may be the basis for an enforcement decision, as when a policeman decides not to cite a driver for exceeding the speed limit by one mile per hour."*[13]

The concept of risk triviality and tolerability implicit in the *de minimis* rule are central to the PMCR design. A key endeavour through the application of the PMCR is to bring focus and intervention attention to credible risks of substance and to provide a mechanism for non-intervention in relation to risks that are trivial.

This cladding risk policy fulfills an important function further to the research work undertaken by CSV and the evidence gathered through research activity:

> *"The de minimis approach may also provide a policy solution to questions that lie beyond the reach of scientific resolution. This would reduce the pressures on regulatory agencies to produce scientific judgments about low-level risks where information is limited or unavailable."*[12]

Meacham[14] notes the incorporation of an agreed target *de minimis* level in relation to risk decisions, based on the as low as is reasonably practicable (**ALARP**) approach:

> *"Thus, there exists a broad spectrum of risk decision approaches to setting target levels: 'acceptable' risks, which arguably individuals and tightly managed groups (e.g., corporations) can agree; 'tolerable' risks, which are imposed, but broadly tolerated, in the sense of trade-offs between risks, costs and benefits to society; ALARP, which aims to push 'tolerable' risks as low as practicable toward an agreed de minimis level; SFAIRP, which aims to push risk as low as practicable, with no defined bounds; and to eliminate the source of a risk of high uncertainty yet high potential concern via the precautionary principle approach."*

The expert judgements used in the assessment of consequence for individual cladding fire scenarios are intended to represent realistic and credible outcomes of a cladding fires in each scenario, capturing qualitative judgements about where the boundary between tolerable and intolerable risks lay.

Three levels have been selected for the consequence dimension of the CSV assessment:

What is the likely level of harm to people that will be experienced as a result of a façade fire involving cladding?

Slight harm	Moderate harm	Extreme harm
Outbreak of fire unlikely to result in serious injury or death of any occupant (other than an occupant sleeping in a room in which a fire occurs)	Outbreak of fire could foreseeably result in injury (including serious injury) of one or more occupants but unlikely to involve multiple fatalities	Significant potential for serious injury or death to one or more occupants

These categorical definitions were adopted directly from PAS 79[15].

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[13] *Dealing With Uncertainty About Risk in Risk Management*, Chris Whipple in National Academy of Engineering (US). Hazards: Technology and Fairness. Washington (DC): National Academies Press (US); 1986

[14] Ultimate Health & Safety (UHS) Quantification: Individual and Societal Risk Quantification for Use in National Construction Code (NCC), B.Meacham (2016)

[15] PAS 79-2:2020, Fire risk assessment – Part 2: Housing – Code of practice

Tolerance risk matrix

Using the matrix below, each cladding fire risk scenario have been assessed as either trivial, tolerable or not tolerable.

		Likelihood What is the likelihood (plausibility) that a fire spread via cladding will reach a scale and intensity that threatens multiple dwellings?		
		Not plausible	**Somewhat plausible**	**Plausible**
Consequence What is the likely level of harm to people that will be experienced as a result of a façade fire involving cladding?	**Slight harm**	Trivial	Tolerable	Not tolerable
	Moderate harm	Tolerable	Not tolerable	Not tolerable
	Extreme Harm	Not tolerable	Not tolerable	Not tolerable

Any cladding fire risk scenario assessed as either trivial or tolerable will be accepted as a tolerable risk and will not be subject to any intervention under the PMCR.

Impact of tolerability assessments on PMCR design

The impact of the tolerability assessments influences both:

1. the level of intervention required as a function of cladding material type and
2. the process of determining the number of SOUs connected by cladding (CFSR, IF-SCAN)

Cladding materials:

- The requirement to apply a PMCR intervention (treating)

  Any cladding cluster containing ACP with a higher proportion of flame-retardant filler relative to polyethylene presents a risk that is tolerable and will not require an intervention through the application of the PMCR in line with ACP-FR policy position.

Cladding connectivity:

Any cladding fire scenario that is assessed as trivial or tolerable will impact both:

- The assessment of cladding clusters (counting)

The count of the SOUs connected in any Cluster Fire Spread Risk (CFSR) or Initial Fire Spread in Cladding Assessment Number (IF-SCAN) assessment[16] will ignore areas of cladding deemed trivial or tolerable.

- The requirement to apply a PMCR intervention (treating)

  No intervention under the PMCR will be required for any area of cladding associated with a cladding fire risk scenario deemed trivial or tolerable under this policy.

This approach reflects a core design feature of the PMCR, which recognises the need to define cladding use scenarios prevalent in Victorian building design that create a level of risk to life safety that is sufficiently low to allow the risk to be ignored where a proportionate response to cladding risk is sought.

[16] See G.02 IF-SCAN Procedure/Method

4 Assessments of risk tolerability

The CSV assessments of the tolerability of specific fire risk scenarios involving cladding are focused upon:

Cladding material	There are a number of façade materials found in Australian building design that have a composition that produces relatively low levels of heat release and lower rates of fire spread when ignited, compared to the façade materials targeted for remediation by the Victorian Government: ▪ Aluminium Composite Panels with a polyethylene core comprising 70-100% of the core material (ACP-PE); and ▪ Expanded Polystyrene (EPS). There is a general proposition, assessed within this policy, that the fire propagation properties of some cladding products are sufficiently low as to require no action under a PMCR risk mitigation approach.
Cladding connectivity	A core focus of cladding risk assessment using the PMCR is the extent to which a continuous run of cladding connects adjacent SOUs and provides potential for external fire spread between dwellings. Because of differences in the design of residential buildings and the architectural features on which cladding is installed, the risk to occupants varies markedly. While certain clad features of a building connect SOUs, the realistic risk to occupants will vary in accordance with the volume of cladding, its orientation and its proximity to SOU openings. The assessment of tolerability considers a range of architectural scenarios involving the use of cladding on a façade and defines the parameters for considering these scenarios as tolerable for the purpose of PMCR application.

The assessment of tolerability for each of the four cladding fire risk scenarios has been presented using a set structure consisting of the following components:

1. Cladding risk scenario	➡	Description of the cladding risk context
2. Risk proposition	➡	Expert opinion about the nature of the risk
3. Risk assessment	➡	Facts, findings and observations to inform the assessment
4. Risk rating	➡	Assessment of likelihood, consequence and overall rating
5. Cladding risk policy decision	➡	CSV risk policy position and parameters or limits to application

CSV will continue to review cladding risk policies to support the implementation of the PMCR. The publication of further policies may follow the conclusion of current CSV research and analysis, necessary to inform policy determinations. Other building design parameters are canvassed within the broader CSV document set, namely D, F and G.

- Timber composite cladding (or polymer wood composites);
- Steel sandwich panels;
- Eaves and soffits with cladding;
- Infills between openings with cladding;
- Cladding with an increased exposure to vehicle and bin fires; and
- Exits and egress paths.

4.1 Cladding materials

ACP with flame retardant filler (ACP-FR)

Description	Different Aluminium Composite Panel (ACP) products vary in their fire risk properties. The filler between the two aluminium panels is a combination of: ▪ A polyethylene material (combustible); and ▪ An inorganic filler, often incorporating flame retardant chemicals that counteract the combustibility of the polyethylene.
Risk proposition	Where the ratio of flame-retardant filler to polyethylene in an ACP product is 1:1 or higher, the risk to life safety is tolerable. Policy guidance for application is given in Section 2 of this document.

Risk assessment summary

ACP – Flame Retardant (ACP-FR) is a category of ACPs that contain inorganic filler material within the core of the composite panel. These fillers can behave as either:

- Inert filler, reducing the total volume of flammable material within the core, and providing no other significant impact on the fire retardance (e.g. $CaCO_3$); or
- Flame retardant filler, undergoing endothermic degradation in the presence of heat, thereby cooling the burning organic material (e.g. $Mg(OH)_2$, $Al(OH)_3$).

For ACP, the proportion of inorganic filler varies from product to product and so too does the combustibility and rate of fire spread associated with the different products.

The prevalence of Expanded Polystyrene (EPS) and ACP in the Victorian built environment and the fire risk associated with their use led the Victorian Government to ban these materials from use in future construction projects and to provide $600 million to fund the targeted removal of EPS and ACP from the highest risk Class 2 buildings.

The Victorian Cladding Taskforce (the Taskforce) noted there was an absence of a standard definition when it came to ACP-FR products:

> *Some stakeholders have also raised concerns about the marketing of FR products, which are variously described as "fire rated", "fire resistant" or "fire retardant". ACP FR products typically have had a mineral component added to their cores. There is no standard definition of "fire rated" in Australia, and discussions with CSIRO suggest that the composition of their cores, and therefore fire performance, can differ markedly.*[17]

This meant that activity to assess the risk of buildings and prioritise cladding rectification works was initiated without a clear distinction between the risk differences between different FR products.

Through the work to develop the PMCR, CSV has taken the opportunity to explore the growing body of international research about the fire behaviour of different facade products and to conduct its own laboratory-based fire tests of ACP-FR. The findings of this literature review and the CSV sponsored fire testing have been reviewed in collaboration with the Victorian Building Authority (VBA) and a position about the risk of ACP-FR was developed.

The CSV analysis commenced with a literature review to ascertain which fire behaviour parameters and measurements are the most critical for assessing external wall cladding materials. Fire performance characteristics such as the time to ignition, effective heat of combustion, peak heat release rate and total energy released, were reviewed to develop indices for both Fire Performance (FPI) and Fire Growth (FGI) for material fire behaviour comparisons.

In assessing the fire risk of various ACP products, the primary focus has up until now been placed upon the PE component and what proportion of the filler material, between the two aluminium sheets, is PE. In general, the lower the proportion of PE, the lower the fire risk associated with an ACP product. This has led to the conventional position that ACP products with a PE level above 30% are unacceptable for use on a building façade.

What also needs to be considered is that the part of the filler that is comprised of other materials (i.e. not PE) also impacts the fire performance of an ACP product. Where the non-PE materials that are part of the filler have Flame Retardant

[17] Victorian Cladding Taskforce, *Interim report*, November 2017

properties, the dangerous fire properties of PE are counteracted. The question is, what combination of FR filler and PE is needed for an ACP product to be tolerated as a façade product?

CSV has commissioned and conducted comparative fire tests at Warringtonfire in Dandenong, Victoria, of three ACP products with different amounts of polyurethane (PE) and Flame retardant (FR) content.

Fire testing conducted by CSV has sought to investigate the fire behaviour of ACP products with different ratios of PE: filler, including in one case (test 3) a filler that is not FR.

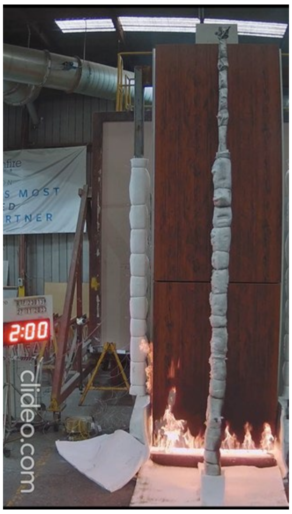
Cladding type	Polymer content	Fire retardant content	Other content
ACP-FR70	26.0%	73.4% (Aluminium Tri hydroxide)	
ACP-FR45	43.9%	45.3% (Magnesium Hydroxide)	
ACP-NFR45	49.8%	-	47.9% (incl. 40.2% Calcium Carbonate)

Tests were designed according to general requirements outlined in ISO 13785-1:2002, incorporating a heating rate defined in ISO 9705-1:2016. The key findings were as follows:

- The fire spread of ACP panels is influenced more by the presence of FR rather than the PE content. A panel which comprises of 43.9% PE and 45.3% FR, or approximately a 1:1 ratio of PE to FR was tested and showed that it performed like that of a panel which had 26% PE and 73.4% FR.
- With an even FR to PE ratio, the fire did not spread or typically extend beyond the boundaries of the flame source, and generated an insignificant heat flux at the top of the panel (2 – 3 kW/m2) and the majority of flaming subsided rapidly upon the termination of the flame source.
- The incorporation of PET insulation behind the cladding did not contribute to external vertical fire spread. The majority of the fire also subsided upon the termination of the flame source, and, in fact, the heat flux detected at the top of the specimen was lower than that of specimens with rockwool insulation.
- The presence of non-FR fillers such as calcium carbonate did not achieve a similar performance as those with FR. With a PE to non-FR ratio of 1:1, specimens were found to perform closer to high percentage PE.

Images from the CSV testing are shown below.

ACP-FR70

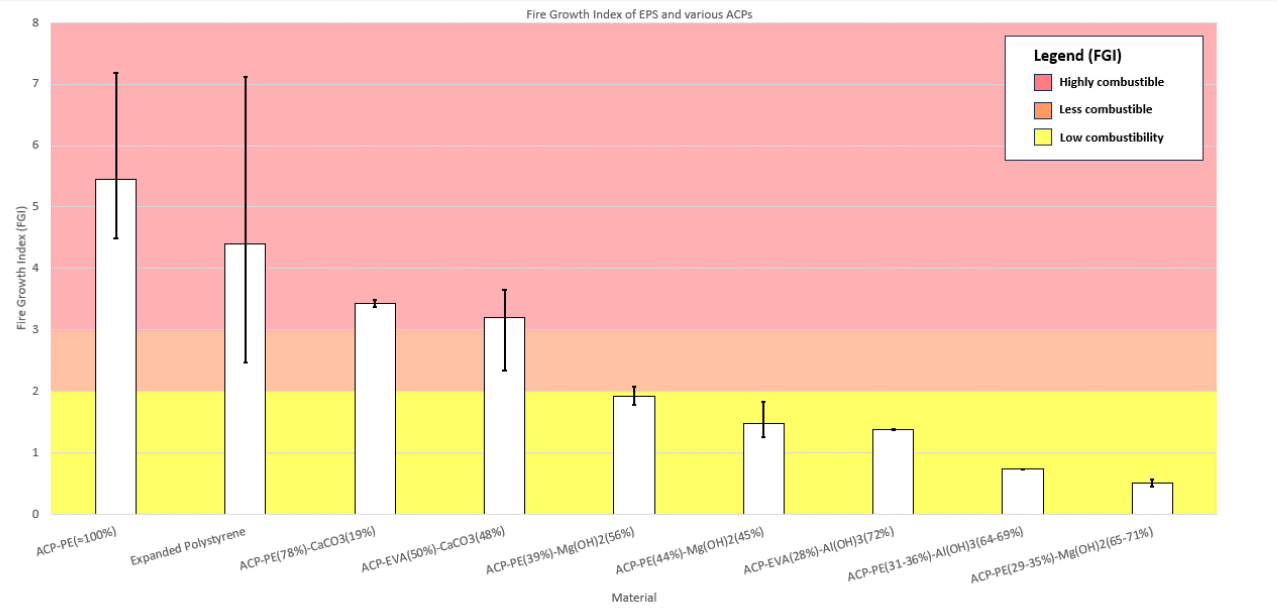


ACP-FR45

ACP-NFR45

The international research together with CSV's own testing allowed comparisons to be made between different cladding products across the two major indices.

The results of a comparative product analysis are shown below.



These data show far lower rates of fire growth and far higher levels of fire performance for ACP-FR compared to ACP-PE and EPS, which are the principal focus of Victorian cladding rectification activity.

<u>Risk rating considerations</u>

ACP-FR products with equal proportions of PE and FR were observed to burn very slowly and do not sustain a pathway of spread within the core independently of a sustained primary fire source. Furthermore, the rate of fire spread for these ACP-FR products is sufficiently slow that it is expected that first fire responders would arrive in time to ensure that a substantial façade fire would be unlikely and external fire spread between SOUs curtailed. This is particularly true where the ACP FR products are located below the 5th level of a building, where firefighting action can be applied from the ground.

This risk rating assessment of risk tolerability considers only:

- ACP products where the ratio PE:FR is 1:1; and
- The ACP FR product is not located above the 4th storey of a building.

In this scenario, the likelihood of an ACP-FR fire reaching multiple SOUs is conservatively assessed as being 'somewhat plausible'.

Even if a level of fire spread were to reach a second apartment before being extinguished, any likely harm to people would be expected to be minimal, if any (a consequence rating of 'slight harm').

Risk rating	
Likelihood	Somewhat plausible
Consequence	Slight harm
Overall rating	

	Not plausible	**Somewhat plausible**	**Plausible**
Slight harm	Trivial	**Tolerable**	Not tolerable
Moderate harm	Tolerable	Not tolerable	Not tolerable
Extreme Harm	Not tolerable	Not tolerable	Not tolerable

Cladding risk policy decision
<u>**Up to and including the 4th storey:**</u> Any cladding cluster containing ACP with a higher proportion of flame-retardant filler relative to polyethylene presents a risk that is tolerable and will not require an intervention through the application of the PMCR. <u>**At the 5th storey and above:**</u> Any cladding cluster containing ACP with a higher proportion of flame-retardant filler relative to polyethylene (ACP-FR) presents a risk that is tolerable in application of the following: ***1. In a sprinkler protected building:*** o For every 6 vertical levels of cladding retained, a non-combustible fire break of 1 vertical level is required (i.e. 6 levels on, 1 level off)[18], ▪ Maximum cluster size in total of **10 SOUs** *and* ▪ Maximum of **10 levels connected vertically** in total, being 4 SOUs below the 5th storey plus 6 SOUs at the 5th storey and above; and o Smoke alarms to be installed to bedrooms in line with E.02 ***2. In a non-sprinkler protected building:*** o **2 SOUs in** total from the 5th storey and above In these scenarios, these products will not require an intervention through the application of the PMCR subject to the limits of application below. <u>**Combustible cladding less than 1000mmm total width**</u> Where ACP-FR cladding is installed as thin vertical strip with a total maximum width of 1000mm in total, no fire break is required. <u>**Limits of application**</u> Further consideration and internal engineering advice is required on a case-by-case basis where: 1. Cladding clusters are adhesively fixed and installed at the 5th storey and above; 2. Brigade access is compromised; 3. Cluster values exceed the above thresholds Note: Where cluster values exceed the above thresholds, cladding clusters may be separated by fire breaks as articulated in: 1. ***Section 4.2 of this document - cladding connectivity, or*** 2. ***As articulated in the sprinkler policy of Doc E.02,***

[18] This is based on fire testing sponsored by CSV.

4.2 Cladding connectivity

Three cladding fire scenarios are assessed in this section:

1. Fire breaks in cladding to limit horizontal fire spread
2. Fire breaks in cladding to limit vertical fire spread
3. Building attachments with cladding

Each of these sections provide a risk assessment and risk rating for the scenarios described.

Fire breaks in cladding to limit horizontal fire spread

Description	The PMCR focusses risk mitigation action on areas of cladding on a building façade that connects multiple SOUs. That is because the connectivity of cladding provides the potential for fire to spread externally via cladding from one SOU to another. Where there is a break/gap in a run of cladding the risk that a fire will spread from one SOU to another via cladding is less likely.
Risk proposition	The risk of fire spread between adjacent SOUs on the same level of a building (i.e. laterally/horizontally) should be considered tolerable where there is a vertical break in a horizontal run of cladding greater than or equal to 450mm.
Risk assessment summary	

Greater risk is associated with façade fires that spread vertically compared to fires with the potential to spread laterally.

This is reflected in building fire safety regulation in Australia, which differentiate the requirements for fire safety in relation to vertical and horizontal fire spread.

Australian buildings are constructed in compliance with the provisions set out in the National Constriction Code (NCC), which is a performance-based code containing *Performance Requirements* for the construction of buildings.

Fire Safety Verification Methods (FSVM), published by the Australian Building Codes Board (ABCB), stipulate a way in which a *Performance Solution* can be developed to satisfy the *Performance Requirements* under the NCC.[19].

In developing a Performance Solution, reference must be made to a range of 'Design Scenarios', which include:

HS: Horizontal fire spread	Scenario 1: A fully developed fire in the proposed building exposes the external walls of a neighbouring building or the allotment boundary to an imposed heat flux. Scenario 2: A fully developed fire on an adjoining allotment or another building or proposed building on the same allotment exposes the external walls of the proposed building to an imposed heat flux.
VS: Vertical fire spread involving cladding or arrangement of openings in walls	The nominated design scenario is that a fire source exposes the external wall of a building with the potential to ignite the external wall (if combustible) or cause spread between vertical openings presenting a risk to life as a consequence of fire spread, falling debris and spread to adjacent buildings.

(Source: https://ncc.abcb.gov.au/sites/default/files/resources/2022/Handbook-Fire-safety-verification-method.pdf)

[19] The NCC provides the following definitions:

- Performance Requirement means a requirement which states the level of performance which a Performance Solution or Deemed-to-Satisfy Solution must meet.
- Performance Solution means a method of complying with the Performance Requirements other than by a Deemed-to-Satisfy Solution.

Source: https://ncc.abcb.gov.au/editions/2019/ncc-2019-volume-three/schedule-3-defined-terms/schedule-3-definitions#ide268dda4-48b1-4482-aff9-23af4805c006

This underscores the difference in risk focus for vertical and horizontal fire propagation. When vertical fire spread is the focus, the assessment considers the transition of fire within a building. However, when horizontal fire spread is the focus, the assessment considers the transition of fire between buildings.

This presumably, underscores a risk concern that upon reaching a second building, a fire may subsequently spread vertically on the second building.

Engineers Australia's Society of Fire Safety (SFS) appear to reinforce the need for greater risk consideration for vertical fire spread compared to horizontal fire spread.

In their work to provide guidance to professionals involved in the safe design of façade/external walls, the SFS identified the typical fire hazards that should be identified as part of the design process. The hazards listed link only to vertical fire spread and make no reference to horizontal fire spread, except where the concern is fire spread to adjacent properties (see textbox below).

Hazard Identification Study

The purpose of the hazard identification study is to define which aspects of the building have the potential to cause harm and conflict with the assessment project goals. The study should cover all aspects of the buildings fire safety design with respect to the façade – active, passive, operational – and review fire scenarios within the building, external to the building, and across the title boundary [reference to horizontal spread] – to identify all possible hazards.

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, also causing vertical downward fire spread
- Façade system fixing failing and causing vertical compartmentation to be breached by downward spread, 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 exterior of the building via openings, balconies, windows, doors
- Means of escape capacity being insufficient to accommodate multiple floors evacuating simultaneously
- Sprinkler system capacity being insufficient to effectively suppress a fire from an external façade fire involving multiple floors
- Fire-fighters having insufficient access to adopt effective external firefighting where the building has been designed for internal firefighting

The intent of the hazard identification study is to catalogue all possible hazards to ensure all eventualities can be investigated later. The initial hazard identification study carried out should focus on 'consequences' so at this early stage a broad sweep of all possible occurrences should be catalogued.

(Source: Society of Fire Safety Practice Guide Façade/External Wall Fire Safety Design, Engineers Australia Society of Fire Safety, 7 March 2019)

This has not been taken to mean that the SFS or the ACBC have concluded that the risk from horizontal fire spread is tolerable, but does illustrate how the relativities in cladding façade fire risk are viewed by peak Australian fire safety bodies when comparing scenarios involving vertical and horizontal fire spread.

Fire incidents

In determining the level of intervention required in scenarios where cladding connects adjacent SOUs on the same level of a building, it is relevant to consider lateral fire spread in real fire incidents.

The Grenfell Tower fire incident in London in 2017 provides a starting point for considering fire spread dynamics. The focus on this fire recognises not only that this building fire, more than any other, drew the current international focus to the risk of Combustible External Cladding, but also it has been the subject of detailed analysis and review since.

A recent study has focussed on modelling the fire spread observed in the Grenfell Tower fire and sought to understand the spread of fire horizontally[20].

This study used observed fire footage to assess the spread of fire vertically and horizontally across four elevations with detailed time-based precision. While the spread of fire vertically occurred very rapidly (originating in a lower-level apartment on the East elevation) reaching the top of the building in 21 minutes (01:08-01:29AM), it was observed that:

[20] *Reconstruction of the Grenfell Tower fire – Part 4: Contribution to the understanding of fire propagation and behaviour during horizontal fire spread*, Guillaume.E, Dréan.V, Girardin.B and Fateh.T (published in *Fire and Materials*, 2022;44:1072-1098)

" . . . observations, showed limited horizontal propagation of the fire during this initial phase of 30 minutes.

After 01:29 AM during Grenfell disaster, when the fire had reached the top of the Tower, observations showed that strongly enhanced horizontal fire propagation occurred, especially via the Tower's architectural crown. The fire spread across the four faces of the Tower from 01:29 AM up to 04:09 AM, due to the combustion of the insulated façade system and the apartment contents."

The buildings targeted for treatment via the PMCR have a very different risk profile to Grenfell Tower.

Nevertheless, the Grenfell Tower fire provides some salient observations relevant to the treatment of risk on PMCR target buildings involving cladding that connects SOUs on the same building level. In particular:

- There was no significant horizontal fire spread in the 30 minutes after the fire ignited and spread vertically; and
- Fire-fighters arrived on scene in a timely fashion and their efforts were effective in limiting horizontal fire spread at the lower levels of the east face of the building, where the fire originated.

Risk assessment under the PMCR

Risk assessments under the PMCR only involve scenarios where cladding can spread fire laterally between 2 SOUs. For a horizonal cladding configuration connecting 2 SOUs it is expected that:

- the rate of fire spread will be relatively slow (compared to a façade fire that advances vertically); and
- there is a reasonable expectation that fire fighters will arrive at the scene of a fire in a timely fashion to undertake fire suppression and evacuation activity (the timely delivery of a fire-fighting response for PMCR target buildings is likely because nearly all of the buildings are urban based and low-rise).

For a horizontal cladding cluster involving 2 SOUs, no action is required under the PMCR where sprinkler protection is available in SOUs. This is consistent with the risk rating method outlined in the *Cladding Risk Mitigation Framework*, which affords these buildings a low cladding risk rating (a building with a low cladding risk rating is deemed to have achieved an Acceptable Cladding Risk under the *Cladding Risk Mitigation Framework.*

For non-sprinklered buildings, the horizontal connection of 2 SOUs presents an elevated risk and requires intervention under the PMCR.

One optional path of intervention is to remove a section of cladding to break the connection between 2 adjacent SOUs on the same level of a building. This action will allow the building to be re-rated from elevated to low. The action is akin to creating a fire break in the cladding to limit the spread of fire across the façade horizontally.

Minimum requirements for breaking a horizontal connection in cladding

Determining the quantity of combustible material (ACP-PE or EPS) to be removed in a horizontal configuration between two openings has been completed using BCA principles.

<u>BCA Principals for Fire Resistance</u>

NCC 2022 Volume 1, Section C Fire Resistance, Part C3D7 Vertical separation of openings in external walls states:

"(1) If in a building of Type A construction, any part of a window or other opening in an external wall is above another opening in the storey next below and its vertical projection falls no further than 450 mm outside the lower opening (measured horizontally), the openings must be separated by—…"

Since the BCA Fire Resistance requirements above do not require specific actions to prevent spread of fire (e.g. construction of a spandrel or floor slab projection) once the openings are greater than 450mm away from each other (measured horizontally), it is rational to conclude that a 450mm separation strip (fire break) is a sufficient quantity of combustible cladding to be removed in order to mitigate the risk of fire spread between two openings in a horizontal configuration.

Not limited to the BCA equivalence demonstrated above, CSV have also accepted the principle that vertical fire propagation is significantly more rapid than horizontal, with the fire spread having a reduced flame propagation length and pyrolysis zone in the horizontal plane.

Based upon the considerations above, CSV have determined that removal of combustible cladding to provide a fire break of at least 450mm is sufficient to mitigate the fire spread risk horizontally between openings.

Risk rating considerations

The rating of risk for this cladding scenario is focussed on 2 SOUs on the same level of a building, where:

- there is cladding between openings in adjacent SOUs; but
- there is a gap in the cladding than runs vertically from the floor to the ceiling of each SOU that provides a horizontal break of at least 450mm.

In this scenario, the development of façade fire in cladding that reaches a significant scale and intensity is considered to be 'not plausible'.

Furthermore, under this scenario the likely consequence would be 'slight harm' to building occupants.

Risk rating	
Likelihood	Not plausible
Consequence	Slight harm
Overall rating	(see matrix below)

	Not plausible	**Somewhat plausible**	**Plausible**
Slight harm	Trivial	Tolerable	Not tolerable
Moderate harm	Tolerable	Not tolerable	Not tolerable
Extreme Harm	Not tolerable	Not tolerable	Not tolerable

Cladding risk policy decision

When counting SOU connectivity as part of a CFSR assessment for an area of cladding on a façade, 2 adjacent SOUs on the same building level are not considered to be connected where there is a horizontal break in the cladding (extending from floor to ceiling) that is at least 450mm.

Fire breaks in cladding to limit vertical fire spread

Description	The PMCR focusses risk mitigation action on areas of cladding on a building façade that connects multiple SOUs. That is because the connectivity of cladding provides the potential for fire to spread externally via cladding from one SOU to another. Where there is a break/gap in a run of cladding, the risk that a fire will spread from one SOU to another via cladding is less likely.
Risk proposition	The risk of fire spread between adjacent SOUs on different levels of a building (i.e. vertically) should be considered tolerable where there is a horizontal break in a vertical run of cladding greater than or equal to 900mm. The tolerability of vertical runs of cladding incorporating 900mm fire breaks should be limited to situations where the cladding: ▪ Is located at lower storeys (and firefighting is less complicated); and ▪ Does not connect multiple of SOUs.

Risk assessment summary

One of the risk mitigation options available under the PMCR is to create fire breaks in cladding to limit the spread of a fire vertically via Combustible External Cladding.

The key policy question is what size of fire break is necessary to bring the risk to a tolerable level under a risk-based approach like the PMCR.

In exploring this question, it is purposeful to consider:

1. The existing regulatory requirements for vertical fire separation under the NCC; and
2. The extent to which cladding adds to the risk to life safety above and beyond the risk already present in buildings without cladding (as presented when one of the most severe forms of fire hazard occurs, a flashover event).

These aspects of fire risk are discussed as part of the assessment of risk tolerance under the PMCR.

Flashovers

One of the major fire hazards that contributes to fire spread between different compartments of a building is a flashover fire.

A useful definition of flashover is provided by the National Institute of Standards and technology (NSTA) in the USA:

> *"Flashover is the transition phase in the development of a contained fire in which surfaces exposed to the thermal radiation, from fire gases in excess of 600° C, reach ignition temperature more or less simultaneously and fire spreads rapidly through the space. This is the most dangerous stage of fire development."*
>
> (Source: https://www.nist.gov/el/fire-research-division-73300/firegov-fire-service/fire-dynamics)

A flashover event can be explosive, involving very high heat release levels and flames with extended reach to other parts of a building. The scale of observed flashover events is depicted in the NIST images below.

In relation to cladding, the concern is that a fire originating inside a building (which accounts for 90% of all fire origins), will break out of an apartment through an opening to reach cladding and spread to other apartments via cladding.

Flashover events present a risk in all buildings, and not just those with cladding on their facade.

NCC requirements for vertical separation of openings in external walls

Section C of Volume 1 of the NCC sets out requirements for fire resistance.

Part C3 deals with compartmentation and separation and C3D7 deals specifically with the 'vertical separation of openings in external walls'. The stated intent of C3D7 (formerly C2.6, NCC volume 1, 2019) is:

> *"To minimise the risk of fire spreading from one floor to another via openings in external walls in buildings of Type A construction."*
>
> (Source: https://ncc.abcb.gov.au/editions/2019-a1/ncc-2019-volume-one-amendment-1/section-c-fire-resistance/part-c2-compartmentation)

The design and function of the PMCR aligns to C3D7 insofar as the PMCR focus is on mitigating risk associated with the transition of fire via cladding from one SOU to another, and breaching SOUs via openings in the façade.

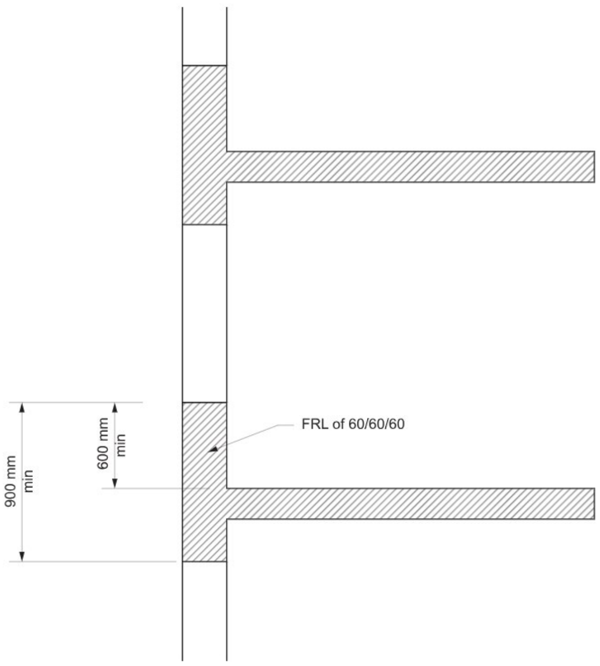
The provisions of C3D7 apply to *'buildings of Type A construction and Class 9a buildings of Type B construction'* and require that façade materials are non-combustible. These requirements provide a good starting point for understanding NCC embedded risk tolerance generally in relation to vertical fire spread between openings in the absence of Combustible External Cladding.

The Guide for the application of C3D7 (formerly C2.6) notes that:

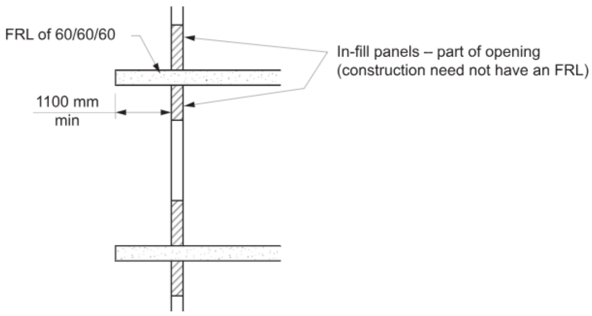
- This requirement does not apply to *'sprinkler protected buildings because the sprinklers should prevent the fire developing to the stage where it could spread to the floor above'*; and
- The requirement can be met for non-sprinklered buildings through the presence of either:
  - *'a non-combustible spandrel or other non-combustible vertical construction having an overall height of 900 mm or more, extending at least 600 mm or more above the upper surface of the intervening floor, and having an FRL of 60/60/60'* or
  - '*a non-combustible horizontal projection having an outwards projection from the external face of the wall of 1 100 mm or more, an extension along the wall beyond the openings of at least 450 mm, and having an FRL of 60/60/60.*'

The Guide presents the following illustrations to depict effective mitigants against vertical fire spread between openings.

Section showing use of spandrel to separate external window openings



Example showing use of slab or horizontal construction to separate external window openings



(Source: https://ncc.abcb.gov.au/editions/2019-a1/ncc-2019-volume-one-amendment-1/section-c-fire-resistance/part-c2-compartmentation)

Despite the potential large scale and high intensity of flashover fires, the spandrel requirements set out in C2.6 suggest that the risk to the SOU on the upper level is tolerated where:

- There is a separation of 900mm or more between the top of the opening in the lower SOU and the sill of the opening in the upper SOU; and
- The spandrel between the openings is non-combustible and meets the fire rating requirements.

Considerations for vertical fire breaks in cladding

Spandrels are a common feature on the buildings that are the focus of PMCR assessment and intervention planning.

The spandrel requirements set out in C3D7 indicate that to mitigate the risk of fire transition (via cladding) between the openings of two vertically aligned SOUs, one option is to ensure that the spandrel between the openings is non-combustible (assuming it is already 900mm or greater). That is the Combustible External Cladding on the spandrel can be replaced with a non-combustible alternative.

The question considered in assessing cladding risk tolerance in relation to vertical breaks in cladding is:

- **IF** it is tolerable to have a 900mm non-combustible separation between openings on adjacent floors of a building;
- **THEN** what level of gap in a vertical orientation of cladding is necessary to consider the risk of vertical fire spread via cladding to be at a tolerable level?

The PMCR design proposes the adoption of the spandrel requirements for vertical separation as a benchmark for the PMCR requirements in relation to vertical fire breaks in cladding.

This assessment is, therefore, limited to the fire break requirements necessary to bring the risk of vertical fire spread to a tolerable level for non-sprinklered buildings.

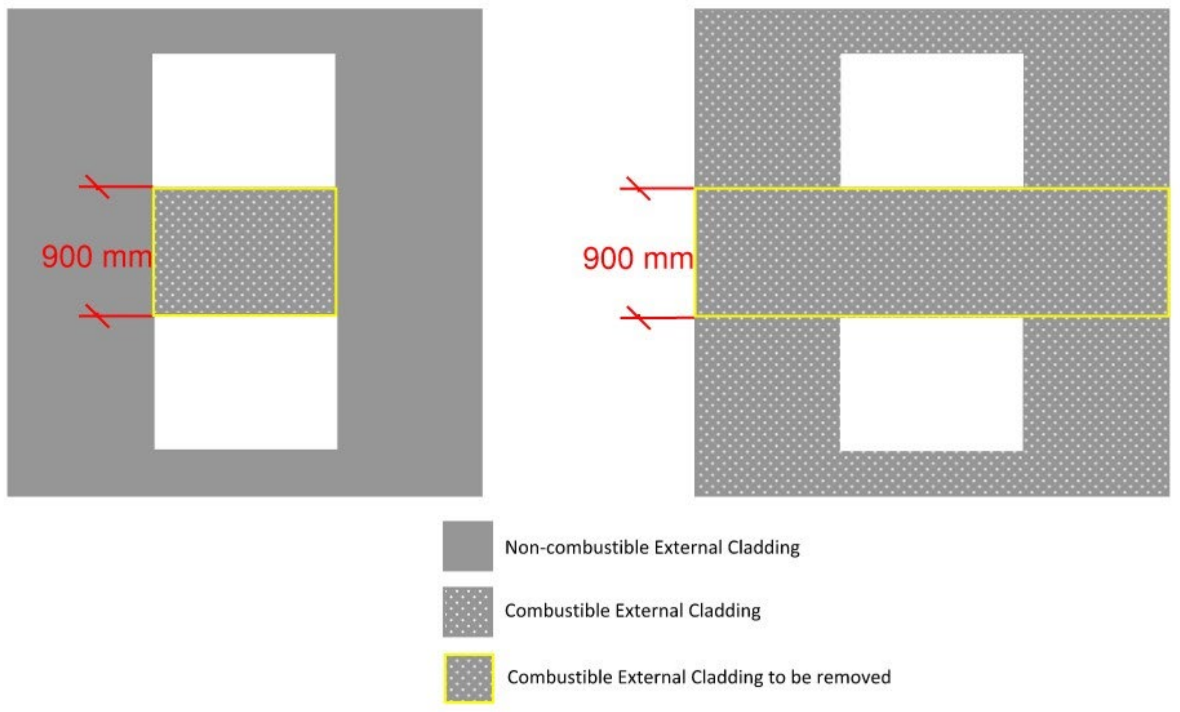
Risk rating considerations

The proposition being considered in this assessment of risk tolerance is captured in the two illustrations below.

- The image on the left depicts a building (**building 1**) with combustible external cladding on the spandrel between the two vertically aligned openings, but no-where else on the façade; and
- The image on the right depicts a building (**building 2**) with combustible external cladding across the entire façade, including on the spandrel between the two vertically aligned openings.

For **building 1**, replacement of the combustible material on the spandrel will achieve a tolerable risk status.

This risk assessment considers the tolerability of a scenario where a 900mm fire break exists across the entire span of the cladding, as represented for **building 2**.



The creation of a 900mm break in the vertical orientation of cladding would be expected to slow the spread of fire via cladding, which would mitigate risk and provide added time for a firefighting intervention to be applied.

Breaking vertical connections of cladding provides a buffer to rapid fire spread and provides greater opportunity to control, contain and extinguish fires through the delivery of a firefighting response. This is particularly true where the cladding materials are located below the 5th level of a building, where firefighting action can be applied from the ground.

This risk rating assessment of risk tolerability considers only:

- **Where no more than 2 SOUs are connected by cladding.**

In a non-sprinklered building where a vertical run of cladding connects any two SOUs, introducing a 900mm break in the cladding across the entire span of the cladding would result in:

- The likelihood of a cladding fire achieving a scale and intensity that threatens multiple SOUs is considered 'somewhat plausible'; and
- In the event of cladding igniting in this scenario, the likely consequence in terms of harm to people is considered to be 'slight harm'.

This assessment was developed to mitigate risk in relation to clusters connecting two or three SOUs (i.e. primarily for buildings with an **elevated** cladding risk).

Risk rating`

Likelihood	Somewhat plausible
Consequence	Slight harm
Overall rating	(see matrix below)

	Not plausible	**Somewhat plausible**	**Plausible**
Slight harm	Trivial	Tolerable	Not tolerable
Moderate harm	Tolerable	Not tolerable	Not tolerable
Extreme Harm	Not tolerable	Not tolerable	Not tolerable

Cladding risk policy decision

<u>Up to and including the 4th storey:</u>

Cladding clusters below the 5th storey of a building with non-combustible vertical fire breaks installed that are at least 900mm high separating individual SOUs pose a tolerable risk, provided these breaks separate all individual SOUs within cladding clusters not exceeding:

- 2 SOUs total in a building where SOUs are not sprinkler protected; and
- 6 SOUs total in a building where SOUs are sprinkler protected.

Where a non-combustible vertical break in Combustible External Cladding is in place, which is at least 900mm and extends across the entire horizontal span of the cladding between two SOUs, these SOUs are to be considered not connected by cladding (*i.e. IFSCAN= 1= acceptable*) for the purpose of cladding risk rating under the Cladding Risk Mitigation Framework.

5th storey and above:

Cladding clusters at the 5th storey or above of a building with non-combustible vertical fire breaks installed, that are at least 900mm high separating individual SOUs, pose a tolerable risk, provided these fire breaks separate individual SOUs within cladding clusters not exceeding:

- **2** SOUs in a building where SOUs are not sprinkler protected; and
- **3** SOUs in a building where SOUs are sprinkler protected

Where cladding cluster values exceed the thresholds prescribed above, these buildings will be subject to further consideration and internal engineering advice on a case-by-case basis.

Note. This policy decision applies only to breaking the cladding connection between 2 individual SOUs.

Further information pertaining the installation of larger 'floor level' fire breaks for the purposes of reducing large clusters into manageable clusters can be found in PMCR cladding policy document 'E.02 – Sprinkler Protection'.

Building attachments with cladding (ACP-PE and EPS)

Description	On many buildings, Combustible External Cladding is not part of the wall system, but instead is an external **attachment** to the wall. Attachments may be decorative features, involve relatively small cladding fuel loads and are often off-set from the façades and some distance from SOU openings. The risk of external fire spread between SOUs and the risk that a cladding fire will enter an SOU through an opening is different for attachments compared to walls. A differentiated and risk proportionate PMCR response is required in relation to attachments constructed with Combustible External Cladding.
Risk proposition	Conditions should be set for the retention of ACP-PE and EPS cladding on attachments under the PMCR based on: ▪ Acceptance that the architectural feature with cladding is an attachment; ▪ The amount and type of cladding; ▪ The degree of off-set between the attachment and the wall; ▪ The distance between the attachment and other proximate areas on the building containing cladding; and ▪ The distance between the attachment and adjacent openings. ACP-FR attachments are considered tolerable and not the subject of this risk proposition. Further information is provided in Section 2 and Section 4.1 of this document.

Risk assessment summary

While the provisions of the NCC require external walls to be non-combustible, previous versions of the BCA prior to 2016 amendment 1-Specification C1.1 Clause 2.4 provided conditions for the use of combustible materials as part of an attachment.

This previous provision appears to introduce a risk-based rationale for the use of combustible materials on attachments to a building, recognising that the integrity of a wall-system and the safety of building occupants is less likely to be compromised where combustible materials are limited to attachments where it does not result in an undue risk of fire spread.

For many of the Class 2 and Class 3 buildings that are the subject of PMCR assessment, a risk-based rationale must be provided to justify intervening to address risk where combustible cladding is on an attachment.

This risk assessment is designed to inform a policy position to guide PMCR application in relation to attachments containing Combustible External Cladding.

What is an attachment?

The Commonwealth Scientific and Industrial Research Organisation (CSIRO), in their publication *Fire safety guideline for external walls* provide a means of determining what is an attachment.

> [CSIRO] *applied the following reasoning to determine when a building element should be assessed as an external wall (or integral part of external wall) or an attachment:*
>
> - *If the cladding/lining/other item is removed and the remaining structure no longer functions suitably as an external wall (e.g. the remaining structure has no fire resistance level, is unable to prevent the penetration of water, is unable to resist wind loads or in certain applications cannot meet acoustic requirements), then it is considered an integral part of the external wall.*
> - *If the cladding/lining/other item is removed and the remaining wall still functions as an external wall then it can be regarded as an attachment.*
>
> (Source: Fire safety guideline for external walls A guide for high-rise construction in Australia, A.Webb and N.White (CSIRO), 18 April 2016)

The PMCR adopts this concept of an attachment in applying this policy.

That is, an external architectural feature of a building is considered an attachment if it is not a functional part of a wall system that serves to:

- protect the structural integrity of a wall; or
- fulfil any other protective function (water ingress, fire resistance, thermal insulation, etc.)

Attachments and the required risk considerations

Any area of a building that contains Combustible External Cladding should be identified as part of a cladding oriented risk assessment process.

In designing an external wall, the Engineers Australia's Society of Fire Safety have suggested that in assessing the fire safety design requirements for attachments, the following questions should be asked:

> *"What are they and what are they made of? Dimensions and fixing details? Orientation to ignition sources and openings? Does the façade protect penetrations from presenting a fire spread hazard?"*
>
> (Source: Society of Fire Safety Practice Guide Façade/External Wall Fire Safety Design, Engineers Australia Society of Fire Safety, 7 March 2019)

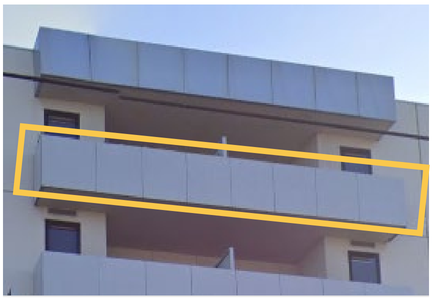
The PMCR design involves the following considerations in relation to attachments containing combustible cladding:

- The amount and type of cladding;
- The degree of off-set between the attachment and the wall;
- The distance between the attachment and other proximate areas on the building containing cladding; and
- The distance between the attachment and adjacent openings.

Types of attachment and risk tolerance positions proposed

In reviewing hundreds of buildings, CSV has identified a number of common design features involving cladding on attachments. This attachment typology is presented below and the parameters that would inform a risk tolerance judgment are identified.

The key focus of this assessment is to define the conditions under which adjacent SOUs are considered to be connected by cladding on an attachment for the purpose of carrying out cladding risk assessments under the *Cladding Risk Mitigation Framework*. In particular, these judgements impact CFSR and IF-SCAN counting rules.

Attachment Type	Description and risk tolerance position
ACP balcony attachment 	Cladding can be affixed to the outside face of a balcony. The potential for the cladding in this scenario to be ignited, spread to other areas of cladding and reach SOU openings has been considered. Where the following conditions are met, ACP cladding on an attachment is considered to pose a tolerable risk to SOU occupants and should not generate a CSFSR or IF-SCAN count, where the ACP balcony attachment: 4. does not return back into a wall that is combustible OR does return into a wall that is non-combustible; 5. no adjacent SOU window or door openings within 450mm of the ACP attachment. 6. the attachment is not more than 1.2m in height; 7. is constructed of non-combustible material on the inside face; 8. spacing between vertical balustrade attachments is greater than 1.2m; and 9. soffits are non-combustible.
EPS balcony attachment	Similar to ACP balcony attachments described above, EPS is often used on the external face of balcony balustrades and this design may carry to multiple balconies on the building in vertical or horizontal alignment. Where the following conditions are met, EPS cladding on an attachment is considered to pose a tolerable risk to SOU occupants and should not generate a CSFSR or IF-SCAN count, where the balcony attachment: 10. does not return back into a wall that is combustible OR does return back into a wall that is non-combustible;

11. no adjacent SOU window or door openings within 450mm of the EPS attachment;
12. the attachment is not more than 1.2m in height;
13. is constructed of non-combustible material on the inside face;
14. spacing between vertical balustrade attachments is greater than 900; and
15. soffits are non-combustible.

Box capping to balconies

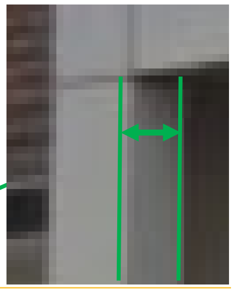
Cladding is sometimes introduced as an architectural feature to box the outer perimeter of a balcony (as exemplified in the image to the left).

The potential for cladding in this scenario to carry fire from one SOU to another, is influenced by the proximity of the cladding to openings.

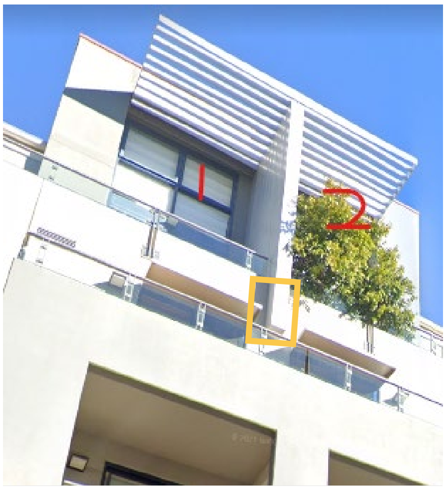
Where cladding returns into the balcony from the face of the balcony there is a greater likelihood that fire will reach an SOU opening.

Where the following conditions are met, a box capped attachment to a balcony is considered to pose a tolerable risk to SOU occupants and should not generate a CSFSR or IF-SCAN count:

- Cladding wrapping round the corner from a balcony face and onto the balcony return wall towards the SOU wall must not exceed a maximum of 150mm from the balcony face;



Cladding attachments above openings



Some building designs use cladding on attachments that start on one level of a building and continue vertically to the floors above.

There is the potential in such scenarios to overestimate the cladding risk by incorporating the lower SOUs in the count of SOUs that are impacted.

The example below shows a vertical ACP-PE fin that starts above the SOU openings on the lower level and continues to the level above. The two SOUs on the upper level would be impacted by a flashover fire on the lower level, but what function does the cladding have on the risk to the SOUs on the lower level (particularly where the cladding is above openings)?

An attachment on the SOU wall is considered to pose a tolerable risk to SOU occupants and the CSFSR or IF-SCAN count should not be incremented to incorporate:

- an SOU in which the cladding is only located in positions above the highest SOU opening for that SOU.

In the example provided, the two upper-level SOUs are included in the CFSR count, but the two lower-level SOUs are not included in the CFSR count.

Attachments separated from openings

The risk of horizontal fire spread from cladding is considered to be tolerable (see the section on horizontal fire breaks in cladding presented earlier in

this paper) where a cladding run is broken horizontally by a space not less than 450mm.

Similarly, a vertical attachment is considered to present a tolerable risk where:

- it is separated from openings by at least 450mm horizontally.

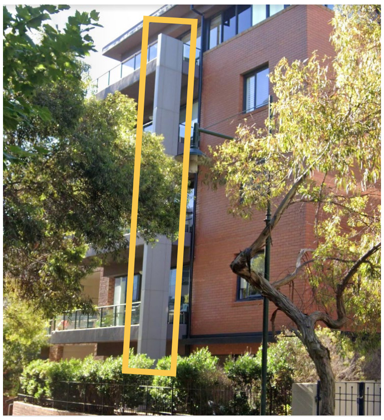
Accordingly, the cladding displayed on the attachment on the **left** is tolerable as the vertical run of silver cladding is **more than** 450mm away from openings.

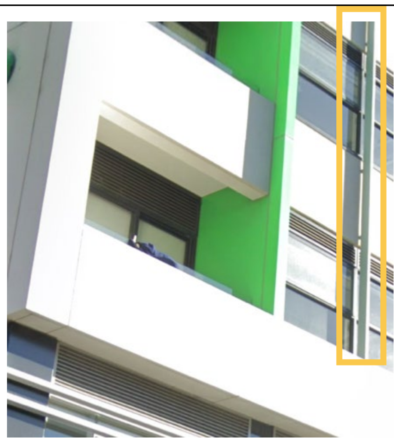
Conversely, the cladding displayed on the attachment on the **right** is not tolerable as the vertical run of silver cladding is **less than** 450mm away from openings.

The cladding generates a CFSR and IF-SCAN count only in relation to the sample on the right.

Attachments not connected to wall

There are many examples of cladding use on attachments that are physically separated from SOU walls (see the three examples below).





Risk focus is directed to these types of attachment where there is a vertical orientation and the prospect of a cladding fire spreading across multiple floors is plausible.

The off-setting of these attachments from a wall means that cladding is generally found:

- some distance from SOU openings;
- in more open balcony configurations; and
- in low volumes (creating small fire fuel loads).

The heat release of fires generated from cladding and the threat of external cladding fires breaching SOU openings is lower in such scenarios compared to fires associated with cladding on SOU walls.

If quantitative parameters were to be set for tolerance thresholds in relation to attachments, they would reflect:

- the dimensions of the area covered by cladding (measure of total fuel load);
- the distance or number of building levels across which the attachment runs vertically; and
- the horizontal distance between the attachment and SOU openings.

Combining these measures quantitatively brings false precision to the characterisation of cladding risk and is considered unnecessary to guide PMCR design, particularly in relation to low and mid-rise buildings.

Instead, a blanket policy positions is proposed, in which any attachment is considered tolerable where the attachment:

- is physically separated from the external facade of the wall; and
- does not extend vertically beyond the fourth level of the building.

Attachments meeting these criteria will not be included in CFSR ad IF-SCAN counts.

However, it should be noted that the governance arrangements for the review and finalisation of RWPs provide for attachments to be singled out for treatment by exception where the risk of cladding fire spread is held to be unduly accentuated due to:

- the proximity of the attachment to SOU openings; and
- the volume of cladding on the attachment.

Risk rating considerations

For each of the five attachment types discussed above (and within the stated bounds of the criteria), it is proposed that:

- The likelihood of a cladding fire achieving a scale and intensity that threatens multiple SOUs is considered 'not plausible'; and
- In the event of cladding igniting in this scenario, the likely consequence in terms of harm to people is considered to be 'slight harm'.

This assessment gives rise to an overall rating of 'trivial'.

Risk rating

Likelihood	Not plausible
Consequence	Slight harm
Overall rating	(see matrix below)

	Not plausible	**Somewhat plausible**	**Plausible**
Slight harm	**Trivial**	Tolerable	Not tolerable
Moderate harm	Tolerable	Not tolerable	Not tolerable
Extreme Harm	Not tolerable	Not tolerable	Not tolerable

Cladding risk policy decision

A CFSR or IF-SCAN count will NOT BE incremented due to an attachment with Combustible External Cladding that meets the following conditions/criteria:

ACP balcony attachment

- does not return back into a wall that is combustible OR does return back into a wall that is non-combustible.
- no adjacent SOU window or door openings within 450mm of the ACP attachment;
- the attachment is not more than 1200mm in height;
- is constructed of non-combustible material on the inside face;
- spacing between balcony attachments is 1200mm vertically or greater; and
- soffits are non-combustible.

EPS balcony attachment	▪ Does not return back into a wall that is combustible OR does return back into a wall that is non-combustible. ▪ no adjacent SOU window or door openings within 450mm of the EPS attachment; ▪ the attachment is not more than 1.2m in height; ▪ is constructed of non-combustible material on the inside face; ▪ spacing between attachments is 900mm vertically or greater; and ▪ soffits are non-combustible.
Box capping to balconies	▪ cladding wrapping round the corner from a balcony face and onto the balcony return wall towards the SOU wall must not exceed a maximum of 150mm from the balcony face
Cladding attachments above openings	▪ the cladding is only located in positions above the highest SOU opening for that SOU.
Attachments separated from openings	▪ cladding is separated from openings by at least 450mm horizontally.
Attachments not connected to wall	▪ is physically separated from the external facade of the wall; and ▪ does not extend vertically beyond the fourth level of the building.

Appendix A: PMCR Document Set Diagram