Protocols for Mitigating Cladding Risk

PMCR Interventions

F.01 – Interventions to Suppress Fires

Interventions are required to mitigate the risk to life safety posed by the presence of combustible cladding on the facades on Class 2 and Class 3 buildings.

The Victorian Government has developed a method for:

- assessing the risk presented by combustible cladding; and
- introducing targeted interventions to bring buildings to an acceptable level of cladding risk.

The **15** related risk mitigation interventions that may be applied fall into **five** categories:

1. **Interventions to suppress fires;**
2. Interventions to reduce cladding fuel;
3. Interventions to address energy ignitions;
4. Interventions to detect fire and alert people, and
5. Intervention to assist safe egress from a building.

This document provides information about those **interventions designed to suppress fires**.

It is designed to assist those assessing a building's cladding risk and deciding how to intervene to reduce cladding risk to an acceptable level.

Version 2

Date: 13 March 2024

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.

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Abbreviations

Term	Meaning
ACP-PE	Aluminium Composite Panel with a polyethylene core
CRMF	Cladding Risk Mitigation Framework
CRPM	Cladding Risk Prioritisation Model
CSV	Cladding Safety Victoria
EPS	Expanded Polystyrene
FRV	Fire Rescue Victoria
Framework	Cladding Risk Mitigation Framework
IF-SCAN	Initial Fire Spread in Cladding Assessment Number
MBS	Municipal Building Surveyor
MG-15	Minister's Guideline 15
NCC	National Construction Code
PMCR	Protocols for Mitigating Cladding Risk
RWP	Remediation Work Proposal
SOU	Sole Occupancy Unit – as defined in the National Construction Code

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 facade:

- 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 be of a construction type or size or may only comprise limited elements of combustible cladding 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 and flow.

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.

1 Introduction

When a building has combustible cladding on the facade, an **intervention** may be necessary to enhance life safety and/or reduce cladding ignition and fire spread risk to an acceptable level.

The level of risk created by the presence of combustible cladding typically varies from building to building. Accordingly, a decision to **intervene** and the extent of **intervention** required must also vary.

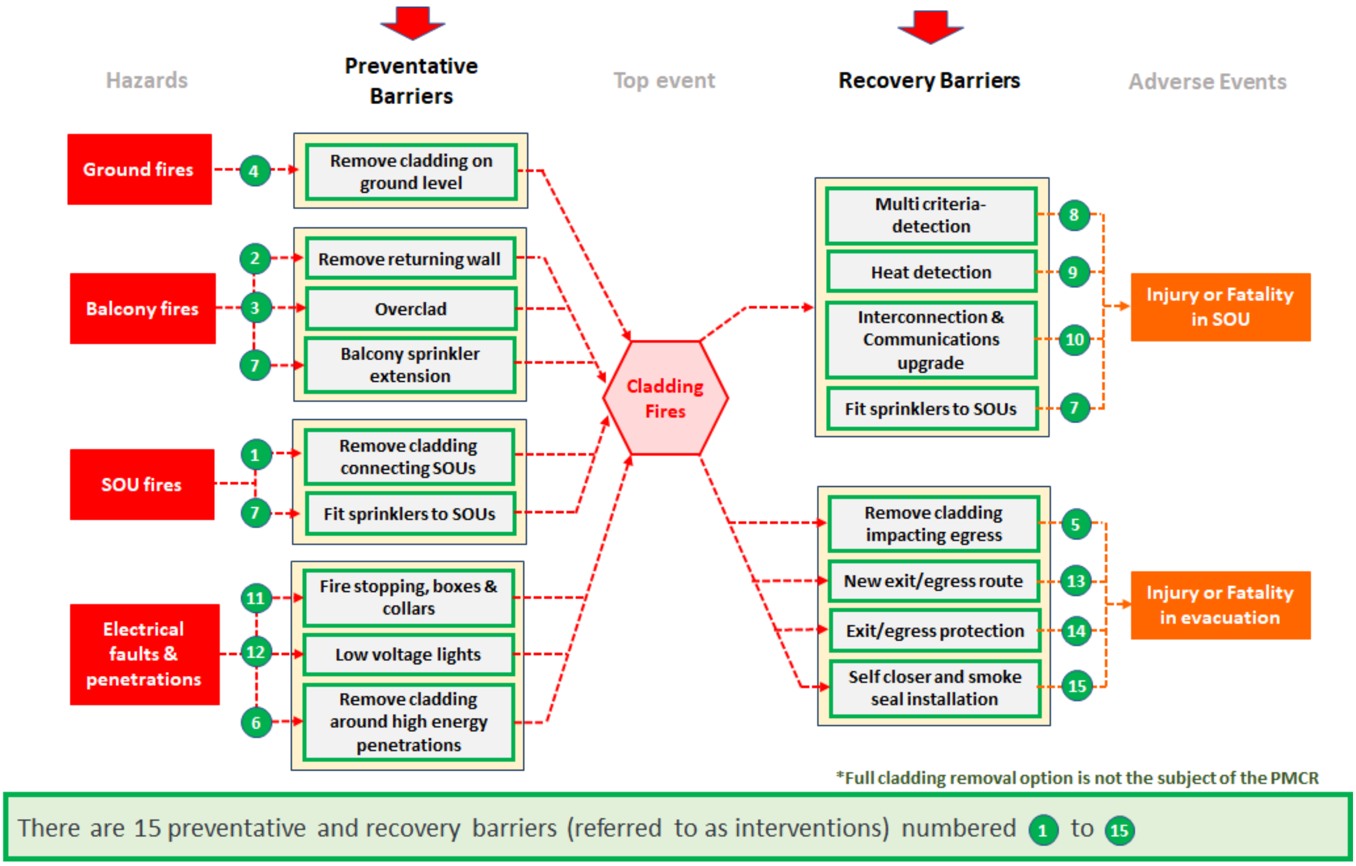
The Victorian Government has authorised the use of **15 interventions** to mitigate cladding risk. The authority for their use is contained in *Minister's Guideline 15* (**MG-15**) and supported by the *Cladding Risk Mitigation Framework* (**Framework**).

The Guideline and Framework are intended to:

- support Municipal Building Surveyors (**MBS**) in rating the cladding risk of a building and determining what level of intervention is required to ensure that the building has achieved an Acceptable Cladding Risk; and
- inform owners about how their building is assessed with regard to cladding risk and the structured way in which Remediation Work Proposals are developed to bring their building to an acceptable level of cladding risk.

Cladding Safety Victoria (**CSV**) is assisting MBSs and owners by providing information about the cladding risk associated with each building and the steps necessary to remedy that risk. This information is provided in the form of a Remediation Work Proposal (**RWP**), that applies the cladding risk methodologies developed by CSV over three years.

A threat barrier analysis can be used to represent how risk-mitigating actions can function to respond to a problem. The CSV method employs this analysis technique to identify the central problem (the 'top event'), in this case a cladding fire, and depict how risk associated with the problem can be mitigated through the implementations of barriers (interventions) designed to control the key hazards identified.



The 15 interventions in the threat barrier analysis act in different ways to mitigate cladding fire risk.

Each intervention may:

- Respond to one or more of the four identified hazards;
- Function to prevent an ignition source from spreading fire to cladding (i.e. interventions that reduce the likelihood of a fire igniting cladding); and/or
- Function to reduce the adverse impacts for building occupants once a fire has reached cladding (i.e. interventions that reduce the consequences of a cladding fire).

Any risk mitigation solution designed under the Framework must target credible hazards on a building and balance both cladding ignition likelihood and consequence considerations.

1.1 Purpose of this report

This report provides information about interventions that are available to reduce the cladding risk on Victorian multi-dwelling residential buildings (Class 2 and Class 3) to an acceptable level.

The 15 interventions function to reduce cladding risk in one of five discernible ways.

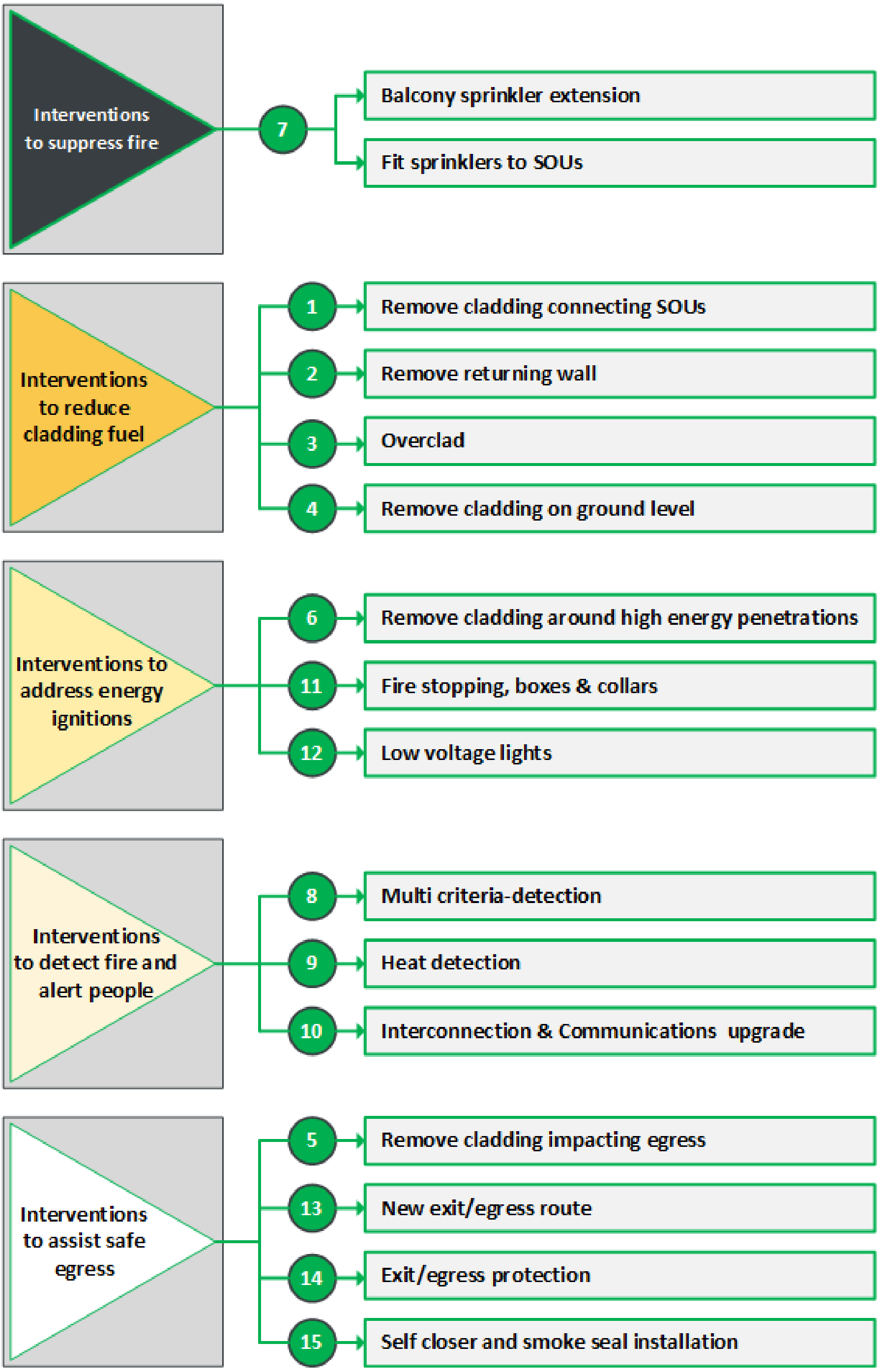
The documentation developed by CSV to support the implementation of the Victorian Government's Framework, includes information to guide MBSs and owners in determining how and when to apply particular interventions.

The information is packaged in five related volumes, one for each category of interventions, as represented in the diagram on the right.

In selecting particular interventions, it is important to understand:

- The ignition hazards that an intervention is responding to;
- The benefit to safety of applying an intervention;
- When an intervention is required to be applied; and
- Any considerations that must be made to guide the selection and installation of an intervention.

This report focuses only on interventions to suppress fires.



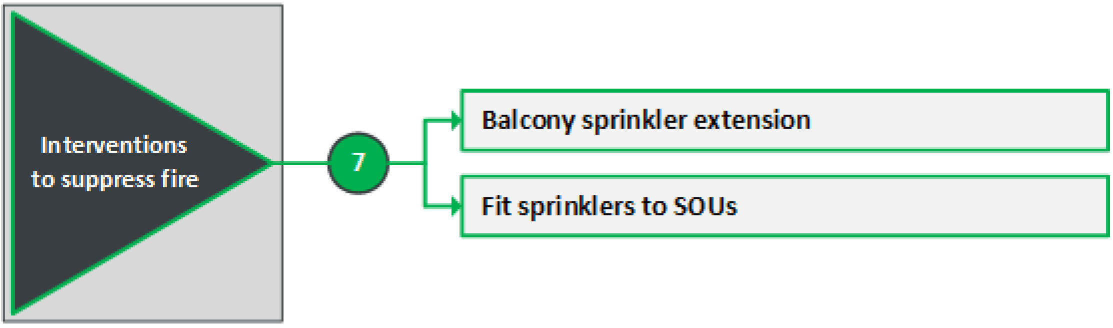
2 What are the interventions?

Automatic fire sprinkler systems provide one of the most efficient mechanisms for suppressing fires. Such systems function to respond to fire and act to:

- Limit the size of a fire; and
- Limit the spread of a fire.

There are two ways in which sprinklers can be used to mitigate cladding risk under the Framework:

1. Installing sprinklers to sole occupancy units (**SOU**) where there are none[1]; and
2. Extending sprinklers to the balconies of SOUs that already have internal sprinklers fitted.



A decision to install sprinklers as part of a Remediation Work Proposal (**RWP**) for a Class 2 or Class 3 building in Victoria should be considered in the context of:

- The applicable Standards for sprinkler installation and operation;
- The National Construction Code (**NCC**) requirements for sprinkler protection; and
- The CSV Cladding Risk Policy that informs RWP decisions about what interventions are required when sprinkler protection (consistent with Intervention 7) is in place.

These matters are the subject of the sub-sections that follow.

2.1 Standards for automatic sprinkler systems

The general provisions of the NCC stipulate that an automatic[2] sprinkler system must conform to the standard AS 2118.1 Automatic Fire Sprinkler Systems – General Systems.

Special provision is made under the NCC within Specification 18, in reference to automatic sprinkler systems in Class 2 and 3 buildings with an effective height of not more than 25 metres.

Specification 18 permits an automatic fire sprinkler system in a Class 2 or 3 building not more than 25m in effective height to comply with either of the following standards:

- AS 2118.1 Automatic Fire Sprinkler Systems – General Systems;
- AS 2118.4 Automatic Fire Sprinkler Systems – Sprinkler protection for accommodation buildings not exceeding four storeys in height;
- AS 2118.6-1995 Automatic Fire Sprinkler Systems – Combined sprinkler and hydrant;
- FPAA 101D Automatic Fire Sprinkler System Design and Installation – Drinking Water Supply; and
- FPAA 101H Automatic Fire Sprinkler System Design and Installation – Hydrant Water Supply.

Adherence to these standards is required for any RWP that incorporates the installation of sprinklers.

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[1] In some instances, a sprinklers system may already be available in a building to service common areas.

[2] The defined terms in the NCC state that '**Automatic** means designed to operate when activated by a heat, smoke or fire sensing device.'

2.2 Regulatory safety requirements for sprinklers

Automatic sprinkler systems are an integral part of sound fire safety design in Australian buildings, supported by NCC performance requirements that mandate their use in particular construction scenarios.

For many years, the installation of automatic sprinkler systems has been mandatory for all Class 2 buildings that are greater than 25 metres in effective height. This requirement reflects the understanding that the ability to fight a fire at height and to safely evacuate building occupants in a timely fashion is more challenging when dealing with taller buildings.

The NCC requirements in relation to sprinkler protection have been extended in recent years in response to the recommendations of a coronial enquiry into the Bankstown fire of 2012 and investigations of the balcony fire that caused the Lacrosse fire in 2014. Amendments to the NCC have been introduced which require:

- sprinkler protection to be provided to covered balconies (previously not required where the floor area of the balcony is less than $6m^2$ or the depth of the balcony is less than 2m) for all new multi-storey residential buildings, hotels, healthcare buildings and aged care buildings that are required to install sprinklers designed to AS 2118.1 (applicable in Victoria from 15 December 2015)[3]; and
- new Class 2 and 3 building with a rise in storeys of four or more (and an effective height of 25 metres or less) to have a sprinkler system as detailed in FPAA101D, FPAA101H, AS 2118.1, AS 2118.4 or AS 2118.6 (applicable from 1 May 2019)[4].

Through the introduction of MG-15 and the Framework, the Victorian Government is seeking solutions to cladding risk that reinforce and support fire safety best practice and accommodate the expanded use of sprinklers in Victorian Class 2 and Class 3 buildings where it is feasible and practical to do so.

The treatment of cladding risk under the Framework will continue to support fire safety best practice in Victoria through the extended use of sprinklers.

2.3 CSV Cladding Risk Policy for sprinkler protection

The life safety benefits of sprinkler protection in residential buildings are strongly evidenced.

International fire incident data is available covering hundreds and thousands of historical structure fires. This data allows the rates of death and injury to be compared for buildings with and without sprinklers.

The empirical evidence is unequivocal. Sprinkler protection in a building substantially reduces the risk of death or injury for building occupants and fire fighters.

CSV has undertaken research to consider how the availability of sprinklers in SOUs changes the need for cladding removal on Class 2 and Class 3 buildings. It is clear that a risk proportionate response to cladding risk must consider both:

- the risk presented by external combustible cladding on a building facade; and
- the safety benefits provided by active and passive safety features, like sprinklers.

CSV has used its own accumulated knowledge of cladding risk together with international fire incident data and its own sponsored research to develop a clear CSV Cladding Risk Policy position about how to respond to facade cladding risk where sprinklers are present.

For an overview about the CSV research and analysis, refer to Appendix B: Sprinklers and cladding – research findings.

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[3] *Automatic Fire Suppression Systems for Covered Balconies in Residential Buildings: Final Decision RIS*, Australian Building Codes Board, June 2016

[4] https://ncc.abcb.gov.au/news/2019/new-residential-fire-sprinkler-requirements-ncc-2019

Assessing Cladding Risk

CSV uses the Cladding Risk Prioritisation Model (**CRPM**)[5] to assess the risk posed by the presence of combustible cladding on a building facade.

The CRPM improved on the previous risk triaging method in that it gave primacy to facade fire spread via cladding through the introduction of a new measure, the Initial Fire Spread in Cladding Assessment Number (**IF-SCAN**), which is a measure of:

> *"The number of apartments[6] (or SOUs) that would be directly impacted under a worst case scenario by a fire that ignites and spreads in combustible cladding prior to the first suppression response by fire fighting agencies."*

The Victorian Government has adopted the CRPM cladding risk rating schema as the cornerstone of MG-15 and the Framework, which codifies the three cladding risk rating categories in Victorian state policy, as defined in Table 1.

Table 1: Cladding risk rating categories

	Risk description	
Cladding risk rating category	**Sprinkler protected**	**Not sprinkler protected**
Unacceptable	Risk of fire spread across the combustible external cladding of **≥ 4 SOUs**	Risk of fire spread across the combustible external cladding of **≥ 3 SOUs**
Elevated	Risk of fire spread across the combustible external cladding of **3 SOUs**	Risk of fire spread across the combustible external cladding of **2 SOUs**
Low	Risk of fire spread across the combustible external cladding of **≤ 2 SOUs**	Risk of fire spread across the combustible external cladding of **≤ 1 SOU**

Source: Cladding Risk Mitigation Framework, Department of Transport and Planning, August 2023

CSV sprinkler-based policy position for cladding

The CSV analysis of international structure fire incident data, combined with its own cladding risk knowledge, has allowed a clear **cladding risk policy position** to be developed for mitigating cladding risk on Class 2 and Class 3 buildings where sprinkler protection is in place.

RWPs must conform to the CSV Cladding Risk Policy position, which provides that:

- Some cladding removal is mandatory for a building with an IF-SCAN of 7 or more;
- Little or no cladding removal is required for a building with an IF-SCAN of 6 or less where SOUs are protected by sprinklers; and
- Sprinkler protection should be extended to balconies for any area of cladding on a facade (referred to as a cladding cluster) where any part of the cladding cluster is located above the fourth storey of a building and the IF-SCAN is between 2 and 6 (where cladding is retained).

Where sprinkler protection is available in a building, the removal of cladding is generally considered to be a disproportionate response to the residual cladding risk that remains.

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[5] The Cladding Risk Prioritisation Model was developed by CSV in collaboration with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Data61 in 2020. For information see, *Cladding Risk Prioritisation Model: A method for assessing combustible cladding risk on Victorian residential Class 2 buildings*, August 2020.

[6] CSV is able to access information about the number of primary dwelling units in each building, referred to as Sole Occupancy Units (SOUs), and via access to architectural plans and elevations is able to relate SOUs to the location of cladding.

3 Scope of intervention

The **objective** of intervening to mitigate cladding risk under the Framework is to bring each building to a state of Acceptable Cladding Risk: meaning that the Relevant Building:

- achieves a 'Low Cladding Risk' rating; or
- presents an overall level of risk to the life and safety of the occupants of the Relevant Building which is reasonably similar or less than the risk which would be presented by the same building, if that building had no Combustible External Cladding.

This involves assessing and responding to cladding risk on two levels:

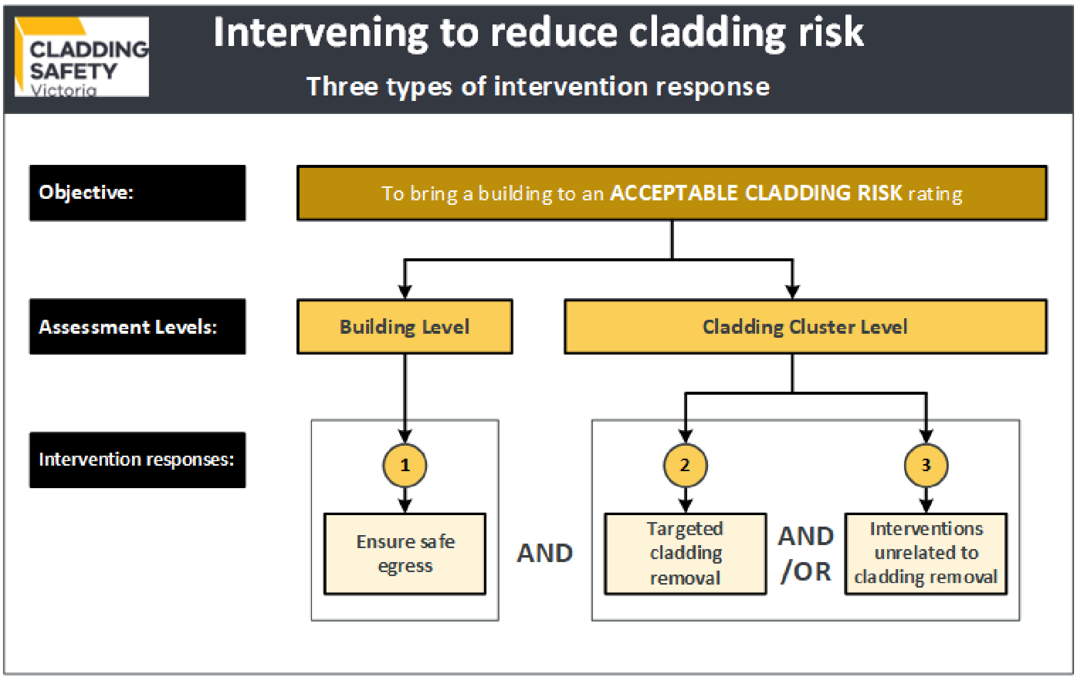
1. Building Level

   This level of assessment is focussed on evaluating the safety of egress options for building occupants. It involves consideration of all available paths of egress from a building as a single assessment exercise. That is, there may be no need for intervention in relation to one egress path where other 'cladding safe' egress paths are available for each occupant.

2. Cladding Cluster Level

   A building may have one or more areas on the facade with combustible cladding. Each of these areas is referred to as a separate cladding cluster. Each cladding cluster must be assessed independently of all other cladding clusters on the building. The optimal way to apply interventions may vary from cluster to cluster.

The method for bringing a Class 2 or Class 3 building with External Combustible Cladding to a state of Acceptable Cladding Risk requires three types of intervention response to be considered. These types of intervention responses are represented diagrammatically below.

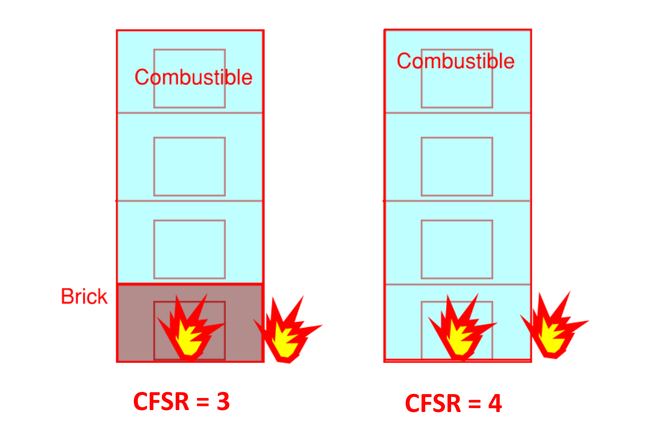


This Intervention Report focusses solely on interventions to suppress fires. These interventions are part of a response designed to combat the risk associated with individual cladding clusters (the third category of intervention responses identified above).

3.1 What is a Cladding Cluster

A Cladding Cluster is an area on a building facade that has a designated External Combustible Cladding product that runs continuously and overlays some part of the floor plan of one or more SOUs. Each Cladding Cluster is given a number (the Cluster Fire Spread Risk - **CFSR**), which represents the number of SOUs connected by the continuous run of cladding.

The images below depict the representation of cladding clusters and the count of the impacted SOUs.



Different cladding configurations lead to CFSR differences

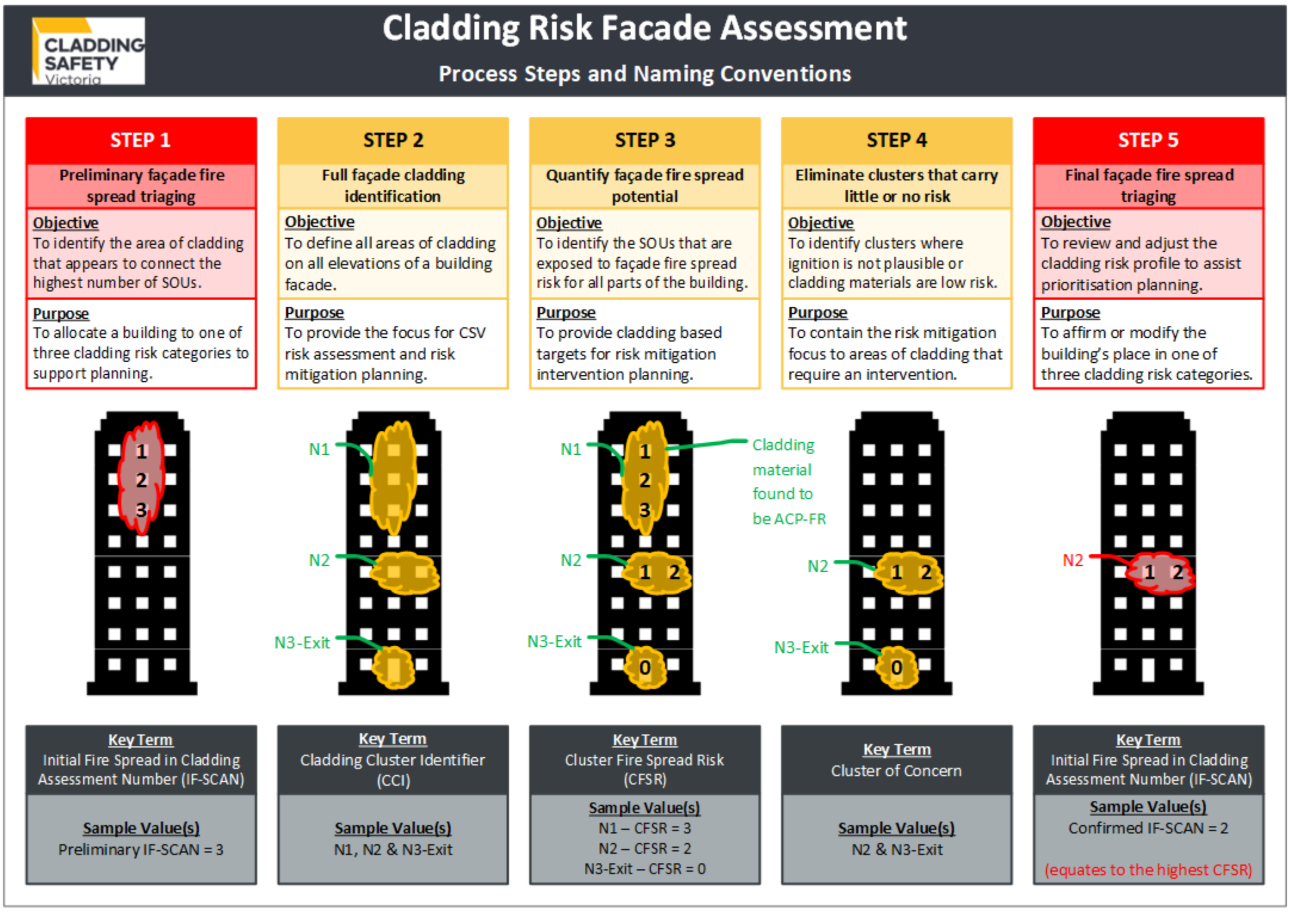
Cladding connects 4 SOUs (CFSR = 4)

3.2 The process of identifying Cladding Clusters

The process for assessing cladding risk and preparing a proportionate response to the cladding risk encompasses five sequential steps that are used to:

1. Determine the risk profile of a building (informed by the IF-SCAN);
2. Identify and assess each individual cladding cluster (using the CSFR);
3. Identify and eliminate any cladding clusters that do not represent a plausible risk to occupants; and
4. Set the scope for the application of interventions under the Framework.

This five-step process is illustrated below.



For more detailed information, refer to G.02 IF-SCAN Procedure/Method.

3.3 Applying interventions to Cladding Clusters

When applying interventions to a cladding cluster as part of an overarching design solution to bring a building to an Acceptable Cladding Risk rating, the interventions only need to be applied to the SOUs that are associated with the cladding cluster, as outlined in G.03 Cladding Remediation Standards.

Building owners may choose, of their own volition, to apply interventions to other SOUs that are not associated with a cladding cluster. In doing so, there is no recognised additional benefit to the assessment of cladding risk under the PMCR Standards.

However, any additional safety measures introduced by building owners to address safety issues unrelated to cladding risk are a welcome ancillary benefit of cladding related remediation projects.

4 PMCR Standards for risk mitigation interventions

PMCR Standards have been developed for the remediation of cladding risk.

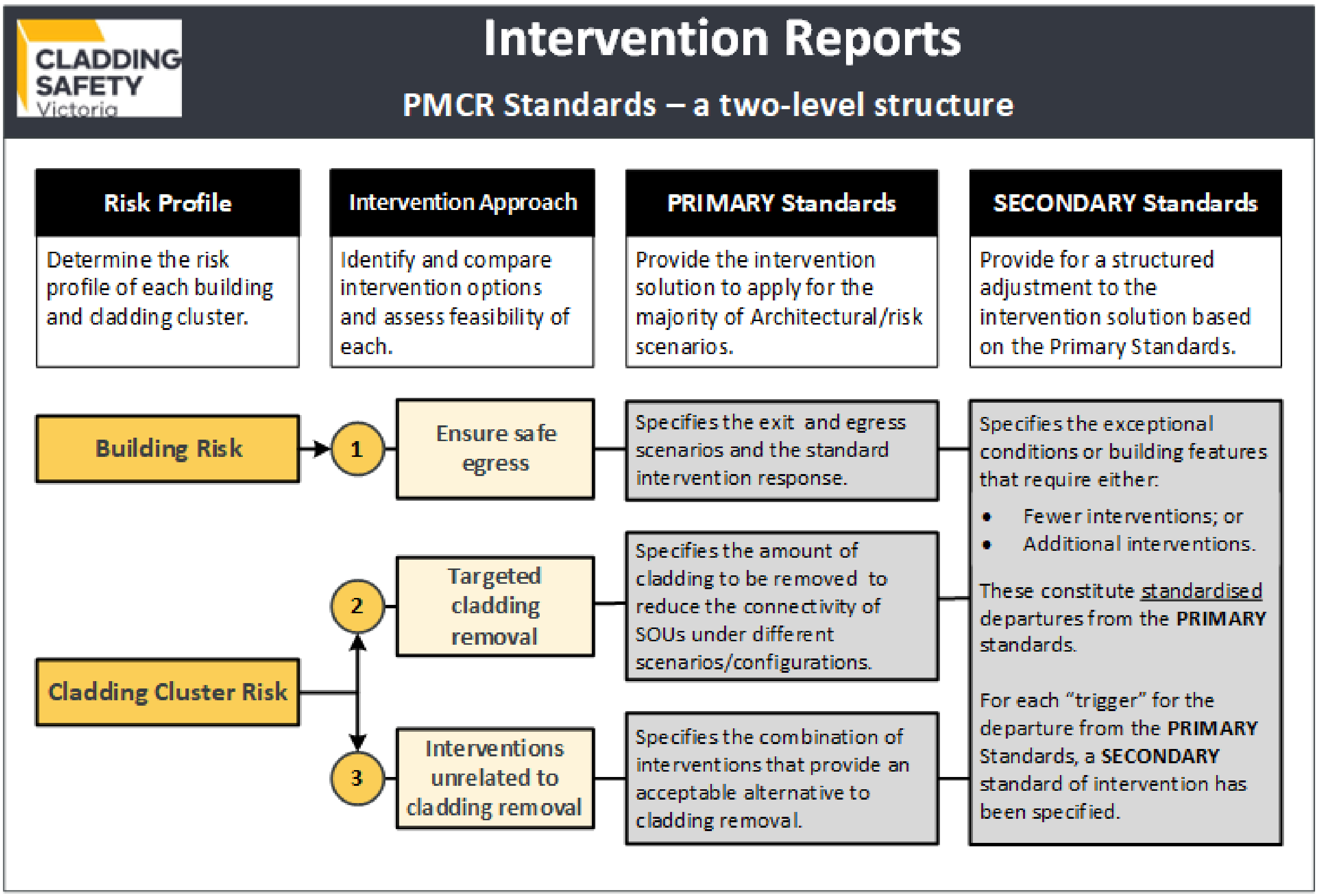
These standards provide a structured way to:

1. Identify the risk profile of each building (and the risk profile of each cladding cluster); and
2. Specify a 'standard' set of interventions that can be applied to bring each cluster and the building to an Acceptable Cladding Risk.

The PMCR Standards comprise two hierarchical levels of standards. This structure is predicated on a risk perspective that:

- A risk profile can be defined for each building and cladding cluster based on a core set of architectural and risk attributes (focussed on exposure to ignition hazards);
- All buildings and cladding clusters that have the same risk profile can generally be brought to an Acceptable Cladding Risk by applying a common set of interventions (**Primary Standards**); and
- Some buildings and cladding clusters will have unique architectural and risk features that warrant a departure from the Primary Standards, and structured means of departure can be formulated (**Secondary Standards**).

This two-level approach to the design of PMCR Standards is illustrated below.



Before determining whether an intervention is required in response to cladding, a building must first have progressed to the stage where all relevant information has been gathered, all combustible cladding clusters have been defined and rated, and IF-SCAN and CFSR ratings have been assigned. Once this has been achieved, the building is ready for solution design and communication to the relevant MBS and building owners.

Applying interventions involving sprinkler protection should be understood in the context of the structured method for risk profiling that applies to cladding clusters (as described in section 4.1).

4.1 Cladding cluster risk typology

The key determinant of the risk profile of cladding clusters is the availability of sprinklers.

The **four criteria** used to identify the risk profile of a cladding cluster are:

1. The availability of sprinklers in SOUs;
2. Cluster Fire Spread Risk – the CFSR;
3. Building floor level associated with the highest point of the cladding cluster; and
4. Type of Combustible External Cladding[7]

The application of these criteria creates a **cladding cluster risk typology** with 11 profiles.

The two tables below illustrate how the four criteria intersect to determine the cladding cluster risk typology that are the focus of the PMCR Standards.

Sprinkler Protected Buildings

<table>
<tr><th rowspan="2">CFSR</th><th colspan="5">Building Rise in Storeys</th></tr>
<tr><th>3</th><th>4</th><th>5</th><th>6 to 8</th><th>9 +</th></tr>
<tr><td>0</td><td rowspan="3" colspan="5">Type A</td></tr>
<tr><td>1</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td colspan="2">Type B1</td><td colspan="3">Type B2</td></tr>
<tr><td>4</td><td rowspan="3" colspan="2">Type C1</td><td rowspan="3" colspan="3">Type C2</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7 +</td><td colspan="5">Type D</td></tr>
</table>

Non-Sprinkler Protected Buildings

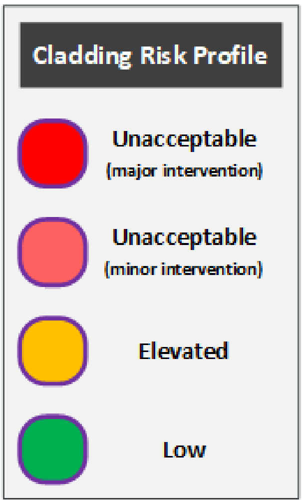
<table>
<tr><th rowspan="2">CFSR</th><th colspan="5">Building Rise in Storeys</th></tr>
<tr><th>3</th><th>4</th><th>5</th><th>6 to 8</th><th>9 +</th></tr>
<tr><td>0</td><td rowspan="2" colspan="5">Type E</td></tr>
<tr><td>1</td></tr>
<tr><td>2</td><td colspan="5">Type F</td></tr>
<tr><td>3</td><td rowspan="2" colspan="2">Type G</td><td rowspan="2" colspan="3">Type H</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="3" colspan="5">Type I</td></tr>
<tr><td>6</td></tr>
<tr><td>7 +</td></tr>
</table>

In total there are:

- 6 cladding cluster types for sprinkler protected buildings (types A to D); and
- 5 cladding cluster types for non-sprinklered buildings (types E to I).

The colours align to those that represent the cladding risk ratings provided in the Framework, being:

- Unacceptable;
- Elevated; and
- Low.



The use of a different colour for cladding clusters with a CFSR of 4-6 in a sprinkler protected building reflects the significant safety benefits of sprinklers observed in CSV and international research.

For these buildings, the requirement for intervention under the PMCR Standards is less focussed on cladding removal than is the case for equivalent buildings without sprinkler protection.

This classification aids in providing a proportionate risk response for all types and also ensures that parity can be maintained between similar buildings and their remediation solutions.

[7] Under the Framework, '**Combustible External Cladding'** means:

i. 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

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

4.2 Interventions when sprinkler protection to SOUs is in place

There are 6 cladding cluster types for sprinkler protected buildings.

The table below identifies how suppression related interventions are applied as Primary Standards for each type under the PMCR Standards.

It should be noted that the sprinkler interventions are only one component of the intervention response. For details about the complete intervention response for each cladding cluster type, refer to G.03 Cladding Remediation Standards.

PMCR Standard Type	Cluster Fire Spread Risk (CFSR)	RIS location of top of cluster	Cladding Type	Sprinkler Installation	
				in SOUs	on balconies
A	0-2	ALL	Both	Existing	
B1	3	Up to 4	Both	Existing	
B2	3	5+	Both	Existing	✓
C1	4-6	Up to 4	Both	Existing	
C2	4-6	5+	Both	Existing	✓
D	7+	ALL	Both	Existing	

4.3 Interventions when sprinkler protection to SOUs is not in place

There are 5 cladding cluster types for non-sprinklered buildings.

The table below identifies how suppression related interventions are applied as Primary Standards for each type under the PMCR Standards.

It should be noted that the sprinkler interventions are only one component of the intervention response. For details about the complete intervention response for each cladding cluster type, refer to G.02 IF-SCAN Procedure/Method.

PMCR Standard Type	Cluster Fire Spread Risk (CFSR)	RIS location of top of cluster	Cladding Type	Sprinkler Installation	
				in SOUs	on balconies
E	0-1	ALL	Both		
F	2	ALL	Both		
G	3-4	Up to 4	Both	✓	
H	3-4	5+	Both	✓	✓
I	5+	ALL	Both		

5 Sprinkler installation considerations

Many of the Victorian Class 2 and Class 3 buildings with combustible external cladding on their facades already benefit from the installation of automatic sprinkler systems.

The extent of sprinkler protection varies from building to building, ranging from systems installed only in common areas of the building to those installed in individual SOUs, and sometimes extending to balconies also. Typical installations provide for:

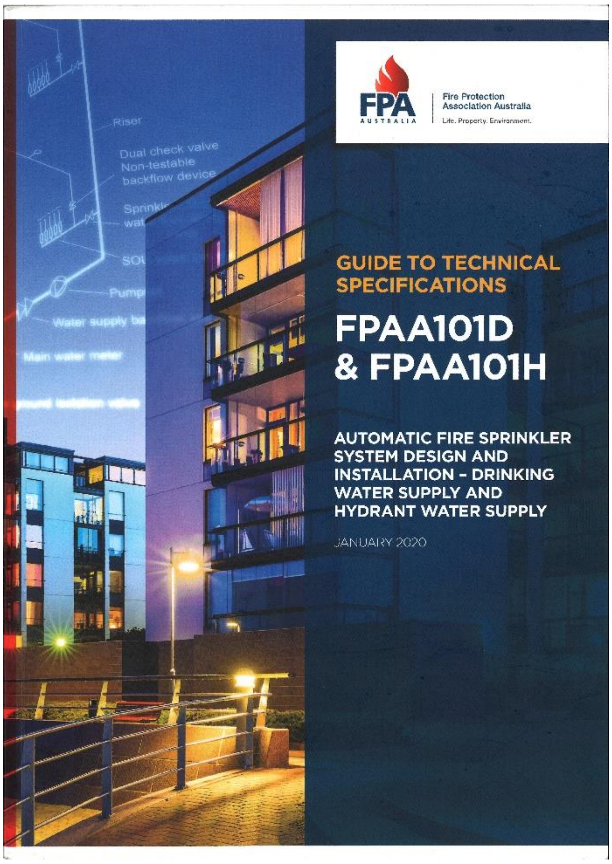
- Basement carparks only;
- Protection of exit and common property paths only;
- Full sprinkler protection including SOUs but excluding balconies and canopies; or
- Full sprinkler protection including SOUs, balconies and canopies.

In all scenarios where some level of automated sprinkler protection is in place, a base level of sprinkler infrastructure will be available that will provide opportunity for the extension of sprinkler protection through an RWP.

Most of the Victorian buildings that have combustible cladding and existing sprinkler protection were constructed more than 10 years ago. It is likely that the existing sprinkler systems installed in these buildings will be systems compliant with AS 2118, the primary standard for sprinkler protection that applies to building with an effective height greater than 25 metres.

In recognition of the safety benefits of sprinklers and to provide practical and affordable access to the benefits of sprinkler protection for building owners, amendments to the NCC have since been introduced that provide new standards for sprinkler installation.

For Class 2 and 3 buildings with an effective height of not more than 25 metres, sprinkler systems can be installed based on AS2118 standards or FPAA Standards that utilise either a hydrant or drinking water supply (as depicted on the right).



For RWPs that involve either the retrofitting of sprinklers into a building without any sprinkler infrastructure or the extension of sprinkler protection in a building with an existing system, consideration of these two standards is required.

5.1 Retrofitting sprinklers in SOUs

The Cladding Remediation Standards provide more than one way to bring a building to an Acceptable Cladding Risk.

One option is to reduce the cladding risk rating by removing or reducing the amount of cladding. Another way is to retain all or most cladding and apply other interventions. One of the most effective ways to reduce cladding risk is to install sprinklers in the individuals SOUs connected by a cladding cluster.

Where installing sprinklers under an RWP, the risk requirements of the Cladding Remediation Standards will be met no matter which Australian Standard is applied. However, the cost of compliance associated with installing sprinklers is likely to vary significantly depending on which Australian Standard is adopted.

Trade-off judgments may need to be made in selecting the optimal sprinkler system to utilise.

Sprinkler-system trade-offs

It is prudent to consider utilising existing sprinkler infrastructure in a building when assessing options to retrofit sprinklers to SOUs. For any building with cladding that has no sprinkler protection in SOUs but some level of sprinkler protection in common areas, the system in place is likely to be a AS 2118 compliant system.

For example, a building with a basement carpark and/or 40 SOUs will have base infrastructure to allow the use of a system compatible with AS 2118.4.

At the time of drafting the PMCR Standards that apply under the Framework, there are few FPAA 101D or FPAA 101H systems known to be in use in Victorian Class 2 and Class 3 buildings. The life safety benefits of these cheaper and practical alternative systems are now recognised in the NCC. The need to find fire safety solutions for a small numbers of SOUs within a building that are impacted by Combustible External Cladding provides an opportunity to consider installing such systems in Victorian buildings.

Trade-off decisions need to be contemplated that:

- **Firstly**, compare the cost and feasibility of using alternate standards (AS 2118 vs FPAA 101D vs FPAA 101H); and
- **Subsequently**, comparing the cost of a sprinkler installation solution to an alternate solution that focuses on the targeted removal of cladding.

This part of the Intervention Report focusses on the factors that inform the first comparison between alternate sprinkler systems.

SOU retrofits based on AS 2118

Extending an existing AS 2118 system to SOUs is unlikely to be cost competitive (compared to other systems) and in some instances may be cost prohibitive where:

1. There are only a small number of SOUs to be sprinkler protected, resulting in the unit cost of installation being high; or
2. The existing AS 2118 infrastructure is remote from the SOUs that are the targets of sprinkler retrofitting, necessitating significant new infrastructure to carry the water to each SOU.

Adopting AS 2118 for an SOU sprinkler retrofit project is likely to be most feasible where the water supply infrastructure is:

- already available on the floor of each SOU that is targeted; and
- is located in close proximity to each SOU.

If these conditions are not met, the use of a FPAA 101D or FPAA 101H system is likely to be the most cost efficient option.

Comparing retrofits based on FPAA 101D with FPAA 101H

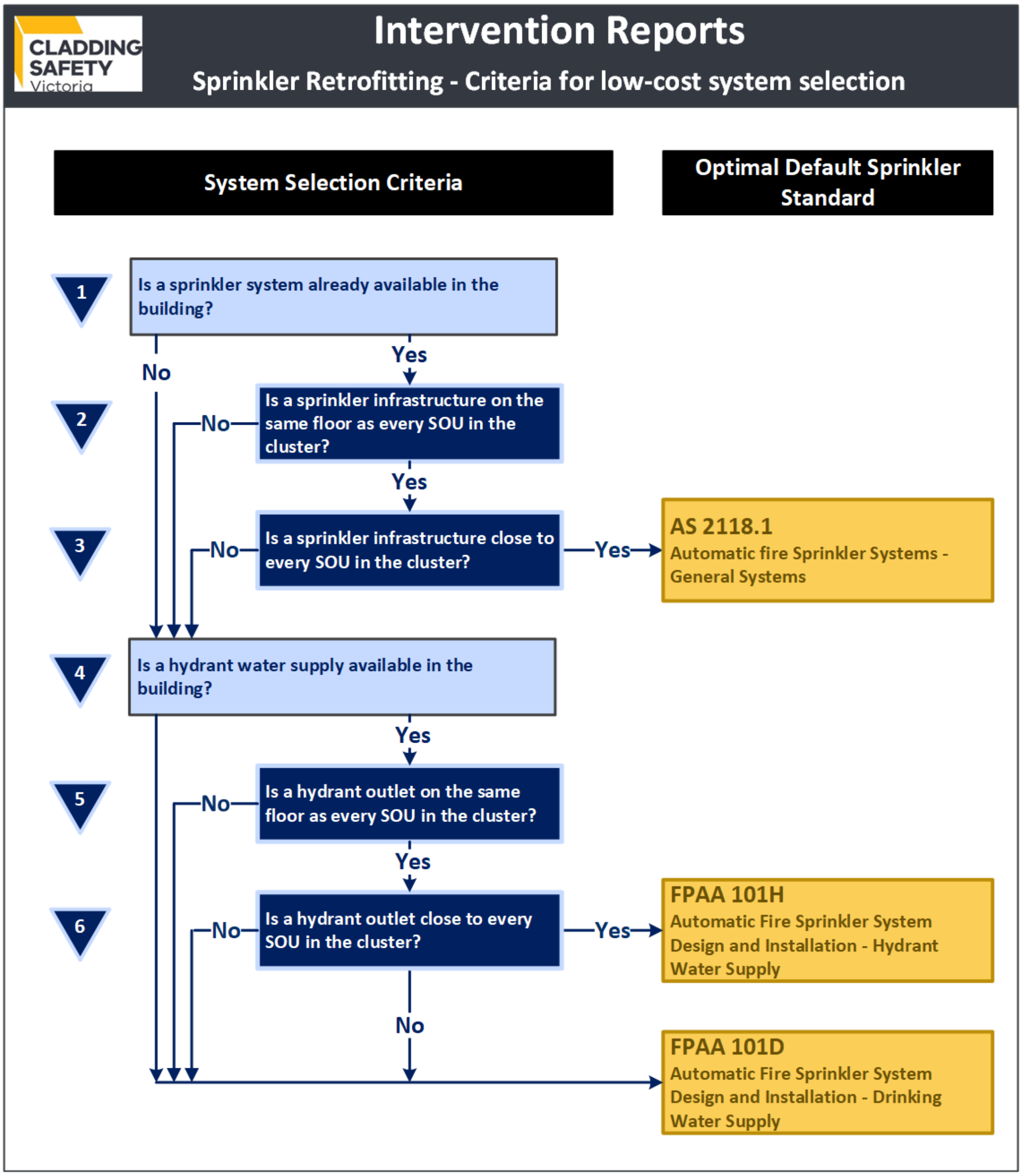
The main differences between these two systems are:

1. The water supply source (located in the SOU for FPAA 101D systems and externally for FPAA 101H systems); and
2. The type of piping used (polyethylene piping for FPAA 101D and wider metal piping for FPAA 101H).

The two systems have the same requirements with regard to:

- Sprinkler head standards;
- Sprinkler head spacing;
- Locations within an SOU requiring a sprinkler head; and
- The standard for minimum sprinkler flow (60L/min).

As both systems produce a similar safety benefit, the decision to choose one or the other will stem from practical considerations, with those differences likely to be reflected in installation costs, pre-existing infrastructure and owner's preferences.



In general, the further away the SOU is from the mains supply (AS 2118) or the hydrant supply (FPAA 101H), the more likely it is that the FPAA 101D systems will be the preferred option. The added distance would impose additional non-SOU infrastructure costs compared to a FPAA 101D system.

It is commonplace for hydrants to be located within fire protected stairwells, when available. If fire protected stairwells are not available, hydrants are generally located close to the stairwell. To provide sprinkler protection to an SOU using a FPAA 101H system, it will be necessary to:

- Extend the hydrant supply to the floor(s) on which the SOUs are located; and
- Extend the supply from the floor level hydrant supply to each SOU.

Depending on the distances involved with extending the hydrant based piping and any complexities involved in doing so, the cost of delivering the same risk benefit is likely to be higher for a FPAA 101H system compared to a FPAA 101D system. The use of a FPAA 101H system is likely to be optimal where the distances needed for piping hydrant water to SOUs is smaller.

5.2 Extending sprinkler protection to balconies

In cases where full sprinkler retrofitting is not required and a sprinkler system is already within an SOU, a decision to extend sprinkler protection to a balcony will be determined by the existing class of sprinkler, the accessibility of extending to the balcony (i.e. is the path inhibited by floor to ceiling glazing), or a lack of balcony cover..

The Australian Standard adopted for providing sprinkler protection on a balcony will be determined by the standard applying to the sprinkler system inside the SOU.

Clusters reaching the 5th floor or higher

The evidence is compelling that internal sprinklers greatly reduce the life safety risk for building occupants (see Appendix B: Sprinklers and cladding – research findings).

For a cladding cluster with a CFSR of 6 or less in a building with sprinkler protection to SOUs, little or no cladding removal is required under the PMCR Standards and sprinklers do not need to be extended to balconies.

The exception to this approach is where the cladding cluster reaches to the 5th floor of the building or higher. It is at this height and beyond that delivering a fire fighting response from the ground becomes complicated.

The experience of fire fighters at the 2014 Lacrosse fire and the Neo200 fire in 2019, demonstrated two things:

1. Internal sprinklers worked effectively and were instrumental in preventing death and injury; and
2. The absence of balcony sprinklers on these buildings allowed the external fires to expand across the facade in a way that was difficult to control.

The *Lacrosse Docklands, Post Incident Analysis Report*, prepared by Fire Rescue Victoria (at the time called the Metropolitan Fire Brigade) on 25 November 2014, included the observation:

“Had the sprinkler system extended to the balcony area of each apartment, fire would have most likely been contained to the level of fire origin.”

A governing principle of the PMCR Standards is that despite the benefits of internal sprinklers, large facade fires cannot be tolerated at a height where fire fighters cannot combat them substantially from ground level.

The extension of sprinkler protection to balconies for cladding clusters located at the 5th level or above is the main avenue for controlling this risk under the PMCR Standards where the CFSR is between 3 and 6.

Closed and open balconies

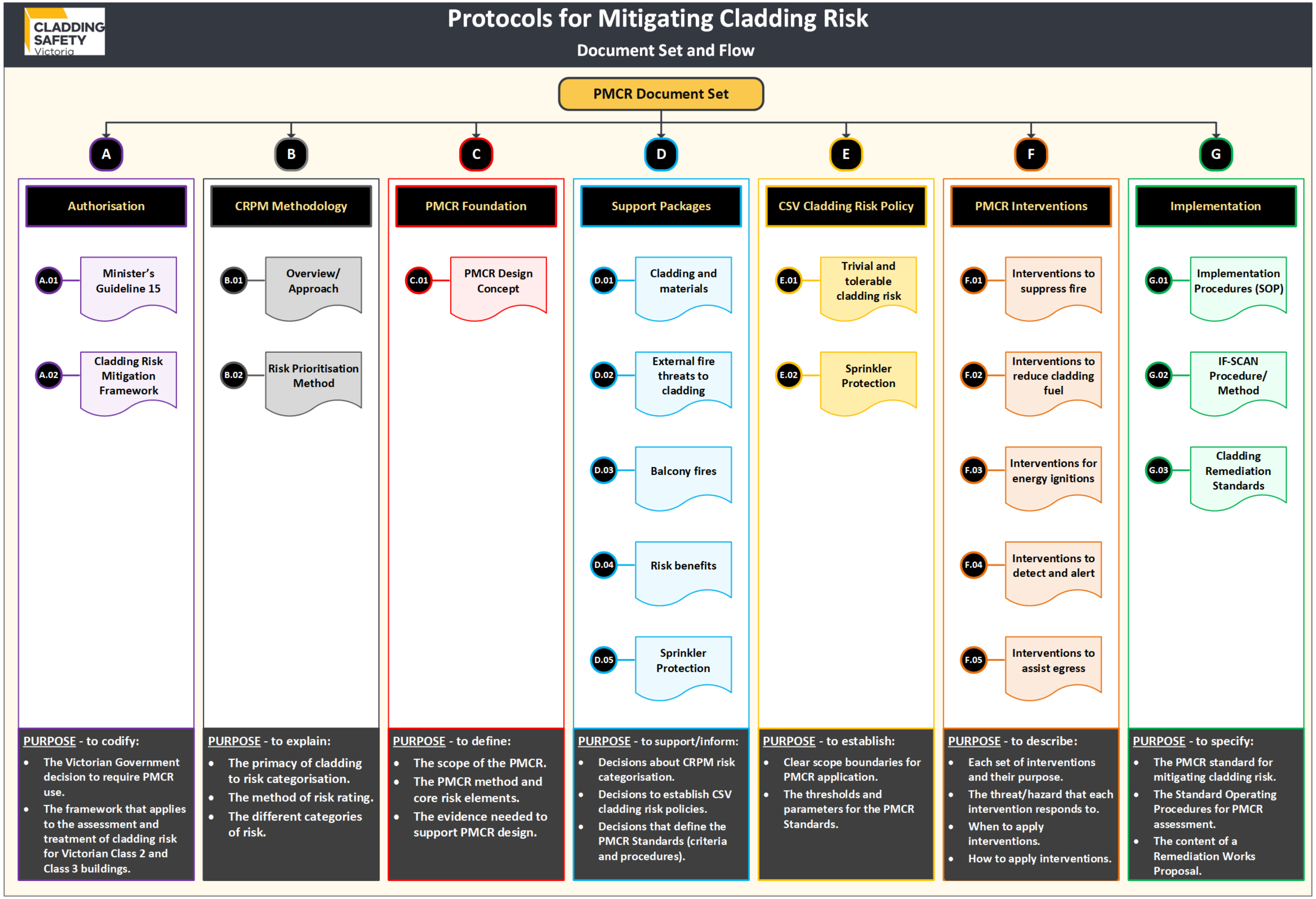
The impact of balcony sprinklers diminishes for open balconies (compared to closed balconies), as the exposure to wind effects limits the ability for sprinkler heads to direct the spray where it is required.

For closed balconies, expending sprinkler protection to the balcony is a preferred option.

For open balconies, expending sprinkler protection should not be considered. In such scenarios, the emphasis under the PMCR Standards should be on targeted cladding removal to break the connection between SOUs created by continuous runs of cladding.

Appendices

Appendix A: PMCR document set and flow



Appendix B: Sprinklers and cladding – research findings

A founding design principle of the approach to cladding risk adopted in MG-15 and the Framework, is that for sprinkler protected buildings a greater facade fire spread risk can be tolerated/accepted compared to buildings without sprinkler protection.

In the early design and application of CSV's risk methodology, a very conservative view of the risk benefits of sprinkler protection was adopted. CSV's subsequent research and analysis has drawn upon international research and fire incident data and developed clearer parameters for valuing the safety benefits of sprinklers.

CSV has used the assembled evidence and knowledge about sprinkler protection to reassess the risk faced by building occupants where sprinkler protection is in place. CSV's risk perspective is also shaped by the views of key stakeholders in matters of building fire safety (regulators, fire fighters, insurers and fire safety experts).

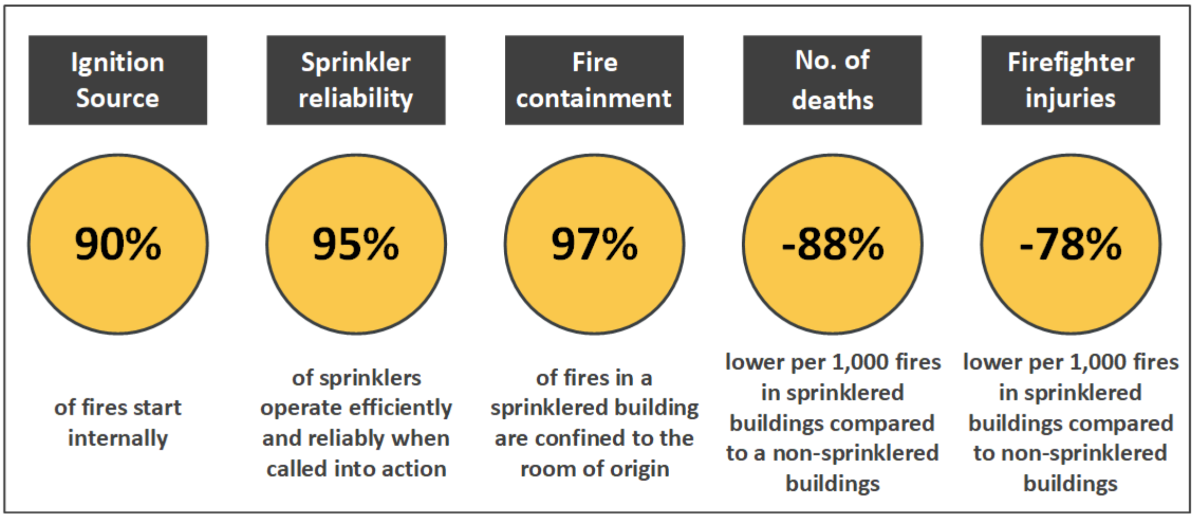
B1. Analysis of fire incident data

The CSV literature review and analysis relies primarily on United States research undertaken under the auspices of the National Fire Protection Association (**NFPA**)[8]. The use of NFPA data and analysis was appropriate because:

- The installation of residential sprinkler systems across a wide range of US buildings has been a requirement of US fire safety regulation for over 20 years;
- Highly detailed, systematic and consistent data is captured about structure fire incidents;
- The fire incident data available in the US allows for comparisons to be made between:
  - ✓ Sprinkler protected and non-sprinkler protected buildings; and
  - ✓ Single and multi-dwelling structures (such as apartment buildings);
- The volume of incident data is extensive, capturing details of 344,900 structure fires in the five year period from 2015 to 2019 that accounted for 2,616 civilian deaths and 11,036 civilian injuries; and
- There is an absence of equivalent Australian fire incident data to enable the benefits of sprinklers for life safety to be evaluated in an Australian context.

The detailed literature review and analysis undertaken by CSV is captured in *D.05 Sprinkler Protection*.

The headline facts about sprinkler protection are evidence based and compelling.



[8] *US Experience with Sprinklers*, NFPA, October 2021.

B2. Cladding removal in sprinkler protected buildings

The key question addressed through CSV research was:

When does a sprinkler protected building with combustible cladding on the facade have a sufficiently low cladding risk to allow cladding to be retained?

To answer this question, the CSV research comparing buildings with cladding (at different IF-SCAN levels) and sprinkler protection to a benchmark building with no cladding and no sprinkler protection.

The policy principle is that where a sprinkler protected building with cladding can be demonstrated to be as safe as a non-sprinklered building with a cladding risk rating of low, the case for substantial cladding retention has been established.

The CSV research into sprinkler protection provided four core streams of information relevant to the development of this CSV Cladding Risk Policy:

1. Defining **benchmarks** (based on the IF-SCAN) for determining when a building with sprinkler protection is 'safe enough' to retain cladding in situ;
2. Analysis of the reduction in **deaths and injuries** that result for a fire in a sprinkler protected building (compared to a non-sprinklered benchmark building);
3. Analysis of the reduction in **property loss** that result for a fire in a sprinkler protected building (compared to a non-sprinklered benchmark building); and
4. Observations about the need for different responses to cladding risk mitigation where **cladding is located at height** in significant volumes.

A synopsis of the key findings is presented in the sections that follow. For full details of the CSV research, please see D.05 Sprinkler Protection.

Benchmarks for cladding retention

The Framework provides that a building has a cladding risk rating of **low** when it is:

- sprinkler protected and has an IF-SCAN[9] between 0 and 2; or
- not sprinkler protected and has an IF-SCAN between 0 and 1.

A key design principle underpinning MG-15 and the Framework is that a building with a rating of **low** does not require cladding removal, except for targeted removal designed to enhance safe access to or egress from a building where unduly compromised. Such buildings are considered to have achieved Acceptable Cladding Risk[10], which provides for all or most cladding to remain, consistent with the threat barrier approach introduced in section 1.

The benchmark:	The benchmark building for the CSV analysis is a non-sprinklered building with an IF-SCAN of 0. To allow cladding retention on sprinkler protected buildings, it is necessary to demonstrate that a building at each ascending IF-SCAN score (3 and above) is as safe (from a death and injury perspective) as a non-sprinklered low rated building with an IF-SCAN of 0 (zero).

[9] The IF-SCAN provides a measure of the number of SOUs connected by cladding that runs continuously across a building facade, where a credible ignition hazard is in evidence.

[10] As defined in the Cladding Risk Mitigation Framework.

Analysis – deaths and injuries

The CSV comparative analysis estimated how expected death and injury rates would likely vary for buildings with cladding at different IF-SCAN levels compared to the benchmark building[11].

The NFPA analysis of fire incident data for the five year period 2015-2019 was used for these calculations. The NFPA analysis develops risk insights based on 344,900 structure fire incidents, comprising:

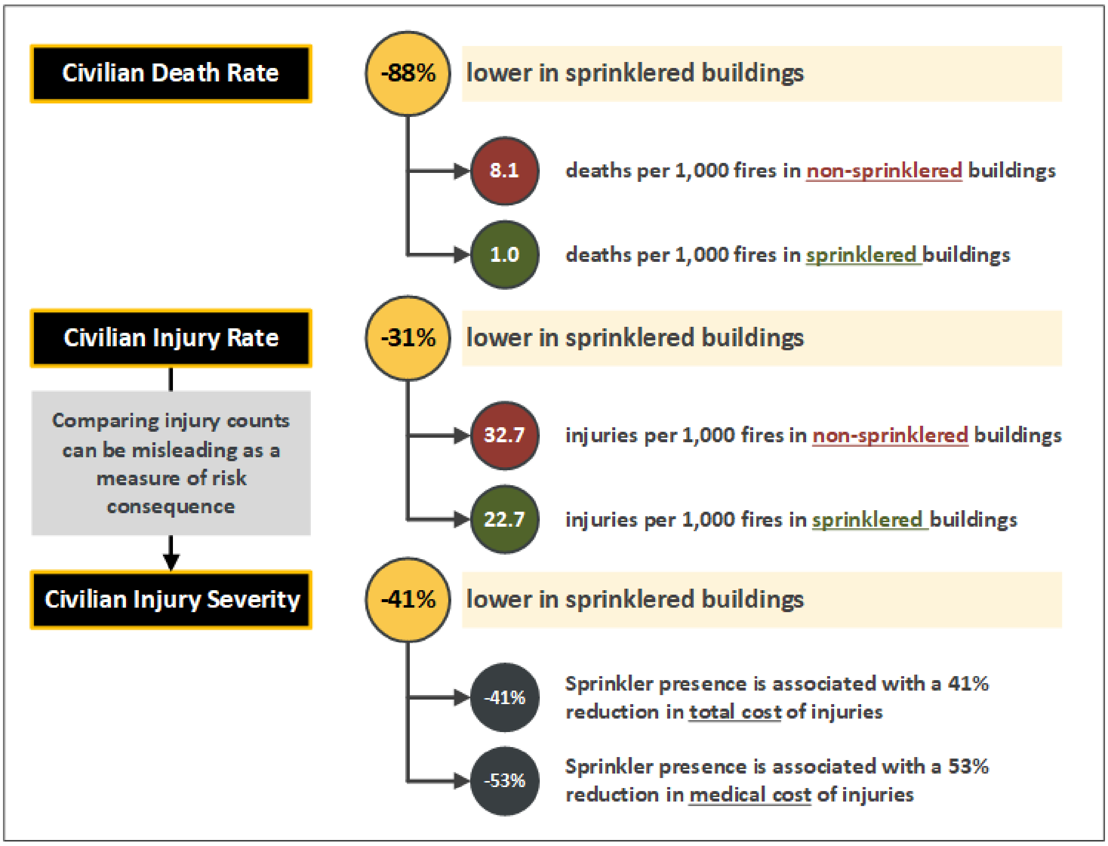
- 318,500 fire incidents in buildings where there were no automatic extinguishing systems (**AES**) present; and
- 25,000 fire incidents where AES were present, including 23,600 where a sprinkler system was present (and the 21,000 of those with a wet pipe sprinkler system, which were the focus of the CSV comparative analysis of deaths and injuries).

The CSV analysis commenced with a review of civilian death and injury rates observed in home structure fire incident data available for the US for the five-year period from 2015 to 2019. The focus was on understanding how the rates of death and injury vary for fires occurring in sprinkler protected buildings compared to those fire events occurring in non-sprinklered buildings.

While death is a discrete, final and unequivocal adverse outcome of fire, injury is not. Injuries can vary substantially in severity and so the CSV analysis of injuries focused not only on injury rates, but also on injury severity.

The **key statistics** about structure fires and sprinkler protection are shown in Figure 1.

Figure 1: NFPA headline statistics about sprinkler protection and the benefits to life safety



Sources: US Experience with Sprinklers, NFPA, October 2021 and Sprinkler Impact on Fire Injury: Final Report, Fire Protection Research Foundation, October 2012.

[11] It should be noted that very conservative assumptions of cladding fire spread were adopted for the CSV analysis. For example, the analysis assumed a 100% probability of upward vertical fire spread via cladding from the lower to upper SOUs and a 90% probability of downward vertical fire spread via cladding from the upper to lower SOUs (falling debris and dripping cladding).

Analysis – property loss

Cladding risk mitigation strategies are overwhelmingly driven by life safety considerations.

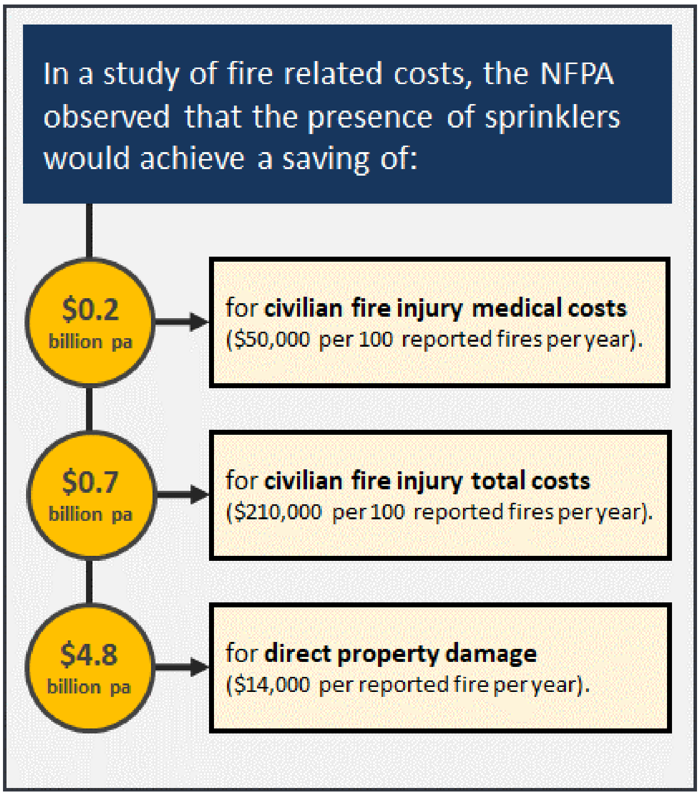
However, structural fires also have financial impacts and any assessment of fire consequences would be incomplete without consideration of the costs of fire.

An interesting dimension of the analysis is the incorporation of research undertaken in the US, which evaluated how the costs of fire reduce in sprinkler protected buildings (compared to non-sprinklered buildings) across three categories of fire related cost.

The US research based on 350,000 reported home structure fires between 2006 and 2010, reported that the savings in 2012 in $US are significant in all three cost categories (as illustrated in Figure 2).

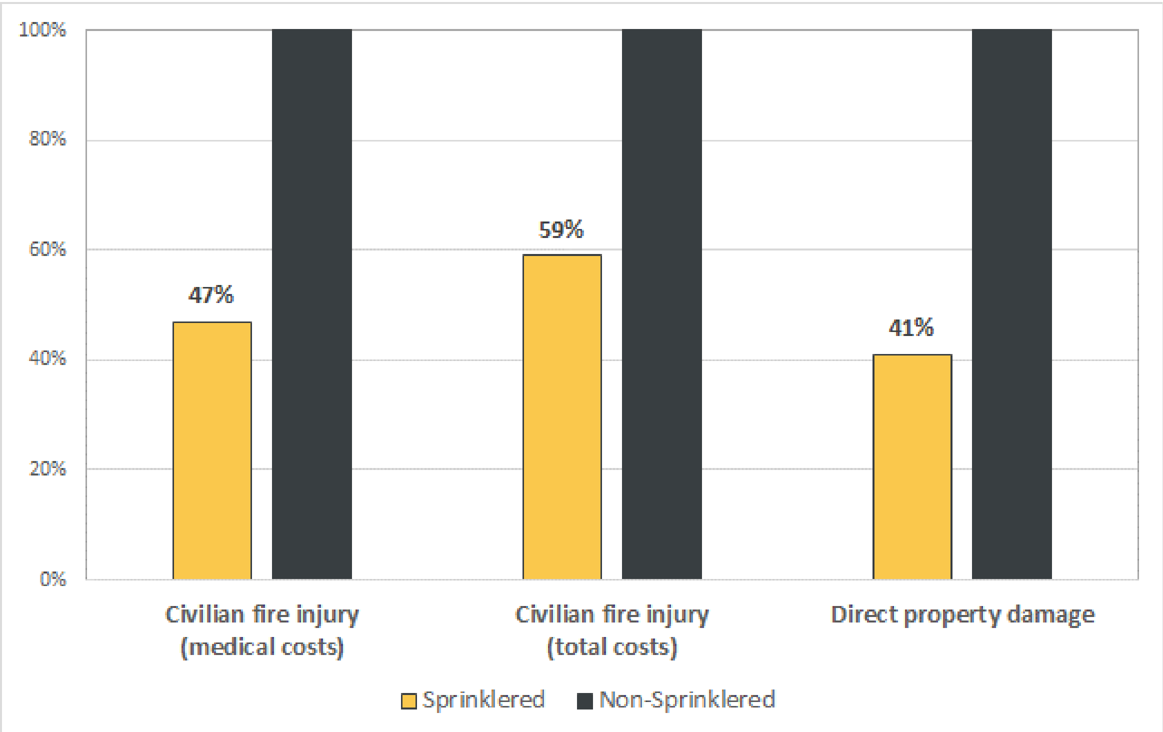
Figure 3 better reflects the relative benefits of sprinklers by expressing average costs per fire in a sprinkler protected building to that for a non sprinklered building.

Figure 2: Estimated annualised cost savings for sprinkler protection ($US, 2012)



Source: Sprinkler Impact on Fire Injury: Final Report, Fire Protection Research Foundation, October 2012.

Figure 3: Ratio of cost per fire for a sprinkler protected building compared to a non-sprinklered building



Source: Sprinkler Impact on Fire Injury: Final Report, Fire Protection Research Foundation, October 2012.

Analysis – fighting fires at height

Quantitative assessments of death, injury and property damage cannot account for all risk considerations associated with preventing (where possible) and suppressing a fire.

Certain fire scenarios accentuate the life safety risks for building fires beyond that computed in general analyses and models. Significant risk escalating scenarios need to be identified and considered in the design of risk mitigating solutions that respond to cladding fire risk.

Melbourne's own contemporary experience of cladding facade fires encompasses:

- the 2014 Lacrosse fire, where a balcony fire spread via the facade from the 6th to 21st floor (16 levels); and
- the 2019 Neo200 fire, where a balcony fire spread via the facade from the 22nd to the 29th floor (8 levels).

The analysis of these incidents provides a tangible Melbourne-centric perspective on the benefits of sprinklers that reinforce the CSV research findings.

There is undoubtedly additional complexity and challenge in delivering a fire-fighting service to combat a fire and aid the safe evacuation of occupants where the fire started or has reached a height well above the ground. Understanding these complexities is important to the PMCR design as it applies to solution design in relation to combustible cladding located high on a building facade.

The key observations made in a UK research study[12] that help to explain the accentuation of risk in fires occurring in high-rise buildings are:

- **Access and reach limitations**

  "*Timely intervention is far more challenging for blocks of flats primarily because the fire cannot normally be fought from the exterior of the building as service ladders and high-reach equipment have access and reach limitations."*

- **Establishment of a bridgehead**

  "*. . . FRS must enter the building to establish what is called a 'bridgehead', normally two floors below where the fire is, requiring the necessary equipment and personnel to be transported up the building. Where firefighting lifts are not installed, or are out of order, this has to be done via the stairs, adding more logistical difficulties, physical resources and time."*

- **Staging areas**

  "If the fire is at a *high* level, it may be necessary to establish one or more staging areas between the bridgehead and the ground floor*".*

Practical exercises were undertaken by the Hertfordshire Fire and Rescue Services (**FRS**) to determine the time required to deliver a fire fighting service in a high-rise fire. The results demonstrate a significant delay, relative to national response time averages, in the commencement of suppression and evacuation activity, which increases the probability of fatality and injury in high-rise fires.

It is conceived that there is a veritable "golden window", a time period within which a fire can reasonably be controlled to limit the harm to people and help to limit property loss.

The Fire Rescue Victoria (**FRV**) service delivery standard for response time for all emergency incidents is 7.7 minutes[13].

Delays in fire services arriving at an incident and setting up equipment to commence suppression/evacuation activity:

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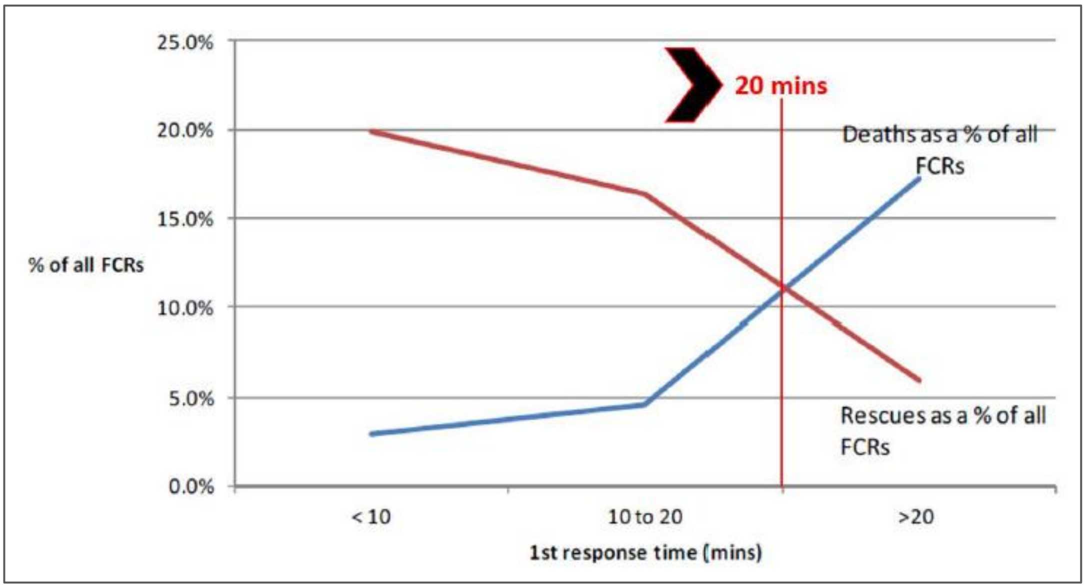
[12] *The Fire Risks of Purpose-Built Blocks of Flats: an Exploration of Official Fire Incident Data in England*, S.Hodkinson and P. Murphy, July 2021.

[13] https://www.frv.vic.gov.au/sites/default/files/2023-03/Response-Times-Code1-table.pdf

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

The UK research 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 4: 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.

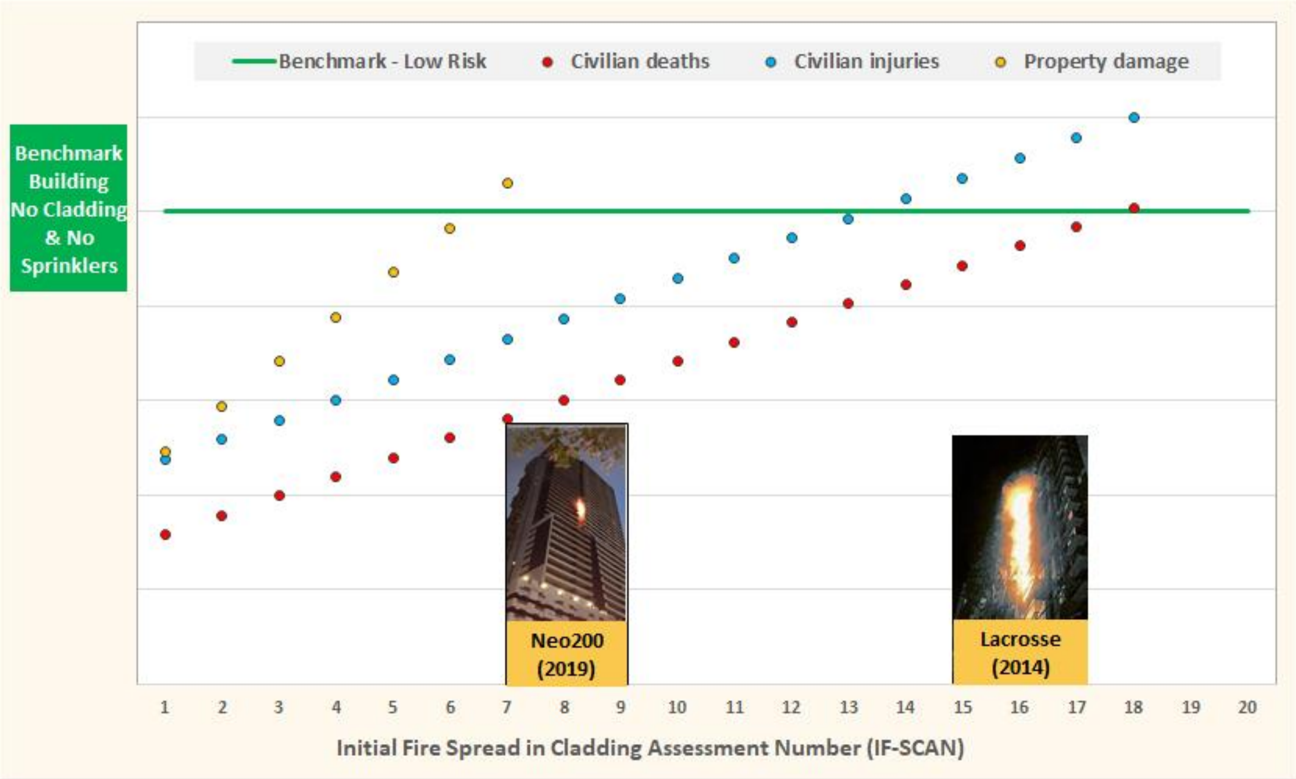
Fighting a cladding fire at height demonstrably adds complexity and potentially delays the initiating of a fire-fighting response. This factor has been considered in the design of the Cladding Risk Policy for retaining cladding in sprinkler protected buildings.

Analysis – summary

The CSV research provides clear evidence to show that many sprinkler protected buildings with combustible cladding on their facades present less risk to life safety than an equivalent building with no cladding and no sprinkler protection.

On all measures that have been evaluated (civilian deaths, civilian injuries and property loss), sprinkler protected buildings with an IF-SCAN of 6 or below (i.e. where a continuous run of cladding makes it possible for a facade fire to spread between up to 6 SOUs) appear safe enough without the removal of cladding.

Figure 5: Benchmark comparison - buildings with cladding and sprinklers vs buildings with no cladding and no sprinklers



The other consideration that has not been lost in framing a CSV Cladding Risk Policy position for the response to cladding on sprinkler protected buildings is **community expectation**.

Melbourne has already had experience of significant facade fires that spread to multiple dwellings because of the cladding. While the 2014 Lacrosse fire and 2019 Neo200 fire are positive examples of sprinklers functioning as required to protect life safety, they are also examples of cladding facade fires that the Victorian community will not tolerate.

Despite the CSV analysis demonstrating the life safety benefits of sprinklers (against the non-sprinklered benchmark) up to an IF-SCAN level of 13, retaining cladding up to this level under a PMCR design would not pass the test of community expectation.

The general approach to cladding retention for sprinkler protected buildings was to limit the application to buildings with an IF-SCAN of 6 or below.

Furthermore, for buildings in the IF-SCAN range from 3 to 6, additional measures may be likely (including balcony sprinklers and/or cladding removal) where the cladding is located at a height above which fire fighters can reasonably fight the fire from the ground.