

An aerial photograph of a city, showing a dense residential area in the foreground and a prominent skyline of skyscrapers in the background. The text is overlaid on the image.

Optimizing Firefighting Tactics with AS2419- Compliant Hydrant Systems

Are we heading in the right direction...





Why I care....

Outcomes...

Our journey,

Our model,

Our environment,

Our training,

Solutions!

Victoria...

Joined 2 services



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graph TD; A[Joined 2 services] --> B[Formed 1st July 2020]; B --> C[Mixed risk across the state]; C --> D[Different procedures]; D --> E[Different understandings];
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Formed 1st July 2020

Mixed risk across the state

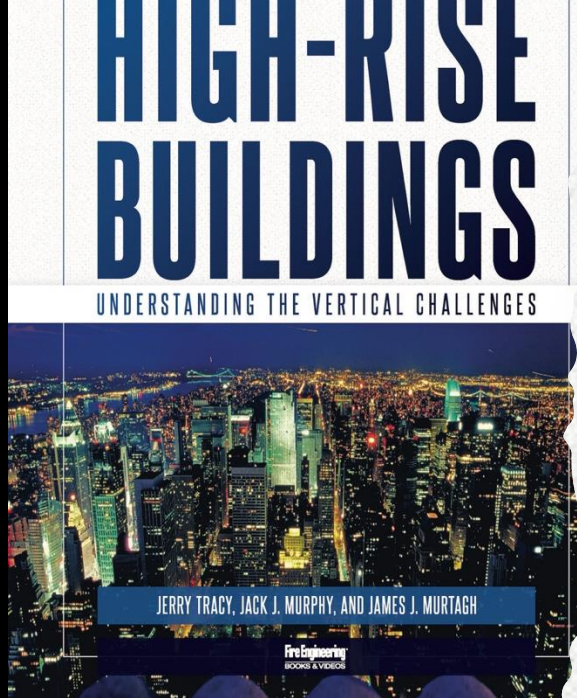
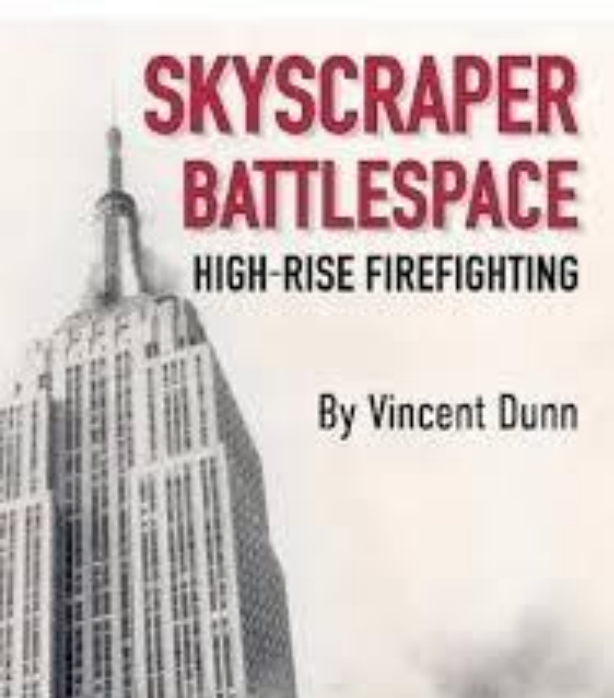
Different procedures

Different understandings



What We Did

Identified major risk to our operational firefighters



What We Did

- Knowledge Gathering

Operational Strategies

Operational Strategy

Supplementary High Rise

OPS 1.1.3 Fires -
Significant Hazards
<ul style="list-style-type: none">• Glass, panels or debris falling from height• Delay in gaining access• Extent of the fire not established• Fixed installations fail or are operating ineffectively• Internal fire/smoke spread• Wind driven fire• Persons confined in lift• Falling through openings and objects falling from height• Loss of fireground accountability

Operational Strategies

Guides to operational response activities based on operational risk assessments applicable to incident type.

Foundation	Principal	Supplementary	
0.1.0			All Incidents
Fires	1.1.0		Structure Fires
		1.1.1	Residential Dwellings
		1.1.2	Hospitals, Medical Research and Health Care Facilities
		1.1.3	High Rise
		1.1.4	Secured Facilities
		1.1.5	Public Assembly Buildings

What We Did

- Comparison of current practice

High-rise buildings

Buildings with four or more floors above ground level or in excess of 25m in height*, whichever is the lesser.

*Buildings which are a residence 25m+ are required to have fire sprinklers installed

Safety

- The IC must be satisfied there is a safe means of access and egress for firefighters:

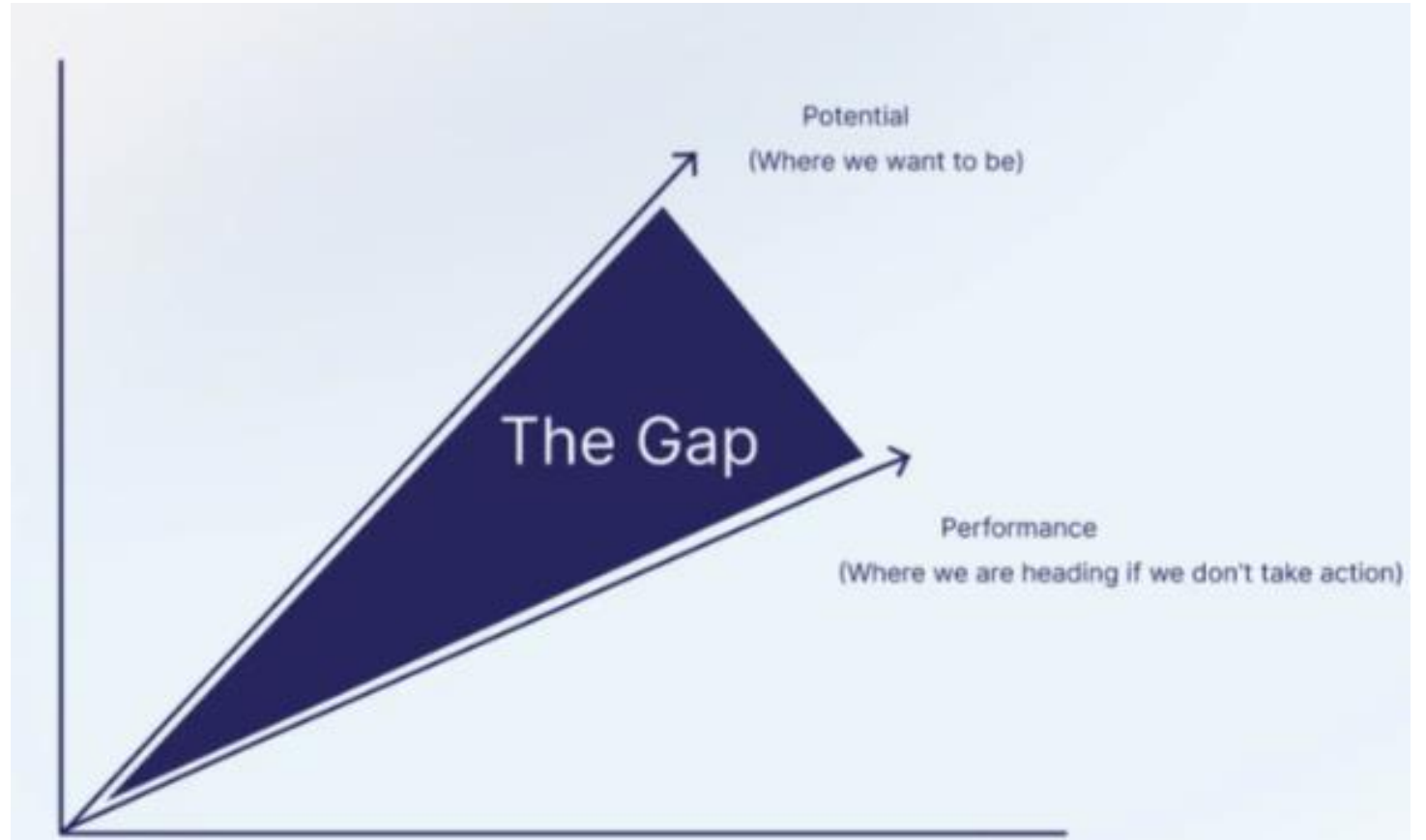
SOP Ref No: F4.1 V1.2

High Rise - Residential

Aide Memoire

What We Did

- Gaps analysis created



What We Did

- Sort information from SMEs



What We Did

- Overlaid advice on our operational reality



What We Did

- Draft
- Trial
- Implement





What We Created

- Doctrine
 - Operational Practices
 - Operational Guides
 - Operational Method Statements
 - Operational Strategies

What we learnt

Evidence based decision making

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graph TD; A[Evidence based decision making] --> B[Data driven]; B --> C[Identification of Patterns];
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Data driven

Identification of Patterns

So where
are we
now...

Operations are continuing to improve however

Our understanding of the environment is highlighting the risks

Our gaps in training are being highlighted

Our operations utilising AS2419 is our biggest risk

FBIM

Fire Brigade Intervention Model determines water requirements based on theoretical heat absorption capacity of water,



Applies efficiency factors of >70% (internal) and 30% (external)

Grimwood Model vs. FBIM (Fire Brigade Intervention Model)

GRIMWOOD MODEL VS. FBIM

Feature / Assumption	Paul Grimwood Model	Fire Brigade Intervention Model (FBIM)
Basis	Simplified heat release rate (HRR) and tactical flow rules	Fire growth modelling using t^2 curve and intervention timing
Flow Rate Formula	24.42 L/min per MW (= 5 L/min/m ² practical benchmark)	Based on fire area at time of intervention (m ² × 2 L/min/n ²)
Efficiency Assumption	- 70% effective water application	Assumes direct attack with high efficiency (implicitly >70%)
Fire Growth Assumption	Fire size estimated by MW or m ² . HRR -500 kW/m ²	Assumes a fast-growing t^1 fire (common in modern interiors)
Time Sensitivity	Tactical deployment fire decisions during attack	Highly sensitive to time of intervention
Target Use	Tactical deployment decisions during attack	Strategic planning for crew arrival and water supply timing

Example Comparison Scenario:

Fire in a 100 m² unit, contents fully involved

•Grimwood:

- Fire load $\sim 0.5 \text{ MW/m}^2 \times 100 \text{ m}^2 = 50 \text{ MW}$ (vent and environment) dependent
- CFR = $50 \text{ MW} \times 24.42 = 1,221 \text{ L/min}$
- Apply 70% efficiency $\rightarrow \sim 1,750 \text{ L/min}$ needed
- Likely to deploy 2+ lines at 500–600 L/min each**

•FBIM:

- Assume fire reaches 100 m² at ~ 10 minutes (fast growth)
- Flow = $100 \text{ m}^2 \times 2 \text{ L/min/m}^2 = \mathbf{200 \text{ L/min}}$
- BUT* this assumes rapid and direct extinguishment and earlier intervention may need less

Key Insight:

FBIM aims to **predict required flow before the fire is fully developed**, whereas Grimwood's model is better suited for **evaluating required flow during active fire conditions**.

So FBIM or Grimwood

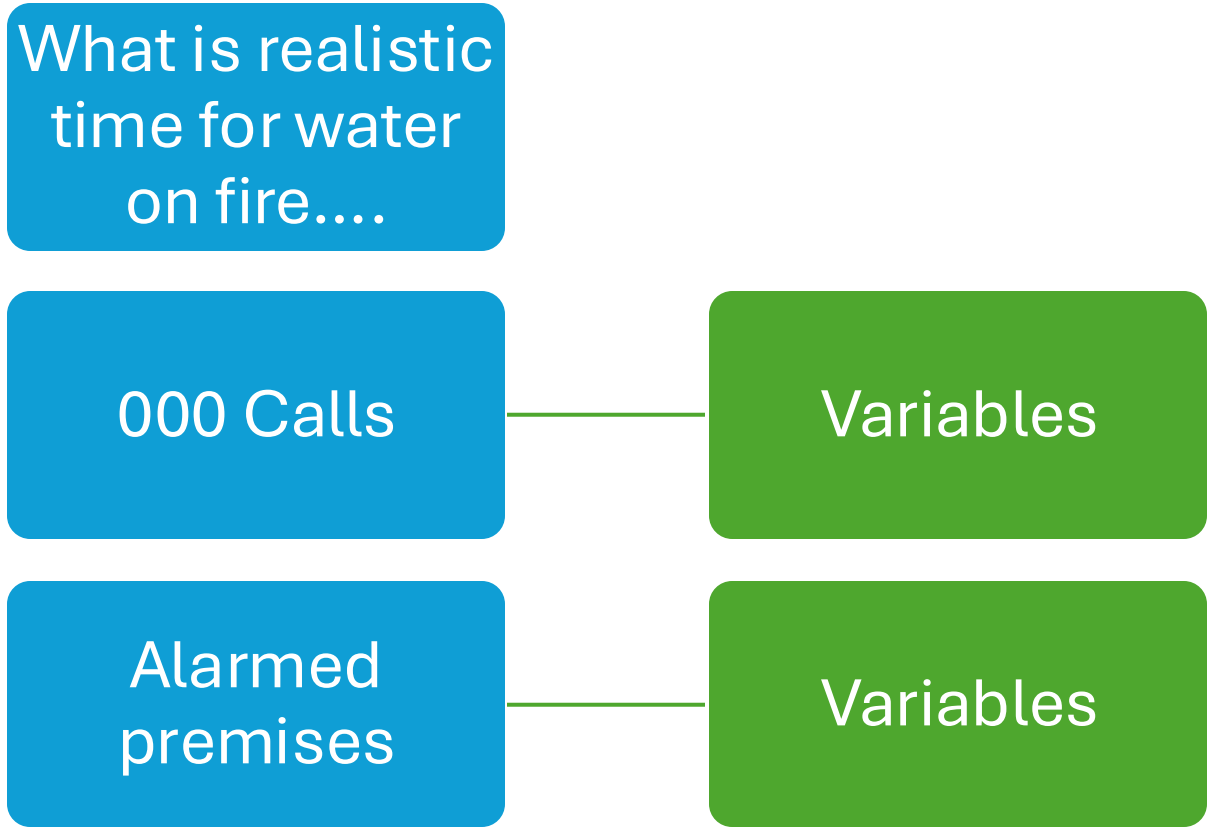
What is realistic
time for water
on fire....

000 Calls

Variables

Alarmed
premises

Variables



AS2419

Number of hydrants required to flow is based upon:

Building Class

Floor span



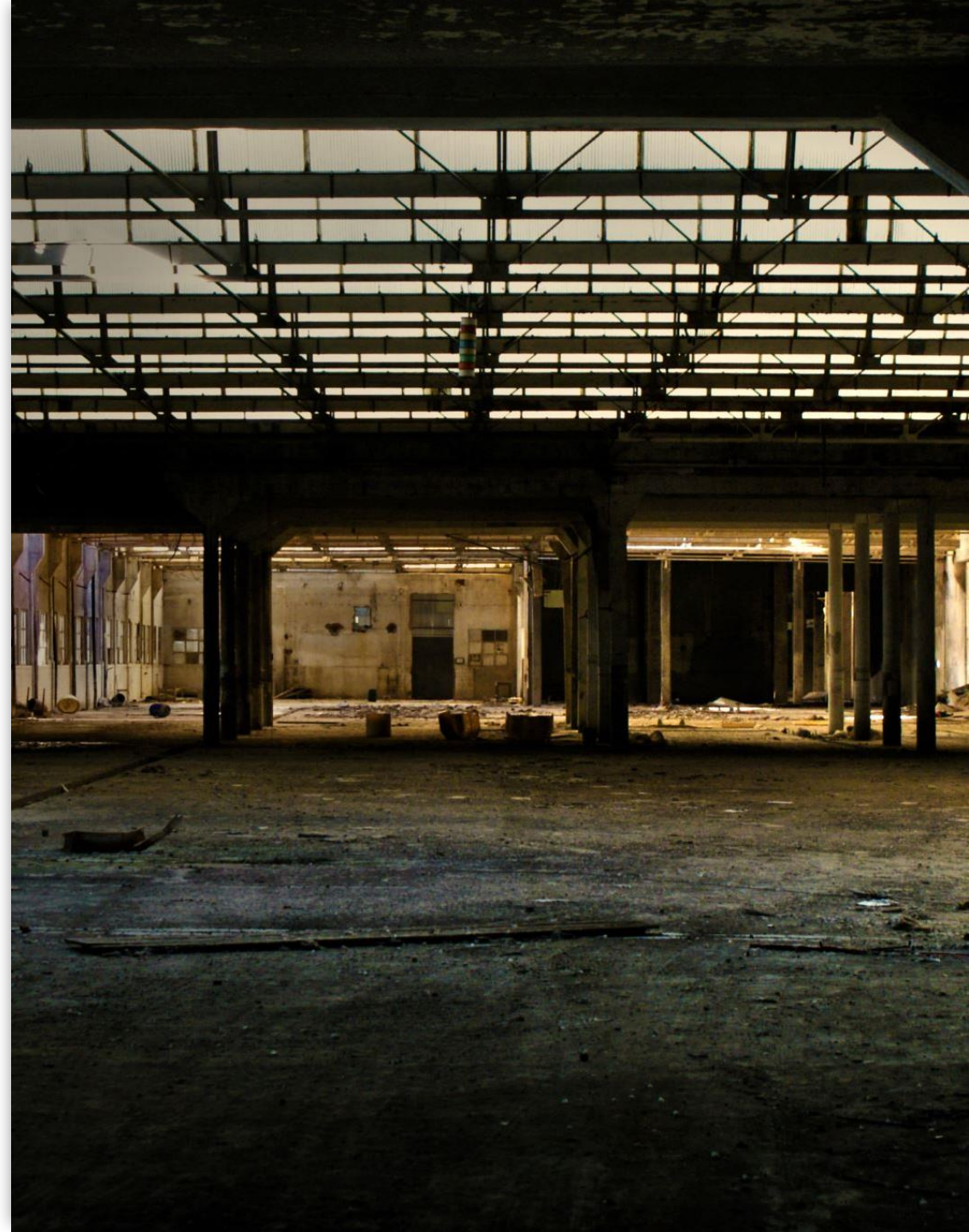
Fire isolated stairs must have a hydrant riser in it. Above 25m you are required to have 2 stairs.



AS2419 Buildings

AS2419 Buildings

- Class 6, 7, and 8 Buildings (<math> < 500\text{m}^2 </math>): At least 1 hydrant (600 lpm) for initial fire service attack. (GW: 2500lpm@70%)
- Compartments (500-5,000m²): Provisions for 2 hydrants (up to 1,200 lpm). (GW: 25,000lpm@70%)
- Unsprinklered Compartments (5,000-10,000m²): Require 3 hydrants (up to 1,800 lpm). (GW: 25,000 – 50,000lpm@70%)
- Buildings (>10,000m²): 3 hydrants + 1 additional hydrant per 5,000m² (over 2,400 lpm). (GW: 5lpm/m²....)



What's this based on

Risk Assessment and Layout

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graph TD; A[Risk Assessment and Layout] --> B[Static and Residual Pressure]; B --> C[Building Size and Type]; C --> D[Accessibility and Visibility];
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Static and Residual Pressure

Building Size and Type

Accessibility and Visibility

AS2419

Most disadvantaged attack hydrant(2005&2021):

Half Duty – 600lpm (5lps) @ 350kpa

Full Duty – 600lpm (10lps) @ 700kpa

Hydrant of Most Disadvantage
(these numbers are flowing water at the hydrant outlet)

Status	Numbers
Feed Hydrant (Pumper Supply)	10 litres a second at 2 bar (600lpm@200kpa)
Unassisted (not boosted) Attack Hydrant	10 litres a second at 3.5 bar (600lpm@350kpa)
Assisted (Boosted) Attack Hydrant	10 litres a second at 7 Bar (600lpm@700kpa)

Pressure Ranges

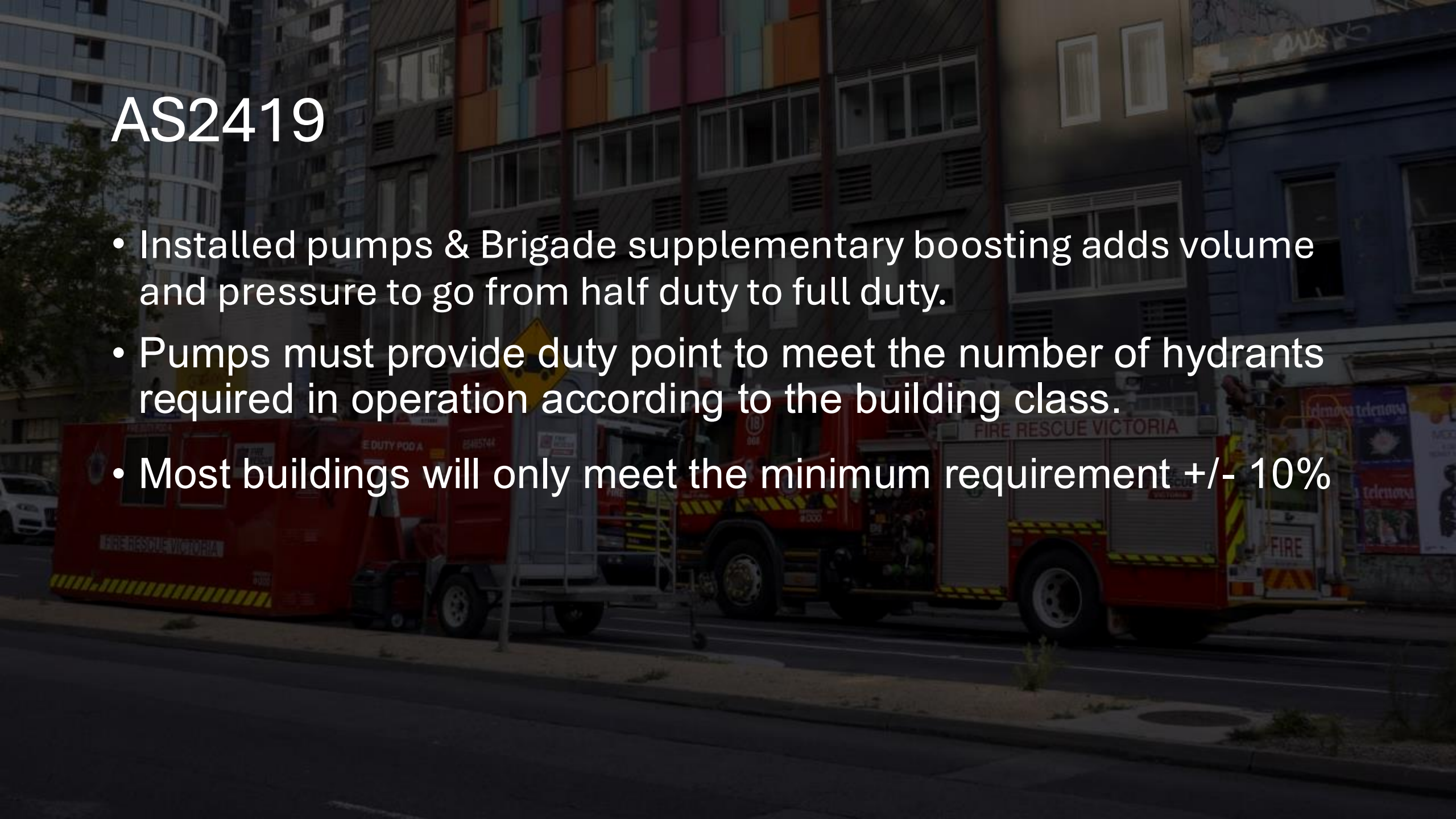
Low of 350kpa/700kpa

Max of 1050kpa (can be increased to 1200kpa)

Can Cascade or pump up/to

AS2419

- Installed pumps & Brigade supplementary boosting adds volume and pressure to go from half duty to full duty.
- Pumps must provide duty point to meet the number of hydrants required in operation according to the building class.
- Most buildings will only meet the minimum requirement +/- 10%



Hydrant Shortfalls

1 length 30m + 10m
Stream

2 lengths 60m + 10m
Stream

3 Lengths 90m + 10m
Stream

Australian Hydrant Packs

- Called high rise/Attack and Lay packs
- 6 states and 2 territories utilising 38mm hose with a range of branches with optimum operating pressure (300kpa, 500kpa, 700kpa)
- Most utilise select-a-flow style branches
- Some use automatic branches
- This is in line with most Fire Services standard hose for a residential dwelling.



Australian Hydrant Packs

- Most services advocate 60m of hose
- To flow 500lpm (most 38mm branch high flow) requires 220kpa a length
- To pump full flow for extinguishment requires 220kpa+220kpa+300kpa/500kpa/700kpa (depending on branch)
- So either **740kpa**, **940kpa**, **1140kpa**



Australian Firefighter training

- 6 States and 2 Territories deliver predominantly CFBT firefighter training.
- Placing little drops of water into smoke while moving to a point to extinguish the fire.
- To develop droplets requirement of 100-250lpm discharged at 700kpa.
- Needs to be coupled with Ventilation control to control HRR.
- **NOT SUITABLE FOR LARGE FLOORPLATES.**
- **TRAINED POORLY.**



Importance of Droplet Size

- Optimal Droplet Size:
 - Effective size: 0.3mm to 0.5mm
 - Used globally by fire brigades
 - Optimal surface to mass ratio
 - Ideal for smoke cooling and steam generation



Flows and Pressures of Proposed Hose Packs					
Hydrant	Proposed	1x30m 38	2x30m 38	Branch	Actual
600lpm@700kpa	235lpm	55kpa	55kpa	700kpa	235lpm@590kpa
600lpm@700kpa	115lpm	30kpa	30kpa	700kpa	115lpm@640kpa

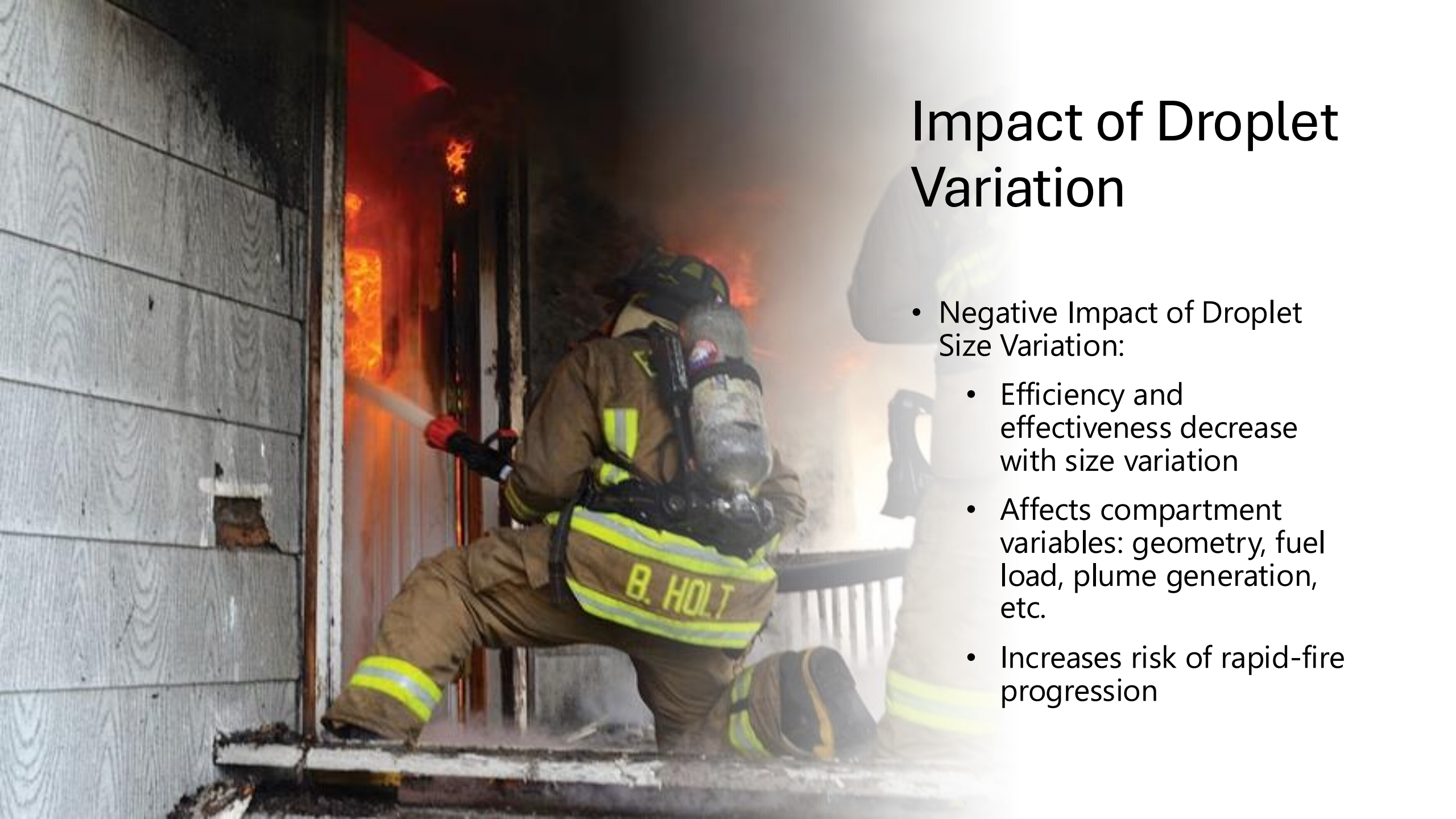
A firefighter wearing a grey helmet and a high-visibility yellow vest is operating a fire hydrant. The hydrant is a vertical metal post with a red hose attached. The firefighter is leaning over, holding the hose. The background shows a rocky, hilly landscape under a grey sky.

AS2419 Limitations

- AS2419 Limitations:
 - Not designed for smaller diameter hose and fog tactics
 - Subpar flow and pressure ranges for droplet firefighting
 - Difficulty achieving 500 lpm from lower hydrants

Impact of Droplet Variation

- Negative Impact of Droplet Size Variation:
 - Efficiency and effectiveness decrease with size variation
 - Affects compartment variables: geometry, fuel load, plume generation, etc.
 - Increases risk of rapid-fire progression



Droplet Atomisation

- Helpful in small compartments
- Hinders in large spaces (e.g., isolated structures, offices, factories)
- Small droplets absorbed by smoke heat, increasing fire intensity



Droplet Speed and Heat Absorption

- Faster droplets penetrate further and turn to steam quicker – Eaten by Plume
- Low pressure reduces discharge velocity, but increases droplet size.
- Large droplets needed for high mass heat absorption.
- Switch to surface cooling - Increase flow rates and wet surfaces for safety



So what should we do:

- Increasing early firefighting water reduces building damage and firefighter heat exposure.
 - Maximise the hydrant ASAP
 - 500 lpm stream extinguishes fires faster and with less water than 100 lpm stream.
 - Adopt a flow rate to floorplate equation to help with incident control
 - Change FBIM to reflect modern fire environment
 - Look at tactics and equipment for response



Flow Rate and Pressure:

- Ensure hydrant systems provide adequate flow and pressure for effective firefighting
- Minimum pressure and flow requirements updated to reflect modern firefighting needs, or change training methodologies to include surface cooling tactics.



Equipment and Training:

- Use equipment that supports high flow rates and lower pressures for effective fire suppression in AS2419 buildings
- Train firefighters on the updated standards and effective use of hydrant systems



Questions?

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