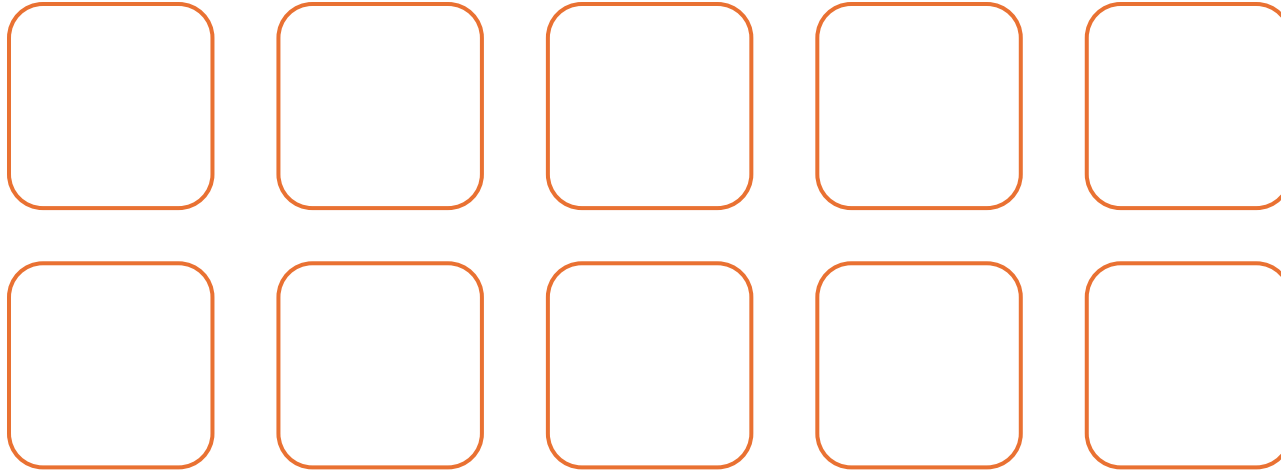




Bushfire smoke resilience & tenability.

THE UNSPOKEN GAP IN SPECIFICATION 43

Evacuation: 10,000



5-7 May 2026



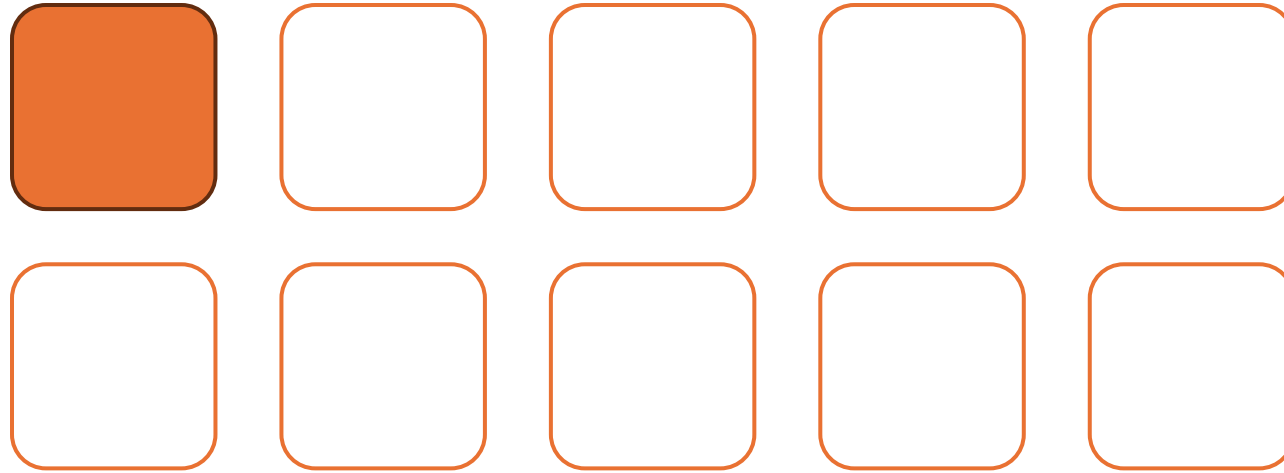
Melbourne Convention & Exhibition Centre



fireaustralia.com.au



Evacuation: 10% Bed-Ridden



5-7 May 2026



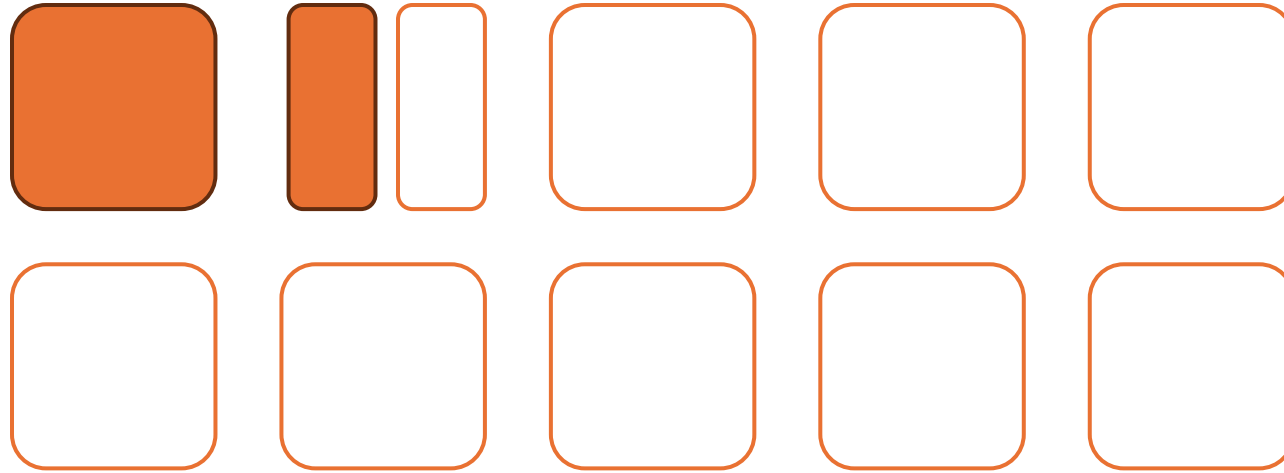
Melbourne Convention & Exhibition Centre



fireaustralia.com.au



Evacuation: 5% in Intensive Care



5-7 May 2026



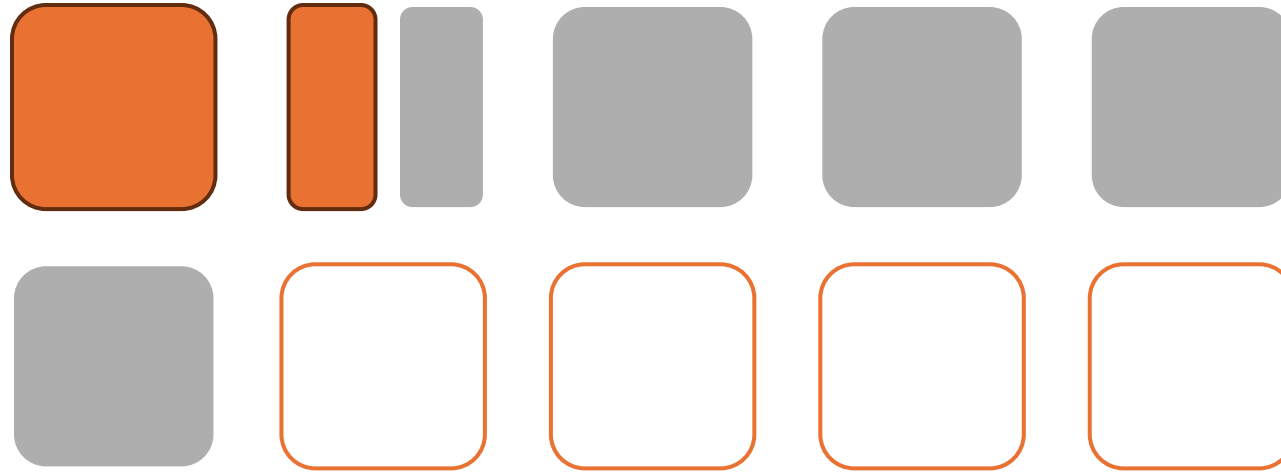
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60% were Immuno-Compromised



5-7 May 2026



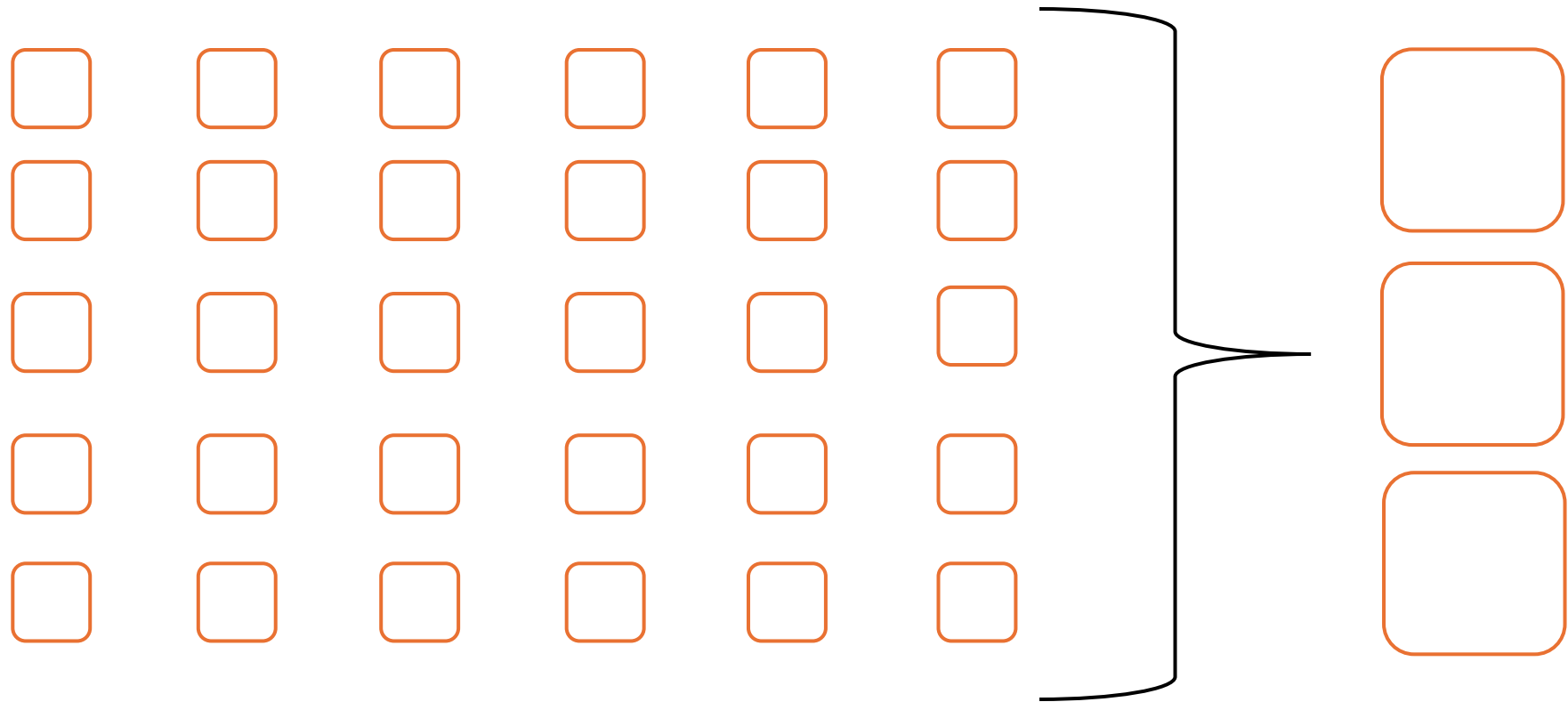
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30 x 4-year olds...



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FIRE
AUSTRALIA2026

Critical Buildings in Bushfire Areas Face Vastly Different Challenges...



5-7 May 2026



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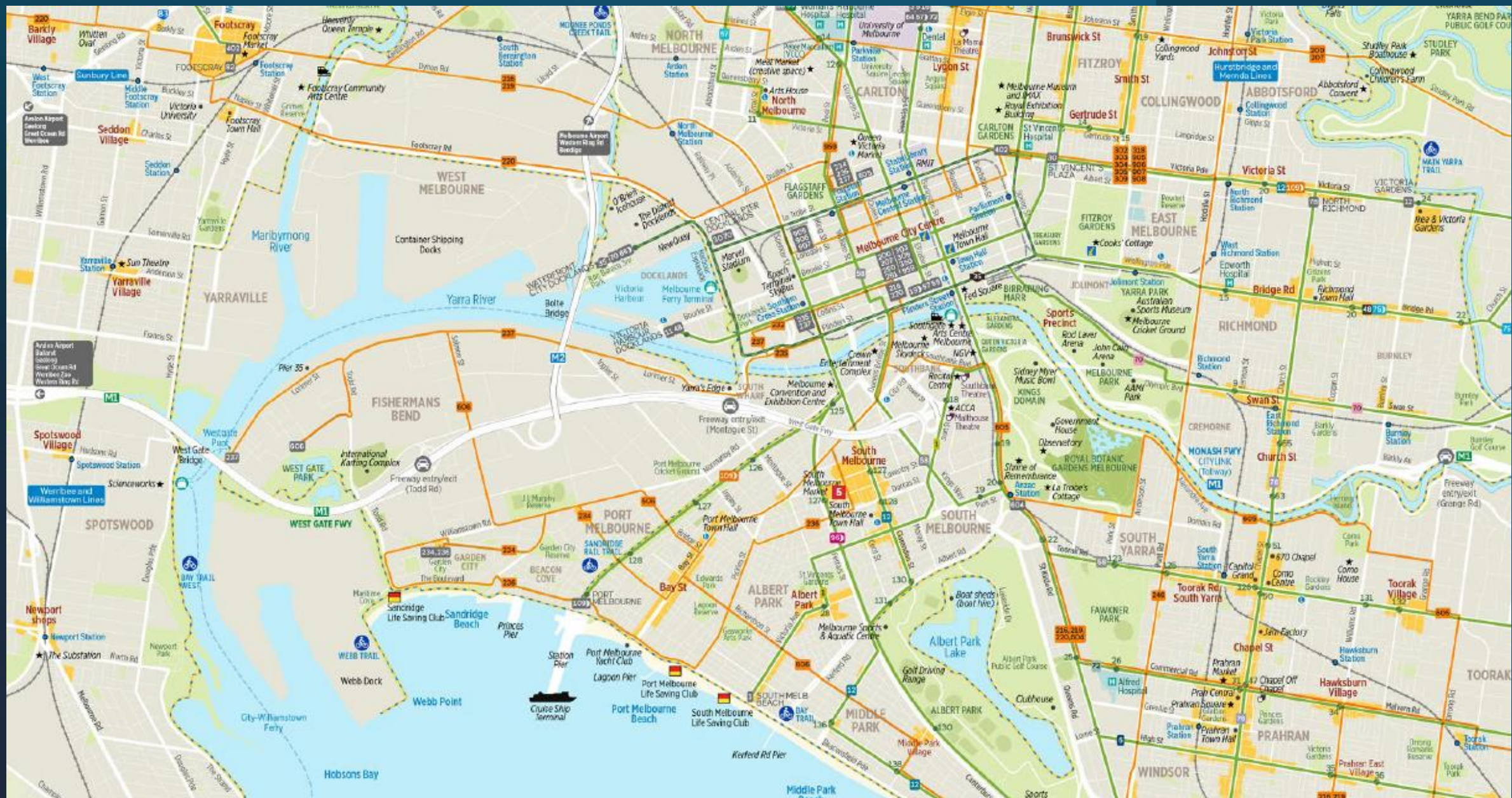


fireaustralia.com.au

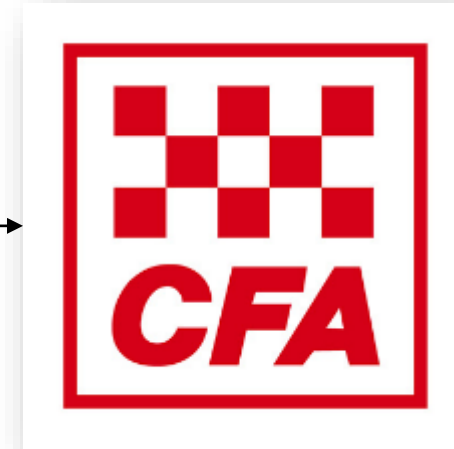


Bushfire Smoke





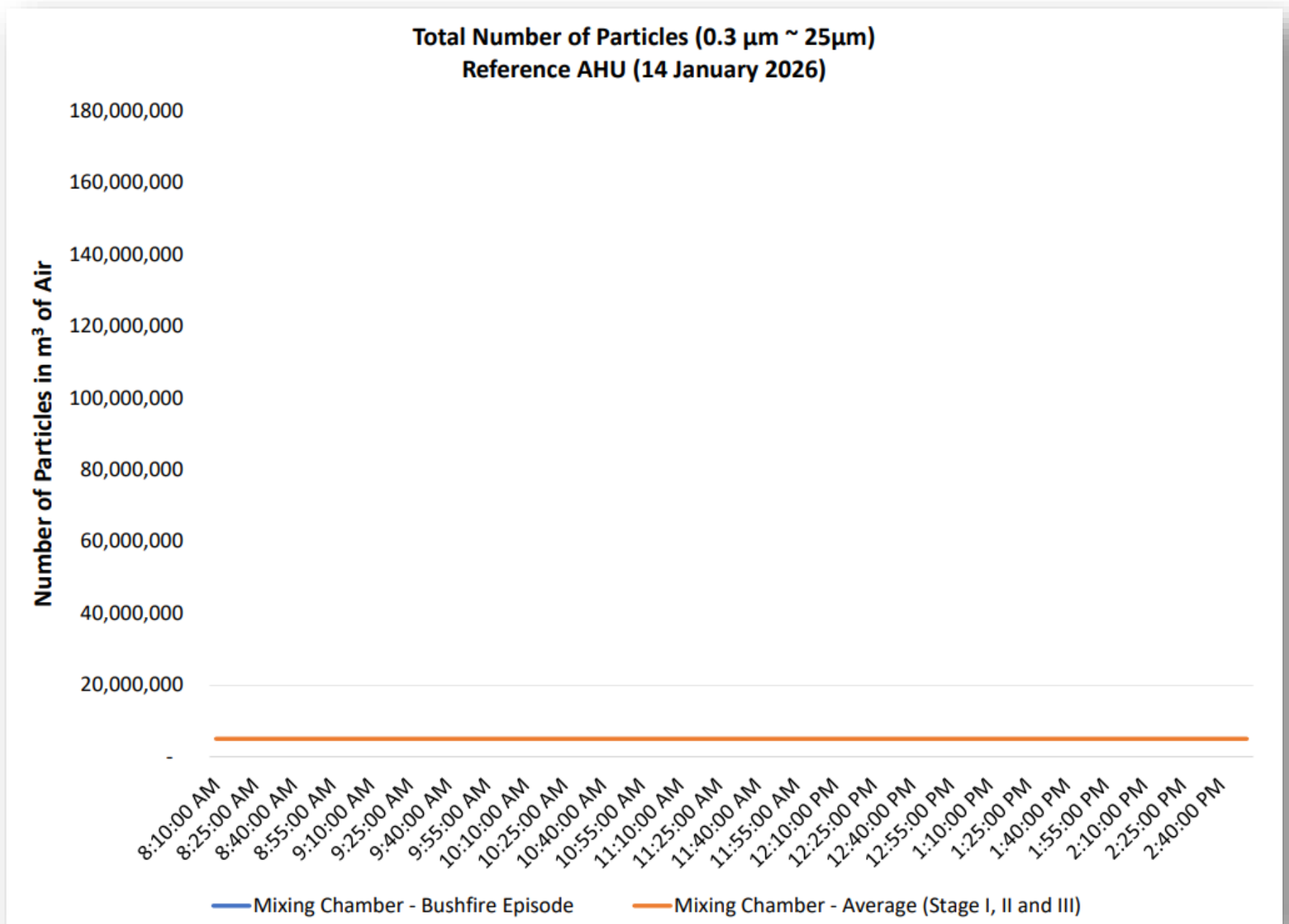
Bushfire Smoke



The Bushfire Event

Bushfires led to over 170m particles per m³ pre-filtration.

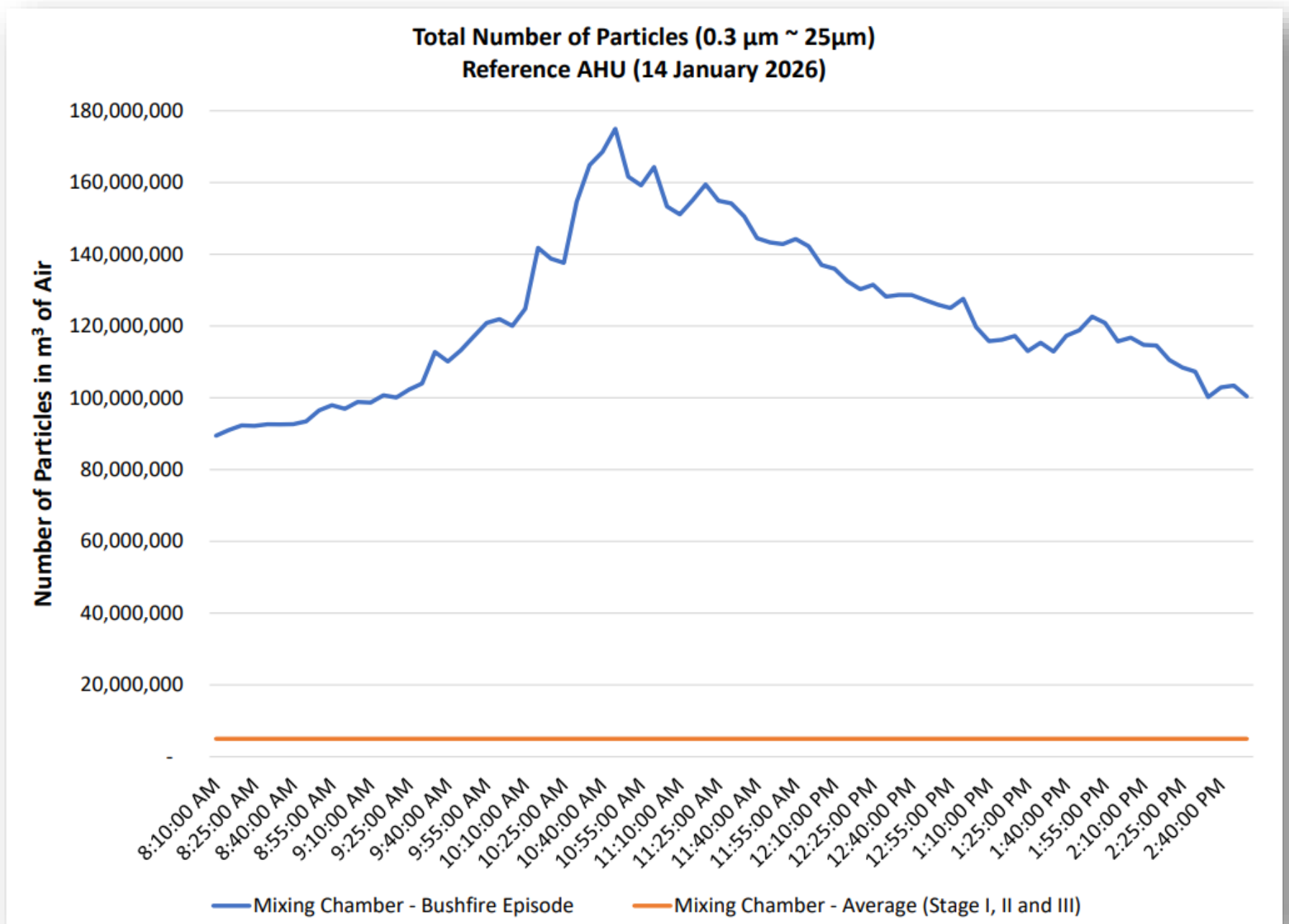
A 30x increase on the average particle number concentration without bushfires.



The Bushfire Event

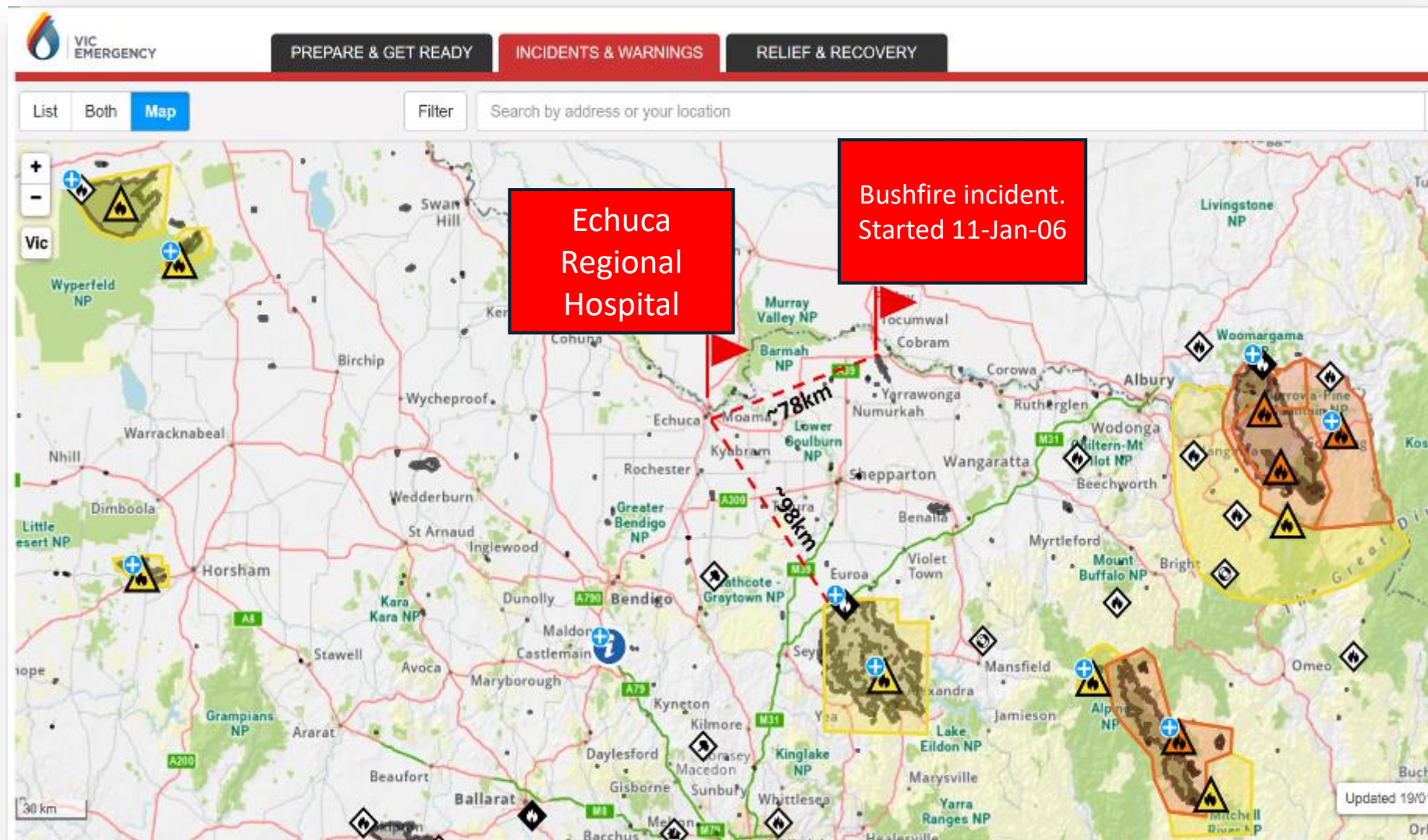
Bushfires led to over 170m particles per m³ pre-filtration.

A 30x increase on the average particle number concentration without bushfires.



Bushfire
Distance

78
kms



*Imagine for a moment if
this hospital was impacted
by a catastrophic fire...*



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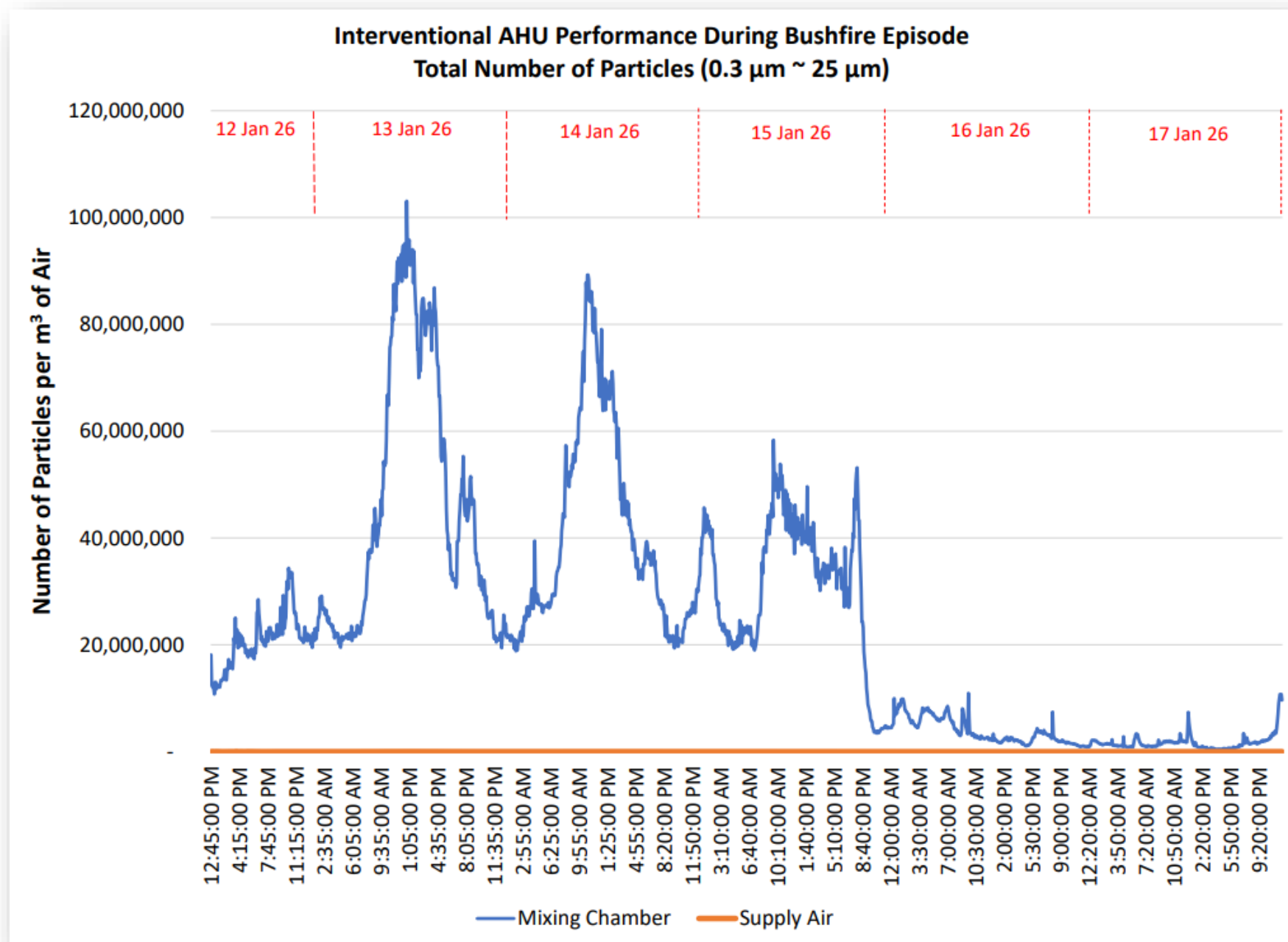


fireaustralia.com.au



Bushfire
Duration

4
Days



Why is this important?

Hospitals Regional patients can't be evacuated

Smoke *will* infiltrate

Conventional HVAC will degrade

Patients and staff will lose visibility and cognition



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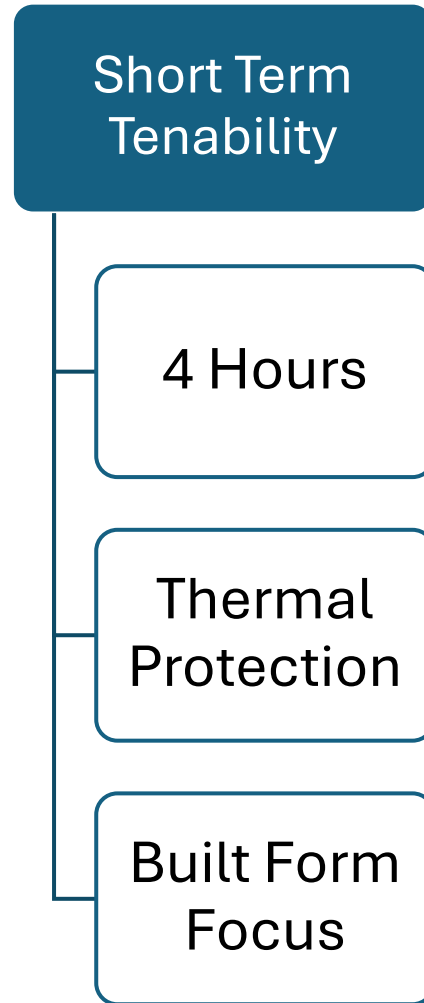




The Extended Tenability Framework



Tenability Framework



5-7 May 2026



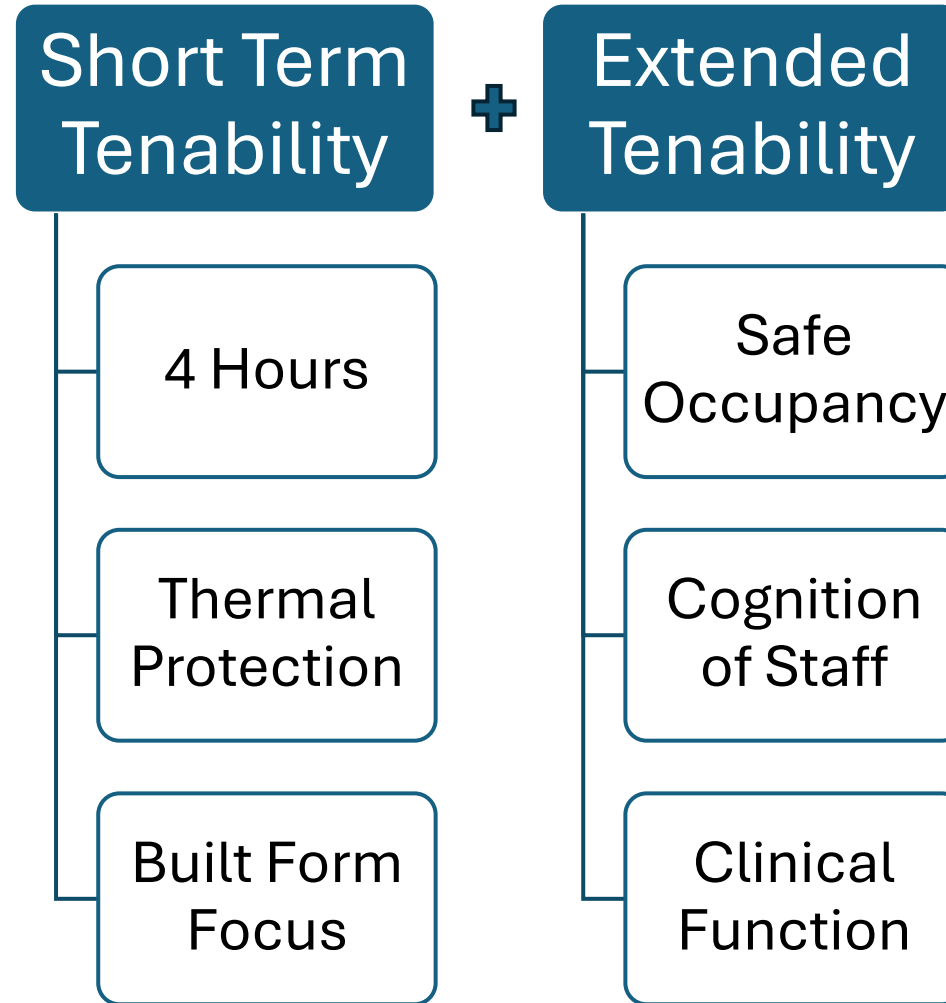
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Tenability Framework



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The Conventional Timeline

Detection

- Unknown levels of air quality
- Unknown levels of bushfire readiness
- Contaminants already coming through G4/F8 filtration

Initial Response

- Close Outdoor Air Dampers
- Building now negatively pressurised

Result

- Unfiltered contaminants entering through front doors
- Infectious aerosols now impacting immunocompromised patients



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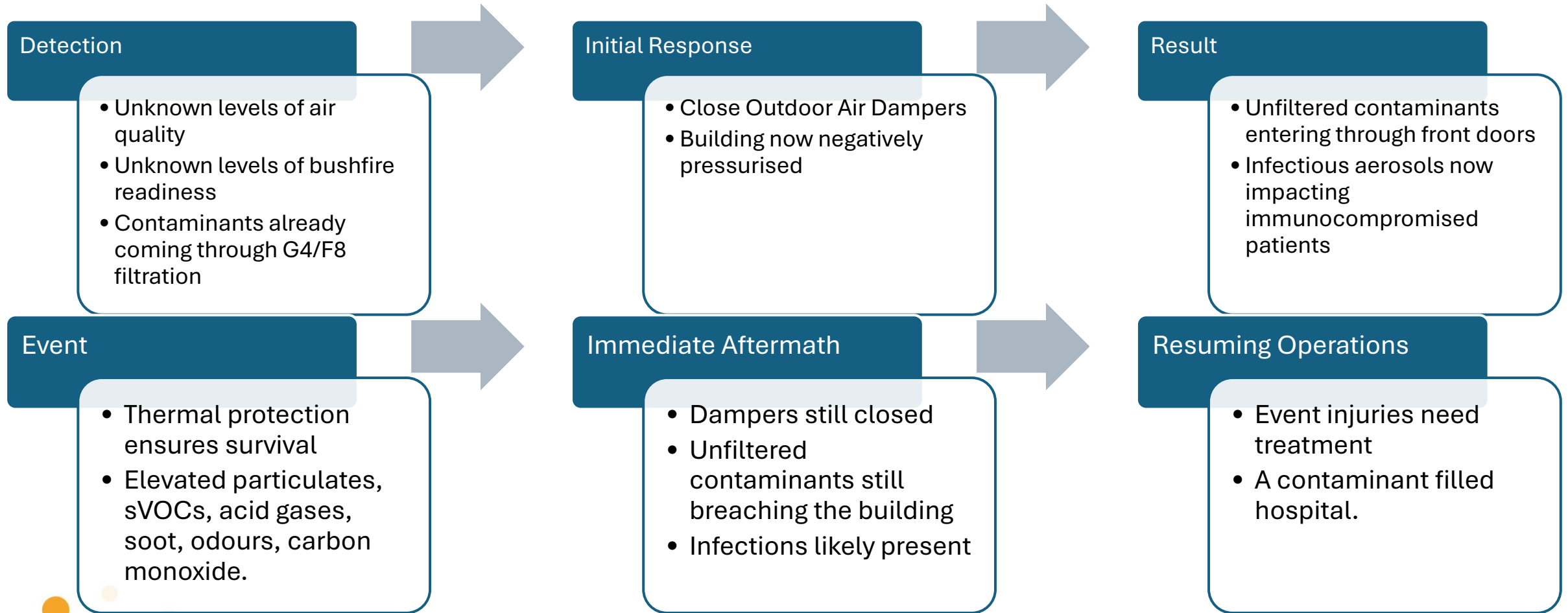
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The Conventional Timeline



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The Conventional Approach



5-7 May 2026



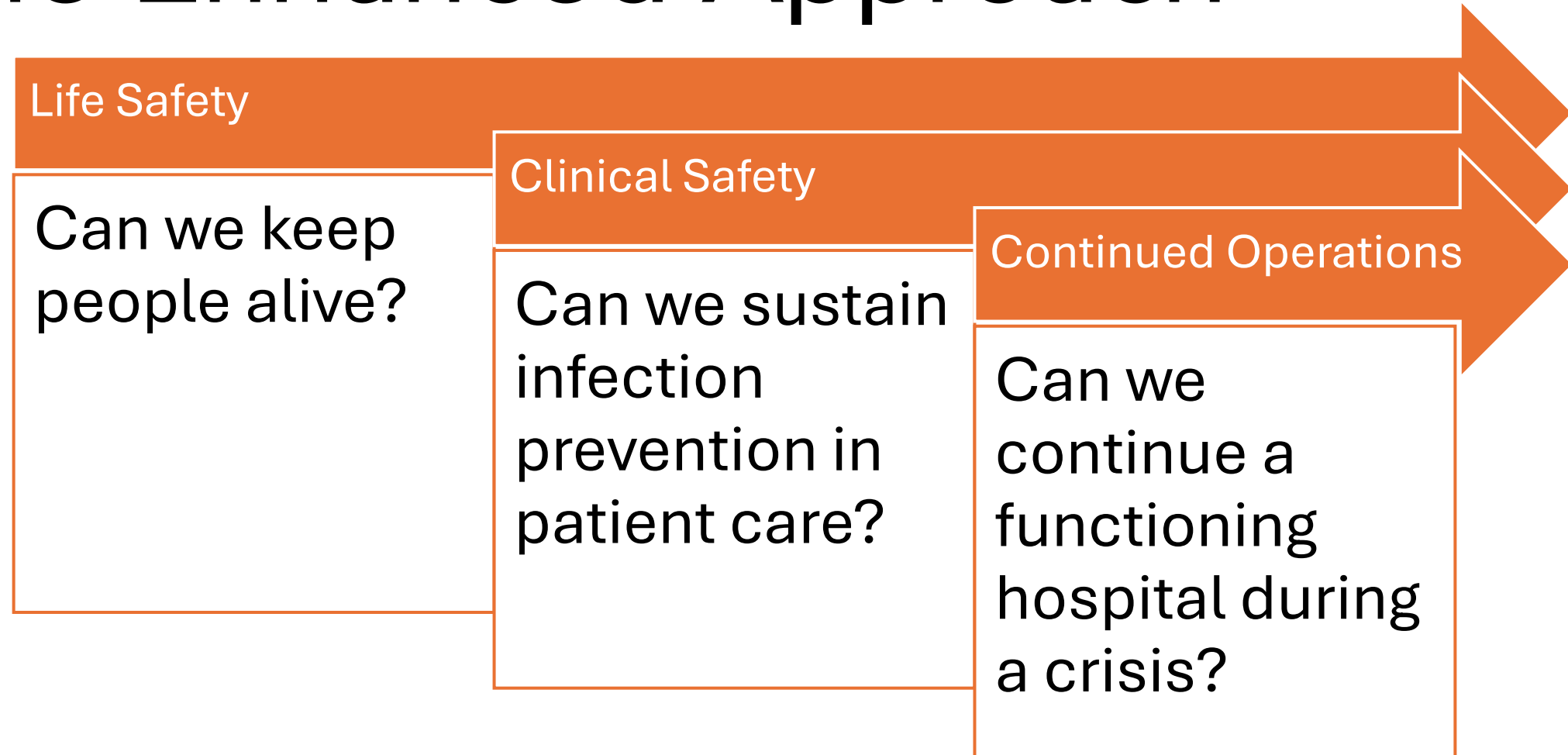
Melbourne Convention & Exhibition Centre



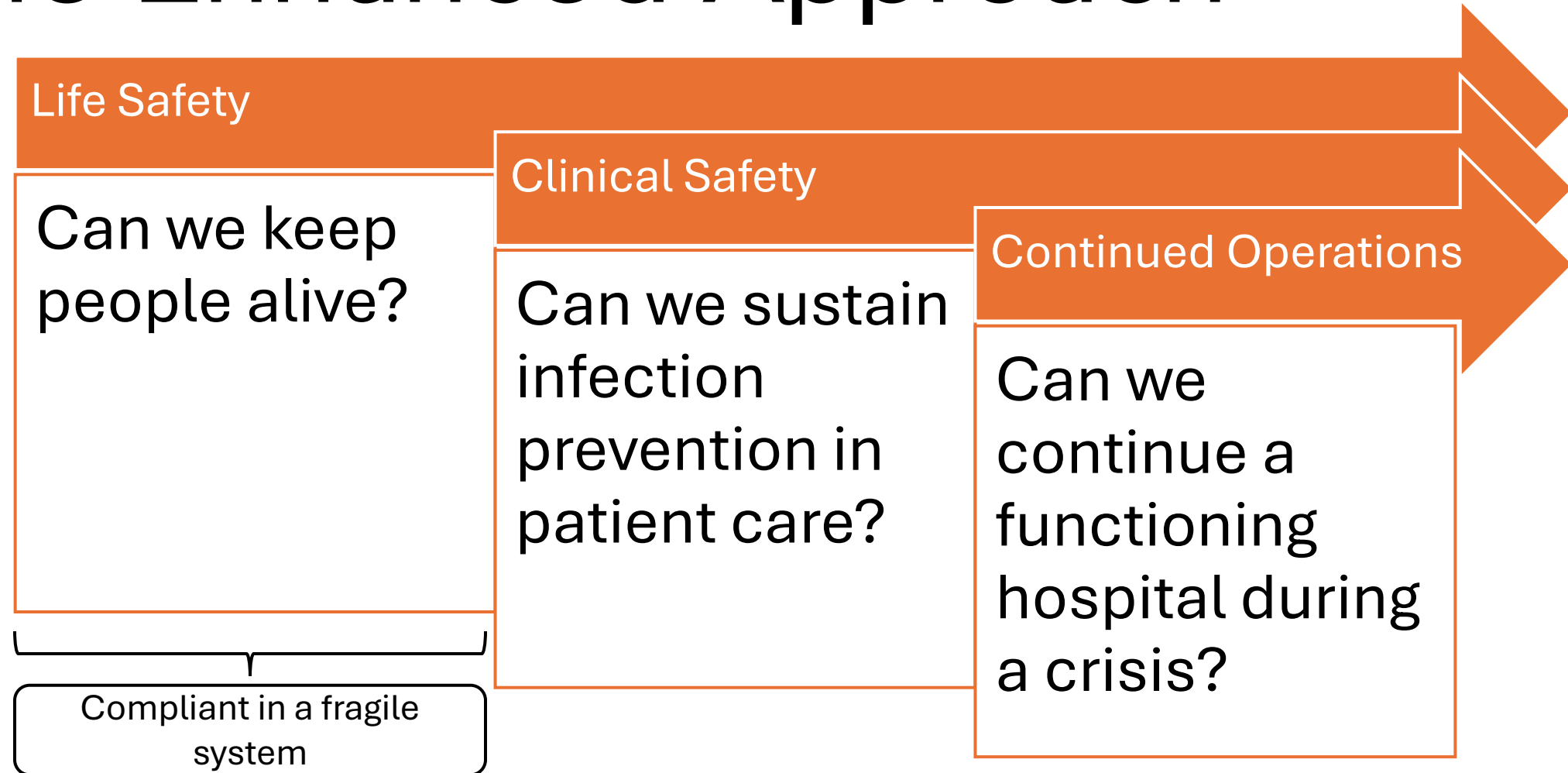
fireaustralia.com.au



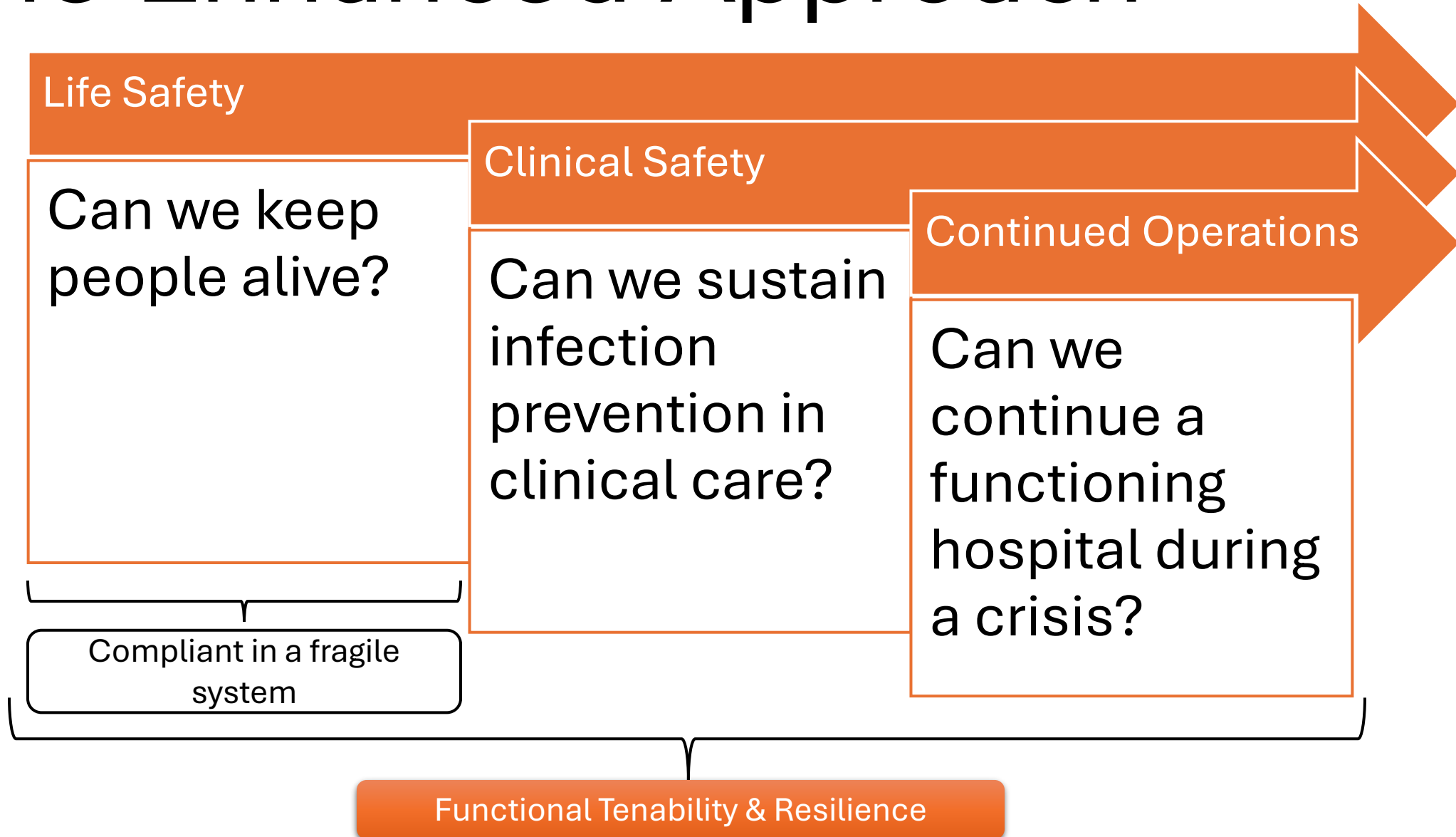
The Enhanced Approach



The Enhanced Approach



The Enhanced Approach



The Enhanced Approach



Minimal smoke
particles &
odours

Minimal
Infectious
Aerosols



5-7 May 2026



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FIRE
AUSTRALIA2026



I'm a Fire Engineer.

WHY DO I CARE?

Why do I care?

Shelter in Place

Supports life safety during event

- Provides an extended duration of tenability for a Spec 43 compliant area



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Why do I care?

Shelter in Place

Supports life safety during event

- Provides an extended duration of tenability for a Spec 43 compliant area

Occupant Resilience

Odour Control

- Less odours, means less sense of infiltration, means less panic by occupants



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Why do I care?

Shelter in Place

Supports life safety during event

- Provides an extended duration of tenability for a Spec 43 compliant area

Occupant Resilience

Odour Control

- Less odours, means less sense of infiltration, means less panic by occupants

Degraded Conditions

Infection Control

- Improves the ability for the hospital to continue operations and aids post event recovery.



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Co-funded by



Victorian
Health Building
Authority

Co-funded by



Victorian
Health Building
Authority

Project partners



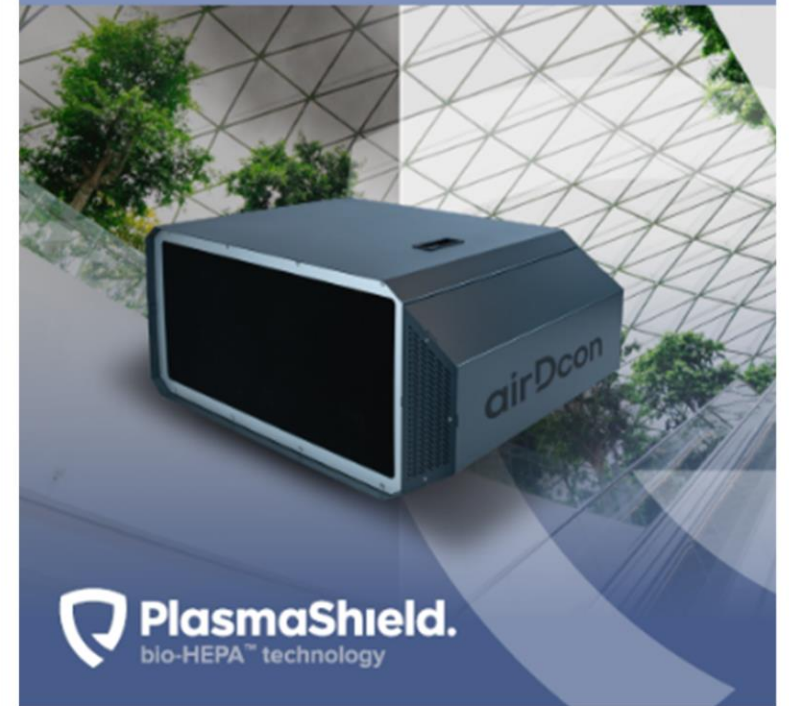
RACE for
2030
BUSINESS

Reliable Affordable Clean Energy

racefor2030.com.au

B3 Sustainable Solutions for Pandemic and Bushfire Resilience in Healthcare Facilities

Progress Report I



 **PlasmaShield.**
bio-HEPA™ technology

Bushfires & Contaminants

Unplanned burns can lead to structural fires, leading to higher toxicity

Contaminant	Controlled Burn	Uncontrolled Burn
Fine particulates <1um	✓	✓
Ultra Fine Particles <0.1um	✓	✓
Semi-VOCs	✓	✓
PAHs - Soot	✓	✓
Carbon Monoxide	✓	✓
Acid Gases and HCN		✓
Heavy Metals		✓
Dioxins, flame retardants, phthalates		✓
Microplastics etc		✓

Arinaitwe E, McNamee M. Firefighter exposures during structural fires: An overview of real-world data. Sci Total Environ. 2026 Jan 15;1012:181211. doi: 10.1016/j.scitotenv.2025.181211.



The Intervention

Echuca Hospital



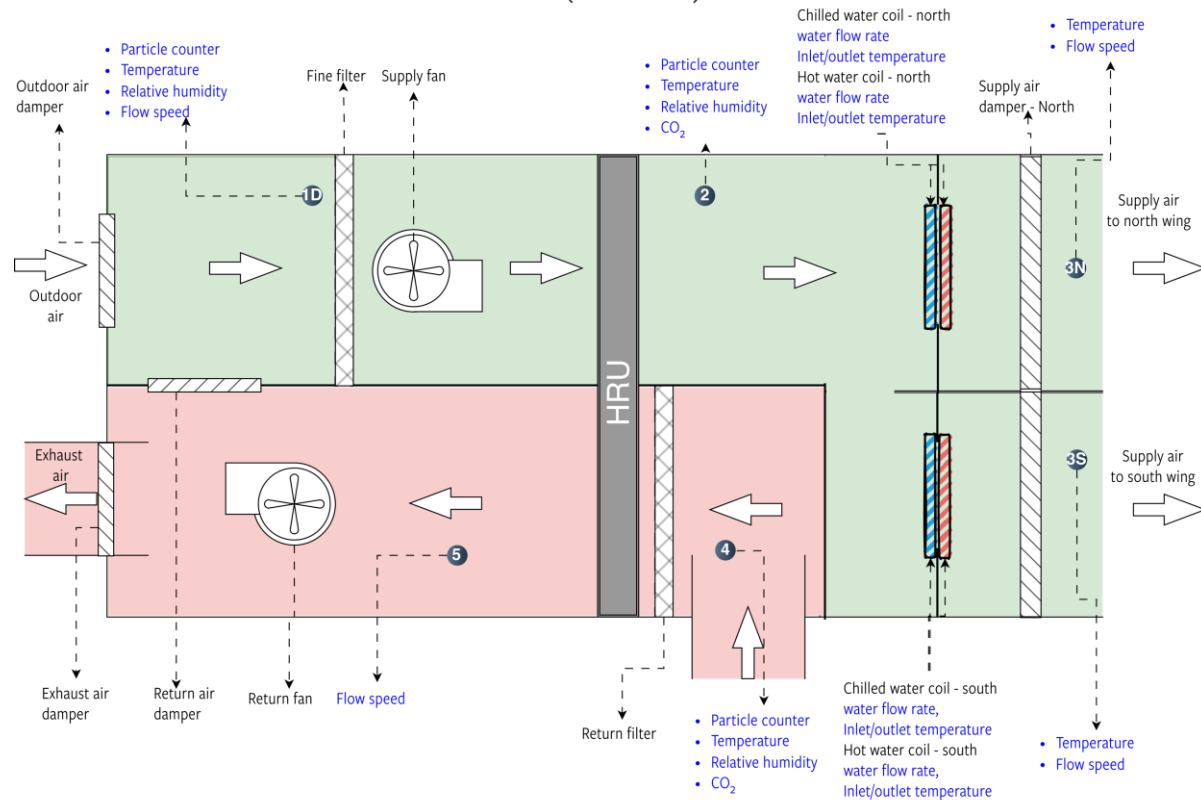
Phase 1: Stage I

System Unchanged

- 100% Outdoor Air System (6:6 ACH)
- Heat Recovery Wheel
- Pandemic Proof

From:
Traditional Filtration &
Heat Recovery

AHU-02 (Intervention)

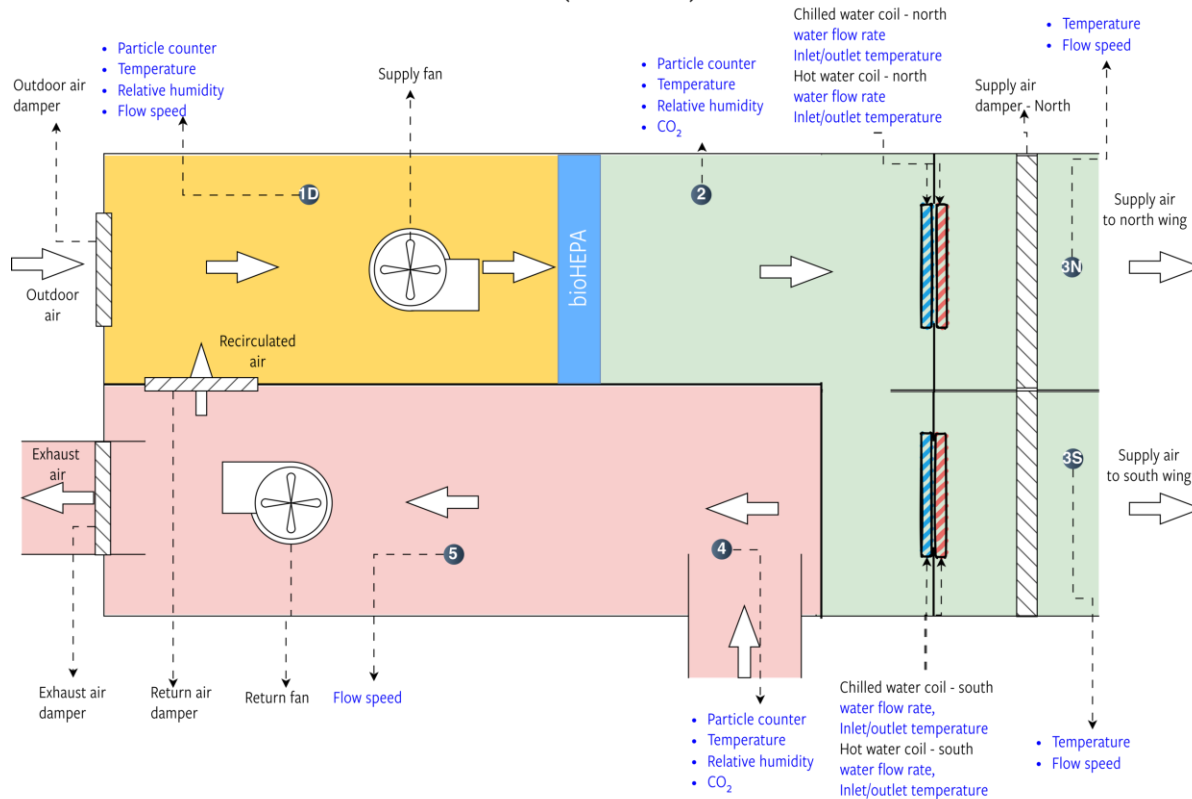


Phase 1: Stage 3

System Swapped

- 33% Outdoor Air System (2:6 ACH)
- bioHEPA Installed
- Pandemic Proof ($2+4ECAi=6:6$ ACH)

AHU-02 (Intervention)



To:

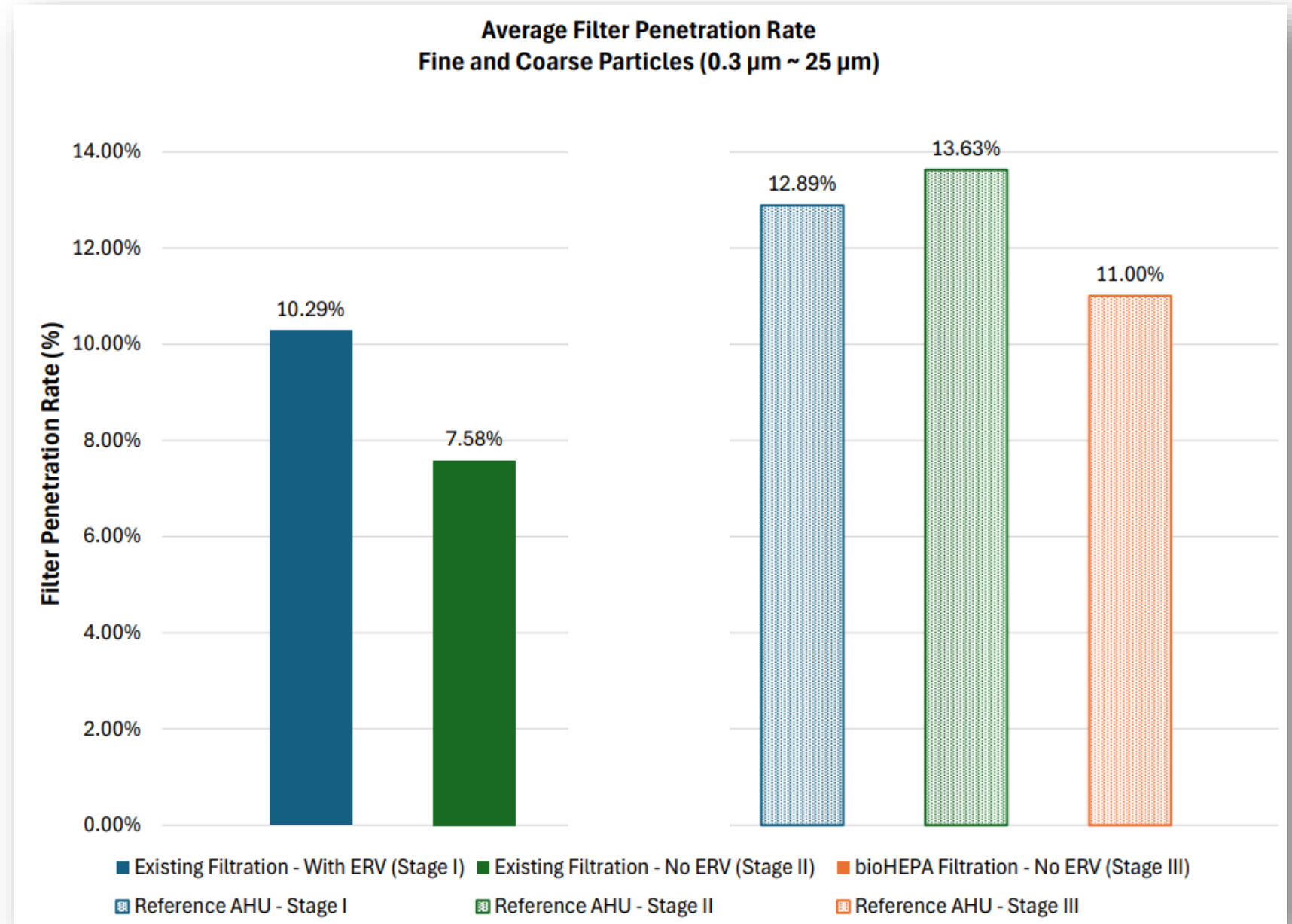
Conventional Outdoor Air +
bioHEPA Decontamination at



Filter Penetration Rate

The intervention AHU is comparable at ~10%, then drops to near-zero with bioHEPA filtration.

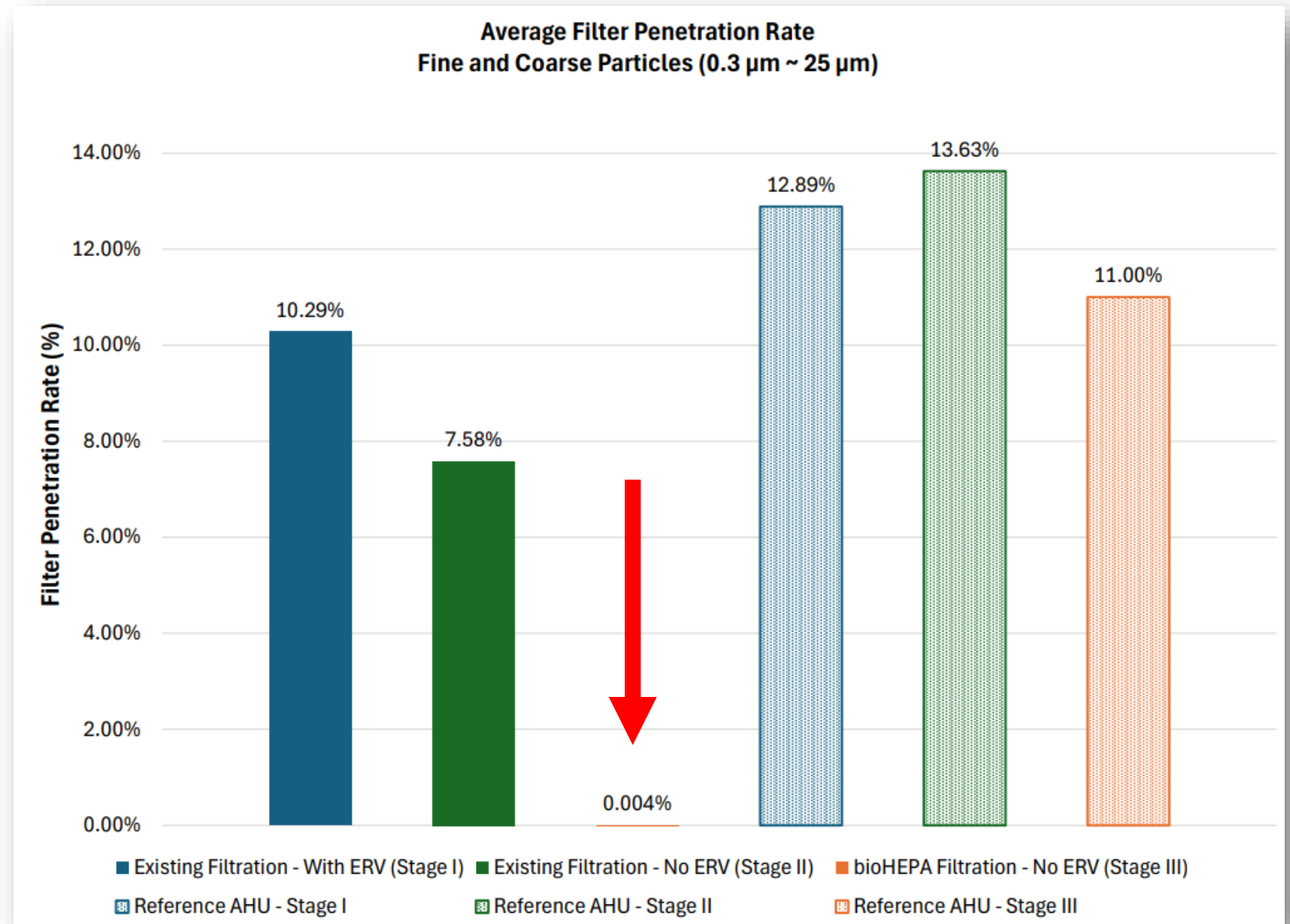
The difference between blue and green appears to be ERV leakage.



Filter Penetration Rate

The intervention AHU is comparable at ~10%, then drops to near-zero with bioHEPA filtration.

The difference between blue and green appears to be ERV leakage.



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

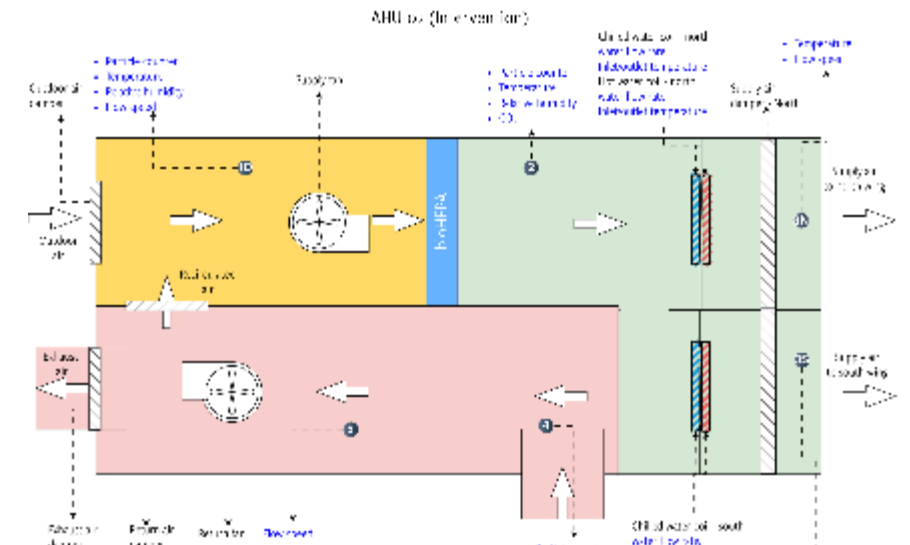
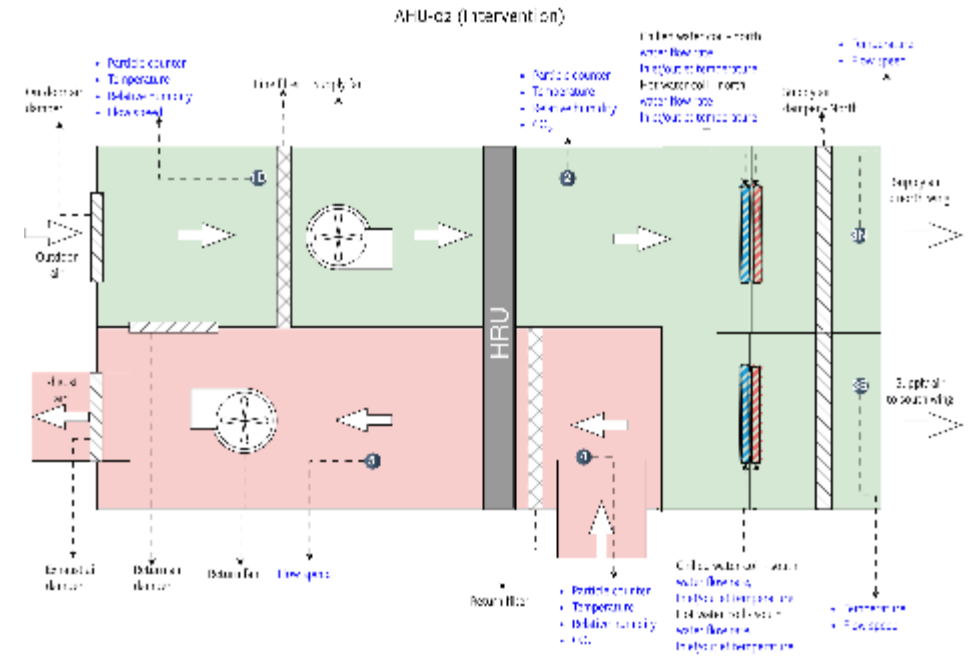
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Number of Data
Records

1,868,078
For the first 3 months



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

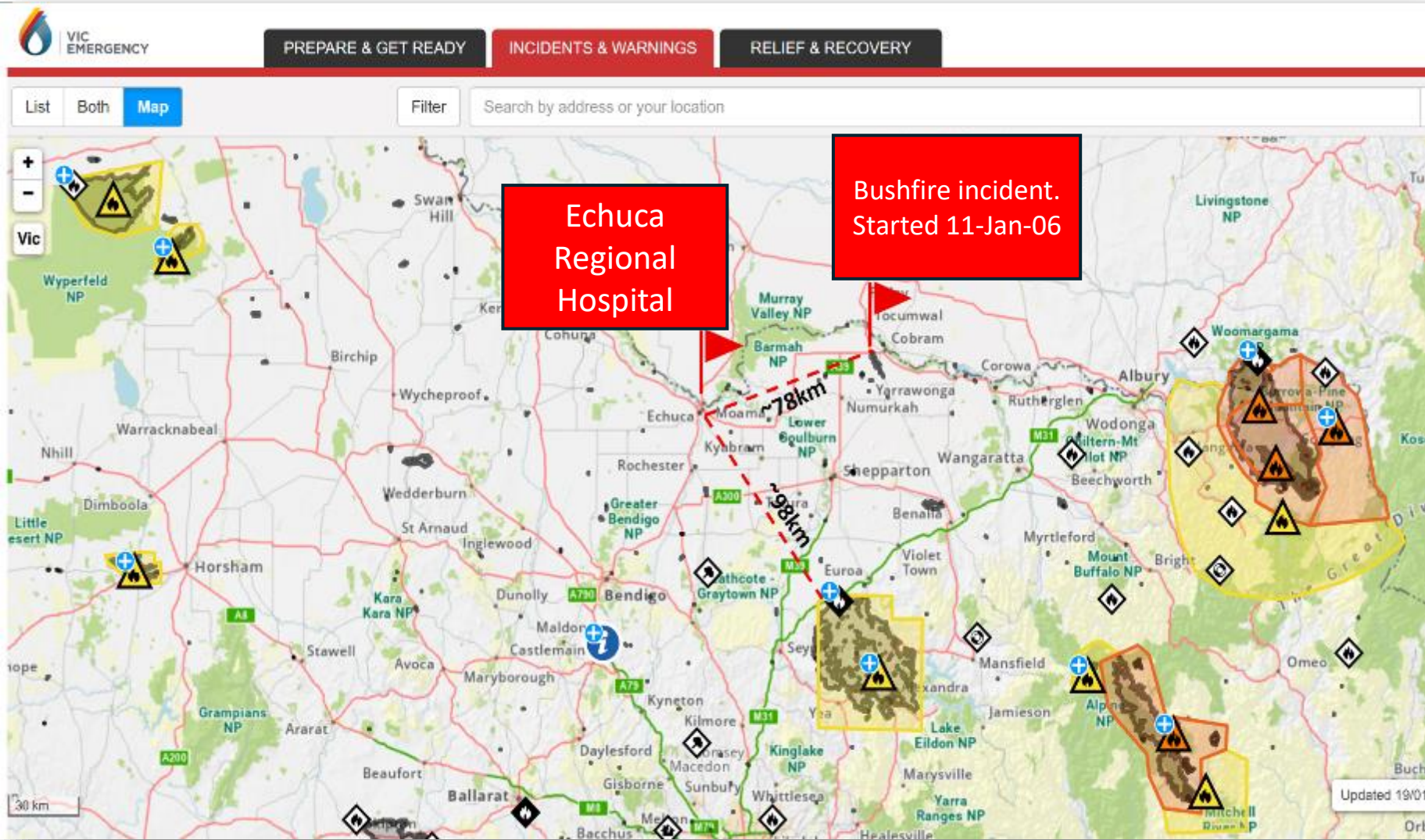
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Bushfire
Distance

78
kms



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

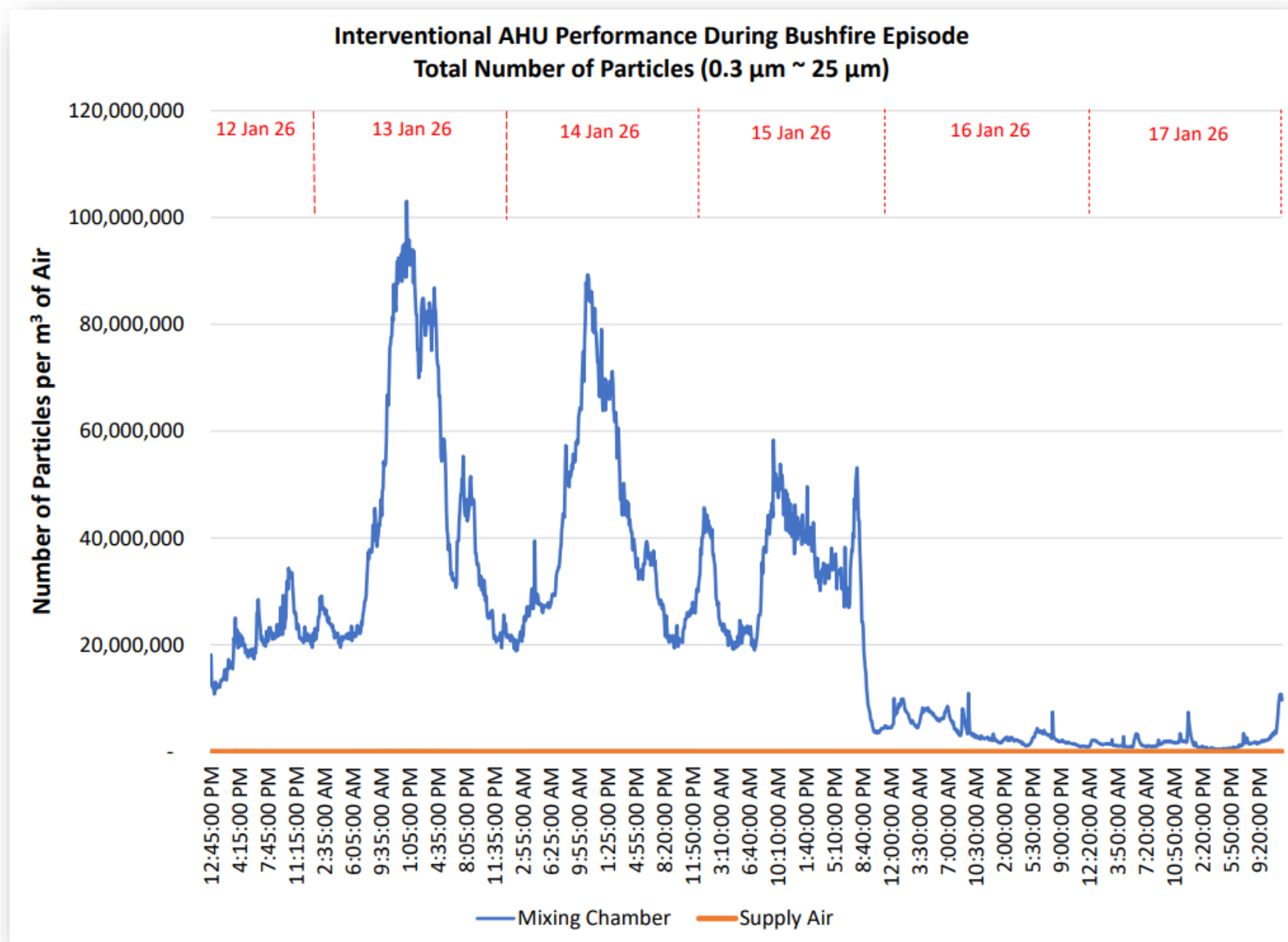
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Bushfire
Duration

4
Days



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

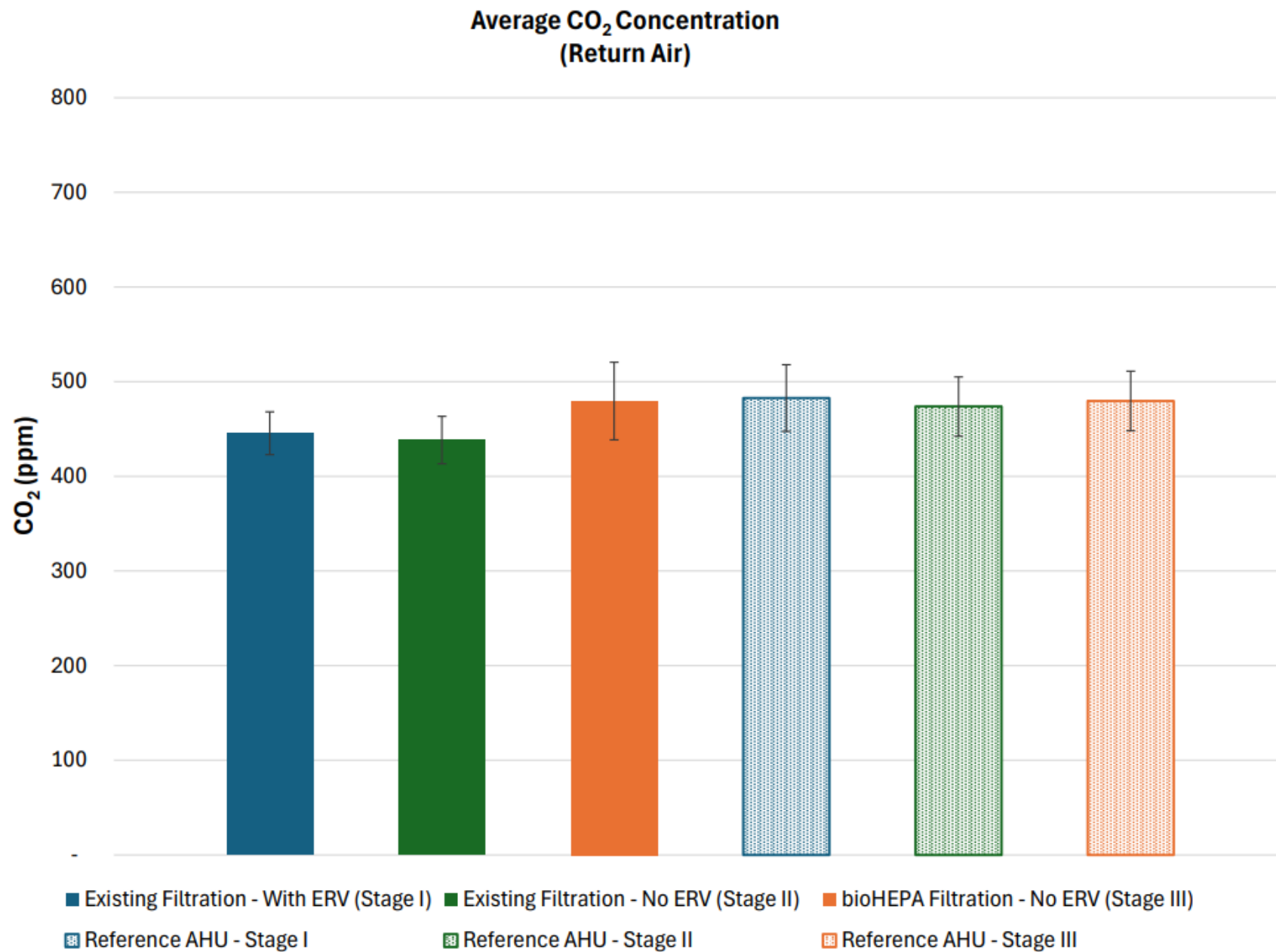
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Indoor Carbon
Dioxide

Below
500ppm



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

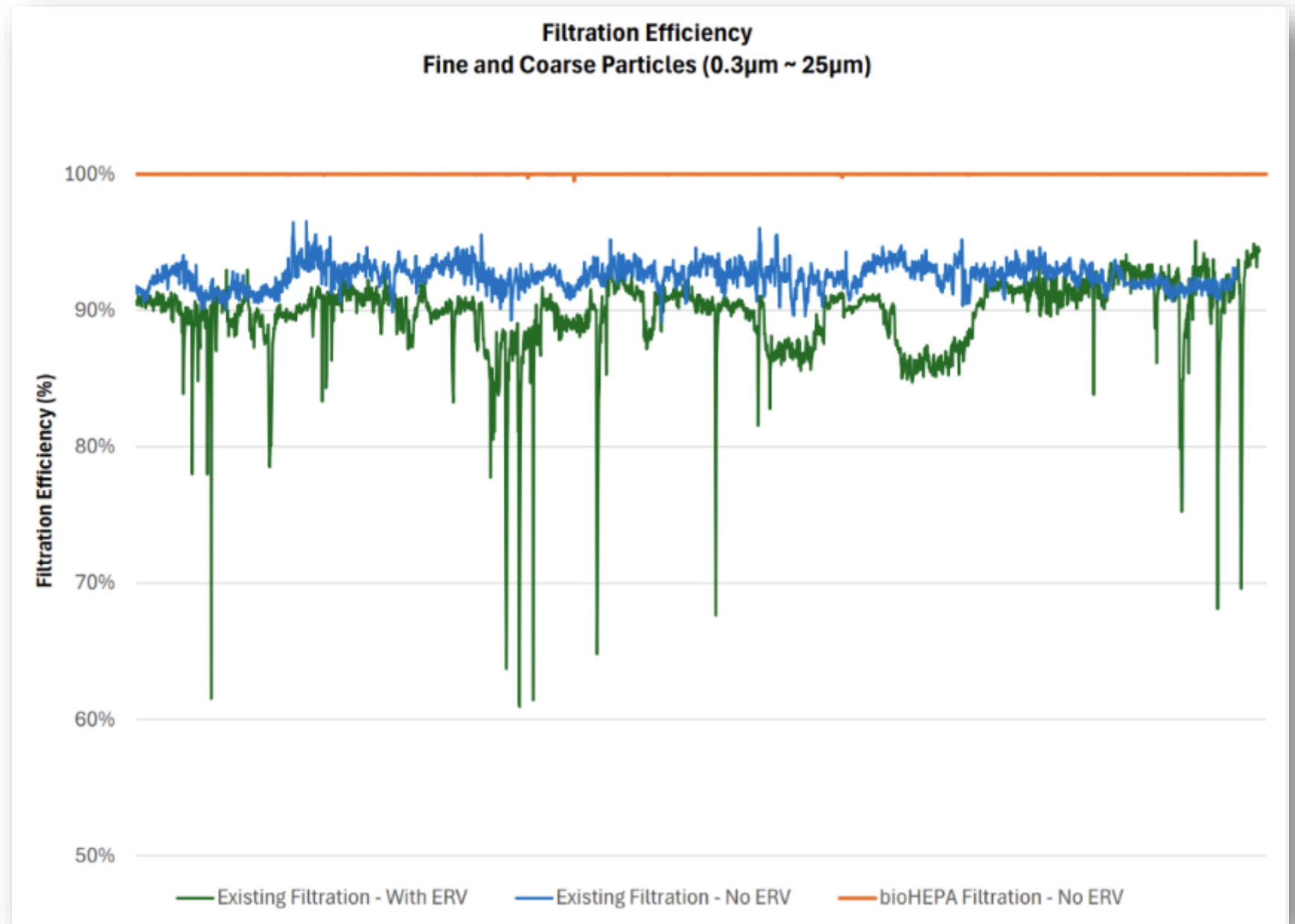
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Filtration
Efficiency

99.996%



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

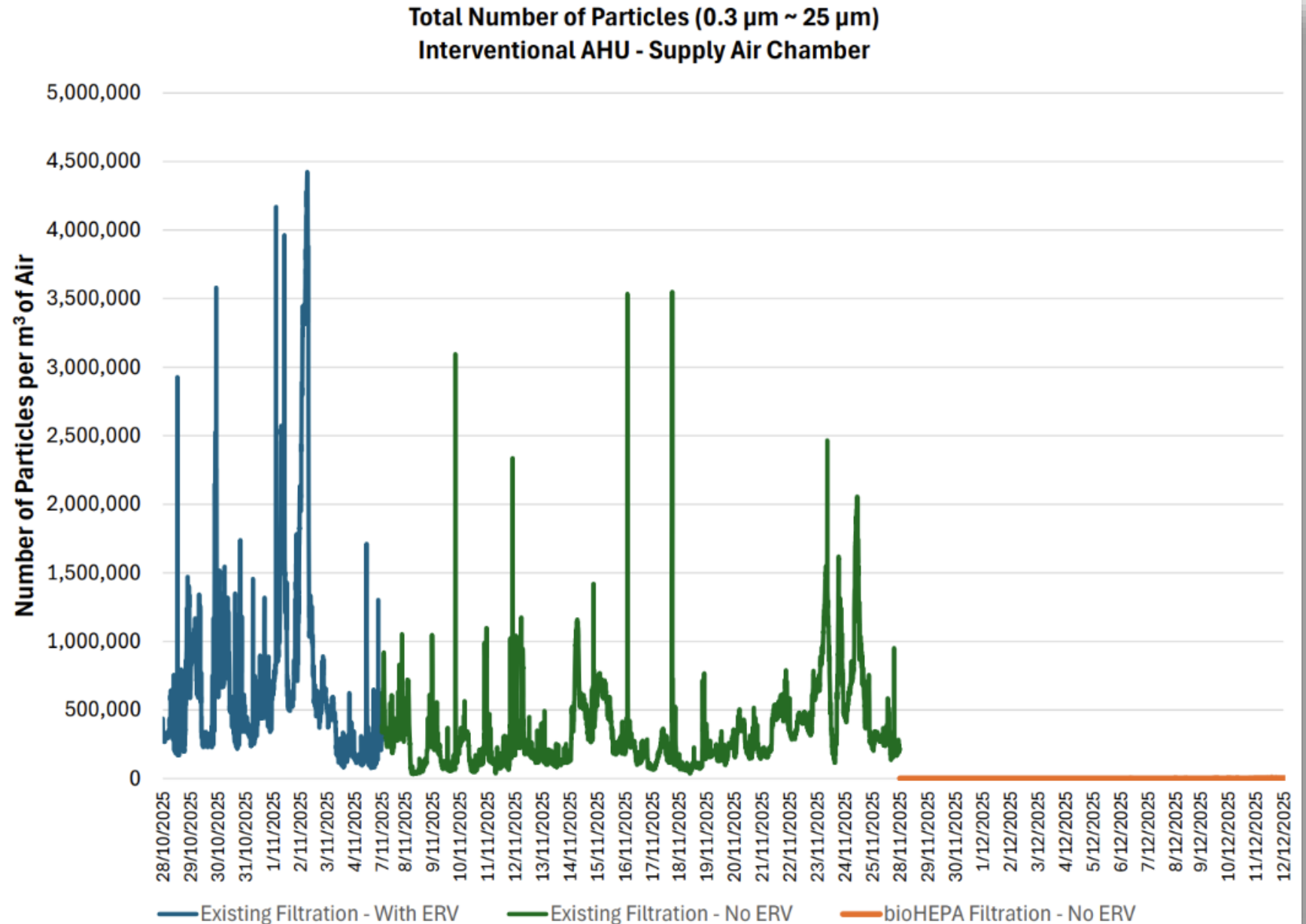
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Filtration
Consistency

Improved



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

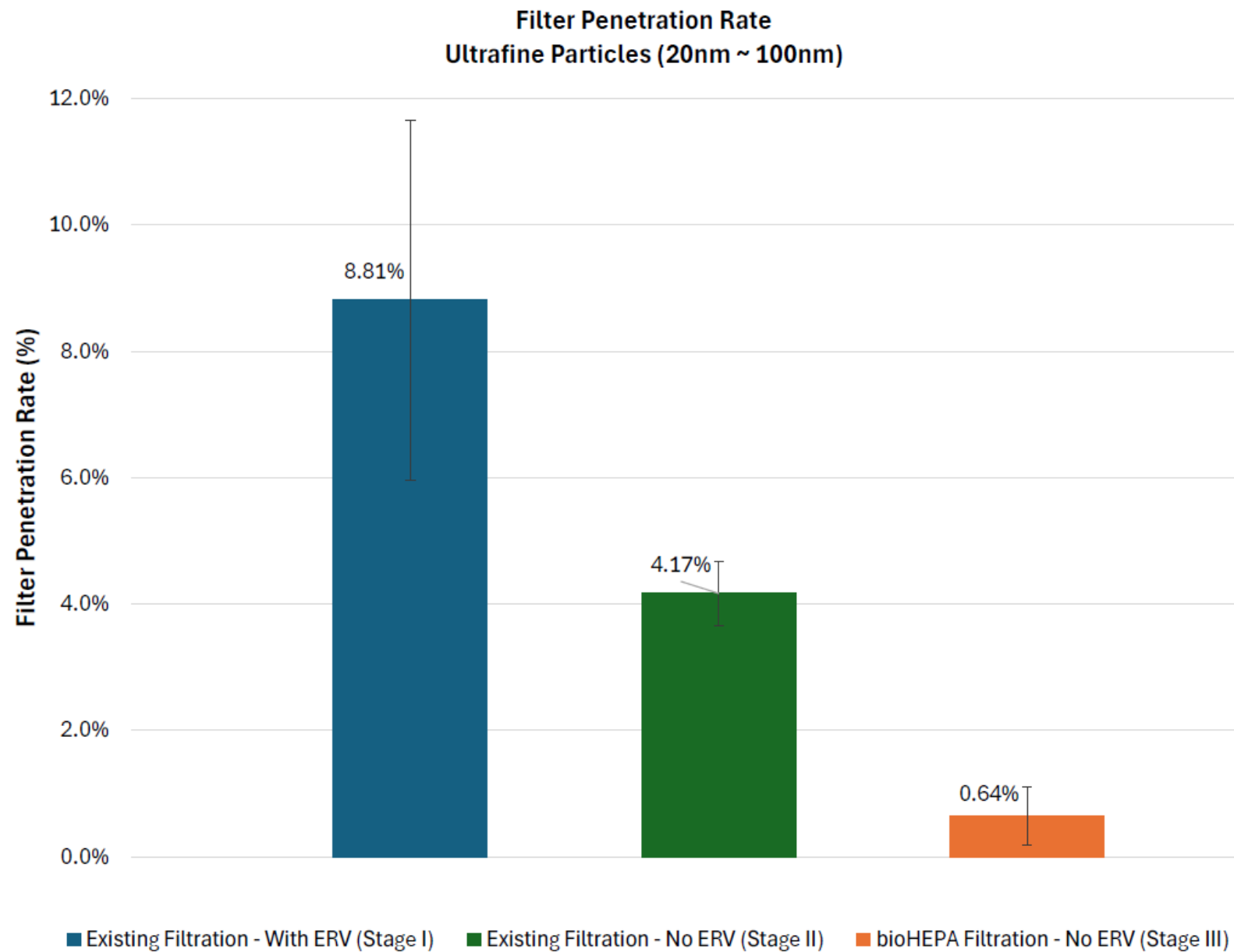
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Ultra Fine
Particles

Improved
12x



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

Peak Load

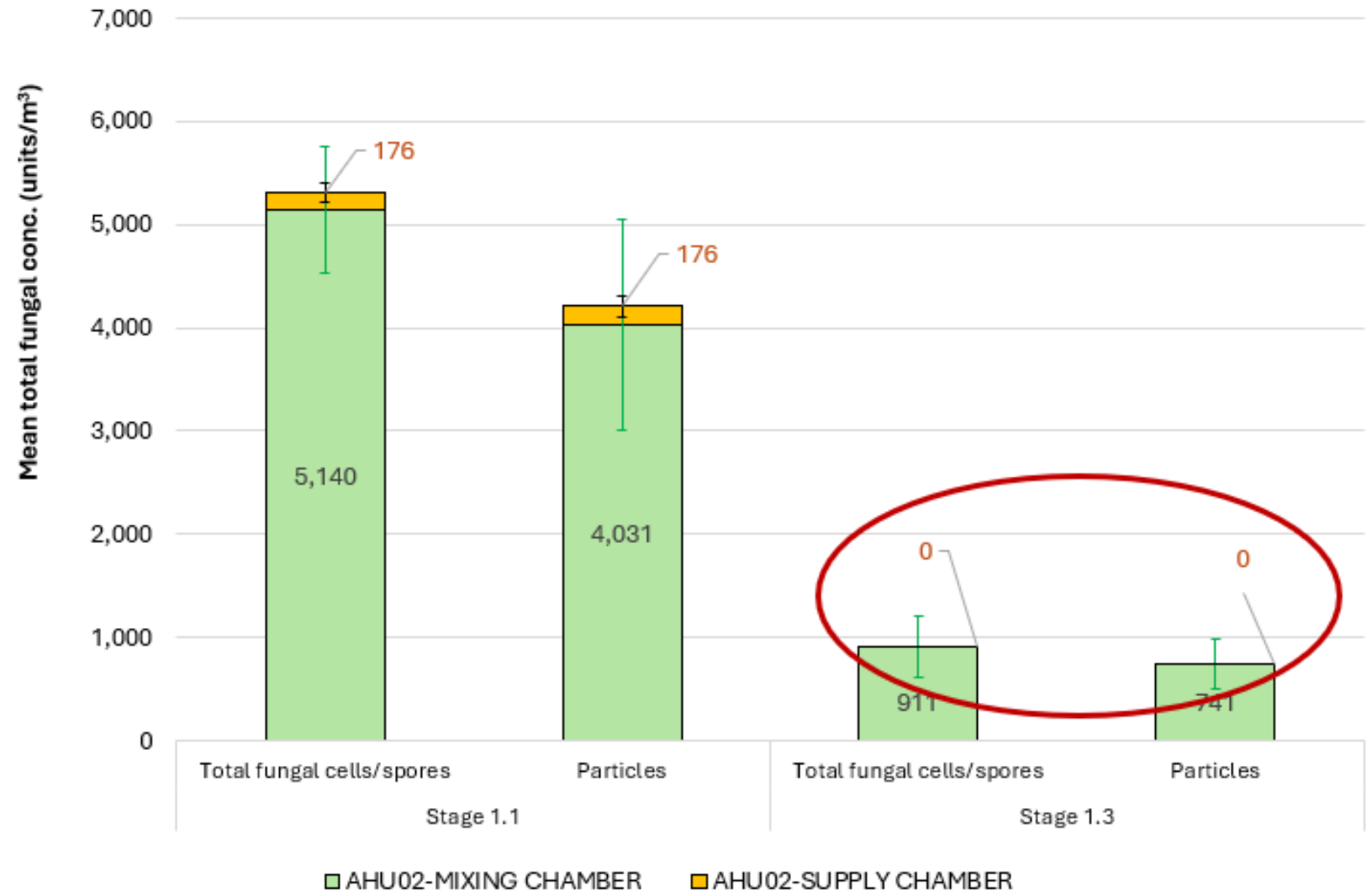
Energy
Consumption

Particles
0.3 to 25 microns

Total
Fungi Levels

Eliminated
Entirely

Airborne Fungal Structures in AHU02 Sections Before and After the Intervention



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Volatile Organic
Compounds

Alcohols
only
Detected

Ethyl Alcohol
+
Isopropyl Alcohol Only
(Disinfectant wipes and hand gel)

Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

Peak Load

Energy
Consumption

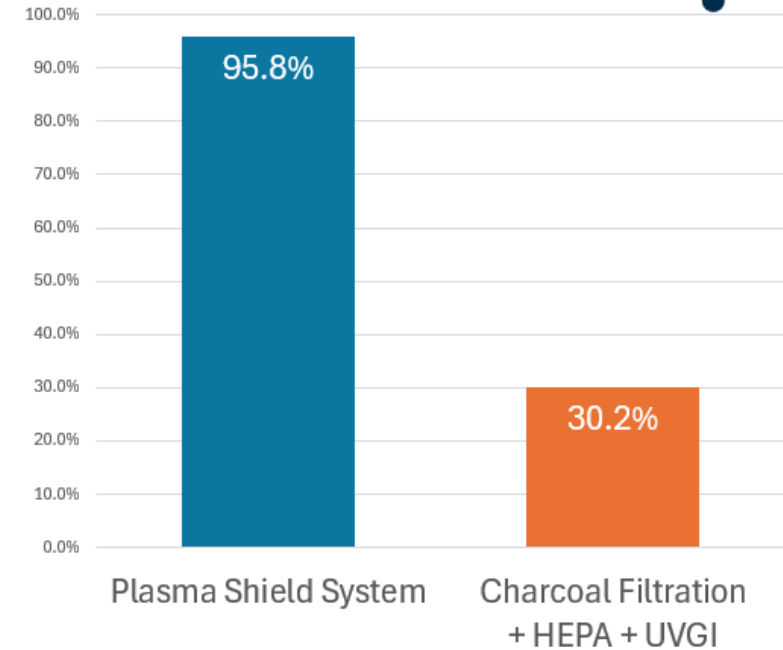
Particles
0.3 to 25 microns

Semi-Volatile
Organic
Compounds

3x Better
than
Charcoal

Bushfire Smoke Testing

Semi Volatile Organic Compound	Single Pass Removal Efficiency
O-cresol	99.0%
P-cresol	90.0%
M-cresol	97.0%
Guaiacol	94.0%
Syringol	99.0%



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

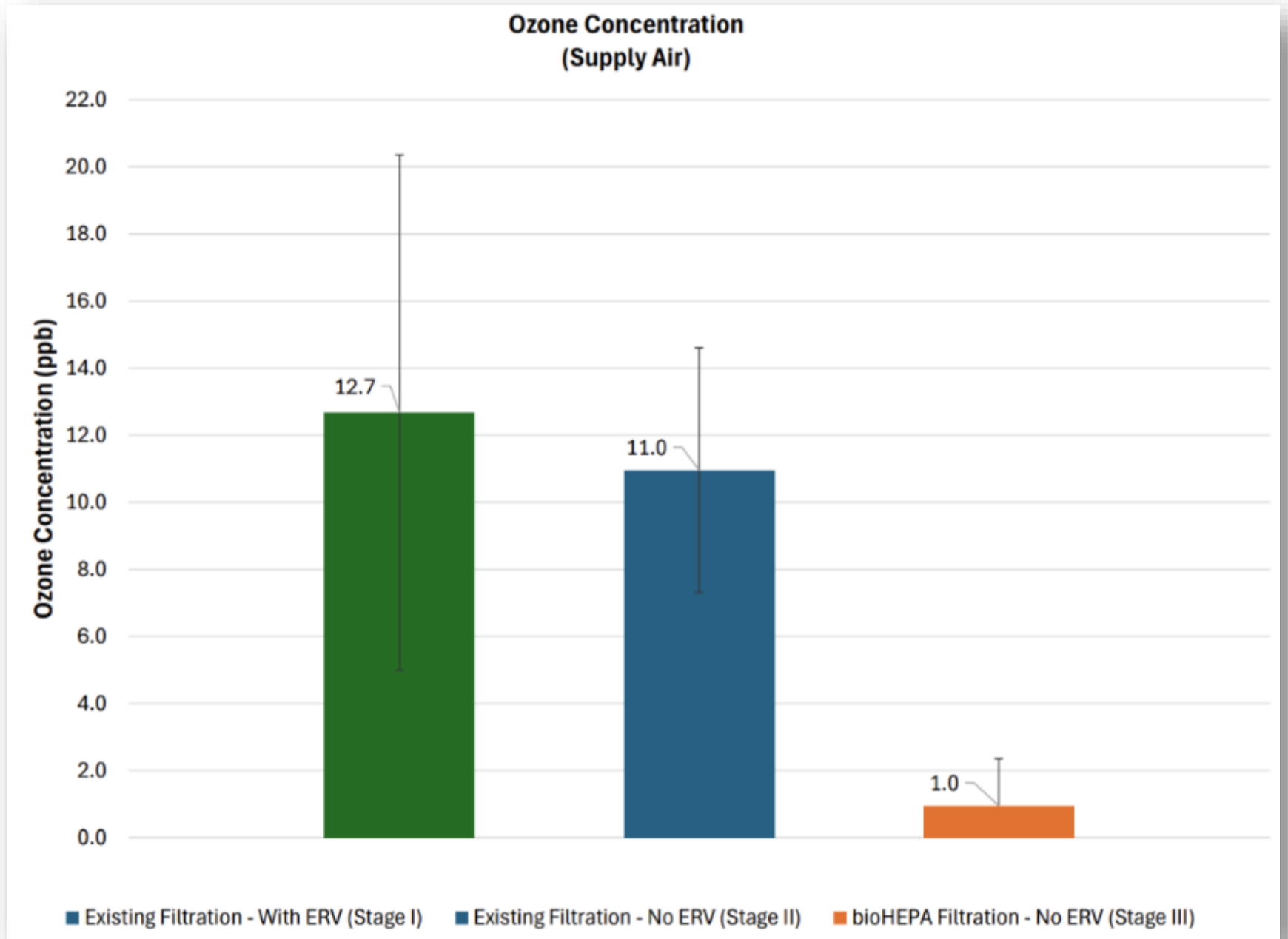
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Ambient Ozone

Technology
Destroyed
Ozone



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Formaldehyde

Not
Detected

WHO indoor air quality guideline is 100 ug/m³

All values at the Mixing Chamber - before the filter - were less than 3 µg/m³ in each Stage

Formaldehyde in the Supply Air - after filter - was not detected after bioHEPA installation

Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

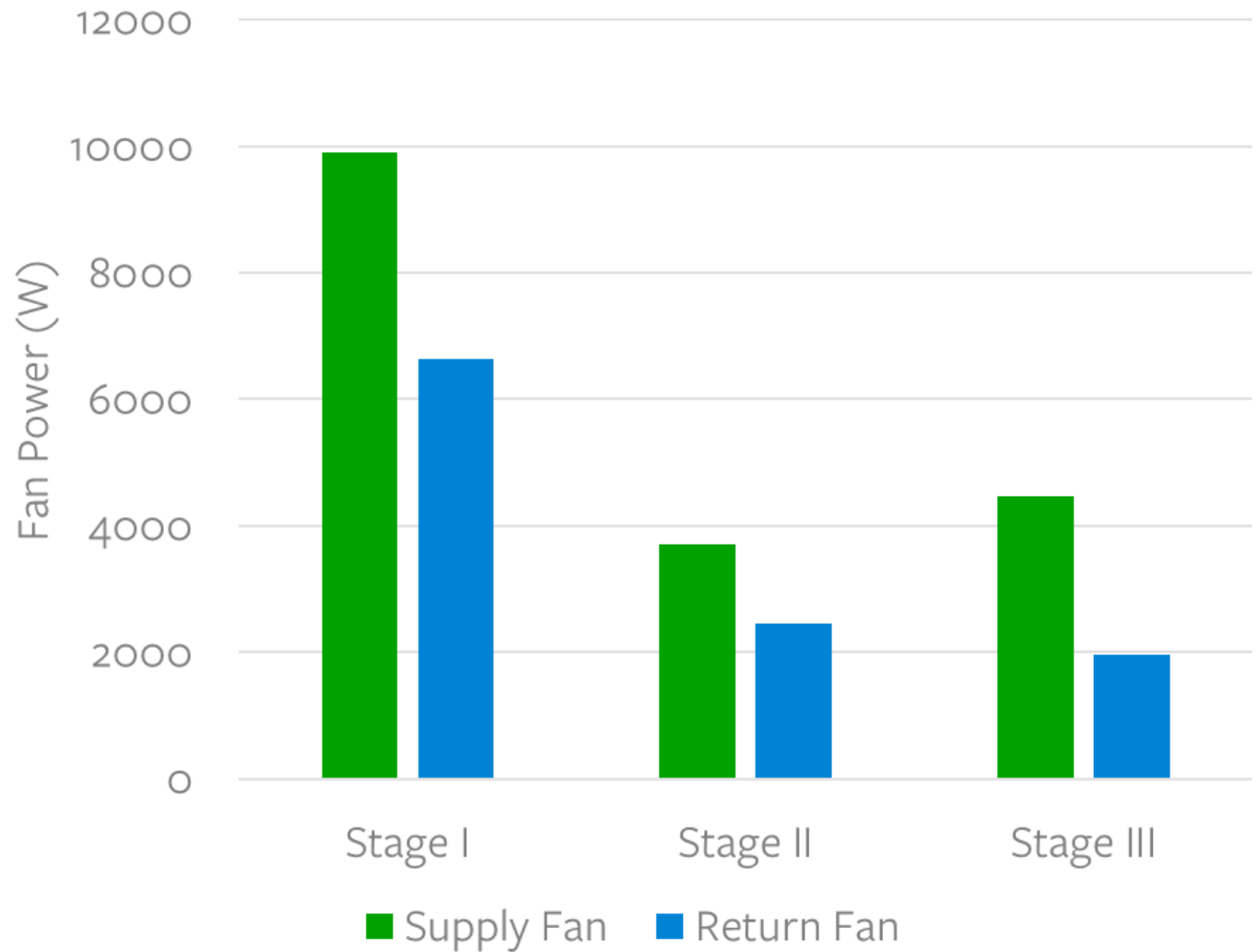
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Pressure Drop

↓ 604
Pascals



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Peak Load

↓ ~10%

51%

Energy Recovery
Ventilation

66.7%

Optimal
Decontamination
Strategy

Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

Pressure Drop

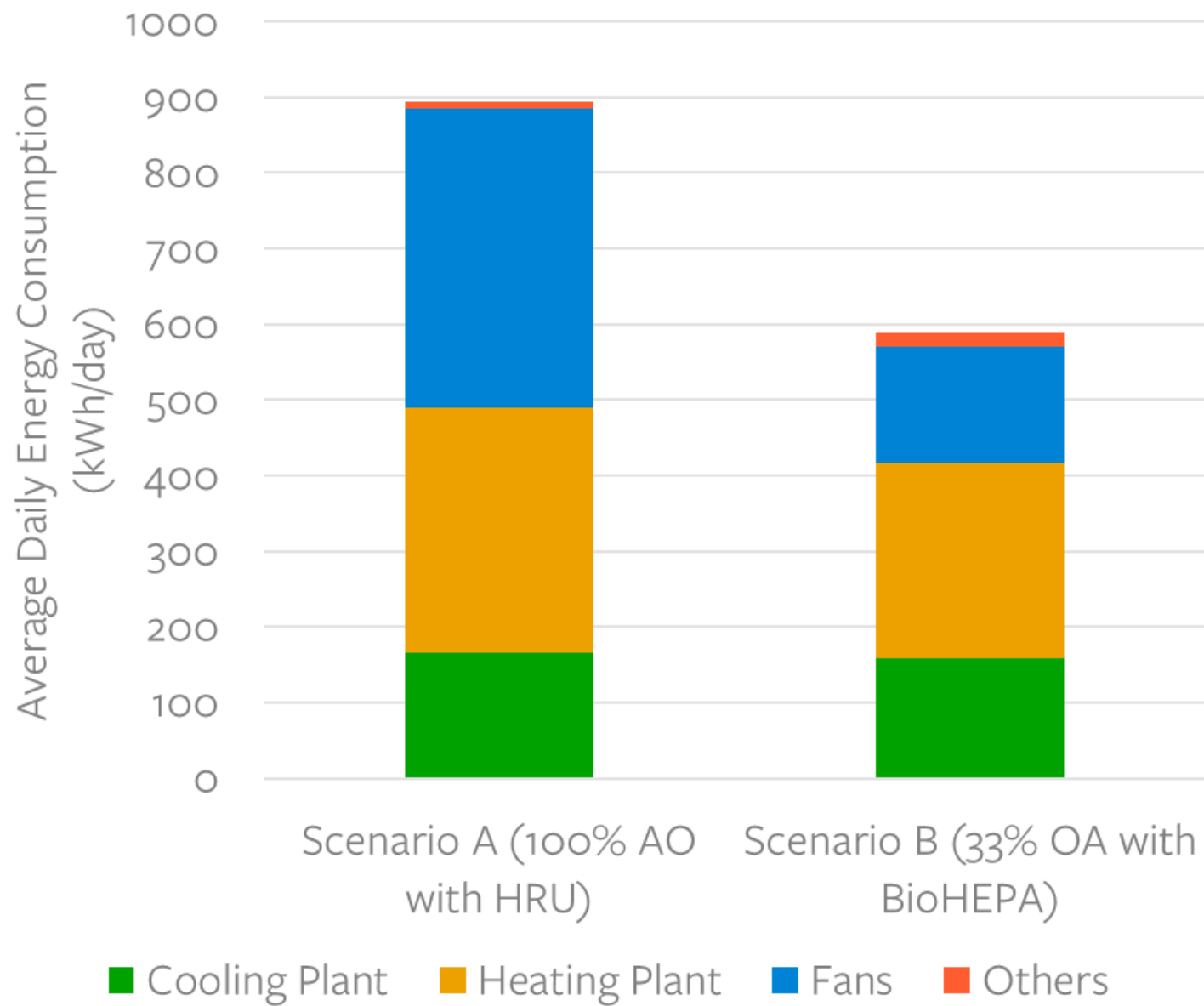
Peak Load

Energy
Consumption

Particles
0.3 to 25 microns

Energy
Consumption

↓ 34%



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 100
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

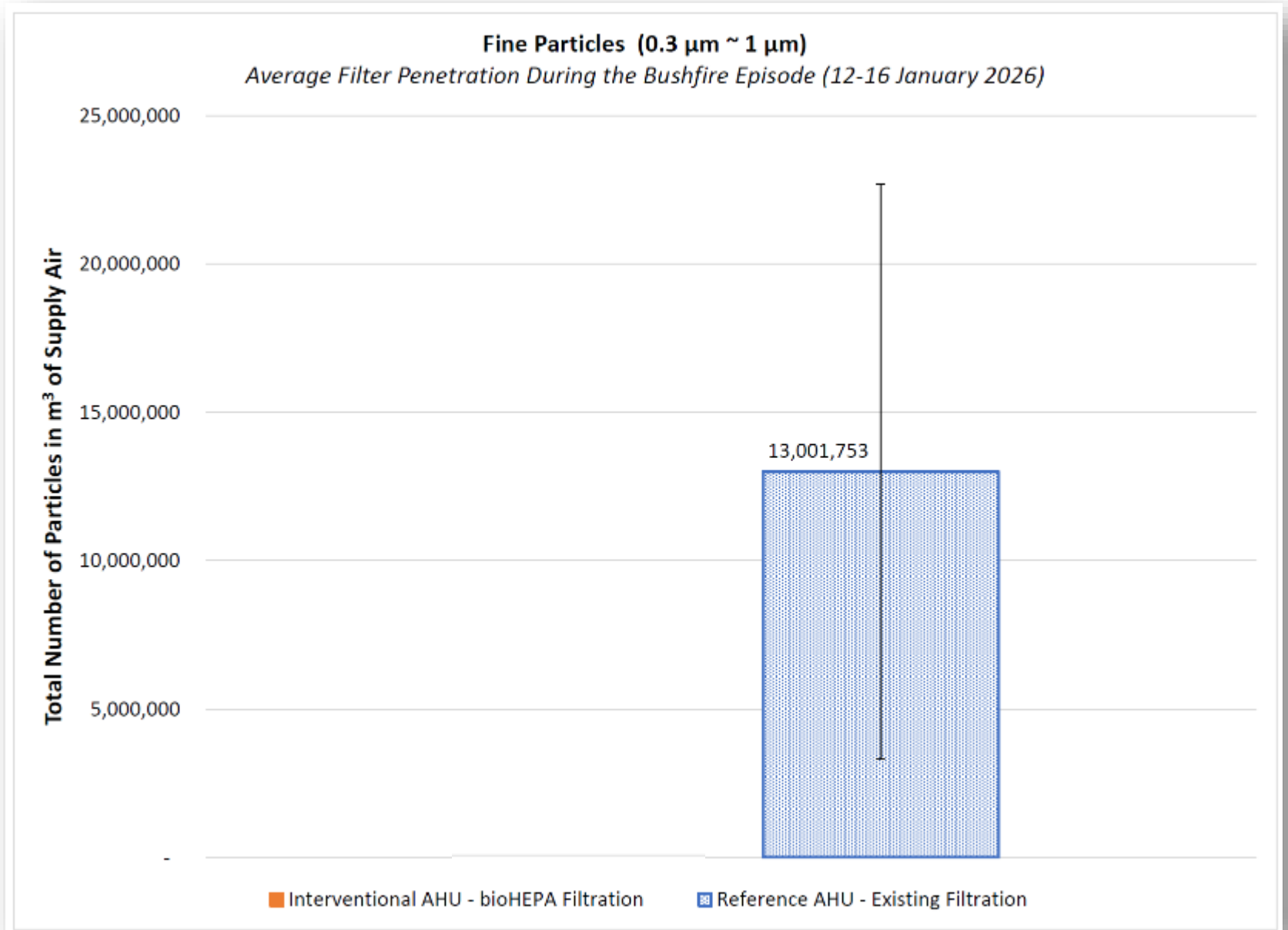
Pressure Drop

Peak Load

Energy
Consumption

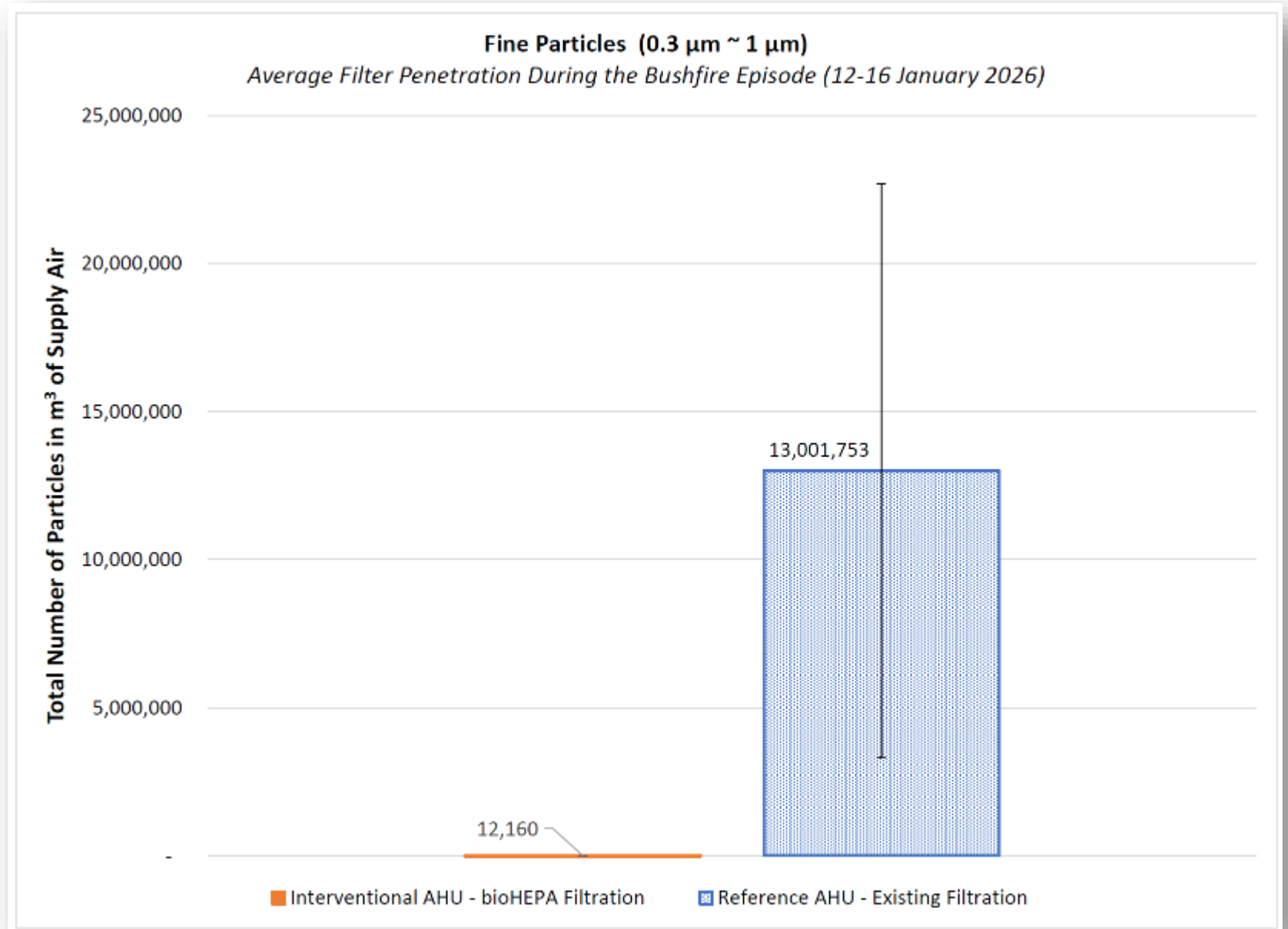
Bushfire Smoke
Infiltration

Bushfire Smoke Infiltration



Bushfire Smoke
Infiltration

1,000x
Improved



Bushfire Smoke Bingo

Number of Data
Records

Bushfire
Distance

Bushfire
Duration

Carbon Dioxide

Filtration
Efficiency

Filtration
Consistency

Ultra Fine
Particles
20 to 500
nanometres

Fungi

Volatile Organic
Compounds

Semi Volatile
Organic
Compounds

Ozone

Formaldehyde

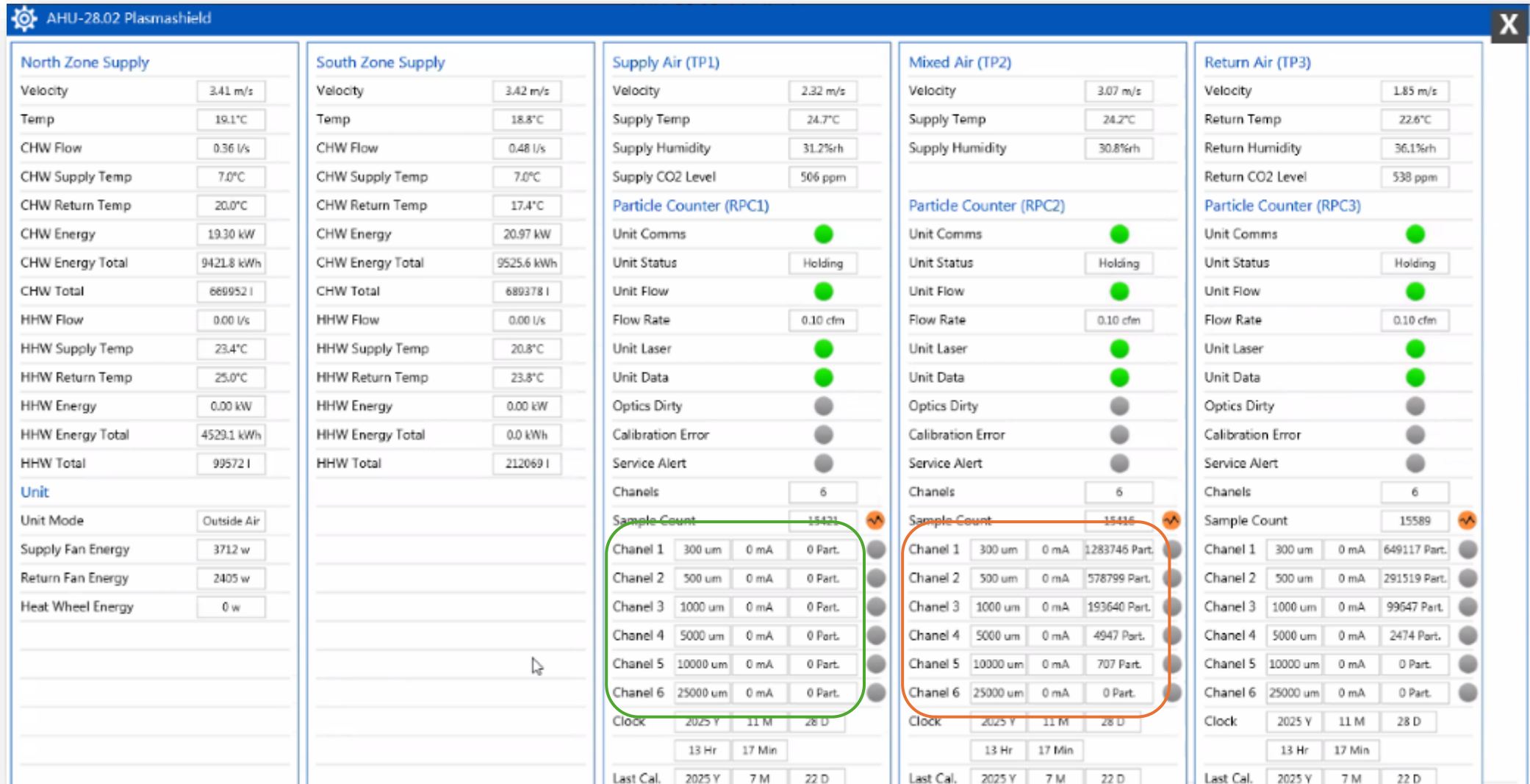
Pressure Drop

Peak Load

Energy
Consumption

Bushfire Smoke
Infiltration

Australia's First Bushfire Smoke Connected BMS



The Enhanced Approach

Maintain Pandemic Mode
+ *Solve Bushfire Smoke*
+ *Solve Bushfire Odours*
+ *Eliminate Mould*



Lower Peak Load
+ *Manage Pressure Drop*
+ *Reduce Energy Use*
+ *Avoid Additional Space*



5-7 May 2026



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The Enhanced Approach

Maintain Pandemic Mode
+ *Solve Bushfire Smoke*
+ *Solve Bushfire Odours*
+ *Eliminate Mould*



Lower Peak Load
+ *Manage Pressure Drop*
+ *Reduce Energy Use*
+ *Avoid Additional Space*

Robust System
&
Multiple Hazard Resilience



5-7 May 2026

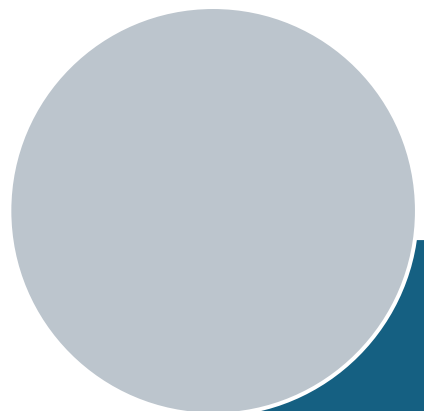


Melbourne Convention & Exhibition Centre

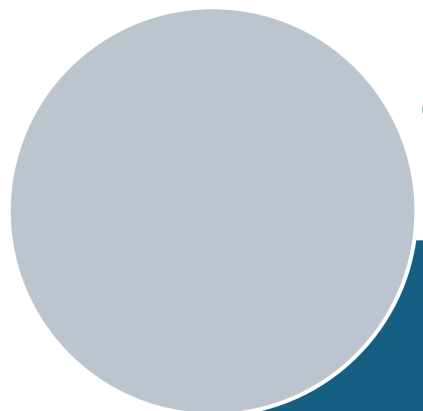


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Sustained Clinical Operations
in Multi Hazard Conditions



Survival



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FIRE
AUSTRALIA2026



bioHEPA Unit

Cleans & Filters Air

One unit, per 45 occupants.

A Huber & Ranner Decontamination AHU (D-AHU) Powered by Plasma Shield Technology

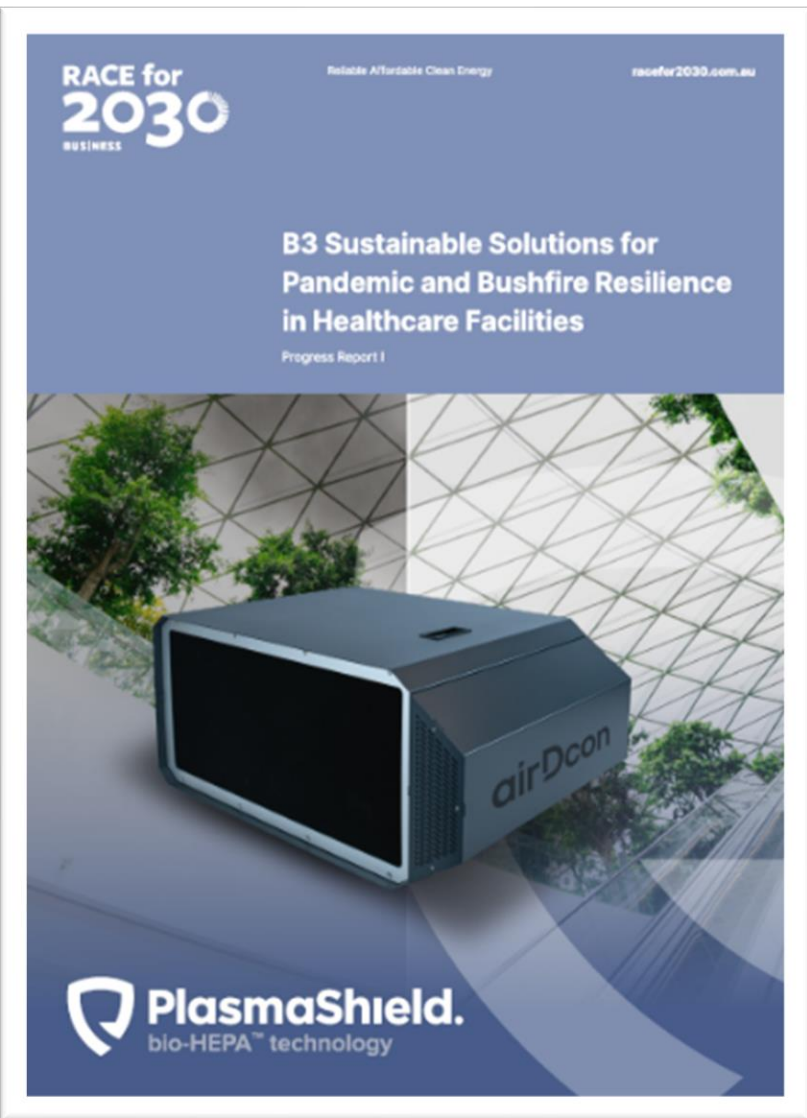


**HUBER &
RANNER**

ERWARTEN SIE MEHR.



PlasmaShield.
bio-HEPA™ technology



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Outdoor Air + Equivalent Clean Air
=
Better Air Quality + Lower Energy

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