

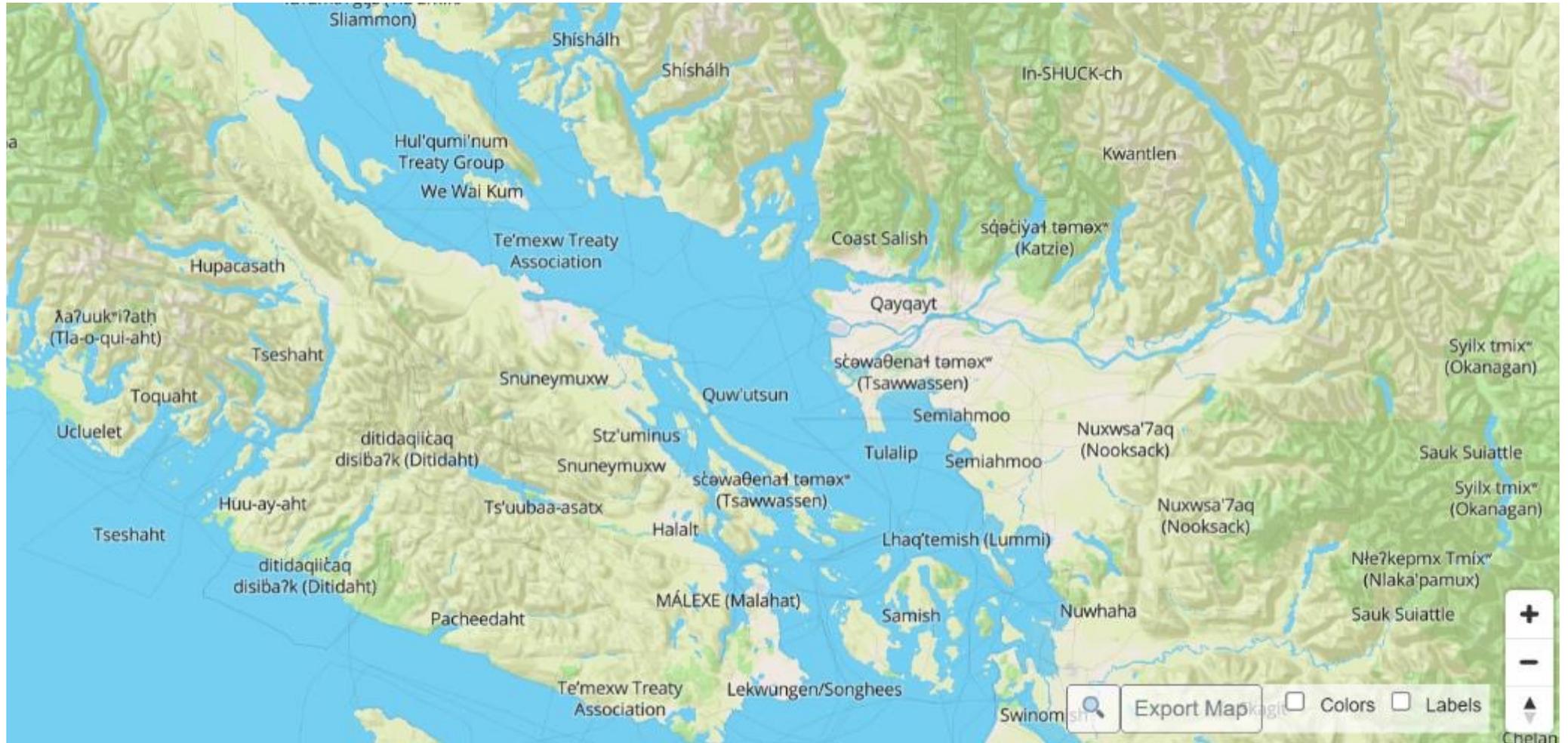


# Air Quality & Health Workshop – Case Study

Magdalena Szpala, Director, Sustainability & Resilience,  
BC Housing

**June 16, 2022**

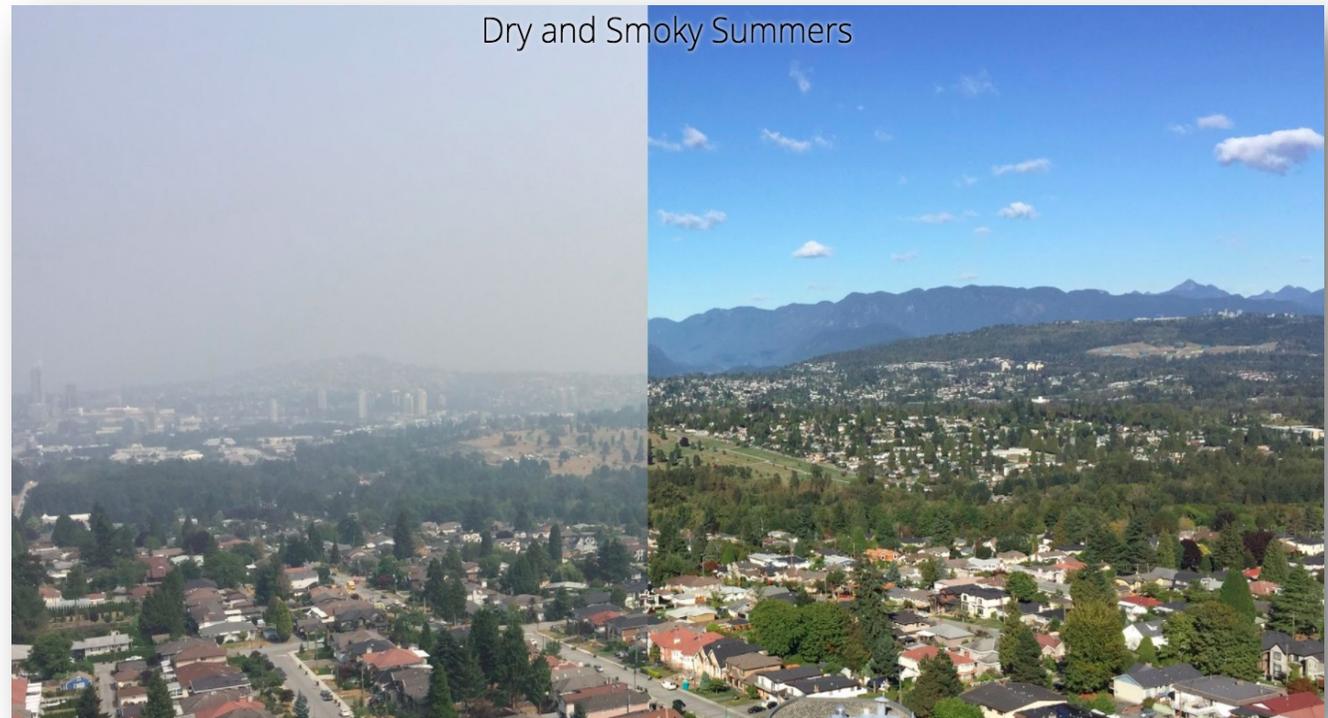
# Acknowledgement



<https://native-land.ca/>

# Presentation Outline

1. About BC Housing
2. What we're doing to be better prepared for heat & smoke
3. What we're learning



Development, management  
and administration of  
affordable housing;

Licensing of residential builders,  
administration of owner builder  
authorizations, and research and  
education.

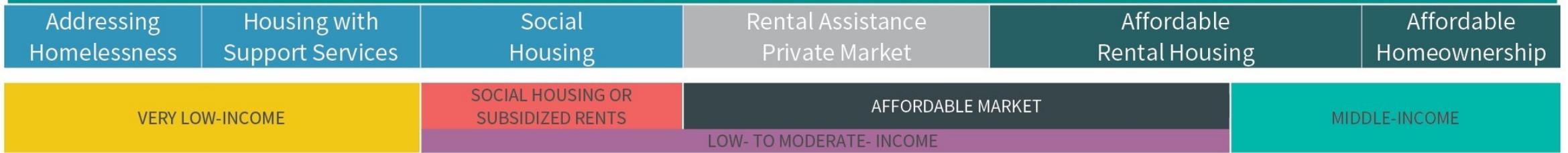


# What does BC Housing do?

- develops a range of housing options
- works with about 800 housing providers
- helps more than 110,000 households in communities across BC
- licenses residential builders
- administer owner builder authorizations
- carries out research and education that benefits the residential construction industry and consumers

## Who We Serve

- Individuals who are homeless
- Individuals with disabilities
- Indigenous individuals and families
- Women and children at risk of violence
- Low-income seniors and families
- Buyers of new homes



Typically \$375/month  
(supportive housing & shelter-rate rentals)

Social Housing: < \$65,000  
Affordable Market Rentals: < \$74,000

< \$99,000

*\*Income limits are based on the Statistics Canada Annual Household Income Survey*

# Key Areas of BC Housing's Extreme Heat & Wildfire Smoke Response



Protecting tenants  
and clients



Making buildings  
more resilient



Collaborating  
with others

# 2022 Survey of the Non-Profit Housing Sector



What would help next time?

- Access to additional funding to purchase items directly
- Access to information such as sample response plans, and health info

38% of respondents identified they do not have a plan in place for extreme heat for summer 2022

The majority of those respondents felt that templates would assist in developing plans



# Components of BC Housing's Response Plan

Education & awareness

Communication

Roles & responsibilities

Tenant risk assessment & wellness-checks plans

Create on-site cooling/clean air options

Communicate off-site cooling/clean air options

Equipment & supplies

Evaluation and update

# Engagement of people with lived experience of extreme heat events in B.C. in 2021

Feedback from service provider **organizations** supporting heat-vulnerable and **people** with lived experience (from equity denied groups):

1) **People with disabilities**

2) Socially isolated & economically marginalised **seniors** (rural and urban)

3) People who are **unhoused** / insecurely housed while often experiencing mental health or substance use challenges (rural and urban).

## LIVED EXPERIENCE OF EXTREME HEAT IN B.C.

Final Report to the Climate Action Secretariat

By Lilia Yumagulova, Tira Okamoto, Erica Crawford, Kerri Klein

April 2022



*“Oftentimes when systems are not in place to offer supports, those on the front lines and in community carry the load. These are the same people carrying the load the rest of the year. Staffing capacity is stretched, resources are scarce, and people are tired.”*

*“Isolation is a major factor... partly chosen [as] people moved to a more remote valley. The mental part and the practical part of isolation is particularly hard for seniors [with] no phone, Internet or vehicle... We had extreme heat, extreme drought, extreme smoke - a deadly challenge over 4 days of extreme heat and their phone is not working. People [were] unhappy or desperate, and not feeling able and not aware to initiate accessing resources.”*

(Susan, Rural Service Provider)

# Key messages

- 1** Focus needs to be on **cooling infrastructure, not just cooling centres**, to keep heat-vulnerable populations safe.
- 2** Heat response must be **resilient to compounding effects**, such as pandemic restrictions, holiday closures, & wildfire smoke.
- 3** There is an **opportunity to apply existing response plans** (e.g., extreme cold, COVID-19) to heat and initiate community-level response and supports.
- 4** **Urban and rural communities have differing needs and priorities** for addressing social inequities exacerbated by heat.
- 5** People living in B.C. can **no longer escape the frequency and intensity of climate change** and we must adapt and be flexible to **our new normal**.

# Making Buildings More Resilient

- **Research: studies, publications, industry trainings**
- **Mobilizing Building Adaptation & Resilience (MBAR): pilot projects, collaborations, round tables**
- **Updates to BCH's Design Guidelines and Construction Standards**
- **Upgrades and retrofits of the existing stock**



## Indoor Environmental Quality of Social Housing Buildings in British Columbia



- Twenty-five suites across five buildings in Metro Vancouver area.
- Sensor collected ambient air temperature, relative humidity (RH), and CO<sub>2</sub> concentrations at 15-minute intervals.
- Suite airtightness and airflow rates through the bathroom exhaust fans were also measured both before and after the retrofit periods (2017-2020)
- Study conducted by RDH Building Science Inc.

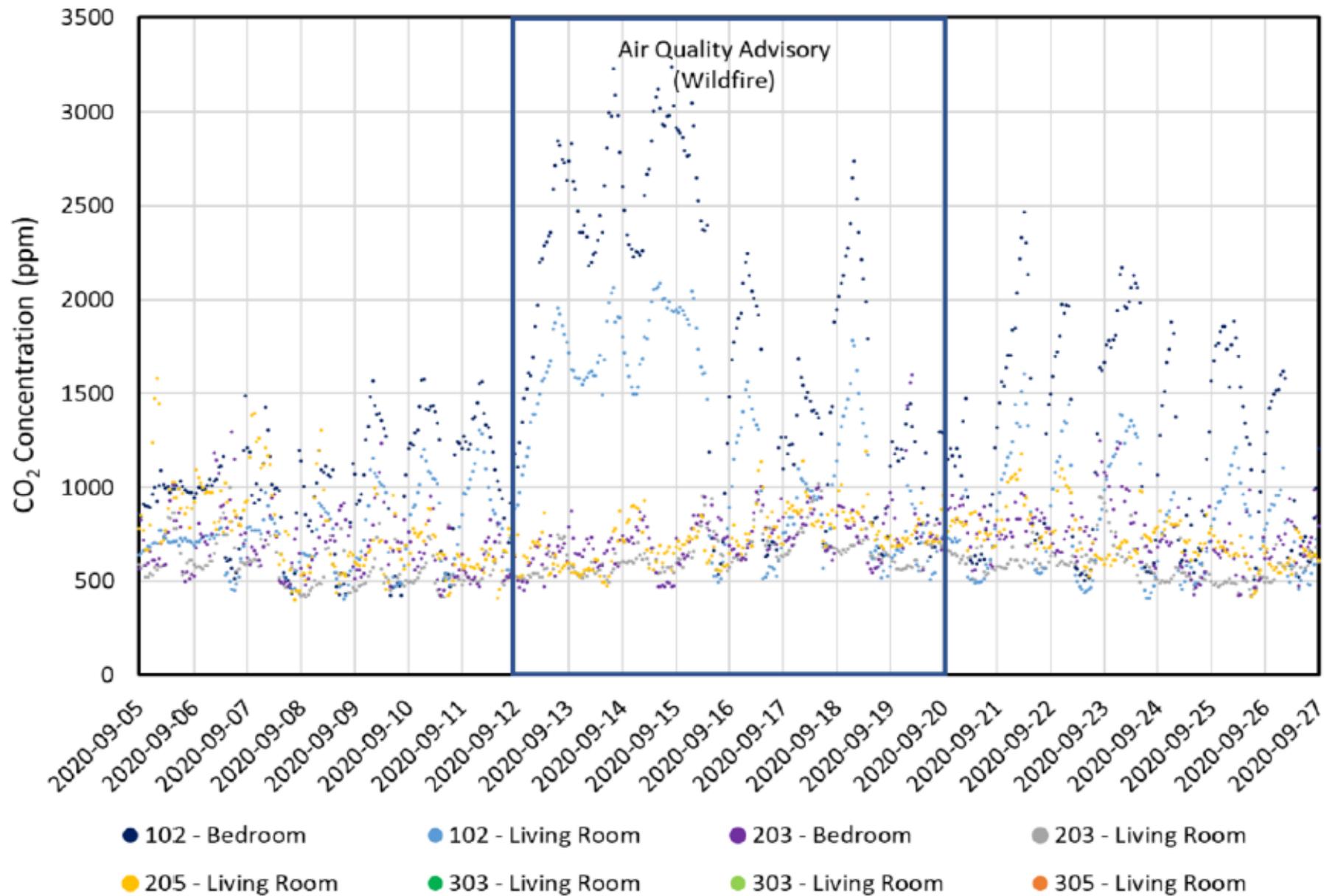
## Key Findings

- Four of the five monitored buildings experienced significant periods of overheating. Relying on open windows was generally ineffective as a cooling strategy for the monitored suites and led to negative IEQ consequences such as transfer of odours and exposure to outdoor contaminants (e.g., wildfires).
- No significant trends were observed in the monitored IEQ parameters pre- and post-retrofit. Continued reliance on open windows for ventilation and the lack of IEQ specific upgrades likely contributed to this finding.
- Improved exhaust fan performance had no significant impact on the monitored IEQ parameters. This is likely the result of lack of use, which may be due to fan noise or other factors.

## Wildfire Smoke (Sept. 2020)

As operable windows were often the main source of fresh air ventilation and cooling in the suites, the wildfires were expected to result in a measurable increase in the indoor air temperature, RH, and CO<sub>2</sub> concentrations.

The results show that the temperature in Building B did not significantly change as a result of the advisory; however, the CO<sub>2</sub> concentrations in Building A appear to have increased suddenly at the beginning of that period (air quality advisory due to smoke).



Appendix F.2 – Carbon Dioxide concentrations for three-week period during Air Quality Advisory (Wildfire) for Building A

# Recommendations

Include specific IEQ strategies for future retrofits, including:

- Addition of suite-level ventilation to provide consistent supply of fresh air to suites instead of relying on exhaust only ventilation and windows (e.g., heat recovery ventilators)
- Addition of suite-level control of space heating equipment
- Suite compartmentalization to improve air sealing between suites and to reduce contaminant transfer (e.g., odours, pests, etc.)
- Addition of active cooling (e.g., centralized air-source or ductless mini-split heat pumps)
- Installation of windows with low solar heat gain coefficients (SHGC) or exterior shading to reduce incoming solar radiation

Providing an airtight enclosure with adequate ventilation & filtration.

# Methods for mitigating smoke from wildfires in the existing BC Housing buildings

Method	Description
Upgrading filters in HVAC systems	MERV-13 or HEPA
Smoke Preparation Supplies	Portable air cleaners
Maintaining & upgrading HVAC Systems	Repairing broken dampers & controls
Optimize system air flow	Assess & maintain adequate airflows, maintain a positive building pressure
Add supplemental filtration when needed	Weatherize the building envelope to reduce infiltration by sealing and caulking cracks
Monitor Indoor PM2.5	Purchase & install PM2.5 sensor



MERV-13 Filter Installed on Rooftop Unit's Air Intake

Source: Pento Consulting report for BC Housing, Jan.2022

# Methods for mitigating smoke from wildfires in the new BC Housing buildings

Method	Description
<b>MERV-13 Filters in Central Air Handling Units</b>	All air handling units shall be specified with MERV-13 filters and MERV-8 pre-filters
<b>HEPA Filters in Central Air Handling Units</b>	Could include a provision for replacing MERV-13 filters
<b>MERV-13 Filters in In-suite ERVs</b>	ERVs should include an option of accepting MERV-13 filters
<b>Reducing Supply of Outdoor Air for Corridor Makeup Air</b>	Provide corridor makeup air units with VSDs to allow reducing supply of outdoor air in wildfire season
<b>Permanent Air Purification Devices</b>	Purification devices such as Panasonic WhisperAir™ units can effectively reduce odors and inhibit harmful pollutants



MERV-13 Filter

Source: Pento Consulting report for BC Housing, Jan.2022

# Upcoming changes

1. Addition of MERV-13 or HEPA filtration requirements
2. Use of future climate files for assessing the risk of overheating & design of mechanical systems
3. Requirements of passive cooling designs
4. Requirements for overheating analysis on major retrofits

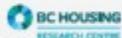


# BC Energy Step Code Design Guide Supplement S3 on Overheating and Air Quality

June 2019



SUPPLEMENT S3  
Version 1.0



Topics include:

- What is Overheating?
- What is Indoor Air Quality?
- Understanding Weather Data
- Performing a Future Climate Analysis
- Key Design Strategies:
  - Passive Cooling
  - Shading to Block Solar Heat Gains
  - Natural Ventilation
  - Coupling Passive Cooling with Active
  - Air Filtration
  - Including Refugee Areas
- Case Studies

## Cooling in New Construction

## HEAT WAVE



**Risks to Buildings, Occupant Safety & Environment**

- Overheating beyond typical comfort conditions
- Electrical system overload due to increased energy usage associated with ventilation and air conditioning systems
- Potential utility service interruption due to increased energy usage
- Decreased lighting and communications connectivity
- Risk of heat exhaustion or loss of life due to overheating, dehydration or hyperthermia
- Decreased outdoor and indoor air quality due to smog and associated risk to human health

**Site Strategies**

Strategy	Cost	Impact	Alignment
Identify and incorporate opportunities for cross-ventilation during floorplan development to increase air flow without dependence on mechanical systems	\$	***	🌬️
Reduce parking, walk and/or add shading or vegetation to reduce the heat island effect	\$	**	

**Design Strategies**

Strategy	Cost	Impact	Alignment
Conduct simulations to explore the thermal performance of individual suites and the building as a whole, focusing on windows to wall ratio, window to floor area ratio, window thermal performance and solar heat gain coefficient, wall thermal performance, airtightness, shading, natural ventilation, stack effect and solar orientation	\$	***	🌡️🌬️
Use the latest climatic data for the modelling of thermal performance of the building and individual units	\$	*	🌡️🌬️
Increase thermal mass performance of horizontal and vertical surfaces through	\$\$\$	***	🌡️

## POWER OUTAGES & EMERGENCIES



**Risks to Buildings, Occupant Safety & Environment**

- Reduced functionality of building heating & cooling systems compromises indoor thermal comfort
- Access to potable water and sanitary services cannot be guaranteed
- Decreased lighting and communications connectivity
- Decreased indoor air quality and associated risk to human health due to lack of ventilation, increased humidity, condensation, and mould
- Meat
- Vul
- Ca

## AIR QUALITY



**Risks to Buildings, Occupant Safety & Environment**

- Decreased outdoor and indoor air quality due to allergens (e.g. pollen)
- Risk of building-related and non-specific building-related illness
- Electrical system overload due to increased energy usage associated with ventilation and air conditioning systems
- Potential utility service interruption due to increased energy usage

**Design Strategies**

Strategy	Cost	Impact	Alignment
Select a minimum of double-paned tempered window and frames with an air barrier seal to provide greater air quality protection	\$	**	🔥
Include mesh debris screens for gutters, eaves and vents to reduce accumulation of allergens	\$	*	🔥
Include mesh screens into operable windows to prevent insects pests from entering occupied areas	\$	***	🌬️🔥🐛
Ensure the building air intakes is away from local sources of outdoor air pollution	\$	***	
Exceed industry standards for ventilation to keep indoor air pollutants and carbon dioxide levels low. Consider including a carbon dioxide monitor to monitor ventilation needs	\$	***	

Number 19



# BUILDER INSIGHT



## Modelling the Future Climate in Passively Cooled Buildings

**Overview**

The Province of British Columbia will experience significant changes in climate over the next several decades. Temperature increases of between 1.3 and 2.7°C are projected by 2050, and the province is already experiencing more extreme weather, including frequent and severe heat waves and wildfire events as a result. The impacts of these

**Builder Insight** is a series of bulletins and companion videos designed to provide practical information on new technologies, research results, good building practices and emerging technical issues in residential construction to Licensed Residential Builders and others in the industry.

Other BC Housing publications, available at [BCHousing.org](http://BCHousing.org)

***I think the heat dome  
has made it so clear that we need to view  
cool and clean indoor air as a human right***

**Dr. Melissa Lem**

(in Globe & Mail article by Kathryn Blaze Baum, 11 June 2022)



# Questions?

For more information, please contact:

Magdalena Szpala, [mszpala@bchousing.org](mailto:mszpala@bchousing.org)