




Iain A Macdonald

## Residential Mechanical Ventilation Systems in Canada

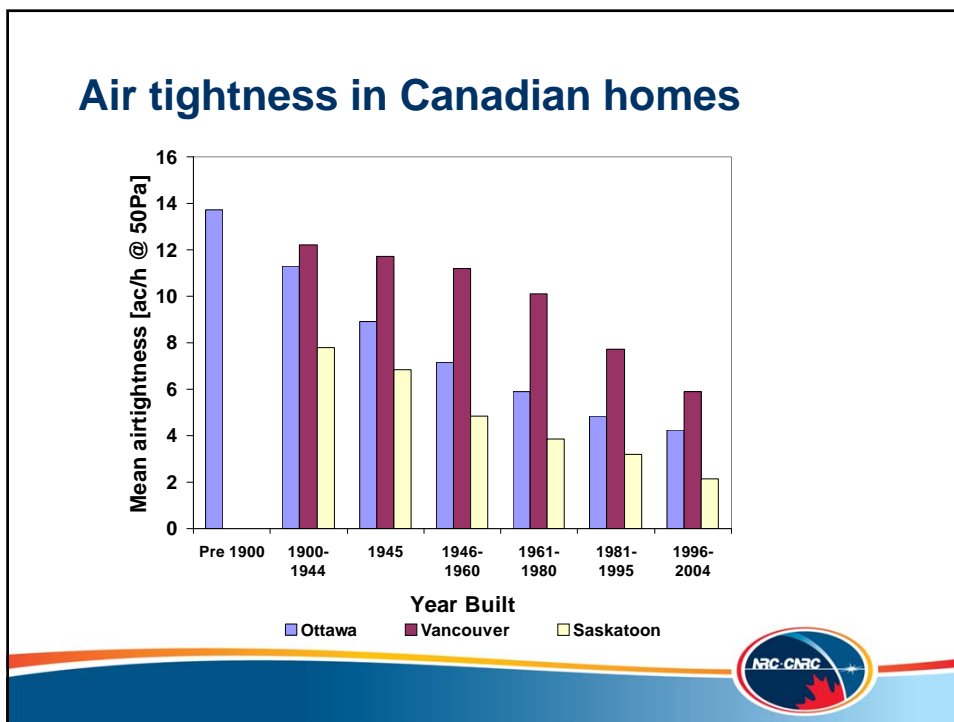
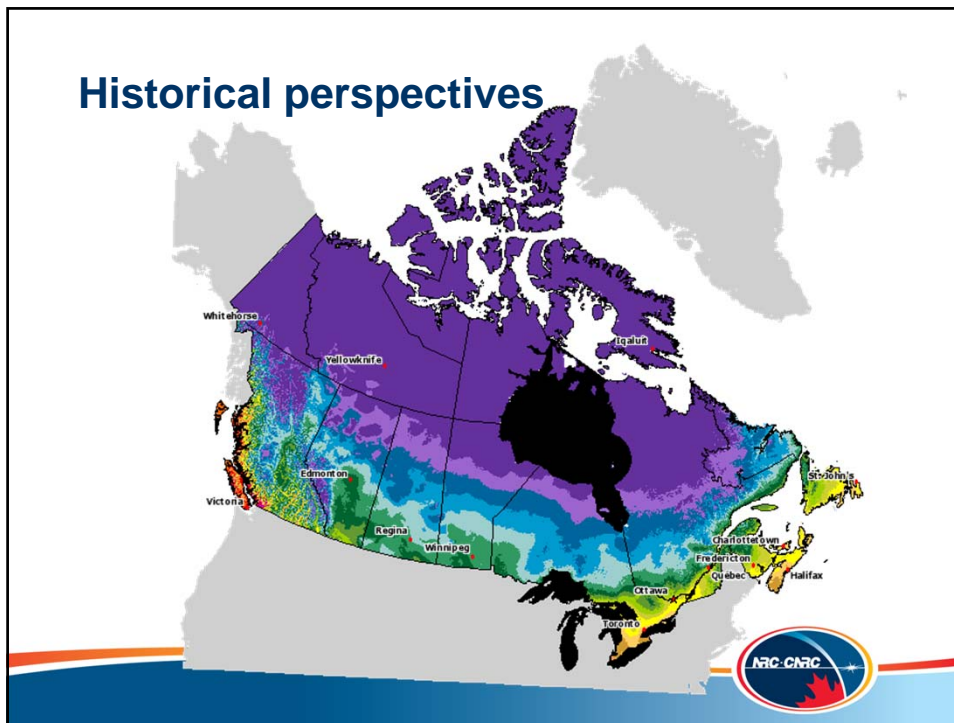
 National Research Council Canada  
Conseil national de recherches Canada

Canada 

### Outline

- Historical perspectives and code development.
- Recent field study results.
- New evaluation protocols.





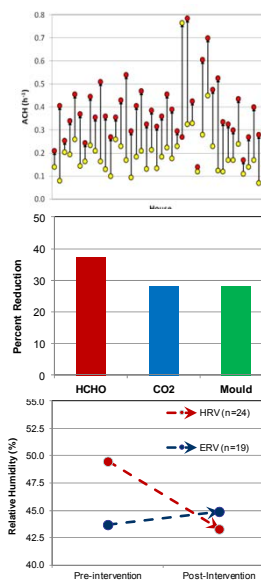
## Field study on Ventilation and Health

- Comprehensive study analysing associations between 16 IAQ measurements with 4 ventilation parameters in 115 homes.
- Assessment of respiratory health of asthmatic children by our research health partner INSPQ.
- Quebec's Working Group on Residential Ventilation is integrating our data in their recommendations for residential ventilation.



## Field study findings

- 83% of the homes were under-ventilated ( $ACH < 0.30 \text{ h}^{-1}$ ).
- HRV/ERV's intervention:
  - increased ventilation.
  - improved IAQ.
  - managed RH.



## Field study findings

Increased ventilation noticeably improved IAQ:

Parameter	Pre-intervention (median)	Post-intervention (median)
CO <sub>2</sub> (24-hr, ppm)	899	770*
Formaldehyde ( $\mu\text{g m}^{-3}$ )	34.3	24.1*
Ethyl acetate ( $\mu\text{g m}^{-3}$ )	10.9	5.5*
$\alpha$ -pinene ( $\mu\text{g m}^{-3}$ )	13.3	5.9*
Airborne mould spore (CFU M <sup>-3</sup> )	57	30*

\* Statistically significant to  $p < 0.05$



## Indoor Air Purification Solutions

- Develop and use protocols to assess the efficacy of solutions & technologies.
- Establish three more scientific and consensus-based protocols.
- Apply protocols to commercially available products and technologies.



## Indoor Air Purification Solutions

Guidance by a Technical Advisory Committee:

- Provide advice on evaluation protocols.
- Representatives from Federal and Provincial agencies, industry associations, NGOs, municipal governments, and standards associations.



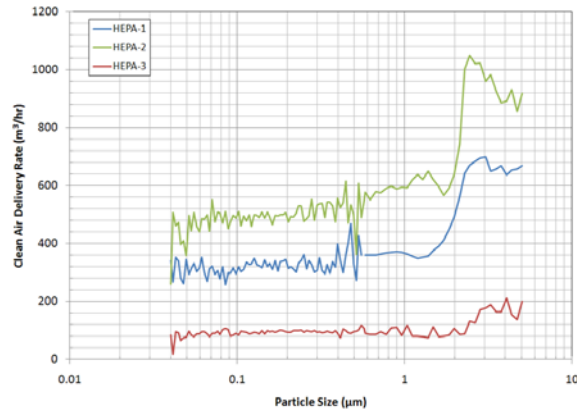
## Portable Air Cleaners (PACs): Objectives

Evaluate initial performance with respect to:

- Emissions and by-product formation.
- Particles and VOC removal.
- Energy consumption.
- Noise generation.



## Portable Air Cleaners (PACs): Outputs/Outcomes



Size-dependent filtration performance of PACs incorporating HEPA filtration  
(Source: Zuraimi, Nilsson et al. 2010)



## Portable Air Cleaners (PACs): Outputs/Outcomes

- Protocol validated against 12 commercially available PAC's employing various technologies.
- Draft ISO standard on VOCs and particle removal.
- Draft CSA standard on ozone by-product formation.



## Portable Air Cleaners (PACs)

- Controlled test environment.
- Contaminant generation.
- Advanced monitoring.
- Long-term performance.



Monitoring  
Equipment



Full Scale  
Chamber



VOC  
Generation



Nano-particle  
counting



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