Conseil national de recherches Canada | National Research Council Canada

Indoor Air Quality Technologies and Health: Canada's R&D Framework and Initiatives

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National Research Council : Business Lines

Strategic Research and Development

Technical Services

Industrial Research Assistance Program

Science Infrastructure

NRC Construction

Research and technical solutions:

- Higher performing, cost-effective building and infrastructure systems
- Development and commercialization of new and improved products
- Performance validation of products, technologies and systems
- Development of regulations, standards and guidelines for compliance

NRC Construction : Technical Competencies

Building Envelope and Materials

Civil Engineering and Infrastructure

Intelligent Building Operations

Fire Safety

Building Regulations

Technical Services

Government of Canada

National Air Quality Initiatives (2007-2016)

Objective:

Improve the environment and health of Canadians,

by reducing greenhouse gas and air pollutant emissions

- **Emissions** – Federal departments develop source emission targets for transportation, industry, etc.
- **Indoor air quality** – Health Canada and NRC collaborate to develop targets and IAQ solutions
- **NRC provides regulators and industry** with validated technical information on IAQ
- **Support industry** to develop and validate energy-efficient IAQ solutions

Goals of Indoor Air Quality Initiatives (2007-2016)

NRC Activities in Support of Government of Canada's Air Quality Initiatives

Increased research capacity in relation to IAQ and health

Increased understanding of health-relevant IAQ factors and their control

Increased industry capacity to develop new and improved IAQ technical solutions

New and updated guidelines and measures relating to IAQ systems and products

Increased uptake of validated IAQ solutions to reduce health risks

Improved capacity and knowledge to reduce risks in indoor environments

Health of Canadians is improved and health care burden reduced

Research and Technical Objectives

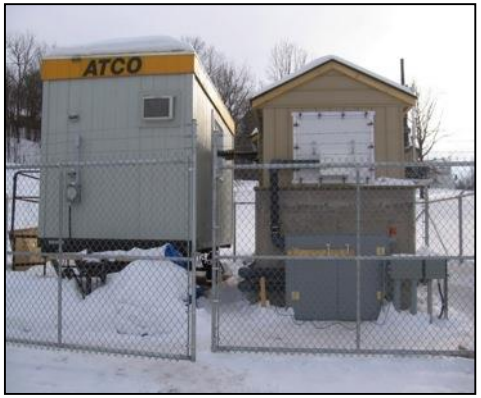
- Expand expertise for lab and field measurements
- Establish relationship among ventilation, IAQ, health
- Develop and deploy technical standards and best practices for IAQ solutions
- Enable industry to develop and validate IAQ solutions

Increased Capacity for Lab Experimentation

Mycologal Laboratory

Analytical Laboratory

Radon Test Facility



HRV/ERV Test Rig

In-duct Filtration and Air Purification

Emission Chambers

New Indoor Air Research Laboratory

Field-measurement of IAQ technologies
under realistic/controlled conditions

Key features

- Flexible architecture
- Building automation system
- Multiple ventilation systems
- Variable envelope air leakage
- Tracer gas systems
- IEQ sensors
- Visualisation of aerosols

Partnership with Health Agencies: New Expertise in Field-Based Measurements

Physical

- Air & wall temp
- IR thermography
- PM
- Fine
- Ultrafine
- Housing and HVAC characterization
- Air exchange rate
- Airtightness

Chemical

- O_3
- NO_2
- Aldehydes
- CO_2
- VOC
- SVOC (dust)
- RH

Biological

- Mould spores
- Air
- Dust
- Settling mould spores
- Endotoxin (dust)
- Ergosterol (dust)
- Allergens (dust)
- Glucans (dust)

Partnerships with medical researchers and health regulators

Field Studies:
Relationship between Ventilation, IAQ and Health

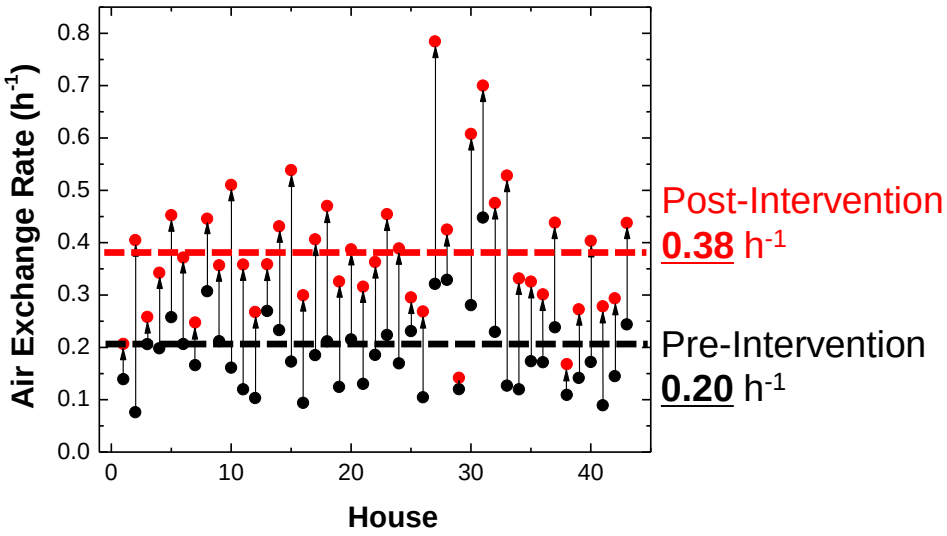
Will increased home ventilation decrease the number of asthmatic symptoms in children?

- Correlation of IAQ with ventilation rates in 111 homes
- Determine the effectiveness of ventilation interventions at improving IAQ and respiratory health

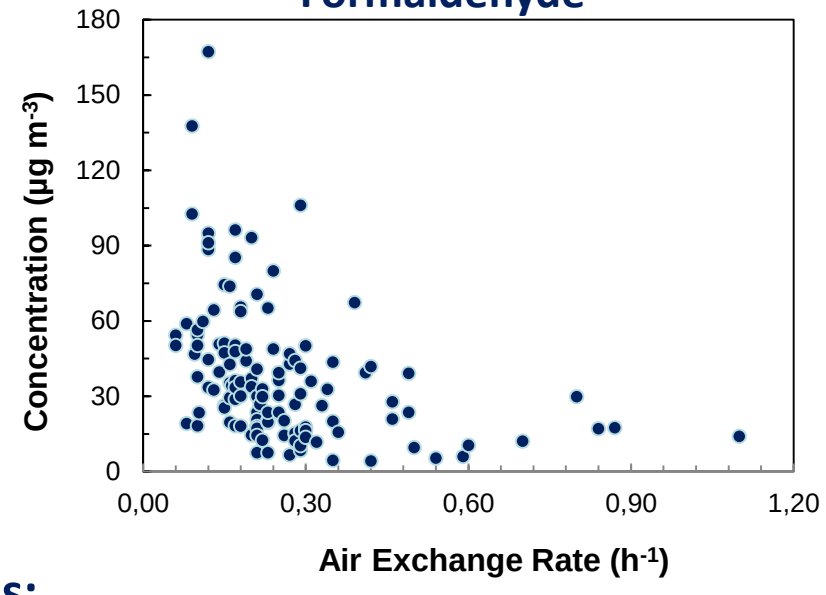
Field Studies:
Relationship between Ventilation, IAQ and Health

Target ventilation rates met through H(E)RV's
Relevant IAQ pollutants significantly reduced

Air Exchange Rate



Formaldehyde



Post-Intervention concentration reductions:

- Benzene ↓15 %
- Formaldehyde ↓30 %
- Airborne mould spores ↓38%

Field Studies:
Residential Attached Garage Intervention Study

Issue: Higher VOC levels in homes with attached garages

Field Study: Effectiveness of solutions at reducing pollutant transfer from garages to occupied spaces

- Solution 1: *Exhaust fan in garage*
- Solution 2: *Improved air tightness of separating wall*

36 homes in Ottawa (2012-2014)

- IAQ measurements pre and post intervention
- Air exchange rate and air tightness measured

Screening and Exposure Assessment Tools

- Develop database of health-relevant contaminants in building materials and consumer products
- Develop next generation of IAQ prediction tools
  - Predict contaminant concentrations
  - Achieve designed IAQ levels
- Canadian health-based emission standards provided by Health Canada
  - First standard on wood products in 2015-2016

Radon Mitigation Methods

Issue: Radon levels in homes above guideline

NRC provides industry with technical information, best practices and evaluation methods for control of radon intrusion

Canadian Centre for Housing Technology and Indoor Air Research Laboratory

Radon Infiltration Building Envelope Test System

Mitigation Methods:
Solutions and Technologies for Air Purification

- Develop and validate protocols and solutions with industry to improve IAQ
- Test products against advanced protocols
- Support industry to develop new technologies


Portable Air Cleaners


HRV/ERV


Indoor Passive Panels


Duct Cleaning


In-Duct Solutions

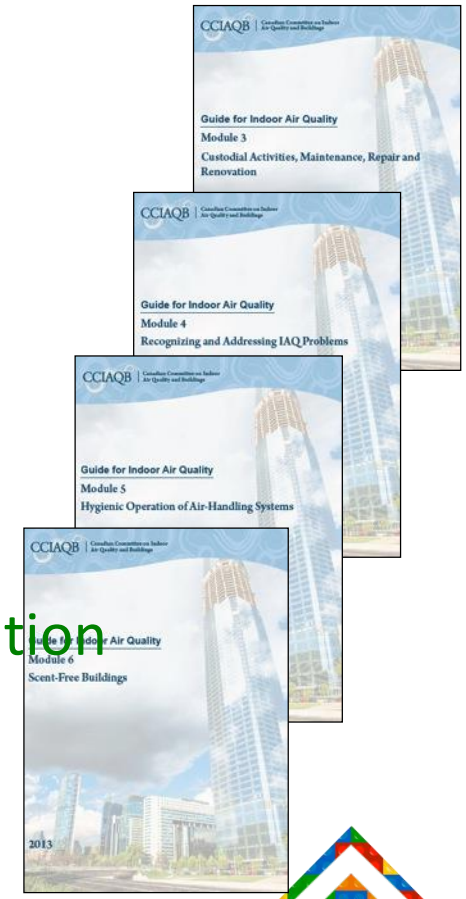
Protocols serve as technical basis for Canadian (CSA) and international (ISO) standards

Canadian Committee on Indoor Air Quality and Buildings

- Multi-stakeholder committee comprised of industry, regulatory bodies and general interest groups

- Mandate: develop and disseminate "best-of-knowledge" and best practices

- Released Guides
  - Introduction to indoor air quality
  - VOC sampling strategies and methods
  - Custodial activities, maintenance, and renovation
  - Recognising and addressing IAQ problems
  - Hygienic operation of air handling systems
  - Scent-free buildings



IAQforum.ca

Outlook:
Childcare Centre Intervention Study (2014-2016)

Objective: Impact of technical solutions and behavioral interventions on IAQ

- 2014-2016: Field study in Canadian childcare centres
- 2014-2015: Experimental protocol and recruitment
- 2015-2016: Pre-intervention: IAQ measurements

Intervention

Post-intervention: IAQ measurement and assessment

Summary

- **Multi-disciplinary capacity on indoor air pollutants** from both technology and health perspectives
- **Guidelines, protocols and standards** based on validated technical information
- Industry is positioned and responding to the **need for energy-efficient IAQ solutions**
- **Best practices to practitioners and occupants**

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