CAUT Health and Safety Fact Sheet

Air Quality

ISSUE 15

The quality of air we work in directly affects how we are able to function on a daily basis in the space we work in – inside or outside of a building. Typically, air quality is understood as the absence of air pollution and contaminants that are known to affect the health of humans and the environment.

Usually, air quality is discussed with relation to indoor work. But it is equally an issue for academic staff who work out of doors and are exposed to poor or bad air quality from various sources - most notably, air pollution.

This fact sheet will address the basics of indoor and outdoor exposures, keeping in mind that air quality is a very complex issue composed of many factors. It will be important for Joint Health and Safety Committees (JHSC) to make this a priority as the health effects can be serious and long-term. JHSC's must ensure that ventilation systems should be designed, installed and tested under the supervision of a qualified ventilation engineer.

The Catalysts

Outdoor air pollution, caused by smelters and foundries for metal works, and the burning of substances as a method of waste disposal has been a problem for more than 100 years.

Indoor air quality issues in modern times crystallized in the early 1970's, when buildings were built to accommodate fuel efficiency. Buildings were sealed, windows did not open, and air was recirculated. The recirculation systems were poorly designed, with insufficient amounts of fresh air being introduced, or fresh air intake ducts located near busy streets, garages or building exhaust vents.

Most, if not all, university and college buildings will suffer from one or all of these flawed designs. JHSC inspections will need to be vigilant in identifying weak links in Heating, Ventilating and Air Conditioning (HVAC) systems. JHSC's should have information and input on all aspects of workplace HVAC systems to facilitate effective maintenance and repairs, and prevention protocols.

> "By tightening up buildings, we may be transforming them into virtual gas chambers."
>
> **Dr. George Burch**
> Tulane University
> Medical School
> (CUPE, Breathing Easy – Ventilation in the Workplace)

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INDOOR

Indoor Air Quality (IAQ) is often not specified in most building codes as design and operation criteria, but is implied in the processes and protocols laid out in legislation. Building codes in Canada and the US usually refer to the American Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 62 "Ventilation for Acceptable Indoor Air Quality" (1989 or 1999 version may be cited), as the standard.

IAQ, or the lack thereof, is responsible for illnesses known by these names: Sick Building Syndrome (SBS), Tight Building Syndrome (TBS), Building-Related Illness (BRI) and Multiple Chemical Sensitivities (MCS).[1]

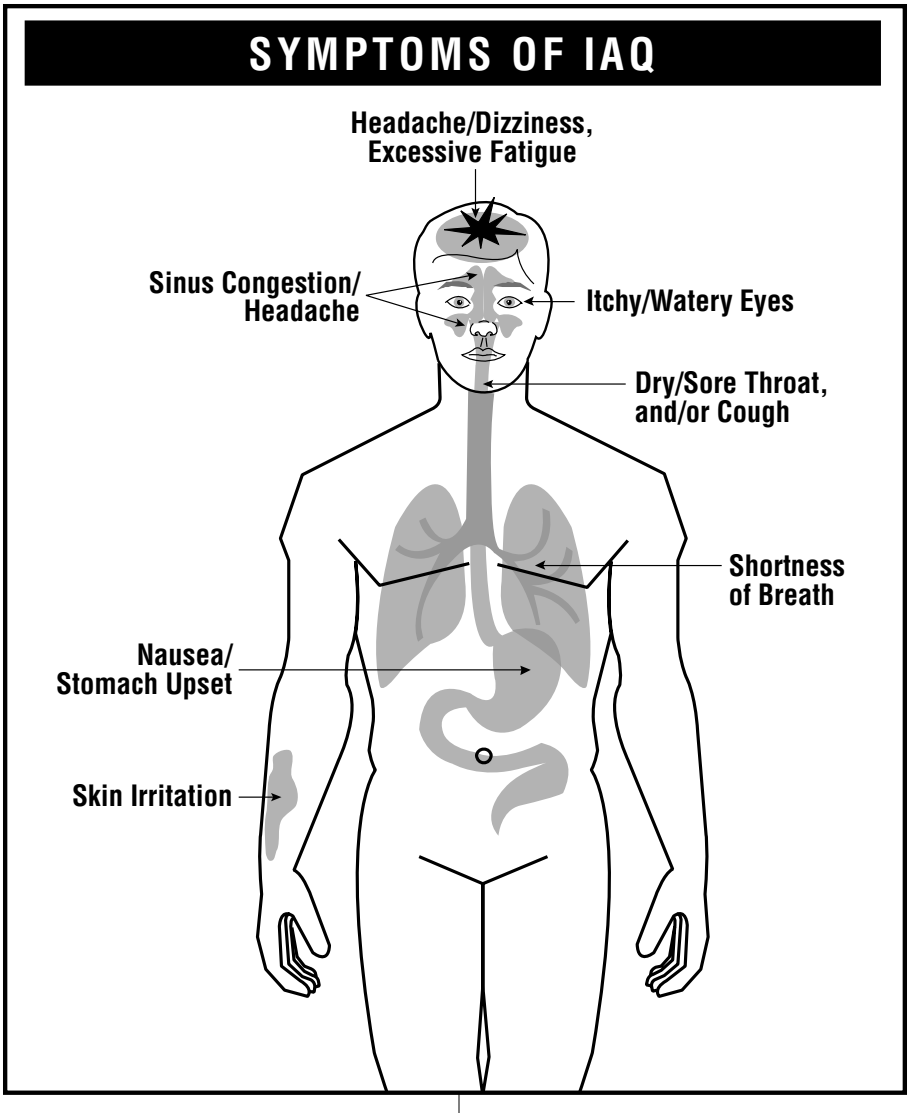
They are caused by contaminants brought in from the outside through poorly designed or maintained HVAC systems, or from the interaction between building materials, furniture, activity, climate and occupants.

Causes

- Inadequate temperature, humidity, lighting, excessive noise
- Chemicals, dusts, moulds or fungi, bacteria, gases, vapours, odours
- Insufficient outdoor air intake

Contaminants

- Carbon dioxide, tobacco smoke, perfume, body odours
- Dust, fiberglass, asbestos, gases (including formaldehyde)
- Toxic vapours and volatile organic compounds (VOCs) from cleansers, solvents, pesticides, disinfectants, glues
- Gases, vapours, and odours from off-gas emissions from furniture, carpets, paints
- Dust mites from carpets, fabrics, foam chair cushions
- Microbial contaminants, fungi, moulds, and bacteria from damp areas, stagnant water and condensate pans
- Ozone from photocopiers, electric motors, electrostatic air cleansers



SOURCE: Indoor Air Quality Health & Safety Guide 2nd Edition (revised), CCOHS, 2004.

Symptoms

- Dryness and irritation of the eyes, nose, throat and skin
- Headache, fatigue
- Shortness of breath
- Hypersensitivity and allergies
- Sinus congestion
- Coughing and sneezing
- Dizziness and/or nausea

People usually notice their symptoms during work hours and feel better when they leave or have been away from the building for a period of time.

OUTDOOR

Air pollution causes approximately 1,900 premature deaths annually in Ontario alone, according to the Ontario Medical Association (OMA). It is also responsible for 9,800 hospital admissions, 13,000 emergency room visits and 47 million minor illness days, annually in Ontario.[2]

Pollution Watch, a joint initiative of Environmental Defence and the Canadian Environmental Law Association, uses data from the federal government's National Pollutant Release Inventory (NPRI), which is the only publicly available annual source of information on a wide range of chemicals released and transferred from individual facilities across Canada. Their national report, released in December of 2004, showed that 4,187,866,272 kilograms of pollutants were released in Canada in 2002. From 1995 to 2002, the amount of toxic pollutants reported released and transferred increased by 49%, with air releases increasing by 21% and water releases increasing by 137%.[3]

We breathe and ingest these pollutants and contaminants each time we are out of doors, particularly in areas of concentrated populations and industry.

Faculty in the geography, archeology, mining, forestry, fisheries, and other departments which take their work into the field, will be exposed to some degree of air pollution.

Causes

- Fine particulate
- Ozone air pollutants

Symptoms[4]

- Coughing, dizziness, wheezing, nausea, headaches
- Weakness, feeling tired

Fine particulates congest the lungs and even pass through the lung into the blood stream to affect other organs. Chemicals can cling to particulate, which then acts as a carrier.

Health conditions known to result from or be made worse by exposure: stroke, asthma, chronic obstructive pulmonary disease (COPD), heart attack, lung infection, lung cancer and congestive heart failure.

In the days following an episode of poor air quality, the number of deaths and hospital admissions is significantly higher. This persists for 2-3 days following the episode.

Ontario has developed a system called The Ontario Air Quality Index (AQI) which is based on hourly measurements of air pollutants that are known to affect the health of humans and the environment. The concentration of these pollutants is reported as an *index*. This system can be used as a guide for those working out of doors as to what the air quality is on any given day. It can be used to modify physical activities and work practices.

Occupational Asthma[5]

According to the Canadian Lung Association, asthma kills approximately 500 Canadians each year. Asthma rates have quadrupled over the past 20 years, with recent studies indicating that exposure to toxic environmental agents account for up to 40 per cent of all asthma cases.

Occupational asthma is triggered by environmental agents in the workplace which act as allergens or irritants.

There are two types of occupational asthma – sensitization caused by a latency period of exposure, and Reactive Dysfunction Syndrome (RADS) which develops without a latency period and is usually caused by high concentration exposures.

Currently, over 250 substances have been identified as asthma-causing agents.

If you are experiencing wheezing, coughing, chest tightness and shortness of breath while in the course of your work duties, seek medical attention and report it to your workplace JHSC.

The Occupational Health Clinics for Ontario Workers (OHCOW) has a series of fact sheets on occupational asthma in several work sectors.

Two Types of Ventilation

General (dilution) ventilation occurs when outside makeup air is exchanged for inside air either for comfort or contaminate control, with air being heated or cooled and circulated throughout the workplace. This type of ventilation (HVAC) is effective for comfort control, but can be difficult to balance with fresh air intake. It has limited use for control of hazardous substances in the air. This system does not remove contaminates – it only dilutes them.

These systems have control louvres which provide a balanced air flow. If the settings are not set properly to bring in the required amount of air, the air quality will be poor.

The filters, fans and heating coils are susceptible to fungi and mould growth, and the buildup of dust and grime, if not cleaned regularly and properly.

To function correctly:[6]
- Exhaust openings should be located near the contaminant sources
- Exhaust outlet and air supply should be located so that all the air supplied passes through the area of contamination
- General air movements should flow so that the contaminant source is between the worker and the exhaust opening
- A combined supply and exhaust system is preferred with a slight excess of exhaust to prevent contamination of adjoining spaces
- Exhaust air must be replaced by a makeup air system
- Exhausted air must not be reintroduced

Local exhaust ventilation removes contaminants from the source where they are generated. It requires much lower air volumes compared to general ventilation, but also requires makeup air from the outside. This system should completely capture the contaminants.

Hoods should be located as close to the source as possible. Each doubling of distance from hood to source requires four times the cubic feet per minute (cfm) air requirement for suction and removal of fumes, vapours and gases.

Too much supplied air is just as bad as not enough air. This creates a negative pressure, allowing backdrafts that can lead to potentially dangerous levels of carbon monoxide.

Makeup air must equal the amount of exhausted air.

Features of negative pressure:
- Hard-to-open doors
- Drafts from windows
- Excessive levels of dust or smoke even when fans are working

Examples of local exhaust systems:
- Cross-draft table for welding operations
- Vacuum purge system on ethylene oxide sterilizers
- Two large-diameter flexible hoses providing continuous positive forced ventilation to prevent accumulation of gases in sewers
- Biological safety cabinet for the handling of chemical, physical and infectious disease hazards in clinical and research laboratories

TOOLS

Health Surveys and Ventilation Assessments

Organizations like the Canadian Centre for Occupational Health and Safety (CCOHS), CUPE and the Workers Health and Safety Centre (WHSC), have developed health surveys to capture workplace statistics on symptoms of ill health related to air quality issues, and ventilation assessment guides to assist with pinpointing problem areas for corrective action within the ventilation systems.

The CCOHS fact sheet on Indoor Air Quality – General, provides a sample health questionnaire (www.ccohs.ca/oshanswers/chemicals/iaq_intro.html?print) and their handbook – Health and Safety Guide, Indoor Air Quality, 2nd Edition, provides both a sample health survey and an inspection assessment guide.

CUPE's Health and Safety Guidelines, Breathing Easy – Ventilation in the Workplace, also provides a sample health survey and ventilation assessment guide (cupe.ca).

The WHSC's training manual on "Indoor Air Quality and Ventilation" has an Indoor Air Quality Worker Concern Survey and an HVAC and Building Inspection Survey in its Resource section.

Contract Language

As with all workplace health and safety issues, it is important to have collective agreement language which lays out specifics regarding the monitoring or access to information about the ventilation systems. Many Canadian jurisdictions do not have specific legislation that deals with indoor air quality issues. In such cases, the "general duty clause" (employer obligations) of the provincial or federal occupational health and safety legislation should be applied.

CUPE[7] has developed model language to insert into your collective agreements:

- "The employer shall ensure that all the instruments necessary for measuring all aspects of the workplace environment are supplied at the employer's expense and available to the union health and safety committee members. The employer shall ensure that at least three union health and safety committee members are adequately trained at the employer's expense on the use of the monitoring equipment."
- "Union committee members have the authority to accompany, monitor or otherwise check the work environment whenever deemed necessary by the union committee members."
- "With respect to conditions in the workplace, the employer agrees to furnish requested health and safety information in its possession to the union…. in writing."
- The employer shall provide the union all health and safety reports, data and records and any other information in the employer's (or their agent's) possession that the union may deem necessary."

Air Quality Index

The Air Quality Index (AQI) measures:

- ozone (O_3),
- carbon monoxide (CO),
- sulphur dioxide (SO_2),
- nitrogen dioxide (NO_2),
- fine particulate matter of 2.5 microns or less ($PM_{2.5}$)
- total reduced sulphur compounds (TRS)[8].

References

Canadian Centre for Occupational Health and Safety
www.ccohs.ca

Canadian Lung Association
www.lung.ca

Canadian Union of Public Employees
www.cupe.ca

Occupational Health Clinics for Ontario Workers
Sarnia@ohcow.on.ca
www.ohcow.on.ca

PollutionWatch
www.PollutionWatch.org

Workers Health and Safety Centre
www.whsc.on.ca

Notes

1 CCOHS, OSH Answers, Indoor Air Quality - General

2 Adapted from PollutionWatch, www.PollutionWatch.org

3 Shattering the Myth of Pollution Progress in Canada: A National Report, December 2004

4 Adapted from OHCOW Sarnia-Lambton, Air Quality and Outdoor Workers, June 2005

5 Adapted from the WHSC Resource Lines, Occupational Asthma: Clearing the Air, Spring 2005

6 CUPE Health and Safety Guidelines, Breathing Easy – Ventilation in the Workplace

7 CUPE Health and Safety Guidelines, Breathing Easy – Ventilation in the Workplace

8 OHCOW Sarnia-Lambton, Air Quality and Outdoor Workers, June 2005