



Air Quality and Health

Issue

Canadians are routinely exposed to air pollution levels which can adversely affect human health. Exposure to air pollution may lead to respiratory effects such as difficulty breathing or the exacerbation of asthma, and has been implicated in playing a role in chronic conditions such as cardiovascular disease. Children, the elderly and people with existing medical conditions are particularly vulnerable to related adverse health effects.

Background

Air is a mixture of gases comprised of 21 percent oxygen, 78 percent nitrogen, plus traces of other substances and gases both natural and man-made. The air we breathe may actually contain thousands of different substances. Air pollution is generated from a variety of sources, occurs both outdoors and indoors, and may be chemical or biological in nature. This fact sheet focuses on chemical air pollutants. Examples of chemical air pollutants include: ground-level ozone (O₃), particulate matter (PM_{2.5} and PM₁₀), sulphur dioxide (SO₂), carbon monoxide (CO), nitrogen oxides (NO_x), and volatile organic compounds (VOCs).

Airborne particles, known as “particulate matter (PM)” or simply “particles”, are very small solids and/or liquids produced by a variety of sources that are important in terms of health impacts. Particulate matter varies widely in its chemical composition and size. From a health perspective, fine particulate matter (PM_{2.5}) poses the greatest threat as it is small enough to be transported deep into the lungs.

Sources

Human activities, including transportation, industrial processes, resource extraction, agriculture, and the use of combustion appliances and consumer products may result in the release of pollutants into the air. Natural events such as forest fires and volcanoes also release airborne pollutants. Levels of exposure to air pollution depend on where people live, work or go to school, and the nature of their activities. Those who live in an urban area are more likely to be exposed to pollution from traffic and industry, whereas in rural areas concerns may centre on wood smoke, chemicals and particulate matter from agricultural operations, and even dust from unpaved roads.

The following are some of the major sources of air pollution.

Transportation

Motor vehicles are important sources of PM_{2.5}, NO₂ and other pollutants. Passenger vehicles account for a significant proportion of total national transportation emissions. Other major contributors to air pollution include large trucks, buses, recreational vehicles, lawn tractors, farming and construction equipment, airplanes, trains and ships.

Industrial production

Industries that significantly contribute to the release of pollutants include petroleum refineries, power generating stations, ore smelters, pulp mills, wood products facilities, and cement manufacturing plants, among others.

Agricultural activities

Agricultural activities are the main source of the airborne contaminants ammonia (NH₃) and methane (CH₄), which are generated primarily from livestock operations and the use of fertilizers.

Farm equipment such as tractors emit many pollutants associated with fuel combustion and the tilling of soils, especially in dry, windy conditions, releases particulate matter into the air.

Combustion appliances

Combustion appliances are appliances that burn fuel for warmth, cooking or decorative purposes. They can produce indoor air pollutants such as carbon monoxide, nitrogen dioxide and particulate matter.

Consumer and commercial products

Consumer and commercial products may contain solvents that are an important emission source of volatile organic compounds (a common class of air pollutants) in Canada. Some VOCs such as benzene and toluene are known to be toxic, but only at concentrations far above those typically found in Canadian homes. There is limited evidence that directly links VOC mixtures found in homes to known health problems. Concerns from VOCs arise from the hypothesis that, when combined, the toxicity of hundreds of VOCs could “add up” to create health hazards, but this remains unproven. Low levels of formaldehyde in indoor air are actually very common and come from off-gassing of some building materials as well as from emission of some combustion appliances. Cigarette smoke remains one of the most important sources of indoor air pollution. Air circulation and moisture levels can affect indoor pollutant concentrations as well.

The Consumer Chemicals and Containers Regulations, 2001 issued under the *Hazardous Products Act*, regulates many consumer chemicals that are used in the

home (see http://www.hc-sc.gc.ca/cps-spc/legislation/acts-lois/consumer_chemicals_e.html). These regulations help to inform Canadians about short-term hazards when using chemicals by requiring hazard symbols and warning statements on the product label.

Health Risks

The degree to which air pollutants pose a risk depends on the extent and nature of the exposure. High-level and/or prolonged exposures are likely to pose greater risks than a one-time exposure or exposure at very low levels. Pollutants vary in their potency and ability to cause damaging health effects. For example, some pollutants may cause temporary eye or lung irritation, while others are implicated in playing a role in chronic conditions such as cardiovascular disease.

Research has demonstrated that the number of deaths and hospitalizations related to respiratory and cardiac conditions increases when the levels of ground-level ozone or fine particulate matter (PM) increase. Health Canada estimates that 5,900 deaths per year in eight Canadian cities (Quebec City, Montreal, Ottawa, Toronto, Hamilton, Windsor, Calgary and Vancouver) can be attributed to air pollution. Canadians spend approximately 90 percent of their time indoors, so in addition to outdoor pollutants it is important to consider the potentially significant impacts of indoor air pollution on health.

The young, the elderly, and people with existing health conditions may be at greatest risk of adverse effects of air pollutants. Air pollution can exacerbate existing health concerns such as asthma and chronic obstructive pulmonary disease. Infants and children are more susceptible to harm from air pollution for a number of reasons.

- Their bodies are still under development. The developing tissues in the lungs are more sensitive to irritants such as air pollutants.
- Children breathe more air per unit of body weight than adults, and they breathe more rapidly. This increases their exposure to pollutants in the air.

- Children are likely to spend more time actively playing outdoors which can increase their exposures to pollutants such as ozone. They tend to spend more time on the floor and are shorter in stature, which means that they are exposed to greater concentrations of pollutants that tend to accumulate on or near the floor
- Children are more likely to breathe through their mouths, causing polluted air to bypass the filtering function of the nose and go directly into the lungs.

Minimizing Your Risk

Negative health effects increase as air pollution worsens. Studies have shown that even modest increases in air pollution can cause small but measurable increases in emergency room visits, hospital admissions and death. Some people are more sensitive to air pollution than others because of illnesses that increase the impact of air pollutants. This includes people with respiratory disease (e.g., asthma, chronic bronchitis, emphysema, etc.), and cardiovascular disease (e.g., angina, history of heart attack, heart failure, arrhythmia, etc.).

There are several steps that can be taken to minimize the risk of exposure to air pollution, as well as to improve the quality of the air, both indoors and outdoors:

- Pay attention to air quality reports in your community. If outdoor air pollution levels rise:
 - reduce or reschedule outdoor physical activities;
 - monitor possible symptoms, such as difficulty breathing, coughing or irritated eyes;
 - follow a doctor's advice to manage existing conditions such as heart or lung disease.
- Drive vehicles less often, and use active (e.g., walking, bicycling) and public transportation where possible and when appropriate. Where vehicle use is necessary, try to arrange to car pool with others, turn your car off instead of idling, and keep your vehicle properly maintained.

- Avoid smoking, particularly indoors.
- Eliminate the source of contamination indoors and ensure your home is properly ventilated. For example: open windows and doors if you must use paint in your home.
- Vacuum regularly to reduce your exposure to dust.
- Contact your local public health department or the Canada Mortgage and Housing Corporation if you need advice for a more severe indoor air quality problem.

Role of Governments

In Canada, air quality management is a shared responsibility of the federal, provincial and territorial governments. While municipalities generally do not have authority over air issues, because of their influence on the day-to-day activities of Canadians and their role in functions such as land-use planning and public transportation, many municipalities are taking actions that affect air quality concerns.

The Government of Canada:

- co-ordinates federal environmental policies and programs, including action on smog;
- administers the *Canadian Environmental Protection Act, 1999* (CEPA 1999) and the *Hazardous Products Act* (HPA);
- leads the development of national goals, standards, guidelines and regulations and voluntary arrangements to protect Canada's air quality;
- acts as the federal champion in the implementation of the Canada-Wide Standards for Particulate Matter and Ozone under the federal/provincial/territorial Harmonization Accord;
- participates in education initiatives to increase public awareness about the causes and effects of smog;
- conducts research on the causes and effects of air pollutants, particularly effects on the environment and human health;

- champions nationally and participates in a number of other science-related activities, including air quality monitoring; quantifying and identifying the sources of smog-causing pollutants through the development and revision of emission inventories; assessing the science of ozone and PM formation; and air quality modeling and forecasting; and
- addresses transboundary air issues and represents Canada's international interests by negotiating international air pollution agreements and instruments to decrease the cross-border transport of air pollutants.

Health Canada, Environment Canada and the provinces are working together to develop a new national health-based Air Quality Index that will inform Canadians of ways they can reduce the impact of air quality on their health.

Health Canada is responsible for undertaking risk assessment, risk management and risk communication for indoor air in accordance with CEPA 1999.

Responsibilities of provincial and territorial governments in Canada include:

- development, implementation and enforcement of regulations and standards for industrial, commercial, and other sources of air pollution;
- licensing, permitting, and monitoring. (In the Territories, control of most industrial emissions, including implementation of Canada-wide Standards, is the responsibility of the federal government when these sources are found on federal lands); and
- authority to control pollution sources varies from province to province, but typically rests on provincial legislation. Such legislation may include, for example, authority to prohibit the release of emissions from industrial and/or

commercial facilities except where authorized (e.g., by permit or certificate of approval), regulate open burning, regulate ozone depleting substances, address some motor vehicle emissions, set other regulations related to air emissions, and inspection and enforcement.

Provinces and territories also undertake a variety of work under other related legislation and constitutional authority, including matters related to energy supply, transportation planning, and outreach and information, among others.

Canada's Clean Air Act

On October 19, 2006, the Government of Canada announced the first and central component of its Environmental Agenda, *Canada's Clean Air Act*. The tabling of the Act is the first step in working toward reducing emissions of both air pollutants and greenhouse gases and protecting human health and the environment. By taking a comprehensive and integrated approach for both air pollutants and greenhouse gases, the government is maximizing the benefits to the health of all Canadians and the environment.

Need More Info?

More information can be found at www.chemicalsubstances.gc.ca

Health Canada's "Health and Air Quality"
www.healthcanada.gc.ca/air

Health Canada's "Let's Talk About Health and Air Quality"
www.hc-sc.gc.ca/ewh-semt/air/out-ext/effe/talk-a_propos_e.html

Health Canada's "It's Your Health"
www.healthcanada.gc.ca/iyh

EC Clean Air Online
www.ec.gc.ca/cleanair-airpur/Home-WS8C3F7D55-1_En.htm

Indoor Air Quality Backgrounder, from the "Tools for Schools IAQ Kit"
www.hc-sc.gc.ca/ewh-semt/pubs/air/tools_school-outils_ecoles/index_e.html

Office Air: A Worker's Guide to Air Quality in Offices, Schools, and Hospitals
www.hc-sc.gc.ca/ewh-semt/pubs/air/office-bureaux/part1_e.html

Canada Mortgage and Housing Corporation
www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/inaiqu/index.cfm

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