7

Outdoor Air Quality and Human Health

OUTDOOR AIR QUALITY AND HUMAN HEALTH

"In theory, pure air is approximately 21 percent oxygen and 78 percent nitrogen, with traces of other gases. In fact, human activities like the burning of fossil fuels release vast amounts of other substances into the atmosphere..." (Health and Welfare 1990).

Canadians have very good air quality compared with other industrialized nations. Nonetheless, studies have shown that there are health impacts associated with current levels of pollutants in urban air. In response to growing global, national and community concerns regarding air pollution, many studies have been undertaken to investigate both the direct and indirect effects of common air pollutants on human health.

This chapter focuses primarily on recent studies on the impacts of certain pollutants on the human respiratory and cardiac systems in the Great Lakes basin.

Another important air pollution issue that has an impact on human health is the problem of stratospheric ozone depletion caused by chlorofluorocarbons (CFCs), which has resulted in increased levels of ultraviolet (UV) radiation reaching Earth. (See also Chapter 3. "Contaminants.")

Depletion of the Ozone Layer and UVB Radiation.

Ground-level ozone and the ozone found in the "ozone layer" are chemically the same (O_3). While ground-level ozone is located within 11 km of the Earth's surface, ozone that makes up "the ozone layer" is located between 11 and 47 km above the Earth's surface in the stratosphere. The ozone found high up in the stratosphere acts as a barrier against the ultraviolet-B radiation emitted from the sun. When this ozone layer is damaged (by chlorine atoms carried by chlorofluorocarbon chemicals (CFCs)) and depleted, more UVB reaches the Earth's surface causing increases in adverse health effects such as skin cancer.

(See also Chapter 3. "Contaminants" and *Contaminant Profiles*.)

7.1 Air Pollutants

Air pollutants were among the first environmental contaminants to be identified and monitored. Air pollutants can be categorized as primary or secondary pollutants depending on their origin. Primary pollutants include gases such as sulphur dioxide (SO_2) and nitrogen oxides (NO_x), and particulates such as lead and carbon. Secondary pollutants are formed in the air when various gases and particulates interact with each other in the presence of sunlight. These include gases such as ground-level ozone (O_3), commonly known as smog, and sulphuric acid (H_2SO_4), which is commonly known as acid rain.

Ground-level ozone, sulphur dioxide, nitrogen dioxide, carbon monoxide and particulate matter have been of greatest interest to Health Canada researchers because of their direct or indirect effects on the cardio-respiratory system. (The following pollutants are discussed in detail in *Contaminant Profiles*.)

- **Ground-level ozone (O_3)** is a gas found in the low atmosphere that is formed when two kinds of pollutants, nitrogen oxides and volatile organic compounds (VOCs), react in the presence of sunlight. High concentrations can be found during hot, still summer weather. Ground-level ozone is the primary component of "photochemical smog" and is different from the blanket of ozone high above the Earth ("stratospheric" ozone or "the ozone layer"), which protects us from the sun's harmful ultraviolet (UV) rays (see Box: The Greenhouse Effect, below). When levels are present above normal background levels, it can cause adverse cardio-respiratory health effects, as well as damage to vegetation and other materials.

The Greenhouse Effect

Natural trace gases in the atmosphere radiate heat from the Earth back to the Earth, creating a climate that is warm enough to be hospitable to life. Increases in the concentrations of certain greenhouse gases (i.e., water vapour, carbon dioxide, methane, nitrous oxide and chlorofluorocarbons) due to human activities cause an enhanced greenhouse effect. This has resulted in concern about rising temperatures on Earth, also known as global warming, or climate change.

- **Sulphur dioxide (SO_2)** is a gaseous pollutant that can be chemically transformed in the atmosphere in the presence of other chemicals and sunlight to form acidic pollutants such as sulphuric acid and sulphates.
- **Nitrogen dioxide (NO_2)** is one of a group of gases called nitrogen oxides, which are composed of nitrogen and oxygen. Like sulphur dioxide, nitrogen oxides can react with other chemicals in the atmosphere in the presence of sunlight to form acidic pollutants, including nitric acid.
- **Particulate matter (PM_{10}, $PM_{2.5/2.1}$)** refers to small solid or liquid particles suspended in the air that can be formed as a result of natural, industrial or other human activities. Particulate matter is measured as TSP (total suspended particles), which includes all sizes of particles, PM_{10} (particles with an average diameter of 10 microns or less) and $PM_{2.5/2.1}$ (fine particles with an average diameter of 2.5 or 2.1 microns or less). The finer particles are of most concern because these are small enough to travel deeply into the lungs. The particles themselves cause health concerns, but they can also carry chemicals into the lung, e.g., polycyclic aromatic hydrocarbons (PAHs), metals, etc.
- **Volatile organic compounds (VOCs)** are compounds containing carbon that evaporate quickly at ordinary temperatures. Volatile organic compounds react with nitrogen oxides to form ground-level ozone.
- **Carbon monoxide (CO)** is a colourless, odourless, poisonous gas caused mainly by incomplete combustion. It is emitted mainly from vehicles.

Q. Is lead still a problem in air?

A. Due to the elimination of lead in gasoline, there has been a significant decrease in public exposure to lead in outdoor air. Remaining air pollution sources of lead include lead smelters, incineration of lead batteries, and the burning of lead-contaminated waste oil. The most common sources of lead exposure today, occur in the home environment. (See Chapter 10. "Home Environments.")

Main Sources of Outdoor Air Pollution

The primary source of ambient (outdoor) air pollution is the burning of fossil fuels such as coal, oil, gasoline and diesel fuel for electricity, heating and transportation. Vehicle exhaust from private and commercial vehicles is a major contributor of nitrogen oxides, carbon monoxide, VOCs, and particulate pollution in urban areas. Pollutants (e.g., sulphur dioxide and nitrogen oxides, particulate matter) are also released by industries such as pulp and paper mills, ore smelters, petroleum refineries, power generating stations and incinerators. Other activities that generate pollutants include home heating and the use of appliances requiring oil, electricity, wood, natural gas or other fuels. Fumes and particulate matter can also be released into the air from naturally occurring events such as volcanoes, wind-driven soil erosion and forest fires.

GREAT LAKES BASIN CONTAMINANT LEVELS

THE GREAT LAKES BASIN HAS CONSISTENTLY HIGH LEVELS OF CERTAIN AIRBORNE CONTAMINANTS DUE TO LOCAL SOURCES OF POLLUTION, WIND PATTERNS, AND GEOGRAPHIC LOCATION. ANNUAL AVERAGE OZONE LEVELS IN THE BASIN HAVE BEEN CONSISTENTLY HIGHER THAN THE NATIONAL AMBIENT AIR QUALITY OBJECTIVE OF 15 PPB FOR THE PAST SEVERAL YEARS. IN GENERAL, LEVELS OF PARTICULATES AND SULPHATES IN THE BASIN HAVE NOT DECLINED OVER THE SAME PERIOD. HOWEVER, LEVELS OF NITROGEN OXIDES (ONE OF THE PRECURSORS TO GROUND-LEVEL OZONE) HAVE SHOWN A DECREASING TREND.

Transboundary Air Pollution

Air pollution does not originate only from local sources. Pollutants can be carried thousands of kilometres from their original source, sometimes from urban areas to less populated areas. This process is generally referred to as "transboundary pollution" or "long-range atmospheric transport." For example, residents of southwestern Ontario are exposed to pollutants carried by wind patterns from large metropolitan centres, such as Detroit, Michigan. Pollutants that originate in the industrial Ohio River Valley of the United States also frequently end up in the Great Lakes basin, particularly in the Windsor–Quebec corridor, where they contribute to ground-level ozone and particulate air pollution. Even areas remote from urban and industrial centres, such as the Arctic, can be affected by air pollutants carried there by weather patterns.

Other Air Pollutants of Concern

Additional air pollutants of concern to human health include polychlorinated biphenyls, dioxins and other persistent organic compounds that are transported long distances by air and are deposited in bodies of water and on land. Their persistence allows them to bioaccumulate in the food chain where they can then pose a threat to people consuming large amounts of contaminated self-caught fish and wildlife.

Other "air toxics" of concern comprise a broad range of substances including toxic metals (i.e., lead, mercury, cadmium, arsenic, chromium and nickel) and compounds such as benzene, formaldehyde and trichloroethylene. These pollutants are monitored through Environment Canada's National Air Pollution Surveillance (NAPS) program (see the *Resource Guide*).

7.2 Air Monitoring and Regulation

Air Quality Objectives (AQOs)

An air quality objective is a statement of the concentration of an air pollutant and the period of exposure to it, which, if not exceeded, affords a specified degree of protection to humans, animals, plants and materials. Objectives are generally set to cover both short- and long-term exposure to air pollutants.

To date, Canada has had a three-tiered system of National Ambient Air Quality Objectives (NAAQOs). NAAQOs were established under this system for sulphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), total suspended particulates (TSP), and ground-level ozone (O_3). These pollutants have been measured daily by a network of air monitoring stations throughout Ontario. These monitoring stations are operated by both federal and provincial agencies. Average or maximum concentrations may be reported over a number of time periods, depending on the relevant provincial objectives or criteria for the pollutant, (e.g., 1 hour, 8 hour, 24 hour or annual average concentration).

The three-tiered system of NAAQOs is being replaced by a more science-based two-tiered system. In this system, the Reference Level is a science-based level, above which there are demonstrated effects on human health and/or the environment. The Air Quality Objective is a level that is based on a combination of scientific, social, technological, and economic information, and represents the air quality management goal for the protection of the general public and the environment in Canada. New NAAQOs are currently being developed under this system, beginning with particulate matter and ozone, which are expected in 1998.

The NAAQOs are established based on recommendations from a Federal-Provincial Advisory Committee and Working Group on Air Quality Objectives and Guidelines. Provincial governments have the option of adopting these either as objectives or as enforceable standards using their legislation. The provinces and the federal government have recently agreed to develop the NAAQOs into Canada-wide standards.

Q. Who monitors the air quality in Ontario and in Canada?

A. Air quality is monitored by both provincial governments and by the federal government. Federal involvement is to ensure a nationally coordinated monitoring system and to meet international agreements. Provincial governments monitor primarily for compliance with emission control guidelines.

The federal government has also established regulations for the release of vinyl chloride, asbestos, lead and mercury from specific stationary sources such as secondary smelters or vinyl chloride plants. Vehicle emissions are regulated by the federal *Motor Vehicle Safety Act*, which sets limits on tailpipe emissions of carbon monoxide (CO), nitrogen oxides (NO_x), hydrocarbons (HCs) and diesel particulates for new vehicles only.

In Ontario, several regulations govern ambient air quality. Regulation 309 defines air quality criteria for 15 pollutants that form the basis of the Ontario Air Pollution Index; Regulation 296 defines Ambient Air Quality Criteria (AAQC) for 23 pollutants; and Regulation 312 limits the amount of sulphur in fuels.

Table 7.1

NATIONAL AMBIENT AIR QUALITY OBJECTIVES FOR SELECTED POLLUTANTS (MAXIMUM ACCEPTABLE CONCENTRATION)

Pollutant (units)	Period of Exposure			
	1-hour	8-hour	24-hour	annual
Sulphur dioxide (ppb)	340	-	110	20
Ozone (ppb)	82	-	-	15
Suspended particulate matter (µg/m^3) (TSP)	-	-	120	70
Carbon monoxide (ppm)	31	13	-	-
Nitrogen dioxide (ppb)	210	-	-	50

The Air Quality Index

The Air Quality Index (AQI), also referred to as the Index of the Quality of Air (IQUA), is an indicator of overall air quality that was developed to better inform the public about the general or prevailing air quality in their community. While the National Ambient Air Quality Objectives (NAAQOs) provide a means for evaluating the levels of individual pollutants, they do not provide a measure of overall air quality.

The AQI is a numerical system based on the three-tiered NAAQO system. When a pollutant is measured, the level is represented on the AQI scale by a specific "index value." The scale is designed so that an index value of 0 corresponds to 0 concentration, 25 corresponds to a maximum desirable level, 50 corresponds to a maximum acceptable level, and 100 corresponds to a maximum tolerable level. After each pollutant has been indexed, the maximum index value is selected as the numerical value of the Air Quality Index. Once the new two-tiered system of air quality objectives is introduced, revisions will need to be made to AQI.

AQI Reading	Level
0 – 25	Good
26 – 50	Fair
51 – 100	Poor
101+	Very Poor

The AQI is released to the public through the media eight times daily and is further released every hour if any of the 34 monitoring sites records AQI values of 32 or higher. Smog advisories also provide information on episodes of high smog levels.

Q. What is the difference between a guideline and a standard?

A. A standard is a legally enforceable limit on the amount or concentration of a substance. Exceeding the standard could result in unacceptable harm to human health or the environment and could also lead to penalties such as fines. Standards, such as those for different air pollutants, and the penalties for exceeding them are usually set out in a legally enforceable regulation.

Criteria and guidelines are advisory limits, but they are not legally enforceable. When the concentration of a substance exceeds the limit, there are grounds for concern. Criteria and guidelines are useful guides for managing the risks associated with exposures to environmental contaminants.

7.3 Air Pollutants and Health

The Health Effects of Air Pollution

There is strong evidence from research on people living in the Great Lakes basin that increases in certain air pollutants are linked to increases in hospitalization for respiratory and cardiac disease, and to increased premature mortality. Most importantly, there does not appear to be a "threshold level" for ground-level ozone or particulates below which no effects are observed; even low levels of ground-level ozone and particulates are damaging to the cardio-respiratory system.

Individual reactions to air pollutants depend on the type of pollutant, how much of the pollutant is present, the degree of exposure and the kinds and levels of individual activity (people working or exercising outdoors have greater exposure). Age and health status are also very important. In general, the more susceptible populations include the elderly and those with cardiac or respiratory diseases such as asthma, emphysema and chronic bronchitis. Children also tend to be more sensitive than adults because they breathe faster, and in summer spend more time being active outdoors.

Health effects may range from difficulty in breathing, through coughing and wheezing, to aggravation of existing cardiac and respiratory conditions. These effects may result in visits to a doctor or an emergency room, increase use of medications, admission to hospital or even premature death. For sensitive individuals, any increase in air pollution, no matter how small, could cause their illness to become more severe.

(See *Contaminant Profiles* for information on health effects of specific airborne contaminants.)

Q. Do outdoor air pollutants contribute to respiratory and cardiac illness?

A. There is strong evidence from the Great Lakes basin that link ozone, airborne particles and acid aerosols to significant respiratory health effects including illness requiring hospital admission and even premature mortality. There is also evidence from the Great Lakes basin that these pollutants cause reduced lung function in children. Although results from the study of hospital admissions for cardiac disease suggest an increase in disease with outdoor sulphate levels, it is unclear exactly how the effect occurs. This represents an important area for future research.

Studies on Air Pollution and Human Health in the Great Lakes Basin

Health Canada has recently completed three important studies examining the relationship between levels of certain outdoor air pollutants and their effects on the respiratory and cardiac health of people in the Great Lakes basin and elsewhere in Ontario. The purpose of these studies was to determine whether increases in levels of certain outdoor air pollutants corresponded with respiratory and cardiac problems (measured as increases in admissions to hospital for respiratory or cardiac diseases) or with increases in deaths due to respiratory or cardiovascular illnesses. The studies focussed mainly on levels of ozone and sulphate because both of these pollutants have been associated with adverse health effects in previous studies.

STUDY 1: "Effects of low ambient levels of ozone and sulphates on the frequency of respiratory admissions to Ontario hospitals"

R. Burnett et al. 1994. *Environmental Research* 65: 172-194.

The purpose of this study was to determine whether daily concentrations of either ozone or sulphates are related to respiratory hospital admissions.

A significant association was found between the number of daily admissions for respiratory problems and both ozone and sulphate levels. Five percent of daily hospital admissions due to respiratory problems in the months of May to August were associated with ozone. Sulphates accounted for an additional 1 percent of these admissions. This result was found consistently among all age groups, although infants were found to be most sensitive (15 percent of admissions associated with the ozone-sulphate pollution mix), while the elderly were least affected (4 percent).

It was previously believed that adverse effects were observed only after a certain "threshold" level of pollution had been reached. However, the investigators did not find a "threshold effect" in this study. Figures 7.1 and 7.2 show the relationships between respiratory admissions and pollutant levels, and demonstrate that even very low levels of pollutants may increase hospital admissions for respiratory disease.

Results from this study have been confirmed in a Canada-wide study, the "Association between ozone and hospitalization for respiratory diseases in 16 Canadian cities," in which preliminary findings show positive associations between daily levels of air pollutants and hospital admissions. (Burnett et al. 1997.)

Figure 7.1

RELATIONSHIP BETWEEN RESPIRATORY ADMISSIONS AND OZONE LEVELS

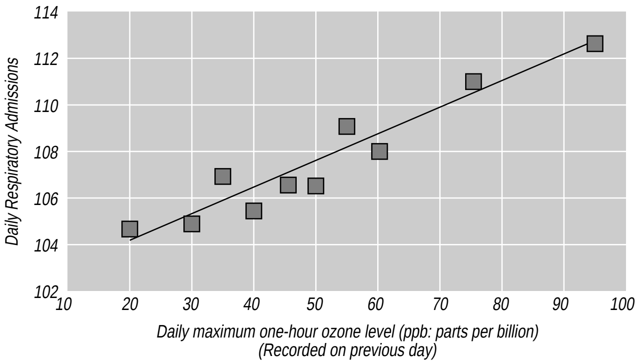
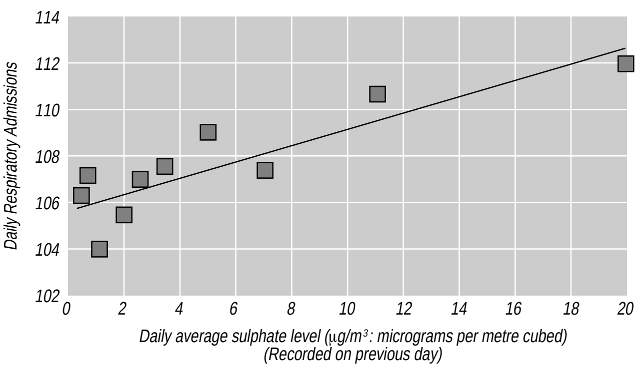


Figure 7.2

RELATIONSHIP BETWEEN RESPIRATORY ADMISSIONS AND SULPHATE LEVELS



STUDY 2: "Associations between ambient particulate sulphate and admissions to Ontario hospitals for cardiac and respiratory diseases"

R. Burnett et al. 1995. *American Journal of Epidemiology* 142(1): 15-22.

The purpose of this study was to determine whether or not there is an association between daily admissions to hospital due to cardio-respiratory illnesses and the daily levels of sulphate in air.

A significant association was found between admissions to acute care hospitals in Ontario due to cardio-respiratory symptoms and sulphates. Figure 7.3, based on data reported in Burnett et al. 1995, shows that higher doses of sulphates will increase the hospitalization rate. Ozone was not found to be a significant risk factor for cardiac disease.

STUDY 3: "Association between daily mortality and air pollution in Toronto, Canada"

H. Ozkaynak et al. August 1995. *Proceedings of the International Society for Environmental Epidemiology* Noordwijkerhout, The Netherlands.

The purpose of this study was to determine whether or not there is an association between premature mortality and levels of certain air pollutants in Toronto.

Strong associations were observed between premature mortality due to respiratory disease and airborne particulates, COH (coefficient of haze — another measure of particulate matter), ground-level ozone and nitrogen dioxide. A 2 percent to 4 percent excess of respiratory deaths could be attributed to the pollutant levels found in this study. These levels are in the range commonly observed in Toronto. Similar associations were observed for cardiovascular deaths. These results provide further evidence of the health risks posed by commonly observed concentrations of the mixture of outdoor air pollutants in a large metropolitan area. These data are also consistent with other studies in North America, Central America and Europe, where strong associations between mortality and air pollution have been observed.

STUDY 4: "Association between ambient carbon monoxide levels and hospitalizations for congestive heart failure in the elderly in 10 Canadian cities"

R. Burnett et al. 1997. *Epidemiology* 8(2):162–167.

The purpose of this study was to explore the relation between ambient levels of carbon monoxide and exacerbation of cardiac illnesses. To do so, the authors examined temporal associations between hospitalization for congestive heart failure in the elderly (> 65 years of age) and several gaseous and particulate air pollutants in Canada's 10 largest cities, spanning diverse populations and climatic profiles, from 1981 to 1991.

There was a positive association between a number of ambient air pollutants (carbon monoxide, nitrogen dioxide, sulphur dioxide, and the coefficient of haze) and daily fluctuations in hospital admissions for congestive heart failure in the elderly. Adjustments for temporal variations in hospitalization rates, hospital usage patterns, and weather could not eliminate these associations. Carbon monoxide was the strongest predictor of hospitalization rates among the air pollutants examined and was least sensitive to covariate adjustment.

Figure 7.3

DAILY HOSPITALIZATION RATES PER MILLION POPULATION BY SELECTED LEVELS OF SULPHATES, 1983-1988 ONTARIO, CANADA

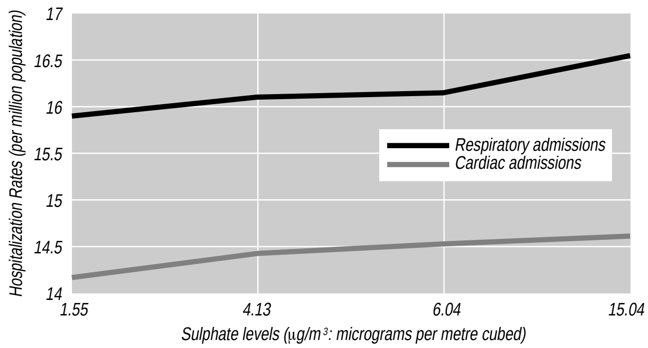
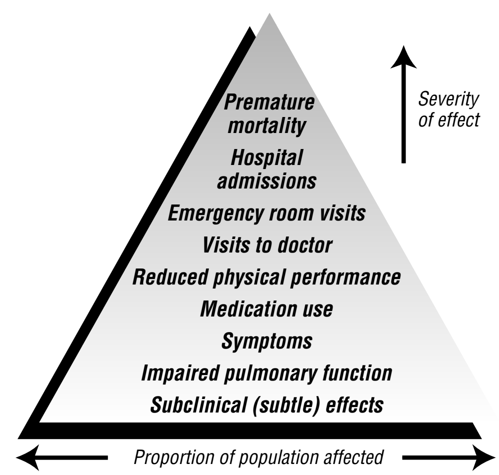


Figure 7.4

THE CASCADING EFFECTS OF AIR POLLUTION



Research demonstrating premature deaths and increased rates of hospitalization due to certain air pollutants could in fact reflect a very large burden of illness in the population. Figure 7.4 shows this "cascading effect," and is adapted from the Canadian Respiratory Journal, *2, 3 (1995): 155-160.*

Q. Do we know the health care costs associated with outdoor air pollution?

A. As a society, we pay for the health effects of air pollution in many ways. These include additional health care costs for hospital admissions, visits to the emergency department or doctor' s office, and in some cases community services such as home care; costs of additional medication such as inhalers for asthma; lost productivity in the workplace, or lost wages due to sick time; a variety of out of pocket expenses which people may incur while they are sick (e.g., additional child care costs); and finally, and perhaps most importantly, lost quality of life and even loss of life.

A recent study examined the economic value of reducing the health effects of air pollution, by introducing cleaner vehicles and fuels in Canada. This study found that the economic value of avoiding these health effects was $24 billion over a period of 24 years. This compared with a cost of $6 billion for implementing this program, i.e., the benefits

IN SOME AREAS OF CANADA CURRENT LEVELS OF CERTAIN OUTDOOR AIR POLLUTANTS AGGRAVATE RESPIRATORY AND CARDIAC DISEASE AND ARE ASSOCIATED WITH PREMATURE MORTALITY.

appear to outweigh the costs. Health Canada and Environment Canada scientists are continuing to examine the benefits and costs of other air pollution control options.

THE SEVERITY AND TYPES OF HEALTH EFFECTS ASSOCIATED WITH AIR POLLUTION VARY WIDELY AND INCLUDE BOTH ACUTE (SHORT-TERM) AND CHRONIC (LONG-TERM) EFFECTS.

Smog Advisories

The Canadian Smog Advisory Program was introduced by Environment Canada in 1993 as a means of providing information to the public on smog episodes. The advisories include both environmental information, such as a description of the pollution sources that contribute to smog, as well as health information to advise the public on the possible health risks associated with smog exposure. Smog advisories are issued when ozone levels are expected to exceed a specified level — generally 80 ppb for a 24-hour period or greater than 120 ppb for any one-hour period. The advisories are usually carried by all local radio stations, television stations and local newspapers.

Reducing Exposure

Exposure to ground-level ozone can be reduced by decreasing the amount of time spent outdoors when smog levels are high. In general, it is best to schedule physical activity when pollutant levels are lower, such as early morning. Avoid exercising near heavy traffic areas. People with cardiac and respiratory problems should stay indoors during high ground-level ozone episodes, keeping the doors and windows closed during these peak hours. Use an air conditioner that combines an absolute filter with activated carbon, especially if you suffer from allergies or asthma. If there is no air conditioning, the house can be aired out at night when the pollution is lower. Follow all doctors' advice regarding appropriate management of the health condition during smog episodes.

Individuals can help to reduce air emissions by using alternative forms of transportation, (see box page 124).

See Smog and Ground-Level Ozone in the *Contaminant Profiles*.

Q. Why is exposure to ground-level ozone reduced when indoors?

A. Ground-level ozone reacts with other pollutants in indoor air and on surfaces. This results in reduced levels of ozone indoors. In fact, levels of ozone indoors tend to be about 50 percent to 80 percent lower than in outdoor air. There is also constant regeneration of ozone occurring outdoors. Indoor ozone is more of a problem in summer when windows are open, however, it will still be significantly lower than outdoor concentrations.

Exposure to ground-level ozone also tends to be reduced indoors because people tend to be less active indoors than out, therefore taking in less air than when they are exerting themselves.

7.4 Reducing Outdoor Air Pollution

Action to Reduce Outdoor Air Pollution

Action has been taken on a wide range of air pollution problems. Some highlights:

- Improvements in vehicle emissions standards have helped reduce the amounts of air pollutants released by individual vehicles. Vehicle emissions are controlled by the federal *Motor Vehicle Safety Act*, which sets limits on tail-pipe emissions of carbon monoxide (CO), nitrogen oxides, hydrocarbons (HCs) and diesel particulates for new vehicles. Mandatory vehicle emissions testing currently being considered in Ontario would significantly reduce air pollution. While car pooling and the use of public transportation reduces the levels of pollutants emitted into the air, the number of cars and trucks in use in Canada continues to increase, and thus the total amounts of most air pollutants have decreased only gradually.
- In 1991, Canada and the United States signed the Canada-U.S. Air Quality Agreement, in which the two countries agree to work together to address the issue of trans-boundary air pollution. The Canadian government works closely with industry on both sides of the border to encourage voluntary reductions and more stringent environmental controls on the types and amounts of pollutants that can be emitted into the atmosphere. Reductions in emissions of several air pollutants have been observed in parts of the Great Lakes basin because of the efforts of some industrial sectors.
- The NO_x/VOCs Management Plan was established in 1989 in order to target the reduction of ground-level ozone. Nitrogen oxides (NO_x) and volatile organic compounds (VOCs) are the primary precursors of ground-level ozone.

Q. What action is being taken on CFCs?

A. As a result of Canada' s ozone protection programs and Canada' s obligations under the *Montreal Protocol on Substances that Deplete the Ozone Layer*, as of January 1, 1996, Canada has prohibited the production and import of newly produced CFCs and other ozone depleting substances (ODS) except for certain essential uses such as CFCs for metered dose inhalers for the treatment of asthma and chronic obstructive pulmonary disease. Environment Canada regulates the production, use, import and export of ODS and certain products containing ODS under the *Canadian Environmental Protection Act* (CEPA).

The provinces are responsible for implementing programs for recovery and recycling of ozone-depleting substances. Nine provinces have regulations on the recovery and recycling of ODS and the Yukon and Newfoundland are currently developing theirs. Environment Canada chairs a federal-provincial working group that provides support for implementation of the recovery, recycling and reclamation of CFCs.

- The Program on Energy Research and Development (PERD) was established in 1974 to ensure that knowledge and technology options are available for Canada to develop and use energy resources in a cost-effective and environmentally responsible manner. Health Canada's involvement in the program began in 1981.
- Federal guidelines are currently being reviewed to take account of recent Health Canada study findings.

How Can I Take Action to Reduce Outdoor Air Pollution?

- Car pool, use public transit, bike or walk.
- Purchase fuel efficient vehicles and keep all vehicles well-maintained.
- Be aware that the use of motorized recreational and sport vehicles contributes to air pollution.
- Recycle or compost grass clippings, branches and other organic materials — the open burning of yard refuse contributes to air pollution.
- Reduce energy use in the home: use energy-saving compact fluorescent lamps, install water-flow reducers in taps and showerheads, use energy-efficient appliances, use appliances less often, and use less heat and air conditioning.

Many municipalities, utilities and environmental organizations produce excellent booklets with practical tips on ways to reduce energy consumption.