

The Region's Air

The earth's atmosphere extends for 200 kilometres above its surface. It performs a number of vital functions. The upper atmosphere (or stratosphere) retains heat near the surface of Earth and provides protection against the sun's harmful rays. In the lower atmosphere (or troposphere), weather patterns create wind, rain, snow and fog, as well as beautiful, sunny days. The unique composition of gases found in the lower atmosphere supports the multitude of oxygen-dependant life forms that have evolved on the planet.

Air quality can be affected by local, regional or long-range factors. Local influences include point sources such as power plants and automobiles. At a regional scale, topography (the shape of the land) and the presence of large bodies of water can affect weather patterns and how pollutants disperse. Distant factors, such as pollution emitted in the Ohio Valley, can affect our air because pollutants can be carried by long-range transport.

In an ecological sense, the boundary of the Region's air is large. The "atmospheric region of influence" or airshed for the Greater Toronto Area has been estimated to stretch from Hudson Bay in the north, to central Georgia in the south, and from the Dakotas in the west to New Brunswick in the east. Because of the size of the airshed, we have only limited control over the quality of the air we breathe in York Region. The nature of air pollution is such that many problems can only be successfully tackled through international cooperation.



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Stresses on the Region's Air

Human activities are now believed to be affecting all levels of the atmosphere. Pollution in the lower atmosphere can affect human health, vegetation and buildings. Pollution in the upper atmosphere can affect climate, human health, and threaten the stability of global food sources. Atmospheric pollutants can have multiple, interactive and sometimes synergistic effects. Sulphur dioxide, for example, is a common pollutant that affects local air quality, contributes regionally to smog, is a major ingredient of acid rain, and is linked to global warming.

Stresses on the Lower Atmosphere

Common Pollutants

Sulphur dioxide, nitrogen oxides, volatile organic compounds, particulate matter (suspended particles) and carbon monoxide are among the common emissions into the lower atmosphere. These pollutants come from many sources including power plants, mobile sources (automobiles and trucks), fuel combustion and industries. In the Toronto area, transportation is the greatest source of sulphur dioxide, nitrogen oxides, particulate matter and carbon monoxide.

In terms of human health, two of the greatest concerns are ground-level ozone and particulate matter. Ground-level ozone (the prime ingredient in smog) is produced when nitrogen oxides and volatile organic compounds react in the presence of sunlight. Motor vehicles are the primary source of nitrogen oxides and a major contributor of volatile organic compounds. More than half of the ground-level ozone measured in southern Ontario comes from sources in the United States. At high concentrations, ozone affects respiratory function with clinical symptoms that include chest tightness, coughing, and wheezing.

Particulate matter is emitted from industrial processes including fuel combustion (including car and truck exhaust), incineration, construction, and metal processing. Natural sources of particulate matter include wind-blown soil and forest fires. Suspended particles are the component of particulate matter in the atmosphere that is most likely to reach the lung (i.e., that have a diameter generally less than 10 microns). Increased incidence of respiratory symptoms, and increased morbidity and mortality from cardiopulmonary disease are associated with inhalation of suspended particles.

Atmospheric lead is an environmental success story. It is highly toxic to the human body, accumulates readily in the environment, can cause damage to the brain, nerves, red blood cells, kidneys, and the digestive system, and is especially toxic in children up to six years of age. Once used as an additive in

gasoline, it was phased out in 1990. The result of these regulations has been a marked decrease in lead concentrations in Toronto air, which closely parallels the decrease of lead in gasoline. Unfortunately, levels of another metal, manganese, have increased in the environment because refiners have replaced lead in gasoline with methylcyclopentadienyl manganese tricarbonyl (MMT). Manganese is less toxic than lead and the concentrations in the air are within the Ministry of the Environment's air quality guidelines.

Acid Rain

Acid rain is formed when sulphur dioxide and nitrogen oxides are emitted into the air and react to form sulphuric acid and nitric acid. Dilute forms of these acids are carried long distances by wind and fall to the earth as wet deposition (rain, hail, snow or fog) or dry (acid gas or dust). Acid rain causes metals to leach into lakes and rivers, impairing their ability to support aquatic life. It also contributes to declining growth rates and death in trees. Soil, lakes and rivers vary in their ability to neutralize acid. Most soils in southern Ontario, including York Region, tend to be more alkaline and thus have better ability to buffer against the effects of acid rain. The soils found farther north, in the ancient granite of the Canadian Shield, have little ability to buffer the effects of acid rain. Here tens of thousands of lakes have been acidified. Human health is also affected by acid rain. Acidic aerosols (sulphates and nitrates) have been associated with decreased lung function, increased cardio-respiratory mortality, and increased hospital admissions in southern Ontario.

The major sources of sulphur dioxide are smelting and power generation; major sources of nitrogen oxides are transportation, industrial processing and fuel combustion, and power generation. Eastern Canada receives more acid deposition than other areas of Canada, with more than half of this estimated to come from sources in the United States.

Since the start of the Canadian Acid Rain Program in 1985, emissions of sulphur dioxide in eastern Canada have decreased by 56% over 1980 figures. This may well not be enough, however. The recovery of lakes from acid precipitation is a long-term process and recovery of biota in lakes may take even longer. During the early 1980s and the mid-1990s, testing in 202 lakes in Ontario, Quebec, Nova Scotia, and Newfoundland revealed that 33% had improved in terms of pH, 56% remained stable, and 11% had worsened.

Stresses on the Upper Atmosphere

Global Climate Change

Like the glass panels of a greenhouse, the earth's atmosphere helps to regulate the temperature at the earth's surface, keeping it from getting too hot or too cold. The portion of the atmosphere that is responsible for this is the so-called "greenhouse gases": carbon dioxide, methane, nitrous oxide, ozone,



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and water vapour. These gases regulate climate by trapping heat from the solar energy reflected from the earth's surface; this mechanism has kept the average surface temperature of the planet within a range of 7°C over the past 3 million years. Because of the burning of fossil fuels, carbon dioxide concentrations in the atmosphere have increased 28% in the last 200 years, and are expected to double in about 40 years. Atmospheric concentrations of methane increased 5% between 1985 and 1994, and nitrous oxide increased 2% between 1984 and 1993. Scientists predict that the result of these changes will be an "enhanced greenhouse effect", increased trapping of solar energy that will lead to an increase in global temperatures. Globally, 1997 was the warmest year of the century based on land and ocean surface temperature data. Including 1998, the top 10 warmest years ever recorded on land have all occurred since 1981. Predictions of what this will mean in terms of climate vary due to uncertainties about the rate of emissions of greenhouse gases and the difficulties of modelling the complex factors that influence climate. Many scientists agree that, whatever the outcomes of global warming, more extreme climatic events will take place: these include floods, droughts, hurricanes and tornadoes.

Destruction of the Ozone Layer

The ozone layer is in the stratosphere 25 km above the earth's surface. Stratospheric ozone helps to regulate the earth's surface temperature and provides a shield against the sun's harmful rays. Stratospheric ozone levels were relatively stable until the late 1970s. Since then, however, there has been a steady decrease in the amount of stratospheric ozone over the entire globe: a 4 to 6% decrease per decade in the mid-latitudes, and a 10 to 12% decrease in higher latitudes. Depletion of the ozone layer allows more of the sun's ultraviolet (UV) light through. Increased levels of UV are predicted to have negative impacts on agricultural crops, forests, fisheries and human health (predicted increases in skin cancer and cataract rates). The main cause of ozone depletion is chlorine and bromine released from chlorofluorocarbons (CFCs) and other compounds used in air-conditioning, refrigerants, foams, aerosols, solvents, and fire extinguishers. Although these substances have been regulated since 1987, it is predicted that stratospheric ozone depletion will continue to worsen until the millenium.

The Current Condition of the Region's Air

How Air Quality is Measured

Federal and provincial regulations set out acceptable concentrations of the major pollutants found in outdoor air. Sampling of air can show whether it meets these criteria for individual pollutants. A composite index - the Air Quality Index (AQI) - has been developed by the Ministry of the Environment based on the most common air pollutants found in our air. These include sulphur dioxide, nitrogen oxides, carbon monoxide, and ozone. The Air Quality Index provides a measure of how "breathable" the air is on a given day. When the AQI is greater than 50, the Medical Officer of Health is informed and an Air Quality Advisory is issued.

The AQI is measured at 29 sites in 24 major cities across Ontario. The only air monitoring station in York Region is located in Stouffville on Highway 47 east of Highway 48; however, it does not monitor all of the parameters required to calculate the AQI. The Region and the MOE are currently working together to locate an AQI monitoring station in Newmarket. It is anticipated that the station will be operational in the year 2000.

Levels of Pollutants

Generally, air quality has improved in the province over the last thirty years. Environmental regulation has dramatically reduced emissions of pollutants such as sulphur dioxide from stationary sources such as power plants, incinerators and industrial plants. No longer do smokestacks belch out black smoke as they did in the 1960s. Levels of particulate matter and ground-level ozone - prime ingredients in smog - have remained high, however, due in large part to the increasing number of automobiles and increased automobile use.

From 1989 to 1995, "moderate" Air Quality Index readings (i.e., levels of at least 31) were recorded at the five monitoring stations closest to York Region on as few as 30 and as many as 100 days a year. A "moderate" level is the level at which damage to sensitive vegetation begins to take place and at which sensitive people may experience respiratory irritation during vigorous exercise.

"Poor" air quality occurs when Air Quality Index is expected to exceed 50. When this happens Air Quality Advisories are issued by the MOE to the local Medical Officer of Health, in areas monitored by AQI stations, and news media the day before the elevated levels are expected. Warnings are then provided to the public. During Air Quality Advisories, sensitive individuals with heart or lung disease, including asthma



Levels of pollutants that form smog remain high in large part because of increased numbers of automobiles and increased automobile use.



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may experience a worsening of their condition. All individuals should restrict their physical activities at these times, especially aerobic activities such as jogging. Between 1993 and 1998, Air Quality Advisories were issued in Toronto between 1 and 8 days a year. The number and length of advisories is influenced to a large extent by weather conditions. Sunny, hot conditions with little wind and stagnant weather patterns favour the production and accumulation of ground-level ozone.

The most frequent cause of elevated Air Quality Index was high levels of ground-level ozone and particulate matter.

Odours

Odours can come from many sources: industries, agricultural producers, landfill sites, sewage treatment plants, and wetlands. Residents living near the Keele Valley Landfill Site in Vaughan have complained to the MOE about odours more than 600 times since the site began operation in 1985. Not all of these odours were from the landfill site. In 1996, Metropolitan Toronto, the owner and operator of the Avondale Composting site located within the Keele Valley Landfill Site, was fined for an Environmental Protection Act violation with respect to odours at the site. In 1997, residents in Vaughan launched a \$600 million class action suit against Metropolitan Toronto claiming the landfill site is a source of pollution and odours harmful to human health.

Noise

Noise can be defined as unwanted sound or sound that interferes with the ability to hear. Noise is usually just unpleasant, but hearing can be damaged by short exposures to intensely loud noise or by prolonged exposure to lower levels of noise.

Regional and provincial guidelines for residential development have been established to reduce the impact of noise. The MOE has developed a model noise by-law that has been the basis for by-laws enacted by several of the area municipalities. Enforcement of noise by-laws is generally complaint-driven.

In York Region, noise has increased as the numbers of people, industries and motor vehicles has grown. York Regional Police received about ten noise complaints a day from 1994 to 1996. Most (about 95%) of these complaints were due to public disturbances such as loud, late-night parties or cars creating excessive noise on the street. Within the Region, seven area municipalities recorded a total of 300 complaints in 1996. Not all of the complaints were recorded, because many were referred to the police department or the MOE.

Indoor Air Quality

With the implementation of energy conservation measures in homes and buildings, concern about indoor air quality has increased. Sealing and insulating buildings reduces energy loss and heating or ventilation costs, but also reduces the rate of exchange of indoor air with that outside. As a result, contaminants became more concentrated indoors where people spend the majority of their time.

Indoor air pollution can result from human activities such as smoking, or appliances such as wood stoves. It can also be caused by some types of building materials, furnishings, paints and cleaning products, and from outdoor air which enters the building (for example from vehicle exhaust). Indoor air pollution can also be caused by biological sources such as fungi, molds, bacteria, pollen and viruses.

There are no “building-related illness” data available in York Region. The York Region Health Services Department sporadically receives complaints about indoor air quality. These have included requests to investigate carbon monoxide levels in indoor parking garages, perchloroethylene emissions from dry cleaners, carbon dioxide levels in schools and recreational facilities, molds in portable school classrooms, and fumes from industrial units close to commercial or residential areas. York Region Health Services staff annually check carbon monoxide and nitrogen oxide levels at all 27 ice arenas in York Region.

Environmental Tobacco Smoke

Environmental tobacco smoke (ETS), or second-hand smoke, is mainly made up of sidestream smoke released directly from the burning tip of a cigarette and to a lesser extent, exhaled mainstream smoke. The World Health Organization has identified tobacco smoke as the most direct and important source of indoor air pollution. The Environmental Protection Agency in the United States has classified second-hand smoke as a Group A (or known human) carcinogen. Exposure to ETS results in an increased risk of lung cancer and heart disease. It is reasonable to expect that ETS will cause the same diseases linked to active smoking such as chronic lung disease, other cancers, and stroke.

Legislation governing smoking in public places and workplaces includes the *Non-Smokers' Health Act*, *Smoking in the Workplace Act*, *The Tobacco Control Act* and *The Municipal Act*. There is currently a great variety in municipal by-laws protecting individuals from ETS across the nine municipalities of York Region.

The provision of by-laws and smoke-free policies are some of the most effective ways to protect people against the health effects of second hand smoke. To protect the health of the residents of York Region, the Region established a No Smoking By-law Task Force in 1999. The goal of the Task Force is to enact smoke-free by-laws governing indoor public spaces in the nine municipalities that comprise York Region through a staged implementation plan.



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Benchmarks of Health

Proposed benchmarks of health for the Region's air resources follow. The table includes measures, targets and current measurement (or status). In some cases, the information needed has not been gathered for this SOE Report. Where this is so, it is indicated in the table.

Benchmarks	Measure	Target	Current Status
Air Quality Index	Annual number of days the Air Quality Index was greater than 31 for at least one hour (measured at the 5 closest monitoring stations in the GTA and the new station in Newmarket, when operational).	Zero	Number of days ranged from 45 to 90 in 1995 at the 5 sites monitored.
Air Quality Advisories	Annual number of Air Quality Advisories that are issued for the Toronto area	Zero	AQA issued on 5 days (1998)
Ozone Levels	Annual number of days that ozone concentrations exceed the criteria for one hour, (measured at Stouffville and the new station in Newmarket, when operational).	Zero	29 days (1995 at Stouffville)
Odours	Annual number of odour complaints received by the MOE from residents in York Region.	Zero	Not collected for this SOE Report
	Annual number of odour complaints received by the MOE about the Keele Valley Landfill Site from residents living nearby.	Zero	135 (1996)
Noise	Annual number of noise complaints received by York Regional Police	Monitor	3,385 (1996)
Indoor Air Quality	Annual number of complaints York Region Health Services receives about indoor air quality.	Monitor	Not collected for this SOE Report

