ARE WE MAKING PROGRESS TO IMPROVE AIR QUALITY?

Yes, significant progress has been made over the past 20 years to improve air quality in the Great Lakes region, however, serious impacts due to air pollution remain. There are opportunities to build on the progress made and continue the improving trend to further reduce human health impacts and the impacts on sensitive ecosystems.

The Issues

- Air quality is a local and regional issue affected by human activities, weather, and topography.
- Many Great Lakes cities experience unacceptable air quality, especially in the summer.
- Levels of ozone and microscopic airborne particles remain a concern in the Great Lakes region, especially in the Detroit-Windsor-Ottawa corridor (extending northward to Sault St. Marie), the Lake Michigan region and the Buffalo-Niagara region. These pollutants continue to exceed air quality criteria and standards at a number of monitoring stations in southern Ontario and the lower Great Lakes region of the United States. Ozone and microscopic airborne particles (particulate matter) combine with other air pollutants to produce a condition known as smog.
- Continued economic growth, population growth, and associated urban sprawl threaten to offset emission reductions through both increased energy consumption and vehicle miles travelled.

Photo: Microsoft Office.

The Indicator

A suite of local and regional pollutants is measured by the governments of the United States and Canada to monitor air quality in the Great Lakes ecosystem and to infer the potential impact of degraded air quality on human health and the environment in the Great Lakes region. Key pollutants of concern are carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, particulate matter, ground level ozone and toxic contaminants in the atmosphere (also known as air toxics.)

A clear day (left) and a smog day (above) over Hamilton Harbour, Ontario. Photos: Chad Boyko.

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Pollutant	Region	Timeline	Trend
Carbon Monoxide (CO)	United States	1993 – 2002	Concentration ↓ 42% Emissions ↓ 21%
	Canada Ontario	1980 – 2000 1991 – 2000	Concentration ↓ 60% Emissions ↓ 4%
Nitrogen Dioxide (NO_2)	U.S. Great Lakes Region	1982 – 2001	Concentration ↓ 19%
	Ontario	1975 – 2002	Concentration ↓ 23%
Nitrogen Oxides (NO_x)	United States	1993 – 2002	Emissions ↓ 12%
Sulfur Dioxide (SO_2)	United States	1993 – 2002 1993 – 2002	Concentration ↓ 39% Emissions ↓ 31%
	Ontario	1993 – 2002 1971 – 2001	Concentration ↓ 20% Emissions ↓ 82%
Lead	U.S. Great Lakes Region	1982 – 2001	Concentration ↓ 95%
	Ontario	1984 – 2000	Concentration ↓ 95%
PM_{10} * (Direct Emissions)	U.S. Great Lakes Region United States	1992 – 2001 1993 – 2002	Concentration ↓ 12% Emissions ↓ 22%
$PM_{2.5}$ * (Direct Emissions)	United States	1999 – 2002 1993 – 2002	Concentration ↓ 8% Emissions ↓ 17%
Benzene (Air Toxics)	United States	1994 – 2002	Concentration ↓ 47%
	Ontario	1993 – 2002	Concentration ↓ 56%
Ozone (O_3) 1-hour maximum	United States	1993 – 2003	Concentration ↓ 2%
	Ontario	1980 – 2003	Concentration ↓ 10%
Ozone (O_3) (8-hour mean)	U.S. Great Lakes Region	1990 – 2003	Concentration ↓ 6%
Ozone (O_3) (seasonal means)	Ontario	1980 – 2003 summer 1980 – 2003 winter	Concentration ↑ 21% Concentration ↑ 29%

Table 1. Ambient concentration and emissions trends for air pollutants in both the United States and Canada over the various time periods. * No Canadian data for particulate matter (PM_{10} and $PM_{2.5}$)

↓ Indicates concentrations decreased over indicated timeline.

↑ Indicates concentrations increased over indicated timeline.

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The Assessment

There has been significant progress in reducing both the ambient concentration and emissions of many of the key air pollutants in the Great Lakes basin. Six criteria pollutants of concern for human health and the environment are listed in the U.S. Clean Air Act (also listed in *The Indicator* section) and progress has been made in reducing ambient concentrations of all six, however, ambient concentrations of ozone and particulate matter are of particular concern in both the United States and Canada. In general, air pollution levels still continue to have significant human health and environmental effects.

Table 1 summarizes trends of ambient concentrations and emissions for pollutants of concern. Sources or reductions for these pollutants include:

- Carbon Monoxide (CO): CO levels in the Great Lakes region have decreased, mainly as a result of more stringent transportation emissions standards.
- Nitrogen Dioxide (No_2): The combustion of fuel in motor vehicles is the most common source of NO_x emissions. Significant reductions of both NO_2 and NO_x, the family of nitrogen oxides, have occurred in the transportation sector.
- Sulfur Dioxide (SO_2): Emissions of this pollutant are from a variety of sources including industrial processes and electrical utilities. Significant reductions have occurred mainly as a result of regulations imposed on coal and fossil fuel burning power plants and some smelters.
- Lead: Regulatory efforts to reduce the content of lead in gasoline have led to significant reductions in both the United States and Canada.
- Particulate Matter (PM): The fraction of particles in the atmosphere with a diameter of 10 microns or less (PM_{10}) or 2.5 microns or less ($PM_{2.5}$) is monitored. $PM_{2.5}$ is of particular concern to human health because it can penetrate deeply into the lungs. Particulate matter is produced by many sources, including cars, trucks, and buses burning diesel and other fossil fuels; the preparation and application of fertilizers and pesticides; road construction; industrial processes; mining; agricultural burning; and the operation of fireplaces and wood stoves.
- Ground-Level Ozone (O_3): O_3 forms during the reaction of sunlight or heat with pollutants already present in the environment, making it a secondary pollutant. O_3 is a problem throughout the Great Lakes region, with the exception of Lake Superior. In 2003, O_3 levels (measured as hourly values) in the United States were the lowest recorded in 20 years. The improved air quality mainly resulted from favourable weather conditions. In Ontario, the maximum recorded hourly O_3 concentrations decreased from 1980 to 2002, while the trend in average seasonal values appears to be increasing over the past 10 years. At their current levels, one-hour O_3 concentrations continue to exceed Ontario's Ambient Air Quality Criterion (AAQC).

Wood stove. Photo: Environment Canada.

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- Air Toxics: Various pollutants with the potential to harm human health or cause adverse environmental and ecological effects are grouped into this category. Example pollutants include benzene, chromium, and carbon tetrachloride.

Current Actions

Major pollution reduction efforts are underway in both the United States and Canada, which focus on better characterization of ambient pollution levels and minimization of pollution emissions.

Under the Border Air Quality Strategy, the Great Lakes Basin Airshed Management Framework pilot project is conducting a joint investigation of local and sub-regional airshed management in a contiguous urban area that crosses the border. The project will focus on the ground level ozone and fine particle (PM) pollution problems that impact the southeast Michigan/southwest Ontario border region.

Monitoring for specific pollutants continues. In the United States, the National Air Toxics Trend Site network detects trends in high risk air toxics such as benzene and chromium. Regulatory agencies in the province of Ontario and the eight Great Lakes states have developed the Great Lakes Regional Air Toxics Emissions Inventory in an effort to reduce airborne deposition of persistent toxic chemicals to the Great Lakes. In 2000, Canada and the United states signed the Ozone Annex to the Air Quality Agreement, committing both countries to reducing emissions of nitrogen oxides and volatile organic compounds, the precursor pollutants to ground-level ozone.

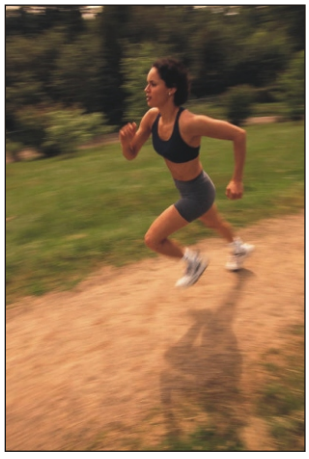

Photo: Microsoft Office.

Additional actions in the United States include a rule known as the "NO_x SIP Call" that requires eastern states to improve air quality by reducing emissions of NO_x; the Clean Air Interstate Rule, which, when fully implemented, will reduce SO_2 emissions in these states by over 70% and NO_x emissions by over 60% from 2003 levels; and the 2007 Clean Diesel Trucks/and Buses and Low Sulfur Diesel Rule and the Clean Air Non-road Diesel Rule, which impose more stringent standards for new diesel engines and fuels beginning in 2006.

Photo: Microsoft Office.

Actions Needed

Improving air quality in areas where it is degraded is a continuing challenge. Although there have been significant improvements in the levels of air pollutants in the Great Lakes region, parts of the region continue to experience poor air quality.

Continuing human health research is needed to better characterize the harmful effects of air toxics.

To Learn More

For further information about Great Lakes air quality, refer to the ***State of the Great Lakes 2005*** report, which, along with other Great Lakes references, can be accessed at **www.epa.gov/glnpo/solec**.

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