WATERLOO REGION PARTNERS FOR CLEAN AIR

Partners as of October 2008

City of Cambridge

City of Kitchener

City of Waterloo

Conestoga College

Region of Waterloo

St. Mary's General Hospital

University of Waterloo

Union Gas

Waterloo Region District Public School Board

Wilfrid Laurier University

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INTRODUCTION

Clean air is a fundamental requirement of human health and well-being. In fact, it has long been recognized that poor air quality has an adverse impact on human health and quality of life. Although natural sources of air pollution, such as forest fires, volcanic activity and wind erosion have been present for millennia, human activity, the increased use of fossil fuels and increasing Industrialization has contributed to global warming, climate change and a rise in air pollution in many parts of the world.[1]

The consequences of exposure to high levels of outdoor air pollution were made clear in the mid-twentieth century when cities in Europe and the United States experienced air pollution episodes resulting in deaths and hospital admissions. This prompted many governments, including Canada, to investigate the effects of air pollution on human health and to enact legislation aimed at improving air quality. While such efforts have improved conditions, the effects of global warming and air pollution continue to pose a significant threat to public health on both a local and global level.[2]

Because of the magnitude and complexity of the challenges posed by these environmental issues, it is impossible for a singular entity, organization or institution to "clean the air." Instead, emissions reductions and improvements to local air quality require the cooperation of many sectors, including: industry and business, government and other public institutions, as well as residents of the community. A mechanism for change, such as the Waterloo Region Partners for Clean Air, can help by providing a cooperative framework for positive environmental change.

The Waterloo Region Partners for Clean Air was originally established in 2005, and includes representation from local government, school boards, college and university, hospitals and a utility. It continues to build on the Clean Air Plan originally developed by Region of Waterloo in 1999. The partnership is intended to help raise the collective, as well as the individual, capacity of each participating organization to achieve reductions in air emissions and further develop the Clean Air Plan. For the past several years, partners have focused on various aspects of their organizations' operations with the intent of improving environmental benefits such as reduced energy consumption and/or lower vehicle emissions.[3]

The initial focus on public sector operations was intentional as the participating partners represent a large presence in Waterloo Region with almost 10,000 employees; over a thousand fleet vehicles and over one hundred buildings. Together, the partner organizations affect many aspects of community living through local government, health care, secondary education institutions and the public school board.

Each of the partner organizations has a mandate to deliver key services to the community while facing periodic human resource, financial and legislative challenges.

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[1] Region of Waterloo Public Health. *Air Quality & Urban Impacts Waterloo Region: A Preliminary Assessment.* Health Determinants, Planning & Evaluation Division. (Waterloo, February 2008). p.10

[2] Ibid.

[3] Waterloo Region Partners for Clean Air. *Clean Air Plan Report 2006/2007*. (Waterloo, October 2007). p.1

Some of the work initiated by the partners is above and beyond their primary organizational purpose and demonstrates a strong commitment to environmental stewardship.

This year's report continues the trend begun in 2005 by highlighting the successes of participating partners and offering background information on air quality issues affecting the community.

Air Quality – A Primer[4]

Outdoor air pollution is the result of a complex combination of a variety of different substances. Although measuring and estimating impacts of the compound effects of these substances continues to be a challenge, environmental agencies worldwide have confirmed a core set of air pollutants and indicators that are widely used to describe air quality.

According to the Ontario Ministry of the Environment's "Air Quality in Ontario, 2006 report," air pollution is created from a number of different sources. For example, the residential sector (32 per cent), other industrial processes (30 per cent), and the transportation sector (20 per cent) are the largest contributors in Ontario of one of the most common pollutants, particulate matter ($PM_{2.5}$). However, the transportation sector is one of the leading sources of air pollutants in Ontario. This sector contributes to approximately 65 per cent of emissions of nitrogen oxides (i.e. NO_x, of which NO_2 is a major product) and volatile organic compounds (VOCs) - both of which contribute to the formation of ozone (O_3).

Ground level ozone (O_3) is formed when NO_x and volatile organic compounds (VOCs) react in the presence of sunlight.

The transportation sector accounts for approximately 35 per cent of all VOC emissions, while other sources, such as solvents (22 per cent) and general industrial processes (16 per cent) are the second and third largest sources of VOC emissions in Ontario. The main sources of sulphur dioxide (SO_2) in Ontario are smelters (48 per cent) and utilities (22 per cent).

Air quality in Ontario has improved significantly over the past 35 years with a reduction in the level of three common air pollutants, namely nitrogen dioxide (NO_2), carbon monoxide (CO) and sulphur dioxide (SO_2) levels. Ozone (O_3) and particulate matter (PM), on the other hand, have been on the rise and present a growing health concern.[11]

As a society, we incur both social and economic losses due to the impact of air pollution on our health. The economic burden of air pollution can be measured in terms of additional health care costs such as hospital admissions, emergency room and doctor's office visits, homecare services and medication in addition to other costs such as reduced workplace productivity, lost wages due to sick time, out of pocket expenses incurred while ill and finally a decline in quality of life or a loss of life itself. [12,13] The Ontario Medical Association (OMA) estimated that in 2005, overall economic losses

[4] The following information has been extracted with permission from: Region of Waterloo Public Health. *Air Quality & Urban Impacts Waterloo Region: A Preliminary Assessment.* Health Determinants, Planning & Evaluation Division. (Waterloo, February 2008). Please refer to this document for a more detailed discussion on air quality and its health impacts in Waterloo Region. The document may be found at: http://chd.region.waterloo.on.ca/web/health.nsf/0/EF84928AED47024D8525711D0069B15A/$file/Air%20Quality.pdf?openelement

associated with air pollution exposure were expected to be approximately $7.8 billion in Ontario and $19.9 million in Waterloo region.[11]

Although everyone is at risk of the negative health effects associated with air pollution, certain populations are more susceptible.[7] This includes people who are innately more susceptible to the effects of air pollutant exposure than others, those who become more susceptible (e.g. as a result of environmental, social factors, personal behaviours) and those who are simply exposed to unusually large amounts of air pollutants. Members of the last group are vulnerable by virtue of exposure rather than as a result of individual susceptibility. Unborn and very young children are particularly sensitive; they take in more air than adults for their relative body weight and therefore a higher level of pollutants. Other groups that are highly sensitive to air pollution include the elderly, those with cardiovascular and respiratory disease, those who are exposed to other toxic materials that add to or interact with air pollutants, and the socio-economically deprived.[12,13,14,15]

Overall, air quality trends reveal that despite some air quality improvements, certain pollutant levels have increased in Waterloo Region. Waterloo Region experienced an improvement in some air quality measures, specifically a decline in the average daily air quality levels for nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) from 2000 to 2006. However, average daily air quality levels for fine particulate matter ($PM_{2.5}$) increased and ozone (O_3) levels showed considerable variability from year to year with increased levels in 2006. This is similar to Ontario trends, showing a reduction of NO_2 and SO_2 levels while O_3 and $PM_{2.5}$ levels have been rising across the province.

Air pollution is also associated with numerous negative impacts not directly related to health. For instance, smog and haze are accompanied by low visibility conditions which degrade the aesthetic appeal of natural environments. Elevated levels of air pollutants can cause plant injury resulting in deforestation and crop loss. Atmospheric levels of nitrogen can also alter soil composition and ecosystem structures by causing certain plant species to flourish and others to decline. Certain airborne pollutants contribute to the corrosion of rubber, metal and carbonate cement building materials. In addition, air pollutants such as carbon dioxide, methane, nitrous oxide, and ozone are greenhouse gases which contribute to global climate change.[16]

Most Common Air Pollutants

Air pollutants may be either emitted into the atmosphere (primary air pollutants) or formed within the atmosphere itself (secondary air pollutants). Primary air pollutants are emitted into the atmosphere from a source such as a factory chimney or exhaust pipe, or through suspension of contaminated dusts by the wind. They include sulphur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs), and carbonaceous and non-carbonaceous primary particles.[4,6]

Secondary air pollutants arise from chemical reactions of primary pollutants in the atmosphere, often involving natural components of the environment such as oxygen (O_2) and water. Prominent secondary pollutants in the air include ozone (O_3), oxides of nitrogen (NO_x), and secondary particulate matter (PM). [4,6]

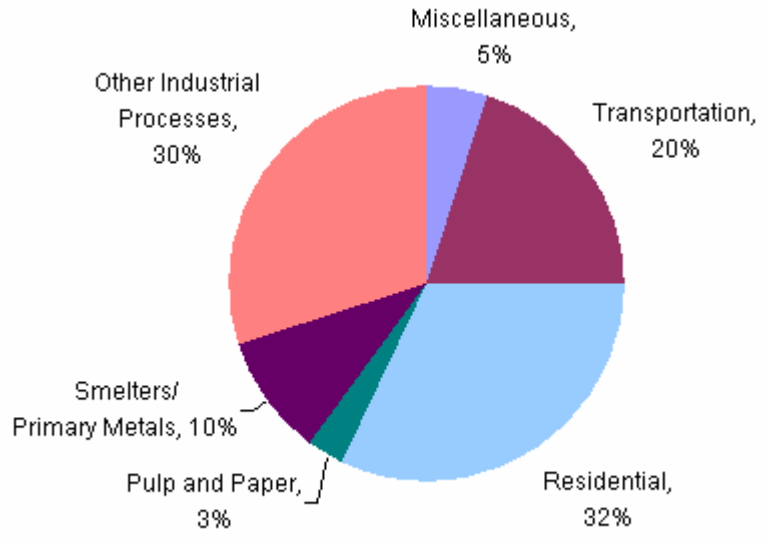
Outdoor air pollution is a complex mixture of a number of different substances. Environmental agencies around the world have developed a core set of air pollution indicators and criteria pollutants which have been widely used to characterize air quality. Focusing on the most common pollutants, a brief overview of particulate matter (PM), nitrogen dioxide (NO_2), ozone (O_3) and sulphur dioxide (SO_2) is presented below.[4,6]

Particulate Matter (PM)

Particulate matter (PM) is the general term used for a mixture of solid particles and liquid droplets found in the air we breathe. These particles come in a wide range of sizes such as PM_{10} and $PM_{2.5}$ where '10' and '2.5' refer to the aerodynamic diameter of the particles. The greatest heath hazard comes from the smallest particles ($PM_{2.5}$ or, Fine Particulate Matter 2.5) because they are easily inhaled, being 30 times smaller than the average diameter of a human hair. [17]

The evidence related to airborne particulate matter (PM) and its public health impact is consistent in showing adverse health effects.[4,6] Major sources of PM that can adversely affect the population's health include motor vehicles, fossil-fuelled electric power plants, industrial facilities, agricultural practices, residential fire places, consumer products and natural processes such as forest fires or wind erosion.[1,17] Figure 1 shows 2005 estimates of $PM_{2.5}$ emissions from point, area and transportation sources in Ontario. According to the Ontario Ministry of the Environment (OME), residential sectors (32 per cent), other industrial processes (30 per cent) and the transportation sector (20 per cent) accounted for the largest contributions of $PM_{2.5}$ emissions. Lesser sources of $PM_{2.5}$ included smelters/primary metals (10 per cent) as well as pulp and paper emissions (3 per cent). [3]

Figure 1: Ontario fine particulate matter ($PM_{2.5}$) emissions by sector, 2005



Particulates can travel great distances, thus affecting the quality of air far from its source. Significant amounts of $PM_{2.5}$ are carried into Ontario from the United States, strongly linked to highly industrialized and urbanized areas of the American Mid-West

and Ohio Valley Regions. It is estimated that 50 per cent of Ontario's $PM_{2.5}$ comes from the United States during periods of widespread elevated levels of fine particulate matter (i.e. total of 5 $PM_{2.5}$ episode days in 2006).[3,17,18]

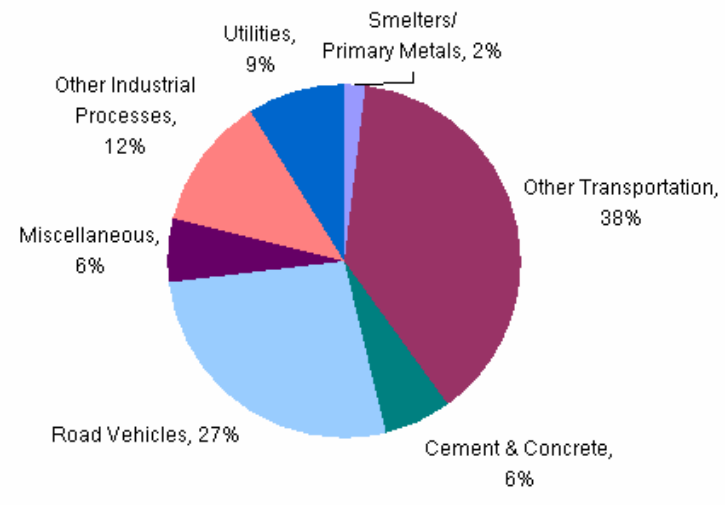
The risk for various health conditions has been shown to increase with exposure to PM and there is little evidence to suggest a threshold below which no adverse health effect would be anticipated. Short-term (on the order of a few days), and long-term (months to years) exposure to PM is statistically associated with serious adverse health outcomes (e.g. mortality, hospital admissions, etc.).[2] The range of health effects is broad, however PM predominantly affects the respiratory and cardiovascular systems.[6] Respiratory conditions such as asthma, bronchitis, cardiovascular or lung disease are exacerbated by breathing in PM. Susceptibility may vary with health or age, but children and the elderly are more sensitive to the effects of PM.[17,19]

Nitrogen Dioxide (NO_2)

Nitrogen dioxide (NO_2) is a reddish-brown gas that has a strong and irritating odour. It is one of the most common smog-causing pollutants and is a precursor of O_3. It can combine with water molecules to form nitric acid, which contributes to the formation of acid rain, snow and fog.[20] A major source of nitrogen oxides resulting from human activities is derived from the combustion of fossil fuels (coal, gas and oil), especially gasoline used in automobiles. Therefore, NO_2 tends to be present at high concentrations throughout a city and at significantly reduced concentrations in adjacent rural areas.[6]

All processes of combustion in the air produces oxides of nitrogen (NO_x) of which NO_2 is a major product. Approximately 65 per cent of NO_x in Ontario comes from the transportation sector (Figure 2). A large part of the remaining 35 per cent comes from power generation, primary metal production and incineration. Although there are natural sources of NO_x (e.g. lightning, aerobic activity of soil bacteria), natural source contribution is small compared to emissions caused by human activity. [3,20]

Figure 2: Ontario nitrogen oxide (NO_x) emissions by sector, 2005



According to epidemiological studies, daily concentrations of NO_2 are significantly associated with increased cardiovascular and respiratory mortality.[6] One of the main health effects of NO_2 is on the respiratory system, with several studies finding increases in daily hospital admissions for respiratory diseases. Sensitivity increases for young children and adults with heart and respiratory disorders and people with asthma and bronchitis.[20] Epidemiological studies have shown that bronchitic symptoms of asthmatic children increase in association with annual NO_2 concentration, and that reduced lung function growth in children is linked to elevated NO_2 concentrations at the current urban ambient air levels within North American and European communities. Nevertheless, it is unclear to what extent the health effects observed in epidemiological studies are attributable to NO_2 itself or to the other primary and secondary combustion-related products with which it is typically correlated.[4,6]

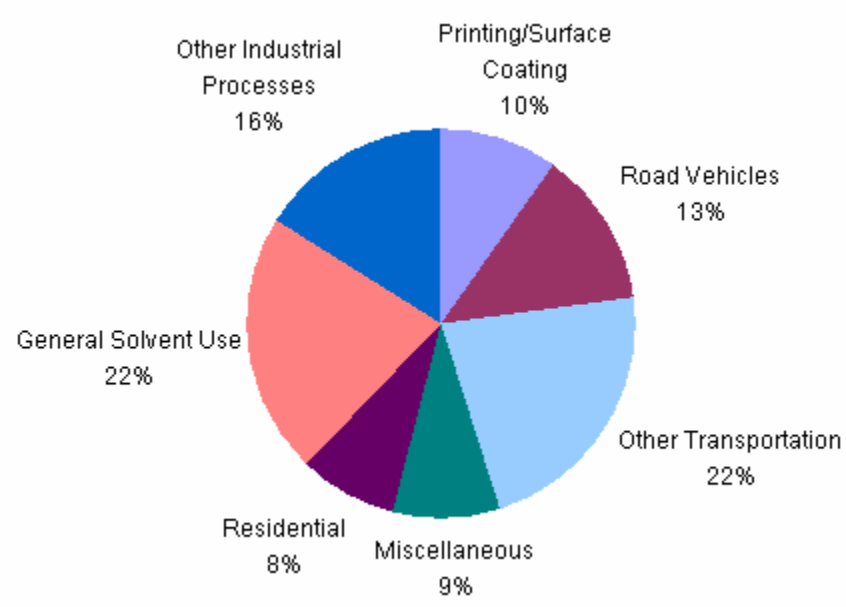
In general, cold weather in the winter results in higher levels of NO_2 in ambient air, owing to reduced atmospheric dispersion. Although industrial and traffic-related emissions are relatively constant over the course of a year, the additional input of pollutants such as nitrogen oxides from domestic heating sources may also contribute to elevated concentrations in the winter season.[21]

Ozone (O_3)

Ozone (O_3) is one of the most widespread global air pollution problems today.[6] It is a colourless, odourless gas that is present in two different areas of the atmosphere (i.e. stratosphere and troposphere). When O_3 is naturally formed in the atmosphere, it protects life from the sun's damaging ultraviolet rays. But at ground level, O_3 acts as an invisible air pollutant that is harmful to humans, animals, plants and man-made materials.[6,22]

Ground level O_3 is formed when nitrogen oxides (NO_x) and volatile organic compounds (VOCs) react in the presence of sunlight (Figure 2, 3). Figure 3 shows the 2005 estimates of VOC emissions from point, area and transportation sources in Ontario. Transportation sectors accounted for 35 per cent of VOC emissions while general solvents (22 per cent) and other industrial processes (16 per cent) were the second and third largest sources of VOC emissions. Lesser sources of VOC included printer/surface coating (10 per cent) and residential emissions (8 per cent).[3]

Figure 3: Ontario volatile organic compound (VOC) emissions by sector, 2005



Studies show that every major Canadian urban centre has levels of ground-level O_3 that pose health risks. [3,22] As O_3 concentrations increase, health effects at the population level become increasingly numerous and severe with exposure to O_3 which is linked to increased hospital admissions and premature mortality.[6,14] Ozone has been recognized as a serious air pollutant with well-defined adverse respiratory health effects.[2] People with respiratory and heart problems, asthma and lung disease are at higher risk, as are healthy adults exercising for long periods of time outdoors.[22] The degree to which ozone has an impact on cardiac morbidity is not as well known.[2]

Ozone exhibits a considerable spatial variation since, once formed, it travels with the prevailing wind, tending to reach higher concentrations in suburban areas, remote downwind locations or at higher altitudes. Ozone has an atmospheric lifetime of days or even weeks, which permit it to be readily transported thousands of kilometres away, crossing regional and national boundaries.[6] During widespread smog episodes in Ontario (i.e. total of 9 ozone episode days in 2006), the United States' contribution to O_3 is expected to be as much as 90 per cent in cities and towns located on the northern shore of Lake Erie, the eastern shore of Lake Huron and in the extreme southwest near the Canada-U.S.A. border.[3,18] With the ability to be transported such long distances in the atmosphere, O_3 is considered a transboundary problem.[6,18]

Weather patterns can greatly influence the seasonal variation of pollutants. Since O_3 is formed in the lower atmosphere, levels of O_3 are normally higher in warmer weather. This is due to the enhanced photochemical formation of O_3, especially during smog events typical of warm, stable atmospheric conditions.[21]

Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) is a colourless gas that is readily soluble in water. [6,23] It combines with water to form sulphuric acid, which contributes to the formation of acid rain, snow and fog.[23] SO_2 is derived from the combustion of sulphur-containing fossil fuels (e.g. coal, oil) and is a major air pollutant in many parts of the world.[6] It is a precursor to sulphates, which are one of the main ingredients of airborne fine particulate matter ($PM_{2.5}$).[23] Natural sources, such as volcanoes, contribute to naturally-occurring levels of SO_2. But in most urban areas, contributions from human activity are of the greatest concern. These include the use of sulphur-containing fossil fuels for domestic heating, stationary power generation and motor vehicles.[6]

In Canada, the main sources of SO_2 are coal and oil combustion at power plants, smelters, and from the oil, gas extraction and refining industries. Many of these sources are located away from cities, but their SO_2 emissions contribute to sulphate particles on a regional scale. Within Canadian cities, the main sources of SO_2 are power plants, refineries, industry (e.g. steel manufacturing), and transportation.[24]

In Ontario, the main sources of SO_2 come from smelters (48 per cent) and utilities (22 per cent) while petroleum refineries and other industrial processes accounted for approximately 10 and 9 per cent of SO_2 emissions, respectively. Lesser sources of SO_2 emissions include transportation as well as cement and concrete sources (Figure 4).[3]

Pollutants, Health and the Transportation Sector

The epidemiological and toxicological evidence related to the effects of transportation-related air pollution on health has increased substantially in recent decades. Research consistently shows the adverse effects of outdoor air pollution on human health, and evidence points to air pollution stemming from transportation as an important contributor. A review of this evidence reveals that transportation-related air pollution contributes to an increased risk of death (particularly from cardiopulmonary causes) and increased risk of respiratory symptoms and diseases.[21,25]

Increasing traffic congestion and the growth of traffic volume in urban areas contributes to the rising concern related to air pollutant emissions. Road-traffic emissions arise from a number of source, including exhaust pipe emissions and contributions from friction processes and suspended road dust. In Ontario, the transportation sector, made up primarily of cars, buses and trucks, is a large emission source of common air pollutants such as $PM_{2.5}$, VOCs, and NO_x. This sector is the largest emission source of NO_x (NO_2 is a major product) and VOCs which both contribute to the formation of O_3.[3,18,21]

Nitrogen dioxide is strongly related to PM, as both come from the same combustion sources.[6] Particulate matter emissions from road traffic come from exhaust pipes, tire wear, brake linings and suspension of road dust. A major source of NO_x is derived from the combustion of fossil fuels (coal, gas and oil), especially gasoline used in automobiles. Nitrogen oxides are often used as markers for transport-related air pollution, and nitric oxide is used as a marker for combustion processes and an indicator of fresh exhaust-pipe emissions near roads. Although NO_2 is a less sensitive

marker for transport-related air pollution, NO_2 is a more relevant marker for adverse health effects.[21]

Assessing a population's exposure to transportation-related air pollutants requires the consideration of a range of factors. It is important that Waterloo region continue to conduct surveillance and publish reports on the health impacts associated with environmental conditions, including transportation-related pollution.

Standards for Air Pollutant Concentrations

Several countries have developed standards for outdoor air concentrations of common pollutants. Canada-wide Standards (CWS) are intended to be achievable targets that will reduce health and environmental risks within a specific timeframe.[26,27] In Ontario, the Ambient Air Quality Criteria (AAQC) represent acceptable effect-based levels in air, with variable averaging times (e.g. 1 hr, 24 hr) appropriate for the effect. The effects considered are based on health, odour, vegetation, soiling, visibility, corrosion or other effects.[28] Table 2 lists outdoor air standards that were developed by the Ontario Ministry of Environment and includes Canadian standards in the absence of provincial standards.[3,27,28,29,30]

Table 2: Air quality guidelines for sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), and fine particulate matter ($PM_{2.5}$) [† ‡ †]

Criteria Pollutant	1 hour Exceedance Level	Average 8 hour Exceedance Level	Average 24 hour Exceedance Level	Source of Exceedance Level*
Sulphur Dioxide (SO_2)	250 ppb	--	100 ppb	AAQC
Nitrogen Dioxide (NO_2)	200 ppb	--	100 ppb	AAQC
Ozone (O_3)	80 ppb	65 ppb	--	AAQC; CWS
Fine Particulate Matter, $PM_{2.5}$	--	--	30 µg/m^3	CWS

The measurement "parts per billion" is represented by "ppb".
‡ The symbol "--" denotes that guideline data was not applicable to the current assessment.
*Ambient Air Quality Criteria (AAQC); Canada-wide Standard (CWS)

It is well documented that higher levels of many airborne pollutants can adversely affect the human body, including respiratory, cardiovascular, reproductive, and neurological systems. Especially well documented are the respiratory and cardiovascular effects of common air pollutants such as $PM_{2.5}$, O_3, and NO_x. However, it is important to note that adverse health effects have been documented at levels well below these official standards and that these standards disregard the synergistic effects of combinations of toxic air pollutants.[7]

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Submissions From Partners

The City of Cambridge

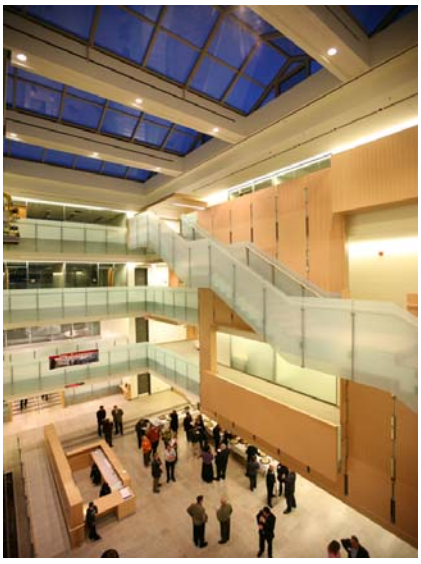
The City of Cambridge has a history with air quality initiatives and has worked with the Region of Waterloo, community organizations, staff, residents, and other municipalities to plan, improve, and build awareness of the issues. In 2008, the City built more than awareness, it built the first Gold LEED certified City Hall in Canada.

Summary of 2008 Air Quality Initiatives

In 2008, an Idling Control Policy was approved in accordance with the Waterloo Partners for Clean Air Plan and the Cambridge Environmental Advisory Committee examined the issue of idling in terms of by-laws, social marketing campaigns and an idle-free zone at the new City Hall building. Cambridge City Green Strategy, a subcommittee of the Cambridge Environmental Advisory Committee, hosted its annual workshop event *"Eat Locally, Eat Wisely"* that focused on food localism. The City continues to support community organizations, such as the Residential Energy Efficiency Program (Waterloo Region Green Solutions) and Grand River CarShare - these programs contribute to energy conservation and reductions in emissions connected with our two largest personal sources – our homes and our vehicles. The City purchased its first hybrid fleet vehicle this year and participated in the Commuter Challenge, a national program that aims to increase awareness of sustainable commuting alternatives. Human Resources implemented a telecommuting initiative. The City is investigating "green building" and "green infrastructure" policies as part of its Official Plan review and implemented green building methods within its new City Hall.

Gold LEED Certified New City Hall

The biggest achievement of 2008 in terms of air quality improvements was the move to the new City Hall building, the first city hall in Canada to achieve the Gold LEED designation.



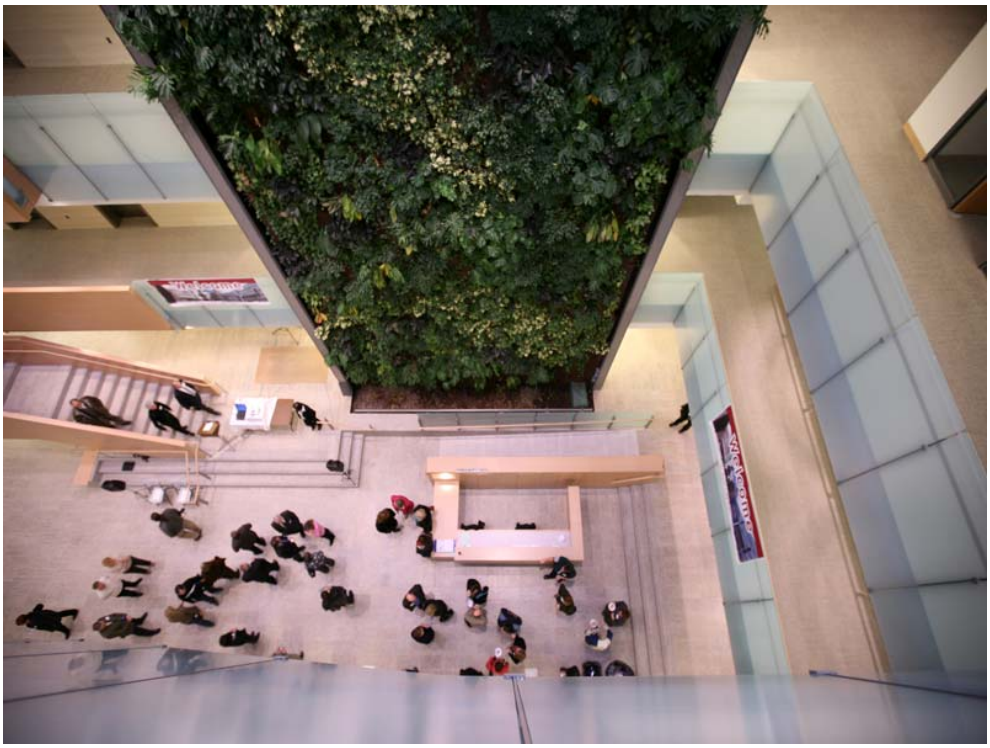
Natural lighting illuminates the atrium and office areas and occupancy sensors turn off lights when not in use or when sunlight levels sufficiently illuminate interior workspaces. Its open concept allows for greater air flow and penetration of natural light, reducing the reliance on air conditioning and artificial lights. Seventy-five percent of the building has natural lighting.

The atrium's focal point is a 110 m^2 "living wall" of tropical plants connected to the building's air circulation system. Staff may open windows for fresh air in shoulder seasons, and a weather station regulates windows on the roof. All of these innovations reduce energy use by over 40% to a comparable building. Indoor air quality has further been addressed through the selection of non-VOC carpet tiles,

potted plants, openable windows, design materials and finishes, and the living wall. A portion of the roof consists of native plants, grasses and shrubs, rather than asphalt or other dark granular substances.

The landscaping around the building is comprised exclusively of native or naturalized species that do not require irrigation. Water conservation performance is achieved through a cistern, low-flow plumbing fixtures, and water efficient landscaping. All rainwater that falls on the new building will be collected in a 10,000 litre cistern tank and is used for toilets. By reducing the building's "water footprint" further reductions in energy use (at the water treatment plants) lead to emissions reductions beyond the building envelope.

Alternative forms of commuting are encouraged through bicycle racks, storage and change rooms, and designated carpool parking spaces.



The City signed a contract with "Bullfrog Power" to supply green energy based on a net zero pollution basis. Green Power is produced from solar, wind, geothermal, biomass or low-impact hydro sources. Bullfrog sources its power from wind and low impact hydro.

A conservative estimate comparing a standard 85,000 square foot building to the new City Hall Gold LEED standard building results in a $160,000 savings on energy per year or some $1.6 Million over 10 years.

The City of Cambridge is a member of Canada Green Building Council, and organization that promotes energy efficiency and resource conservation through the design, construction, and operational phases.

City of Kitchener

ISO 14001 Environmental Management System for Fleet and Fleet Operations

In April of 2008, the City of Kitchener fleet and fleet operations earned the prestigious ISO 14001 environmental certification – a standard that puts Kitchener on the leading edge of municipalities in the province in terms of environmental due diligence.

This newly registered ISO 14001 Environmental Management System (EMS) applies to the repair, maintenance, and procurement of fleet vehicles and other motorized equipment, and means that the 1,130 vehicles and other equipment utilized in regular city operations – fire equipment, pumping station equipment and equipment used at the city's golf courses – will be repaired and maintained to a higher environmental standard under the new system. An annual surveillance audit is scheduled for April 1, 2009.

The key benefits of maintaining registration to the ISO 14001 standard include:

- ISO 14001 is recognized as an international best practice
- The system enables the city to become a leader in environmental practices
- Sets the standard for the city to maintain compliance with environmental laws
- Allows the city to demonstrate leadership through sustainable initiatives, remain accountable for environmental performance, and practice stewardship by reducing environmental impacts
- Provides accountability for work already in place

ISO 14001 registration for the city's fleet operations was identified as one of 2006's *Five Best Bets for Air Quality* selected from amongst 50+ Recommended Actions outlined in the citizens' Environmental Committee report on *Air Quality in Kitchener* tabled with Council in May 2006.

When this first area of City operations was registered under ISO 14001, Kitchener Council immediately directed staff to investigate other operating areas within the corporation that could potentially benefit from the same ISO environmental management system principles and practices. The current registration for fleet allows additional areas of City operations to be added, and managed, under a single system going forward.

Air quality continues to remain one of the most pressing environmental issues for modern cities. So this first step towards a more comprehensive ISO 14001 EMS throughout the City is important along with the other *Best Bets for Air Quality* being investigated and implemented each year by Kitchener.

Kitchener's hybrid vehicle fleet uses 46% less fuel than other fleet vehicles of the same size and similar purpose. Fuel reduction is one of the performance measures for our ISO 14001 environmental management system.

City of Waterloo Energy Management Plan

Reduction of Energy Consumption & Greenhouse Gas Emissions by 30% within 2 Years

The City of Waterloo's Energy Management Plan, which was approved by Council in January 2008, outlines measures to reduce the City's energy load, optimize systems performance and streamline overall operations. The goal of the Plan is to reduce the City's greenhouse gas emissions and annual energy costs by 30% from a 2004 baseline within 2 years. The Plan encompasses buildings, pumping stations, parking areas, sport fields, street lighting, etc. and the term "energy" has been used to describe all three utilities – fuel, electricity and water. The City anticipates that the Plan implementation will begin in the fall of 2008.

The savings outlined within the Plan will be achieved through the implementation of lighting, heating, ventilation, air conditioning, and building automation system upgrades in a pre-determined sequence. In addition, the Plan identifies best practices to further aid the City in attaining its energy and emission reduction goals: a measurement and verification program, integration of Leadership in Energy and Environmental Design (LEED) standards, employee awareness, community outreach, and green procurement options.

The Plan states that the City can achieve their energy and emission reduction targets with an investment of $4,265,000 over 2 years. By reducing energy costs by over $960,000 per year (using 2007 rates), the City will also reduce consumption of electricity by 7,081,358 kWh/2,075 tC02e), gas by 510,401m^3/986 tC02e, and water by 29,071m^3, for a total reduction of 12364eMWH/3,040 tC02e.

The benefits of implementing the Plan include, but are not limited to, reducing costs by using less energy and materials, meeting the legislative requirements outlined in Bill 21 – Energy Conservation Responsibility Act and demonstrating leadership by being proactive about environmental change.

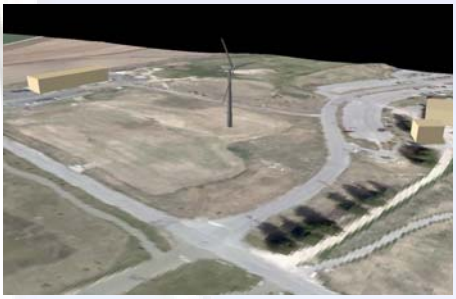
Wind Energy in Waterloo

Project Background

The City of Waterloo in partnership with the Region of Waterloo and University of Waterloo will be installing two temporary 50 metre meteorological (MET) towers in the region with the goal of determining the feasibility of wind energy in our area. The two met towers will be installed in Summer 2008. One will be located near RIM Park and the other near the Waterloo landfill on Erb Street West. Funding for this project is being provided by the Federation of Canadian Municipalities (FCM) Green Municipal Fund (GMF).

The two met towers, approximately 15 stories tall, will be in place for approximately a year in order to collect a sufficient amount of data. This data includes: wind speed and direction at various heights; as well as temperature and barometric pressure. This data will be analyzed by the Wind Energy Group at the University of Waterloo in order to determine if using wind energy in our area is feasible. If wind energy is viable, consultation with the community would then take place and mid-sized wind turbines could be installed.

Example of a MET tower



Example of a Wind Turbine Installation

Benefits of Wind Energy

- **Economic**
  - Construction jobs could increase as more wind farms are installed in Canada
  - Wind farms can attract thousands of tourists a year which brings income to local businesses
- **Environmental**
  - Wind turbines only take ~6-8 months to offset the energy used to make them[2]
  - A turbine can offset 1.69 tonnes/MWH of CO_2 as compared to burning coal
- **Case Study - Pincher Creek Alberta (169 wind turbines)[3]**
  - Enough power to supply up to 51,000 homes
  - $10 million injected to local economy through supplies and services
  - 21 new jobs with $1.4 million total annual payroll
  - ~$900,000 in municipal taxes

Source/Activity	Indicative noise level (dBa)
Threshold of Hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350 m	35-45
Car at 65 kph at 100 m	55
Busy general office	60
Truck at 50 kph at 100 m	65
Pneumatic drill at 7 m	95
Jet aircraft at 250 m	105
Threshold of pain	140

Causes of Bird Fatalities Number per 10,000 Fatalities[1]	
<1	Wind Turbines
50	Communication towers
710	Pesticides
850	Vehicles
1060	Cats
1370	High tension lines
5820	Buildings/Windows
140	Other

[1] A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions, Erickson, et. al.
[2] http://www.bwea.com/ref/faq.html
[3] http://www.canwea.ca/images/uploads/File/NRCan_-_Fact_Sheets/12_community.pdf

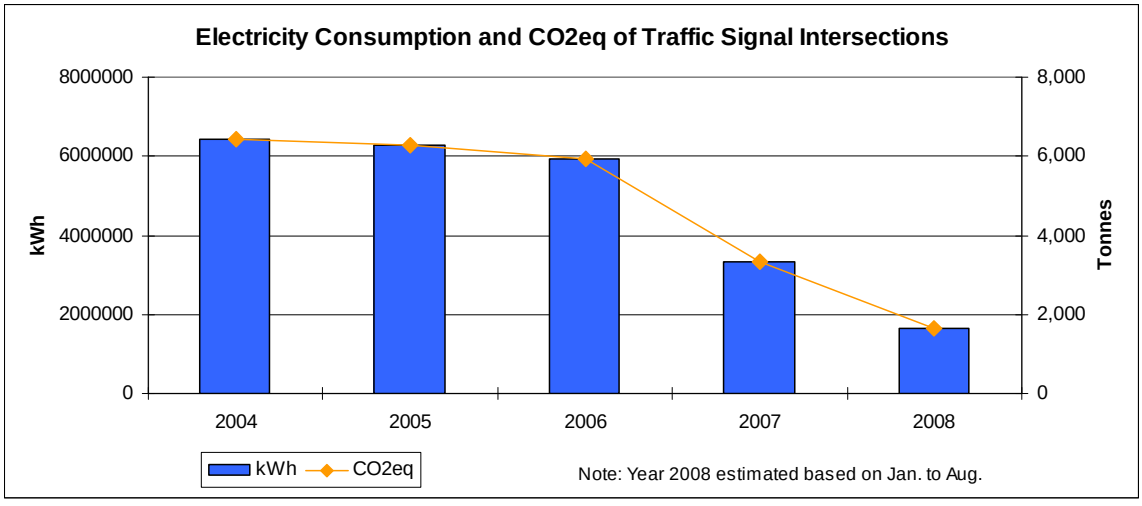
Region of Waterloo – Energy Conservation Office (ECO)

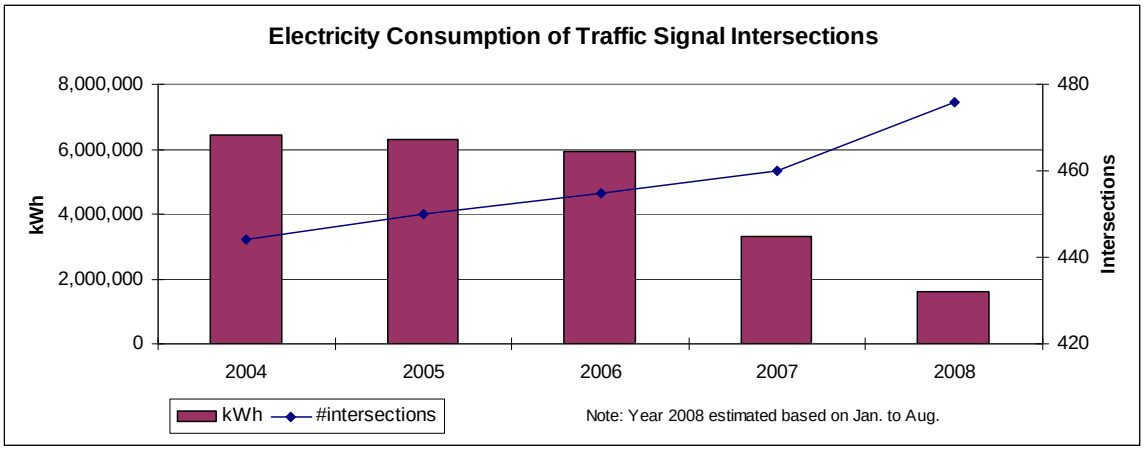
Promoting Conservation, Piloting Renewable Energy, Enhancing the Environment

Over the past fifteen years, Facilities Management staff have worked closely with all Regional departments to identify proven energy-saving opportunities, facilitate rebate or grant funding processes and implement retrofit projects, as well as validate savings. Recently Regional Council endorsed the establishment of a Corporate Energy Conservation Office within the Facilities Management division funded largely from annual energy savings over the last several years. This will enable the Region to more aggressively reduce its energy use and impact on the environment.

One area identified to substantially decrease the Region's electricity consumption and subsequently lower green house gas emissions was to convert all traffic signals from incandescent lamps to light emitting diode (LED) technology. Working closely with Transportation Engineering staff, Facilities partnered with the three local distribution companies, Cambridge and North Dumfries Hydro, Kitchener-Wilmot Hydro and Waterloo North Hydro to access grants totalling $363,000 available from the Ontario Energy Board's Conservation and Demand Management program. The project was initiated in the summer of 2005 and was completed in 2007.

Prior to the LED retrofit project the Region used approximately 6,429,000 kWh's of electricity per year at a cost of $723,170 to operate 444 intersections which emitted 1,703 tonnes of CO2e. After the completion of the project the Region now operates 476 intersections, uses 1,631,000 kWh's of electricity at a cost of $217,344 and has reduced GHG emissions by 1,271 tonnes CO2e annually. An absolute decrease of 75% in electricity consumption, despite an increase in the number of intersections.





The ECO office has also been investigating and implementing various technologies using new and innovative methods to reduce consumption and utilize alternative energy sources to reduce our reliance on the provincial electricity grid and lower our emissions. Projects complete or in the pre construction phase include:

- 20 kW photovoltaic system enrolled in the OPA Standard Offer Program
- Wind feasibility study with the City of Waterloo and the University of Waterloo
- Solar thermal energy used to heat water at a Regional Childcare Centre
- Geothermal installation scheduled for Regional Library Headquarters and new Sunnyside Supportive Housing complex
- Heat recovery from facility make up air and exhaust systems
- Heat recovery from laundry waste water and dryer exhaust air

Other Region of Waterloo Departmental Initiatives

Other departments of the Region of Waterloo have also engaged in a variety of different initiatives through 2008. A summary of these initiatives appears, below:

- Public Health produced a comprehensive report on air quality in the region. The report, entitled: *Air Quality and Urban Health Impacts Waterloo Region: A Preliminary Assessment*, is available at the following website: http://chd.region.waterloo.on.ca/web/health.nsf/0/EF84928AED47024D8525711D0069B15A/$file/Air%20Quality.pdf?openelement

- In May 2008, Region of Waterloo Public Health submitted an innovative report to Community Services Committee on Drive-Through restaurants operating in the region. The report can be found on the web at the following link: http://www.region.waterloo.on.ca/web/region.nsf/8ef02c0fded0c82a85256e590071a3ce/C4D543DD1E70237E8525744400490252/$file/PH-08-023.pdf?openelement

- Grand River Transit (GRT) made two significant changes to its fleet: the introduction of six Hybrid buses and the decommissioning of 16 natural gas buses. The remaining 7 NG buses will be removed from service May 2009. GRT continues to use Ultra-Low Sulfur Diesel fuel in its diesel fleet. The 6 Hybrids are scheduled on routes in such a way that there can be direct comparisons with clean diesel buses. Initial indications show a 15% improvement in mileage. GRT's Safety Dept is also in the early stages of a Smart Driver program, which is intended to improve mileage and reduce emissions.

Case Study for Waterloo Region Partners for Clean Air – 2008/09 Clean Air Plan

For hundreds of people in the neighbourhood surrounding St. Mary's General Hospital, having access to locally grown, fresh fruits and vegetables is now much easier, thanks to a unique neighbourhood market. The market is an innovative partnership among Region of Waterloo Public Health, Opportunities Waterloo Region and St. Mary's, with support from the Lyle Hallman Foundation, Together 4 Health Coalition, and TD Friends of the Environment.

Operating one afternoon per week (Fridays), the market procures fresh local produce from farms in Waterloo Region and sells the produce right on site at the hospital. The market:

- Increases social connectivity by serving as a community meeting place for staff, patients, visitors, and the community at large
- Increases access to fresh locally grown vegetables and fruits for people who may not be able to afford to travel to farms or other market locations
- Increases the physical activity level of neighbourhood residents promoting walking or biking
- Contributes to the long-term development of healthy eating habits
- Supports our local farmers and the rural economy
- Protects and preserves local rural communities and farmlands
- Reduces dependency on imported foods, thereby reducing greenhouse gas emissions
- Provides an opportunity for skill development

St. Mary's, a recognized environmental leader in health care, is an eager participant in the first-of-its kind program in Canada. "We see this as an opportunity to not only promote healthy living, but to support an initiative that will have a positive impact on our environment while further strengthening the relationship we have with our community," says Moira Taylor, President of St. Mary's General Hospital.

The market has been running successfully for the past two summers and was honoured in April 2008 with a prestigious provincial Innovation Award from the Minister of Health & Long-Term Care.

Case Study for Waterloo Region Partners for Clean Air – 2008/09 Clean Air Plan

St. Mary's General Hospital has made significant progress in all areas of environmental and energy management. St. Mary's promotes "Health Care for a Healthy Environment" and continually strives to be an environmental leader in the health care industry. St. Mary's proactively develops and participates in programs and processes that help reduce, and when possible, eliminate the environmental impacts associated with daily activities and operations.

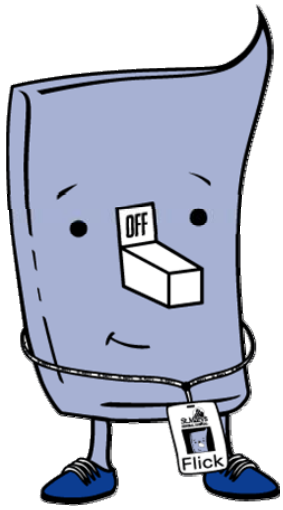
Through setting yearly environmental objectives and targets, St. Mary's has accomplished the following pollution prevention, energy, leadership, and community awareness achievements:

Pesticide Use

In 2000, St. Mary's was among the first hospitals in Ontario to eliminate chemical (pesticide and herbicide) usage on hospital grounds. Through working with the hospital's landscaping contractor and other professionals in this field, St. Mary's has maintained a healthy, chemical free landscape. In the summer of 2001, to further facilitate this objective, St. Mary's made significant efforts to be proactive and reduce SMOG producing air emissions from gas-powered lawnmowers by rescheduling grass cutting on Ministry of Environment designated SMOG days. The hospital has also substituted common chemical fertilizer for the exclusive use of a new alternative- corn gluten meal (a natural fertilizer with inherent herbicidal properties). For winter months, St. Mary's utilizes (on the majority of hospital grounds) an environmentally friendly salt alternative that reduces plant damage that occurs each spring.

Energy Awareness Campaign

Flick-the-Switch, St. Mary's own energy awareness mascot, reminds staff daily to turn off unused equipment and lighting. Reminder labels are placed on light switches and cleaning staff can leave "oops you left me on" notes to remind staff that equipment such as computer monitors can be turned off when not in use. Regular email messages from Flick remind staff about how they can help reduce our overall energy use. St. Mary's has also promoted energy conservation at home through education and complimentary product give aways, such as distributing 200 compact fluorescent light bulbs.



Building & Systems Improvements

One of the greatest challenges for many hospitals is managing aging infrastructure with limited resources. This is an area, however, where significant impact can be achieved – St. Mary's has demonstrated that impact by undertaking the following improvements:

Decreased Electrical Usage through:

- Upgraded lighting and occupancy sensors (lights are only on if someone is in the room)
- Variable speed drives for heating/cooling circulation pumps & cooling tower fan
- Energy efficient fan and motor in air-handling units
- New energy efficient boilers and chillers
- Modernization of 4 main elevator drives
- Upgrade to primary electrical breaker/ capacitor bank
- Annual medical gases inspection trap audits/repairs/upgrades
- Annual infrared electrical device audits/repairs/upgrades
- Annual compressed air sonic audits/repairs/upgrades

Decreased Natural Gas Usage through:

- Hospital window replacement
- Replace roof insulation & upgrade (from R-18 to R-21.6)
- On-demand domestic hot water (DHW) system versus traditional DHW reservoir tanks
- Annual steam trap audit/upgrades

Decreased Water Usage through:

- Transition from water cooled vacuum pumps to air cooled
- Installation of ceramic disc positive stops on faucets to eliminate water leakage

Recycling and Re-Use Programs

St. Mary's has a well established recycling program which includes:

- Paper
- Glass, cans, plastics
- All batteries
- Printer/toner cartridges and cell phones
- Paper Towels – sent for composting
- Food Waste – sent for composting
- Electronics (e.g. computer equipment)
- Florescent light tubes
- Scrap metal
- Cardboard and boxboard

Green Purchasing

All new product requests at St. Mary's undergo a rigorous approval process that includes a full environmental assessment of the product and its packaging.

Outdoor Air Quality

St. Mary's participates in several initiatives to improve outdoor air quality and decrease greenhouse gas emissions.

Anti-Idling - A proactive anti-idling campaign has been in place for several years, which includes signage and notices to all vendors.

Alternative Transportation Program - The SMART program (St. Mary's Advocates Responsible Transportation) uses incentives such as discounts in public transit passes and parking fees to encourage staff to find alternative transportation to work.

Ontario Hospital Clean Air Challenge – St. Mary's is an active participant in this program which is led by the Canadian Centre for Pollution Prevention. Through the sharing of best practices, successful projects and policies St. Mary's has demonstrated its leadership and innovation in decreasing greenhouse gas emissions associated with hospital operations.

Smoke Free Property – In 2004, St. Mary's became the first hospital in Waterloo Region to make its entire property smoke-free.

Wilfrid Laurier University

Community Involvement:

Commuter Challenge

Wilfrid Laurier University won first place for participation in the Canadian Commuter Challenge 501+ employee's category for Waterloo Region.

The Commuter Challenge, which took place June 2 to 6, encourages participants to walk, bike, rollerblade, take public transit or carpool to and from work in an effort to reduce vehicle emissions and traffic congestion. This is the seventh year Laurier has participated, with about 20 percent of employees joining the challenge.

Laurier contributed to the 140,045 kilometres that Waterloo Region participants commuted during the challenge, saving more than 28,000 kilograms of greenhouse gas emissions.

Car-Pool

Parking and Transportation Resources at Wilfrid Laurier University has developed a new green initiative through Carpool.ca which is a Canadian rideshare program designed specifically for the post-secondary environment. Carpooling programs can dramatically and cost-effectively reduce campus traffic by providing students, faculty, and staff with a fast convenient tool to find others with whom to share their commute. This system is designed to be a 'self-serve' ride-matching service.

Grand River Carshare

This coming fall, Wilfrid Laurier University Waterloo Campus is looking to increase its participation in alternative transportation means by allowing faculty, staff, and students alike to take part in a new carshare initiative by partnering with Grand River CarShare. This program will allow participants to reduce the number of single occupancy vehicles traveling to the campus, decreasing emissions and combating the rising price of gas.

Building Equipment Changes:

- Conversion of the Aird Building 220 ton chiller from CFC 11 to 440 pounds of non ozone depleting HCFC 123
- Replaced 3-HVAC (15 year) units at Alumni Hall (3, 4 + 5 ton) to high efficiency units.
- Replaced 15 year old 12.5 ton HVAC unit to a high efficiency unit
- Replaced 2 - 75 ton 15 year old HVAC units to higher efficiency units and replaced old variable frequency drives with new VFD's

Programs:

Energy Management

Embarked on developing an Energy Management Plan (to be completed in 2009) that will consist of the following:

- Energy audits in all buildings to identify conservation opportunities
- Identifying sub-metering locations for gas, water, and electricity and networking meters to a utility monitoring system
- Developing a long term energy education awareness campaign for the University community

Waste Management

- Collected data pertaining to waste composition and collection practices;
- Reviewed recycling programs and waste collection practices;
- Determined the total quantity of waste diverted from landfill through current reduction, reuse, and recycling initiatives;
- Completed a Waste Audit Report summarizing the results and preparation of a Waste Audit Summary and Waste Reduction Action Plan.
- Recycling containers have been distributed across campus.
- Diversion rate has increased significantly since implementing new recycling program.
- Construction material is recycled and re-used.

Cleaning Products

WLU has initiated a review of cleaning product and cost rationalization to compare a 'traditional' program measured against a 'green' program.

- By a gradual introduction of environmentally preferred products, the numbers of products were reduced, cost savings were realized, and environmental impact was reduced while maintaining 'Superior' performance.
- The supplier now provides a full and complete green cleaning program custom-tailored for Wilfrid Laurier University.
- The full program of maintenance products includes cleaners, disinfectants, degreasers, floor finish, strippers, carpet cleaners, as well as paper towels and toilet tissue. This, together with a full range of support materials and training on 'Going Green', were made available to all University custodial staff, ensuring a complete and successful transition.

Policies:

- WLU has established a Sustainability Policy.

Next Steps

Those environmental issues identified as significant to the populations served by the WRPCA membership continue to evolve. In order to continuously improve upon the relevance and the impact the partnership will have on these dynamic issues, we will evolve in a number of areas:

- Continue to meet regularly to discuss common issues, and share best practices. Guest speakers will continue to be brought in where the membership seeks additional outside expertise.

- Search for new membership within our community to give a more comprehensive scope to our efforts. In 2008, we benefited from the addition of Union Gas, and Grand River Hospital.

- Discuss future directions, common goals and issues, and potential opportunities for further collaboration.

- Continue to share experiences, best practices, and challenges with member organizations to improve upon environmental stewardship.

Appendix A

Waterloo Region Partners for Clean Air
TERMS OF REFERENCE
Revised January 25th 2008

FUNCTION

The purpose of Waterloo Partners for Clean Air (WRPCA) is to increase the capacity of member organizations to reduce energy use and air pollution. WRPCA will meet regularly to share information, showcase best practices and seek opportunities for collaborative action.

STRUCTURE

WPRCA will be comprised of organizations with a desire to implement initiatives that will result in improved air quality in Waterloo Region. These organizations will include, but are not limited to municipalities, universities, school boards, and hospitals found within Waterloo Region. Current membership includes:

- City of Cambridge
- City of Kitchener
- City of Waterloo
- Conestoga College
- Region of Waterloo
- St. Mary's General Hospital
- University of Waterloo
- Waterloo Region District School Board
- Wilfred Laurier University

Membership may be expanded to include additional organizations at the discretion of the current member organizations.

As deemed beneficial by members, sub-committees of the WRPCA may be formed to address issues of specific interest.

A quorum consisting of at least 50% of the members shall be in attendance in order for a meeting to proceed. Should group decisions be necessary, consensus shall be sought among all members. However, if consensus cannot be achieved, a vote of majority will be used for decision-making.

MEETING FREQUENCY AND LOCATION

Meetings will consist of topic-specific presentations and take place quarterly. Additional meetings may be arranged because of an identified need. Topics will be pre-determined by members and presentations will be arranged by Region of Waterloo Public Health. Unless otherwise arranged, meetings will take place at Region of Waterloo Public Health, 99 Regina St. S., Waterloo at a date and time convenient to the majority of the group.

WRPCA members will attempt to ensure that for each meeting or presentation, the most relevant representatives from their organizations are in attendance.

MEETING ADMINISTRATION

Meetings will be chaired by a Region of Waterloo Public Health representative. Region of Waterloo Public Health will prepare agendas and record minutes for each meeting. All WRPCA members will receive copies of the minutes and an agenda for the next meeting at least one week prior to the meeting. Region of Waterloo Public Health will coordinate the distribution of meeting materials such as minutes and agendas.

Any media inquiries regarding the activities of WRPCA will be directed to Public Health for the purpose of developing a coordinated response.

WRPCA GOALS

The goal of WRPCA is to provide up to date information, best practices and case studies to its members in order to facilitate actions to improve air quality in Waterloo Region.

As a means to publicly recognize the actions and progress of each member organization, a Clean Air Report will be created annually. The Clean Air Report shall contain a standardized tool for indicating specific emission-reducing activities implemented by each member.